

Radio- Electronics

**INSIDE RCA'S
VIDEODISC PLAYER**

\$1.25 MAY 1981

**Build a digital LED VU meter
Pirate broadcast stations
Computer control for your robot**

**What's new in home video
Selectric-to-computer interface
Dolby's new N-R system for hi-fi**

LEARN ABOUT MICROPROCESSORS



**Single-board assembly language
computers lead the way**



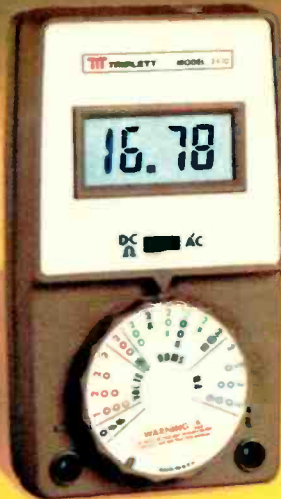
303092 DRK 64SDH091 14 R DEC86
LLOYD DARKNELL
64SD HYTEWOOD DR
CUPERTINO CA 95014

THE NEW DIGITAL

performers.



MODEL 3400
Now only \$125



MODEL 3410
Only \$140



MODEL 4000
Only \$235



MODEL 4200
Only \$270

GO DIGITAL WITH MORE FEATURES FOR THE SAME COST!

When you're shopping for digitals, be sure to check out these Triplet Digital Multimeters. They're loaded with extras that extend multimeter life and make your job a lot easier and safer.

MODEL 3400 . . . Hand size, 3½ digit with handy single range switch. Six functions with 24 ranges including Hi/Lo Power Ohms, auto-zero and auto-polarity. Overload protected to 600V on all ranges. Battery life is 200 hours min. Low battery indicator with 50 hours to spare. Price is now only \$125.

MODEL 3410 . . . All the features of the Model 3400 plus 1000 Volt AC/DC range and overload protection up to 600V on current ranges and up to 1000V on ohms or voltage ranges without fuse blow. Typical battery life of 500 hours. Price is only \$140.

MODEL 4000 . . . Bench type, overload protected with multiple fusing to 1000V on all ranges, RF shielded, auto-zero and auto-polarity. Six functions with 32 ranges, Hi/Lo Power Ohms and 3½ digit, .43" easy-read LED display. Single range selection and pushbutton function selector. Price is only \$235. (Battery version Model 4100)

MODEL 4200 . . . All the features of the Model 4000 plus a true RMS converter that computes the root-mean-square level of a complex AC input signal and displays the digital equivalent. Price is only \$270. (Battery version Model 4300)

MODELS 4100 & 4300 (not shown) . . . Ni-Cad rechargeable battery versions of Models 4000 & 4200. Price of Model 4100 is \$290 . . . Model 4300 is \$325.

Triplet's over 75 years experience is evident in the engineering firsts included in these digital testers. For a free, no-obligation demonstration, contact your Triplet Distributor, Mod-Center or Representative. Triplet Corporation, Bluffton, Ohio 45817.



Triplet performance... a tough act to follow

TRIPLETT

Telephone (419) 358-5015 • TWX: 810-490-2400

CIRCLE 43 ON FREE INFORMATION CARD

CIRCLE 60 FOR In-Plant Demonstration

Sabtronics.

An entire range of low-cost, top-quality instruments.



A. 2010A — \$84.00*, B. 2015A — \$99.00*, C. 8610A — \$99.00*, D. 5020A — \$115.00*,
E. 8000B — \$199.00**, F. 2035A — \$79.00*, G. 2037A — \$99.95*

IN CANADA CONTACT: Kumar & Co., Ontario Canada

Sabtronics revolutionized the market with the first low-cost, high-performance Digital Multimeter. Now we have an entire range of outstanding instruments in a reasonable range of prices. In fact, nobody can beat us in our price/performance ratio. And we can sell at a low price for some very good reasons. Our engineers design high performance products to be built at a low cost. And we refuse to stick on high mark ups. Plus we make sure your price stays low by selling directly to you. Because we sell so many instruments, we don't have to charge a high price. Naturally, we also offer all the helpful accessories you might want. And all our products are under warranty for good quality and high performance. In addition, you get from us the same quality aftersale service as any high priced instrument manufacturer. With Sabtronics instruments available, there's no need for you to spend a lot of money to do highly accurate testing and measuring.

2010A 3½ Digit LED DMM
2015A 3½ Digit LCD DMM
8610A 600 MHz 8-Digit Frequency Counter
8110A 100 MHz 8-Digit Frequency Counter
5020A 0.2 to 200 KHz Function Generator
8000B 1 GHz 9-Digit Frequency Counter
8610B 600 MHz 9-Digit Frequency Counter
2035A 3½ Digit LCD Handheld DMM
2037A 3½ Digit LCD Handheld DMM

*price in kit form. Also available factory assembled, tested, and calibrated. Call us for prices.

**price fully assembled, tested, and calibrated.

Call us for more information:
(813) 623-2631

Making Performance Affordable

sabtronics 
INTERNATIONAL INC.

5709 N. 50th Street Tampa, FL 33610

AN INCREDIBLE BREAKTHROUGH.

Introducing the Bearcat® 350, the first scanner that shows you broadcasting frequencies in plain and simple English.

The new Bearcat 350 easily qualifies as the most advanced scanner in the history of scanner radios.

Besides being the most sophisticated Bearcat Scanning monitor, it is also the world's first alpha-numeric scanner. Simply put, for the first time you have the option of scanning frequencies by numbers or names.

Quantum leap.

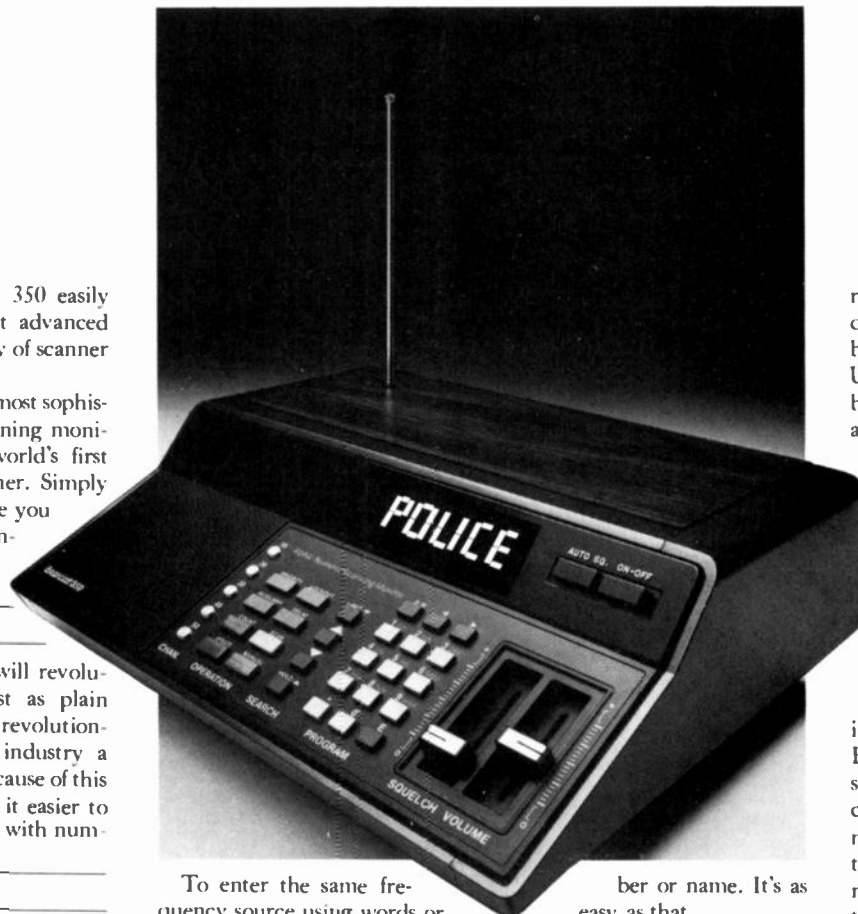
The Bearcat 350 will revolutionize scanners just as plain English computers revolutionized the computer industry a few years ago. All because of this simple fact: We find it easier to deal with words than with numbers.

How it works.

Programming the Bearcat 350 for numeric and alphabetic capabilities is deceptively uncomplicated. First to program the frequencies numerically you stop the scanning action.

Then you press the alpha-numeric key. Next you program in the frequency number in the usual manner. Touching the "enter" button locks the frequency in the Bearcat 350's memory bank.

© 1981 Masco Corp. of Indiana



To enter the same frequency source using words or abbreviations simply press the alpha-numeric key again. Your unit is ready to be programmed by frequency name.

"Type" in the word or abbreviation for the frequency source. Press the "enter" button again. Your Bearcat 350 is ready to receive frequencies by num-

ber or name. It's as easy as that.

More than words.

Even without the alpha-numeric capabilities, the Bearcat 350 would be an unbelievable advancement in no-crystal scanning.

Its complex synthesized technology gives it the capability of

receiving every local public frequency automatically. You will be able to receive low, high, UHF, UHF-T public service bands, the 2-meter and 70 CM amateur (Ham) bands, plus the AM aircraft band.

The Bearcat 350 scans up to 50 channels in five banks—10 channels per bank.

Impressive extras.

It took Bearcat Scanners, the leader in scanner radios, to give you these impressive features in the Bearcat 350: patented selective scan delay, direct channel access, scan speed control, automatic squelch, patented track tuning circuitry and front mounted speaker. And look at these extras: two digital display panels, AC/DC operation, counter on each channel to determine which are most active, priority, and attractive die cast metal cabinet. See your Bearcat Scanner dealer today. Ask about the incredible Bearcat 350. Your perception of scanner radios will never be the same again.

Electra Electra Company
Division of Masco Corp. of Indiana
300 East County Line Road
Cumberland, Indiana 46229
International Business Office
Suite 102 1828 Swift
North Kansas City Missouri 64116

BEARCAT® SCANNERS

CIRCLE 2 ON FREE INFORMATION CARD

SPECIAL FEATURES

- 45 **LEARNING ABOUT MICROPROCESSORS**
To learn how microprocessors work and how to program them, hands-on experience is the proven method. Single board assembly-language computers provide the means. **Jorma Hyypia**
- 49 **INSIDE RCA'S VIDEO DISC PLAYER**
Here's a look at how RCA's videodisc player works and how the signals are processed. **Chester H. Lawrence.**

BUILD THIS

- 53 **UNICORN-1 ROBOT—ADDING COMPUTER CONTROL**
A look at the hardware and programming requirements needed to add computer control. **Chester H. Lawrence.**
- 59 **LED VU METER FOR YOUR HI-FI**
Here's an all-electronic digital VU meter that you can add to your hi-fi system. **Bradley Albing**
- 64 **COMPUTER-TO-ELECTRIC INTERFACE**
Part 2 - An inexpensive way to use an IBM Selectric typewriter as a hard copy printer for your computer. **E. G. Brooner**

TECHNOLOGY

- 4 **LOOKING AHEAD**
Tomorrow's news today. **David Lachenbruch**
- 16 **SATELLITE TV NEWS**
The latest happenings in an exciting new industry. **Gary H. Arlen**
- 76 **HOBBY CORNER**
Negative ion generators—what they're all about. **Earl "Doc" Savage, K4SDS**
- 84 **NEW IDEAS**
A prize-winning application from a reader.

VIDEO

- 56 **HOME VIDEO UPDATE**
A look at the video innovations from Japan, most of which will be available here soon. **Leonard Feldman**
- 86 **SERVICE CLINIC**
If all else fails, look for a leaky transistor. **Jack Darr**
- 88 **SERVICE QUESTIONS**
R-E's Service Editor solves technicians' problems.

RADIO

- 67 **PIRATE BROADCAST STATIONS**
They're unlicensed and illegal, but they can provide an interesting alternative to the standard broadcast fare. **Robert B. Grove**

AUDIO

- 70 **NEW DOLBY NOISE-REDUCTION SYSTEM**
Dolby's new system provides 20dB of noise reduction. Here's how it works. **Leonard Feldman**

**EQUIPMENT
REPORTS**

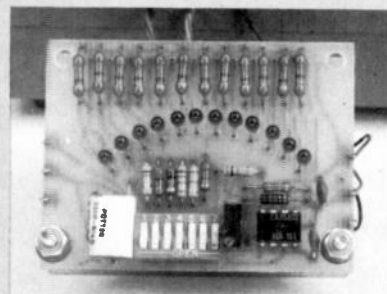
- 32 **Global Specialties 2001 Function Generator**
- 34 **Sencore Model DVM-56 Microranger DMM**
- 36 **Alliance Model HD-73 Antenna Rotator**
- 42 **Radio Shack Metal Detector**

DEPARTMENTS

- | | |
|------------------------------|--------------------|
| 14 Advertising Sales Offices | 22 Letters |
| 112 Advertising Index | 91 Market Center |
| 92 Computer Market Center | 78 New Products |
| 14 Editorial | 83 Stereo Products |
| 113 Free Information Card | 6 What's News |

ON THE COVER

To understand how computers and microprocessor-based equipment works, it is necessary to understand how microprocessors work and how they're programmed. This month, we evaluate several single-board computers and the supplied documentation to determine how effective each one is as a learning tool. The story starts on page 45.



ADD AN LED DIGITAL VU meter to your hi-fi system for precise recording. Construction details start on page 59.



SPEED VIEWING allows you to listen to the sound while the VCR is scanning the tape. For this and other video innovations being introduced in Japan, turn to page 56.

Radio-Electronics, (ISSN 0033-7882) Published monthly by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Controlled Circulation Postage Paid at New York, N.Y., and additional offices. One-year subscription rate: U.S.A. and U.S. possessions, \$13.00, Canada, \$16.00. Other countries, \$18.00. Single copies \$1.25. © 1980 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

Subscription Service: Mail all subscription orders, changes, correspondence and Postmaster Notices of undelivered copies (Form 3579) to Radio-Electronics Subscription Service, Box 2520, Boulder, CO 80322.

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

looking ahead

CANON ENTERING VIDEO

This leader in 35mm still photography will field its own line of video equipment and is expected to be just one of many film-photography companies to put its name on electronic photography gear for the consumer. Canon announced it would offer a portable videocassette recorder and a color video camera on the Japanese market this June. The camera will be a compact Canon-made unit using a $\frac{2}{3}$ -inch pickup tube and 3:1 zoom lens. The VCR will be built for Canon by Funai Electric. At presstime, it wasn't known whether the Canon name would appear on such equipment in the United States. Currently another name in photography—Technicolor—has exclusive rights to the Funai-built mini-VCR (which uses a tiny cassette of quarter-inch tape) in this country.

VCR-CAMERA COMBINATIONS

Canon says its ultimate goal is a hand-held combination solid-state camera and mini-VCR, which seems to be the goal of just about every other manufacturer in the field of electronic photography. The third Japanese manufacturer to demonstrate the prototype of such a combination is Matsushita, which showed a 4.6-pound unit using a cassette about the size of a standard audio cassette, capable of two hours of recording. Matsushita's Micro Video System (MVS) is not compatible with the two previous developmental entries—Sony's Video Movie and Hitachi's Mag Camera.

In Japan, there were indications that serious talks looking toward all-in-one camera-recorder standardization were about to begin. They would include the three companies which have already demonstrated their proposed entries, along with other manufacturers interested in the field. That presumably would affect Fuji Photo Film, which says it is ready to mass-produce mini-cassettes for portable combinations. Fuji proposed a cassette similar in proportions to the audio cassette, and said it had developed two types of tape for it—metal "MV," capable of two hours' playing time, and evaporated-metal "VV," which could record and play up to four hours. Both tapes are believed to be 9-microns thick. Fuji said that although metal tape costs about three times as much as oxide tape manufactured for audio applications, the differential wouldn't be that great in video.

CHEAP VCR's

Almost simultaneously with RCA's introduction of the under-\$500 videodisc player, lower-priced VCR's have started to appear in force. Sanyo continues to have the cheapest unit—a single-speed Beta which lists at \$699 but often sells for \$100 less. But now Panasonic, Quasar, Magnavox, and others in the VHS camp—including RCA—have introduced low-end "no-frills" recorders which are being sold at around \$649 or less, although their list prices frequently are considerably higher. Sears, Ward, and J.C. Penney all have dropped catalog prices of VCR's (to \$685, \$790 and \$688, respectively), and the same units are frequently advertised at considerably lower prices in sales catalogs and retail stores. Lower-priced VCR's probably are coming, and a stripped-down version at a suggested list of about \$500 wouldn't be surprising before year's end.

VIDEODISC LINEUP

Manufacturers of 87% of the color TV sets sold in the United States are now committed to the videodisc-player market, along with a few companies not currently in the color-TV business. Companies representing 59% of the color-TV market have embraced the RCA-developed CED system, 15% the JVC-Matsushita VHD system, 13.2% the Philips-MCA LV optical system, with 12.8% uncommitted or unknown.

Here's the latest lineup of companies committed to videodisc players and the formats that they have chosen: CED—RCA, Zenith, Sears, Montgomery Ward, Sanyo, Hitachi, J.C. Penney, Sharp, Toshiba, and Radio Shack. VHD—GE, Quasar, Panasonic, JVC, and Sansui (the last is tentative and indicates it may switch to CED). LV—Magnavox, Sylvania, Philco, Gold Star, Advent, Pioneer, Fisher, and Samsung.

1,125-LINE TV

Having filed with the FCC for consideration of standards for high-definition television, CBS is exploring all proposed systems in its search for "movie-quality" TV as a new deluxe service for broadcast stations, direct satellite-transmissions and cable TV. It demonstrated a 1,125-line system developed by Japan's NHK to an SMPTE conference in San Francisco, and was planning demonstrations of other systems at presstime. The NHK system was shown using special Matsushita 32-inch picture tubes which had an 8:5 aspect ratio. The system required a 30-MHz bandwidth for a single channel. Another system, developed by CBS, uses computer techniques to conserve bandwidth.

DAVID LACHENBRUCH
CONTRIBUTING EDITOR

Take a good look at VACO.



THE SUPER CASE
70260

The world famous Super Case. Complete with 48 of the most popular and professional problem-solving tools. From screwdrivers and nutdrivers to pliers, wrenches, crimping tools and more. A super variety and super value. *All* unconditionally warranted from Vaco, of course. The Super Case and all the other fine Vaco tools can be seen in our new 1981 catalog. It's free, just write. Say you want to take a good look at VACO.

Vaco Products Company, 1510 Skokle Blvd.,
Northbrook, IL 60062 U.S.A.

VACO[®]

CIRCLE 16 ON FREE INFORMATION CARD

Negative-feedback inventor inducted into hall of Fame

In a ceremony at Arlington, VA February 18, retired Bell Labs engineer Harold S. Black was inducted into the National Inventors Hall of Fame in the U.S. Patent Office.



HAROLD S. BLACK

Though Black developed the idea of negative feedback in 1927, it did not reach consumer-audio equipment until years later. But it was used in long-distance telephone transmission as early as 1928. Seventy amplifiers using negative feedback were used for a field test of the system in 1931, in Morristown, NJ. In 1936, Philadelphia and New York were linked with a commercial long-distance system using negative-feedback amplifiers.

Besides its standard audio use, negative feedback is now applied in medical technology, computers, chemical control systems, spacecraft-guidance systems, and numerous other fields. "I have seen hundreds of thousands of uses," Black said recently.

Dr. Black holds 11 fellowships and 19 memberships in professional societies. He has received 62 U.S. patents and 271 foreign ones, and has written 42 technical papers. His awards include the John Potts Memorial Award of the Audio Engineering Society.

Radio service dealers to convene in Florida

The National Electronics Convention and Trade Show is being held in Tarpon Springs, FL (near Tampa/St. Petersburg) August third to sixth, 1981. The convention is co-sponsored by the National Electronic Service Dealers Association (NESDA), the International Society of Certified Electron-

ics Technicians (ISCET) and the Florida Electronic Service Association (FESA).

Early registration will be profitable to the delegates. Registrations prior to April 30 will cost \$90 per person, plus \$80 for each additional family member. Between April 30 and June 30, the rate is \$100 per person and \$80 for each additional family member. After June 30, rates are \$110 for one and \$90 for additional family members. Persons 16 years old and under may attend the convention for \$50 each.

For the registration fee the convention-goer may participate in a technical school, the "Magic of Electronics" trade show, the instructors' conference, a seminar on cable television, and golf and tennis tournaments, along with meals and cocktail parties. There will also be time for sight-seeing around the noted local attractions, such as Busch Gardens and DisneyWorld.

For those who wish to attend only the Monday and Tuesday instructors' schools, there is a special rate of \$50. Fee for the management school is \$20 for one, \$30 for two from the same company, and \$50 for each non-member.

The theme of the convention is "The Magic of Electronics." This year a seminar on cable television will also be featured.

For additional information and convention registration please write to NESDA, 2708 West Berry, Ft. Worth, Texas 76109.

Can the consumer bring back quality production in USA?

The American consumer, by exercising vigorously his right to complain about poor quality, can bring about an improvement in product quality, Dr. Norihiko Nakayama, president of Fujitsu America, told a seminar of management executives in New York recently.

"In my opinion," Dr. Nakayama declared, "Americans should refuse to settle for inferior goods." If a tool breaks, he said, take it back to the store. If the store won't give satisfaction, go to the manufacturer. And there are other avenues for protest. A groundswell of protest would cause management to take the steps necessary to heighten quality.

Those statements were made during a seminar: "Using Japanese Quality Control and Productivity Techniques in U.S. Industry," sponsored by the American Management Association and the Technology Transfer Institute.

Dr. Nakayama hinted that the Japanese consumers' attitude may be an important reason for the quality which is one of the factors in the success of Japanese imports. In his home country, customer complaints are taken seriously, he says: "To the Japanese, keeping the customer is important, and so is the company's reputation."

Radar helps steel industry



NEW IMPROVED RCA RADAR helps steel technicians control the loading of materials into blast furnaces. The newer furnaces have rotating tops that make it possible to control the distribution of the iron ore, coke, and limestone used in making steel. That new scanning radar not only measures the height of the load accurately, but also gives information on its profile, thus detecting unevenness in the loading.

Henry C. Johnson of RCA Labs is shown adjusting the new radar, which is an improvement on an older one that gave height, but not profile, information. The coiled coaxial cable above his head is a delay line designed to act as a calibration unit in improving the accuracy of the system.

Random House to distribute classroom computer items

The Radio Shack division of Tandy Corp has named Random House an authorized distributor for Radio Shack TRS-80 computer products for classroom use. Random House is a large publisher of classroom materials for schools.

The agreement is called by Charles A. Phillips of Radio Shack, "... an important step in Radio Shack's strategy to better address the growing market for microcomputers and instructional software in the schools."

Besides offering Radio Shack's computer products through its educational sales force, Random House is undertaking an extensive development effort to produce software for teaching and administrative applications in schools.

The Radio Shack/Random House arrangement is not exclusive, Mr. Phillips said; at least one other agreement with an educational publisher is being negotiated.

continued on page 12

Facts from Fluke on low-cost DMM's

For a measurement like this, every millivolt matters.

In digital multimeters, accuracy and resolution go hand in hand. After all, an extra millivolt of resolution means nothing unless you can trust its accuracy. For critical measurements like checking avionics, calibrating medical systems, or simply verifying the performance of your circuit, it takes a precision DMM to fill the bill.

The new 4½-digit Fluke 8050A delivers 0.03% basic dc accuracy and 0.005% of full scale resolution. Measure ac and dc voltages with 10 µV of sensitivity. Or resolve 10 nA of current and 10 milliohms of resistance. All guaranteed for one full year.

That's the kind of performance you demand in a

bench/portable DMM. And it's from Fluke, the leader in DMM's with a thirty year reputation for reliable, high-quality precision instrumentation.

Of course, there's more to the 8050A story. With our hybrid True RMS converter you get honest, accurate ac answers to 50 kHz without missing any significant distortion components. A dB function features 16 selectable reference impedances. And the relative mode lets you make offset measurements in all instrument functions.

You'll also find all the other dependable Fluke features on the new 8050A. Conductance for those high resistance and leakage measurements to 100,000 Megohms. Extensive overload protection and safety features. A full line of accessories. And a low price of only \$369 U.S.

For all the facts on the new 8050A's accuracy and reliability, call toll free 800-426-0361; use the coupon below; or contact your Fluke stocking distributor, sales office or representative.



FLUKE

IN THE U.S. AND NON-EUROPEAN COUNTRIES:

John Fluke Mfg. Co., Inc.
P.O. Box C9080, M/S 250C
Everett, WA 98206
(206) 342-6300
Telex: 152662

IN EUROPE:

Fluke (Holland) B.V.
P.O. Box 5063, 5004 EB
Tilburg, The Netherlands
(013) 673 973
Telex: 52237

RE-5/81

- Please send 8050A specifications.
- Please send all the facts on Fluke low-cost DMM's.
- Please have a salesman call.

Name _____

Title _____

Mail Stop _____

Company _____

Address _____

City _____

State _____

Zip _____

Telephone () _____

Ext. _____

For technical data circle no. 39

The future belongs to the creative electronics technician.

NEW FROM NRI. DESIGN TECHNO

Be prepared to grow with the world's biggest growth industry. Enroll now in this exciting career program from the leader in electronics training.

There are a lot of good jobs out there in electronics. But the best jobs go to the people who can think and work creatively. Those who can conceive and design circuits and equipment... those who can initiate ideas and carry them through... those who can turn theoretical concepts into reality. These are the people commanding up to \$18,000 as starting salaries, earning \$30,000 or more with experience and ability. And NRI can help you join their company.

The First Complete Program of Its Kind

Now, for the first time in the history of home study, NRI offers you a new and exciting course in Electronic Design Technology. A course that starts with the fundamentals and builds from there to prepare you for an electronic career where the growth is. You're trained for exciting jobs in the creation of communications equipment, computers, consumer products, anything that needs electronic circuits.

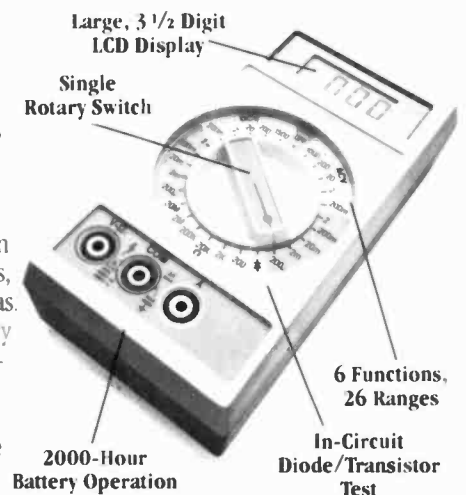
Only NRI gives you such complete and concentrated training in the design of electronic circuits. And you learn at home in your spare time, without quitting your job or wasting time, travel, and gas going to night school. You learn with NRI-developed training methods that combine knowledge with practical experience.



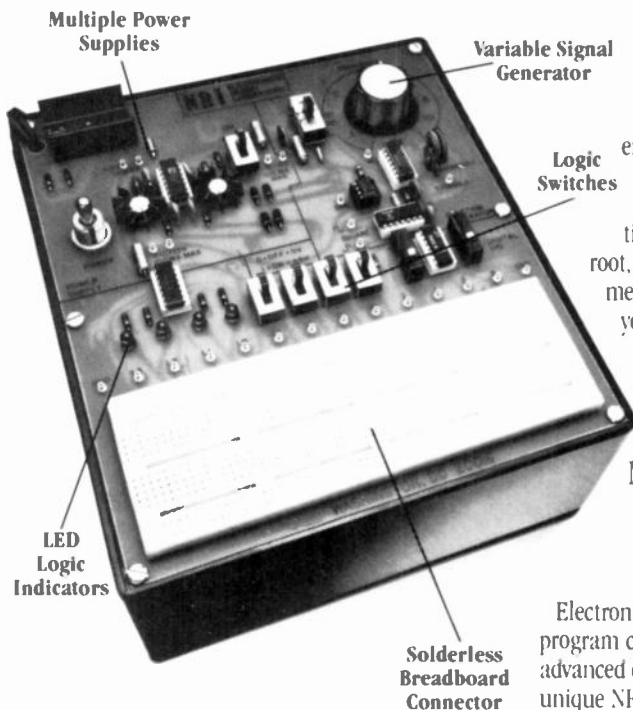
NRI Circuit Designer Gives Hands-On Experience

You learn by doing. No ivory-tower, strictly theoretical course here. You actually design and build modern electronic circuits, run tests, and verify specs. You learn how various systems interact, design your own circuits to perform specific tasks, learn to look for better ways and new ideas.

The NRI Circuit Designer is a totally unique instrument with full breadboarding capability, built-in multiple power supplies and a multi-function signal generator for circuit testing. Fast, simple connections let you build up prototype



ELECTRONIC LOGY TRAINING



circuits, immediately check them out for function or faults. It handles both linear and digital integrated circuits as well as discrete components such as transistors and diodes. Six practical lab units carry you through both the theoretical and practical world of electronic circuit design.

Professional Working Instruments

Your course also includes the choice of the professionals...the 6-function, 26-range Beckman digital multimeter for fast, accurate voltage, current, and resistance measurements. It features accurate LCD readout and full portability. You also get the famous Texas Instruments TI-30 scientific calculator to speed and simplify circuit analysis and design. It's a true

engineering instrument that includes trigonometric functions as well as square root, logarithms, and memory. Together with your Circuit Designer, they work to give you a sound basis of practical experience.

NRI Fast-Track Training

Although the NRI Electronic Design Technology program carries you through advanced electronics, the unique NRI lesson concept simplifies and speeds learning.

Especially written for individual instruction, each lesson covers its subject fully and thoroughly. But extraneous material is eliminated, language is clear and to the point, organization is logical and effective.

You'll start with subjects like Fundamentals of Electronic Circuits, progress rapidly through Circuit Theory to Solid-State Electronics and on to Digital Electronics, Computers, and Microprocessors. Hand in hand with your theory will be practical Design Lab experiments, circuit demonstrations, and test/measurement procedures that make it all come to life.

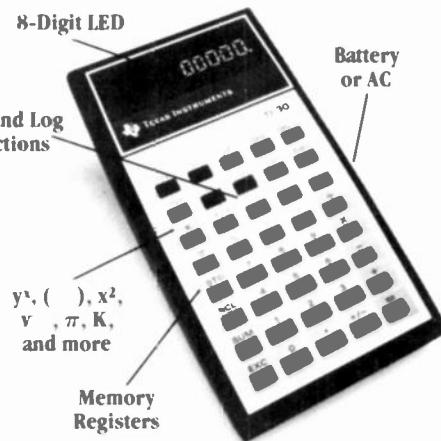
No Experience Necessary

You need absolutely no electronic experience to be successful with this modern course. If you're a high school graduate with some algebra, you should handle it without any trouble. We even include, at no extra charge, the NRI Math Refresher Module, designed to help you

brush up on your math and teach you any new concepts you may need from basic algebra through phasors and circuit analysis.

Free Catalog, No Salesman Will Call

There's so much to tell you about



this exciting new course for the electronic 80's, we can't do it all here. Send the postage-paid card for our free, 100-page catalog with all the facts about this and other NRI electronics courses. We'll rush it right to you without obligation. Look it over and discover for yourself why only NRI can prepare you so well for your future. If card has been removed, please write to us.



NRI SCHOOLS
McGraw-Hill Continuing
Education Center
3939 Wisconsin Ave.
Washington, D.C. 20016

We'll train you for the good jobs.

continued from page 6

Standard & Poor's software for Radio Shack TRS-80

Standard & Poor's, the firm of financial experts best known as publisher of The Wall Street Journal, has prepared a complete stock analysis and portfolio-management package for microcomputer enthusiasts who are also investors.

Available for use on the Radio Shack TRS-80 microcomputer, Standard & Poor's STOCKPAK provides for evaluating and managing a stock portfolio of up to 100 securities, with as many as 30 transactions on each issue. It also makes it possible to analyze 900 New York, American exchange, and over-the-counter common stocks, and generate reports to guide investment decisions.

The STOCKPAK system is designed for use with Radio Shack's Model I or Model III TRS-8032K business-computer systems. It includes four program diskettes and a comprehensive user's manual.

The first program diskette is the Portfolio-Management System, which provides for the maintenance and control of a portfolio, or a simulation capability for any group of securities to be evaluated.

A second diskette contains the Screen and Select System, with which the user can apply a variety of investment criteria to the 900-stock data base, identifying securities to meet such requirements as price/earnings ratios of less than 10, selling below a given price, and more. Stocks selected and

criteria statements can be stored for instant recall.

Diskette three is a Report Writer System which creates reports of stocks meeting user-selected criteria, along with additional information from the data base.

The fourth diskette is a Demo Data Base which contains the 900 common stock data base of the most widely traded stocks and includes 30 financial items on each of the companies.

The STOCKPAK system for the TRS-80 is available from Radio Shack stores and other outlets for \$49.95. A monthly updating of the data base is available from Standard & Poor's, if desired, at an annual subscription fee of \$200.

Computer voice processing to make big jump in '80's

Talking to your computer instead of typing instructions on a terminal, and listening to it instead of reading a printout, will become fairly common in industrial operations and financial transactions during the first half of the 1980's. During the second half, voice processing will come to the forefront in office systems and consumer products. So says an International Business Research Report, issued by Frost & Sullivan Inc. of New York City and London.

Using voice as computer input is not only more appealing because of its "natural-

ness," but saves time by freeing hands and eyes. At present, there are several problems: Vocabulary of most systems is limited—generally they are scheduled to respond to discrete commands, not continuous speech. The vast majority of present systems respond to only one operator, whose speech they have been trained to understand. Independent systems, which recognize the voices of different operators, are rare. (F&S believes that a sufficiently low-cost, large-vocabulary system that can accept continuous speech will be available within the next few years.)

Voice response—the other half of voice processing—is a technique that converts computer-generated digital data into human or synthetic speech, depending on whether the vocabulary has been tape-recorded or electronically synthesized. It has already been used to a limited extent, as in a Simpson-Sears experiment with linkage of telephone customer orders to a computer, military testing of voice-response equipment for instructing flight crews, and a General Motors assembly-line installation. Within a year, Texas Instruments plans to introduce a speech synthesizer with a 2,000-word vocabulary, says Frost & Sullivan.

Foundation gives \$500,000 for computer education

The Foundation for Computer Education, based in Cupertino, CA, has just made its fourth set of awards, amounting to \$150,000, to 26 educational systems. That brings the value of grants given to educational institutions and individuals to \$500,000 since October 1979.

These grants of computer equipment are given for projects intended to improve education through the use of small, low-cost computers. The projects range from basic word-attack skills for kindergarten through third grade, to genetics and molecular biology at the university level.

Some 87 projects have been approved and have received awards of computer equipment. The 87 recipients are eligible for a grand prize—to be given to the institution or individual demonstrating the outstanding example of a program leading to improved education with small computers.

The non-profit organization was chartered as the Apple Education Foundation in 1979, and was joined since by Bell & Howell as a major supporter, and assisted by a number of computer or computer-related firms that donated equipment or services. The systems awarded include Apple II personal computers, Apple being still the principal sponsor of the foundation.

The systems given the educational groups range in value from something over \$2,000 to about \$7,000, the bulk of them between \$4,000 and \$6,000. R-E



STANDARD & POOR'S STOCKPAK system used with a Radio Shack TRS-80 microcomputer.

Now, a mini-scope with the features most wanted by field engineers!

B&K-PRECISION'S new Model 1420 is a good example of what can materialize when a company listens well. This new 15MHz dual-trace mini-scope was designed by B&K-PRECISION engineers from a clean sheet of paper to respond to the special needs of field engineers... a *mini-scope* with *lab-scope* features.

So small in size (4.5"x8.5"x12"), the 1420 easily fits into a standard attache case with plenty of additional storage room for a DMM, tools and accessories. For use in any environment, the 1420 can be powered from an AC line, 10 to 16VDC or an optional internal battery pack. Unlike some competitive mini-scopes, adding a battery pack will not add to the size of the slim 1420.

The rugged 1420 features dual-trace operation and an honest 15MHz response. In addition, its smooth roll-off provides useful response to 20MHz.

An efficient rectangular CRT displays waveforms with high brightness for good readability under all field service conditions.

Too many field-service mini-scopes sacrifice features and performance for compact size, handicapping the field engineer. The new generation 1420 has overcome these problems. In spite of its small size, the 1420 has eighteen sweep

ranges that span from 1 μ S/div. to 0.5S/div. in a 1-2-5 sequence; variable between ranges. Sweep magnification is X10, extending the maximum sweep rate to 100nS/div. For use with computer terminals or video circuits, a video sync separator is built in. For added ease of use, automatic selection of chop and alternate sweep modes is provided, as is front-panel X-Y operation.

The new 1420 mini-scope comes complete with two 10:1/probes and is available *now* from your local B&K-PRECISION distributor. Available options include carrying case and probe pouch.

To receive a free 16-page color brochure describing the 1420 and the complete B&K-PRECISION oscilloscope line, call toll-free, (800) 621-4627 (312) 889-9087 in Illinois.



BK PRECISION DYNASCAN CORPORATION

6460 W. Cortland Street • Chicago, IL 60635 • 312/889-9087

International Sales, 6460 W. Cortland Street, Chicago, IL 60635 • Canadian Sales, Atlas Electronics, Ontario

CIRCLE 46 ON FREE INFORMATION CARD



Model 1420 \$825

REVISIONS
1-28-88
2-28-88
3-28-88
4-28-88
5-28-88
6-28-88
7-28-88
8-28-88
9-28-88
10-28-88
11-28-88
12-28-88
13-28-88
14-28-88
15-28-88
16-28-88
17-28-88
18-28-88
19-28-88
20-28-88
21-28-88
22-28-88
23-28-88
24-28-88
25-28-88
26-28-88
27-28-88
28-28-88
29-28-88
30-28-88
31-28-88
32-28-88
33-28-88
34-28-88
35-28-88
36-28-88
37-28-88
38-28-88
39-28-88
40-28-88
41-28-88
42-28-88
43-28-88
44-28-88
45-28-88
46-28-88
47-28-88
48-28-88
49-28-88
50-28-88
51-28-88
52-28-88
53-28-88
54-28-88
55-28-88
56-28-88
57-28-88
58-28-88
59-28-88
60-28-88
61-28-88
62-28-88
63-28-88
64-28-88
65-28-88
66-28-88
67-28-88
68-28-88
69-28-88
70-28-88
71-28-88
72-28-88
73-28-88
74-28-88
75-28-88
76-28-88
77-28-88
78-28-88
79-28-88
80-28-88
81-28-88
82-28-88
83-28-88
84-28-88
85-28-88
86-28-88
87-28-88
88-28-88
89-28-88
90-28-88
91-28-88
92-28-88
93-28-88
94-28-88
95-28-88
96-28-88
97-28-88
98-28-88
99-28-88
100-28-88

The State Of The Art Moves Ahead

The electronics industry never stands still. Not a single working day passes that engineers and scientists are not busy researching and analyzing in an attempt to advance the state of the art a notch or two. Very often, we are not aware of that massive effort until we see the results brought to the marketplace.

Two recent conferences—the International Electron Devices Meeting held in Washington, DC, and the International Solid-State Circuits Conference held in New York—provided a look at the semiconductor industries' view of where the state of the art is today and where it will be tomorrow (the next few years). Since semiconductors are often viewed as the heart of modern electronics, by watching the advances made in the semiconductor field we begin to realize the advances being made in the industry as a whole.

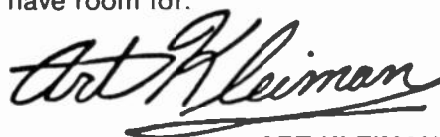
Although many topics were discussed at the conferences, one stands out as a measure of the state of the art. VLSI (Very Large Scale Integration) will be the next generation of IC's to reach us. Those IC's will pack more circuitry into less area, consume less power, and operate faster than ever before. To say the least, those IC's will be very sophisticated and extremely powerful from a designer's point of view.

To produce the new IC's, new fabrication processes are required. Called electron beam and X-ray lithography, the processes produce circuit patterns on the silicon wafers with smaller line widths. Currently, IC's are being produced with line widths of 3 micrometers. Experimental IC's are being fabricated with line widths down to 1 micrometer and industry analysts are predicting line widths down to 0.5 micrometer in the not-too-distant future.

What does that mean in terms of actual IC's? Matsushita has fabricated a 64K static RAM. Packed onto a 5.44 × 5.8 mm chip, this RAM contains over 402,000 components. Both Nippon Telegraph & Telephone and a joint effort by NEC and Toshiba has produced 256K-bit dynamic RAM's. The NEC/Toshiba device uses 1.5-micrometer lines while the NTT device is 20% smaller, using 1-micrometer lines.

On the microprocessor front, Intel has unveiled a three-IC set that comprises a 32-bit micromainframe (that's Intel's word). It's been dubbed a micromainframe because it has the computing power of a mainframe computer and processing power can be increased by adding CPU's without changing software. Intel has also developed a virtual memory capability that permits 1 gigabyte of address space. That's 1000 megabytes. I remember being thrilled when I finally expanded my home computer to 64K of RAM. Speed is also increasing. Zilog plans to introduce two updated versions of their 16-bit CPU, the Z8003 and Z8004, that will run at 10MHz. That would make them the fastest CPU's available.

This should give you a pretty good idea of what is happening behind the scenes and what the future may bring. If you have any comments or predictions, please send them to me and we'll publish as many of the best ones as we have room for.



ART KLEIMAN
Managing Editor

Hugo Gernsback (1884-1967) founder
M. Harvey Gernsback, editor-in-chief
Larry Steckler, CET, publisher
Arthur Kleiman, managing editor
Josef Bernard, K2HUF, technical editor
Carl Laron, WB2SLR, assistant editor
Jack Darr, CET service editor
Leonard Feldman
contributing high-fidelity editor
David Lachenbruch, contributing editor
Karl Savon, semiconductor editor
Herb Friedman, communications editor
Earl "Doc" Savage, K4SDS, hobby editor
Gary H. Arlen, contributing editor
Ruby Yee, production manager
Robert A. W. Lowndes, production associate
Joan Burwick, production assistant
Gabriele Margules, circulation director
Arline R. Fishman,
advertising coordinator

Cover photo by Robert Lewis

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

Gernsback Publications, Inc.
200 Park Ave. S., New York, NY 10003
President: M. Harvey Gernsback
Vice President: Larry Steckler
Secretary/Treasurer: Carol A. Gernsback

ADVERTISING SALES 212-777-6400

Larry Steckler
Publisher

EAST

Stanley Levitan
Radio-Electronics
200 Park Ave. South
New York, NY 10003
212-777-6400

MIDWEST/Texas/Arkansas/Okla.

Ralph Bergen
The Ralph Bergen Co.
540 Frontage Road—Suite 361-A
Northfield, Illinois 60093
312-446-1444

PACIFIC COAST Mountain States

Marvin Green
Radio-Electronics
413 So. La Brea Ave.
Los Angeles, Ca 90036
213-938-0166-7

SOUTHEAST

Paul McGinnis
Paul McGinnis Company
60 East 42nd Street
New York, N.Y. 10017
212-490-1021



Non-Linear Systems' Touch Test 20. The 2 lb. 4 oz. test lab.



The Touch Test 20 DMM weighs only 2 lbs. 4 oz. Yet it puts twenty key test functions at your fingertips. Plus exclusive light pressure touch function selection. Shown from above on leather shoulder sling (optional).

Road test the remarkable Touch Test 20. Now, with its 20 key test functions at your fingertips, (plus the ability to measure 10 electrical parameters and 44 ranges) you can take one lab to the field instead of a cumbersome collection of individual testers.

Another bright idea. The Touch Test 20 is the only DMM with light pressure touch function selection. No more dials to fiddle with. Instead, an LED shows the function you choose. And when you switch, you get an audible bleep and a visual blip to let you know.



Operation's a snap. A light touch chooses the function. An LED shows it.

Functional. Not gimmicky. We believe that in DMM design, form should follow function. For example, it's rare that a DMM is used hand-held. Usually it's placed so the operator's hands are free to manipulate the test leads and the equipment being tested. That's why we developed the Touch Test 20 — to fit where and how it would be used. The result is the

most innovative portable/bench-type multimeter in the industry today.

Small wonder. The Touch Test 20 is designed specifically for mainline electronics measurement and testing. It checks AC and DC voltage, AC and DC current as well as resistance. Analyzes temperature in Celsius and Fahrenheit. Measures conductance and capacitance. It also performs diode/transistor and continuity tests. All with the accuracy that's synonymous with the name Non-Linear Systems.

Shop-proven. Field-proven. The Touch Test 20 is ideal for benchtop use. The large, 0.55-inch LED numbers make it easy to read. And its dial-free, light touch selection system prevents the unit from skittering across the tabletop. Light and versatile, it's the perfect, portable road lab, too.

The Touch Test 20 comes with test leads, temperature probe and resistor/capacitor test adapter. It features automatic polarity and overload indication plus in-circuit test capabilities. The Touch Test 20 is available in two models — rechargeable battery or line operated. All parts and labor are guaranteed for a full year. And each model is available with optional accessories like a leather carrying case with shoulder strap and belt loop, to help you get the job done.

Touch Test 20 at a glance

Measurements

AC Voltage	10 μ V to 750 VRMS, 6 ranges.
DC Voltage	10 μ V to 1000 VDC, 6 ranges.
AC Current	10 μ A to 10 A, 4 ranges.
DC Current	0.01 μ A to 10 A, 7 ranges.
Resistance	10 milli Ω to 20 meg Ω , 7 ranges.
Temperature	-40°C to 150°C, -40°F to 302°F, 2 ranges.
Conductance	0.01 nS to 200 nS (equivalent to 5 megohms to 100,000 megohms) 2 ranges.
Capacitance	1 pF to 200 μ F, 6 ranges.

Tests

Diode	Diode and transistor junctions in conducting and non-conducting directions.
Continuity	Audible signal.

Size

2.9" H x 6.4" W x 7.5" D
(74 mm x 163 mm x 191 mm)

Weight

2 lb. 4 oz. (1.02 kg)

Price

\$467.00 with batteries
\$435.00 without batteries

8 DMMs. One right for you. Non-Linear Systems also offers eight other outstanding digital multimeters. Trim and low-priced, each of our three, three and one-half and four-digit DMMs is a performance and value-packed instrument.

Get the word on us. NLS has been intelligently innovating in the digital instrument industry for nearly three decades. From the introduction of the first digital voltmeter to breakthrough products like the Touch Test 20.

Today we offer a full line of competitively-priced, state-of-the-art equipment. From miniscopes, digital voltmeters, digital panel meters and counters, to frequency meters, logic probes, line-frequency meters and pre-scalers.

Our entire lineup is available now from top electronic distributors throughout the world. Contact your local distributor today.

For further technical information, or the location of your nearest distributors, contact Non-Linear Systems, Inc., 533 Stevens Ave., Solana Beach, CA 92705. Telephone (714) 755-1134. TWX 910-322-1132.



Non-Linear Systems, Inc.

Specialists in the science of staying ahead.

© 1980 Non-Linear Systems, Inc.

See us at the Electronics Distribution Show
at booths E2 and E4 in the Galleria

CIRCLE 41 ON FREE INFORMATION CARD

OTHER SATELLITES ON THE WAY

Two more satellites—carrying up to 612 new transponders—will be in orbit over the U.S. by mid-1985—and that doesn't include the proposed Comsat DBS plan. The quadrupling of satellite facilities will come as a result of the FCC's recent decision to expand its "open skies" policy. As part of the same ruling, the Commission is moving toward a "short-spacing" of birds, permitting them to fly at intervals of about 3° instead of the current 4° apart.

The new birds will be operated by GTE, Hughes Communications, Inc., and Southern Pacific Communications, each of which will launch two new satellites and build a third as a ground spare, ready for launch in case of a problem with the orbiting bird. In addition, companies already in the space game, such as AT&T, RCA Americom, and Western Union will be permitted to put more satellites in orbit.

Overall, the new satellite facilities will cost more than \$2 billion. Many of the birds will be used for video service, although some of the new satellite operators are expected to concentrate on data communications, teleconferencing, and other non-video services.

The FCC hopes to come to a decision this year about spacing of satellite orbits, to avoid interference while making the most efficient use of spectrum space. The FCC is also examining related matters, such as future satellite usage of 12/20-GHz and higher bands.

NEW CABLE PROGRAMMING

The cable-TV industry continues to find itself on the receiving end of new entertainment services—many of them unveiled during the semi-annual industry conventions. At a recent industry gathering, more than half-a-dozen satellite-fed program services were announced, along with several augmentations of current program packages. Many of the new services will be on the bird shortly—with some of them, such as Showtime's expansion to a 24-hours-on-weekends service already in operation.

Culture is the main ingredient in several of the new program packages, including the previously announced CBS Cable service which is due to go on the Westar bird by June. "Alpha," a joint effort by ABC Video Enterprises and Warner Amex Satellite Entertainment, should be underway by the time you read this aboard Satcom I, using the same transponder as WASE's "Nickelodeon." Alpha will feature performing- and visual-arts programs.

Bluebird, another new program service, will offer many shows from British Broadcasting Corp. (the type now seen on public-TV channels) along with other original cultural programs. Bluebird channel is operated by an affiliate of New York's Rockefeller Center and is currently negotiating with several satellite companies for transponder space.

A number of other specialized services via satellite are also in the works. For example, an "adult" movie channel (mostly R-rated, sexploitation movies) is being offered by Satori's "Private Screenings" service from midnight to 6 a.m. aboard Westar. Bravo, another of the culture channels, will introduce an evening newscast at 8 p.m., concentrating on cultural events taking place in selected cities nationwide. Times Mirror Satellite programming will launch a home shopping service, offering catalog-type information and giving cable customers (and other satellite viewers) the opportunity to order merchandise via a special video catalog.

EUROPEAN MOVIES AND TV SHOWS

More European TV programs and movies are taking to the skies over America, thanks to two recent deals by major satellite-program delivery services. Satellite Program Network, which is establishing its second network SPN-II on Westar III Transponder 9, is turning over three hours every night to Telefrance-USA. The shows will run from 9 pm to midnight (eastern time) and include a regular cycle of shows: Sunday, family programs; Monday, French TV shows; Wednesday, "great French films;" Friday "French Life Today" and European TV specials. The other nights will offer reruns of the previous evening's shows. The Telefrance-USA package is dubbed into English and is aimed at the U.S. audience.

On Satcom I Transponder 9, USA network has begun carrying The English Channel, a series of culturally oriented programs which includes documentaries, music, drama and entertainment, much of it produced by British independent TV stations.

Meanwhile many new program suppliers are slipping programs aboard satellites, filling in the gaps between the major program services now carried aloft. For example, "Telehorse" will be beamed daily aboard Westar by Hughes TV network. The shows will be scrambled and will cover races from various Chicago-area racetracks, sent exclusively to Las Vegas betting parlors so gamblers can watch events on which they are wagering. Over on an HBO transponder on Satcom, a few moments in the morning will be turned over each month to a cable-TV industry publisher, who will present information about the business; that will be aimed primarily at cable-TV executives.

GARY H. ARLEN
CONTRIBUTING EDITOR

Here's the easy way to join the microprocessor revolution.

Heathkit/Zenith Self-Study Courses give you a thorough understanding of microprocessor theory and applications. They put you in command of your electronics future.

From TV's and toys to cars and computers, the microprocessor finds its way into our lives. Your future in electronics requires a working knowledge of microprocessors and now there's an easy, low-cost way to get it.

Heathkit/Zenith step-by-step home-study. You learn at your own pace with an illustrated, easy-to-follow text, reinforced by color visuals and audio cassettes. The easy step-by-step format organizes the material into bite-size units. Test questions at the end of each step assure a thorough understanding before proceeding to the next step. Learning has never been easier.

Hands-on programming exercises. You learn by doing, not just reading. Special exercises performed on the Heathkit/Zenith Microprocessor Trainer give you hands-on experience in programming and interfacing. You come away with a complete working command of the microprocessor and how it's used in a growing number of devices today.

Recommended for college credit. Many Heathkit/Zenith Courses are now recommended for college credit by the American Council on Education. If you can't go back to college, now you can bring college home to you.

Free Heathkit Catalog. Details and prices on the complete line of Heathkit/Zenith Self-Study Courses are in the new, free Heathkit Catalog. Send for yours today or pick one up at your nearby Heathkit Electronic Center.

DON'T LET CHANGING TECHNOLOGY PASS YOU BY.

Heathkit/Zenith offers a complete line of home-study courses on the latest in electronic specialties:

Operational Amplifiers	Digital Techniques	AC & DC Electronics
Phase-Locked Loops	Electronic Test Equipment	Electronics for Hobbyists
I.C. Timers	Electronic Circuits	Communications
Active Filters	Semiconductor Devices	



Send for free catalog. Write to Heath Co., Dept. 020-776, Benton Harbor, MI 49022.

In Canada, write Heath Co., 1478 Dundas Street East, Mississauga, Ontario, L4X 2R7.



Visit your Heathkit Store.

Heathkit products are displayed, sold and serviced at 62 Heathkit Electronic Centers in the U.S. and Canada. See your telephone white pages for locations. In the U.S., Heathkit Electronic Centers are units of Veritechnology Electronics Corporation.

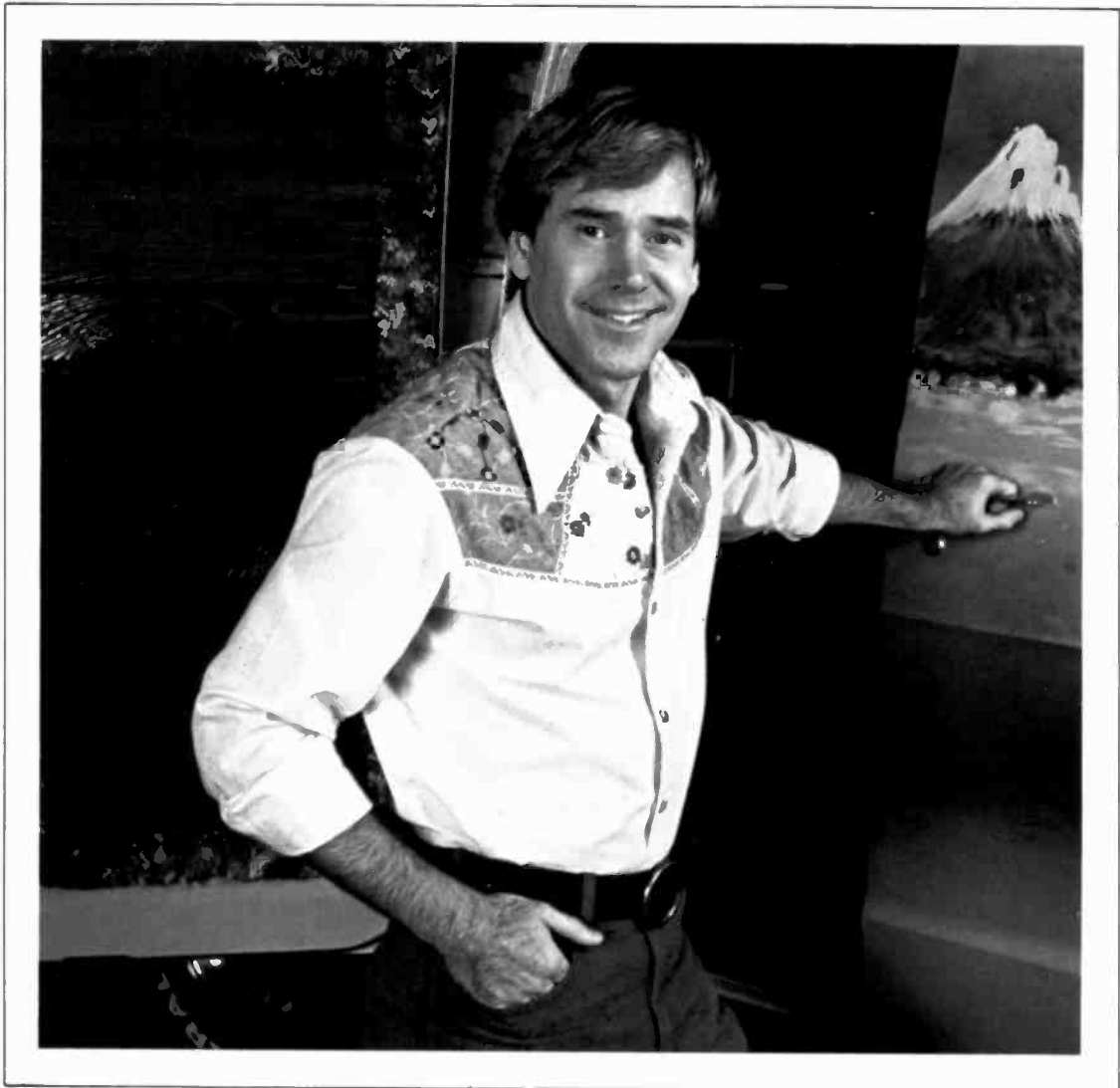
Heathkit



Educational Systems

ED-161

You gotta shop around.



**When you do, you'll probably pick CIE.
You can't afford to settle for
less when it comes to something like
electronics training that could
affect your whole life.**

When you shop around for tires, you look for a bargain. After all, if it's the same brand, better price—why not save money?

Education's different. There's no such thing as "same brand!" No two schools are alike. And, once you've made your choice, the training you get stays with you for the rest of your life.

So, shop around for your training. Not for the bargain. For the best. Thorough, professional training to help give you pride and confidence.

* * *

If you talked to some of our graduates, chances are you'd find a lot of them shopped around for their training. They pretty much knew what was available. And they picked CIE as number one.

Why you should shop around yourself.

We hope you'll shop around. Because, frankly, CIE isn't for everyone.

There are other options for the hobbyist. If you're the ambitious type—with serious career goals in electronics—take a close look at what we've planned for you at CIE.

What you should look for first.

Part of what makes electronics so interesting is it's based on scientific discoveries—on ideas! So the first thing to look for is a program that starts with ideas and builds on them!

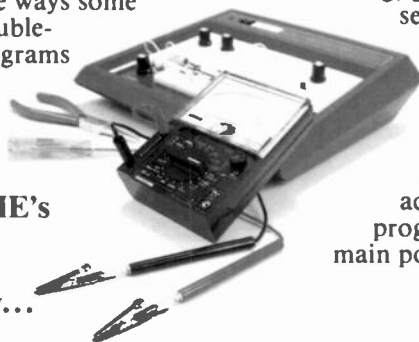
That's what happens with CIE's Auto-Programmed® Lessons. Each lesson takes one or two principles and helps you master them—before you start using them!

How practical is the training?

This is the next big important question. After all, your career will be built on what you can do—and on how well you do it.

Here are ways some of CIE's troubleshooting programs help you get your "hands-on" training...

With CIE's Personal Training Laboratory...



you learn and review the basics—perform dozens of experiments. Plus, you use a 3-in-1 precision Multimeter to learn testing, checking, analyzing!



When you build your own 5 MHz Triggered-Sweep, Solid-State Oscilloscope you take your first real professional step. You use it as a doctor uses an X-ray machine—to "read" waveform patterns... lock them in...study, understand and interpret them!

When you get your Digital Learning Laboratory you'll be into digital theory—essential training today for anyone



who wants to keep pace with the state of the art of electronics in the eighties. With CIE's Digital Lab, you'll be applying in dozens of fascinating ways the theory you've learned. For example, you'll compare analog and digital devices. You'll learn to make binary to decimal conversions and to work with semiconductor devices and circuits. You'll see how digital equipment is vital in today's exciting, growing fields such as security where digital theory provides the brains for space-age alarm and protective devices.

Of course, CIE offers even more advanced training programs, too. But the main point is simply this:

All this training takes effort. But you'll enjoy it. And it's a real plus for a troubleshooting career!

Do you prepare for your FCC License?

Avoid regrets later. Check this out before you enroll in any program.

More than half of CIE's courses prepare you for the government-administered FCC License exam. In continuing surveys, nearly 4 out of 5 CIE graduates who take the exam get their Licenses!

Associate Degree

Now, CIE offers an Associate in Applied Science Degree in Electronics Engineering Technology. In fact, all or most of every CIE Career Course is directly creditable towards the Associate Degree.

Shop around...but send for CIE's free school catalog first!

Mail the card. If it's gone, cut out and mail the coupon. If you prefer to write, mention the name and date of this magazine. We'll send you a copy of CIE's FREE school catalog—plus a complete package of independent home study information! For your convenience, we'll try to have a representative contact you to answer your questions. Mail the card or coupon—or write:

CIE, 1776 East 17th St.,
Cleveland, OH 44114.

CIE Cleveland Institute of Electronics, Inc.

1776 East 17th Street, Cleveland, Ohio 44114

YES... I'm shopping around for the right kind of career training in electronics troubleshooting — and CIE sounds well worth looking into. Please send me my FREE CIE school catalog — including details about the Associate Degree program — plus my FREE package of home study information!

Print Name _____

Address _____ Apt. _____

City _____

State _____ Zip _____

Age _____ Phone _____
(area code)

Check box for G.I. Bill information:
 Veteran Active Duty

Mail today!

RE-12

letters

CABLE TELEVISION

Is cable television a friend or foe? With so many choices of programming—HBO, C-SPAN, BRAVO, ESPN, QUBE, etc.—It would seem imminent that a potential viewer will have a veritable video smorgasbord at his fingertips. But will he? Superficially, it would seem logical that there would be an unlimited variety of "top shelf" entertainment available, 24 hours a day.

Don't bet on it!

In the past, the three major TV networks—ABC, CBS, and NBC—were the only rivals in the vast national telecasting market. With only three suppliers of programming competing for their share of the 140,000,000 TV viewers, a substantial slice of the pie was nearly guaranteed to all. That convenient and powerful system was extremely attractive to advertisers—the only source of income in commercial TV. Coupled with the expertise of the American Research Board (ARB) and the Nielsen ratings system, demographics dictated to the advertisers exactly where their target audience was. It was scientific, lucrative, and efficient. In fact, it was a near-perfect medi-

um in which to expose, sell, and saturate a market.

Advertising on TV is sold on a "cost per thousand" (viewers) basis. The more viewers of a program (and the commercial), the more money is charged per commercial spot run. When 140,000,000 viewers are divided by only three networks, simple arithmetic shows that a higher potential gross income can be realized than when there are 30 or more national "networks" vying for the audience.

It doesn't require a genius to extrapolate in what direction TV programming will go when the audience, and the revenues to produce network programming, is diluted to one-tenth or less of its current standing. To maintain the present quality of programming (and many think that it is already decadent), networks will be forced to increase their "cost per thousand" rates to a point where advertisers will be forced to seek alternative media to reach their targets more effectively.

Ultimately, the demise of networks and their affiliated local-TV-station outlets will become inevitable. Then we will all be

forced to pay top dollars for mediocre programming on a cable system comprised of 30, 40, or 50 channels of second- and third-rate programming.

Our only hope may be that, after a few years of "all-pay TV" someone will come up with the idea of supplying first-rate entertainment free to anyone who can receive a TV signal via wireless techniques, and which will be sponsored by advertisers in exchange for commercial announcements within the programs that they sponsor. *Eureka!* We will have re-invented commercial TV! But will it be too late?

MYLES H. MARKS,

Technical Director WIIC-TV (NBC Affiliate)

Mr. Richard Johnson's comments in the letters department of your February 1981 issue stir me. Perhaps Mr. Johnson is so involved in his work that he can only see the trees and cannot concern himself with the forest. Not being familiar with El Cajon-San Diego TV services, I can't comment on them, but I can comment on the cable TV in Reno. If Teleprompter TV is a "mom & pop" operation, it certainly has expanded.

Your best guide through the solid state jungle...

The new 1981 RCA SK Series Replacement Guide

SK Series
1981
Replacement Guide
• Consumer • Industrial/MRO
Includes State Replacement Recommendations

**Largest Edition Ever—
408 pages**

As I understand it, from the San Francisco Bay area to Iowa it is one system.

But perhaps Mr. Johnson means that the systems in El Cajon, CA, Wellington, NV, and Hawthorne, NV, are "mom and pops" and number three systems, while Teleprompter is only one system.

The January 1981 issue of Saturday Review has another comment: "Can PBS Survive Cable?", by Peter Caranicas. That is a very interesting article. But perhaps again CBS cable is a "mom and pop" operation. Sure.

It is my present personal opinion that Mr. Johnson is so anxious to get the cable-industry view across to the public that he doesn't pay any attention to the facts.

As a viewer of several years, and an electronics hobbyist of some more years, the future is of great concern to me. We have viewed the great variety of TV around the large population centers. And, as at present, we have also been in other locations where only one channel was available. In Reno, three stations broadcast the three networks only, and cable opens up the programming with three more channels—two independent, and PBS. I believe that is a necessary service.

However, what with the increasing costs, I am uncertain about how long it will last. When we first subscribed, the price was under \$5.00 a month; now it is \$7.50, with indications that the company wants more. Fortunately, competition is on the scene, and the price increase has not yet happened—and, strangely, the reception has improved tremendously.

With our economic system the way it is,

perhaps enough viewers will not be able to afford the increasing costs of cable TV, and thus broadcasting will continue.

J.T. KING
Reno, NV

BALLY ARCADE USER GROUP

"The Cursor Group" is the only comprehensive manufacturer-supported user group for the Bally Arcade. We support over 40 affiliated local user groups (with over 8,000 members) and establish new user groups on a regular basis.

The Bally Arcade uses a beefed-up version of Palo Alto Tiny BASIC to include: analog-to-digital conversion, 3-voice music synthesizer, 156 X 128 resolution, with up to 256 colors and complex user-accessible graphics.

We inform our members of many commands and routines available that the manufacturer did not make the user aware of in their documentation, such as: PEEK and POKE, floating-decimal-point math, machine-language bootstrap, 3-voice music, five or more colors on screen at the same time, DMA graphics, voice recognition, adding a full-sized ASCII keyboard, printer, etc.

We make available to our members nine separate manuals that literally decode all the secrets of the Bally Arcade, to include electrical specifications of custom chips, executive software descriptions, etc.

We publish the *only* professionally produced monthly newsletter, containing sophisticated, glitch-free software and programming hints, along with many vital tutorials and hardware projects.

Membership fees range from \$9.75 for six months to \$18.95 for one year. A sample newsletter can be purchased for \$2.00. Those interested should write to The Cursor Group, P.O. Box 266, North Hollywood, CA 91606.

We have upgraded the Bally Arcade from what many publications think of as a toy to a very serious small microcomputer.

THE CURSOR GROUP.
Fred Cornett, President

MODULATION

In the "Letters," department (January 1981), Mr. Davis states: "White is 12.5% carrier level, not zero modulation, which is the blanking level. Maximum modulation (87.5%) occurs at white, not sync, which is +40%."

Much of that statement is incorrect. That is not unusual in articles I have read about TV modulation down through the years. So let's try to set the matter to rest.

In this particular case, I believe we have an IEEE graticule that's causing the confusion. That scale is very useful around a TV studio, and other spots, for measuring levels; and, of course, for transmitter-modulation measurements, if used properly.

When modulating a TV transmitter, it sees only the overall signal, which means the whole composite signal (sync plus video). We cannot speak of +40% sync or minus that. The blanking level is not zero modulation; it is simple zero on the IEEE scale (no relation). Tip of sync is 100% modulation, as Jack Darr stated. Sync is transmitted at 25% and is not 40%. The scale reads 40 *units*—not 40%.

The RCA Replacement Guide tells you how to make over 170,000 solid state replacements using fewer than 1,400 SK and KH types.

Solid state is growing fast. So fast that servicing it puts you in a jungle of brands and unfamiliar components with new and different applications.

The 1981 RCA SK Series Replacement Guide takes you through these uncharted parts with confidence and knowledge.

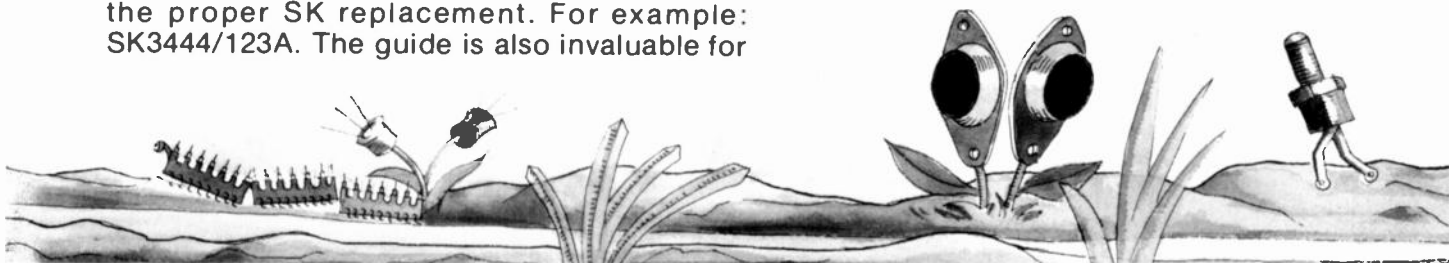
Over 170,000 foreign and domestic replacements are listed in this one handy book. With it, you can find RCA SK replacements for transistors, rectifiers, thyristors, integrated circuits and high-voltage triplers in just seconds.

Clearly indexed and easy to understand, the guide contains 1,382 RCA SK and KH types — including 200 new types for '81. A convenient dual-numbering system helps you quickly find the proper SK replacement. For example: SK3444/123A. The guide is also invaluable for

many industrial applications. Use it to make MRO replacements right from your shelf.

So when you're working in the solid state jungle, get yourself a great guide — the 1981 RCA SK Series Replacement Guide. It definitely leads the way. Pick up your copy now from your RCA SK distributor or send a check or money order for \$2.25 to: RCA Distributor and Special Products Division, P.O. Box 597, Woodbury, N.J. 08096.

RCA SK Replacement Solid State



**ΩMEGA
SALES
CO.**

**"WHOLESALE COMPUTER PRICES"
DIRECT TO THE PUBLIC**

East Coast: 12 Meeting St., Cumberland, RI 02864
West Coast: 3533 Old Conejo Rd, #102,
Thousand Oaks, CA 91320

**PRODUCT SPECIAL
of the MONTH!!**



**Products are
NOW
IN
STOCK
AT
ΩMEGA
SALES
CO.**

Atari 800 16K - \$749
32K - \$849

Atari 850 Interface Module \$159

Atari 825 Printer \$695



Intertec Superbrain
32K Ram \$2449
64K Ram \$2649



Apple II - 16K, 48K
Call for Price



Epson MX-80 \$569

ΩMEGA OFFERS THE BEST DELIVERY AND PRICE ON:

APPLE • ATARI • TRS-80 Model II • INTERTEC •
DIABLO • EPSON • HEWLETT-PACKARD • SOROC •
COMMODORE • NEC • QUME • CENTRONICS

Centronics - Ltd. quan.

730-3 \$ 525
704-9 \$1250
730-1 \$ 525
753 \$1750
703-9 \$1550



NEC spinwriter
5510-5530 - \$2395



Televideo
912 B or C— \$679
920C— \$739



Diablo 630 - \$1995
(with tractor feed) \$2195

ΩMEGA sells only quality merchandise to our customers.

ΩMEGA will try to match any current advertised price with similar purchase conditions. Before you buy anywhere else — be sure to call ΩMEGA Sales Co.

West Coast
1-805-499-3678

East Coast
1-401-722-1027

CALL TOLL FREE FOR ΩMEGA'S PRICE!

East Coast: 1-800-556-7586

Telex: 952106



ΩMEGA ships via UPS, truck, or air. COD's.
Visa, Mastercharge accepted, with no service charge.



The total units on the scale for transmitter measurements must be 160 units—two divisions above 100 units, which appear on the scale. Zero carrier should be set at that point. Zero carrier is displayed, on the scope, by chopping the signal after it is detected from the transmitter, either by a mercury relay or electronic means.

That signal is generally not available to the studio engineer, so he never sees it. That probably causes much of the confusion. If we set the carrier at two divisions above 100, we wind up with a total of 160 divisions; thus, if sync is set at 40 divisions, we end up with 25% sync (measured from zero carrier to tip of sync), which is correct. 100% modulation of video is never reached. It is set by FCC rules. A 12.5% protection area is provided, for two reasons. Firstly, to avoid white-picture saturation, due to characteristic curve distortion; second, to eliminate over-modulation (carrier chatter), which would cause problems with Inter-carrier receivers.

A word about power output may be useful. We must consider video as a subtractive process. As we fill in the white-picture area, our power output decreases. TV and AM transmitters act quite differently. In AM, an average signal does not change the power input (DC input). The output power *does* change, due to the modulation in *added* fashion. But in a TV transmitter, the power output changes in a drastic fashion. The difference here is that the DC input power changes in TV and consequently the output power changes, too. The TV transmitter power is at a maximum *only* with an all-black picture (with sync-only modulated). As we apply video, the power decreases in accordance with the white content of the picture. At all-white picture, the power is minimum. In a typical 50 kW transmitter, the plate current can change from 6 amps to 11 amps using 6800 volts. Quite a power change, eh? Those figures might make a ham operator drool.

C. M. ROGERS.

Valley Center, KS

THE HP-85

With reference to Mr. Gilder's report on the HP-85 in your December 1980 issue: There are a couple of minor errors. Firstly, the beeper can be programmed for both duration and pitch. The standard pack of programs, supplied with each machine, includes a rendition of the *William Tell Overture* using the beeper.

Second, if a binary routine, included with a tape from the user's library, or available in the printer/plotter ROM, is used, the entire graphics image can be stored as a single string. The graphics screen can thus be used for storage, adding 6K to the available memory.

BOB STAINER

Cape St. James., B.C. Canada

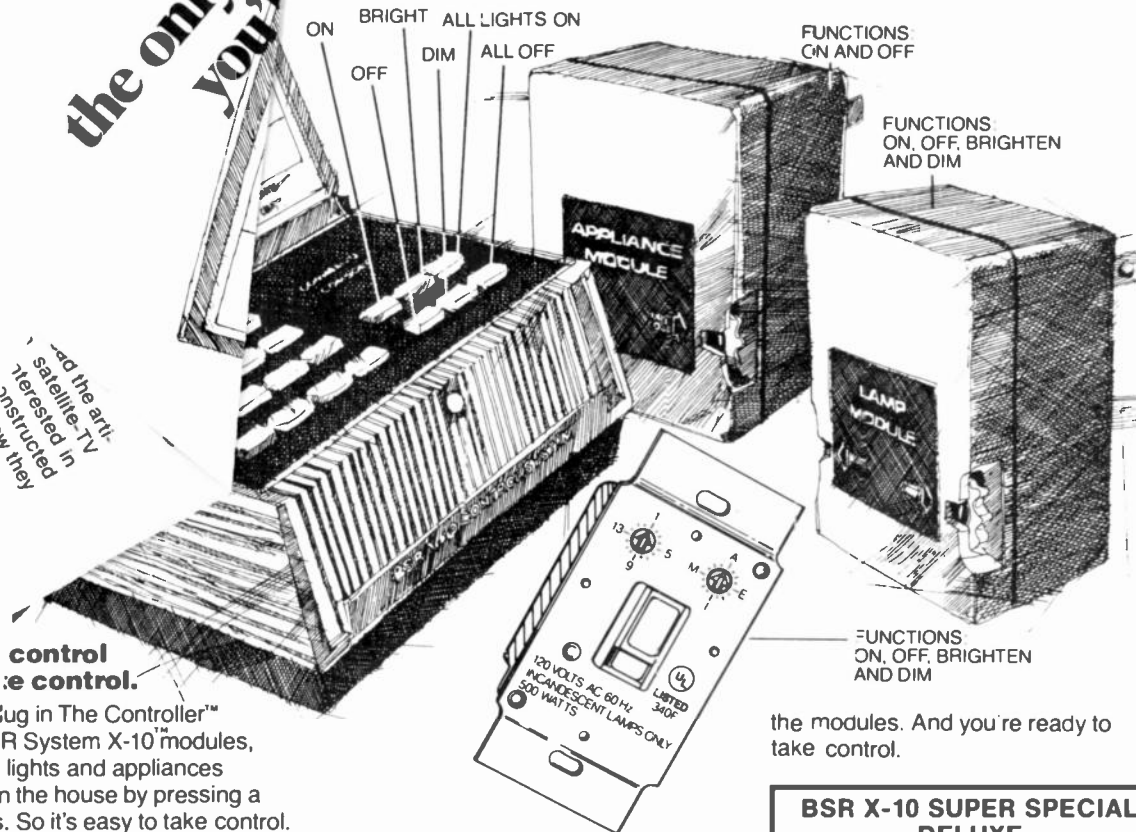
KEEPING AIRWAVES PUBLIC

I was interested in your editorial (December 1980) on keeping the airwaves public; but the fact is, as you know very well, the airwaves haven't all been free to the public for at least the last 50 years. I cite as an example the scrambled telephone messages which have been transmitted on our shortwave bands as far back as the mid '30's. Those messages were—and as far as

continued on page 26

the only "plug-in" remote control system you'll ever need for your home.

Read the article in the satellite TV section. Interested in how they work? Send me more information.



control the control.
 Plug in The Controller™ BSR System X-10™ modules, control lights and appliances in the house by pressing a button. So it's easy to take control.

the modules. And you're ready to take control.

BSR X-10 SUPER SPECIAL DELUXE ULTRASONIC CONSOLE
 REGULARLY \$49.95
NOW \$29.95

With the purchase of three or more modules

Modules normally \$20.00 ea.
 Modules of your choice
 3 or more \$16.95 ea. 6 or more \$14.95 ea.
 Ultrasonic Hand Unit
 Normally \$24.95 Now \$18.95
 Please add \$3.00 for shipping

TOLL FREE HOT LINE
 800-223-0474

THE TIMER™ Automatically Programs Lights, Appliances. Just plug in The Timer and the BSR X-10 modules and you can program up to 8 lights and appliances to go On and Off up to twice a day. UL listed. \$74.95 if purchased separately. If purchased with 3 or more modules \$59.95

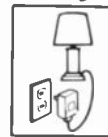
NEW



existing household wiring to the module of your choice. The Lamp Module turns on, off or dims any incandescent lamp up to 300 watts. The Appliance Module turns appliances like TVs, window fans or stereos on and off. And the Wall Switch Module is designed to turn on, off or dim any light or lamp up to 500 watts normally operated by a wall switch.

There's even a Cordless Controller that transmits signals to an Ultrasonic Command Console from up to 30 feet away. So there's plenty of control for everyone.

Simplicity is built into the system.



No special wiring is needed. Simply plug The Controller Command Console into any wall outlet in any room of the house.

Then plug your lamps and appliances into the appropriate modules. Plug in

The Controller is designed to control every room in the house.

By pressing the buttons on the Command Console keyboard, command signals are transmitted over

ADVANCE ELECTRONICS

45 Street, New York, N.Y. 10036 212-687-2224

LETTERS

continued from page 24

I know still are—scrambled for the sake of privacy, but are nonetheless transmitted on our public airwaves.

That, to my way of thinking, is just as wrong as the thing you are complaining about. I have always felt that it wasn't right. Messages broadcast over our "free" airwaves should be available for all to listen to without special "secret" deciphering equipment. Yet, for some reason, I have never seen or heard of any complaints about scrambled broadcasts over the public air waves in any radio magazine.

But something that is of much more concern to me than that is some of the FCC's proposals of butchering up the AM broadcast band even worse than it has already been messed up—like narrowing the bandwidths to 9 kHz and eliminating the so-called clear-channel stations. After all, the original idea was that frequencies between 550 kHz and 1700 kHz were for long-distance communication. Local broadcasting can as well be done at much higher frequencies. But that is not what is being done and as a result the AM band has become so cluttered up with stations that it is only good for local coverage.

That is certainly not in the public interest. On the other hand, I, for one, do not believe that the 70-UHF channels will be used for TV entertainment in years to come—if ever.

JOHN R. SIMPSON
Tampa, FL

EINSTEIN NOT CONTRADICTED

In the January 1981 issue, under "Letters," Mr. Anthony Hans Klotz of Babylon, N.Y., claims that certain rules postulated by Einstein were "never real originally." I'm afraid that he is overlooking a key word in the consequences of the postulates: "observed." The behavior of light (which must be used to make length measurements) causes an *observed* length contraction which is quite real. One might claim that the length contraction in an "absolute" sense does not occur. Such a claim is in itself "unreal" because it could never be verified experimentally.

Mr. Klotz's supposed "charged capacitor contradiction" arises because he applies special relativity considerations to the observed dimensions of the moving charged capacitor but totally ignores the special relativity considerations which must be applied to the electromagnetic fields of the capacitor. (The special theory applies to electromagnetic radiation of *any* frequency, while light is simply electromagnetic radiation within a very narrow band of frequencies that can be perceived by the eye.)

Unfortunately, the editor repeats the ubiquitous misconception that the mass of an object moving at the speed of light would be infinite. The accepted reality is that the *mass does not vary with the speed at all*, it is the *observed momentum* that becomes infinite at the speed of light. No reputable physicist today would consider the mass of an object to increase with its speed. As an authoritative reference, I offer the book, *Classical Mechanics*, by Gold-

stein (published by Addison-Wesley); see the last paragraph of Chapter 6, section 4, entitled "The force and energy equations in relativistic mechanics." There exists a knowledge there that comports with the physics of special relativity. I have written about this in my book, "The Physics of Special Relativity," which is available from Chagrin Falls, OH.

SUGGESTIONS RE

During the past year, I have read many articles on building reception systems. I would be hearing from any readers who have built such systems from your articles, telling me how they turned out.

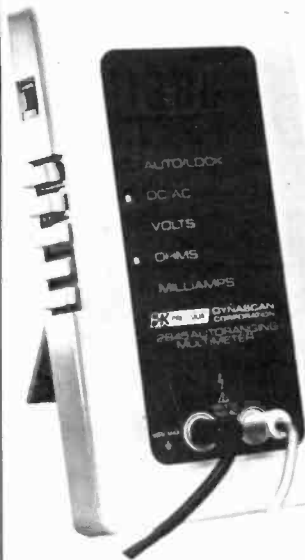
It would be especially nice if someone living in the San Diego area could get in contact with me. An investment of \$1000.00 needs to be investigated before my construction begins. While the electronics end of it doesn't seem bad, I'm worried about the construction of the spherical antenna required, and the amount of time and effort that must be spent to assure the spherical surface.

JOE ST. LUCAS,
8685 Ferndale,
San Diego, CA, 92126

R-E

BK PRECISION

Microcomputer-Controlled Autoranging DMM Model 2845



- Computer stabilized accuracy to 0.1%
- Auto-perfection
Selects range for maximum resolution
- Audible continuity indicator
Built-in audible tone generator
- G-MOV overload protection
Provides AC and DC voltage range protection to 1000 VDC or AC peak
- Shielded in RF fields
Accuracy maintained in RF fields

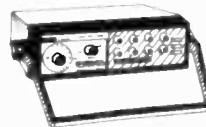
- Long life, high reliability
Four hermetically sealed reed relays perform range switching with virtually no contact wear.
- Microcomputer intelligence
Designed around 4-bit microcomputer. Analyzes stored data and range that provides greatest display resolution. Program memory capacity 1024 x 8 bits of ROM supported by 48 x 4 bits of data memory RAM

... in stock and available for immediate delivery.

Dual Trace 5"
30 MHz Triggered Scope
Model 1479A



Sweep/Function
Generator
Model 3020



Semiconductor
Transistor Tester
Model 520B



Portable Digital
Capacitance Meter
Model 820



Order with Confidence and get the Fordham Advantage!

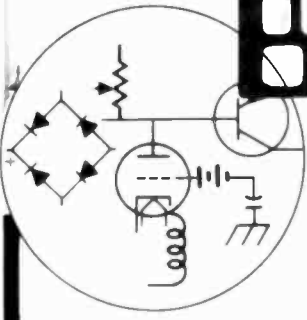
Call for our prices **TOLL FREE**
(800) 645-9518
in N.Y. State call (516) 752-0050

FORDHAM
855 Conklin St. Farmingdale, N.Y. 11735

- Master Charge
- BankAmericard
- VISA
- COD
- Money Order
- Check
- COD's extra

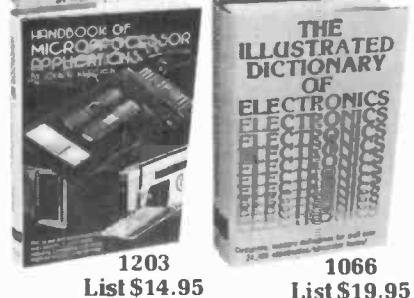
26 RADIO-ELECTRONICS

ELECTRONICS BOOK CLUB



Take 4
exceptional **\$1.00**
books for
(values to \$70.80)

Start saving now for discounts up to 75% on hundreds of interesting, info-packed volumes . . . PLUS special Members' Bonus Benefits!



More books to pick from . . .

- How to Make Home Electricity From Wind, Water and Sunshine. List \$10.95. No. 1128
- 99 Test Equipment Projects You Can Build. List \$12.95. No. 805
- Radio Astronomy for the Amateur. List \$8.95. No. 714
- Tower's International Op Amp Linear-IC Selector. List \$12.95. No. 1216
- 303 Dynamic Electronic Circuits. List \$9.95. No. 1060
- The Master IC Cookbook. List \$16.95. No. 1199
- How to Design & Build Your Own Custom TV Games. List \$14.95. No. 1101
- Modern Digital Communications. List \$10.95. No. 955

7 very good reasons to try Electronics Book Club . . .

- **Reduced Member Prices.** Save up to 75% on books sure to increase your know-how
- **Satisfaction Guaranteed.** All books returnable within 10 days without obligation
- **Club News Bulletins.** All about current selections—mains, alternates, extras—plus bonus offers. Comes 14 times a year with dozens of up-to-the-minute titles you can pick from
- **"Automatic Order".** Do nothing and the Main selection will be shipped to you automatically! But . . . if you want an Alternate selection—or no books at all—we'll follow the instructions you give on the reply from provided with every News Bulletin
- **Continuing Benefits.** Get a Dividend Certificate with every book purchased after fulfilling Membership obligation, and qualify for discounts on many other volumes
- **Bonus Specials.** Take advantage of sales, events, and added-value promotions
- **Exceptional Quality.** All books are first-rate publisher's editions, filled with useful, up-to-the-minute info

ELECTRONICS BOOK CLUB Blue Ridge Summit, PA 17214

Please accept my Membership in Electronics Book Club and send the 4 volumes circled below. I understand the cost of the books selected is \$1.00 (plus shipping/handling). If not satisfied, I may return the books within ten days without obligation and have my Membership cancelled. I agree to purchase 4 or more books at reduced Club prices during the next 12 months, and may resign any time thereafter.

714 805 955 1060 1062 1066 1101 1120
1123 1128 1160 1186 1199 1203 1209 1216
1221 1225 1236 1245 1248 1250 1261 1339

Name _____ Phone _____
Address _____
City _____
State _____ Zip _____
(Valid for new members only Foreign and Canada add 20%.)

EQUIPMENT AND TRAINING NO OTHER SCHOOL CAN MATCH.

**NTS HOME TRAINING INVITES YOU TO EXPLORE MICROCOMPUTERS,
DIGITAL SYSTEMS AND MORE, WITH STATE-OF-THE-ART EQUIPMENT
YOU ASSEMBLE AND KEEP**

Without question, microcomputers are the state of the art in electronics. And NTS is the only home study school that enables you to train for this booming field by working with your own production-model microcomputer.

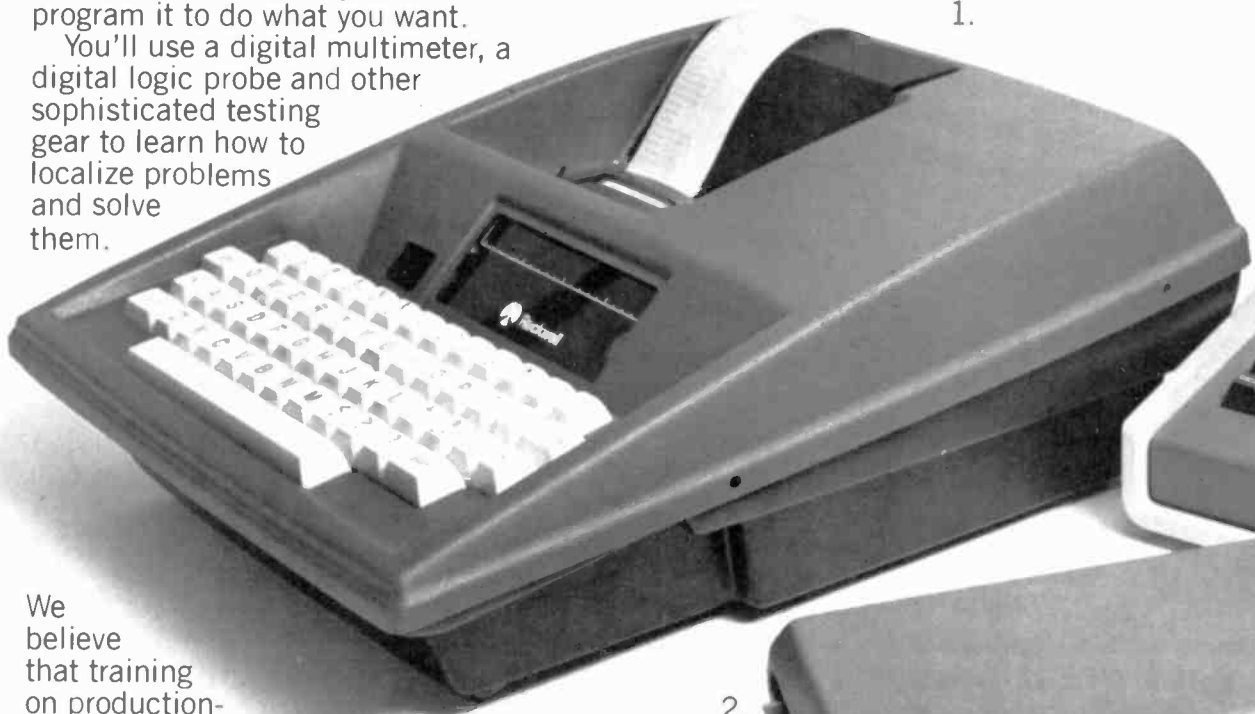
We'll explain the principles of troubleshooting and testing your microcomputer and, best of all, we'll show you how to program it to do what you want.

You'll use a digital multimeter, a digital logic probe and other sophisticated testing gear to learn how to localize problems and solve them.

Send for the full color catalog in the electronics area of your choice—discover *all* the advantages of home study with NTS!

NTS also offers courses in Auto Mechanics, Air Conditioning and Home Appliances. Check card for more information.

1.



2.



We believe that training on production-model equipment, rather than home-made learning devices, makes home study more exciting and relevant. That's why you'll find such gear in most of NTS's electronics programs.

For instance; to learn Color TV Servicing you'll build and keep the 25-inch (diagonal) NTS/HEATH digital color TV.

In Communications Electronics you'll be able to assemble and keep your own NTS/HEATH 2-meter FM transceiver, plus test equipment.

But no matter which program you choose, NTS's Project Method of instruction helps you quickly to acquire practical know-how.



Simulated TV Reception

4.



3.

1. The NTS/Rockwell AIM 65 Microcomputer A single board unit with on-board 20 column alphanumeric printer and 20 character display. A 6502-based unit 4K RAM, expandable.
2. The NTS/KIM-1 Microcomputer A single board unit with 6 digit LED display and on-board 24 key hexadecimal calculator-type keyboard. A 6502 based microcomputer with 1K RAM, expandable.
3. The NTS/HEATH H-89 Microcomputer features floppy disk storage, "smart" video terminal, two Z80 micro-processors, 16K RAM memory, expandable to 48K.
4. The NTS/HEATH GR-2001 Digital Color TV (25" diagonal) features specialized AGC-SYNC muting, filtered color and new solid-state high voltage tripler rectifier.

NTS NATIONAL TECHNICAL SCHOOLS

TECHNICAL TRADE TRAINING SINCE 1955
Resident and Home Study Schools
4000 SO. FIGUEROA ST., LOS ANGELES, CA. 90037

NTS Training Programs
in Consumer and
Industrial Electronics



NATIONAL TECHNICAL SCHOOLS

4000 South Figueroa Street, Dept. 206-051
Los Angeles, California 90037

Please rush FREE color catalog on course checked below

- | | |
|---|---|
| <input type="checkbox"/> MicroComputers/MicroProcessors | <input type="checkbox"/> Auto Mechanics |
| <input type="checkbox"/> Communications Electronics | <input type="checkbox"/> Air Conditioning |
| <input type="checkbox"/> Digital Electronics | <input type="checkbox"/> Home Appliances |
| <input type="checkbox"/> Industrial Technology | <input type="checkbox"/> Color TV Servicing |

Name _____ Age _____

Address _____

Apt. _____ City _____

State _____ Zip _____

- Check if interested in G.I. information.
 Check if interested ONLY in classroom training in Los Angeles.

equipment reports

Global Specialties 2001 Function Generator



CIRCLE 101 ON FREE INFORMATION CARD

GLOBAL SPECIALTIES CORPORATION (70 Fulton Terrace, New Haven, CT 06509) has introduced the *model 2001* function generator. This versatile instrument produces four different output waveforms: a sine wave, a square wave, a triangle wave and a TTL-level square wave. The *model 2001* covers frequencies from 1.0 Hz to 100 kHz in five overlapping pushbutton-selectable ranges. A vernier dial is calibrated from 0.1 to 1.0. The frequency of the output waveform is the dial measurement multiplied by whatever range pushbutton is selected (10 Hz, 100 Hz, 1 kHz, 10 kHz, or 100 kHz). For example, dial 0.5 and push the 1-

kHz button and you get 500 Hz. The dial is accurate to within $\pm 5\%$ of the setting.

A variable output-level control is used to control the level at two output jacks marked HI and LO. The high output delivers from 0.1 to 10.0 volts P-P (or more than 40 dB) into 600 ohms. The low output is -40 dB down, or from 1–100 millivolts into an open circuit or 0.5 to 50 millivolts into 600 ohms. The *model 2001* holds the output constant within 0.5 dB over its entire frequency range.

The TTL squarewave output is at the dial frequency and capable of driving up to 10 TTL loads with risetimes and falltimes of less than 25 nanoseconds. The amplitude is 0 or 5 volts, and is not adjustable by the level control. The TTL signal is always in phase with the other outputs (other outputs can be used simultaneously).

The sine wave output has less than 2% distortion. The triangle waveform is within a $\pm 1\%$ linearity error; the square wave has risetimes and falltimes of less than 100 nanoseconds. All those outputs can be swept over any desired frequency band. An AC voltage of up to ± 10 volts can be fed into the SWEEP IN jacks. That can be used to check the frequency response of

a filter, for example. The manufacturer recommends using a triangle wave and driving the scope's horizontal sweep with the same type of wave. Since the triangle wave is linear with time, the scope shows a linear display of the frequency-response characteristics of the filter. Any peaks, regeneration, lack of symmetry, or other faults will show up instantly.

The operator's manual contains full instructions for this. To show the response of a 5-kHz bandpass filter for example, set the frequency dial at 0.55 and press the 10-kHz range pushbutton. Setting the sweep voltage at 9.7 volts (P-P) will cause the *model 2001* to sweep from 1 kHz to 10 kHz.

If an offset signal-voltage is needed (one that is not symmetrical about zero), press the DC OFFSET pushbutton. The LEVEL control now becomes an offset control. For instance, you can create a square wave that goes from 0 volt to +5 volts, or from 0 volt to -5 volts. If the scope is set to DC input, that also varies the position of the trace on the screen.

An instrument like this one can be very helpful in all kinds of audio testing. The triangle waveform, for example, is ideal for locating

continued on page 34



RCA Receiving Tubes for one-trip servicing.

Most callbacks aren't caused by bad servicing. Components are the reason.

That's why you need receiving tubes you can trust, dependable receiving tubes from RCA. We offer over 1,000 types – all produced to exacting specifications.

For miniatures, Novars, Compactrons, Nuvistors, Glass Tubes, Metal Tubes and more, count on your RCA Distributor. He's got the tubes that help you finish the job in just one trip.

Increase your profits with RCA service aids and sales promotion aids.

See your local RCA Tube Distributor for RCA's technical guides, service tools and tube caddies. They all make your service work faster and easier while RCA's in-store signs and eye-catching displays promote your business professionally.

RCA Receiving
Tubes



RCA Distributor & Special Products Division,
Deptford, N.J. 08096

Yesterday you could admire all-band digital tuning in a short wave receiver.* Today you can afford it.



RF-4900

Tune in the Panasonic Command Series™ top-of-the-line RF-4900. Everything you want in short wave at a surprisingly affordable price. Like fluorescent all-band readout with a five-digit frequency display. It's so accurate (within 1 kHz, to be exact), you can tune in a station even before it's broadcasting. And with the RF-4900's eight short wave bands, you can choose any broadcast between 1.6 and 31 MHz. That's all short wave bands. That's Panasonic.

And what you see on the outside is just a small part of what Panasonic gives you inside. There's a double superheterodyne system for sharp reception stability and selectivity as well as image rejection. An input-tuned RF amplifier with a 3-ganged variable tuning capacitor for excellent sensitivity and frequency linearity. Ladder-type ceramic filters to reduce frequency interference. And even an antenna trimmer that changes the front-end capacitance for reception of weak broadcast signals.

To help you control all that sophisticated circuitry, Panasonic's RF-4900 gives you all these sophisticated controls. Like an all-gear-drive

tuning control to prevent "backlash." Separate wide/narrow bandwidth selectors for crisp reception even in crowded conditions. Adjustable calibration for easy tuning to exact frequencies. A BFO pitch control.

RF-gain control for improved reception in strong signal areas. An ANL switch. Even separate bass and treble controls.

And if all that short wave isn't enough. There's more. Like SSB (single sideband) amateur radio. All 40 CB channels. Ship to shore. Even Morse communications. AC/DC operation. And with

Panasonic's 4" full-range speaker, the big sound of AM and FM will really sound big. There's also the Panasonic RF-2900. It has most of the features of the RF-4900, but it costs a lot less.

The Command Series from Panasonic. If you had short wave receivers as good. You wouldn't still be reading. You'd be listening.

*Short wave reception will vary with antenna, weather conditions, operator's geographic location and other factors. An outside antenna may be required for maximum short wave reception.



RF-2900

Panasonic
just slightly ahead of our time.

clipping in any stage from input to output. You can detect the slightest clipping tendency by noting the flattening of the triangle wave's sharp peaks. Nonlinearity shows up instantly as a curvature of the rising and falling ramps. Faults such as these show up very easily with these tests.

The instruction manual details all modes of operation and shows control settings, waveforms, and a handy chart showing the scope patterns produced by many typical defects. Full calibration data is in the back of the book, if needed. The *model 2001* is a handy instrument with many possible uses. It sells for \$186.00. **R-E**



WITH THE AVAILABILITY OF LOW-COST MICROPROCESSOR IC'S it was just a matter of time before they would be used in electronic test equipment. One of the most recent additions to

the field is the *model DVM56* Microranger from Sencore (3200 Sencore Dr., Sioux Falls, SD 57107). According to the company's service manual the *model DVM56* was designed to free the technician or engineer from the need to switch ranges manually, interpolate readings, or have to figure out where the decimal point should be, making servicing faster. The *model DVM56* does all of those things automatically.

Physically, the *model DVM56* is somewhat large as compared to more conventional DMM's. The unit measures 4 X 8 X 11 1/2 inches. The front panel measures approximately 4 X 8 inches. The unit is solidly built and its large size gives you an idea of the amount of circuitry packed inside the cabinet.

The *model DVM56* measures AC and DC current up to two amperes. Resistance measurements from 0.01 ohm to 99.99 megohms can be made in either the high- or low-power mode. The low-power mode is used for in-circuit testing of solid-state devices as there is insufficient voltage to forward-bias a junction. AC voltage is measured in three modes over three ranges: peak-to-peak (two kilovolts maximum), average RMS, and true RMS (.0001 mV to 999.9 volts for both RMS modes). DC-voltage measurements up to 10 kilovolts are possible with the *model TP222* 10-kilovolt probe (included). Without the probe, DC voltages from 0.1 mV to 1.999 kilovolts can be measured.

There are two decibel ranges. The dBm range uses the standard reference of 1 milliwatt into 600 ohms (0.7746 volts RMS). If any other reference is desired, the dBp range is used. To "program" a reference into the *model DVM56*, simply press the OHMS & dBp ZERO button while measuring the reference. All further dB readings will be referenced to the programmed reading.

Another feature is the ability to select the resolution for a particular application. By pressing one of the three pushbuttons on the front panel, the user can select 3-digit, 4-digit, or 4 1/2-digit resolution. As the instruction booklet points out, the 4 1/2-digit readout will most likely be most important when using the *DVM56* in calibrating procedures. For most applications, 3 digits will suffice. Certainly, 4 digits exceed the capabilities of most DMM's.

There is also a RANGE HOLD button. Since the *model DVM56* will actually switch through as many as three basic ranges of voltages, it will be useful to be able to perform multiple measurements using the same range. For instance, if you are servicing a piece of electronic equipment where all the voltages will be in the kilovolt range, there seems to be little reason to allow the *model DVM56* to start off in the MILLIVOLT range, autorange to the VOLT range, and finally up to the KILOVOLT range. When you want to use one range, a press of the RANGE HOLD button while a reading is displayed, will keep the meter in that range until you want to use the autoranging feature again. That feature works the same way for all functions (voltage, resistance & current).

Another unusual feature is PEAK & NULL. As most technicians and engineers are already aware, DMM's are unable to take the place of analog meters when it comes to adjusting traps or tuned circuits where an exact minimum or maximum reading is needed. This feature will do a fantastic job of such peaking or nulling. Two small LED indicators (labeled with + and - signs and direction indicators) on the front panel are used to indicate a peak or null.

continued on page 36

Hear there and everywhere.



Easy tuning, digital display, professional quality R-1000

The R-1000 is an amazingly easy-to-operate, high-performance, communications receiver, covering 200 kHz to 30 MHz in 30 bands. This PLL synthesized receiver features a digital frequency display and analog dial, plus a quartz digital clock and timer.

R-1000 FEATURES:

- Covers 200 kHz to 30 MHz continuously.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock with timer to turn on radio for scheduled listening or control a recorder through remote terminal.
- Step attenuator to prevent overload.
- Terminal for external tape recorder.
- Tone control.
- Built-in 4-inch speaker.

- Three IF filters for optimum AM, SSB, CW. 12-kHz and 6-kHz (adaptable to 6-kHz and 2.7-kHz) for AM wide and narrow, and 2.7-kHz filter for high-quality SSB (USB and LSB) and CW reception.
- Dimmer switch to control intensity of S-meter and other panel lights and digital display.
- Effective noise blanker.
- Wire antenna terminals for 200 kHz to 2 MHz and 2 MHz to 30 MHz. Coax terminal for 2 MHz to 30 MHz.
- Voltage selector for 100, 120, 220, and 240 VAC. Also adaptable to operate on 13.8 VDC with optional DCK-1 kit.

OPTIONAL ACCESSORIES:

- SP-100 matching external speaker.
- HS-5 and HS-4 headphones.
- DCK-1 modification kit for 12-VDC operation.



KENWOOD

TRIO-KENWOOD COMMUNICATIONS INC.
1111 WEST WALNUT / COMPTON, CA 90220

CIRCLE 42 ON FREE INFORMATION CARD

NOW SONY TEACHES YOU THE THEORY BEHIND VIDEO COLOR SYSTEMS AT THE TOUCH OF A BUTTON.

It's a whole new way of getting an education in color video technology—Sony-style.

The classroom is home or shop. The seat—your most comfortable. The hours—your own. The method—five videocassettes and five accompanying booklets that make up a complete, self-paced learning program. With Sony teaching.

Called "Color Systems," this second course in Sony's Video Fundamental Series is designed for those who require a thorough background in all aspects of color theory as it applies to the video industry today.

You'll see clear demonstrations that unravel the mysteries of color circuitry—from cameras to CRT's. You will learn about the equipment and signals used for testing, plus useful techniques for troubleshooting color video systems. Each cassette comes with its own study booklet, whose self-review questions show you when you're on top of the material and ready to move on.

You can order a preview tape, individual tapes on a specific subject or the entire Color Systems course in Betamax or U-matic format.

Course Contents: 1. Properties of Color. 2. Color Camera Systems. 3. Video Display Systems. 4. Encoding NTSC Color. 5. Decoding NTSC Color.

Whether you own, sell or service video equipment, or have an overall electronics background, "Color Systems" will make you thoroughly at home in the world of color video technology.



SONY COLOR SYSTEMS COURSE

I'm interested in learning color video technology. Please send me:

COLOR SYSTEMS SERIES—COMPLETE

(5 cassettes/booklets, customized album and binder supplied)

Betamax 1 hr. 2 hr. \$295.00
Regular Price \$330.00
 ¾" U-matic \$355.00
Regular Price \$405.00

INDIVIDUAL LESSONS

(Price per cassette/booklet)

Betamax 1 hr. 2 hr. \$66.00
 ¾" U-matic \$81.00

Circle lesson # and indicate quantity desired in space provided.

1 ____ 2 ____ 3 ____ 4 ____ 5 ____

PREVIEW TAPE

Betamax 1 hr. 2 hr. \$12.50
 U-matic \$28.00

Add appropriate sales tax and \$1.75 per cassette (\$8.75 for complete course) for handling and shipping. (UPS in continental U.S. If outside, add \$30.00 for Export Charges, plus Collect Freight Charges; special handling is extra.) For phone orders, call (213) 537-4300, x331, or visit your local SONY Video Products Dealer.

We honor VISA and MasterCard via phone or mail.

Name _____

Address _____

City _____ State _____

Zip Code _____ Phone # _____

VISA/MasterCard Number _____ Exp. Date _____

Signature _____

Mail to: Sony Video Products Company, Tape Production Services, 700 W. Artesia Blvd., Compton, California 90220.

Please send additional information.

NOTE: Tapes returnable if defective when received. Please allow two weeks for delivery.

SONY
Video Communications

Sony, Betamax and U-matic are registered trademarks of the Sony Corp.

CIRCLE 31 ON FREE INFORMATION CARD



EQUIPMENT REPORTS

continued from page 34

In use, the operator selects the desired function, depresses the PEAK & NULL button, connects the test leads to the circuit to be adjusted, and watches the two red lamps on the panel. When both lamps glow (and one or the other of them goes out when you adjust the coil or other device) the circuit is in perfect adjustment. The markings indicate which way you must adjust to obtain a peak or null.

Large (0.5-inch) LED's are used in the display and are easy to read at a distance. A bail-type handle also serves as a handy tilt stand for bench use, and the construction of the cabinet is rugged enough to withstand hard useage.

Front-panel banana jacks let you use any test

leads you may already own. Three high-quality leads are supplied. Two of the leads (black and red) have alligator-clip terminations, while the third (red) has a probe.

As already mentioned, the unit comes with a 10-kilovolt transient-protector probe (model TP222). The probe allows the model DVM56 to make DC-voltage measurements up to 10 kilovolts. Sencore recommends that the probe be used whenever DC voltage measurements are made, as it increases the meter's input impedance, resulting in less circuit loading. That means, of course, a more accurate reading. The isolation resistor in the probe also tends to decouple the leads from the circuit, and that results in less capacitive loading.

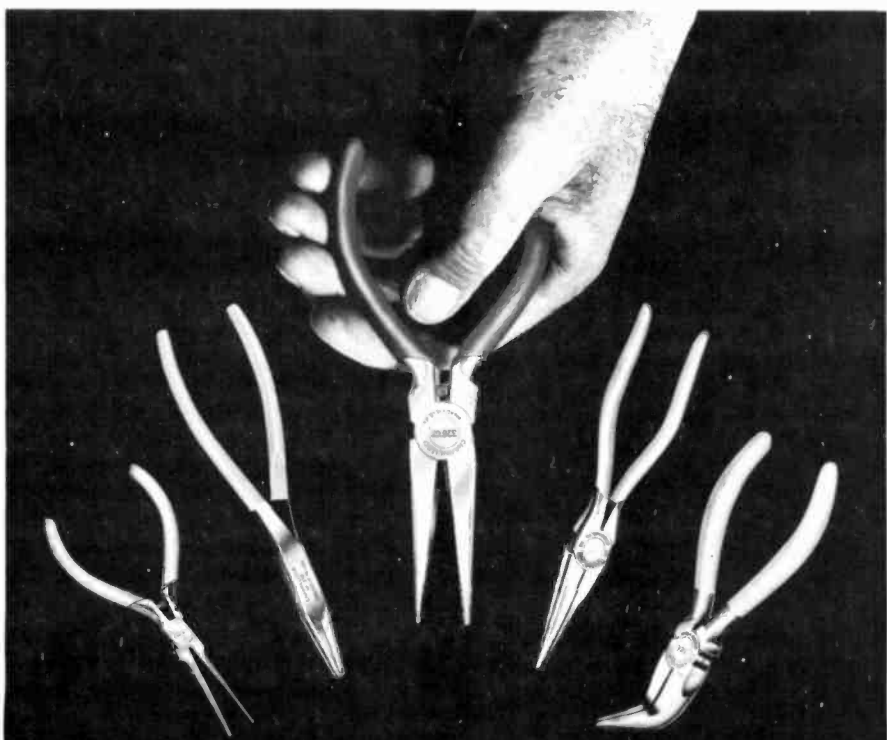
Although readings obtained using the probe were good, there were some drawbacks. In use, the probe, which is five inches long, is slipped

onto the end of the standard probe, which is also five inches long. That results in a rather clumsy, 10-inch-long test probe. Additionally, the probe must be removed for all ranges other than DC VOLTS.

The model DVM56's case has feet for stability when used on a flat surface. Other case features include a provision for cord storage, a clip for the 10-kilovolt probe, and a spare-fuse compartment. There is also a 15-volt accessory jack for use with the optional LA220 AC amplifier. A slide-out chart at the bottom edge of the case (just under the front panel) has complete instructions for using the unit.

One of the few problems noted in use is the delay in obtaining readings once the test probes have been attached to the circuit. The instructions list the "thinking time" for the microprocessor as two seconds, maximum. However, you will have to get used to that delay first, as most good technicians place a probe on a connection and look at the meter with the expectation of seeing a reading immediately. The two seconds may seem like an eternity to a fast technician. The delay is shortened when using the RANGE HOLD function, as the unit will not have to cycle through the ranges. However, it seems as though the time is lengthened when using the TP222 probe. When you consider that you would have to reach up and change the ranges of a normal meter, perhaps the wait is justified. To be sure, you can get used to it.

The model DVM56 sells for \$795. R-E



Sometimes It Pays To Have Nosey Friends

... friends that give you a firm grip on fine work in tight places. That make it easy to reach the hard to reach. Long nose pliers by CHANNELLOCK. Slender, perfectly mated jaws with no side wobble. Sharp, hand honed cutters. Beautiful high polished finish. Blue dipped plastic comfort grips. Quality in every detail (at no premium in price). CHANNELLOCK. Be sure that name is on the pliers YOU buy.

CHAN NEL LOCK

CHANNELLOCK, INC. • Meadville, Pennsylvania 16335

Meet The Rest Of The Family. Send For Free Catalog.

Alliance Model HD-73 Heavy-Duty Antenna Rotator



CIRCLE 103 ON FREE INFORMATION CARD

ALLIANCE, MANUFACTURER OF THE FAMOUS Tenna-Rotor TV antenna rotators since the early 1950's, has released a heavy-duty antenna rotator designed for amateur and CB use. The model HD-73 comes well packaged with a control unit, a rotator motor, accessory hardware, and a manual. The six-conductor cable required for installation is not included.

Before purchasing any rotator, you should determine whether it will be adequate for your antenna. Wind loading and vertical-weight bearing are probably the two most important considerations. Because the rotator is affixed to the uppermost part of the antenna mast or tower, an additional vertical support is required to attach the antenna to the rotator. The longer that vertical support is, the greater the stress on the rotator because of leverage from

continued on page 38

CIRCLE 20 ON FREE INFORMATION CARD

We gave solderless breadboarding a new name.

Proto-Board® breadboards, by Global Specialties. The leading name in solderless breadboarding.

You find them wherever electronics is important. From labs to production lines to classrooms to home workshop benches. Their name, synonymous with solderless breadboarding. And for good reason.

Proto-Board breadboards introduced engineers, technicians and hobbyists to a new way

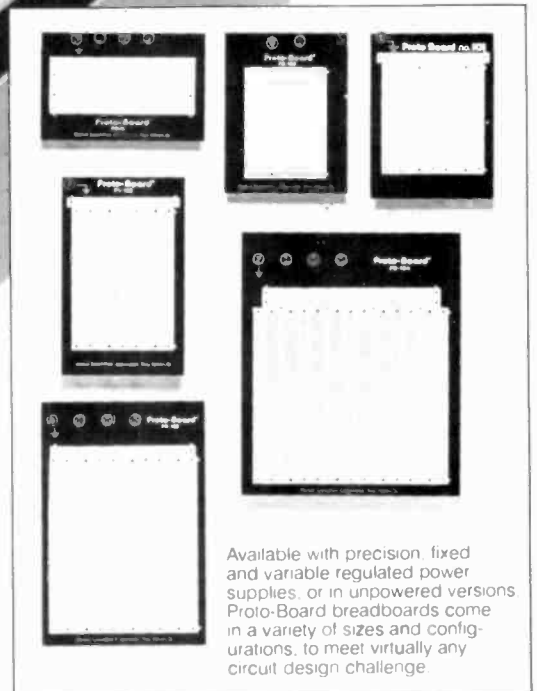
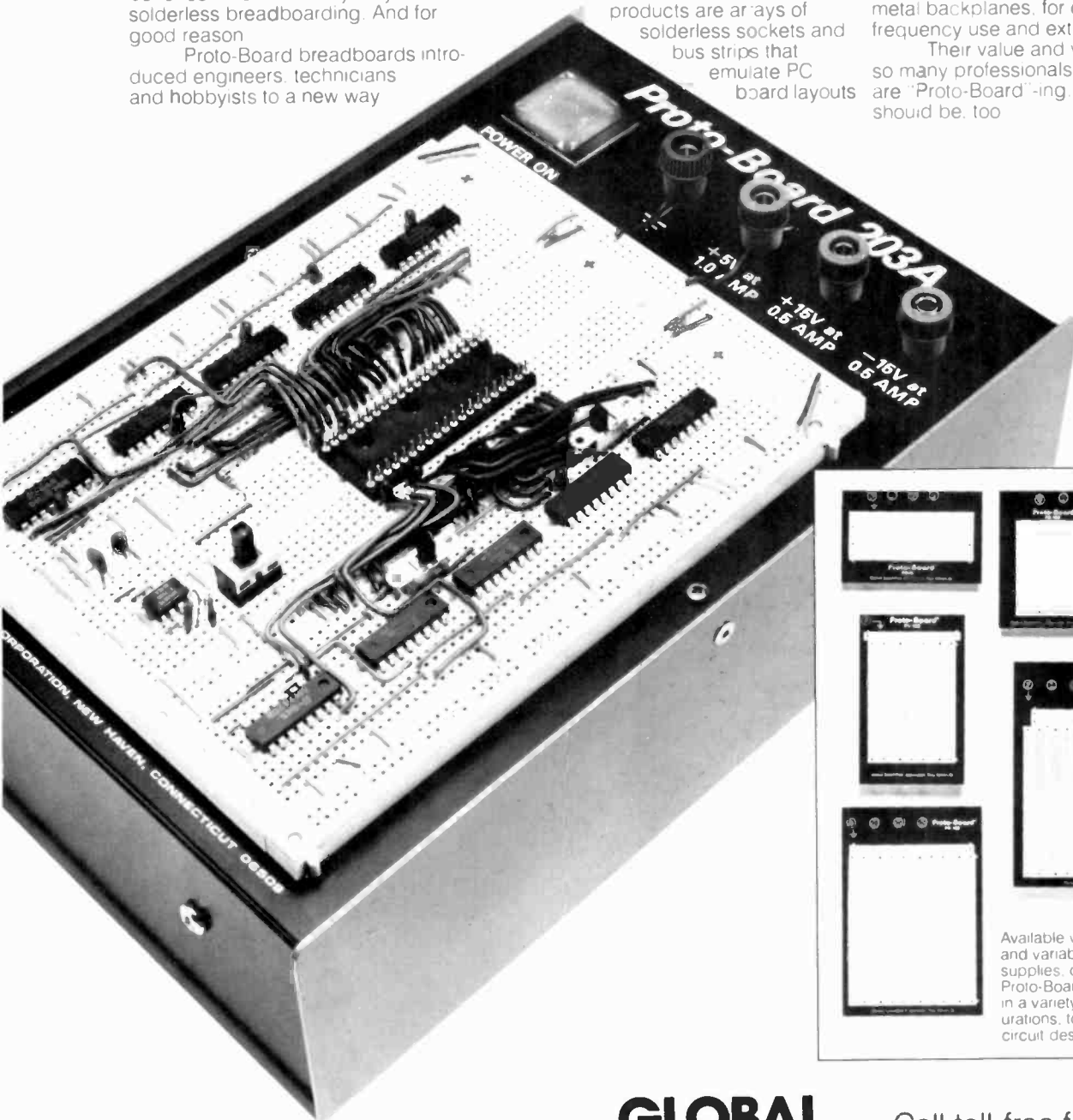
of designing and building electronic circuits, as fast as they can think. Testing, modifying and expanding as quickly as new thoughts occur.

Saving precious time and money by freeing creativity from manual labor.

Global Proto-Board products are arrays of solderless sockets and bus strips that emulate PC board layouts

while permitting instant insertion and removal of components from the largest DIP to the smallest discretes. With a rugged construction built to provide positive connections and withstand day-in, day-out professional use—even as test fixtures. And mounted on sturdy metal backplanes, for extended high-frequency use and extra durability.

Their value and versatility are why so many professionals and hobbyists are "Proto-Board"-ing. And why you should be, too.



Available with precision, fixed and variable regulated power supplies, or in unpowered versions. Proto-Board breadboards come in a variety of sizes and configurations, to meet virtually any circuit design challenge.

70 Fulton Terr. New Haven, CT 06509 (203) 624-3103 TWX 710-465-1227
 OTHER OFFICES: San Francisco (415) 421-8872 TWX 910-372-7992
 Europe: Phone Saffron-Walden 0799-21682, TLX 817477
 Canada: Len Finkler Ltd., Downsview, Ontario

**GLOBAL
 SPECIALTIES
 CORPORATION**

© Copyright 1981 Global Specialties Corporation

Call toll-free for details
1-800-243-6077
 During business hours

CIRCLE 54 ON FREE INFORMATION CARD

See us at E.D.S. 81, Booth No. T/10, 12 and U/9, 11

Quietrole

The Original...

A First in the industry, with over thirty years of use by satisfied customers.



Spray Pack Mark II gets into places of close tolerance and washes out the dirt, leaving a thin film of lubricant which lasts indefinitely, with zero effect upon current capacity and resistance.

Spray Pack Mark II has been tested and proven in the Space Age and is still the finest lubri-cleaner available. It is quick, safe, effective - a MUST for every tool caddy.

Spray Pack Mark II is the best-priced lubri-cleaner.

Available at Leading Distributors



CIRCLE 25 ON FREE INFORMATION CARD

EQUIPMENT REPORTS

continued from page 36

wind loading. When vertically polarized beam antennas are used, that problem is aggravated. No metal vertical part of the antenna support should be closer than one-quarter wavelength to the lowest tips of the antenna elements. Assuming that a two-meter beam is used, a nonmetallic support between the antenna boom and rotator should be about three feet long.

In CB installations the nonmetallic support above the rotator theoretically should be at least 18 feet long! Obviously, that length is rarely (if ever) met in the field, but it could be a consideration for those operators who want the best radiation pattern possible from a vertically polarized antenna. Horizontally polarized antennas present no such problem, and can be mounted as close to the rotator as is practical.

The *model HD-73* rotator weighs approximately 10 lbs. when mounted, and is housed in heavy-duty aluminum. It is designed for wind loading in excess of 100 miles-per-hour (10.7 square-foot-per-wind-load area) and is water resistant. The rotor provides 400 inch/pounds of starting torque, and 1800 inch/pounds of brake torque to resist windmilling.

The motor is designed to operate from only 20 VAC (provided by the control unit) in order to comply with safety limits mandated by Underwriters' Laboratories, Inc.

An improved braking action reduces torque stresses on the antenna system. There is very little play noticeable in the bearings. Those bearings fill two complete raceways to help equalize the weight load on the rotator. The

system can accommodate up to 1000 lbs. of balanced vertical load.

The support bracket is designed for in-tower centering without having to use shims. Four bolts are provided for mounting the unit without spacers; in addition, a drilling template is supplied.

Alternatively, the rotator can be mast-mounted. No-slip support brackets are supplied that have a good "bite," and can accommodate a mast pipe of 1 3/4-2 1/2 inches O.D.

The control unit is powered from 120 VAC at 0.8 amps. It is housed in a plastic cabinet and features a large, brightly illuminated azimuth-indicating meter that is lighted by a replaceable bayonet-base panel bulb.

Calibration is shown in 10-degree increments, as well as in compass points. In our tests, resolution of the indicator was very good—within a few degrees. A front-panel calibration control definitely helps to trim up the accuracy.

The motor is activated by pressing a bar on the control unit, either to the left or the right to correspond with the desired beam rotation. Dual speeds are featured: FAST (approximately 1 rpm) and SLOW (approximately 1/2 rpm).

Overload protection is provided by both a fuse and a thermal switch. Overheating is a problem, and it is recommended that the *model HD-73* not be used for extended periods of rotation. The transformer is small and becomes quite warm with only moderate use. The control unit is switched off when not in use.

Contact sparking of the controlling wafer switch was visible and audible during some rotator activation. Subsequent inspection revealed that the open contacts are large enough

continued on page 42

INTERNATIONAL FM-2400CH

FREQUENCY METER FOR TESTING MOBILE TRANSMITTERS AND RECEIVERS

Portable • Solid State • Rechargeable Batteries

The FM-2400CH provides an accurate frequency standard for testing and adjustment of mobile transmitters and receivers at predetermined frequencies.

The FM-2400CH with its extended range covers 25 to 1000 MHz.

The frequencies can be those of the radio frequency channels of operation and/or the intermediate frequen-

cies of the receiver between 5 MHz and 40 MHz.

Frequency stability: $\pm .0005\%$ from $+50^\circ$ to $+104^\circ\text{F}$.

Frequency stability with built-in thermometer and temperature corrected charts: $\pm .00025\%$ from $+25^\circ$ to $+125^\circ$ (.000125% special 450 MHz crystals available).

- Tests Predetermined Frequencies 25 to 1000 MHz
- Extended Range Covers 950 MHz Band
- Pin Diode Attenuator for Full Range Coverage as Signal Generator
- Measures FM Deviation.

FM-2400CH (meter only) \$690.49

RF crystals (with temperature correction) \$28.89 ea.

RF crystals (less temperature correction) \$21.92 ea.

IF crystals catalog price

Write for catalog



INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee Oklahoma City, Okla. 73102

CIRCLE 24 ON FREE INFORMATION CARD

STANDOFFS & SPACERS:

We Stand Out In Standoffs & Spacers

To give you an idea of how we cover you: In standoffs and spacers alone, we carry over 500 assorted sizes and styles. Aluminum, brass, phenolic and stainless-steel, tapped or thru-hole for all thread sizes. We have them for every possible application. Our wide selection of standard parts is available for immediate delivery... what we do not have we can design and make for you in any size or material (no charge for our engineering service). We design and make everything ourselves, which accounts for our high quality and low prices.



NEW FREE CATALOG ON REQUEST

KEYSTONE
ELECTRONICS CORP.

TWX 710-581-2861 CABLE-KEYELCO
49 BLEECKER STREET, NEW YORK, N.Y. 10012 212-475-4600

CIRCLE 62 ON FREE INFORMATION CARD

You'll be a little richer after building one of these.

H-19 Professional Video Terminal



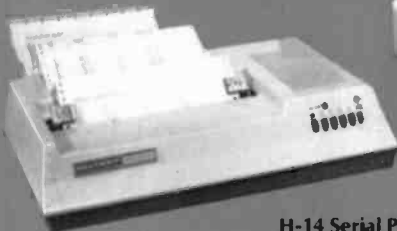
H-8 Personal Computer with Dual Floppy Disk Storage



H-11A 16-Bit Computer with Dual Floppy Disk Storage



H-89 All-In-One Computer with Floppy Disk Storage



H-14 Serial Printer



Self-Instruction for Assembly and BASIC Programming

Richer in knowledge

Once you build your own computer, you'll know it inside out. You'll know how to make it work for you, how to make it grow as your skills grow.

Richer in savings

Build-it-yourself kits cost less — about 30% less than comparable assembled computers. And you'll probably never need to pay someone for service because no one will know your computer better than you.

Is it hard?

Not at all. Heath makes it simple with easy-to-assemble designs and with step-by-step manuals that guide you from unpacking to final plug-in. And a Heathkit helping hand is always just a phone call away.

Innovative software

Heath offers you innovative programs for running your home or business, and exciting games for your family. You can have Microsoft™ BASIC™, one of the most powerful and widely used languages.

Heath User's Group (HUG) will share with you a library of over 500 programs to make your computer serve you in ways you never imagined.

Complete hardware

Choose from three computer systems:

The H89 All-In-One Computer gives you everything in one compact, convenient unit.

The flexible H8 gives you the freedom to combine memory and interfacing for exactly the system you require.

And the powerful H11A gives you 16-bit

power for your most complex programs. The Heathkit line includes video terminals, matrix and letter-quality printers and a complete selection of accessories. You'll even find award-winning self-instruction packages to teach yourself programming in BASIC or Assembly.

FREE CATALOG

It's all in the new 104-page Heathkit Catalog, along with nearly 400 electronic kits for your home, work or pleasure. Send for your free catalog today, or pick one up at your Heathkit Electronic Center.*



Heathkit®

*Visit your Heathkit Electronic Center in the U.S. or Canada where Heathkit Products are displayed, sold and serviced. See your white pages for the location nearest you. Heathkit Electronic Centers are units of VeriTechnology Electronics Corporation in the U.S.

Write to Heath Company, Dept. 020-774, Benton Harbor, MI 49022
(In Canada write Heath Company, 1480 Dundas St. E., Mississauga, Ont. L4X 2R7)

CIRCLE 15 ON FREE INFORMATION CARD

EQUIPMENT REPORTS
continued from page 38

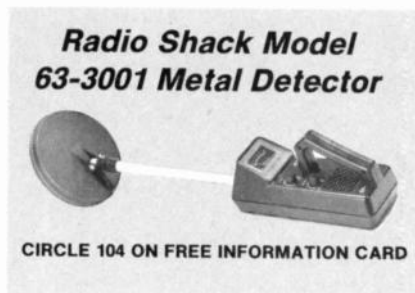
to accommodate the current. The sparks may be disconcerting but do not appear to pose any hazard.

Cable installation is simple. A chart directs the user as to which type of cable to order for the length of control line needed. Screw-type terminal blocks are included on both the control unit and rotator housing to accommodate the six-conductor cable.

The manual is one of the best we've seen. It is fully illustrated, and includes theory, instructions, a troubleshooting guide, a schematic diagram, an exploded diagram of the rotator, and a complete parts list.

We judge the Alliance model HD-73 heavy-

duty antenna rotator to be a reliable system for most nondemanding amateur and CB installations. It sells for \$154.95. From the Alliance Manufacturing Co., 22790 Lake Park Blvd., Alliance, OH 44601. **R-E**



THE MAJORITY OF METAL LOCATORS CAN BE divided into three basic types: BFO, induction balance, and transmitter-receiver. The new Radio Shack (1400 One Tandy Center, Ft. Worth, TX 76102) model 63-3001 metal locator is the latter type.

The unit is equipped with a telescoping aluminum shaft that may be adjusted in length to suit the user. The extendable shaft is long enough for average-height users. A tall adult might have to stoop over slightly to get the search head close enough to the ground for sensitive searching.

The locator requires 6 "AA" cells (not supplied). The battery compartment is easily accessible through a sliding cover. No assembly is required and the unit is ready to go as soon as it is unboxed.

The search head is made of plastic and it is water resistant. But it is not immersion-proof, so don't plan on using the unit to probe for objects below the water line. The tilt of the search head is adjustable to suit the user.

Two coils located in the search head are used to locate buried or hidden objects. The coils are arranged so that the signal from the transmitting (search) coil cannot be detected by the receiving coil. When the search head passes over an object, an electromagnetic field between the coils changes shape, and the receiving coil can then detect the signal from the transmitting coil.

Some materials (non-ferrous) cause the field to diverge (spread out), while ferrous (iron) substances cause the field to converge (squeeze together). Those dissimilar fields are used to analyze a target, or to discriminate against trash in the ground. The search coil is Faraday-shielded to minimize capacitive effects.

Two controls are used to adjust the detector for best sensitivity. One of those controls selects between ferrous and non-ferrous materials; the other is used for peaking. Indication is provided both by a visual panel meter and a speaker. A third control sets the speaker volume. The meter is tilted for a comfortable viewing angle. For noisy environments, or where quiet operation is preferred, an earphone (included) can be used. Using the earphone turns off the speaker.

A shielded four-conductor retractable mike cable connects the search head and the control compartment. It is mounted internally through the center of the heavy-gauge, seamless aluminum-tubing shaft. The shaft itself is securely attached to the control compartment.

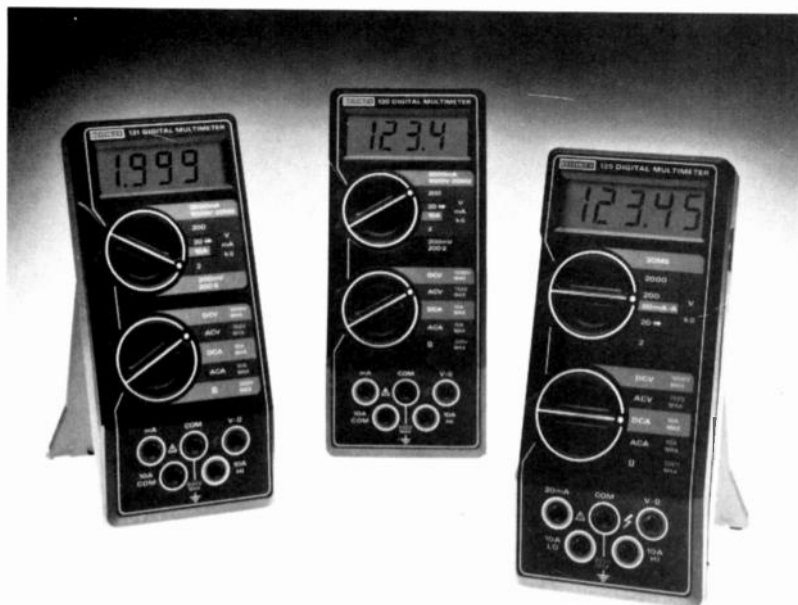
A phenolic printed-circuit board contains five transistors and two diodes. It is etched well and neatly laid out. The board is very roomy and is easy to service should service ever be required. Unfortunately, no circuit diagram is provided.

In order to extend battery life, we followed the manual's instructions and bought Radio Shack's alkaline batteries. The detector wouldn't work at all. A close inspection revealed the cause. The center-post terminals of the Radio Shack alkaline batteries are too short to touch the contacts in the battery compartment. Use standard "AA" cells, or make sure that the batteries you buy have center posts long enough to make contact with the battery holder.

Once the unit was operating, we proceeded to adjust it as recommended in the manual. The manual provides a number of valuable tips. Read it, then read it again! Metal locators are tricky to use; practice is necessary!

There was some capacitance effect; non-continued on page 89

ADVANCE IS PROUD TO INTRODUCE the
KEITHLEY Line of High Quality Digital Multimeters
Featuring The New 130 Hand-Held DMM



Rugged DMMs from Keithley — all feature large, bright LCD display, easy-to-use rotary switches, externally accessible battery and fuse, 10A current range, diode test capability, low battery indicator, cushioned components.

Model 131. Similar to Model 130, with increased accuracy **\$134**

Model 130. Our most popular model, the price/performance champ . . . **\$115**

Model 135. First 4½-digit DMM with hand-held convenience . . . **\$219**

MODEL	ACCURACY					SENSITIVITY				
	DCV	DCA	ACV	ACA	Ω	DCV	DCA	ACV	ACA	Ω
130	0.5%	1%	1%	2%	0.5%	100μV	1μA	100μV	1μA	100mΩ
131	0.25%	0.75%	1%	2%	0.2%	100μV	1μA	100μV	1μA	100mΩ
135	0.05%	0.5%	1%	1.5%	0.2%	100μV	10μA	100μV	1μA	100mΩ

Case \$10.00 Shipping \$3.00

THE TEST EQUIPMENT SPECIALISTS
TOLL FREE HOT LINE
800-223-0474

54 WEST 45th STREET NEW YORK N.Y. 10036 212-687-2224

ADVANCE ELECTRONICS



Video Review knows a bright idea when it sees one.



Simulated TV picture. Simulated wood cabinet.

Video Review magazine tests a lot of sophisticated video products.

They get to see virtually every make and type of color TV receiver. Which makes their selection of Magnavox as their standard TV receiver pretty impressive.

"We thought the Magnavox picture quality and resolution were superb."

"Ever since *Video Review* began testing products," says the magazine, "we've been looking for a top quality, 19-inch TV set that might serve as a standard of reference for all of the other products we test... video cameras, video cassette recorders, video cassettes.

"We thought the Magnavox picture quality and resolution were superb, and that off-the-air sensitivity was also extremely good.

"Major VHF channels were received with uniformly accurate color fidelity. This receiver produced superior color pictures

even when using its own indoor VHF and UHF antennas"

"The special tuning features and remote control capabilities of the Magnavox receiver are awesome."

"The tuning system is purely electronic and totally digital," they continue. "There is a fine tune switch and a memory lock button. If any channel is received mistuned, the user simply fine tunes up or down in frequency by holding the button, and when perfect tuning has been achieved, the button is released and the memory lock button is depressed once.

"Nearby is Magnavox's Video-matic feature. Depressing this button activates the electronic eye for automatic brightness adjustment, color adjustment circuits and automatic fine tune."

"...unusually good for any receiver."

Overall, *Video Review* rated the Magnavox 9.5 or better (out of a

possible 10.0) on Video Quality, Reception Sensitivity, Color Fidelity, and Video Resolution and Fidelity. As they put it, "...unusually good for any receiver."

We can only add that once you see a Magnavox color TV at your Magnavox dealer, we think you'll agree.

For Magnavox color TV specifications, write Magnavox Consumer Electronics Company, Dept. 700, P.O. Box 6950, Knoxville, Tennessee 37914.

© 1980 MAGNAVOX CONSUMER ELECTRONICS CO

**MAGNAVOX
MAGNAVOX
MAGNAVOX
MAGNAVOX**

The brightest ideas in the world are here to play.

CIRCLE 64 ON FREE INFORMATION CARD

“You fix TV’s... what brand should I get?”

You’re on the spot. Any set you tell your customer about has a chance of failing sometime.

But though we’re not saying we’re perfect, we’d like you to recommend RCA. Because we’re sure your customer will love its picture performance.

You can find the problem and repair it quickly if anything does go wrong. Because with RCA’s unitized chassis, failures are easy to handle.

RCA gives frequent hands-on workshops, as well as lectures. So when failures do occur, you’ll be ready.

RCA has more than 500 parts distributors nationwide. We have this large network because we don’t want you to have to wait too long for parts.

We also keep your inventory expenses lower by using components instead of modules, in most circuits.

We know your customers think you’re responsible for everything about their sets.

Good and bad.

And that’s why we here at RCA are doing everything possible to make sure that when you finish a service call, everybody’s smiling. Your customer’s happy with your recommendation. And you’re still the expert.

RCA

**RCA IS MAKING
TELEVISION
BETTER AND BETTER.**



For your free subscription to RCA COMMUNICATOR, our magazine of news and advice for service technicians, write RCA, Dept. 1-455, 600 North Sherman Drive, Indianapolis, IN 46201.

COMPUTERS

LEARNING ABOUT MICROPROCESSORS

How do microprocessors do what they do? Use an assembly language computer to find out.

JORMA HYYPIÄ

THE MOST ENJOYABLE WAY TO LEARN THE ESSENTIALS of computer programming is to play with a hobby-type computer that permits communicating with the machine in "plain English" by means of a typewriter-style keyboard. However, that way you learn little or nothing about the way computer magic is actually created by the complex patterns of electrical signals whizzing around through those mysterious "black-centipede" integrated circuits that cling to the PC boards inside every computer. To truly understand the more esoteric, fascinating *fundamentals* of micro-computer operation, you need to work with a training-type computer or with a hobby computer that uses assembly-language programming.

Comparing hobby computers that use the BASIC programming language with assembly-language training-computers is a little like trying to equate competitive Frisbee throwing with chess mastery. It can't be done because each requires the development of uniquely different special skills. So before plunking down several hundred dollars for a bona-fide trainer, know what it can and can't do. For



example, you should understand that it is *not* suitable for game playing and other conventional entertainment applications, or for balancing checking accounts. It is for serious study, either in an academic environment, or at home, through some sort of self-education program.

The five computers discussed in this article are reliable, thoroughly user-tested machines. They are anything but carbon copies of each other, since each offers unique options you should consider carefully before making a purchase. The E&L *MMD-1* computer is an outstanding example of a basic teaching and control computer. The *SYM-1* has found widespread use in computer-control applications. The *ELF II*, available in kit form, is the least expensive way for a soldering-iron hacker to get into assembly-language computing while still having the option of expanding the system by adding an ASCII-keyboard.

Computer knowledgeable readers may be puzzled by the inclusion of the *COSMAC VIP*, which is marketed as a home-entertainment computer. Its inclusion in this article is justified because it provides a comfortable middle ground for those who might be fearful of an all-out intellectual plunge into computer fundamentals. The *VIP* can be used to explore some of the more esoteric aspects of computer operation and programming; but it can also be used for highly entertaining game-playing when there is need of a temporary respite from study.

Finally, for those who want an easy-to-understand but thorough, course in computer fundamentals, there's the Heathkit *ET-3400* and its associated learning program.

Any one of those computers is ideal for an electronics hobbyist who invents computerizable gadgets, because it can be used as a control device as well as a learning aid.

All other factors being equal, you may wish to choose a training computer that uses the same microprocessor used in the high-level language computer you already own or plan to buy. That way your training will relate more directly with your other computer activities. For example, the *SYM-1* uses the 6502 microprocessor developed by MOS Technology that is also found in such popular computers as *Apple II*, *Challenger IP*, *Superboard II*, and *PET*. The popular 8080A microprocessor, originally from Intel, used in the *MMD-1* is also found in *CompuColor II* and in the Heathkit *H8* computer. The *VIP* uses RCA's own 1802 microprocessor, which is also in *ELF II*. Heathkit's *ET-3400* features a 6800 microprocessor designed by Motorola. The Z-80 microprocessor developed by Zilog, used in the Exidy *Sorcerer* and Radio Shack's *TRS-80*, is,

unfortunately, available only on fairly high-priced single-board computers.

Some general information

All of the computers discussed here are programmed in what's known as *machine language*. While programs written in machine language may take a bit more effort on the part of the programmer, they are worth it: They run more quickly and occupy less memory than programs written in BASIC—which you may already be familiar with from using hobby-type computers.

Machine language uses numbers, rather than words, to generate the binary code—ones and zeroes—that is used by the microprocessor as instructions and data.

Machine *code* (instructions in machine language) is generally expressed using one of two counting systems—*octal* or *hexadecimal*.

In our normal, non-programming, lives we use a counting system based on the number ten (0, 1, 2, 3, 4, 5, 6, 7, 8, 9). After "9," we move over one position and start again (10, 11, 12 ... etc.). The octal system uses the base eight. In octal, you count "0, 1, 2, 3, 4, 5, 6, 7, 10, 11, 12 ... etc." The number eight is represented by "10", nine by "11," and so on.

The hexadecimal system uses the base 16. In it, you count "1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, 10, 11 ... etc." The first six letters of the alphabet are used to represent single-digit numbers above nine—in hexadecimal, that is. Confusing as that may seem, it soon becomes second nature.

Hexadecimal (or *hex*, for short) is particularly convenient for working with eight-bit microprocessors because with just two digits you can express any value that requires eight bits or fewer.

In practice, you'll probably write your programs in *assembly language*. Assembly language uses abbreviations, called *mnemonics*, to give the programmer a kind of shorthand with which to work. Each mnemonic represents a computer instruction and has a corresponding *op code*—a hex or octal number that can be fed into the computer through a simple keypad.

After hand-assembling your programs using mnemonics, you'll translate the mnemonics to op-codes in hex or octal, and enter them into the computer.

Before you purchase your training-type computer, watch the prices carefully if you want to obtain full value for your dollars. In general, a training computer should cost substantially less than a good high-level language computer of comparable quality. However, you can pay a great deal more for the trainer of your choice than for one of the least expensive hobby jobs. It is impractical to specify prices in this article because market conditions could make

them change by the time you read it. But, more important, what you pay depends on the extras you want, or *need*, to buy to make the computer of your choice fully operable.

Four of the five computers described here use simple LED readouts, but the *VIP* requires the purchase of an RF modulator so you can use a regular TV set as your display device. Although the *ELF II* has an LED readout, it too can be used with a TV set and RF modulator.

It is very important that you consider carefully the completeness and intelligibility of the instructional literature that comes with any computer. If it is inadequate, or simply hard to understand, you'll find yourself spending more money on books. And right there you have one of the most persuasive arguments for taking a good look at E&L's *MMD-1* if you want the best in self-education opportunities. The *Bugbook* literature that comes with it is without peer, especially because the text is intimately related to the *MMD-1* itself.

Mini-Micro Designer (MMD-1)

This trainer, which is widely used as an educational aid in computer schools here and abroad, and also as a control computer for industrial operations, makes use of an 8080 A microprocessor and octal notation. For any serious student/hobbyist, that computer stands out as the Rolls-Royce for both self-education and control applications. It comes complete with a power supply, for instant plug-in operation, and commands a premium price.

The basic unit comes with an octal keyboard, 24 discrete LED's that serve as readouts to tell you what is going on inside the computer, and a handy solderless breadboard on which to plug in simple electronic components for experimentation. Since those components are not soldered, you can disassemble an experiment quickly to clear the board for the next. If you intend to do a great deal of experimentation, the use of a second, outboard, solderless breadboard is strongly recommended since replacement of the built-in breadboard is difficult if it should be damaged.

You get 256 bytes—8-bit words—of RAM (Random Access Memory) for programming, plus another 256 bytes of ROM (Read Only Memory) that control computer operations. The odds are that you will soon want to expand that basic setup by adding a memory interface upper-deck (see Fig. 1) that provides up to 2048 additional bytes of RAM plus the circuitry needed to interface the computer with a cassette tape-recorder and/or Teletype equipment. Beyond that, you can expand the memory all the way to 64K (65,536 bytes) if you have the need and can afford the cost.

To derive the greatest learning benefits

from the *MMD-1* and *Bugbooks*, plan to invest in at least some of the many outboard units that can be purchased factory-assembled or at lower cost, in kit form. But perhaps the best choice is a "student station" that incorporates many of the outboards into a single peripheral unit, and comes with an extra solderless-breadboard plus more than a score of extra IC's and other components for use in experiments.

The *MMD-1* comes with a keyboard executive (KEX) PROM (Programmable Read Only Memory) to handle the assembly-language instructions. You should start with that IC, plus an associated load/dump (L/D) IC because they relate best to the *Bugbook* text. Later you may wish to trade those PROM's for replacements, a combined KEX/L/D and a Monitor PROM, so that you can single-step through any program in *running* sequence, not merely through consecutive memory locations.

After completing the self-training course in microcomputer use, you can continue to use the *MMD-1* as an experimental tool and/or control device. For example, it could be used to operate a model railroad system automatically.

SYM-1

The *SYM-1*, shown in Fig. 2, is an extremely versatile machine constructed on a single 8 x 11-inch printed circuit board. It uses the 6502 microprocessor and is programmed in hex. The board includes a 28-key control pad for data entry, a six-digit 7-segment LED read-out display, 4K bytes of ROM that contain the operating system and 1K of static RAM.

The board also contains five programmable interval timers, four relay drivers/input buffers, 15 bi-directional TTL-level lines, and 51 I/O lines (expandable to 71). Interfaces include a dual-baud-rate cassette recorder interface with remote control and RS-232 (serial) and TTY (parallel current-loop) interfaces.

On-board memory is expandable to 4K bytes (and even more, off-board) and there is provision for up to 28K bytes of user-programmable ROM.

Software options include an 8K Microsoft BASIC and a resident assembler/editor/loader, both in ROM. There is also a Keyboard Terminal Module that, together with an inexpensive RF adaptor and your TV set, gives you a complete computer system with keyboard entry and video display.

The *SYM-1* requires only a five-volt power supply. You can either provide your own or buy one specifically designed for the *SYM*.

One feature of the *SYM-1* that should not be ignored is that fact that is closely related to the recently discontinued *KIM-1*, a single-board computer that enjoyed great popularity among hobby-



FIG. 1—MINI-MICRO DESIGNER, the MMD-1, from E&L Instruments, is shown with its memory expansion board.

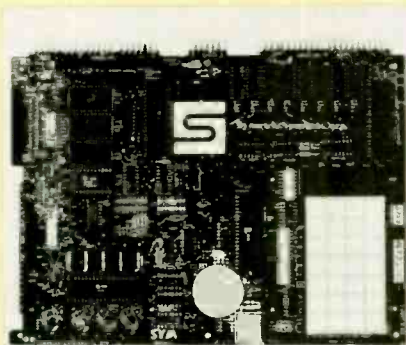


FIG. 2—THE SYM-1 from Synertek Systems Corporation is compatible with the KIM-1. It uses a 6502 microprocessor.

ists and for which an enormous amount of software has been written. The *SYM-1* is *KIM-1*-compatible: Not only does it use the same microprocessor as the *KIM*, but one of the two cassette formats it uses for program storage is the same as the *KIM*'s and it uses the same hardware interface busses as the *KIM*. What this boils down to is that any software written and/or recorded for the *KIM* will also run on the *SYM-1*!

In addition to the *SYM-1*'s copious documentation (two thick manuals—*Reference* and *Programming*) the *SYM-1* user has at his disposal sources of information such as *The First Book of KIM* by Butterfield, Ockers and Rehnke (Hayden Book Company).

The *SYM-1* is not the least complex computer described here, but it is worthy of consideration by anyone who has committed himself to learning how microcomputers work and to making the most of the capabilities of his machine.

ELF II

This computer, which makes use of RCA's 1802 microprocessor, comes factory-assembled or as an easy-to-build kit that can be put together in one evening. Quality components are used throughout. The PC board, for example, is of highest grade, double-sided with plated-through holes. Sockets are provided for three of the 17 integrated circuits, and I picked up additional sockets for the other IC's for less than five dol-

lars. I think that the slight extra expenditure for sockets is a good investment since they totally eliminate the chance of damaging IC's with soldering-iron heat, and because troubleshooting by component-substitution becomes a cinch. The kit-assembly instructions are very clear.

The kit costs under \$100, and you can buy a power supply for about five dollars extra. Another five spent on Tom Pittman's *Short Course on Microprocessor & Computer Programming* would be no waste. You can also buy the *ELF II* fully assembled and tested, complete with power supply, RCA 1802 User's Manual, and the *Short Course*.

The *ELF II* features a full hex keypad, two-digit hex output display, stable crystal-clock for timing purposes, and 256 bytes of RAM that is expandable to 64K. Included in the kit is an RCA 1861 video-IC that permits display of your programs on any video monitor, or on a regular TV set by use of an inexpensive RF-modulator.

Most of the left-half of the PC board (see Fig. 3) is unused, but is ready for the addition of all kinds of add-on's as your needs and desires grow along with your increasing familiarity with the *ELF II*. Its 5-slot, plug-in, expansion bus permits you to add such features as: *Giant Board* kit with cassette I/O, a *Kluge* (prototyping) *Board* that accepts up to 36 IC's, 4K RAM boards, an ASCII keyboard, a light pen, a color graphics & music system and a video-display board.

Software available includes: Tiny BASIC, an assembler, a disassembler, the Elf-Bug monitor, and a text editor. There is also a recently introduced full BASIC that requires 8K of RAM plus ASCII and video-display boards.

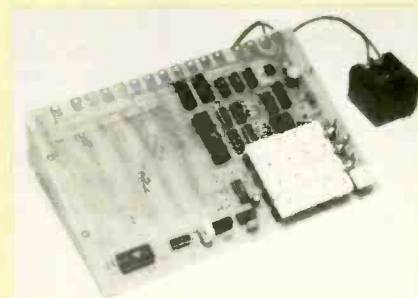


FIG. 3—AVAILABLE either as a kit or assembled, the ELF II from Netronics has 256 bytes of RAM (expandable to 64K).

All that can come later. If you are a novice, and are interested in gaining some insights into assembly-language programming, begin with the kit, which permits basic experimentation with such fascinating things as a counter, alarm system, lock, controller, thermostat, timer, and telephone dialer, to mention a few possibilities. The assembly manual includes a sample program that displays a picture of a space-

ship on your TV screen, and suggestions about where to obtain additional literature.

COSMAC VIP

That computer, shown in Fig. 4, uses RCA's own 1802 microprocessor and must be connected to a computer video monitor or to a conventional TV set by means of an RF-modulator. The modulator can be used with the add-on color board and a color TV if you want full-color pictures.



FIG. 4—THE COSMAC VIP from RCA must be connected to a video monitor or, using an RF modulator, a conventional TV.

The VIP comes with 20 interesting game programs that you can key into the computer with the hex keyboard, and then store on cassette tape for more convenient future use. Since the computer is not intended as a trainer, RCA provides no self-instruction material other than the programming manual. However, you can learn much about assembly-language programs just by studying the game programs in the manual in context with mnemonic code and other technical data also provided.

Several add-on modules are available. For example, a color board (VP590) greatly enhances games by displaying them in full color on your TV set. You can develop your own color programs with full control of both foreground and background colors. Conversion of the basic VIP board to color is easy. Just remove three IC's from the main PC board and transplant one of them to the plug-in color board. You must also reprogram the CHIP-8 control program used with black-and-white image programming into a more powerful CHIP-8X program for color.

For the ultimate in game-playing fun, also install a plug-in Simple Sound Board (VP595). If you have an early VIP model you may have to add several IC's and resistors to make the sound board operative. If your sound board puts out only a continuous tone that can't be shut off except with the main power switch, look for the missing components.

For more serious electronic music-making, try the Super Sound Board (VP550) that features two independent sound-generating systems so that you can obtain stereo music on your hi-fi

audio equipment. There's independent control of note frequency, duration, and amplitude for each channel, and you can program both melody line and harmony. It's even possible to add an optional drum synthesizer.

The instruction manual provides a short course in music writing, and shows how to convert any sheet music into computer language so that the music can be played through a home hi-fi system. You need know nothing about writing or reading music, and you don't even have to know how to play a kazoo to make electronic music, or to create all sorts of weird sounds, including "outer space" type music.

My only problem with the Super Sound Board came with writing the required PIN-8 machine-language program that drives the system. More than 3,500 digits on a reference sheet must be keyed into the computer memory correctly or the program "bombs out" and you have to start all over again. For that reason, be sure to make a copy of your freshly keyed-in program on cassette tape *before* you attempt to run it! That way, if it bombs, you can quickly put the defective program back into memory for debugging. It's a lot less painful than starting all over again from the beginning. If you still have trouble, try to borrow a demonstration tape from your VIP dealer, or make a copy in his store. But that's the easy way out.

Heath ET-3400

For those interested in working with the 6800 microprocessor, Heathkit's ET-3400 (Fig. 5), available either in kit form or assembled, fills the bill.

MANUFACTURERS

Write to the following manufacturers if you are unable to find detailed information about any of these microcomputers through local retail computer stores:

MMD-1: E&L Instruments, Inc. 61
First Street, Derby, CT 06418
CIRCLE 95 ON FREE INFORMATION CARD

SYM-1: Synertek Systems Corporation,
P.O. Box 552, Santa Clara,
CA 95052
CIRCLE 96 ON FREE INFORMATION CARD

COSMAC VIP: RCA Cosmac VIP
Marketing, New Holland Pike,
Lancaster, PA 17604
CIRCLE 97 ON FREE INFORMATION CARD

ELF II: Netronics R&D Ltd., 333 Litch-
field Road, New Milford, CT 06776
CIRCLE 98 ON FREE INFORMATION CARD

ET-3400: Heath Company, Benton
Harbor, MI 49022
CIRCLE 99 ON FREE INFORMATION CARD

It has its own power supply and comes with 256 bytes of RAM (expandable to 512 bytes) and a 1K monitor program in ROM. Programming is done in hex using a built-in keypad and data is displayed by six 7-segment LED's.

One nice feature of that computer trainer is a built-in solderless breadboard for prototyping and interfacing, and for memory circuits that can be connected to the microprocessor. Associated with the breadboarding section is an 8-position DIP switch for inputting binary data to circuits built on it, and eight discrete LED's to indicate logic states within those circuits.

Heath also has an accessory, the ETA-3400, that connects to the trainer by means of a 40-wire ribbon cable. The unit comes with 1K of RAM and can be expanded to 4K. It has an RS-232 serial interface for connection to a teletype or video terminal, and an audio



FIG. 5—A BUILT-IN solderless breadboard is among the features of the ET-3400 computer trainer from Heath.

cassette interface that permits programs to be stored.

Also included with the ETA-3400 is a Tiny BASIC interpreter in ROM. Working from a terminal, you can program in BASIC and, from within a BASIC program, call machine-language routines that were written using the trainer.

To round things out, Heath offers a Microprocessor Self-Instruction Program (course) that uses the ET-3400 as a teaching tool.

As was stated at the beginning, working with a training-computer or other assembly-language machine is very different from keyboard/video chatting with a high-level language computer that tells you when you've made a mistake, and that may even suggest where to look for the trouble. Not so with training computers. So you'll have to apply yourself a lot harder, but that's the way you'll learn about microprocessors. Learning the inner secrets may not be as tough as learning chess, but it will be no Frisbee-thing either. Still interested? Then it's your move!

RE

RCA VIDEODISC CIRCUITRY

It sure doesn't work like a VCR. Look what happens between picking the signal off the disc and converting it into something that will produce a picture on your TV

CHESTER H. LAWRENCE

IN THE OVERVIEW OF THE RCA VIDEODISC system presented last month, we pointed out that the output signal from the pickup arm was composed of several separate signals. This month we will follow the video and see how it is processed by the videodisc player circuitry.

Figure 1 is a block diagram of the video-processing circuitry. Since the signal from the pickup arm includes a 260-kHz servo signal that could interfere with the demodulation of the video carrier, the composite signal from the pickup arm is first fed through a 260-kHz trap that removes the servo signal, thus eliminating this source of possible interference.

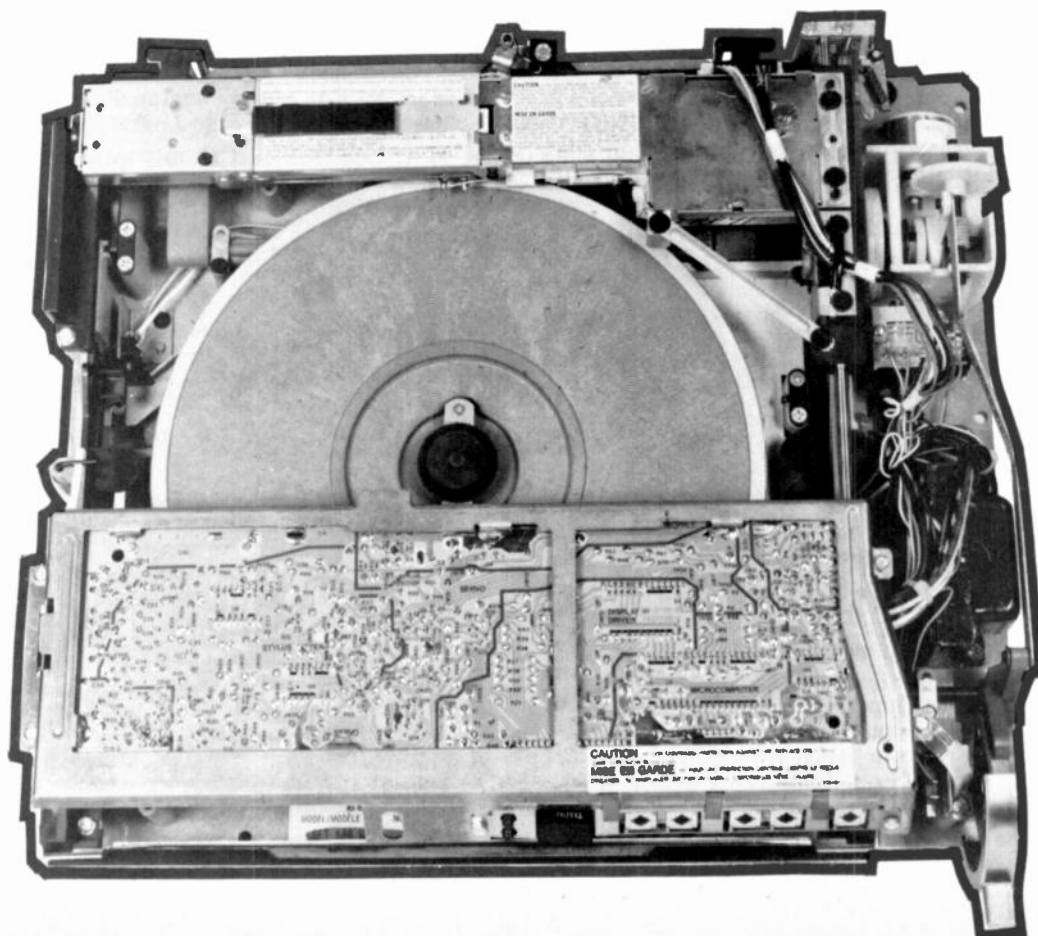
Another potential source of trouble is the relatively low-frequency 716-kHz sound carrier. It can cause modulation of the spacing between the stylus and signal on the disc. The phase modulation of the video carrier that results can result in an undesirable 716-kHz visual beat (sound beat) in the video picture on the TV screen.

To keep this from happening, the NLAC (Non-Linear Aperture Correction circuit) shown in Fig. 1 separates the sound-beat information, phase inverts it and adds it to the original signal. In effect, this cancels the sound-beat signal before it can appear in the video FM signal.

After passing through the NLAC,

the video carrier is fed through a 2- to 9-MHz bandpass filter network and then on to the video demodulator. In the video demodulator, the video carrier is demodulated to develop the composite video signal that is fed to the comb filter.

The defect detector is also a part of the video demodulator. It is activated whenever a defect in the video carrier is spotted. When the defect detector is activated its output is applied to the comb filter. It causes the comb filter to automatically insert the corresponding portion of the previous horizontal line of information into the output signal whenever a defect is spotted. In this way, momentary defects in the video



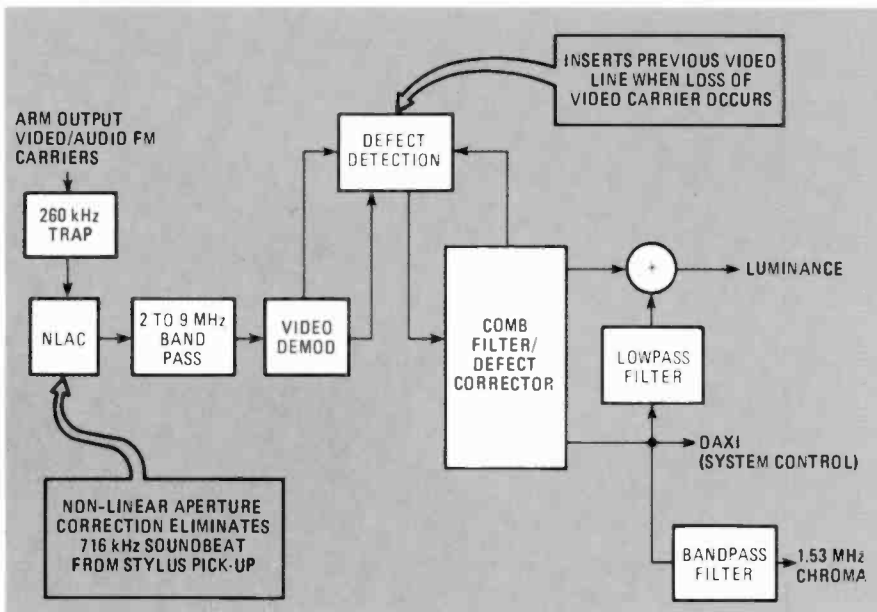


FIG. 1—BLOCK DIAGRAM OF THE VIDEO PROCESSING circuitry. The NLAC and DEFECT DETECTION blocks represent circuits you probably haven't even seen before.

carrier do not appear as visible noise impulses on the picture displayed on the TV screen. Instead the previous horizontal line fills the gap. The fault circuit can fill up to three horizontal lines with color information before any visible degradation in the signal performance becomes noticeable to the viewer.

The comb filter is primarily used to separate the chrominance and luminance signals. Efficient chrominance/luminance separation is rather important, because the RCA videodisc system uses a "buried" subcarrier system that places the chrominance information at a subcarrier frequency of 1.53-MHz. This frequency is approximately at the midpoint of the luminance bandpass.

The chrominance information, however, is frequency interleaved with the luminance. As a result, the energy content of the chrominance signal is spaced at 1/2 the horizontal-rate difference from the luminance signals. This is why the comb filter can effectively separate these signals.

Non-linear aperture correction

The signal from the pickup arm is a composite of several signals. These include the 5-MHz video FM carrier, a 716-kHz audio FM carrier, a 260-kHz servo-sensor signal and a 5-MHz ± 716 -kHz beat signal. The servo-sensor signal is eliminated by a trap in the bandpass filter that passes frequencies between 0.5 and 9 MHz. But this filter and trap cannot eliminate the 5-MHz ± 716 -kHz beat signal. If this signal is not eliminated undesirable sound beats appear on the screen of the TV being used to watch the videodisc picture.

Figure 2 shows the circuitry that

corrects for the 716-MHz soundbeat signal. The video FM carrier is applied to the base of Q101, the NLAC buffer, after passing through the bandpass filter. The buffered signal from Q101's emitter is then fed through RC network C106, R108, and C104 to the base of Q103, the NLAC amplifier. This signal contains the audio carrier and the video carrier plus an in-phase soundbeat.

At the same time the signals from Q101's emitter are also fed through capacitor C105, diode CR102 and capacitor C108 to Q102's collector. Diode CR102 mixes the video and audio carrier signals and generates a 5-MHz ± 716 -kHz soundbeat signal that is 180° out of phase with the beat signal amplified by Q101. The in-phase audio

and video carriers are also there after mixing.

Since the signal from Q101's emitter is also coupled to the base of Q102; diode CR101, which is connected from Q102's emitter to ground through C107, conducts out of phase with diode CR102. This produces a soundbeat signal that 180° out of phase with the soundbeat signal from diode CR102. This signal is inverted by Q102 and along with the signal from CR102 appears at Q102's collector.

In Q103's base circuit, the 180° phase-shifted 716-kHz soundbeat is added to the in-phase 716-kHz soundbeat from Q101's emitter. This cancels the soundbeat information in the video carrier signal, which is then amplified by NLAC amplifier Q103 and NLAC driver Q104. The output signal is coupled from the emitter of Q104 and supplied to the video demodulator circuit.

Video FM demodulator

The video FM carrier output from the NLAC circuit, after having been corrected for sound-beat information, is supplied through a 2- to 9-MHz bandpass filter to pin 3 of video demodulator IC U201 (see Fig. 3). The incoming FM video carrier is first amplitude limited by a limiter stage and then coupled to one input of a phase-lock-loop detector. The other detector input is a 5.3-MHz VCO signal. Its center frequency is set by C215. This capacitor is connected between pins 5 and 6 of the integrated circuit. A filter network is coupled to pins 5 and 6 of the integrated circuit to filter the PLL (Phase Lock Loop) feedback signal.

The modulation on the video FM carrier causes the frequency of the

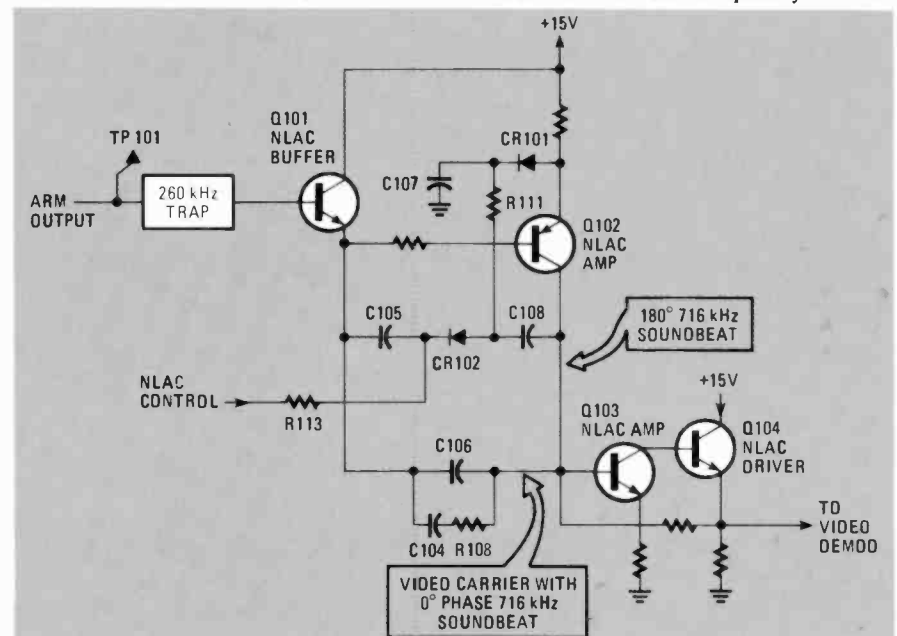


FIG. 2—SOUNDBEAT CORRECTION CIRCUIT eliminates a signal that would cause undesirable beats to appear in the picture on the TV screen when the videodisc is played.

carrier to vary. The PLL detector generates a difference signal that is proportional to the instantaneous phase difference between the carrier and VCO reference. This difference signal (or error signal) controls the frequency of the 5.3-MHz VCO to maintain phase lock between the carrier and the VCO. Since the VCO frequency is forced to track the carrier, the error signal, that controls the VCO, is the original video information.

Demodulated video output exits the integrated circuit at pin 7. Here it is filtered and then coupled to the base of phase equalizer transistor Q201 through VIDEO LEVEL ADJUST control R202. After being phase equalized by Q201, the signal is reinstated into the integrated circuit at pin 9 where it passes through a gated inverting amplifier and leaves the IC at pin 11.

Before demodulation, the amplitude-limited video carrier signal is applied to a defect-detection circuit in U201. It compares the incoming video FM carrier with the VCO. The defect-detector circuit generates a logic HI whenever video-carrier loss is detected. The logic HI defect-detector input is fed through an inverting amplifier to produce a logic LO output during a defect. The logic LO defect-detector output pulse at pin 13 is coupled to the comb-filter circuit to gate ON the defect-correction circuitry.

During LOAD/UNLOAD, RAPID ACCESS FORWARD and REVERSE, and PAUSE, the output of the video FM demodulator is "squelched" to prevent noise from appearing on the TV receiver screen. This is done by applying a NOT SQUELCH signal (SQ) to pin 8 of the integrated circuit. Internally, the squelch circuitry controls both the inverting amplifier

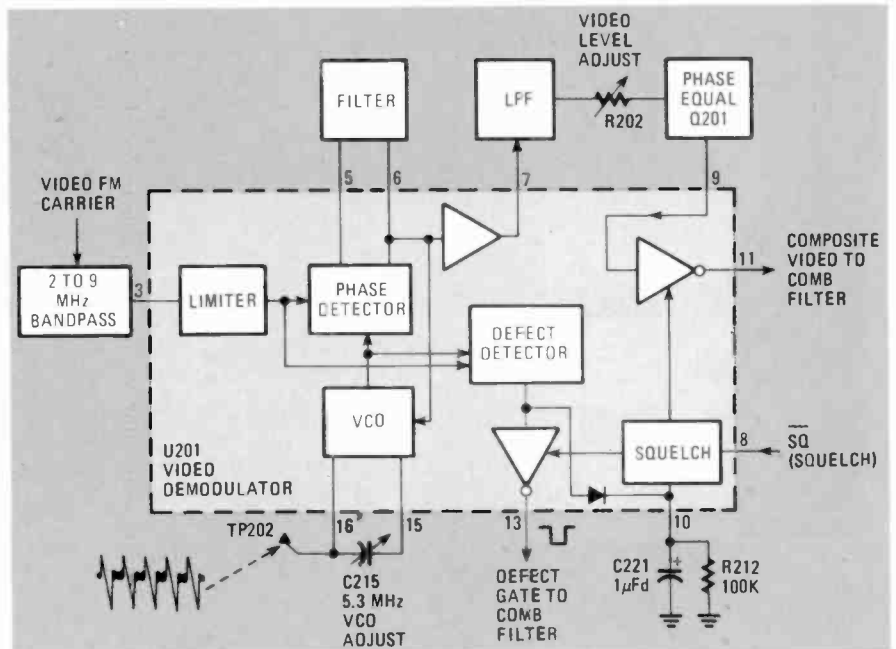


FIG. 3—VIDEO FM DEMODULATION CIRCUIT is effectively contained in a single IC. Note that the defect detector is also built into this rather special-purpose device.

that provides the composite video-output signal to the comb filter, and the defect pulse-inverter circuit. The squelch action on the defect-inverter circuit prevents the defect gate output from going to a logic LO when the carrier disappears because the stylus has been lifted off the disc. If the defect-detection output were not disabled, the comb-filter circuit would continue to recycle the previous horizontal line of information.

When the NOT SQUELCH line returns to logic HI, the video demodulator is allowed to operate. However, noise generated by lack of video carrier does not appear in the demodulator output signal at pin 11. Internal positive-going defect-detector pulses, generated when

the PLL detector is unlocked hold a charge of about 2 volts on C221 connected to pin 10.

As the stylus begins picking up good signals and the demodulator PLL locks, the defect pulses cease, allowing the voltage on C221 to discharge to 1 volt through the time constant of C221 and R212. At this point, the internal squelch circuitry is deactivated allowing the video-demodulator output amplifier to resume normal operation.

The time constant of C221 and R212 allows enough time for adequate video carrier to be recovered. This provides nondistorted video information to the display when returning to the PLAY mode. Once the squelch system un-squelches, the squelch circuit no longer responds to defect pulses. Therefore, the system can only be squelched by pulling pin 8 LO via the NOT SQUELCH line.

Comb filter/defect corrector

Figure 4 is a simplified diagram of the video-processing operation. You'll note that the composite video from the video demodulator is fed to one input of an electronic DEFECT SWITCH. This is built into the comb-filter IC. At the same time, delayed video is fed to the other input of the DEFECT SWITCH.

The defect gate pulse from the video demodulator automatically switches the input to the comb filter from the composite video output from the video demodulator to the delayed video input from the comb filter delay line, whenever the defect pulse appears.

When the video carrier is recovered, the defect gate pulse goes HI, switching the comb-filter input back to the normal composite video output from the video demodulator.

In addition to supplying the delayed

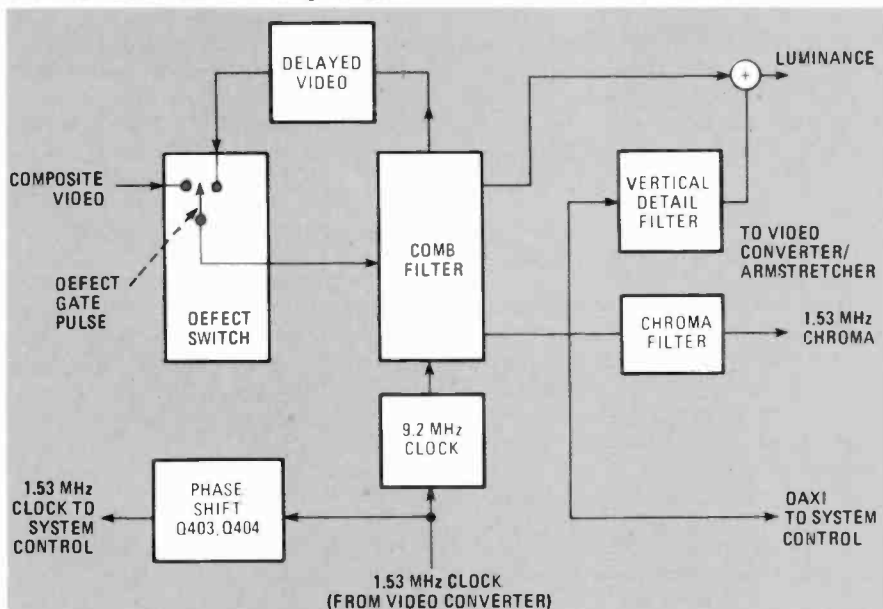


FIG. 4—BLOCK DIAGRAM SHOWS A SIMPLIFIED view of the video processing operation. The comb filter is fed the composite video signal circuit or a delayed composite video signal. The decision is made by the defect switch.

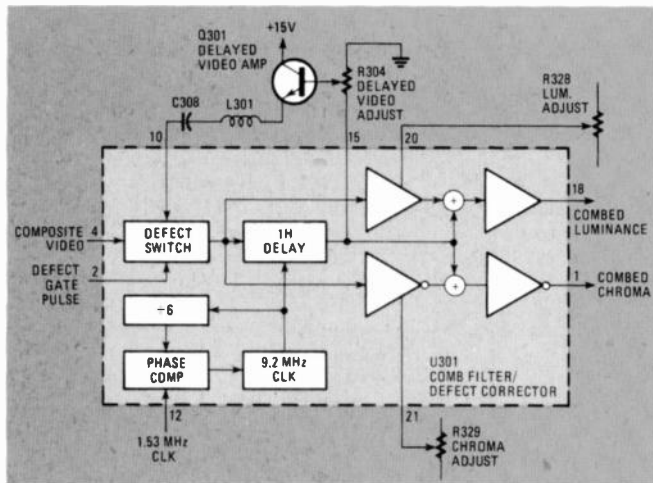


FIG. 5—COMB FILTER/DEFECT CORRECTOR operation is detailed in this block diagram. It's important that you understand how it works.

video signal, the comb filter also separates the luminance and the buried subcarrier chrominance information. The combined chrominance is then bandpass filtered to separate the vertical detail and DAXI (Digital Auxiliary Information code used to develop the time indication) from the combed chrominance signal.

The comb filter uses a 9.2-MHz clock that is developed from the 1.53-MHz clock signal generated by the video converter. This 1.53-MHz signal is also fed through two phase-shifting transistors to provide the clock signal needed by the system control circuits.

As shown in greater detail in Fig. 5, composite video from the video demodulator is applied to pin 4 of U301, the comb-filter defect corrector. The defect gate pulse from the demodulator is applied to pin 2. Delayed video information from the comb filter's output appears at pin 15 and is applied through R304 the DELAYED VIDEO ADJUST control to the base of Q301 the video amplifier. The signal is amplified by Q301 and returned to the defect switch through pin 10.

During normal operation the input to the delay line consists of the composite video output from the video demodulator. Whenever the video-carrier signal is lost, the defect gate pulse on pin 2 of U301 goes to Logic LO. This switches the defect switch so it now supplies the delayed video signal.

If the video carrier is lost for an extended period, the horizontal line of information that occurred before the video-carrier loss is recirculated through the delay line and back to the defect switch several times.

At the same time the composite video is fed to the delay line, it is also coupled to two separate amplifier channels. One of these is the luminance pass channel. This signal is amplified and its gain controlled by R328 the LUMINANCE ADJUST control.

The amplified signal is then fed to one input of an internal adder circuit. The other input to this adder circuit is fed from the output of the delay line. Since adjacent lines of luminance information contain essentially the same information, the adder's output will be the sum of the luminance signals. However, since the chrominance signals have a 180° phase shift from one line to the next, these signals will cancel, removing chrominance information from the adder's output. As a result, the signal at pin 18 contains only combed luminance information. All of the chrominance signal has now been eliminated.

The incoming composite video from the defect switch also passes through the chrominance pass channel. The chrominance pass-channel amplifier is an inverting amplifier whose gain is controlled by R329, the CHROMINANCE ADJUST control.

The inverted signal from this amplifier is then fed to one input of another internal adder circuit. The other input of this adder is the delayed composite video. Because of the inversion in the amplifier, the chrominance information that appears at the inputs to the adder are now in phase and a combed chrominance output appears at pin 1 that is twice the value of the incoming chrominance.

At the same time the inversion results in the luminance signal being out of phase with the delayed signal and the luminance signals cancel in the adder. Therefore, the luminance has been removed from the chrominance output at pin 1.

The delay line that is used in the comb filter is driven by a 9.2-MHz clock. Its output is divided by six and then applied to a phase comparator that compares the phase of the divide-by-six clock signal with the 1.53-MHz clock signal from the video converter. The phase comparator output is then ap-

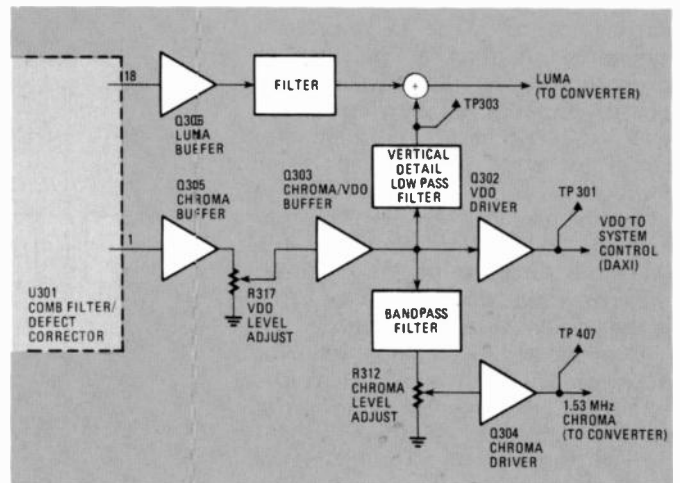


FIG. 6—FOLLOWING THE COMB FILTER some additional signal processing is required. Details are shown here.

plied to the 9.2-MHz clock voltage-controlled oscillator to insure that the clock signal is exactly six times the 1.53-MHz clock rate.

After being processed by the comb filter, the combed chrominance information from pin 1 of U301 is passed through Q305, the CHROMA BUFFER as shown in Fig. 6. The chroma signal is then fed through R317, the VDO LEVEL ADJUST (Vertical Detail Output) control to Q303 the VDO BUFFER transistor. Q303's output is then split into three. One path is through a filter network that passes only vertical-detail output signals. These signals are coupled to an adder, where they are combined with the combed luminance.

Another output from Q303 is applied through VDO driver Q302 and contains the DAXI code that is coupled to the system control circuit.

The third combed chrominance signal from Q303 is applied to a bandpass filter that passes only frequencies between 1 and 2 MHz. This signal contains the chrominance information (1.53 MHz \pm 500 kHz). The output of this bandpass filter is fed to R312, the CHROMA LEVEL ADJUST control. Its arm is connected to the CHROMA DRIVER transistor, Q304. The resulting 1.53-MHz chroma subcarrier is then coupled to the video converter IC.

The combined luminance information taken from pin 18 of U301 is coupled to Q306 the LUMINANCE BUFFER. And from there it goes through a filter network to one input of an adder circuit. The other input to this adder contains the signal that has been separated from the combed chrominance output. These two signals are added to develop complete combed luminance.

Now that we've taken a trip through the video-processing circuitry of the RCA videodisc player there are important circuits still to be described. We will examine more of them next month.

R-E

JAMES A. GUPTON JR.

WITH THE UNICORN-1 ROBOT OPERATING under radio control, what now? Why, *computer* control, of course! This part will deal with that subject, although, because of its complexity, only in general terms.

For those of you already involved with computers—micro or otherwise—much of what will be discussed here may seem elementary. For those who have not yet been exposed to that fascinating area of electronics we will try to keep things as simple as possible.

What will be covered here will be the *concepts* involved in having the actions of a robot determined by an electronic device rather than by a human operator. That's where much of the challenge of computer control comes in.

A human can exercise his judgment—without necessarily having to think about it—and change the robot's actions to meet the circumstances. The computer also has to exercise judgment, but before it can do that it must be taught—or programmed—*how* to make judgments; that involves a great deal of highly detailed programming.

For those of you who are unfamiliar with computers, it is not enough just to connect a computer to the robot and say, "Go ahead . . . do your stuff." Every action must be pre-planned, and, more important, every consequence of every action must be considered and the appropriate reaction prepared.

That is one reason why we will not present specific programs for robot control but will, instead, talk about the way those programs will have to function.

Methods of computer-control

To put it broadly, there are three ways that a computer can be used to control the robot's actions.

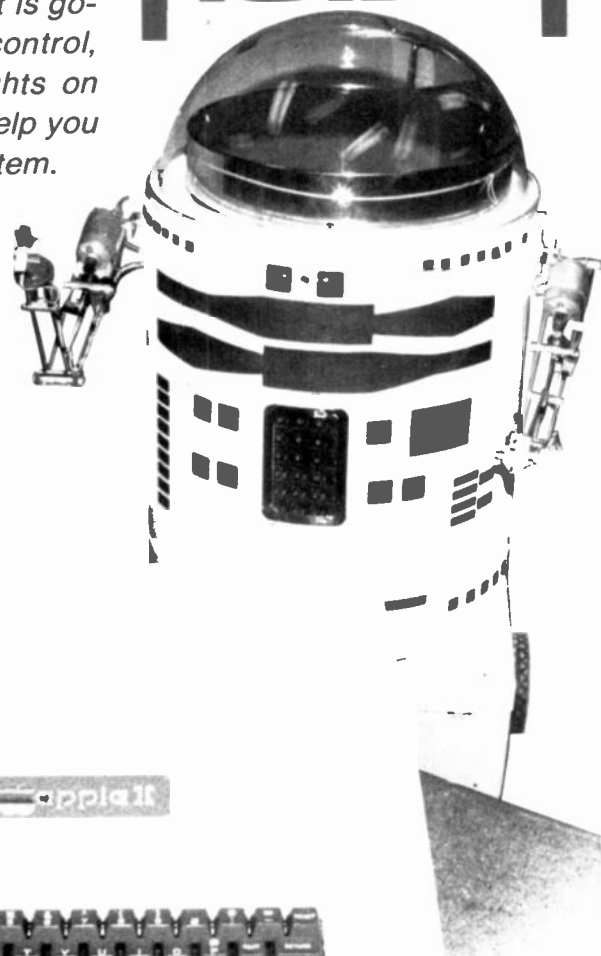
The first, and simplest, would substitute a computer, *located outside the robot*, for the command consoles described earlier in this series. That computer would be linked to the robot either by cable or by radio.

The program for that system would be fairly simple and would allow the operator to type in a command, to which the robot would respond. For example, entering "GO" or "G" would cause the robot to move forward; "TURN LEFT" or "L" would cause it to turn to the left, and so on.

That elementary program could be modified to operate with a speech-recognition device—several of which are available for a couple of hundred dollars—to allow the robot to respond to the spoken

Computer Control for the UNICORN-1 ROBOT

Part 10—If your robot is going to use computer control, here are some thoughts on the subject that will help you in setting up your system.



word. The vocabulary would be limited (but adequate) but the commands would have to be given to the external computer, not to the robot directly.

The second system would be a program, or series of programs, that would command the robot to perform a predefined sequence of actions.

For example, the robot might be instructed to move forward for ten seconds, stop, raise its right arm in a salute, beep its horn, and then turn around and return to its starting position.

Such programs could become very elaborate, but have a major drawback. Unless the robot is equipped to respond to its environment (and, so far, it isn't) any unknown factor that enters the picture could have serious consequences.

Using the program above as an example, suppose that, unknown to you, the robot is facing a brick wall, five feet in front of it. Shortly after the robot begins to carry out the instructions given to it by the computer, it will run smack into that wall! Not only will that interfere with the rest of the program, but it can also cause damage to the robot and, possibly, the wall. Or maybe, instead of a brick wall, there's a person or a piece of furniture in the way. The overall damage—and its consequences—could be considerably more serious.

In any case where the robot is operating without human intervention, provision must be made for the program to be overridden!

Any program of that nature must contain some means for the human supervisor to stop or alter the robot's actions at any time. That is one reason that the "drop-dead" circuit was included on the latch board (Part 9)—one command would activate that circuit and cause the robot to stop in its tracks, should any unforeseen circumstance arise.

The third method of computer control, and the most fascinating, involves the robot having its own, on-board, computer. The precautions given for the second method also hold here. We'll talk about that method in more detail shortly.

Interfacing

Whichever method is chosen, the robot must be equipped to respond to (and, perhaps, "talk back" to) the computer. Fortunately, the circuits already being used by the robot are designed with that in mind.

There are two formats that computers can use to output data or to receive it: *parallel* and *serial*. The parallel format is always used by the computer internally.

The unit of information that the computer uses for communication is called a *byte*. A byte is made up of eight bits (*binary digits*)—each one either at a logic-"high" or logic-"low" state—and the computer operates on all eight bits at once. Frequently, when a computer is used to operate a printer, the parallel for-

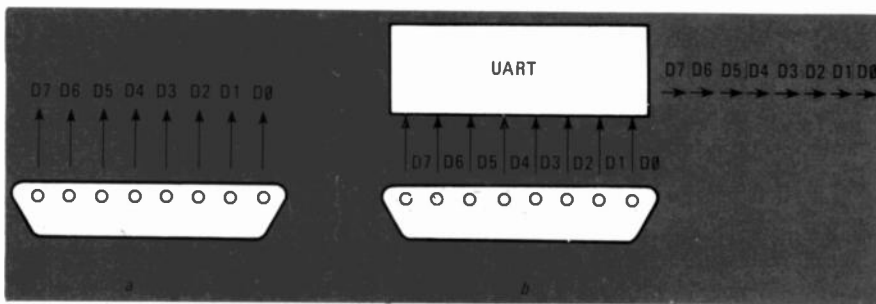


FIG. 83—ALL THE BITS of a byte are sent simultaneously in parallel communications (a). A UART (b) converts parallel data into serial data for transmission over a single line.

mat is used and eight lines are used to connect to the printer—one for each bit of the byte.

On the other hand, sometimes it is convenient—or even necessary—to transmit computer data using only a single line (by telephone, for example). In that case, the serial format is used. The computer takes each byte and sends it out bit-by-bit, one after the other, indicating the beginning and end of each byte. At the other end, the eight bits are received in the order in which they were sent; when they have all arrived, they are used in parallel. Both of those systems are illustrated in Fig. 83. The device that performs the parallel-to-serial and the serial-to-parallel conversions is known as a UART (*Universal Asynchronous Receiver/Transmitter*). UART's would be used if commands were transmitted to the robot by radio.

If you connect your computer to the robot by means of a cable from the computer's parallel port, it would be a good idea to use twice as many lines as necessary (16) and ground every other one. That will help keep electrical noise from getting mixed in with the data.

(For more information on how computers operate see "Your Own Computer" in the October 1980 issue of *Radio-Electronics* and the article on assembly language computers on page 45 of this issue.)

The decoder-, latch-, and relay-driver-boards in the Unicorn-1 use parallel data. Using the same technique as used with the 7402 IC's on the decoder board, any two bits of an eight-bit word (byte) can be NOR'd or NAND'ed to produce a single control bit for the relay-driver board. If you're knowledgeable, more complex and versatile encoding/decoding schemes can be used.

Which computer?

There are two classes of computers that must be considered: those for external use and those that can be mounted on-board the robot.

Almost any computer that has at least one parallel port can be used for the first purpose and it is not our intention to single out one manufacturer's over the other. If you are contemplating buying a computer, refer to the articles mentioned above.

The important thing is that the com-

puter be equipped with a parallel port and that it be flexible enough to meet your needs—present and anticipated. For example, if you are considering using voice control, make certain that there is a speech-recognition board available for your computer.

It should be noted that some computers—such as the Radio Shack *TRS-80* and the Commodore *PET*—do not have parallel ports as such, but that their expansion connectors—frequently used to connect to printers—are actually just that. The thing to look for is eight *data lines*, usually designated "D0" through "D7." If you have those, you have your parallel port.

You will also want a cassette and/or disk interface to allow you to save programs that you have written for the robot.

One thing you should avoid are inexpensive computers that are actually glorified video games. They generally will not have the facilities you need and it will prove difficult (or impossible) to add them.

The other possibility is a single-board computer that can be mounted in the robot. In addition to a parallel port and cassette interface, that computer must also have a hexadecimal ("hex") keypad for programming, and some kind of LED display, if it is not going to be used together with an external computer. An example of how such a computer would be interfaced to the robot is shown in Fig. 84.

A good computer for the purpose is the *KIM-1*. Unfortunately, that computer was recently discontinued; but you may still be able to find one here and there. Other possibilities include the *SYM-1* (a sort of super *KIM*), the *ELF-II* or the *Explorer/85* (keypad version). Again, refer to the article on page 45. Both the *ELF-II* and the *Explorer/85* are manufactured by Netronics, 333 Litchfield Road, New Milford, CT 06776. The *SYM-1* is produced by Synertek Systems Corporation, P.O. Box 552, Santa Clara, CA 95052.

Bear in mind that some of those computers may require a power supply other than 5- or 12-volts DC. In that case a power inverter (see Fig. 85) can be used to turn the robot's 12-volt supply into 117 VAC, which the *computer's* power sup-

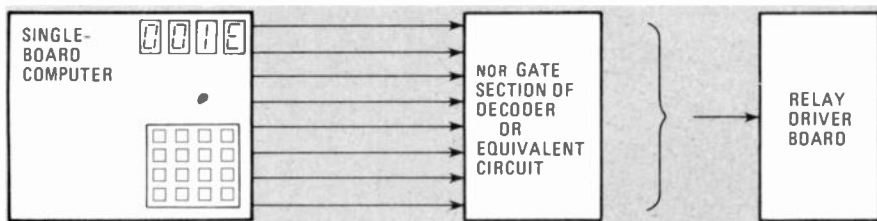


FIG. 84—SINGLE-BOARD COMPUTER can be connected to NOR gate section of latch board or to an equivalent circuit designed to give a single output from a two-bit input. That is only one of many possible schemes.

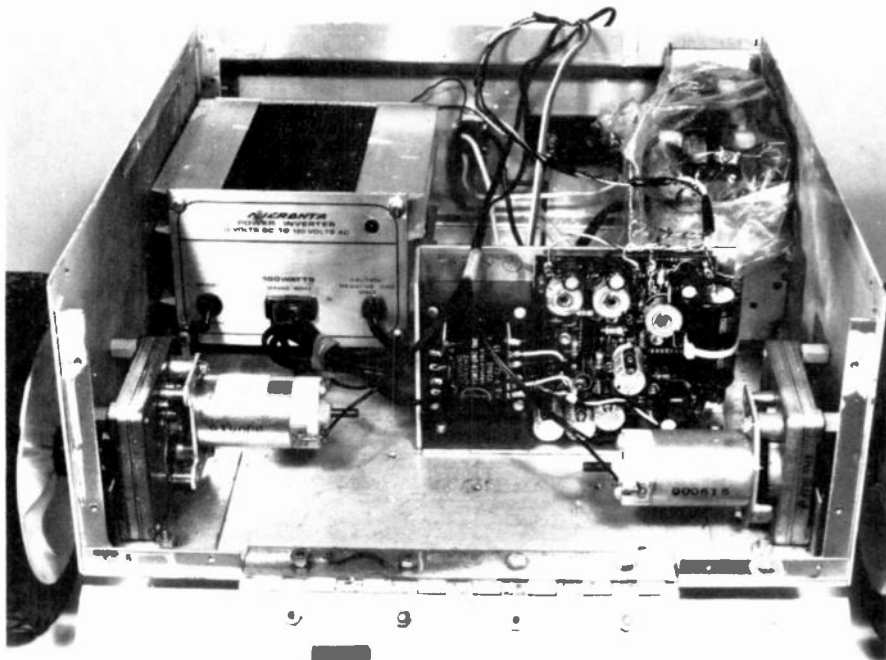


FIG. 85—AN INVERTER (left rear) may be needed if the on-board computer has power requirements other than +5 or +12 volts DC.

ply can then convert readily to its own requirements.

Finally, if you already own a computer but intend to install another in the robot, it would be a good idea to make sure that both computers use the same-type, or compatible, microprocessors. The *KIM-1* and *SYM-1* use the 6502, which is also found in the *Apple II*, *OSI Challenger(s)* and the *PET*, and the *Z-80* in the *TRS-80* is compatible with the *Explorer/85's* 8085.

The 1802, used in the *ELF II* and in RCA's *VIP*, is not normally found in larger computers, but that does not mean that an 1802-based single-board computer should not be used in the robot.

The fact that both of your computers use the same microprocessor means that both of them speak the same language, at the microprocessor level. That, in turn, means that you can use your larger computer to develop and debug (troubleshoot) programs to run on the robot's computer and to *download* (transfer from the larger to the smaller computer) those programs, either directly or, if the cassette interfaces are of the same type, from tape.

The programming itself will also be

easier, since—assuming that your programs are in machine language and not in BASIC—you will be able to use an assembler, making your work go more quickly and also making it easier to follow the flow of the program.

Programming

As you may have gathered by now, it would be impossible to present computer programs for robot-control, there being so many variables involved.

If you are working with an external computer, you will probably want to work in BASIC or another high-level language, using the *OUT* command, or its equivalent, to transfer data to the robot.

As mentioned above, the on-board computer will almost certainly have to be programmed in machine language. It's more difficult to work with than BASIC, but it *does* have advantages. Programs take up much less memory space, and also run more efficiently. You may even want to write your "big-computer" programs entirely in machine language through the use of an assembler.

This section has of necessity, been sketchy after all, even books on the subject have not been able to cover the mat-

ter completely.

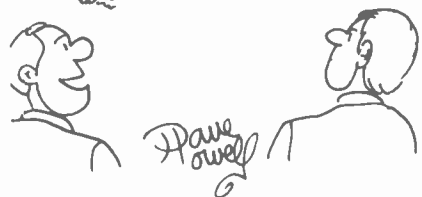
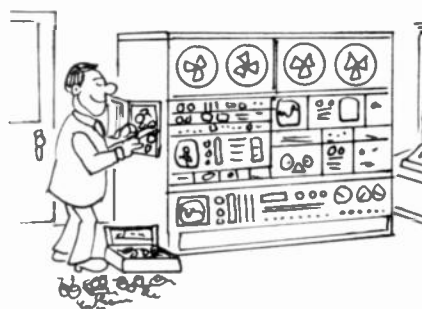
If you are going to use a computer with your robot, we recommend that you do as much supplementary reading as you can. Personal-computer magazines such as *Byte* magazine and *Interface Age* have had special issues dealing with robots, and the subject comes up frequently there and in other computer publications. Another good source of information that is often overlooked is your local library.

Todd Loofbourrow's book, *How to Build a Computer-Controlled Robot* (Hayden Publishing Company) contains a number of robot-control programs written for the *KIM-1* (or *SYM-1*) as well as a number of more generalized flowcharts. Much of the information presented there may be adaptable to your robot.

A very good—although rather technical—article on "An Interactive Programming Language for Control of Robots" by Li Chen Wang appeared in the September 1977 issue of *Dr. Dobb's Journal of Computer Calisthenics & Orthodontia*. It involves a robotic simulation on a computer's video display and its principles could be adapted to control a "flesh-and-blood" robot. (That issue, #18, Volume II, No. 8, is available in limited quantities from: *Dr. Dobb's Journal*, 1263 El Camino Real, Box E, Menlo Park, CA 94025 for \$2.50, postpaid, second class.) It's worth looking into for readers already familiar with computer programming.

In the next part of the *Unicorn-1* series we will take a look at sensors. We will discuss sensors in general, and show you some specific examples that can allow your robot—and the computer that controls it—to respond to the world around it.

We would like to hear about how you're doing with your version of *Unicorn-1*. Write (and send photographs) to: **ROBOT UPDATE**, *Radio-Electronics*, 200 Park Avenue South, New York, NY 10003. **R-E**



"Charlie's OK at fixing computers. He seldom does any damage that an electronic technician can't repair."



HOME VIDEO UPDATE

LEONARD FELDMAN
CONTRIBUTING EDITOR

Here's a look at the latest video innovations from Japan. Most will be available here soon.

THE EMPHASIS IN HOME-ENTERTAINMENT products seems to be shifting, at least for the moment, from high-fidelity components to video and its many related products. Both in the United States and in Japan, new video products and advances in video technology abound. In this article, I will present a few of the newsworthy developments that have come to my attention in recent weeks.

Having just returned from a visit to the Japan Electronics Show held in Tokyo, and personal visits to many of Sony Corporation's factories, much of the news presented here originated in the Orient. It has been my experience, though, that even if the products seen in Japan are not yet sold in the U.S., with a few exceptions they will all be sold here within the next six months to one year. New ideas and products originated by Japanese manufacturers are most often test-marketed in their own domestic market and then exported to the rest of the world.

Jitterless VCR still-pictures

Many VCR's, both VHS and Beta format, have, for some time, featured a "freeze-frame" mode that stops playback of a video tape so the helical-scan head drum repeats a single picture over and over again, presenting what appears to be a still picture on the face of the associated TV screen. Unfortunately, most of these "still frame" systems present a picture that, at its best, is somewhat blurred and at its worst is marred by wide bands of noise streaking across the picture horizontally or diagonally.

To understand why this happens, it is necessary to review the way video signals are recorded on video cassette recorders (VCR's). The system used is called an azimuth recording system. In the NTSC system of television transmission, the TV picture consists of two fields for each frame. There are 60 fields per second or 30 complete frames per

second. A VCR uses multiple heads to record the video signal. In the Betamax system, for example, the two video heads are located 180° apart, around the perimeter of the fast-spinning head-drum. One head, tilted at one angle, is designated as a "plus" azimuth head, while the other head is set at different, opposite, angle and is designated as a "minus" azimuth. One head normally records one field and the other head records the signal of the adjacent field which, together with the first recording, equals one complete frame. This system, one of *Betamax's* distinguishing characteristics, prevents the video signal of one track from interfering with that of the adjacent track.

With this type of arrangement, when the VCR is put in the "still-frame" mode (the horizontal motion of the tape is stopped and only the head drum revolves), the video head straddles two tracks at once, as shown in Fig. 1. That is, the head scans part of the A-1 field's

picture as well as B-1 field's picture. The "still" picture produced is actually a combination of two fields, or one complete frame. As can be seen in Fig. 2, when there is a fast moving object in the scene being reproduced, such as the rapidly moving end of the golf club in the diagram of Fig. 2, the resulting picture becomes quite blurred. It can no longer be regarded as a true "still" picture.

Sony Corporation, at the Electronics Show in Japan, introduced a new model *Betamax* VCR, the *SL-J9*. They claim it is the first home video recorder that can produce still-frame pictures that are as good as those used in broadcast equipment. The new capability is the result of what Sony calls their Double-Azimuth Head.

The diagram at the left, in Fig. 3, shows the ordinary head/drum arrangement, in which the "A" side has a "plus" azimuth head while the "B" side of the drum incorporates a "minus" azimuth head. In the diagram at the right, however, one of the video heads (the one that would normally be designated as having the "minus" azimuth) also has a "plus" azimuth (hence the name Double-Azimuth Head).

When the VCR is placed in the "still frame" mode, the signal is read or scanned by the normal "plus" azimuth head as well as by the "plus" azimuth section of the double azimuth head. During this mode of operation, the "minus" azimuth portion of the head is inactive. As shown in Fig. 4, when the tape is stopped, only the signal that was recorded on the "plus" azimuth track is scanned. This means that the B1 field (in Fig. 1) is not traced at all. In playback, the A1 field is played back twice during the still mode of operation. All this results in a completely motionless picture. To get slow-motion that is equally noise and jitter free, Sony has combined this new still-frame approach with normal playback. Thus, in the slow-motion mode, still frame is followed by normal playback, which, in turn is followed by another still picture, etc.

Other video innovations

The Tokyo Electronics Show also saw the introduction of new VCR's and receivers that can handle any of the world's major broadcast video systems, new lightweight video cameras, and what may well become the central com-

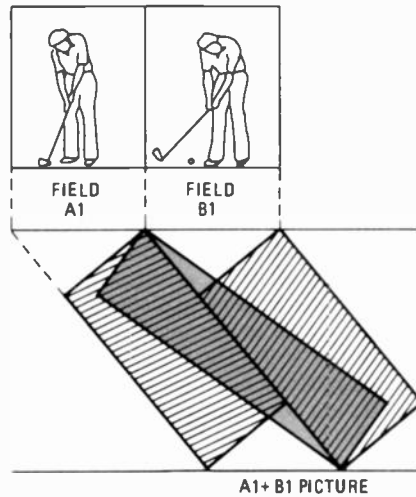


FIG. 1—DUAL HEADS IN TODAY'S VCR's often result in blurred pictures because the two fields that make up a single picture can be different.



FIG. 2—THIS BLURRED PICTURE was caused when the two fields shown in Fig. 1 were combined to form this stop-frame picture.

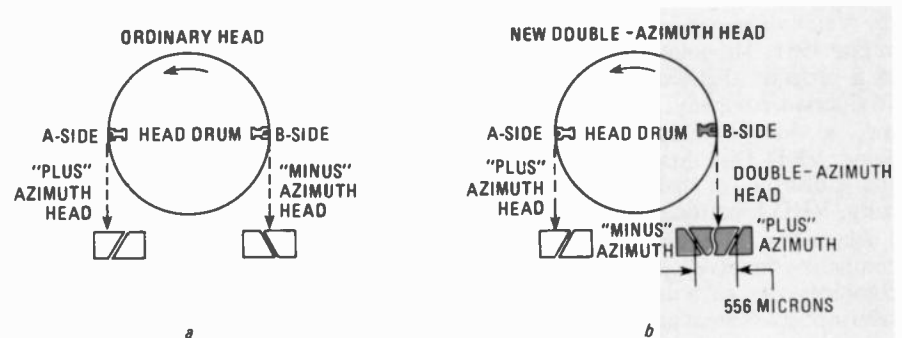


FIG. 3—COMPARISON OF CONVENTIONAL HEAD WITH DOUBLE-AZIMUTH HEAD can be seen in this side-by-side comparison—only the azimuth of the second head has been changed in the double-azimuth head.

ponent in the home entertainment system of the future, a TV monitor color screen called *Profeel*, also introduced by Sony Corporation.

Profeel, as presently offered to the Japanese domestic consumer, consists of three different sized high-quality

color monitor components ranging from a giant 27-inch screen (measured diagonally) down to a 16-inch version. Since the monitors contain only the electronics needed to produce the high-quality color picture and its associated audio tracks (there is no TV-RF/IF section), the tuner section of a VCR is used with the *Profeel* monitors. Optionally, the viewer can buy a separate *Profeel* component tuner at a cost (in Japan) of approximately \$300.00. In Japan many of the broadcast programs already transmit stereo audio along with the TV picture. The stereo audio signals coming from the VCR or the component tuner can be fed directly to a component high-fidelity system or the matching *Profeel* speaker systems available as part of the program. The whole idea suggests that someday in the future, video will become component-oriented in much the same way that audio equipment did in the 1960's and 1970's. When you think about that, it makes a lot of sense, since we are seeing more and more video-related items that need to be interfaced with a television monitor but do not require the RF and IF circuitry contained in a full TV receiver.

Panasonic (National, in Japan), Sharp, and Sony all offered three-system video-cassette decks. The three systems referred to have nothing to do with the VCR format, but rather relate to the three systems of standards used in TV broadcasting around the world. Thus,

Sony's version of this new VCR, the *SL-77*, can record and play back in the PAL and SECAM modes used in Europe and elsewhere, and can play back (without being able to record) prerecorded video cassettes using the American and Japanese NTSC system. To deliver that

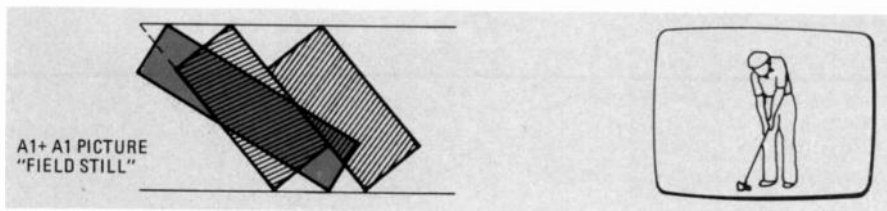


FIG. 4—USING THE DOUBLE-AZIMUTH HEAD the still-frame picture appears sharper and interference-free.

added versatility, the machine requires about 50% more parts than a conventional VCR and, at Japanese prices, will cost about \$200.00 more than similar-featured one-system machines. Sharp's model VC-6500E, a VHS-format unit, is similarly priced and also handles all three video formats. There were universal TV receivers in a variety of screen sizes and prices that are also switchable and can handle all three of the world's major TV standards, as well as a variety of different electric line voltages and frequencies.

Status of videodiscs

Some manufacturer-exhibitors at the Tokyo Electronics show exhibited more than one type of videodisc—presumably to illustrate their technical and manufacturing capabilities. Toshiba, in fact, showed not only the optical Philips/Magnavox/Pioneer type of player and a JVC/Panasonic/GE VHD capacitance type, but even had on hand a player that could handle the U.S.-originated RCA *SelectaVision* (CED) discs.

A few weeks after the Tokyo Electronics Show closed in Japan, there was important news about the looming videodisc battle right here in the United States. Late in October, 1980 General Electric Company, Matsushita Electric Company of Japan, (MEI), Victor Company of Japan (JVC) and Thorn EMI of Great Britain announced formation of three jointly-owned companies to launch the VHD videodisc system in the U.S. in late 1981. The joint ventures consist of a program distribution and artistic production company, VHD Programs, Inc., a videodisc manufacturing company, VHD Disc Manufacturing Co., and a disc player manufacturing company, VHD Electronics Inc.

According to executives of all the companies involved, the VHD system combines the advantages of both the laser-optical system and the capacitive-groove type systems with which it will compete. Its 10.2-inch diameter disc, developed by JVC, features fast and slow motion, fast forward and reverse, still-frame mode, and random access, with one hour's playing time on each side. Since the big question about VHD's ability to compete with other systems had been the question of available programming or software, the entry of Thorn EMI into the group is a significant development.

Already negotiations are underway with 20th Century-Fox, Warner Home Video, Columbia, MGM/CBS and other major studios. The initial VHD library, subject to final negotiations, will include at least 160 current, all-time favorites, and future motion pictures from major studios and independents. VHD Programs, Inc. is also negotiating licensing agreements to distribute VHD disc programs to the home video market with Walt Disney Productions, Filmways and a number of independent production companies, including Time-Life films.

The projected VHD player reproduces full-color video programs in two-channel stereo sound. The user will also be able to select a videodisc with a different language on each of the two sound tracks. The VHD player rotates the disc at 900 revolutions per minute (as compared with 1800 rpm for the laser-optical disc and 450 rpm for the RCA *SelectaVision* discs). An optional random access feature will permit viewers to program more than 10 separate segments for playback in a preselected order and speed selected for each segment. By adding an optional digital audio processor to the basic player, digital audio sound for high fidelity enthusiasts becomes available.

In the mastering process of the VHD system, information is recorded onto a photo-sensitized glass master disc by focusing a minute laser beam directly onto its surface. The laser beam is split

in two, with one part used to record program information while the other is used to record a special tracking signal. A metallic disc produced from the glass disc is used for the remainder of the manufacturing process, similar to the procedure that is used in audio-record stamping.

The VHD diamond capacitance-playback stylus used in playing these discs has an electrode that detects the capacitance variations between the disc and the stylus. The stylus is able to detect both the main signal and the tracking signal simultaneously and is therefore able to track effectively even though there are no grooves in the VHD disc itself.

Listen fast—or slow

The hand-held remote control unit shown in Fig. 5 should be familiar to most readers who have seen or own one of the new VCR's equipped with the special-effects features shown on the face of the controller. What may not be so familiar is the VSC logo that has been affixed to the top of the unit. It stands for Variable Speech Control Company, a small San Francisco-based outfit that has come up with audio circuitry that meets the new requirements of the VCR's. Now, thanks to the development of a new custom IC, it becomes cost-effective for manufacturers to include what VSC calls their "speed listening feature." While viewers are now able to double the viewing speed (or, in some cases, increase it even more) on a home VCR, they have had to content themselves with either turning off the audio tracks or listening to unintelligible "Donald Duck"-like speech that normally occurs at increased speeds. As explained by Mr. Marvin Flaks, president of VSC Corporation, the human brain can easily process verbal information at speeds of 250 to 300 words per minute, or about twice the average speaking rate. At this speed, comprehension may actually increase, as concentration intensifies. The VSC feature simply allows you to listen to the increased audio rate by restoring the *pitch* or frequency range of the audio tracks to their normal range.

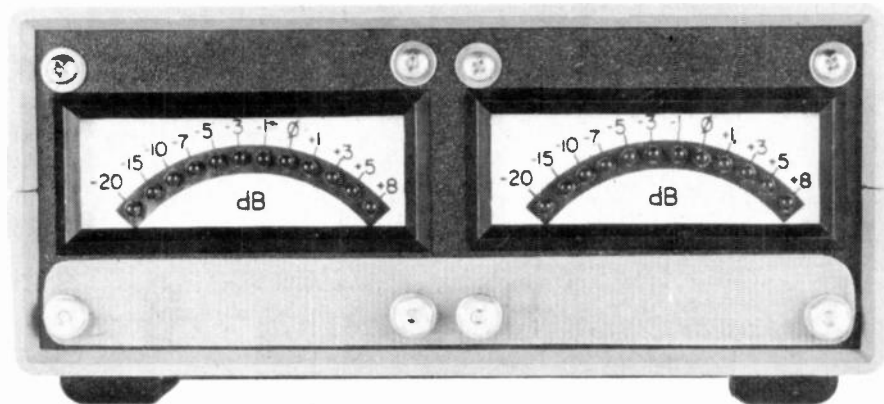
Among the companies that have already licensed VSC technology are Sony, Panasonic, JVC, General Electric and Aiwa. The feature also lends itself to use in hand-held audio-cassette decks, car tape decks, telephone-answering machines, and, possibly, videodisc players that also feature fast-play modes.

That's a quick look at what's new and what's coming soon in home video. One thing you can be sure of is that there will be many more innovations as manufacturers try to keep up with each other, and with the public's demand for more sophisticated equipment. R-E



SPECIAL SPEED-VIEWING CIRCUITRY permits viewer to listen to sound while he scans the tape. The circuitry is in the VCR.

LED VU Meter



for your Hi-Fi

Here's a high-precision, all-electronic VU meter for home recording. An LED display replaces the conventional meter movement.

BRADLEY ALBING

ANYONE FAMILIAR WITH RECORDING, BE it the home recordist or the pro, recognizes the need for an accurate VU meter to facilitate setting audio levels. An accurate VU meter allows us to maximize the S/N ratio while minimizing the distortion caused by clipping in amplifier stages or saturation of the tape.

In the past, the analog, or mechanical, VU meter was used. Those meters were (and are) available with varying degrees of accuracy for varying amounts of money. As with most other things, higher accuracy means higher cost. The VU meter responds, more or less, to the average level of the audio; although it can respond fairly quickly, it is not a peak-reading or responding meter.

In an attempt to overcome some of the shortcomings of the analog VU meters, an all-electronic VU meter has been designed around the Exar XR-2276 IC. This bar-graph generator IC is one of a series of recent developments by IC manufacturers intended for the market previously dominated by mechanical meters.

Up until about two years ago, anyone wishing to construct a "moving LED" or "bar-graph" display had to assemble a series of comparators and resistive voltage dividers to monitor the analog input and light a series of LED's. With the introduction by Texas Instru-

ments, National Semiconductor, and Exar Integrated Systems of a series of IC's, the task has been greatly simplified.

All of those IC's are generally the same; they use a voltage-divider network with ten or twelve voltage taps, ten or twelve comparators, a stable internal reference voltage, and an analog input signal buffer. Each voltage tap is applied to one input of each comparator, while the other inputs are tied together and fed from the output of the analog signal buffer. As the input signal increases, succeeding stages of comparators trip, supplying drive current to their corresponding LED. If the LED's are arranged in line, we have a bar-graph display; or, in the variation used with the VU meter, we may imitate a conventional meter dial.

The resistors in the voltage divider may be selected to produce a linear response (e.g., 1 volt between any trip point and the previous or next trip point), a logarithmic response (e.g., 3 dB between any trip point and the previous or next trip point), or a specialized logarithmic scale such as the VU meter with its inherent expanded scale around the 0 VU point. At the present time, only Exar is manufacturing an IC suitable for use in a VU meter.

The XR-2276 has all the circuitry necessary to determine the level of the

incoming signal and display it instantaneously. This peak-reading ability helps prevent pre-amp or tape overload from rapid, short-duration peaks in the program material to which a normal VU meter won't respond. Instead of using the conventional moving needle, the XR-2276 drives a series of LED's arranged in a manner similar to the VU meter scale with which most people are familiar.

Circuit description

Referring to Fig. 1, the input signal is applied to resistive divider R1 through R8; the appropriate tap is selected with DIP switch S1 through S7. The signal is then amplified by IC1; R11 is a vernier gain adjustment to supplement S1 through S7. IC2 functions as a full-wave precision rectifier.

The signal is next applied to IC3 which may be configured for different response characteristics: 1) A low-pass filter which gives the meter an averaging response; 2) peak-and-hold response which will show short-duration peaks and hold them long enough to be seen; or 3) fast or peak-responding without "hold." The last variation includes a jumper that allows the user to determine quantitatively the amplitude and duration of audio peaks by the brightness of the LED's while the first two variations conform more to standard response times for VU and

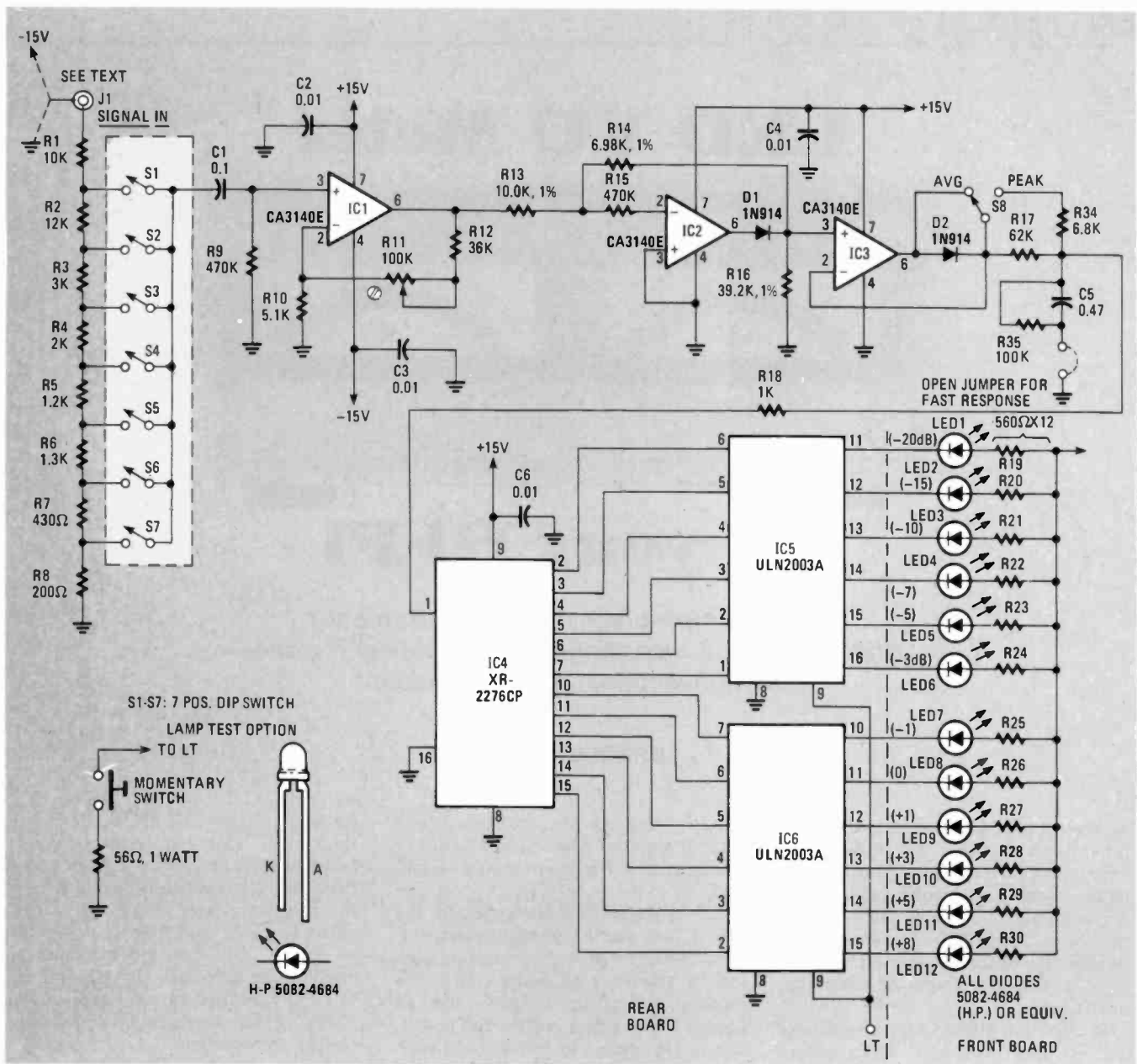


FIG. 1—THE SCHEMATIC DIAGRAM OF THE VU METER used as the prototype of several versions. Interior and exterior views are shown in the photographs.

peak-reading audio-level meters. (You can wire a SPST switch in place of the jumper to allow switch-selectable response.)

The audio signal finally arrives at IC4, the XR-2276, where it is converted into one-(or more)-of-twelve digital output signals. The output of that device goes to the driver-transistor arrays (IC5 and IC6) and then to the LED's.

The power supply is an unregulated split supply delivering approximately + and - 15 volts.

There are several variations and options available to the constructor. Those options concern the input attenuator, the LED drive circuitry, and the power supply. See Figs. 2 and 3 for details.

Construction

Nearly all components are mounted on PC boards. The display and associated circuits for each VU meter are mounted on two boards—the foil patterns are in Figs. 4 and 5. The pattern for the power-supply board is in Fig. 6. The components used, and the wiring of the boards, will be determined by the options and variations that you select. The two boards used for the circuitry and display panel are mounted with their foil sides facing each other and interconnected with short sections of No. 20 or 22 solid wire. You can use pieces clipped off resistor leads for this purpose. There are twelve jumpers across the top of the boards and others on each side. Figure 7 is an interior view of a stereo VU meter

with the Option-E (120-volt AC) power supply. That combination is Version 2. See parts list.

The appropriate components are mounted on the power-supply board which should then be connected to two signal processing and display boards.

The LED's protrude through the meter dial which can be fabricated by gluing a facsimile of Fig. 8 to stiff cardboard and punching 1/8-inch holes at the crosshairs. Alternately, you can order a ready-made meter dial. (See parts list.) Next, the bezel is mounted in the enclosure's front panel. The easiest way to hold it in place is to run a hot soldering iron tip along the adjoining surfaces of the bezel and front panel to weld the two pieces together. Be careful—don't use too much heat.

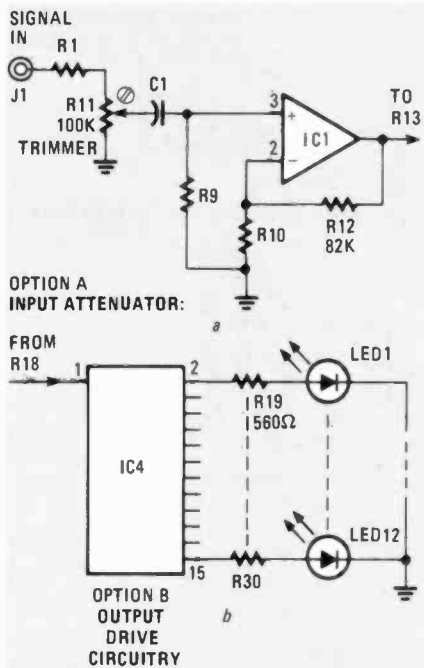


FIG. 2—OPTIONS FOR HOME recording use. In circuit at a, the stepped attenuator and switch have been replaced by a multi-turn trimmer resistor originally used in controlling the gain of IC1. Use the modified LED drive circuitry at b if you can get along with lower brightness from the indicators.

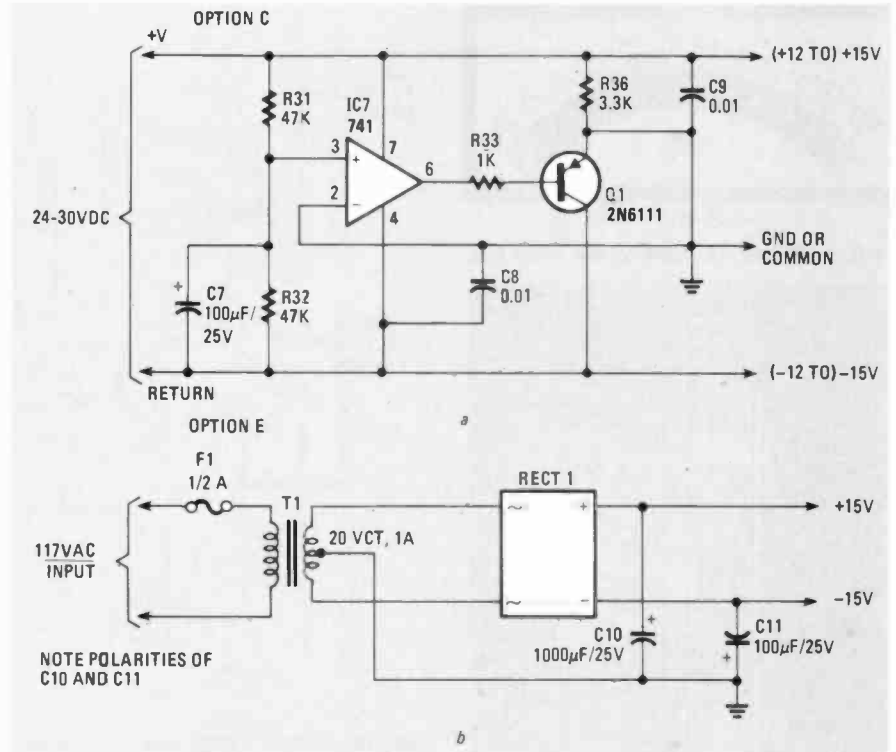


FIG. 3—POWER SUPPLY VARIATIONS. Option C is used when you have a convenient external source of 24-to-30 volts DC. IC7 and Q1 provide the dual-polarity output voltages. Use the arrangement at b (Option E) when you want to power the instrument from 117-volt AC lines.

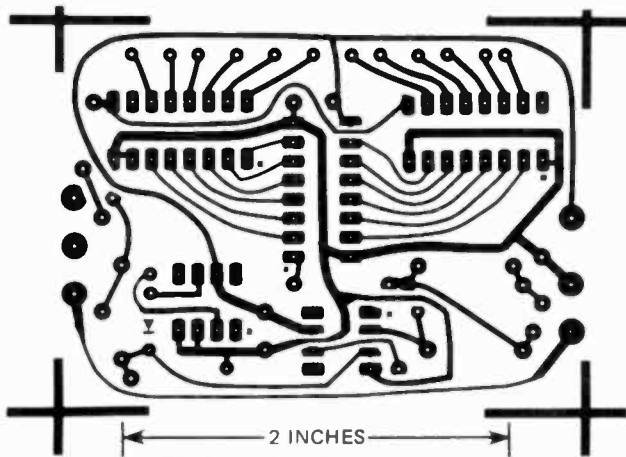


FIG. 4—FOIL PATTERN for the rear PC board. This board is 2.7 inches wide and 2 inches high.

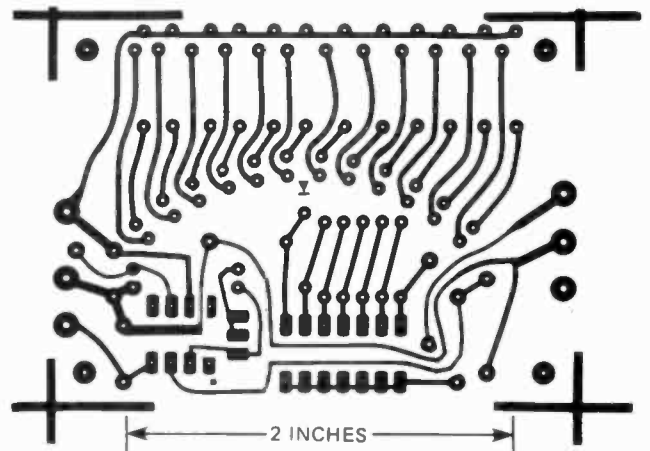


FIG. 5—PC PATTERN for the front board. The LED indicators are arranged so they protrude through holes in an arc in the meter dial.

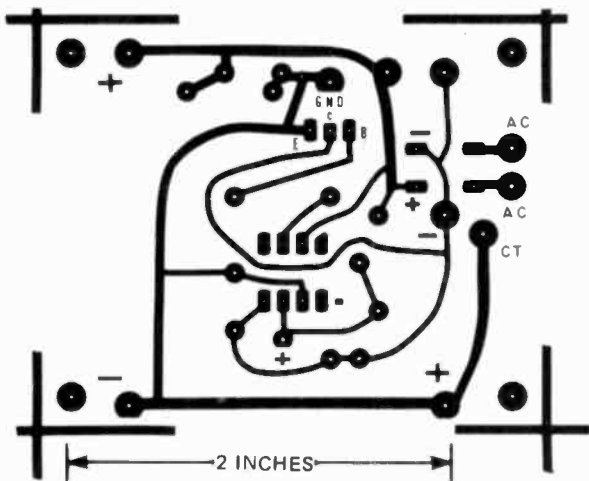


FIG. 6—FOIL PATTERN for the power-supply PC board. It is used for both versions of the supply circuit.

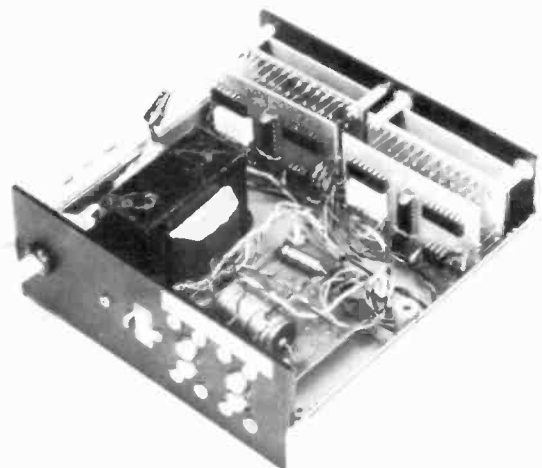


FIG. 7—INTERIOR VIEW of the prototype stereo VU meter. Note how the two circuit boards, meter face, and front panel go together.

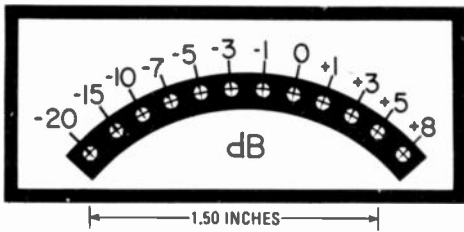


FIG. 8—PHOTO PATTERN for the meter face.

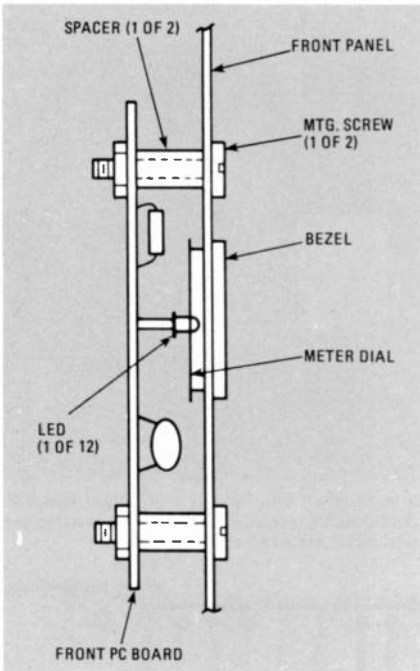


FIG. 9—CROSS-SECTIONAL DRAWING shows how parts are fastened to the front panel.

KIT OF PARTS

A complete kit of parts for the different version of the VU meter is available from: BFA Electronics, P.O. Box 212, Northfield, OH 44067. Ohio residents please add applicable sales tax.

VU-1: Includes Boards 1 and 2 (front and back boards) and, optionally, Board 3, depending on power source; also 1 bezel, 1 meter dial and all parts needed for PC boards, case not included. Request either Option C, D, or E.* Order: VU-1-C @ \$27.00 or VU-1-D @ \$24.00 or VU-1-E @ \$31.00. Add \$2.00 postage and handling.

VU-2: Includes 2 pieces each of Boards 1 and 2 and 1 Board 3, 2 bezels, 2 meter dials, all appropriate parts for all P.C. Boards (parts for Board 3 will be for Option E) and a plastic case. (Case has no holes—user must machine it as required). Order: VU-2 @ \$74.95. Add \$2.50 postage and handling.

VU-3: Includes 2 pieces each of Boards 1 and 2 and 1 of Board 3. \$10.00. Add \$1.00 postage and handling.

- *Option C: 24-30 volts DC operation
- Option D: ± 15 volt DC supply already available
- Option E: 120 volts AC operation

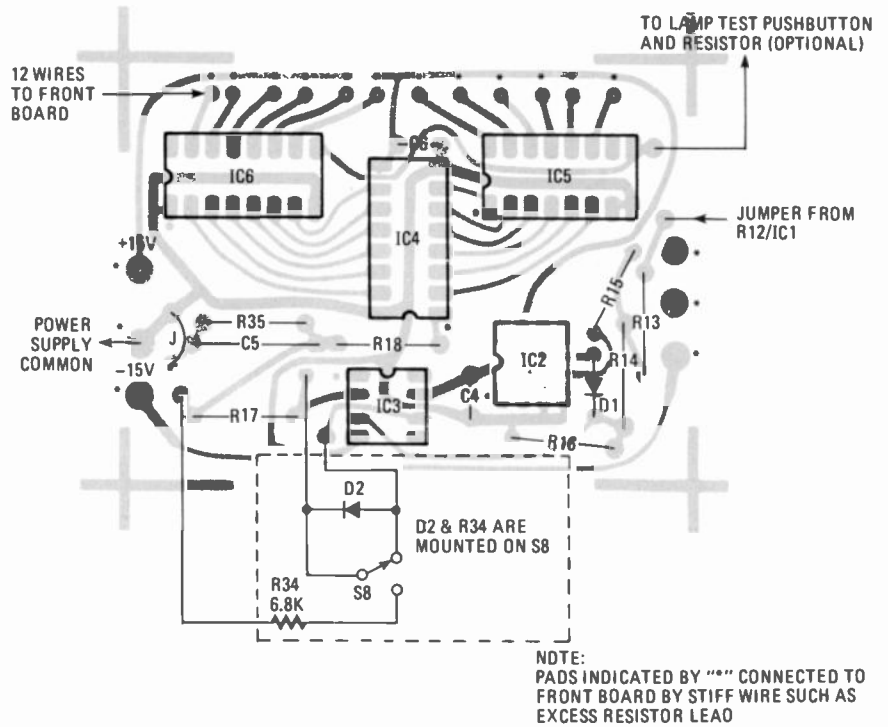


FIG. 10—WHERE PARTS ARE POSITIONED on the rear PC board when using the circuit in the schematic in Fig. 1.

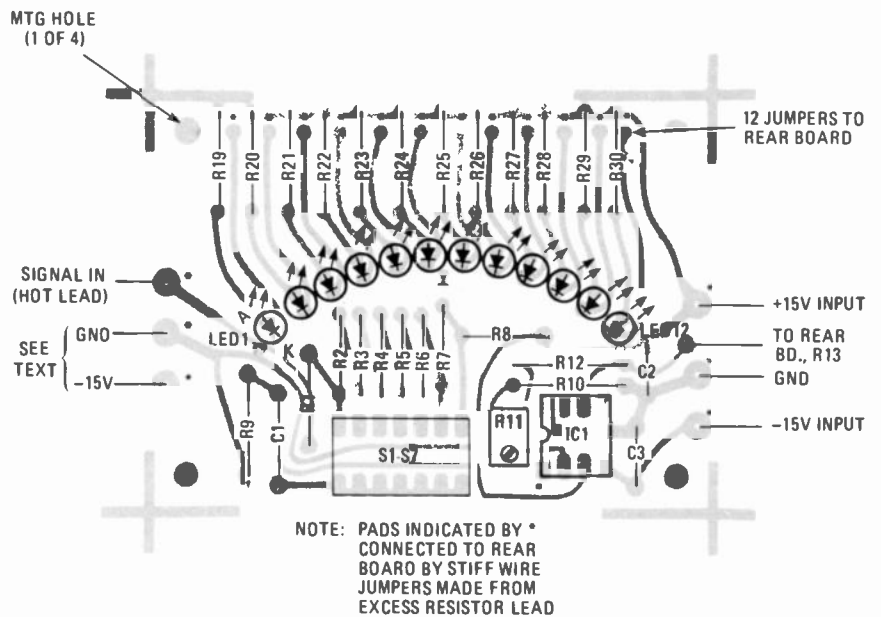


FIG. 11—PARTS LAYOUT for the front circuit board. Check the polarity of all LED's before installing. On the types specified, the cathode terminal lead is shorter than that for the anode.

Finally, mount the coupled PC boards on the front panel with the LED's and meter dial extending into the bezel. Use spacers and No. 4-40 nuts and bolts as shown in Fig. 9.

Figures 10 and 11 show the layout of parts on the rear and front circuit boards, respectively, when using the circuit as shown in Fig. 1. Figure 12 shows the component side of the front board.

Applying the options

If you eliminate the switchable attenuator and substitute an adjustable trimmer resistor as in Fig. 2-a, refer to the

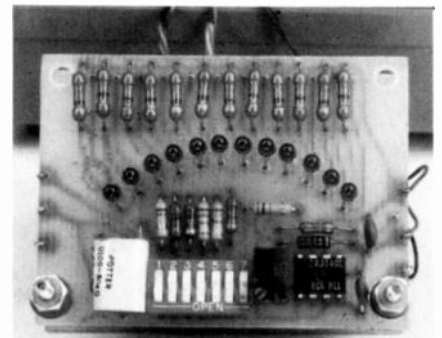


FIG. 12—FRONT-VIEW PHOTO of the front PC board. The switch must be set for the desired calibration before the cabinet is buttoned up.

JUMPER TO REAR BOARD,
AS IN ORIGINAL
PC BOARD LAYOUT

OPTION B
(DELETE IC5 AND IC6—
MOVE R19-R30 TO REAR BOARD)

PARTS LIST

All resistors 5%, 1/4 watt unless otherwise specified

- R1—10,000 ohms,
- R2—12,000 ohms,
- R3—3000 ohms,
- R4—2000 ohms,
- R5—1200 ohms,
- R6—1300 ohms,
- R7—430 ohms,
- R8—200 ohms,
- R9—470,000 ohms
- R10—5100 ohms
- R11—100,000 ohm, single or multi-turn trimmer (Bourns 3352W-1-104, 3299W-1-104 or equivalent)
- R12—36,000 ohms
- R13—10,000 ohms, 1%, 1/10 watt
- R14—6980 ohms, 1%, 1/10 watt
- R15—470,000 ohms
- R16—39,200 ohms, 1%, 1/10 watt
- R17—62,000 ohms
- R18—1000 ohms
- R19—R30—560 ohms
- R31, R32—47,000 ohms*
- R33—1000 ohms*
- R34—68,000 ohms
- R35—100,000 ohms
- R36—3300 ohms

Semiconductors

- LED1—LED12—H-P 5082-4684 or equivalent T-1 LED
 - D1, D2—1N914
 - Rect1—50-volt, 1 A bridge rectifier**
 - Q1*—2N6111 (National) or equivalent
 - IC1-IC3—CA3140E (RCA)
 - IC4—XR2276CP (Exar)
 - IC5, IC6—ULN 2003A (Sprague, TI, Signetics)
 - IC7*—LM741CN (National) or equivalent
- ### Capacitors
- C1—0.1 μ F, 100 volts Mylar
 - C2-C4, C6, C7*-C9*—0.01 μ F, 25-volt ceramic disc
 - C5—0.47 μ F, 10 volts, Mylar
 - C11**—100 μ F, 25-volt aluminum electrolytic
 - C10**—1000 μ F, 25-volt aluminum electrolytic
 - S1—S7—7-position DIP switch
 - S8—SPDT switch
 - T1**—20-volt, 1-amp CT transformer (Stancor P8604 or equivalent)
 - F1**—1/2-amp 3AG fuse

*Used only with DC input option
**Used only with 117 VAC option

Note: The quantities shown above are for a single-channel unit. With the exception of the power-supply components, two of each will be required for a stereo meter.

“Option A” section of Fig. 13. It shows how attenuator resistors R2 through R8 are eliminated and replaced by R11 and a few jumpers. Refer to Fig. 11 for the locations of all other components on this board.

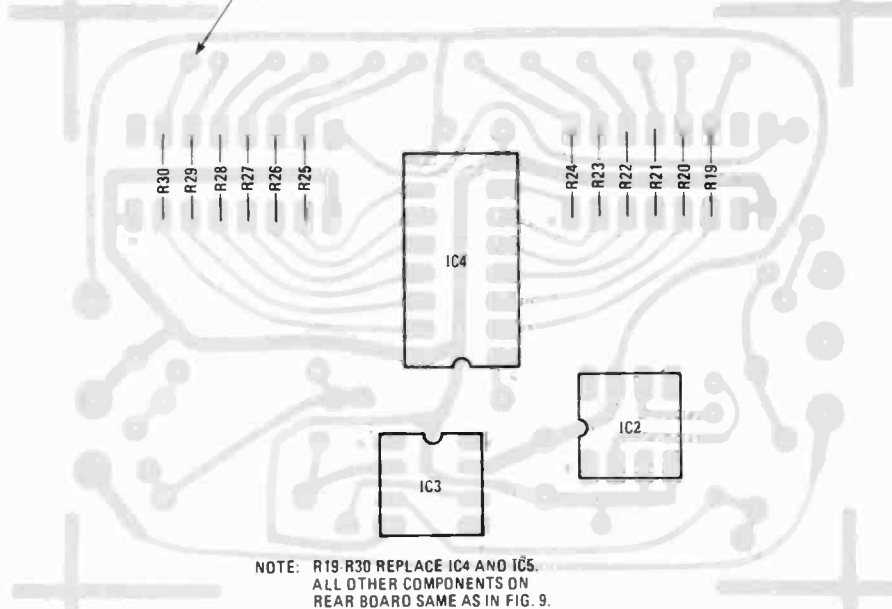
If you can get along with lower brightness from the LED indicators, do not install IC5 and IC6 on the rear board. In their places install resistors R19 through R30 across the IC terminal pads as in Fig. 14. Refer to the

continued on page 90

NOTE REVERSAL OF ORIGINAL LED POLARITY

FIG. 13—COMPONENT LAYOUT GUIDES for the front panel when using Options A and B. Note that the LED polarity has been reversed in Option B.

STIFF WIRES OR EXCESS RESISTOR LEADS TO FRONT BOARD



NOTE: R19-R30 REPLACE IC4 AND IC5. ALL OTHER COMPONENTS ON REAR BOARD SAME AS IN FIG. 9.

FIG. 14—THIS PARTS LAYOUT is used for the rear board when Option B is taken. Note that IC's 5 and 6 have been completely eliminated and replaced by resistors R19 to R30.

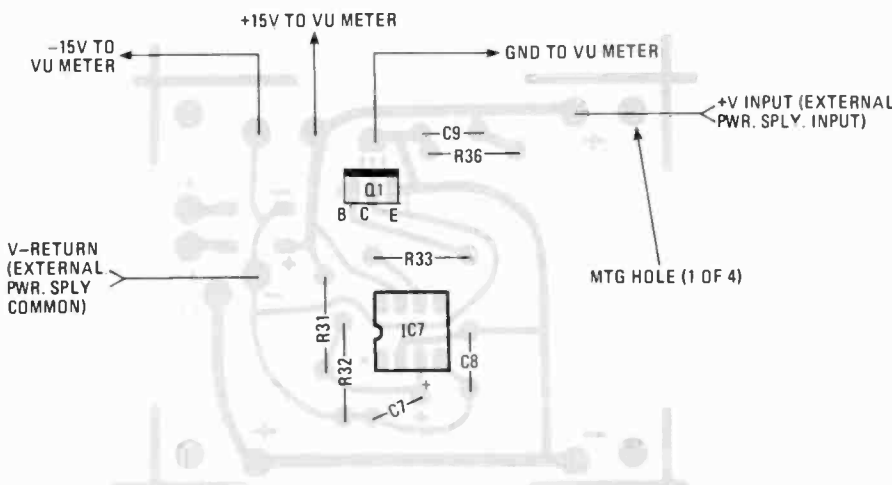


FIG. 15—PARTS FOR THE POWER SUPPLY are positioned on the board as shown when using a 24-to-30-volt DC external supply.



Computer-to- Selectric Interface

Part 2—This month we'll take a look at the software required to drive the interface and the printer.

E. G. BROONER

IN PART 1 OF THIS ARTICLE ON CONVERTING AN IBM *SELECTRIC* terminal/printer for use with a microcomputer, we covered the hardware end of the project, a four-IC interface board that is connected to the parallel- or expansion port of the computer—wherever eight-bit parallel data can be output. Now we'll consider the software needed to drive the interface (and the printer).

We stated earlier that the software would provide both the translation from ASCII and the time delay needed by the different functions. The software will vary from one computer to the next, unless they are alike in every respect. The differences are the ORG (starting address) of the assembly-language or machine-language program, the CPU register in which the character is stored, up to the time of printing, and other minor differences. The timing can remain the same for any processor running at 2 MHz or thereabouts; for faster or slower machines, the values of the timing words will need changing.

The software is presented in two versions, shown in Table 1 and Table 2. The 8080 assembly-language version in Table 1 can be used with any 8080 or Z-80 system, bearing in mind only the timing, ORG, and register differences that may have to be changed. The computer's I/O port assignments must

also be considered.

The BASIC program (Table 2) is specifically for the TRS-80, Model 1, and simply *POKE's* the numerical data into memory as a means of loading the driver. The BASIC version, needless to say, is easier to load from a disc than would be a machine-language program on tape. After it has been *POKE-ed*, the program will be accessed by the *LPRINT* command each time a character is to be printed. To do that some of the DOS (*Disk Operating System*) must be altered. The program takes care of all those matters.

Both programs accomplish the same purpose. Whenever a character is to be output, (either printable or control) the CPU's accumulator must be freed temporarily of any other tasks. The contents of the various registers are all "pushed" onto the stack for later recovery. At the last possible moment, the character will be passed from the register in which it is contained (such as the B register under North Star DOS and the C register under CP/M) to the accumulator, from where it will be output to the printer port. The correct code for the character will have been found in the lookup table, which will be explained in a moment.

The software has a unique feature which saves some time, and also some wear and tear on the mechanism: it saves the

TABLE 1

```

1: ;
2: ;
3: ; DRIVER PROGRAM FOR DATEL SELECTRIC
4: ; WITH COMLABS INTERFACE (TRS-80 VERSION)
5: ;
6: ;
7: ; DATA LINE ASSIGNMENTS:
8: ;
9: ; D0 = ROTATE 1/BACKSPACE
10: ; D1 = ROTATE 2/TAB
11: ; D2 = ROTATE 2A/INDEX
12: ; D3 = ROTATE 5/RETURN
13: ; D4 = TILT 1/SPACE
14: ; D5 = TILT 2
15: ; D6 = SHIFT
16: ; D7 = NORMAL/SPECIAL SELECT
17: ;
18: ;
19: ; CHARACTER TO PRINT IS IN C REGISTER
20: ;
21: ;
22: ; ORG 7F00H ;FOR 16K RAM
23: ; ORG 0BF00H ;FOR 32K RAM
24: ; ORG 0FF00H ;FOR 48K RAM
25: DATEL: PUSH PSW ;SAVE REGISTERS
26: ; PUSH B
27: ; PUSH D
28: ; PUSH H
29: ; MOV A,C ;REMOVE PARITY
30: ; ANI 7FH
31: ; MVI B,BSCODE ;CHECK FOR BACKSPACE
32: ; CPI 08H
33: ; JZ NORM
34: ; MVI B,HTCODE ;CHECK FOR TAB
35: ; LXI H,LONG ;DELAY FOR TAB AND CR
36: ; CPI 09H
37: ; JZ CYCLE
38: ; MVI B,CRCODE ;CHECK FOR CR
39: ; CPI 0DH
40: ; JZ CYCLE
41: ; MVI B,SPCODE ;CHECK FOR SPACE
42: ; SUI 20H
43: ; JZ NORM
44: ; JC DONE ;IGNORE OTHERS
45: ; MOV E,A ;CONVERT TO ELECTRIC CODE
46: ; MVI D,00H
47: ; LXI H,TABLE
48: ; DAD D
49: ; MOV B,M ;CODED CHAR IN B
50: ; LXI H,SHIFT
51: ; MOV C,M ;OLD SHIFT IN C
52: ; MOV A,B
53: ; ANI 40H
54: ; MOV M,A ;SAVE NEW SHIFT
55: ; XRA C ;SAME AS OLD?
56: ; JZ NORM ;YES, NO SHIFT CHANGE
57: ; MOV A,M ;CHANGE SHIFT
58: ; STA PORT
59: ; LXI D,SHDLAY

```

```

60: ; CALL WAIT
61: ; NORM: LXI H,SHORT ;NORMAL DELAY
62: ; CYCLE: LDA SHIFT
63: ; ORA B ;COMBINE WITH CHAR
64: ; STA PORT
65: ; LXI D,HOLD
66: ; CALL WAIT ;IMPULSE DELAY
67: ; LDA SHIFT ;PRESERVE SHIFT STATUS
68: ; STA PORT
69: ; XCHG
70: ; CALL WAIT
71: ; DONE: POP H ;RESTORE REGISTERS
72: ; POP D
73: ; POP B
74: ; POP PSW
75: ; RET
76: ;
77: ;
78: ; DELAY FOR 2 MHZ CLOCK IS 35 USEC/UNIT OF D,E
79: ;
80: ; WAIT: MOV A,D ;DELAY LOOP
81: ; ORA E
82: ; RZ
83: ; XTHL
84: ; XTHL
85: ; NOP
86: ; DCX D
87: ; JMP WAIT
88: ;
89: ; SHIFT: DB 00H ;INITIALLY LOWERCASE
90: ;
91: ;
92: ; CONVERSION TABLE
93: ;
94: ; TABLE: DB 00H,0FFH,0D5H,0FEH,0F9H,0F5H,0FDH,95H
95: ; DB 0F0H,0F1H,0FCH,0C6H,8CH,80H,0D6H,89H
96: ; DB 0B1H,0A9H,0B6H,0BEH,0B9H,0B3H,0B4H,0BBH
97: ; DB 0BAH,0B0H,0CDH,8DH,0D7H,86H,97H,0C9H
98: ; DB 0F6H,0DCH,0E0H,0ECH,0EDH,0E5H,0CEH,0CFH
99: ; DB 0E1H,0D4H,0C7H,0E4H,0E9H,0DFH,0E6H,0D9H
100: ; DB 0C5H,0C4H,0DDH,0D1H,0E7H,0EEH,0DEH,0D0H
101: ; DB 0EFH,0C1H,0F7H,00H,0F4H,00H,00H,0C0H
102: ; DB 00H,9CH,0A0H,0ACH,0ADH,0A5H,8EH,8FH
103: ; DB 0A1H,94H,87H,0A4H,0A9H,9FH,0A6H,99H
104: ; DB 85H,84H,9DH,91H,0A7H,0AEH,9EH,90H
105: ; DB 0AFH,81H,0B7H,00H,00H,00H,00H,00H
106: ;
107: ; PORT EQU 37E8H ;OUTPUT PORT ADDRESS
108: ;
109: ; BSCODE EQU 01H ;BACKSPACE CODE
110: ; HTCODE EQU 02H ;TAB CODE
111: ; CRCODE EQU 08H ;CARRIAGE RETURN CODE
112: ; SPCODE EQU 10H ;SPACE CODE
113: ;
114: ; HOLD EQU 0400H ;HOLD TIME = 33 MSEC
115: ; SHORT EQU 0600H ;NORMAL DELAY = 50 MSEC
116: ; LONG EQU 6000H ;CR/TAB DELAY = 0 85 SEC
117: ; SHDLAY EQU 0D00H ;SHIFT DELAY = 110 MSEC
118: ; END

```

TABLE 2

```

1000 REM PROGRAM TO POKE SELECTRIC DRIVER INTO MEMORY
1010 ON ERROR GOTO 1030
1020 PRINT
1030 INPUT "SYSTEM SIZE (16, 32 OR 48)":MS
1040 M=VAL(M$)
1050 IF M < > 16 AND M < > 32 AND M < > 48 THEN 1030
1060 D=4*(M-16)
1070 M=(M+16)*1024-256
1080 POKE 16421.2
1090 POKE 16422.0
1100 POKE 16457.255
1120 POKE 16456.M/256-1
1130 IF MV32767 THEN M=M-65536!
1135 REM "!" INDICATES SINGLE PRECISION VARIABLE
1140 ON ERROR GOTO 1200
1150 READ B
1160 IF B < 0 THEN B=ABS(B)+D
1170 POKE M,B
1180 M=M+1
1190 GOTO 1150
1200 PRINT
1210 NEW
1220 REM PROGRAM DATA
1230 DATA 245,197,213,229,121,230,127.6,1,254

```

```

1240 DATA 8,202,71,-127,6,2,33,0,96,254
1250 DATA 9,202,74,-127,6,8,254,13,202,74
1260 DATA -127,6,16,214,32,202,71,-127,218,97
1270 DATA -127,95,22,0,33,113,-127,25,70,33
1280 DATA 112,-127,78,120,230,64,119,169,202,71
1290 DATA -127,126,50,232,55,17,0,13,205,102
1300 DATA -127,33,0,6,58,112,-127,176,50,232
1310 DATA 55,17,0,4,205,102,-127,58,112,-127
1320 DATA 50,232,55,235,205,102,-127,225,209,193
1330 DATA 241,201,122,179,200,227,227,0,27,195
1340 DATA 102,-127,0
1350 REM TABLE DATA
1360 DATA 0,255,213,254,249,245,253,149
1370 DATA 240,241,252,198,140,128,214,137
1380 DATA 177,169,182,190,185,179,180,187
1390 DATA 186,176,205,141,215,134,151,201
1400 DATA 246,220,224,236,237,229,206,207
1410 DATA 225,212,199,228,233,223,230,217
1420 DATA 197,196,221,209,231,238,222,208
1430 DATA 239,193,247,0,244,0,0,192
1440 DATA 0,156,160,172,173,165,142,143
1450 DATA 161,148,135,164,169,159,166,153
1460 DATA 133,132,157,145,167,174,158,144
1470 DATA 175,129,183,0,0,0,0,0

```

SHIFT bit from the last character that was transmitted. The SHIFT bit will have been a "one" if the last character was upper case and "zero" if it was lower case. Before printing the next character, the program checks to see if the "case" has changed. Since the shift mechanism stays locked, either in upper or lower case, it is only necessary to send the shift bit again when the case changes!

If a shift bit is required, it is sent first and held for a certain time period, after which the rest of the character follows. After the character has been sent, and the data held for an appropriate length of time, a "zero" is output to the port. That completes the print cycle for each printable or control

TABLE 3

```

100 REM MODIFIES PRINT TABLE FOR BALL 185
110 INPUT "TABLE ADDRESS IN DECIMAL";T
120 FOR X=T+33 TO T+58
130 Y=PEEK(X)-64: REMOVE SHIFT BIT
140 POKE X,Y: REM NEW U.C. CODE
150 NEXT X
160 POKE T+14,150: REM PERIOD
170 POKE T+17,191: REM NUM. 1
180 POKE T+28,237: REM < SYMBOL
190 POKE T+30,206: REM > SYMBOL
200 POKE T+60,208: REM \ SYMBOL
210 POKE T+62,222: REM UP-ARROW

```

TABLE 4

ASCII	CHARACTER	BALL NO. 185	BALL NO. 134	ASCII	CHARACTER	BALL NO. 185	BALL NO. 134
32	!	255	255	81	Q	132	196
33	"	213	213	82	R	157	221
34	#	213	213	83	S	145	209
35	\$	254	254	84	T	167	231
36	%	249	249	85	U	174	238
37	&	245	245	86	V	158	222
38	'	253	253	87	W	144	208
39	(149	149	88	X	175	239
40)	240	240	89	Y	129	193
41	*	241	241	90	Z	183	247
42	+	252	252	91	\	208	244
43	,	198	198	92	^	222	0
44	-	140	140	93	_	192	192
45	.	128	128	94	a	156	156
46	/	150	214	95	b	160	160
47	0	137	137	96	c	172	172
48	1	177	177	97	d	173	173
49	2	191	169	98	e	165	165
50	3	182	182	99	f	142	142
51	4	190	190	100	g	143	143
52	5	185	185	101	h	161	161
53	6	179	179	102	i	148	148
54	7	180	180	103	j	135	135
55	8	187	187	104	k	164	164
56	9	186	186	105	l	169	169
57	:	176	176	106	m	159	159
58	;	205	205	107	n	166	166
59	<	141	141	108	o	153	153
60	=	237	215	109	p	133	133
61	>	134	134	110	q	132	132
62	?	206	151	111	r	157	157
63	@	201	201	112	s	145	145
64	A	246	246	113	t	167	167
65	B	156	220	114	u	174	174
66	C	160	224	115	v	158	158
67	D	172	236	116	w	144	144
68	E	173	237	117	x	175	175
69	F	165	229	118	y	129	129
70	G	142	206	119	z	183	183
71	H	143	207	120			
72	I	161	225	121			
73	J	148	212	122			
74	K	135	199	123			
75	L	164	228	124			
76	M	169	233	125			
77	N	159	223	126			
78	O	166	230	127			
79	P	153	217	128		111	111
80		133	197				

character. The contents of the stack are now "popped" back into the appropriate registers and control returns to the operating system.

Whether you use the 8080 assembly-language version or the TRS-80 disk BASIC version, great care should be exercised in entering the programs; they modify the DOS, and just one wrong byte can prevent the entire system from working.

Changing typing elements

It should be noted that the portion dealing with the translation table can be modified as needed. For some balls and/or character sets many changes may have to be made. For example, IBM ball (IBM calls them "typing elements") 185 is a desirable type for use with BASIC programs. Several table changes are necessary to use that ball. It has upper-case letters where the lower-case letters would normally be; the codes for upper-case letters must be changed, in the table, to be the same as those for lower case. The codes for the additional characters, for which that ball was recommended, must be added to the table in the correct places. To illustrate how simple those changes are, see Table 3, a simple BASIC program that will make the necessary changes in Table 2 in a few seconds. The table is changed in memory by that routine and you can then save the changed version, or simply run the "change" program whenever using the second ball.

Once you have mastered the tilt/rotate patterns, and understand the method of assigning numbers to each character, you should have no particular problem in doing that for your own system. The programs as presented are correct in most details for balls used in normal typing.

The use of the lookup table is described for those who may be unfamiliar with them. The "codes" are the numeric value that must be output for each character. In the ASCII table, characters come in a certain order. The table in the program is made up of the new values for the corresponding characters, and the actual ASCII code is used to access the table codes. The twenty-third ASCII character, then, will direct the program to the twenty-third code in the translation table. That code may or may not be the same as the ASCII value, but in any event it is the table code that is finally sent to the printer. If you change to a ball with characters located differently, you simply determine where in the table to make the change, and change the code for those characters.

Table 4 illustrates the correspondence between the ASCII table and the translated code. That code is only correct for the assignments we made to the tilt/rotate and other lines, as shown at the beginning of the assembly-language program. You can make up your own code if the data lines are assigned differently, or if you use a ball that does not have characters positioned as did ours, which were an IBM 134 and 185.

One more peculiarity of that software needs pointing out for those who use other machines and are not familiar with the TRS-80 (for which the sample programs were written). In those listings, the character to be output is handled by an STA instruction rather than an OUT instruction. That was done because the TRS-80 printer port is not a port in the true sense, but, rather, is treated as a memory location, into which successive characters are written. That part of the program can easily be changed for computers using more conventional I/O standards.

Our converted *Selectrics* have been satisfying in many ways. The low price of the finished product was more than welcome, and anyone who loves to tinker with hardware cannot help but enjoy such an activity. As stated earlier, those machines are not fast, and 100 to 150 words per minute (comparable to a *Teletype*) is inadequate for many of the purposes a computer might be used for. Nevertheless, these converted terminals are a good alternative for anyone trying to save money on hardware, particularly if word processing is to be the major consideration.

COMMUNICATIONS

Pirate Broadcast

Stations

RADIO HEARTLAND
THE BEST IN THE MIDWEST

Dear _____,

Thanks for your reception report.
We confirm the station you heard was Radio Heartland, operating on:
7325 KHz (40.95m)

Time: _____ Date: _____

Further reception reports or comments on our program are welcome!

Free Radio Campaign - USA
R.D. # 2, Box 542
Wescosville, Pennsylvania 18106

CHIEF ENGINEER

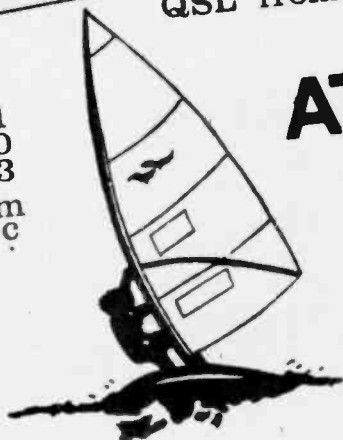
QSL from F.M. Radio - Station

ATLANTIS

P.O. Box
Rotterdam
Netherlands

Thanks for QSO

1
0
3
m
c



Although their schedules are subject to change without notice, when you can find them these stations offer an interesting alternative to standard broadcast fare.

ROBERT B. GROVE

IN OUR JUNE, 1980 ISSUE WE EXPLORED the fascination of monitoring "spy" numbers stations. At this writing, the riddle as to the origin of those mysterious transmissions is still unresolved.

But the numbers stations are not the only unlicensed signals on the airwaves. Pirate and clandestine broadcasters populate the radio spectrum from medium-frequency wavelengths (200-1600 kHz) through shortwave. Even listeners to the FM and TV bands encounter those phantom signals occasionally.

Who are the perpetrators, and what are their motivations? To answer those questions, we must first separate the pirates and clandestines into their own categories.

The pirates

Operating a radio transmitter without a license is hardly new in the United States. Many CB'ers have been doing it

for years! So have hams who would rather not spend the time and energy needed to take the amateur radio examination or learn the required Morse code.

Pirate broadcasting began early this century when radio regulations were very loosely structured and enforcement was virtually non-existent. Perhaps the best documented pirate station was that of David Thomas, owner of unlicensed station WUMS ("Was Unlicensed Marine Station").

Originally built to operate on 1235 kHz, WUMS' homemade transmitter was switched to 2004 and 1560 kHz in 1938. Messages were sent to Ohio River vessels in the ferry service, and the station broadcast entertainment as well.

In 1939 WUMS was hauled into Federal Court on charges of operating an amateur radio station without a license. Since WUMS was obviously not in the amateur service—not op-

erating in the amateur-frequency bands—the charges were dropped.

In 1948, following a series of transmissions monitored by stations as far away as China, WUMS was cited again by the FCC. After the Commission reportedly spent some \$10,000 for prosecution, the case was once again thrown out of court.

After more than 50 years of virtually continuous operation, WUMS has finally gone off the air for good after establishing a world's record for perpetual piracy! Its transmitter has been accepted by the Smithsonian Institution, joining the company of names like Edison and Marconi, to be enshrined with other artifacts of our nation's memorabilia.

Needless to say, unlicensed pirate stations drive the FCC bonkers. Schedules are erratic, locations are rarely given, and transmission times are often short.

The United States is not as saturated

with those stations as is Great Britain, unofficially the home of pirate broadcasting. Long wave, medium wave, shortwave, FM, and even TV pirates flood the airwaves over the Isles. A large number of them are in Ireland, such as Radio Dublin, Weekend Muzick Radio, Radio Nautilus International, European Music Radio, Radio Zenith, Radio Condor International, and many more.

Holland is the home of Radio Dolfijn International, and AIR is in Glasgow, Scotland. For additional entertainment there is the Voice of the Pyramids, Voice of Venus, Radio Confusion—the list is endless.

But the United States is certainly not devoid of illicit broadcast activity. One

of the most famous in recent history is the Voice of the Voyager, a pirate broadcaster in Minneapolis who constantly gave a Houston, TX mailing address over the air. To compound the obfuscation, return mail was sent to listeners from Ann Arbor, MI. That one gave the FCC fits, and took the cooperative efforts of all 13 FCC field stations to locate it finally, and shut it down!

Even as early as 1933, stations attempted to avoid prosecution by transmitting from international waters. RXKR operated aboard the motor vessel *City of Panama* off the coast of southern California. Basking in the balmy breezes of the Pacific, RXKR conducted its programming right in the

middle of the standard broadcast band. Fairlawn, NJ, was the home of pirate station WBBH. Operating on an arbitrarily-chosen frequency of 4970 kHz, operator "Mr. Fisk" claimed to be using a Gates BFE-50 C commercial broadcast transmitter. When finally caught by the FCC in 1966, ostensibly broadcasting from the fictitious "Courtland School of Music", Fisk was found to be using a converted 50-watt amateur transmitter.

Fisk's programming was unusually professional, quite possibly better than any others that Fairlawn residents had to choose from in the normal course of their daily legitimate listening!

Another recent casualty of relentless pursuit by FCC officials was WDAB of

UNDERGROUND STATIONS

FREQ. (kHz)	IDENTIFICATION AND SCHEDULE (Time: Universal Coordinated)	FREQ. (kHz)	IDENTIFICATION AND SCHEDULE (Time: Universal Coordinated)
1128	Mersey Alternative Radio	6420	KVHF Sun. 0945
1187	Alternative Radio 2200-0200 Sat. eve./Sun.	6955	Radio Nautilus International 0300
1271	Radio City 1100-1500 Sat./Sun.	6960	Voice of Venus 0330
1320	Radio Jackie 0800-1700 Sat./Sun. (going to court; longest record for operating on land in Britain)	6965	WARG/WONS 0400-0500 "Your Free East Broadcaster." Also 6980, 6988 kHz.
1463	Radio Condor International 0900-1400 Sun. Also 6243, 11463 kHz; Ireland.	7050	XR705 0600.
1620	PRN; New England	7053	Voice of Alpha 66; 0115-0149 (Miami)
2460	Radio Watergate International/RWI Abscam. East coast, 0500 weekends; 35 watts. Operator "Jack Cass, Mr. Personality." Also on 2340, 2630 kHz.	7082	Radio Abdala (Miami) 0100-0200
2390	Radio Nautilus International 0400 winter months; "Danny King" 35 watts.	7090	Radio Libertad Cubana/Radio Rebelde (Miami); "Commandante David." 0100-0330
3240	Voice of the Pyramids; not yet active. Also 4670, 5825, 6240, 6250, 7470, 9330, 11850, 15020, 15030, 11615 kHz.	7325	Radio Zodiac; European Music Radio Sun. 0630-0845
3405	WHY Radio 0700. 90 watts.	7340	Weekend Muzick Radio
3885	WBLO 2330 and 1500. Also 4020-kHz Sun.	7342	Radio Impact 0600-0800. Also 7325 kHz.
4004	Radio Indiana 0400-0530. Also 6990, 7315, 7360 kHz. 21600 kHz at 2200. "Voice of Indiana"; Johnson Valiant II transmitter, 200 watts into 60 foot longwire.	7350	Moonshine Radio; "Alderaan Broadcasting Company;" 0455-0537. Sister station: Green River Radio
5930	Radio Dublin (c/o Disk-It, Finglas Village, Dublin 11, Ireland.) Also 6210, 6250, 6275, 6310, 6350 kHz.	7365	Radio Confusion 0003
6204	Radio Iris; Holland.	7400	The Voice of the Cuban Patriotic Junta. 0200
6235	ABC International; Radio Zenith; European Music Radio; Radio Zodiac 49. Sundays.	7420	The Voice of Revolutionary Vinco
6260	Radio Cill Dara International (Ireland); Sun. 1000-1300. Radio Cavendish (Scotland); Sun. 0800 (also 7320 kHz).	7570	The Voice of the Burmese People. 1130
6265	Radio Krypton; Sun. 1200-1300.	9615	Radio Noticias del Continente (TIRL); (Costa Rica)
6279	Syncom International; Sat./Sun. 0100-0600; Sun. 0800-1100. Also 6248, 7430 kHz. 21522 kHz; Fri./Sat. 2300-0100.	9585	Voice of the Communist Party of Turkey. 0555-0629
		9730	Voice of the Egyptian People; 1900-2000 (Anti-Begin; anti-Sadat)
		11615	La Voz de la Resistencia Chilena; 0100-0137. Also 7246, 7195 kHz
		15045	Radio Free Grenada; ostensibly broadcasts coded messages as obituaries weekends at 2230

Daytona Beach, FL. Run by two local disc jockeys, the Commission threatened them with heavy fines if they resumed operation. Capitulating against those odds, they now operate a legal FM cable service and stay out of trouble!

Why pirate?

Just what is it that motivates someone to start a pirate broadcasting operation? Frustration with the cumbersome licensing procedure? Indignation against authority? A keen sense of the thrill of the chase? Perhaps all of those and more. Let's ask Mr. "Guy Wire", operator of Radio Liberation in the quaint Plaquemes parish town of "Putrid," LA.

Q. Why did you decide to put a pirate station on the air?

A. Why not? It seemed like it would be fun ... it was my way of thumbing my nose at FCC censorship.

Q. What kind of programming did you do?

A. We had a staff of about 20; we got our idea of taping on cassette from Radio Havana. We were probably heard in all the states east of the Mississippi. Programs included "The Pol Pot Exile Show," rebroadcasts of The Voice of Free Grenada, some Spanish-language programming, and even an entire evening of barking dogs!

Needless to say, the FCC had fun with that one. When they finally located the neighborhood, the FCC engineers had considerable trouble finding "Guy Wire" who had spotted the suspicious vehicle and buried his transmitter!

Eventually, at the urging of his parents, the culprit exhumed the corpse of the illegitimate transmitter and put on one last demonstration for the FCC officials.

Threatened with a \$10,000 fine, "Guy Wire" promised never to repeat his escapade.

In the United States, a spokesman for pirate stations is Al Muick. An informative copy of his "Free Radio Campaign" newsletter is available postpaid for \$1 by writing: Free Radio Campaign, RD#2, Box 542, Wescosville, PA 18106.

Not all is in fun

As amused as we may become with the antics of some pirates, many transmissions have a definite purpose. During World War II, a British pirate attempted to damage Nazi morale by broadcasting stories that Field Marshal Rommel was a homosexual!

And that takes us to the second group of unlicensed broadcasters.

The clandestines

Some stations prefer to maintain their anonymity because of the nature of their broadcasting contents. Often



A CONVERTED CB TRANSCEIVER and two portable phonographs are the mainstays of WJAM, "The Free Radio Service of Connecticut."

politically-motivated, their transmissions are intended to persuade listeners to take drastic action against the ruling authority.

One of those, Radio Noticias del Continente (TIRL) is in Costa Rica and probably Cuban supported. It is suspected that the station was formerly called Radio Sandino, an anti-Somoza operation.

Also Communist-inspired, Radio Magallanes espouses its anti-Chilean messages, and the Voice of the Communist Party of Turkey lets its will be known.

The revolutionaries

Few American pirates or clandestines are Anti-American. Most are merely critical of certain government policies, often using the airwaves to voice their disenchantment.

But there are a few prominent anti-Castro broadcasters, sending their counter-revolutionary messages from, not surprisingly, south Florida.

Judging from the length of time those stations have been active, coupled with their blatant admission of location (mostly Miami or Key West), it would appear that the Federal Communications Commission is not particularly concerned with their presence. That may be in part due to the recent appearance of a powerful Radio Moscow relay station, beamed toward the United States from Cuba, on 600 kHz.

All of the anti-Castro Miami stations operate at the low end of the amateur 40-meter band, causing considerable grief for legitimate users. The Voice of Alpha 66 can be heard on 7053, usually between 0115 and 0150 hours daily. Radio Libertad Cubana (Radio Rebelde) is nearby on 7090 kHz, featuring the unique programming of Comandante David, usually between 0100 and 0330. Radio Abdala is just a fraction of a dial turn away at 7082 kHz, operating from 0100-0200.

Recently, nationwide publicity was given to a "raid" on one of the stations, the identity of which was not disclosed by FCC officials. A day or two later, another group, the Bay of Pigs Veterans Association's *Radio Giron* issued a news release claiming to be the operation that was shut down. Since no one had ever heard of Radio Giron, considerable question was raised as to the validity of the claim.

Was the Radio Giron statement issued to satisfy public demand to know which operation had been shut down? Was the FCC news release an unfortunate snafu which should have never been issued? Was the entire incident contrived, ostensibly to satisfy the many hams who had reported the illegal interference in their coveted 40-meter band?

At this writing, the south Florida clandestines are still alive and well, broadcasting their anti-Castro messages with apparent impunity.

Operating frequencies and schedules

Here we present an extensive list of the more frequently reported pirate and clandestine broadcasters. Because of the tenuous nature of their operation, frequencies and schedules change frequently. We cannot be held responsible for the accuracy of this list, but the basic ranges of times and frequencies are typical. Most of the broadcasters are in the British Isles, and many are reported by American and European listeners.

It would seem that the best time to look for the pirates is from 0900-1400 hours, and the best frequency ranges are 6235-6280 and 7325-7370 kHz. They are invariably low power, so some persistence and patience will be necessary.

Is pirate radio a wave of the future? Yes! says Al Muick of Free Radio Campaign. Especially in England where at least three new stations are expected to be operational shortly.

Radio Europe (Radio del Mare) will be afloat in the English Channel serving the Dutch and Belgian listeners of Radio Mi Amigo. According to Muick, the operator of this endeavor is "Ferry Eder."

Another operation will be conducted in the shortwave bands by ex-ABC England personnel. All three operations are expected to utilize medium-wave and VHF as well.

Pirate/clandestine radio is alive and well. Next time you casually tune across your shortwave dial and happen to discover a weak signal arguing with the establishment, the chances are good that you are listening to a fresh breath of individuality adrift in a sea of drivel. Let us know what you hear! R-E

The author would like to thank John Santosuosso and Al Muick for their contributions in preparing this article.

NEW DOLBY NOISE REDUCTION SYSTEM

Dolby B is certainly the best known noise reduction system on the market, but it isn't the only one. New Dolby C is Dolby Laboratories' answer to the competition.

LEONARD FELDMAN
CONTRIBUTING HI-FI EDITOR

AFTER MORE THAN TEN YEARS OF BEING the acknowledged leader in the field of noise-reduction systems for use in consumer-type cassette tape recorders, Dolby Laboratories, under the direction of Dr. Ray Dolby, has announced a new noise-reduction technique, to be known as *Dolby C*. (*Dolby A* is the professional noise-reduction system used by many recording studios, and *Dolby B* the well known consumer-product system.)

Before the development of *Dolby-B* noise-reduction and its commercial acceptance in the early 1970's, about the best signal-to-noise ratio that you could expect from even the best cassette tape decks was perhaps 40 or 45 dB. Adding a full 10 dB of noise-reduction or hiss reduction above 5 kHz was considered to be (and still is) one of the most important contributions to the high-fidelity field by any single inventor.

Virtually every important manufacturer of high-fidelity component stereo cassette decks signed license agreements with Dolby Laboratories and incorporated *Dolby-B* noise-reduction circuitry in its products. Today, it would be difficult, if not impossible, for a manufacturer to sell a stereo cassette deck priced above \$150.00 if it did not incorporate *Dolby B* or an equivalent system.

But *Dolby B*, while certainly the best known electronic noise-reduction system in use today, is not the only one.

Since its introduction we have seen a variety of noise-reduction systems developed. Many of them offer greater decreases in audible tape noise reduction than *Dolby B*. Among those are the well known linear companding (compression-expansion) system developed by dbx, Inc. In addition to increasing the available dynamic range on cassettes by applying 2 dB:1 dB compression during recording and the reciprocal, 1 dB:2 dB expansion during playback, the dbx system delivers more than 30 dB of noise reduction in the process.

Nakamichi, the well known maker of high-quality cassette decks, in cooperation with Telefunken of West Germany has come up with a two-band noise-reduction system that it calls *High-Com II*. It is a variation of Telefunken's professional noise-reduction system and, though frequency-selective, it provides approximately 20 dB of noise reduction at mid- and high frequencies.

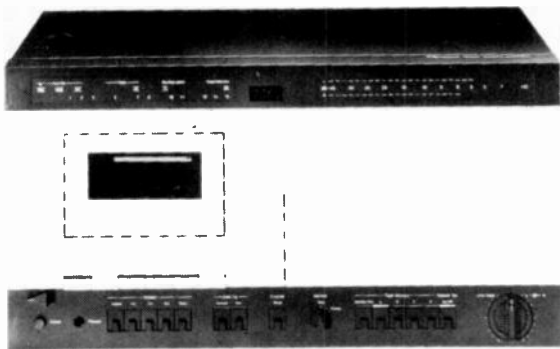
Meanwhile, in Japan, Sanyo and Toshiba have developed their own noise-reduction systems: *Super-D* and *ADRES* respectively. Each one offers considerably more noise-reduction capability than *Dolby B*. Here, in the U.S., CBS Records has hinted that it has developed a noise-reduction system that not only provides more noise reduction than Dolby, but produces recordings that sound good even when played without any special cir-

cuitry or decoding device.

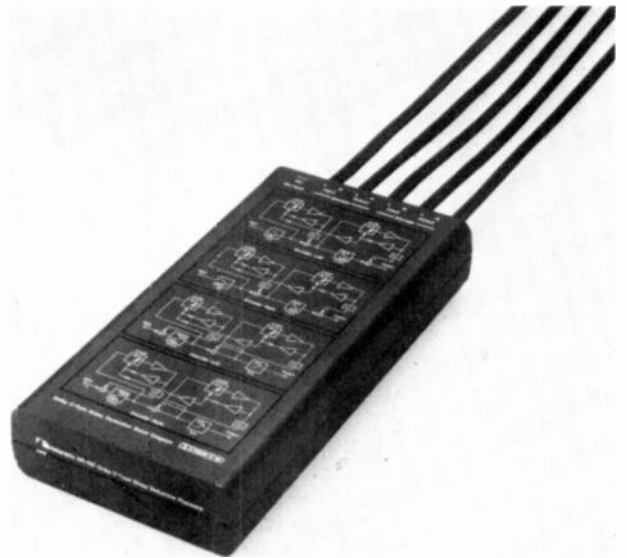
Other noise-reduction systems that are directly competitive with *Dolby B* include *ANRS*, developed by JVC and, more recently, *Super ANRS*. In addition to providing noise reduction, those systems also deal with the problem of high-frequency tape saturation.

Many audiophiles were beginning to wonder whether Dolby would come up with a new noise-reduction system to compete with all of the newer systems that have been gaining increased acceptance and popularity. Instead, about two years ago Dolby Laboratories came up with a headroom-extension system that they called *Dolby HX*. That circuit varied instantaneous recording bias and equalization to provide better headroom when recording high-level, high-frequency signals. When such signals occur in the program material, the bias is automatically lowered. When mid- or low-frequency signals predominate, the bias is increased to provide the best recording conditions for those frequencies. And because dynamic alteration of recording bias levels changes the overall flatness of frequency response, recording equalization is dynamically varied as well.

Very few companies use *Dolby HX* in their cassette decks. Some have expressed fears that the instantaneous lowering of bias during moments when high-frequency, high-level, passages



THE NEW NAKAMICHI 700ZXL computing cassette deck and its accessory NR-100 *Dolby C* noise reduction processor.



are recorded would have an adverse effect upon the distortion of low and mid-frequency signal content being recorded at the same instant. Accordingly, many companies have not used *Dolby HX* despite the fact that all Dolby licensees were offered the new innovation without having to pay additional royalty fees.

Now, Dolby has come up with a new noise-reduction system. It was demonstrated at the Winter Consumer Electronics Show in Las Vegas. Rumors concerning that new system were widely circulated long before Dolby disclosed its details. Back in October 1980, while attending the Tokyo Audio Fair, I learned that the rumors were true and that the new noise-reduction system would be called *Dolby C*. Many Japanese licensees of Dolby are already working on cassette decks that contain the new noise-reduction circuitry and will introduce those models by mid-1981.

How *Dolby C* works

In many respects, *Dolby C*-type noise reduction works like *Dolby A* and *Dolby B*. Like those earlier systems, *C*-type noise-reduction is a dual-path

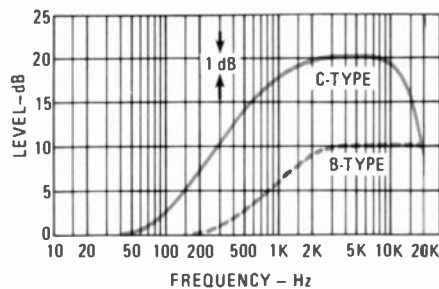


FIG. 1—THE BAND of frequencies over which noise reduction takes place is extended two octaves lower in *Dolby C* as compared with *Dolby B*.

system that reduces noise using a low-level side-chain (a level-sensing mechanism in the Dolby system). In addition, the sliding-band technology of the *B*-type noise-reduction system is used in the new system, although the band of frequencies over which noise reduction takes place has been extended two octaves downward, as illustrated in the comparison graphs of Fig. 1. *Dolby C*-type noise reduction required other new developments to achieve its 20 dB of noise reduction while, like *Dolby A* and *Dolby B*, still retaining freedom from side effects like "breathing" and "pumping."

According to Dolby Laboratories, the *Dolby C* noise-reduction system solves the problem of achieving high levels of compression (during recording) and expansion (during playback), without introducing undesirable side effects, by using two processing stages in series. Each stage supplies 10 dB of compression during recording and the same amount of expansion during playback decoding. Furthermore, each circuit operates at its own independent level.

One stage, identified as the high-level stage in Fig. 2, is sensitive to signals at about the same levels as in *Dolby B* noise reduction, while the second stage, a lower-level stage, operates on signals of lower amplitude. Since the two stages are in series, their net effect is to multiply the signals, which is the same as adding or subtracting decibels. In that way, a total of 20 dB of compression and expansion is obtained, and that is the equivalent of 20 dB of noise reduction.

Because of the independent-stage arrangement, the program signal is never subjected to the problems associated with a single 20-dB compression or expansion stage. The in-

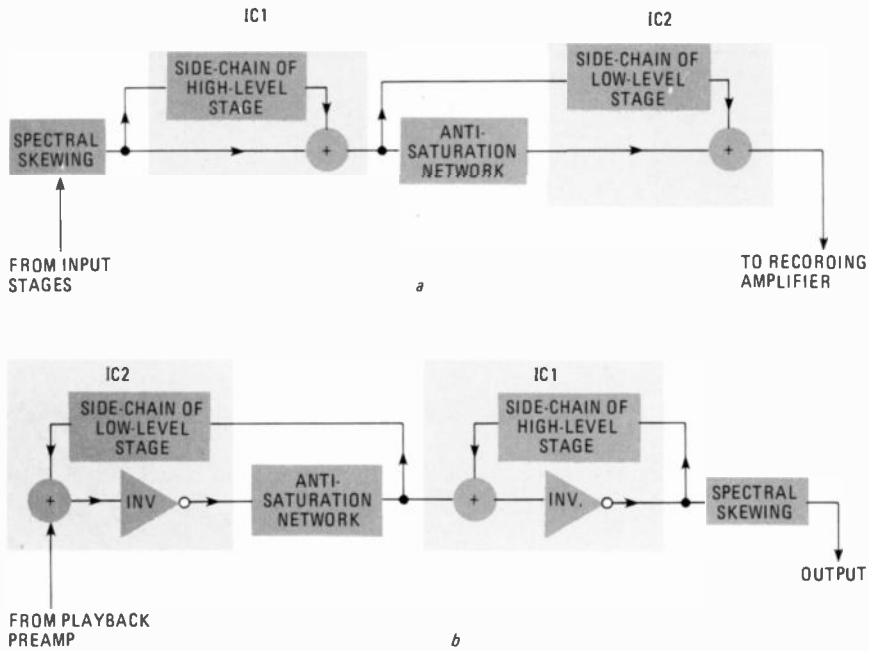


FIG. 2—BLOCK DIAGRAM of the *Dolby C* encoder (a) and decoder (b) circuits. Side chains are *Dolby's* level-sensing mechanism.

dependent and cumulative action of the two compression/expansion stages can best be understood by referring to Fig. 3. *Dolby* maintains that the two-level, two-stage, configuration provides more accurate control of the program signal than is possible with a single compander circuit.

To execute the two-level, two-stage configuration for *Dolby-C* noise reduction, two conventional IC's are used, according to *Dolby Labs*. That means that a *Dolby-C* noise-reduction system can initially be built using readily available parts. In the future it is expected that integrated-circuit manufacturers will produce a single, dedicated, *Dolby-C* integrated circuit to make it easy to add that system to new products. One of the two stages of *Dolby C* can easily be configured to provide the well-known *Dolby-B* noise-reduction characteristic at the push of a front-panel switch, for example, so that cassette decks incorporating C-type noise reduction can also deliver *Dolby-B* noise reduction for compatibility with existing *Dolby B*-type recordings as well as the new *Dolby-C* recordings.

Overall compatibility

An important consideration in the development of *Dolby C* was the compatibility of recordings made with the new system. Just as *Dolby B* had to be compatible with recordings that had no noise-reduction encoding in them (consumer noise reduction did not exist, for all practical purposes, at the time that *Dolby-B* was first introduced), *Dolby-C* noise reduction has been designed on the premise that *Dolby B* is now in universal use. As a result, recordings made

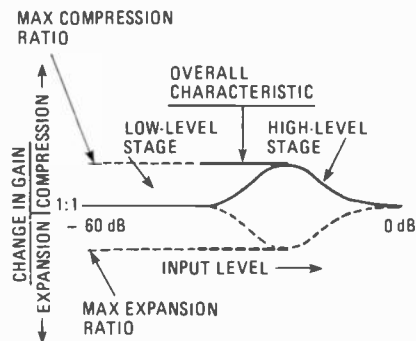


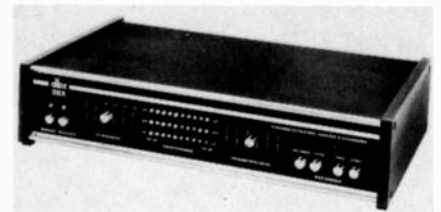
FIG. 3—THE EFFECT of the two compression/expansion stages on a program signal. The two stages work together to achieve the full 20 dB of processing required.

with *Dolby-C* noise reduction will be listenable on high-fidelity cassette machines equipped with B-type noise reduction.

Of course, reproduction will not be perfect under those conditions, just as the reproduction of *Dolby-B* recordings on machines not equipped with any *Dolby* circuitry is not perfect. They are listenable, however, especially if the amplifier's treble control is adjusted to compensate for the *Dolby* effect. *Dolby* maintains that *Dolby-C* recordings would even be tolerable when played back on lower-fidelity portable cassette units not equipped with any type of noise-reduction circuitry. Accordingly, *Dolby Laboratories* will develop professional-grade C-type noise-reduction encoders for use in cassette duplication.

Other features of *Dolby C*

Besides the two stages of companding, *Dolby-C* noise reduction incor-



LINEAR COMPRESSION/EXPANSION is used to reduce noise in the model 3BX from dbx, Incorporated.

porates several other circuit innovations. Two of those circuit innovations, designated in Fig 2 as the anti-saturation and spectral-skewing networks, introduce precisely calculated frequency-response modifications during recording and compensate for them during playback.

Those response modifications are introduced as a further safeguard against audible side effects. Specific benefits of those additional circuits include the reduction of encode-decode errors and a reduction of upper-middle and high-frequency tape saturation and attendant side effects, such as high-frequency losses and intermodulation distortion.

While the new system uses readily available components including *Dolby-IC* processors, the complexity of the C-type noise-reduction system is said to be between two and three times that of a conventional B-type circuit. Furthermore, according to *Dolby*, to take full advantage of the noise-reduction capabilities of the *Dolby-C* system, the recorder using it must have a very high level of mechanical and electrical performance and sophistication, including low-noise circuitry surrounding the noise-reduction processor itself. Because of those cost and quality considerations, it is likely that the new system will appear first as a supplement to standard *Dolby B* in high-performance, higher-priced cassette decks. In the future, the use of *Dolby-C* circuitry may be simplified somewhat by the development of specific-purpose *Dolby-C* IC's. When that happens, we may see some lower- or mid-priced cassette decks incorporating the new noise-reduction system.

As was the case with *Dolby HX*, *Dolby Labs* will provide C-type noise reduction to its licensees under their existing *Dolby* license agreements without imposing an additional royalty for using the new system.

It is evident that *Dolby*, the first developer of noise-reduction systems for consumer tape recorders, is not about to resign from its position of supremacy in the highly competitive noise-reduction field just because others have come up with noise-reduction schemes that are claimed to be superior to the one originally developed by *Dolby!R-E*

Save on Scanners! NEW Rebates!

Communications Electronics™, the world's largest distributor of radio scanners, celebrates Father's Day early with big savings on Bearcat scanners. Electra Company, the manufacturers of Bearcat scanners is offering consumer rebates on their great line of scanners, when purchased between April 1 and May 15, 1981.

With a scanner, you can monitor the exciting two-way radio conversations of police and fire departments, intelligence agencies, mobile telephones, energy/oil exploration crews, and more. Some scanners can even monitor aircraft transmissions! You can actually hear the news *before* it's news. If you do not own a scanner yourself, now's the time to buy your scanner from Communications Electronics. Choose the scanner that's right for you, then call our toll-free number to place your order with your Visa or Master Charge.

We give you excellent service because CE distributes more scanners worldwide than anyone else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are in stock for quick shipment, so if you're a person who prefers fact to fantasy and who needs to know what's *really* happening around you, order your scanner today from CE!

NEW! Bearcat® 350

The Ultimate Synthesized Scanner!
Allow 120-240 days for delivery after receipt of order due to the high demand for this product.
List price \$599.95/CE price \$419.00

4-Band, 50 Channel • Alpha-Numeric • No-crystal scanner • AM Aircraft and Public Service bands • Priority Channel • AC/DC Bands: 30-50, 118-136 AM, 144-174, 421-512 MHz.
The new Bearcat 350 introduces an incredible breakthrough in synthesized scanning: Alpha-Numeric Display. Push a button—and the Vacuum Fluorescent Display switches from "numeric" to word descriptions of what's being monitored. 50 channels in 5 banks. Plus, Auto & Manual Search, Search Direction, Limit & Count, Direct Channel Access, Selective Scan Delay, Dual Scan Speeds, Automatic Lockout, Automatic Squelch, Non-Volatile Memory. Reserve your Bearcat 350 today!

Bearcat® 300

List price \$549.95/CE price \$349.00/\$25.00 rebate
Your final cost is a low \$324.00

4-Band, 50 Channel • Service Search • No-crystal scanner • AM Aircraft and Public Service bands • Priority Channel • AC/DC Bands: 32-50, 118-136 AM, 144-174, 421-512 MHz.
The Bearcat 300 is the most advanced automatic scanning radio that has ever been offered to the public. The Bearcat 300 uses a bright green fluorescent digital display, so it's ideal for mobile applications. The Bearcat 300 now has these added features: Service Search, Display Intensity Control, Hold Search and Resume Search keys, Separate Band keys to permit lock-in/lock-out of any band for more efficient service search.



NEW! Bearcat® 350

FREE Bearcat® Rebate Offer

Get a coupon good for a \$25 rebate when you purchase a Bearcat 300, 250, 220 or 210XL; \$20 rebate on model 160; \$10 rebate on model Four-Six Thin Scan and \$5 rebate on the Bearcat 5. To get your rebate, mail this coupon with your original dated sales receipt and the Bearcat model number from the carton to Electra. You'll receive your rebate in four to six weeks. Offer valid only on purchases made between April 1, 1981 and May 15, 1981. All requests must be postmarked by May 30, 1981. Limit of one rebate per household. Coupon must accompany all rebate requests and may not be reproduced. Offer good only in the U.S.A. Void where taxed or prohibited by law. Resellers, companies, clubs and organizations—both profit and non-profit—are not eligible for rebates. Employees of Electra Company, their advertising agencies, distributors and retailers of Bearcat Scanners are also not eligible for rebates. Please be sure to send in the correct amount for your scanner. Pay the listed CE price in this ad. Do not deduct the rebate amount since your rebate will be sent directly to you from Electra. Orders received with insufficient payments will not be processed and will be returned.

Bearcat® 250

List price \$429.95/CE price \$279.00/\$25.00 rebate
Your final cost is a low \$254.00

50 Channels • Crystalless • Searches Stores • Recalls • Digital clock • AC/DC Priority Channel • 3-Band • Count Feature.
Frequency range: 32-50, 146-174, 420-512 MHz.
The Bearcat 250 performs any scanning function you could possibly want. With push button ease you can program up to 50 channels for automatic monitoring. Push another button and search for new frequencies. There are no crystals to limit what you want to hear. A special search feature of the Bearcat 250 actually stores 64 frequencies and recalls them, one at a time, at your convenience.

Bearcat® 220

List price \$449.95/CE price \$289.00/\$25.00 rebate
Your final cost is a low \$264.00

Aircraft and public service monitor. Frequency range: 32-50, 118-136 AM, 144-174, 420-512 MHz.
The Bearcat 220 is one scanner which can monitor all public service bands plus the exciting AM aircraft band channels. Up to twenty frequencies may be scanned at the same time.

Not only does this new scanner feature normal search operation, where frequency limits are set and the scanner searches between your programmed parameters, it also searches marine or aircraft frequencies by pressing a single button.

Bearcat® 210XL

List price \$349.95/CE price \$229.00/\$25.00 rebate
Your final cost is a low \$204.00

18 Channels • 3 Bands • Crystalless • AC/DC Frequency range: 32-50, 144-174, 421-512 MHz.
The Bearcat 210XL scanning radio is the second generation scanner that replaces the popular Bearcat 210 and 211. It has almost twice the scanning capacity of the Bearcat 210 with 18 channels plus dual scanning speeds and a bright green fluorescent display. Automatic search finds new frequencies. Features scan delay, single antenna, patented track tuning and more!

NEW! Bearcat® 160

List price \$299.95/CE price \$189.00/\$20.00 rebate
Your final cost is a low \$169.00

16 Channels • 3 Bands • AC only • Priority Dual Scan Speeds • Direct Channel Access Frequency range: 32-50, 144-174, 440-512 MHz.
Would you believe...the Bearcat 160 is the least expensive Bearcat crystalless scanner.

This scanner presents a new dimension in scanning form and function. Look at the smooth keyboard. No buttons to punch. No knobs to turn. Instead, finger-tip pads provide control of all scanning operations, including On/Off, Volume and Squelch. Of course the Bearcat 160 incorporates other advanced Bearcat features such as Priority, Direct Channel Access, Dual Scan Speeds, Automatic Channel Lockout, Scan Delay and Auxiliary. All this performance in sleek, contemporary styling. And at a price so low, it astounds even us!

Bearcat® 5

List price \$134.95/CE price \$94.00/\$5.00 rebate
Your final cost is a low \$89.00

8 Crystal Channels • 3 Bands • AC only Frequency range: 33-50, 146-174, 450-508 MHz.
The Bearcat 5 is a value-packed crystal scanner built for the scanning professional — at a price the first-time buyer can afford. Individual lockout switches.

Bearcat® Four-Six ThinScan™

List price \$189.95/CE price \$124.00/\$10.00 rebate
Your final cost is a low \$114.00

Frequency range: 33-47, 152-164, 450-508 MHz.
The incredible, Bearcat Four-Six Thin Scan™ is like having an information center in your pocket. This three band, 6 channel crystal controlled scanner has patented Track Tuning on UHF, Scan Delay and Channel Lockout. Measures 2 1/4 x 6 1/4 x 1". Includes rubber ducky antenna. Order crystals for each channel. Made in Japan.

TEST ANY SCANNER

Test any scanner purchased from Communications Electronics™ for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).

CIRCLE 44 ON FREE INFORMATION CARD

Fanon Slimline 6-HLU

List price \$169.95/CE price \$109.00
Low cost 6-channel, 3-band scanner!

The Fanon Slimline 6-HLU gives you six channels of crystal controlled excitement. Unique Automatic Peak Tuning Circuit adjusts the receiver front end for maximum sensitivity across the entire UHF band. Individual channel lockout switches. Frequency range 30-50, 146-175 and 450-512 MHz. Size 2 1/4 x 6 1/4 x 1" includes rubber ducky antenna. Order crystal certificates for each channel. Made in Japan.

Fanon Slimline 6-HL

List price \$149.95/CE price \$99.00
6-Channel performance at 4-channel cost!

Frequency range: 30-50, 146-175 MHz.
If you don't need the UHF band, get this model and save money. Same high performance and features as the model HLU without the UHF band. Order crystal certificates for each channel. Made in Japan.

FANON SCANNER ACCESSORIES

SCMA-6 Mobile Adapter/Battery Charger.....\$49.00
CHB-6 AC Adapter/Battery Charger.....\$15.00
CAT-6 Carrying case for Fanon w/Belt Clip.....\$15.00
AUC-3 Auto lighter adapter/Battery Charger.....\$15.00

OTHER SCANNERS & ACCESSORIES

Regency M400 Scanner.....\$259.00
Regency M100 Scanner.....\$199.00
Regency R1040 Scanner.....\$169.00
SP50 AC Adapter.....\$9.00
SP51 Battery Charger.....\$9.00
SP58 Carrying Case for Bearcat 4-6 ThinScan™.....\$12.00
FB-E Frequency Directory for Eastern U.S.A.....\$12.00
FB-W Frequency Directory for Western U.S.A.....\$12.00
FFD Federal Frequency Directory for U.S.A.....\$12.00
MK350 Mobile mounting kit for Bearcat 350.....\$12.00
B-4 1.2 V AAA Ni-Cad's for ThinScan™ and Fanon.....\$9.00
A-135cc Crystal certificate.....\$3.00
Add \$3.00 shipping for all accessories ordered at the same time.

INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your scanner, it is essential that you use an external antenna. We have six base and mobile antennas specifically designed for receiving all bands. Order #A60 is a magnet mount mobile antenna. Order #A61 is a gutter clip mobile antenna. Order #A62 is a trunk-lip mobile antenna. Order #A63 is a 3/4 inch hole mount. Order #A64 is a 3/4 inch snap-in mount, and #A70 is an all band base station antenna. All antennas are \$35.00 and \$3.00 for UPS shipping in the continental United States.

BUY WITH CONFIDENCE

To get the fastest delivery from CE of any scanner, send or phone your order directly to our Scanner Distribution Center. Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

Mail orders to: Communications Electronics™, Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$7.00 per scanner or phone product for U.P.S. ground shipping and handling, or \$14.00 for faster U.P.S. air shipping to some locations. If you have a Master Charge or Visa card, you may call anytime and place a credit card order. Order toll free in the U.S.A. Dial 800-521-4414. If you are outside the U.S. or in Michigan, dial 313-994-4444. Dealer inquiries invited. All order lines at Communications Electronics™ are staffed 24 hours.

Scanner Distribution Center™ and CE logos are trademarks of Communications Electronics™.

† Bearcat is a federally registered trademark of Electra Company, a Division of Masco Corporation of Indiana.
‡ Regency is a federally registered trademark of Regency Electronics Inc.

Copyright © 1981 Communications Electronics™



854 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.
Call TOLL-FREE (800) 521-4414 or outside U.S.A. (313) 994-4444

We're first with the best.™



KEITHLEY

VIZ formerly RCA

TRIPLETT



PHILIPS

HICKOK



New Portable Digital Capacitance Meter

BK PRECISION



Call For Our Price

MODEL 820

- Measures capacitance from 0.1 pF to 1 Farad
- Resolves to 0.1 pF
- 10 ranges for accuracy and resolution
- 4 digit easy-to-read LED display
- 0.5% accuracy
- Special lead insertion jacks or banana jacks
- Fuse protected
- Uses either rechargeable or disposable batteries
- Overrange indication

FLUKE DIGITAL MULTIMETERS

Model 8022A:
The Troubleshooter

\$139

- Six functions
- 3 1/2-digit resolution
- dc voltage
- ac voltage
- dc current
- ac current
- resistance
- diode test
- 0.25% basic dc accuracy
- LCD display
- Overload protection

Model 8020A:
The Analyst

\$189

Model 8024A:
The Investigator

\$229



NEW

• Seven functions

- dc voltage
- ac voltage
- dc current
- ac current
- resistance
- diode test
- conductance (1/R)
- 3 1/2-digit resolution
- 0.1% basic dc accuracy
- LCD display
- Overload protection
- Free case
- Two year parts and labor warranty

• Nine functions

- dc voltage
- ac voltage
- dc current
- ac current
- resistance
- diode test
- conductance (1/R)
- logic level and continuity detect
- temperature (K-type thermocouple)
- Peak hold on voltage and current functions
- Selectable audible indicator for continuity or level detection
- 3 1/2-digit resolution
- 0.1% basic dc accuracy
- LCD display
- Overload protection

DATA PRECISION Model 938

0.1%, 3 1/2-Digit, LCD DIGITAL CAPACITANCE METER



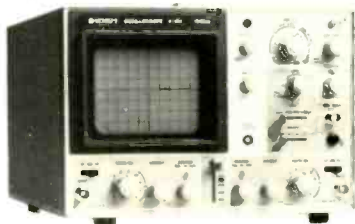
\$185

- WIDE RANGING — from 199.9 pF full scale (0.1 pF resolution) up to 1999 μ F full scale, in eight ranges...virtually every capacitance you'll ever need to measure.
- FAST AND EASY TO USE — Direct reading, pushbutton ranges. Just plug in and read.
- EXCEPTIONALLY ACCURATE — provides $\pm 0.1\%$ basic accuracy.
- TOUGH AND COMPACT — Built to take rough usage without loss of calibration accuracy. Fits and goes anywhere, takes very little bench space, always handy for quick capacitance checkout, matching, calibration, and tracking.
- PORTABLE — Palm-sized, light-weight, operates up to approximately 200 hours on a single 9V alkaline battery.
- EASY READING — big, clear, high-contrast 3 1/2-digit LCD display, a full 0.5" high, readable anywhere.
- VALUE PACKED — Outstanding measurement capability and dependability. Outperforms DC time-constant meters, and even bridges costing 2 to 5 times as much.
- RELIABLE — warranted for 2 full years.



- V-151B 15 MHz Single Trace
- V-152B 15 MHz Dual Trace
- V-301B 30 MHz Single Trace
- V-302B 30 MHz Dual Trace
- V-550B 50 MHz Dual Trace, Dual Time Base

Call For Special Intro Price Offer



New Low Distortion Function Generator

BK PRECISION



Call For Our Price

MODEL 3010

- Generates sine, square and triangle waveforms
- Variable amplitude and fixed TTL square-wave outputs
- 0.1 Hz to 1MHz in six ranges
- Push button range and function selection
- Typical sine wave distortion under 0.5% from 0.1Hz to 100kHz
- Variable DC offset for engineering applications
- VCO external input for sweep-frequency tests

New Sweep/Function Generator

BK PRECISION



Call For Our Price

MODEL 3020

- Four instruments in one package—sweep generator, function generator, pulse generator, tone-burst generator.
- Covers 0.02Hz-2MHz
- 1000:1 tuning range
- Low-distortion high-accuracy outputs
- Three-step attenuator plus vernier control
- Internal linear and log sweeps
- Tone-burst output is front-panel or externally programmable

Simpson

BK PRECISION

LEADER

DORIC

NLS Non-Linear Systems

WESTON

DATA PRECISION

PORTABLE OSCILLOSCOPES
BATTERY OPERATED

MS-15



Single Trace 15MHz

NLS Non-Linear Systems

Call For Our Prices

MS-215



Dual Trace 15 MHz

MS-230



Dual Trace 30MHz

THESE 1981 B&K OSCILLOSCOPES
ARE IN STOCK AND AVAILABLE
FOR IMMEDIATE DELIVERY



BK PRECISION

- 1479A Dual-Trace 30 MHz
- 1477 Dual-Trace 15 MHz
- 1432 Dual-Trace 15 MHz Portable
- 1476 Dual-Trace 10 MHz
- 1466 Single-Trace 10 MHz
- 1405 Single-Trace 5 MHz
- 1420 Dual-Trace 15 MHz Portable

CALL FOR OUR
EARLY BIRD SPECIAL LOW PRICE

KEITHLEY

Model 169
BENCH/PORTABLE DMM

- 3½ Digit liquid crystal display
 - 0.25% basic accuracy
 - 26 Ranges
- \$169.00**



WESTON

The Roadrunner
Model 6100

- 5 Range audible signaling function
- 0.5" LCD display
- 6 Functions
- 29 Ranges



BEEP!
BEEP!

Reg. \$155.00

SPECIAL
\$139.00

includes free case

80MHz Counter with Period Function



BK PRECISION

Call For Our Price

MODEL 1820

- 5Hz to 80MHz reading guaranteed—100MHz typical
- Period measurements from 5Hz to 1MHz
- Period average, auto and manual positions
- One PPM resolution
- Totalizes to 999999 plus overflow
- Elapsed time measurements from 01 to 9999 99 seconds plus overflow
- One-megohm input resistance
- Bright .43" high LED readouts



THE TEST EQUIPMENT SPECIALISTS

TOLL FREE HOT LINE
800-223-0474

54 WEST 45th STREET, NEW YORK, N.Y. 10036 212-687-2224



ADVANCE
ELECTRONICS

Here's a look at negative-ion generators, and other tidbits,

EARL "DOC" SAVAGE, K4SDS, HOBBY EDITOR

IN JUNE 1980, I PASSED ALONG A REQUEST from Russ Lane for some information about building a negative-ion generator. Thanks for your responses.

For the uninitiated, there are those who maintain that exposure to air that contains negative ions promotes physical and mental well-being. I simply don't know whether it does or doesn't, so I can only say, "To each his own!"

In any case, there is general agreement that breathing ozone (O₃) for an extended period is unhealthy. Further, an ion generator will produce ozone if it is not adjusted properly. So, if you build your own, be sure to have all the information you will need and make the adjustments that prevent ozone formation.

Negative ions are introduced into the atmosphere when a negatively charged object "leaks" them into the air. To get an appreciable quantity of ions, you need several thousand volts—at least 5,000.

There are four convenient methods of producing the required high voltage. One is to begin with 110 volts AC or more from a transformer and add on a long series of voltage-doubler circuits. Another is to use a "firing transformer" designed to produce an arc (normally to ignite an oil furnace).

Very little current is needed to produce ions. Safety precautions with either of the above methods include placing a very high resistance between the supply and the charged object in order to limit the current in case you accidentally come into contact with it.

Two ways that are more satisfactory for producing high voltage require a little more circuitry. They are to use either an automobile ignition coil or a TV flyback transformer to change a low input-voltage into 5-to 20-thousand volts. For increased efficiency, the low voltage should be interrupted DC (square wave) rather than AC. That is usually done with heavy-duty switching transistors driven by a square-wave generator (a 555 IC) or

by a feedback winding added to the flyback transformer.

There are two advantages to those last two methods. One is that the current is automatically limited. The other is that those systems are more readily adjusted to prevent ozone formation.

Of course, the final high-voltage must be rectified; the usual approach is to use a solid-state diode designed for TV high-voltage supplies. The negative output lead is connected to the "charged object."

Unit charges (electrons) disperse over the surface of an object with a concentration proportional to the radius of curvature at any given point. What that means is that the electrons collect around sharp angles and points (see Fig. 1). So, if you want them to leak off into the air, your object must have one or more sharp points. Then, with a good high voltage, the electrons "spray off" the charged object and ionize the air molecules.

That shape factor is the reason why builders of ion generators often use one (or more) sewing needles as the charged object. The negative output of the high-voltage supply is simply connected to the needle.

Because of the shape factor, you should be careful when you hook-up and route the high-voltage lead. Avoid leaving wire ends sticking out. Watch for sharp projections that may be left on a solder blob. Avoid sharp bends in the wires—use gentle curves when changing direction. After all, you want to lose as few electrons as possible before reaching the needle(s).

There you have the basics for building your own negative-ion generator. Special thanks to Dennis Doonan (Racine, WI), Istvan Mohos (Phoenix, AZ), Richard Kaufman (New York, NY) and others who came up with much of the foregoing information.

Magazine index

How often does this happen to you? You remember an article with informa-

tion that you need but you can't remember what issue it was in—maybe not even the year it appeared or in what magazine. You tackle the annual indexes if you have them or worse yet, the table of contents in each individual issue.

That process can be a real headache; it can take from hours to days. And that is only when you can remember the article—what about those articles that you have forgotten?

I have some magazine files that go back more than 25 years. Searching for something vaguely recalled used to be a chore, but not any longer—my TRS-80 does the searching for me.

What does your microcomputer do for you besides play games? Put your computer to work keeping and searching a master index—one or more depending upon your needs.

An 8K or 16K computer can hold a surprisingly large index if you are careful about how you arrange the data. That is especially true if you use your imagination to create a coding system that will reduce memory requirements. Here's an example:

IDENTIFY UNMARKED IC'S
Radio-Electronics
P. 45, JAN 80

can become

ICIDXMARK/RE0450180

Of course you should use your own system, but it is obvious that the second entry takes less memory but conveys the same information.

Well . . . yes, it *did* take time to create the index files for the several magazines—especially for the ones that go back a number of years. Once done however, it takes only a few minutes every month or two to stay current.

Now my searches are quick and complete. The reference mentioned above will turn up in a long list if I key in "IC" and on a much shorter one under "ICID."

Don't let your computer just play around—put it to work. And if you don't have one yet, here is one more reason to get one.

Help!

Pat Hazen of New Orleans is asking for help in designing an alarm circuit to substitute for an output-meter indicator in a detection device. He is speaking specifically of the gas detector in the July 1976 issue of *Radio-Electronics*.

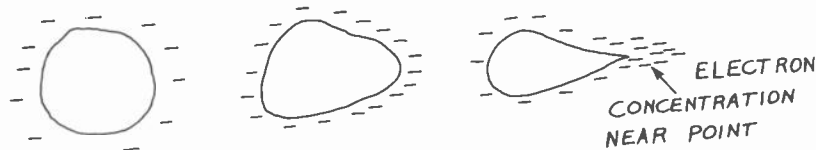


Fig. 1

Apparently, Pat does not wish to use a mechanical device, but that still leaves transistor switches, flip-flops, and other possibilities. Can you come up with a suitable alarm circuit to help Pat out.

Recently available

PanaVise Products, Inc. (2850 East 29th Street, Long Beach, CA 90806) has a comprehensive catalog of their heads, bases, mounts, and accessories. With all the possible combinations, they have a holder/vice for almost any application.

An extensive listing of general and computer-related parts, equipment, and accessories is to be found in the Advanced Computer Products, Inc. catalog (PO Box 17329, Irvine, CA 92713).

Digi-Key Corp. (PO Box 677, Thief River Falls, MN 56701) has a catalog with a very broad listing of parts for the builder. The chances are good that Digi-Key has what you may need, including books. You can get their catalog by calling, toll-free, 1-800-346-5144. R-E

**SHARE
THE COST OF
LIVING.**

**GIVE TO THE
AMERICAN CANCER SOCIETY.**

This space contributed as a public service

Radio- Electronics

**SPECIAL REPRINT
BUILD A BACKYARD SATELLITE TV RECEIVER**



**First Printing: Sold Out!
Second Printing—Just Off Press!
Reprints Now Available!**

Don't miss out again!

Send away today for your 36-page booklet containing complete reprints of all seven articles in the series on Backyard Satellite TV Receivers by Robert B. Cooper Jr.

This all-inclusive report gives you all the data you need to build your own Backyard Satellite TV Receiver.

■ TELLS ALL ABOUT domestic satellite communications, with full details on how you can pull those elusive TV signals from space.

■ LEGAL REQUIREMENTS, technical specifications, and how you, the home constructor, can meet them. Find out what mechanical and electronics skills you need.

■ RECEIVER CHARACTERISTICS, technical details and specifications, along with examples of actual receivers built at comparatively low cost.

■ ANTENNA DESIGN... and exactly how you can build a spherical antennae, while keeping total earth station cost for the complete system under \$1,000.

■ THE FRONT END is critical when you build your own system. We help you explore several different approaches to making one that will work for you.

■ RECEIVER-SYSTEM hardware, and how it goes together to bring you direct-from-satellite TV reception in your own home.

To order your copy: Complete coupon and enclose it with your check or money order for \$6.00 U.S. We will ship your reprint, postpaid in U.S. and Canada within 6 weeks of receipt of your order. All others add \$3.00 for postage. New York State residents must add 48¢ sales tax.

Radio-Electronics

MAY 81

Please print

Satellite TV Reprints
45 East 17th Street
New York, N.Y. 10003

(Name)

(Street address)

I want _____ reprints @ \$6.00 U.S. each,
postpaid. I have enclosed \$_____ N.Y.
State residents must add 48¢ sales tax.

(City)

(State)

(Zip)



FREE!
1981
DISCOUNT
ELECTRONICS
CATALOG

JOIN THE PAK!

Send for our Free catalog and become a member of our exclusive Pak. Our members receive Poly Paks'

exciting catalog several times a year. We offer:

Penny Sales, Free

Premiums and Low,

Low Prices on a wide variety of

Electronic Products such as Computer Peripherals, Integrated Circuits, Speakers, Audio Equipment, Rechargeable Batteries, Solar Products, Semiconductors, and much, much more!

Take advantage of our 25 years as America's foremost Supplier of discount electronics.

RUSH ME YOUR FREEDISCOUNT CATALOG!

NAME: _____

ADDRESS: _____

CITY: _____

STATE: _____

ZIP: _____

CLIP AND MAIL COUPON TODAY TO:

POLY PAKS, INC.

P.O. BOX 942, RA5

S. LYNNFIELD, MA. 01940

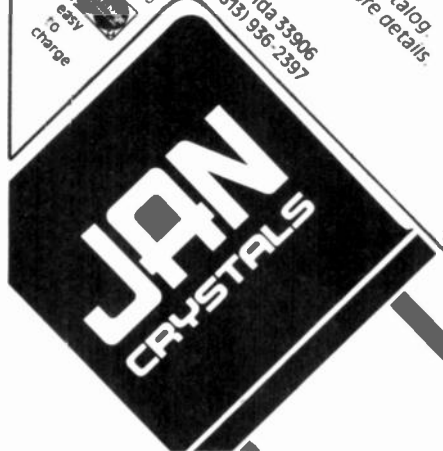
(617) 245-3828

CIFCLE 26 ON FREE INFORMATION CARD

**High stability
crystals for frequency
or time. Use the best.**

- CB meter
- 2 meter
- Scanner
- Industry
- Marine VHF
- CB standard
- Amateur bands
- General
- Communication
- Micro processor crystals

Send 10¢ for our latest catalog
Write or phone for more details
Jan Crystals
P.O. Box 0607
Ft. Myers, Florida 33906
all phones (813) 956-2397



CIRCLE 18 ON FREE INFORMATION CARD

SAVE TIME AND MONEY!

6100 UNIVERSAL DESIGNER

- Save on digital bread boarding
- Easy transition from prototype to wiring diagrams
- Aids digital circuit design

Kit \$49.95
Assembled \$59.95

SELF-TEACHING AID:

6101 DIGITAL LOGIC COURSE \$29.95

- Learn digital logic with 26 self teaching experiments

0101 SOLID STATE CLOCK/CALENDAR UNIT

BIG 2½" DISPLAY!

- 12/24 hour selectable
- Alarm output

Kit \$49.95
Assembled \$79.95
Oak Case \$29.95



Satisfaction Guaranteed on All Assembled Units

FOR FAST DELIVERY CALL TOLL-FREE
1-800-426-6254 EXT 15

PRCCOM 14905 N.E. 40TH, DEPT RE-5
REDMOND, WA 98052 (206) 883-9200

Please rush me the following:

- | | |
|--|---------|
| <input type="checkbox"/> 6100 UNIVERSAL DESIGNER KIT | \$49.95 |
| <input type="checkbox"/> 6100 UNIVERSAL DESIGNER ASSEMBLED | \$59.95 |
| <input type="checkbox"/> 6101 DIGITAL LOGIC COURSE | \$29.95 |
| <input type="checkbox"/> 0101 CLOCK/CALENDAR KIT | \$49.95 |
| <input type="checkbox"/> 0101 CLOCK/CALENDAR ASSEMBLED | \$79.95 |
| <input type="checkbox"/> OAK CASE | \$29.95 |

ADD \$3.00 PER ORDER POSTAGE & HANDLING

NAME _____

ADDRESS _____

CITY _____ ST _____ ZIP _____

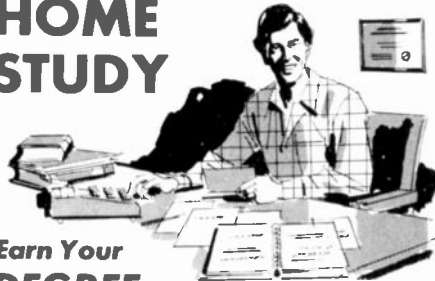
CREDIT CARD NO _____ EXP _____

SIGNATURE _____ VISA MASTERCARD

CIRCLE 17 ON FREE INFORMATION CARD

Put Professional Knowledge and a
COLLEGE DEGREE
in your Electronics Career through

HOME STUDY



Earn Your DEGREE

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

In the Grantham electronics program, you first earn your A.S.E.T. degree, and then your B.S.E.T. These degrees are accredited by the Accrediting Commission of the National Home Study Council.

Our free bulletin gives full details of the home-study program, the degrees awarded, and the requirements for each degree. Write for *Bulletin R-81*.

Grantham College of Engineering
2500 So. LaCienega Blvd.
Los Angeles, California 90034

new products

More information on new products is available. Use the Free Information Card inside the back cover.

POWER ETCHING SYSTEM & ETCHING SOLUTION HEATER, GC Cat. No. 22-394 and GC Cat. No. 22-392 includes an etching tank, pump, and heater, and is designed to handle two single- or double-sided boards up to 8 X 10 inches in size at the same time.



CIRCLE 151 ON FREE INFORMATION CARD

The basic tank system, GC Cat. No. 22-394, includes a 1.25-gallon molded polyethylene tank with lid, agitating pump, hose, wire base PC-board holder, and instructions. The base can be mounted on a bench, left portable, or mounted as a bench well. The pump keeps acid agitating for faster, more even etching. PC boards fit into a submersible rack, with handles, that keeps boards separate and hands away from the acid. The tank lid can also be used as an auxiliary lab tray.

The Etching Solution Heater, GC Cat. No. 22-392, greatly reduces etching time. The heater attaches easily to the tank and its thermostat quickly adjusts to solution temperature.

The price of the basic tank system is \$55.98; the heater costs \$10.25.—GC Electronics, 400 South Wyman St., Rockford, IL 61101.

TIMED LIGHT CONTROL, the *Night Sentry*, is designed to give your home a "lived-in" look while you're away. This wall-model, solid-state light timer provides automatic control of indoor or outdoor light fixtures—including porch, post, kitchen, bathroom, and bedroom lights—using a microprocessor. Its "memory" permits automatic self-programming; you use it as a conventional



CIRCLE 152 ON FREE INFORMATION CARD

light switch and after 24 hours of use, your pattern of light-use will be repeated daily.

The *Night Sentry* can be programmed in a matter of seconds, and up to 48 on-off settings per 24-hour period are possible. It can be installed in minutes with only a screwdriver. The suggested retail price for the *Night Sentry* is under \$25.00.—Dynascan Corporation, 6460 W. Cortland St., Chicago, IL 60635.

DUAL-TRACE OSCILLOSCOPE, model HM312, offers precise, drift-free performance over varying conditions. Both vertical amplifiers have a bandwidth of DC to 20 MHz, with a maximum sensitivity of 5 mV-per-cm. Full X-Y operation is available by switching channel 2 into the horizontal-deflection system.



CIRCLE 153 ON FREE INFORMATION CARD

The model HM312 will trigger on as little as a 4-mm signal up to 30 MHz. Triggering is auto or variable level, with the source being channel 1, 2, or external. A TV-frame sync filter is also provided. Sweep speeds range from 0.2 seconds to 40 nanoseconds. All of the critical DC voltages are regulated.

The input-line transformer can be connected to operate from 110 to 237 volts AC, 50 to 60 Hz. There is a built-in 1-kHz, 0.2-volt (± 1%) square-wave generator that is used for checking probe compensation.

The model HM312 comes in an all-metal case (9.3 X 8.3 X 15 inches) that is particularly suited for lab and field use. There is a handy carry handle and retractable tilt-up stand that pulls down from under the unit. The price of the model HM312 is \$610.00.—Hameg, Inc., 191 Main St., Port Washington, NY 11050.

DMM, model 467, is a hand-portable combination of digital and analog LCD displays to analyze both steady and pulsing signals, plus differential + and - peak-holding capability and fast-pulse detection and indication.

In the differential mode, the model 467 can make percent modulation and signal-tracing measurements. In the pulse-detection mode, it can give visual and/or audible indication of pulse presence and logic states. Other standard features include 26 AC/DC voltage, current and resistance ranges, true RMS AC voltage and current measurements, 0.1% DC accuracy on the

voltage ranges, continuity detection with both visual and audible indications, high-voltage tran-



CIRCLE 154 ON FREE INFORMATION CARD

sient protection, and excellent overload capabilities.

The *model 467* is cordless and gives up to a year of service on a single 9-volt alkaline battery. It measures 2 X 5.6 X 4.6 inches, weighs 1½ pounds, and comes with a 9-volt battery, U.L.-approved test leads with screw-on alligator clips, and an instruction manual. The price is \$239.00.—Simpson Electric Company, 853 Dundee Ave., Elgin, IL

AC POWER-LINE TESTER KIT, model 3600-K, features a new hand-size battery-operated 3½-digit AC power-line tester, a *model 10-L* clamp-on AC ammeter, a *model 101* line separator, man-made leather top opening hand-and-shoulder carrying case, two 4½ foot long test leads, and a 9-volt battery.

The digital *3600 AC* power-line tester has a single-selector switch for AC volt ranges, 0-200 volts and 0-600 volts. Accuracy is ± 0.5% of reading. AC-current range (requires the use of the *model 10-L* clamp-on ammeter) is 0-20-200 amps. Ac-



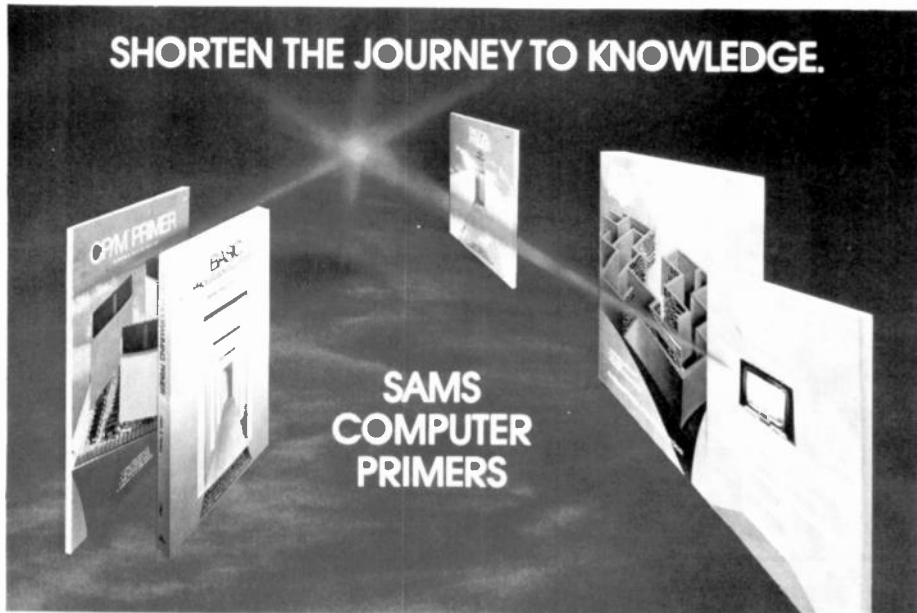
CIRCLE 155 ON FREE INFORMATION CARD

curacy is ± 3% of reading.

The *model 10-L* clamp-on AC ammeter adapter is used to make current measurements without circuit interruption when clamped around a single conductor, and 0-20-200 amps may be read directly as AC amperes on the *model-3600* display. If conductors cannot be separated, the *Triplet model 101* line separator is provided in the kit to make fast and accurate measurements.

A large, easy-to-read 0.5-inch, 3½-digit liquid-crystal display with low-battery alert and over-range indication, is provided. The *model-3600* tester is compact and weighs 10 ounces with its 9-volt battery. Typical battery life is 500 hours in usage and the display indicates when eight hours of battery life remain. It also has auto-zeroing, inherent protection (up to 600 volts on all ranges) from overloads without damage, and meets ANSI C39.1 specifications. The price is \$150.—Triplet Corporation, One Triplet Drive, Bluffton, OH 45817. R-E

SHORTEN THE JOURNEY TO KNOWLEDGE.



SAMS COMPUTER PRIMERS

The popular Sams series of Computer Primers provide a working knowledge of computers without being dry and complex. The Primer Books guide you through the subject at an easy pace. Your journey to understanding is short, exciting, and fun. The Sams Primers offer good graphics . . . a good balance of data . . . an upbeat, positive style . . . and are organized so that you can read them straight through like a novel.

CP/M™ PRIMER, by Mitch Waite and Stephen Murtha. A non-technical discussion of CP/M disk operating systems for 8080 and Z-80-based microcomputers. No. 21791. \$11.95.

PASCAL PRIMER A complete guide to the hottest new language in computers by Mitch Waite and David Fox. No. 21793. \$16.95.

COMPUTER GRAPHICS PRIMER An easy-to-understand guide to creating drawings, plans, maps, and schematics on a computer monitor. By Mitch Waite. No. 21650. \$12.95.

MICROCOMPUTER PRIMER (Second Edition) Up-to-date facts on popular microcomputers. Don't buy a computer without reading this book by Mitch Waite and Michael Pardee. No. 21653. \$11.95.

BASIC PROGRAMMING PRIMER A valuable guide to BASIC, today's most widely used microcomputer language. By Mitch Waite and Michael Pardee. No. 21586. \$10.95.

Sams Books.

Mail To Howard W Sams & Co. Inc.
4300 West 62nd Street PO Box 7092 Indianapolis, IN 46206

Save 10% on Orders of \$20 or More!	Quantity	_____	_____ Payment Enclosed _____ Check _____ Money Order
CP/M Primer	No. 21791	\$11.95	_____ VISA _____ MasterCard Interbank No. _____
PASCAL Primer	No. 21793	\$16.95	Account No. _____ Expiration Date _____
Computer Graphics Primer	No. 21650	\$12.95	Name (print) _____
Microcomputer Primer	No. 21653	\$11.95	Signature _____
BASIC Programming Primer	No. 21586	\$10.95	Address _____
	Amount of order	\$ _____	City _____
Deduct 10% if order is \$20 or more	\$ _____	State _____ Zip _____	
Add local sales tax where applicable	\$ _____	Prices good in U.S.A. only Prices subject to change without notice	
Shipping & handling costs	\$2.00	CALL TOLL FREE 1-800-428-3696 for the name of your local Sams Book outlet or to order by phone	
Total amount of order	\$ _____	Offer expires 8/31/81 AD084	

CIRCLE 23 ON FREE INFORMATION CARD



NOW YOU CAN BUILD YOURSELF AN ORCHESTRA

The most advanced — most versatile organ you ever dreamed of is now within most everyone's reach . . . because you build it yourself the exclusive WERSI way.

Expand your instrument according to your taste and budget. With WERSI's 'Building Block' system, you'll never need to trade organs again!

Superior WERSI quality also available in pianos, synthesizers, amps, rhythm units, etc. . . . kit or factory assembled.

Send \$6 for the exciting Sight and Sound package everyone raves about. You'll receive the famous "WERSITIME 2" 12" LP with accompanying libretto as well as a full color, 104 page manual, widely acclaimed as the encyclopedia of organ builders, introducing you to the Wonderful World of

WERSI world leader in quality do-it-yourself instruments

WERSI ELECTRONICS, INC. Dept. M4
P. O. Box 5318, 1720 Hempstead Road
Lancaster, PA 17601

Please send above demo pack @ \$6.00.

Name _____

Address _____

City _____ State _____ Zip _____

Albia Electronics

ALL NEW!

DM-10 LOW OHM METER MODULE

Measures resistance from 10 milliOhms to 20 Ohms. Now you can measure resistance down to 10 milliOhms with this low cost, easy to use DVM module. Check coil resistance, transformers, relays, chokes, printed circuit board copper paths and ground cables. Special zero balance control nulls out input cable resistance to insure accurate readings. Your DVM has to be set to 2V range during operation.



- Resistance range 10 milliOhms to 20 Ohms
- Zero Calibration control
- Battery powered (push to read battery saver circuit). Requires 1.9 Volt Battery (not included).
- Size 6.25" x 3.75" x 2"
- (Input cables not included or available)

FREQUENCY METER MODULE LOW COST DM-11, "5Hz to 100MHz"

Measure frequencies from 5Hz to 100MHz on your digital voltmeter with a resolution of 3 1/2 digits — easy to use — perfect for field service — lab testing — home hobbyists! Connect the DM-11 to your DVM, set the DVM to the 2VDC range, connect a signal to the DM-11 via a BNC cable (not included) and measure the frequency of any source. Hi Lo Range LED's insure fast accurate readings.

- Input Sensitivity < 100Hz < 80mV
- 100Hz - 60MHz < 30mV
- > 60MHz < 70mV
- Size 6.25" x 3.75" x 2"
- External 9V DC power supply included. (Model MMAC-2)
- BNC Input Cable Accessory (Model PSA-2 add \$14.95)



Completely assembled and tested! Ready to use!

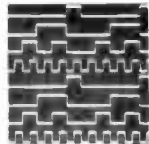
YOUR CHOICE

Any 2 For \$124.99
\$69⁹⁵
 All 4 For \$239.99
 EACH

8 CHANNEL SCOPE MULTIPLEXER, DM-12

Convert your single channel scope into a 4 or 8 channel instrument, just connect the DM-12, 8 channel scope multiplexer to your scope, clip the 8 input probes to the signals you want to view. Simple, easy, fast — can handle logic level TTL signals from 0C to 3MHz. Features separate spacing and trace amplitude controls and selectable sampling rate — all to insure easy clear scope display.

- 8 TTL compatible input channels (1 TTL load per channel) can drive 50 Ohm scope cable.
- Maximum full screen amplitude 1.6 Volts adjustable.
- Trace amplitude and spacing controls.
- 4 or 8 channel selector switch.
- 8 color coded input cables, 24" long with insulated alligator clips.
- External 9 VDC power supply included (Model MMAC-2).
- Size 6.25" x 3.75" x 2"
- BNC Output Cable Accessory (Model PSA-2 add \$14.95).



Completely assembled and tested! Ready to use!

LOW COST DM-8 CAPACITANCE METER MODULE

Connect this high quality low cost Capacitance Meter Module, DM-8 to your digital Volt Meter and turn it into a Digital Capacitance Meter — the Low Cost Way!

- Push to read range (button) from 1pF to 20,000µF
- Zero calibration control
- In one easy to use, self-contained package
- Battery powered, with "push to read" battery saver circuit (9V batteries not included).
- Size 6.25" x 3.75" x 2"

(When placing order specify the make and model DVM you're using so that factory modifications, if required, may be made before shipment is made.)

Completely assembled and tested!

Ready to use!
INSTANT ORDER INFORMATION BELOW!



LOW COST HIGH FREQUENCY COUNTER — NOW IN STOCK!!



The Albia Model DM-7, 8 Digit High Frequency Counter is easy to use, switch selectable time base input by a single BNC, nothing to build — nothing more to buy!

- 5 Hz to 550 MHz
- 8 big easy-to-read .43" high intensity LED display
- Crystal (±3 ppm @ 25 C) controlled 0.1 or 1.0 sec. gate times
- Convenient benchtop size (7" x 10" x 3") durable attractive case

NEVER BEFORE AT THIS LOW PRICE

\$149⁹⁵
 Includes Warranty

COMPLETELY ASSEMBLED • PRE-CALIBRATED • PRE-TESTED

REGULATED TRIPLE POWER SUPPLY BARGAIN PRICED ALBIA MODEL DM-6

A fully assembled and tested power supply that provides a solid, fully wired triple power supply including fixed 5V @ 1 Amp, 5V to 15V @ 0.5 Amp, and -5V to -15V @ 0.5 Amp — all supplies regulated, short proof. Each supply has short indicator LED. Complete and ready for use in a durable (8" x 6" x 3 1/2") metal case.

\$99⁹⁵
 Includes Warranty



ALBIA SATISFACTION WARRANTY: If for any reason, whatsoever, you are not completely satisfied with your purchase, return it within 30 days of purchase date for a full refund — it's as simple as that!

FOR FAST AND DEPENDABLE DELIVERY SERVICE

CALL TOLL FREE: 1-800-243-6953 9 A.M. to 5 P.M. E.S.T.

WE ACCEPT MASTER CHARGE, VISA AND AMEX CREDIT CARDS

Connecticut Residents add 7 1/4% Sales Tax • Prices shown in U.S. currency only. Foreign orders add 15%.

ALBIA ELECTRONICS INC

24 Albia St. • New Haven, CT 06512

POSTAGE & HANDLING	
ORDERS	ADD
UP TO \$10.00	\$1.95
\$10.01 - \$25.00	3.75
\$25.01 - \$50.00	4.65
\$50.01 - \$100.00	6.45
ORDERS OVER \$100.00 WITHIN UNITED STATES	7.55

FREE ALBIA "TEMPLATE" WITH EVERY ORDER RECEIVED by May 25, 1981

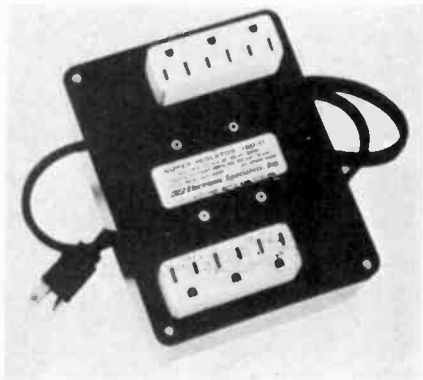


FREE!!
 NEW 1981
 MID-YEAR
 CATALOG

Exciting new products!
 Send today!!



SUPER ISOLATOR, model ISO-11, is designed to curb problems in microprocessor installations resulting from severe AC powerline spikes, surges, and hash—those unexplained crashes, memory losses, or other glitches. (Disks, printer, and processor often interact, aggravating such problems.)



CIRCLE 156 ON FREE INFORMATION CARD

The *model ISO-11* features two individually dual-pl filtered AC socket banks (six sockets in all). Heavy-duty spike/surge suppression is incorporated in the design. Equipment interactions are eliminated; and disruptive and damaging line spikes and hash are controlled.

The *model ISO-11* is priced at \$85.95.—**Electronic Specialists, Inc.**, 171 South Main Street, Natick, MA 01760.

PROGRAMMABLE DMM, model 192, "smart" DMM offering 0.005% accuracy, 1- μ V sensitivity, 6½-digit resolution, front-panel math functions, and data-storage capability. Additional features include fast autorange (150 ms per range change), one-button zero, a speed of over 25 readings per second at 4½-digit resolution (or 20 readings per second at 5½-digit resolution), and high-input impedance of 10^9 ohms up to the 20-volt range.



CIRCLE 157 ON FREE INFORMATION CARD

An optional AC-volts function, which uses AC averaging, is priced at \$175.00. For an additional \$395.00, the user may opt for full IEEE-488 interfascibility.

The *model 192's* math programs include scale factor and offset modifications ($Y = aX + b$), percentage deviation from an entered nominal value, storage of minimum/maximum values (also serving as a peak-hold memory), and hi/Lo pass limits. There is also a choice of multiple or single-input connectors. Separate inputs for DC volts, AC volts, and ohms on the front-panel enhance system accuracy by allowing the optimum cable type to be used for each function. A rear-input adapter allows multiple and single rear inputs when used with the IEEE-488 option.

The *model 192* also is a high-performance, low-cost datalogger, due to its data-storage feature. Ten different readings may be programmed from the front panel, allowing up to 100 readings to be stored over a period of up to four days. The *model 192* is priced at \$995.00.—**Keithley Instruments, Inc.**, 28775 Aurora Road, Cleveland OH 44139.

R-E

What's News

Quality service instruments to be available locally

The John Fluke Mfg. Co., long known as a leading builder of high-class electronic instrumentation, has announced a new plan of broad marketing and distribution to meet the needs of service technicians, and hobbyists, as well as educational and personal users.

In the first six months of the program, Fluke will have at least 400 local dealers throughout the country, ranging from electronics distributors to automotive stores and hobby shops. The program will

make a complete line of high-quality handheld and bench low-cost digital multimeters available locally. The user will be able to inspect the meters at the store and purchase them locally, while still being assured of any needed service from Fluke. Fluke is the first large instrument manufacturer to mount such a program.

The program is being initiated with the Fluke Series D, a group of five digital multimeters, with prices ranging from \$125 to \$299, meter accuracy from 0.5 percent to 0.1 percent, and a corresponding range in meter functions. **R-E**

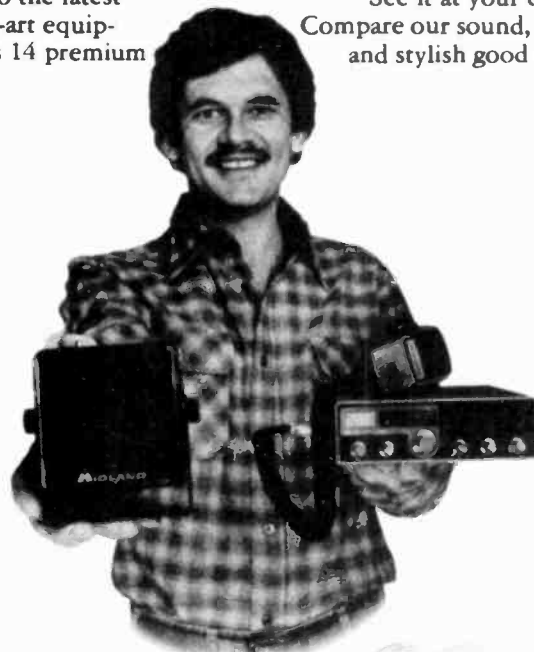
Now Midland Precision Series 5001 mobile CB has superb 21-404 extension speaker as a bonus!

Communications-quality mobile extension speaker can be mounted on dash or hump, then plugged into your external speaker jack. Puts CB reception right where you want it—up front, sharp and clear.

The Midland Model 5001 was designed for CBers ready to step up to the latest state-of-the-art equipment. It has 14 premium

advances, including: a human-engineered mike; easy-vision (sunlight or darkness) green LED digital channel readout; new bevel-shaped controls for non-visual, fingertip adjustment; illuminated S/R/F/SWR meter; 9/19/NOR switch with LED indicators.

See it at your dealer. Compare our sound, specs, and stylish good looks!



Write for free, full-color brochure showing our Precision Series line. Midland CB, P.O. Box 1903, Kansas City, Missouri 64141.

A member of the Beneficial Corporation family.



CIRCLE 83 ON FREE INFORMATION CARD

stereo products

More information on stereo products is available.
Use the Free Information Card inside the back cover.

STEREO HEADPHONE, model 60A, offers high quality sound at an affordable price. It features individual volume and balance controls, a sensi-

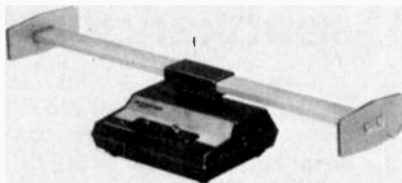


CIRCLE 131 ON FREE INFORMATION CARD

tivity of 110 dB at 1,000 Hz with 1 mW, a matching impedance of 8 to 16 ohms, and a maximum input of 0.5 watt. Other features are leathery soft ear

cushions and a 10-foot coiled connecting cord with a 3-circuit phone plug. It's packaged in a 3-color display carton. Suggested retail price of model 60A is \$14.95. —BP Electronics, 855 Conklin St., Farmingdale, NY 11735.

FM STEREO ANTENNA, the Stereo-Captor model FM-4400, is an indoor antenna featuring a built-in amplifier that boosts and cleans up weak FM signals, therefore adding more stations in most areas. Operating on 110-117 VAC, the unit eliminates multi-path distortion and optimizes signal-to-noise ratio for clear reception. It also has a bi-directional signal element that turns 90



CIRCLE 132 ON FREE INFORMATION CARD

degrees to receive FM stations in all directions for maximum capture area. Measuring 19 in. wide by 3½ in. deep, this compact unit is housed in a deep brown enclosure and can sit on a shelf or on top of a stereo receiver. Coaxial cable and transformer are included. Price is \$71.95. —Winegard Co., 3000 Kirkwood St., Burlington, IA 52601.

CASSETTE DECK, model KX-500, has Dolby and metal tape capability and features fast, efficient fluorescent peak-meters. The four-position tape selector is combined with a variable bias-adjust control to optimize the performance of each tape.



CIRCLE 133 ON FREE INFORMATION CARD

The deck's drive system has a dual-belt design and an extra-wide flywheel that results in a wow-and-flutter of less than 0.05% WRMS. Other features are new "soft touch" controls, automatic shutoff in all modes, a single RECORD button, a



"IN JUST 10 DAYS, I'LL SHOW YOU HOW TO DO

REAL MATH

$$\int_a^b f$$

$$\frac{df}{dx}$$

$$\sum_{n=1}^{\infty} a_n$$

ON YOUR SCIENTIFIC CALCULATOR!*

- Quick.
- Guaranteed.
- Easy.
- Fun, too!

INTRIGUED BY CALCULATORS? Then you can step up your math skills fast! Use my new method in guidebook form. It's called **CALCULATOR CALCULUS** and comes with this guarantee: *If after 10 days you're not astounded at the problems you're solving on your own calculator, return the guidebook for an immediate refund.*

But the point is - you won't want to send it back. For this is the *easiest, fastest shortcut* ever! The day you receive your copy in the mail you'll want to put it to work. It's that exciting and helpful.

My name is Dr. George McCarty. I teach math at the University of California. I wrote this guidebook to cut through the confusion. It does just that — with worked-out examples, simple exercises and practical problems — all designed to work with precision and magic on your own calculator.

POWER METHODS. Need to evaluate functions, areas, volumes — solve equations — use curves, trig, polar coordinates — find limits for sequences and series? It's all here!

If you're in the biological, social or physical sciences, you'll be doing Bessel functions, carbon dating, Gompertz' growth curves, half-life, future value, marginal costs, motion, cooling, probability, pressure — and plenty more (even differential equations).

Important numerical techniques? Those algorithms are here, too — rational and Padé approximation, bracketing, continued fractions, Euler's method, Heun's method, iteration functions, Newton's method, predictor-corrector, successive substitutions, Simpson's method and synthetic division.

LOOK AT WHAT USERS SAY. Samuel C. McCluney, Jr., of Philadelphia writes:

"**CALCULATOR CALCULUS IS GREAT!** For ten years I have been trying to get the theory of calculus through my head, using home-study courses. It was not until I had your book that it became clear what the calculus was all about. Now I can go through the other books and see what they are trying to do. With your book and a calculator the whole idea becomes clear in a moment, and is a MOST REFRESHING EXPERIENCE. I program some of the iterative problems you suggest and it

always GIVES ME A THRILL to see it start out with a wild guess and then approach the limit and stop."

Professor John A. Ball of Harvard College (author of the book 'Algorithms for RPN Calculators') adds:

"I wish I had had as good a calculus course."

Professor H. I. Freedman of the U. of Alberta, writing in *Soc. Ind. Appl. Math Review*, states:

"There can be no question as to the usefulness of this book...lots of exercises...very clearly written and makes for easy reading."

C.B. of Santa Barbara says: "Your book has given me much instruction and pleasure. I do not hesitate to recommend it. 'CALCULATOR CALCULUS' inspires the reader to understand everything down to the last detail. You have put your heart into the teaching."

I WANT YOU TO TRY THIS. So, if you act now, you can invest in 'CALCULATOR CALCULUS' for only U.S. \$14.95 (to USA or foreign: add \$1 for shipping, or \$4 by AIR; in Calif. add 90¢ tax).

***GET MY COMPLETE KIT,** with a TI-35 calculator, a 200 p. Student Math Book, AND the guidebook, ALL for \$39.95 (to USA only: add \$2 for shipping, or \$5 by AIR; in Calif. add \$2.40 tax). As pennywise Ben Franklin said, "An investment in knowledge pays the best dividends." GET STARTED NOW — Tax deductible for professionals.

NO RISK WHATEVER! Send for it today. Be sure to give me your complete mailing address with your check or money order. If you want to charge it (Visa or MC), tell me your card no. and exp. date. *Prompt shipment guaranteed.*

Thank you!

George W. McCarty

EduCALC Publications, Box 974, Dept. A-4, Laguna Beach, California 92652
In California, call 714-497-3600; elsewhere
TOLL FREE 24-hour Credit Card orders: 800-854-0561, Extension 845; Dept. A-4

RECORD MUTE switch, PAUSE control, two microphone jacks with built-in preamps, a headphone jack, and LED recording and pause indicators. With Dolby on and chrome, ferri-chrome or metal tape in use, the frequency response is 30 to 16,000 Hz and the signal-to-noise ratio is 64 dB. The Model KX-500 is priced at \$225. —Kenwood Electronics, Inc., Dept. P, 1315 E. Watsoncenter Rd., Carson, CA 90745.

RECORD CLEANER, the Cecil Watts Record and Stylus Care Kit, is a three-piece starter kit designed to introduce the user to this basic non-liquid system of record care. The principle behind



CIRCLE 134 ON FREE INFORMATION CARD

this record cleaning device is that it is used in a semi-dry or slightly moist state and therefore does not leave a film or residue on the record that can result in a lack of stylus contact and subsequent distortion. The kit includes Parastatik Disc Preener, Parastatik Anti-Static Fluid and Watts Stylus Cleaner. Price is \$13.95. —Empire Scientific Corp., 1055 Stewart Ave., Garden City, NY 11530.

AM/FM STEREO, Concept model CD-82, is both an AM/FM stereo and cassette player featuring automatic reverse and has normal bias as well as metal tape capabilities. Other features are a line-output preamplifier that makes the unit compati-



CIRCLE 135 ON FREE INFORMATION CARD

ble with most power amplifiers, and a stereo high-blend capability that helps provide clearer reception in low-signal areas. The model CD-82 is also compatible with a variety of equalizers and boosters. Price is \$299. —J.I.L., 737 West Artesia Blvd., Compton, CA 90220.

CASSETTE DECK, RT-30, is a metal-capable DC-controlled motorized deck and features a 12-LED Sharpscan peak level display, damped eject,



CIRCLE 136 ON FREE INFORMATION CARD

and an automatic program search system. Specifications of this model include a signal-to-noise

ratio of 66 dB (Dolby on over 5 kHz), a frequency response of 30 to 14,000 Hz for normal, 30 to 15,000 Hz for CrO₂/FeCr, and 30 to 17,000 Hz for metal tapes. Suggested retail price is \$199.95. —Sharp Electronics Corp., 10 Keystone Pl., Paramus, NJ 07652.

SPEAKER SYSTEM, model B450T10, is a 3-way wedge-shaped system designed for use in autos, recreational vehicles, boats, and homes. It can sit on any flat surface or can be secured over a 6 X 9-inch mounting hole. Each speaker includes a 4-inch air suspension woofer with a 10-ounce magnet, 2-inch midrange, and a 1/2-inch tweeter.

Manufacturer's specifications include a power rating of 50 watts, impedance of 4 to 8 ohms and a frequency response of 65 to 20,000 Hz.

The model B450T10P, that includes a built-in amplifier, is also available. The B450T10 series speakers are housed in aluminum die cast enclo-



CIRCLE 137 ON FREE INFORMATION CARD

tures that measure 8 1/4 X 5 X 7 inches. Comes with adjustable mounting brackets, mounting hardware, 5-foot heavy-duty hook-up wires and installation instructions. The B450T10 sells for \$198, the B450T10P sells for \$238. —International Components Corp., 105 Maxess Rd., Melville, NY 11747. R-E



Design of Digital Systems - six volumes

ADVANCED COURSE
DESIGN OF DIGITAL SYSTEMS

Six large-format volumes — each 11 1/2" x 8 1/2"

CONTENTS

The contents of Design of Digital Systems include:

Book 1 Octal, hexadecimal and binary number systems, representation of negative numbers, complementary systems, binary multiplication and division

Book 2 OR and AND functions, logic gates, NOT, exclusive-OR, NAND, NOR and exclusive-NOR functions, multiple input gates, truth tables, DeMorgan's Laws, canonical forms, logic conventions, Karnaugh mapping, three-state and wired logic

Book 3 Half adders and full adders, subtractors, serial and parallel adders, processors and arithmetic logic units (ALUs), multiplication and division systems

Book 4 Flip-flops, shift registers, asynchronous counters, ring, Johnson and exclusive-OR feedback counter, random access memories (RAMs), read-only memories (ROMs)

Book 5 Structure of calculators, keyboard encoding, decoding display data, register systems, control unit, program ROM, address decoding, instruction sets, instruction decoding, control program structure

Book 6 Central processing unit (CPU), memory organization; character representation, program storage, address modes, input/output systems, program interrupts, interrupt priorities programming, assemblers, executive programs, operating systems, and time-sharing

OUR CUSTOMERS

Design of Digital Systems has been bought by more than half the 50 largest corporations in America, and by Motorola, Intel, DEC, National Semiconductor, Fairchild, General Instrument, Hewlett-Packard, Heath Co., MIT, NASA, Smithsonian Institute, Bell Telephone Labs and many, many more, as well as corporations and individuals in over 50 countries

CAMBRIDGE LEARNING Inc.

1 Judith Drive
North Reading,
MA 01864

Call (617) 664-3657 to
order by phone—free.

7 days, 24 hours

- * Order free by phone
- * Mastercharge/VISA
- * No shipping charges
- * Money-back guarantee
- * Tax deductible
- * Save \$5

Designing Digital Systems

Two programmed learning courses:
hardware and software; theory
and application.

BASIC COURSE



Digital Computer Logic & Electronics

CONTENTS

Digital Computer Logic and Electronics is designed for the beginner. No mathematical knowledge other than simple arithmetic is assumed, though you should have an aptitude for logical thought. It consists of 4 volumes — each 11 1/2" x 8 1/2" — and serves as an introduction to the subject of digital electronics

Contents include Binary, octal and decimal number systems, conversion between number systems, AND, OR, NOR and NAND gates and inverters, Boolean algebra and truth tables, DeMorgan's Laws, design of logical circuits using NOR gates, R-S and J-K flip-flops, binary counters, shift registers and half-adders

NO RISK GUARANTEE

There's absolutely no risk to you. If you're not completely satisfied with your courses, simply return them to CLI within 30 days. We'll send you a full refund, plus return postage.

TAX DEDUCTIBLE

In most cases, the full cost of CLI courses can be a tax deductible expense.

PHONE ORDERS - FREE

To order by phone, call (617) 664-3657 with your credit card information. It won't cost you a dime, because we'll deduct the cost of your call from the price of the courses you order.

TO ORDER BY MAIL

You may use the order form below if you wish, but you don't need to. Just send your check or money order (payable to Cambridge Learning, Inc. to the address below. If you don't use the order form, make sure your address is on your check or the envelope, and write "DDS" (Design of Digital Systems) "DCL" (Digital Computer Logic & Electronics), or "both" (both courses) on your check.

Mass. Residents add 5% sales tax. We pay all shipping costs.

We also accept company purchase orders.

AIR MAIL

The prices shown include surface mail postage anywhere in the world. Air mail postage costs an extra \$10 for both courses (10 volumes).

DISCOUNTS

Call or write for details of educational and quantity discounts, and for dealer costs.

SAVE \$5

If you order both courses, you save \$5. Order at no obligation today.

To: Cambridge Learning Inc., 1 Judith Drive, North Reading, MA 01864

Please send me

sets of Design of Digital Systems	\$19 95	\$ _____
sets of Digital Computer Logic & Electronics	\$14 95	\$ _____
sets of both courses	\$29 90	\$ _____

Enclosed is check / money order (payable to Cambridge Learning Inc.) for total \$ _____

NAME _____

ADDRESS _____

CITY/STATE/ZIP _____

CIRCLE 33 ON FREE INFORMATION CARD

new ideas

ELECTRONIC VOICE SUBSTITUTE

DID YOU EVER LOSE YOUR VOICE BECAUSE of laryngitis, or for some other reason? This device will give you a new "voice" of variable volume and pitch. It can also be used on Halloween, or other occasions, and it's a lot of fun just to play with, in order to see how many different voices you can create.

pitch of your "voice" is controlled by R1.

Now we get to the heart of the circuit: Q1. Transistor Q1 can be a 2N1086, 2N1091, or any other equivalent NPN germanium-type such as a Radio Shack 276-2001. Sounds picked up by the microphone are amplified by the 741 and that IC's output drives the transistor to

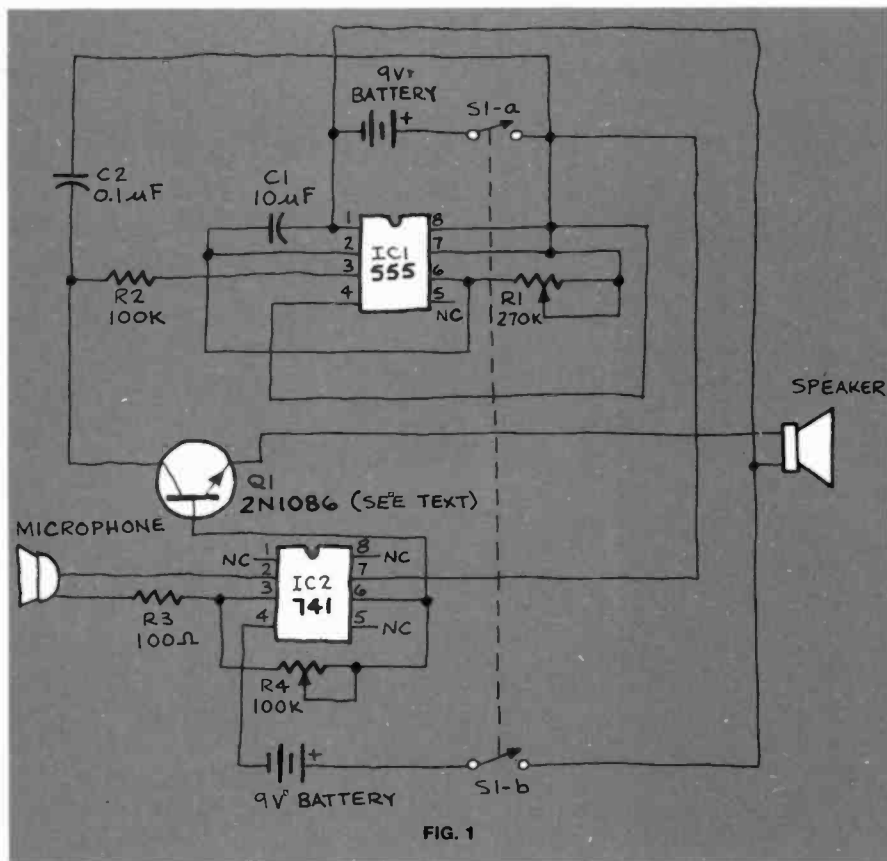


FIG. 1

As shown in Fig. 1, your voice—or even a whisper—is amplified up to 1000 times by the 741 op-amp. That op-amp requires a dual-polarity power supply (positive and negative voltages of equal magnitude). Thus, it needs two 9-volt batteries. If you look carefully you'll notice that two batteries are used for the 741 and that one of them is shared with the 555 IC.

If additional amplification is desired, as many op-amps as you feel are necessary can be added. Another option would be to use one of the many IC's that contain two or more op-amps.

The 555 acts as the tone generator, and it's configured in the astable mode. Its pin-3, square-wave output is transformed into a triangle wave by R1 and C2. The

saturation. When the transistor is in the saturated state, the triangle wave is able to reach the speaker, and your new "voice" is heard.

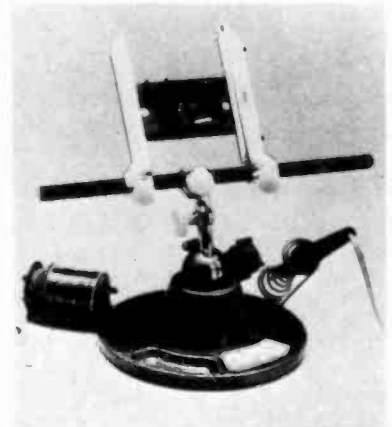
Unwanted noise may occasionally trigger your "voice" due to the high gain of the 741 op-amp. If this gets to be a problem there are several simple solutions you can try. One would be to use a higher-impedance microphone. Another would be to substitute a higher value for resistor R3. A potentiometer may also be used so that the value can be adjusted to fit the ambient conditions. On-off switch S1 is a DPDT type.

Any technique can be used in building this circuit. I hope that the device will be useful or fun for you—or both!—J. Paul Sturgis

NEW IDEAS

This column is devoted to new ideas, circuits, device applications, construction techniques, helpful hints, etc.

All published entries, upon publication, will earn \$25. In addition, Panavise will donate their model 324 Electronic Work Center, having a value of \$49.95. It combines their circuit-board holder, tray base mount, and solder station (see photo below). Selections will be made at the sole discretion of the editorial staff of **Radio-Electronics**.



I agree to the above terms, and grant **Radio-Electronics Magazine** the right to publish my idea and to subsequently republish my idea in collections or compilations of reprints of similar articles. I declare that the attached idea is my own original material and that its publication does not violate any other copyright. I also declare that this material had not been previously published.

Title of Idea

Signature

Print Name

Date

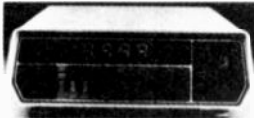
Street

City

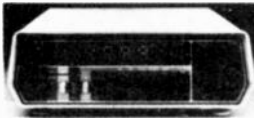
State

ZIP

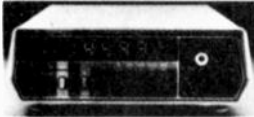
Mail your idea along with this coupon to: **New Ideas Radio-Electronics**, 200 Park Ave. South, New York, NY 10003



Model 178. A no-frills 4½-digit three-function DMM for production use. High accuracy and all the capability needed for most general purpose uses **\$249**



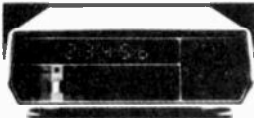
Model 179. Has all the features offered by the 178 plus TRMS AC, AC and DC current, 10µV sensitivity, and switch selectable HI-LO ohms **\$329**



Model 179-20A Has all the features of the Model 179 but also includes an additional 20A range, for applications beyond the 2A range of most DMMs **\$359**



Model 177. This five-function, 4½-digit DMM has 1µV, 1mΩ, 1nA accuracy and 1V analog output. **\$499**



Model 191. Our top-of-the-line, 5½-digit DMM. Microprocessor control provides 0.007% basic DC accuracy. Also has pushbutton null **\$595**

Model 169. Our "macho meter" is a tough, 3½-digit bench DMM with 0.25% basic DC accuracy, large 0.6" LCD display, range and function annunciators on the display and 1-year battery life. **\$169**

Model 130. Our rugged, hand-held 3½-digit LCD DMM has five full functions, 0.5% basic DC accuracy, easy-to-use rotary switches, impact-resistant case, light (only 10 oz.) weight and a 10A current range. **\$115**

KEITHLEY



SEND FOR OUR CATALOG

Call TOLL FREE:
NORTHEAST REGION (800) 526-2514
 N.J. CALL:
(201) 227-7720

AMPOWER INST., INC.

26 JUST ROAD, FAIRFIELD, N.J. 07006
 OUT OF NORTHEAST—CALL COLLECT

"WE SERVICE WHAT WE SELL"



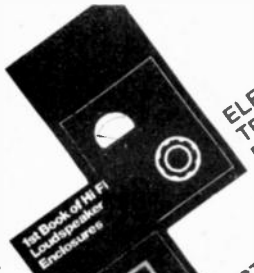
Mastercharge
 BankAmericard
 and
 COD Accepted
 add \$10.00 to
 cover shipping
 handling insurance
 N.J. res. add
 5% tax.

SEND FOR
 OUR
 COMPLETE
 LINE CARD

**PRICES SUBJECT
 TO CHANGE**

CIRCLE 45 ON FREE INFORMATION CARD

SPECIAL THIS MONTH



ELECTRONIC TEST EQUIPMENT CONSTRUCTION.
 Regular price \$4.50

This month ONLY \$3.95



1ST BOOK OF HI-FI LOUDSPEAKER ENCLOSURES.
 Regular price \$2.95

This month ONLY \$2.50



PRACTICAL COMPUTER EXPERIMENTS.
 Regular price \$4.50

This month ONLY \$3.95



POPULAR ELECTRONIC CIRCUITS BOOK 1.
 Regular price \$4.95

This month ONLY \$4.25



52 PROJECTS USING IC741.
 Regular price \$2.95

This month ONLY \$2.50

Electronics Paperback Books
 Quality Paperbacks at Affordable Prices

SPECIAL PRICE GOOD UNTIL 5/31/81

To order from this ad: Check off the books you want. Total the prices. Add in shipping. NY State residents add Sales Tax. Total it up, enclose your check and mail.

- Radio Circuits Using IC's \$3.50
- Single IC Projects \$3.95
- IC 555 Projects (Expanded Edition) \$4.50
- 28 Tested Transistor Projects \$3.50
- Electronic Calculator Users Handbook \$2.95
- Handbook Of IC Audio Preamp and Power Amp Construction \$3.24
- 50 Circuits Using Germanium Silicon and Zener Diodes \$2.25
- 50 Projects using Relays SCR's and Triacs \$2.95
- 50 FET (Field Effect Transistor) Projects \$3.50
- Digital IC Equivalents and Pin Connections \$6.95
- Linear IC Equivalents and Pin Connections \$6.95
- 50 Simple LED Circuits \$2.25
- How To Make Walkie-Talkies \$3.50
- Popular Electronic Projects \$3.50
- Electronic Music and Creative Tape Recording \$3.50
- Projects In Opto Electronics \$3.50
- How To Build Your Own Metal & Treasure Locators \$2.95

ELECTRONIC TECHNOLOGY TODAY INC. 5-81
 17 Slate Lane, Central Islip, NY 11722 No Canadian Orders

Total Price
 Shipping and Handling
 (60¢ 1 or 2 books. 25¢ each addl.)
 Subtotal
 Sales Tax (NY State Residents only)
 Name
 Address
 City State Zip

MAY 1981

If all else fails, look for a leaky transistor. Here's what they're all about.

JACK DARR, SERVICE EDITOR

A FEW DAYS AGO I GOT A LETTER FROM A technician in Maryland who was having trouble with an RCA CTC-53. The set had all kinds of symptoms; weak color, intermittent drive-lines on the raster, very poor sync, and so on. He tried everything he could think of, including replacing all of the IF transistors and even the video detector diode. The key clue he gave me was that the DC voltages were all off around the AGC stage.

If you have problems in a "controlled stage" like the IF, be sure that the control circuit isn't causing the problem. In this case the control circuit is the AGC (Fig. 1). The symptoms sounded familiar. I'd had almost exactly the same problem some time ago, and I've heard of several similar cases. The cause in mine, and, I suspected, in his, was a leaky transistor in the AGC stages. The keying pulse was present, but the DC voltage was far off. This is one of the RCA chassis that uses a comparatively high AGC voltage (from +50 to +55 volts). He measured only about +25 volts, so that excessive bias was evidently holding down the IF gain to the point where many things were upset. Leakage in any keyed stage, such as AGC or sync can cause it to stay on too long, among other things.

Leaky transistors aren't all that common. However, that is one possibility we must consider whenever we run into one of those mysterious multiple-symptom cases. (A more common cause, of course, for multiple symptoms is a bad filter capacitor that allows feedback between all stages. If the B+ lines are clean on the scope, though, that isn't it.)

Don't try to measure transistor leakage with anything but a good transistor tester. You can *not* identify a leaky transistor with a VOM. Leakage in silicon transistors may be as little as 10-15 microamperes and still upset circuit operation. I've seen it happen. The older germanium types have a normal leakage higher than that, but we see very few of those in signal circuits any more.

There are quite a few good transistor testers on the market. I have one that's been around for a while, a Sencore CG-151. It reads actual leakage on an analog meter. It also tests FET's. I've heard that FET's can be very tricky with leakage, though I haven't run into that as yet.

Leakage causes problems in any circuit. Not long ago, a friend and I found a puzzling problem in a very complex DC voltage-regulator circuit in an imported set. The trouble turned out to be a leaky control transistor in an error-amp circuit. That fouled up the regulator stage, and as a result there was no regulation to speak of. The key clue here, as in all cases like it, is that the circuit simply does not work as it should! Resistors, supply voltages, etc. seem to be OK but the set still does not work. So, the active device—the transistor—would be a good suspect. One good check, if you have a duplicate of the suspicious device, is to replace it and recheck the operation. Since it's usually necessary to take the transistor out to get a definitive leakage test (with no shunts), you may as well try a new one anyhow. If no substitute is available, test the original. If it shows leakage, you'd better order a replacement.

I've noticed that quite a few of the new sets are coming out with fairly complex voltage-regulator circuits. Those circuits include not only the regulator itself, but the error-amps, etc. Some also include a "start-up" circuit that develops a pulse of DC to kick the horizontal oscillator into action. If you find one with poor regulator action, or anything else that isn't normal, suspect the possibility of leakage in one of the transistors.

Here's another oddball that came in the last batch of letters. The symptom was an odd horizontal line that floated up and down, and varied in width. Checking through the circuit to see where the vertical blanking was, I found that it came through a blanker transistor. I suggested that the transistor be checked for possible leakage since the variable nature of the symptom made that quite a possibility.

The triplets

A great many solid-state sets use the RGB circuit. There are three video output stages, one for each color: red, green, and blue. In most sets, those stages are identical triplets. This is one time when plug-in transistors or small modules can be very helpful. If you see odd one-color symptoms, try interchanging two of the three output stages/transistors. If the problem is in the blue, for instance, swap the red and blue output stages and see if you now have the same problem in the red. If so, that output stage is bad; leakage here may be the cause.

A letter came in a while back concerning a "blue smear" around objects, especially light-colored ones. I suggested swapping two of the three output transistors, with the idea that a leaky blue output transistor might be causing a "blue blooming". (I did tell him to check the convergence first, but that wasn't it!)

Transistors can do some strange and interesting things. I've had one on my bench for a long time that was removed from the third IF stage of a Zenith. On the curve tracer, at room temperature, it makes a beautiful "set of fingers." Cool it off a bit with a short puff of freeze spray, and the pattern collapses. Warm it up by holding your fingers on it, and the pattern comes back. Warm it up a bit more by holding a soldering iron near it, and the pattern collapses again. The transistor will work only over a very narrow range of temperatures. Leakages are often temperature-sensitive so freeze spray and a

continued on page 88

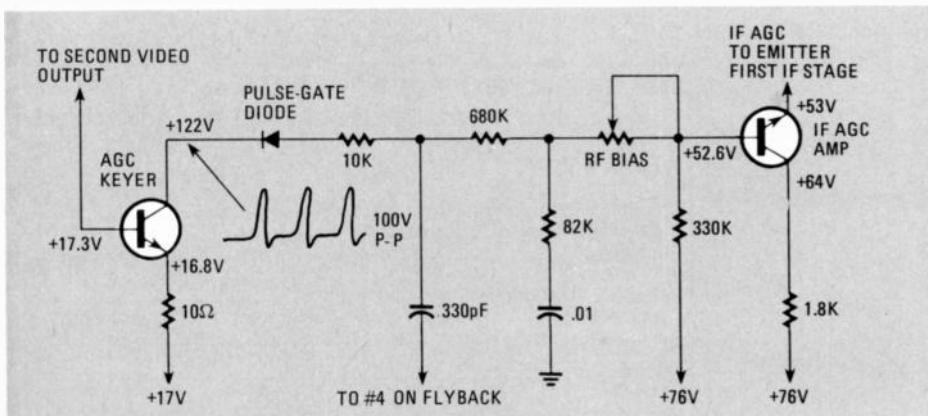


FIG. 1

By Netronics

ASCII/BAUDOT, STAND ALONE

Computer Terminal

COMPLETE FOR ONLY \$149⁹⁵



The Netronics ASCII/BAUDOT Computer Terminal Kit is a microprocessor-controlled, stand alone keyboard/terminal requiring no computer memory or software. It allows the use of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output.

The keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include onboard regulators, selectable parity, shift lock key, alpha lock jumper, a drive capability of one TTY load, and the ability to mate directly with almost any computer, including the new Explorer/85 and ELF products by Netronics.

The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

VIDEO DISPLAY SPECIFICATIONS

The heart of the Netronics Computer Terminal is the microprocessor-controlled Netronics Video Display Board (VID) which allows the terminal to utilize either a parallel ASCII or BAUDOT signal source. The VID converts the parallel data to serial data which is then formatted to either RS232-C or 20 ma. current loop output, which can be connected to the serial I/O on your computer or other interface, i.e., Modem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: 1.5 P/P into 75 ohm (EIA RS-170) • Baud Rate: 110 and 300 ASCII • Outputs: RS232-C or 20 ma. current loop • ASCII Character Set: 128 printable characters—



BAUDOT Character Set: ABCDEFGHIJKLMNOPQRSTUVWXYZ-? *\$%&'()*+,-./0123456789:;<=>? Cursor Modes: Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing • Cursor Control: Erase, End of Line, Erase of Screen, Form Feed, Delete • Monitor Operation: 50 or 60Hz (jumper selectable).

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375

Netronics R&D Ltd., Dept. RE-5
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

- Netronics Stand Alone ASCII Keyboard/Computer Terminal Kit, \$149.95 plus \$3.00 postage & handling.
- Deluxe Steel Cabinet for Netronics Keyboard/Terminal In Blue/Black Finish, \$19.95 plus \$2.50 postage and handling.
- Video Display Board Kit alone (less keyboard), \$89.95 plus \$3 postage & handling.
- 12" Video Monitor (10 MHz bandwidth) fully assembled and tested, \$139.95 plus \$5 postage and handling.
- RF Modulator Kit (to use your TV set for a monitor), \$8.95 postpaid.
- 5 amp Power Supply Kit In Deluxe Steel Cabinet (±8VDC @ 5 amps, plus 6-8 VAC), \$39.95 plus \$2 postage & handling.

Total Enclosed (Conn. res. add sales tax) \$ _____

- By—
- Personal Check Cashiers Check/Money Order
- Visa Master Charge (Bank # _____)

Acct. # _____ Exp. Date _____

Signature _____ Print Name _____

Address _____

City _____ State _____ Zip _____

Send Me More Information

Start Computing For Just \$129.95 With An 8085-Based Professional Computer Kit—

Explorer/85

100% compatible with all 8080A and 8085 software & development tools!

No matter what your future computing plans may be, Level "A"—at \$129.95—is your starting point.

Starting at just \$129.95 for a Level "A" operating system, you can now build the exact computer you want. Explorer/85 can be your beginner's system, OEM controller, or IBM-formatted 8" disk small business system... yet you're never forced to spend a penny for a component or feature you don't want and you can expand in small, affordable steps!

Now, for just \$129.95, you can own the first level of a fully expandable computer with professional capabilities—a computer which features the advanced Intel 8085 cpu, thereby giving you immediate access to all software and development tools that exist for both the 8085 and its 8080A predecessor (they are 100% software compatible)—a computer which features onboard S-100 bus expansion—plus instant conversion to mass storage disk memory with either 5-1/4" diskettes or standard IBM-formatted 8" disks.

For just \$129.95 (plus the cost of a power supply, keyboard/terminal and RF modulator, if you don't have them already), Explorer/85 lets you begin computing on a significant level... applying the principles discussed in leading computer magazines... developing "state of the art" computer solutions for both the industrial and leisure environment.

Level "A" Specifications

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8155 ROM with 2k deluxe monitor/operating system, and an 8155 ROM/I/O—all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

Level "A" makes a perfect OEM controller for industrial applications and is available in a special Hex Version which can be programmed using the Netronics Hex Keypad/Display.

PC Board: glass epoxy, plated through holes with solder mask • I/O: provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader

• provision for 24-pin DIP socket for hex keyboard/display... cassette tape recorder input... cassette tape control output... speaker output... LED output indicator on SOD (serial output) line... printer interface (less drivers)... total of four 8-bit plus one 6-bit I/O ports • Crystal Frequency: 6.144 MHz • Control Switches: reset and user (RST 7.5) interrupt... additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard • Counter/Timer: programmable, 14-bit binary • System RAM: 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems... RAM expandable to 64k via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F000 leaving 0000 free for user RAM/ROM. Features include tape load with labeling... tape dump with labeling... examine/change contents of memory... insert data... warm start... examine and change all registers... single step with register display at each break point, a debugging/training feature... go to execute on address... move blocks of memory from one location to another... fill blocks of memory with a constant... display blocks of memory... automatic baud rate selection... variable display line length control (1-255 characters/line)... channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling... tape dump with labeling... examine/change contents of memory... insert data... warm start... examine and change all registers... single step with register display at each break point, a debugging/training feature... go to execute on address... move blocks of memory from one location to another... fill blocks of memory with a constant... display blocks of memory... automatic baud rate selection... variable display line length control (1-255 characters/line)... channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling... tape dump with labeling... examine/change contents of memory... insert data... warm start... examine and change all registers... single step with register display at each break point, a debugging/training feature... go to execute on address... move blocks of memory from one location to another... fill blocks of memory with a constant... display blocks of memory... automatic baud rate selection... variable display line length control (1-255 characters/line)... channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

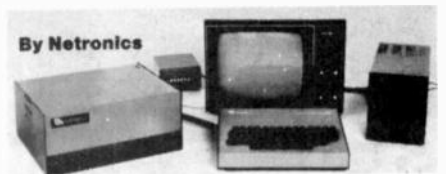
Netronics R&D Ltd., Dept. RE-5

333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

- Explorer/85 Level "A" Kit (ASCII Version), \$129.95 plus \$3 p&h.
- Explorer/85 Level "A" Kit (Hex Version), \$129.95 plus \$3 p&h.
- 8k Microsoft BASIC on cassette tape, \$64.95 postpaid.
- 8k Microsoft BASIC in ROM Kit (requires Levels "B," "D," and "E"), \$99.95 plus \$2 p&h.
- Level "B" (S-100) Kit, \$49.95 plus \$2 p&h.
- Level "C" (S-100 6-card expander) Kit, \$39.95 plus \$2 p&h.
- Level "D" (4k RAM) Kit, \$69.95 plus \$2 p&h.
- Level "E" (EPROM/ROM) Kit, \$5.95 plus 50¢ p&h.
- Deluxe Steel Cabinet for Explorer/85, \$49.95 plus \$3 p&h.
- ASCII Keyboard/Computer Terminal Kit (features a full 128 character set, upper & lower case, full cursor control, 75 ohm video output convertible to baudot output, selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator)), \$149.95 plus \$2.50 p&h.
- Hex Keypad/Display Kit, \$69.95 plus \$2 p&h.
- Deluxe Steel Cabinet for ASCII Keyboard/Terminal, \$19.95 plus \$2.50 p&h.
- Power Supply Kit (±8V @ 5 amps) in deluxe steel cabinet, \$39.95 plus \$2 p&h.
- Gold Plated S-100 Bus Connectors, \$4.85 each, postpaid.
- RF Modulator Kit (allows you to use your TV set as a monitor), \$8.95 postpaid.
- 16k RAM Kit (S-100 Board expands to 64k), \$199.95 plus \$2 p&h.
- 32k RAM Kit, \$329.95 plus \$2 p&h.
- 48k RAM Kit, \$459.95 plus \$2 p&h.
- 64k RAM Kit, \$589.95 plus \$2 p&h.
- 16k RAM Expansion Kit (to expand any of the above up to 64k), \$139.95 plus \$2 p&h each.
- Intel 8085 cpu User's Manual, \$7.50 postpaid.
- Special Computer Grade Cassette Tapes, \$1.90 each or 3 for \$5, postpaid.
- 12" Video Monitor (10 MHz bandwidth), \$139.95 plus \$5 p&h.
- North Star Double Density Floppy Disk Kit (One Drive) for Explorer/85 (includes 3 drive S-100 controller, DOS, and extended BASIC with per-

CIRCLE 58 ON FREE INFORMATION CARD



registers... single step with register display at each break point... go to execution address. Level "A" in the Hex Version makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.

Hex Keypad/Display Specifications

Calculator type keypad with 24 system defined and 16 user defined keys. 6 digit calculator type display which displays full address plus data as well as register and status information.

Level "B" Specifications

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for onboard 4k RAM expansion select-able in 4k blocks... address decoding for onboard 8k EPROM expansion select-able in 8k blocks... address and data bus drivers for onboard expansion... wait state generator (jumper selectable), to allow the use of slower memories... two separate 5 volt regulators.



Explorer/85 with Level "C" card cage.

Level "C" includes a sheet metal superstructure, a 5-card gold plated S-100 extension PC board which plugs into the motherboard. Just add required number of S-100 connectors

Level "D" Specifications

Level "D" provides 4k or RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

Level "E" Specifications

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for soon to be available RAM IC's (allowing for up to 12k of onboard RAM).

Order A Coordinated Explorer/85 Applications Pak!

Experimenter's Pak (SAVE \$12.50)—Buy Level "A" and Hex Keypad/Display for \$199.90 and get FREE Intel 8085 user's manual plus FREE postage & handling!

Student Pak (SAVE \$24.45)—Buy Level "A," ASCII Keyboard/Computer Terminal, and Power Supply for \$319.85 and get FREE RF Modulator plus FREE Intel 8085 user's manual plus FREE postage & handling!

Engineering Pak (SAVE \$41.00)—Buy Levels "A," "B," "C," "D," and "E" with Power Supply, ASCII Keyboard/Computer Terminal, and six S-100 Bus Connectors for \$514.75 and get 10 FREE computer grade cassette tapes plus FREE 8085 user's manual plus FREE postage & handling!

Business Pak (SAVE \$89.95)—Buy Explorer/85 Levels "A," "B," and "C" (with cabinet), Power Supply, ASCII Keyboard/Computer Terminal (with cabinet), 16k RAM, 12" Video Monitor, North Star 5-1/4" Disk Drive (includes North Star BASIC) with power supply and cabinet, all for just \$1599.40 and get 10 FREE 5-1/4" minidisquettes (\$49.95 value) plus FREE 8085 user's manual plus FREE postage & handling!

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375

Netronics R&D Ltd., Dept. RE-5

333 Litchfield Road, New Milford, CT 06776

- Personal Check Cashiers Check/Money Order
- Visa Master Charge (Bank # _____)

Acct. # _____ Exp. Date _____

Signature _____ Print Name _____

Address _____

City _____ State _____ Zip _____

City _____ State _____ Zip _____

City _____ State _____ Zip _____

Send Me Information

MAY 1981

**PHILIPS KNOWS
HOW TO SUCCEED
IN BUSINESS.
THEY JUST BOUGHT
SYLVANIA ECG.**

SYLVANIA RECEIVING TUBES
SYLVANIA ECG® SEMICONDUCTORS
SYLVANIA DATA DISPLAY TUBES
SYLVANIA PICTURE TUBES
SYLVANIA SPECIAL PRODUCTS

Philips ECG, Inc.

A NORTH AMERICAN PHILIPS COMPANY

Wanna make some money?

Then get in on the ground floor of outer space by becoming a dealer in satellite earth stations from Advanced Electronics. The Earth Station People

You'll be able to offer your customers a 'turn-key' system from a complete installation to the most comprehensive advertising and marketing program ever devised for the satellite earth station industry

We like to think the wave of the future is here. So, give us a call and let us tell you what is happening in San Francisco, Houston, Los Angeles and Las Vegas. It's Amazing

FROM OUTSIDE NEVADA CALL
800-634-6047
 ADVANCED ELECTRONICS, INC.
 AEI 5081 Arville Street
 Las Vegas, Nev. 89118
 (702) 871-8766
 THE EARTH STATION PEOPLE

CIRCLE 61 ON FREE INFORMATION CARD

Remove Vocals

Remove the lead vocal and substitute your own voice with most stereo recordings using our new, low cost VOCAL ZAPPER™. Great for practice, professional demos or just for fun.

WITH THE

VOCAL ZAPPER™



FROM
PAA Electronics, Inc.
 1020 W. Wilshire, Oklahoma City, OK 73116 - (405) 843-9626

- Rush my Vocal Zapper Kit, \$24.95 plus \$3 postage & handling enclosed.
- Send assembled Vocal Zapper, \$39.95 plus \$3 postage & handling enclosed.
- Send Free Catalog

name _____
 address _____
 city _____ state _____ zip _____
 Visa MC card no. _____

PAA Electronics, dept. 5R, 1020 W. Wilshire, Okla. City, OK 73116

CIRCLE 19 ON FREE INFORMATION CARD

LED VU METER

continued from page 63

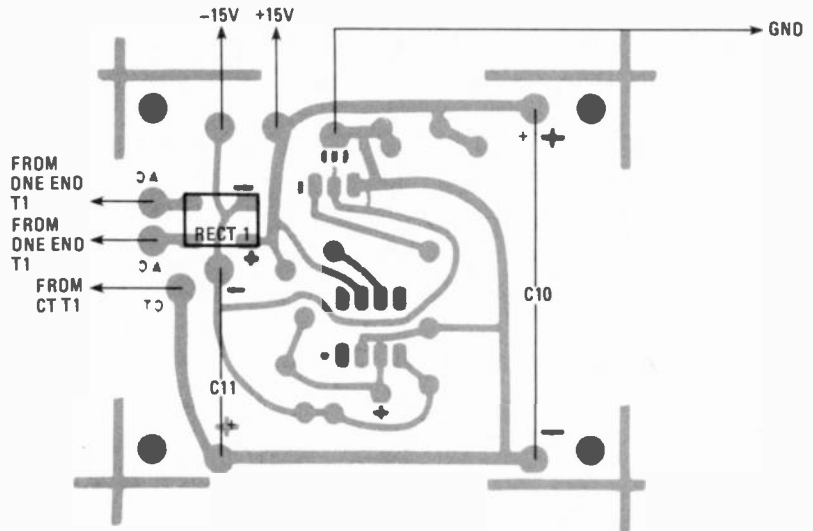


FIG. 16—POWER-SUPPLY LAYOUT when the VU meter is designed to operate from AC power lines. Only the rectifier bridge and filter capacitors are on the PC board. The transformer is bolted to the bottom of the enclosure.

Switch Setting	0 VU Point	Approximate Voltage Level for 0 VU Reading	Corresponding Power Developed into Various Load Impedances		
			600 Ω	8 Ω	4 Ω
S1	-10dB	0.32V	0.167mW	0.01w	0.02w
S2	0 dB	0.77V	1.0mw	0.08w	0.15w
S3	+4dB	1.23V	2.5mw	0.19w	0.38w
S4	+8dB	1.95V	6.7mw	0.48w	0.95w
S5	+12dB	3.08V	15.8mw	1.19w	2.37w
S6	+22dB	9.75V	158mw	11.9w	23.7w
S7	+32dB	30.8V	1.58w	119w	237w

“Option B” section of Fig. 13 for the other changes. Note that the LED polarity has been reversed; the anodes have been jumpered together and returned to a common ground.

The VU meter can be operated from either an external source of 24-to-30 volts DC as shown in Fig. 3-a or a 20-volt center-tapped as in Fig. 3-b. When using the external supply, a 741 op-amp and 2N6111 power transistor are used as the voltage splitter and regulator to develop the dual-polarity voltages (+ and - 12-to-15 volts DC). The component layout for that version of the power supply is shown in Fig. 15. Figure 16 shows the location of the bridge rectifier and filter capacitors when using the power-supply option in Fig. 3-b.

Operation

After inspecting the PC Boards for mistakes, omissions, solder bridges, and the like, apply power and supply an input signal. The signal can come from the LINE output or TAPE output jacks of the stereo system or tapped from the input jacks of the tape deck, or, in the case of an audio console, a

spare LINE output. If a signal generator is available, apply a signal to the system and increase its level until the tape deck's VU meters indicate 0 VU. Set one and only one rocker switch (S1-S7) for an 0 VU reading (i.e., the 0 VU LED just starts to light). Use R11 as a vernier to “fine-tune” that adjustment. If the VU meter is being used to establish the point where a power amplifier starts to clip, perform the setup as before, while monitoring the speaker output with the VU meter and an oscilloscope. When clipping is seen, set the appropriate rocker switch and adjust R11 as before. See Table 1 for power levels versus switch setting. If Option A is used (simple potentiometer for input attenuator; no switches), simply rotate the control for the appropriate reading with any given input, as explained above.

When recording, levels should generally be kept below 0 VU with occasional peaks above 0 VU. The more peaks that occur above 0 VU, the greater the distortion. The user's needs and equipment will dictate the acceptable amount of program material allowed to exceed 0 VU.

RE

market center

SATELLITE TELEVISION

SATELLITE TV self-help newsletter. Three issues \$6.00. 'LITE NEWS, Box 973-RE, Mobile, AL 36601

Satellite TV

FOR THE HOME

Sick of Network TV?

Our receiver lets you get over 75 channels of television directly from earth-orbiting cable TV satellites: HBO, Showtime, super stations, sports and movies worldwide.



We don't just sell information! We Manufacture Hardware!

From offshore oil rigs, data links to hotels and backyard installations, we wrote the book. Constantly updated, our 94 Page technical information book and catalog gives you all the facts. Inexpensive dishes, feeds, telemetry software, kits and more. Recommended reading by NASA, The Office of Consumer Affairs and quality companies like Rockwell/Collins. Send \$7.95 today!

CALL 24-hrs. C.O.D. Hotline (305) 339-7800



SPACECOAST
RESEARCH CORPORATION
P.O. Box 442-E, Altamonte Spgs, FL 32701

LINK ANALYSIS: understand the science behind satellite TV receiving systems. Six page print-out on equipment configurations for your site. Signal strengths, antenna gains required. Azimuth, elevation, to NA satellites, F1 programmers, frequencies. Link equations solved for antenna/LNA tradeoffs. Provide longitude/latitude or nearest highway intersection. \$12. check, visa/MC (account, expiration) CHANNEL ONE, Willarch Road, Lincoln, MA 01773. 617/259-0333

SATELLITE ANTENNA MANUAL to build a 12 foot, screened, all-aluminum, parabolic antenna with polar mount. Plans \$30.00. SA ELECTRONICS, Box 277, South Milwaukee, WI 53172

SATELLITE VISION

We manufacture the highest spec 3-meter dish & video dish in the world 41db gain! We also sell direct. Immediate delivery or you pick up. Complete details including satellite TV information, aiming service and discount schedule. Send \$1.25 for postage & handling to: TIGER TENNAS P.O. Box 561 Casselberry, Florida 32707



Enjoy Satellite TV Now



Better than Cable TV—Over 200 TV and radio services. Why waste money? Learn the whole story and build a video system the family can enjoy. No commercials, FREE movies, sports and Vegas shows—worldwide, crystal clear reception connects to any TV set. Big (8x11 in.) book loaded with details, photos, plans, kits—TELLS EVERYTHING! Satisfaction Guaranteed. Send \$7.95 TODAY! Add \$2.00 for 1st class (air mail) or call our 24 hour C.O.D. rush order line (305) 862-5068. GLOBAL ELECTRONICS, P.O. Box 219-E, Maitland, Florida 32751

CLASSIFIED COMMERCIAL RATE (for firms or individuals offering commercial products or services). \$1.85 per word prepaid (no charge for zip code) . . . **MINIMUM 15 WORDS.** 5% discount for 6 issues, 10% for 12 issues within one year, if prepaid.

NON-COMMERCIAL RATE (for individuals who want to buy or sell a personal item) \$1.00 per word prepaid . . . no minimum.

ONLY FIRST WORD AND NAME set in bold caps. Additional bold face (not available as all caps) at 10¢ per word. All copy subject to publisher's approval. **ADVERTISEMENTS USING P.O. BOX ADDRESS WILL NOT BE ACCEPTED UNTIL ADVERTISER SUPPLIES PUBLISHER WITH PERMANENT ADDRESS AND PHONE NUMBER.** Copy to be in our hands on the 26th of the third month preceding the date of the issue (i.e., August issue closes May 26). When normal closing date falls on Saturday, Sunday, or a holiday, issue closes on preceding working day.

To run your own classified ad, put one word on each of the lines below and send this form along with your check for \$1.85 per word (minimum 15 words) to:

SATELLITE television...Howard/Coleman boards to build your own receiver. For more information write: **ROBERT COLEMAN**, Rt. 3, Box 58-ARE, Travelers Rest, SC 29690

BUSINESS OPPORTUNITIES

CAR painting made easy for the common man. Instructions \$2.50. **VANO CONVERSIONS**, P.O. Box 3100, Truckee, CA 95734

MECHANICALLY inclined individuals desiring ownership of Small Electronics Manufacturing Business—without investment. Write: **BUSINESS-ES**, 92-R, Brighton 11th, Brooklyn, NY 11235

NEW tax loopholes discovered. Everyone eligible. Free sample newsletter. Write: **ULC**, Box 179-CU, Clarkston, GA 30021

PROJECTION TV . . . Make \$200.00+ per evening assembling projectors . . . Easy . . . Results equal to \$2,500 projectors . . . Your total cost less than \$15.00 . . . Plans, lens & dealer's information \$14.00 . . . Illustrated information free . . . **MACROCOMGIX**, Washington Crossing, PA 18977

CRT rebuilding machinery. \$1000/\$3000 weekly possible when you own our patented picture tube rebuilding equipment. Training provided. Phone (312) 583-8565. Write: **LAKE SIDE**, 4071 N. Elston, Chicago, IL 60618

LCD watches US\$7.50 up. For catalog enclose US\$1.00 to: **RELIANT (ENGINEERING) CO.**, P.O. Box 33610, Sheungwan, Hong Kong

WANTED

MIRROR in the lid, spinning disc, and other pre-1946 television sets wanted. Call collect: (203) 521-5280

RESEARCH AND DEVELOPMENT

Research and development in electronics: For details write: **ARTRON LABS, INC.** P.O. Box 25292, Chicago, IL 60625

CB RADIO

GET more CB channels and range! Frequency expanders, boosters, speech processors, how-to books, plans, modifications. Catalog \$1. **CB CITY**, Box 31500RE, Phoenix, AZ 85046

Buy Gov't Surplus SAVE To 85%.

Send 60¢ For Big Bargain Catalog

1000's Of Bargains! Surplus, Excess Inventory. Brand Name New Equipment

COMPRESSORS • WINCHES • GEAR MOTORS
TELEPHONES • WELTERS • POWER PLANTS
SURVEYING INSTRUMENTS • ELECTRONICS
FIRE/BURGALAR ALARMS • PAINT GUNS
TARPS • BINOCULARS • TOOL BOXES
HYDRAULICS • AIR TOOLS • PUMPS

SURPLUS CENTER Box 82209-RE Lincoln, Nebraska Zip Code 68501

4 one • CAPACITANCE METER 1pF to 999Kuf
in • FREQUENCY COUNTER 35MHz
kit • SQUARE WAVE GEN. 1Hz to 99KHz-
• OHMMETER - 3.58MHz Xtal - Regulated PS - Five
8" Readouts - Low cost TTL Circuits - Automatic
Decimal Placement - Be AMAZED - Build it for
\$50 or less. I purchase the plans, etched P.C.
board 4-3/4" by 6-3/4" and front panel decal
for \$15.29! **BAGNALL ELECTRONICS, Refund**
179 May Street, Fairfield, Conn. 06430 any Kit

EDUCATION & INSTRUCTION

ELECTRONICS books from world publishers. Lowest prices; ask catalog. **BUSINESS PROMOTION**, Lajpatrai Market, Delhi, India

UNIVERSITY degrees by mail Bachelors, Masters, PhD's . . . Free revealing details. **COUNSELLING**, Box 317-RE 5, Tustin, CA 92680

BROADCASTING! Start your own radio station at home, school, church! Become DJ-engineer. Free information. "BROADCASTING", Box 130-F5 Paradise, CA 95969

RADIO TELETYPE

WORLD press radioteletype stations list. Over 50 news services transmitting 24 hours in English worldwide. Much news confidential. Hundreds of frequencies and times. Simple equipment. How to set up, sources of equipment. Book with lists, \$5.00 postpaid. **UNIVERSAL ELECTRONICS**, 1280 Aida Drive, Reynoldsburg, OH 43068.

VIDEO

WHOLESALE video tape, all brands and sizes, check our low prices, free catalog. **VIDEO TAPE WHOLESALERS**, 2420 Honolulu, Dept. RE, Montrose, CA 91020.

FOR SALE

SCANNER/monitor accessories—kits and factory assembled. Free catalog. **CAPRI ELECTRONICS**, Route 1R, Canon, GA 30520

RF power transistors—tubes—special parts for "ham" linears. MRF454 \$17.00, MRF455A \$14.00, 8950 \$9.00, 6LF6 \$5.50, catalog and cross-reference help available. COD—Visa/MC. **WESTCOM** 1320 Grand, San Marcos, CA 92069. (714) 744-0728

PICTURE tube rebuilding equipment—we sell and buy new and used equipment. Free training. **ATOL TELEVISION**, 6425 Irving Park, Chicago, IL 60634, Phone 312-545-6667

RESTORE old radios or TV's to operating condition! Tired of searching for servicing information? Sams library of manufacturer's data for old radios dates to 1920. Photofact 1981 index lists available service data for over 110,000 TV's. Auto Radios, CB's, and more. Send \$2.50 plus 50¢ shipping to: **HOWARD W. SAMS CO.**, Dept X0108, 4300 W. 62nd St. Indianapolis, IN 46268.

PRINTED circuit boards, your artwork. Fast delivery. Reasonable. **ATLAS CIRCUITS**, Box 974, Waynesville, NC 28786. (704) 456-3739

30 channel cable converter. Only \$38.95. Shipping free. **BOB'S TV**. 93-15 86 Drive, Woodhaven, NY 11421

LASER handbook with burning, cutting, Ruby Reds, Co's, complete plans, books, and parts. Send \$4.00 to **FAMCO**, dept re, box 1902, Rochester, NH 03867

RECONDITIONED test equipment. \$1.00 for catalog—**JAMES WALTER TEST EQUIPMENT**, 2697 Nickel, San Pablo, CA 94806

CHEMICALS, apparatus, project books, wide selection. Catalog \$1.00 send to: **PIONEER Ltd.** Ind, 14a Hughey St., Nashua, NH 03060

SECORE TV analyzer, brand-new, life time guarantee. Must sell. \$800.00 or best offer. **FRED HAMMOUD**, 10656 Pine, Taylor, MI 48180

RESISTORS carbonfilm 5% 1/4W 100 pk, 1/2W 100 pk, 1/8W 75pk, metalfilms 1% 50 pk, \$3.00 per pk, state values, \$6.00 minimum, CA tax 6%, quantity pricing available. Shipping 60¢ per pk, check or M.O. **RESISTORS**, 1670D Greenport Ave., Rowland Hgts., CA 91748

70 watt power booster \$40.00, car cassette \$30.00, 30 day warranty; **MSC**, PO Box 706, Mancos, CO 81328 +\$1.50 postage

RESISTORS 1/4W, 1/2W 5% carbon films 3¢ ea. No minimums. 1% metal films. Send for details. Bulk pricing available. **JR INDUSTRIES**, 5834-C Swancreek, Toledo, OH 43614

TELEPHONE or office bugged? Latest detection equipment finds out fast. Free literature. **CLIFTON**, Box 220-M, Miami, FL 33168

MICROWAVE TV Downconverter, includes 17 dB gain horn antenna and tunable power supply. Assembled and tested \$210.00 postpaid. **ABLE-TRONICS**, 9155-C Archibald Ave., Cucamonga, CA 91730

100 brand new Philips cable TV converters/VCR programmers. \$3560 (US funds). Prepaid to your door. Sample \$48. **BIRNBOM**, 3655 Ridgewood, Suite 103, Montreal, Canada H3V 1B4 (phone 514-739-0614) USA Inquiries

RF spectrum analyzer, ASL model 8622, 10 to 1,000 MHz, 3-inch CRT, manual and application notes, weight 22 lbs. Excellent condition. \$895. **M.W. ROBERTS**, 3694 East Tompkins, Las Vegas, Nevada 89121. 702-451-3517.

ATTENTION ELECTRONIC TECHNICIANS

Highly Effective Home Study BSEE Degree Program for Experienced Electronic Technicians. Our New Advanced-Placement Program grants Credit for previous Schooling & Professional Experience. Advance Rapidly! Our 36th Year! Free Descriptive Literature.

COOK'S INSTITUTE OF ELECTRONICS ENGINEERING
Desk 10 • P.O. Box 20345 • Jackson, MS 39209

DELTA CAPACITIVE DISCHARGE IGNITIONS. New, fully assembled, factory guaranteed. MK10B, \$41.50. MK10C, \$43.88. Tristar T-500 \$39.00. T-Max \$42.00. PPD domestic, Canada. **SIEVERTS ELECTRONICS**, P.O. Box 171, W. Campton, NH 032228

SAVE up to 50% on name brand test equipment. Free catalog and price list. **SALEN ELECTRONICS**, Box 82-F, Skokie, IL 60077

TELEPHONE on/off button—press to turn off bell—caller hears ring, you hear silence. Intimate moments, naps etc. Shuts off one phone. All nor-

HAND HELD GAME BOARD SPECIALS

These are the complete functional circuit boards from popular hand held games — no case or batteries supplied.

Computer Perfect

Has 10 LEDs and tone signals. You try to guess correct button sequence to light LEDs in order. Requires two 9V batteries. With instructions. C24404 \$4.50



Computer Mind

You guess the secret number stored in computer chip memory. Has 10 LEDs and keyboard. Requires one 9V battery. With instructions. C24405 \$3.75



Starsound Board

Unique board uses IC circuitry and gravity switch to produce space engine sounds. Point the board downwards and it produces "idle" sounds. Point upwards and the sound increases in pulsating frequency to produce "Blastoff" sounds. Originally had LED circuitry but this has been removed. Sound portion is 100% perfect. Requires 9V battery and speaker. C24406 \$2.50
2" Speaker for above. C24311 99¢



120 VAC Xenon Strobe Kit

Complete variable rate strobe light kit. Contains all parts. PC board, line cord and instructions. C23071 \$7.50



Super LED Flasher Kit

Great for Robot projects this simple to build kit uses IC circuitry to randomly flash 4 LEDs; 2 red, 1 yellow, 1 green. Complete with all parts, PC board and instructions. Size: 2" x 2". Operates on 9VDC. C24407 \$4.98



P.O. BOX 27038
DENVER, COLORADO 80227

Phone Orders 303-781-5750 • Minimum Ad Order: \$6.00
• Please include \$1.50 for postage
• VISA MC accepted
• Phone orders are welcome

Send for our free catalog of unique items

CIRCLE 10 ON FREE INFORMATION CARD

mal phones. Instructions. Satisfaction or money back. Send \$5.95. **THE ARMCHAIR EMPORIUM Ltd.** 825 Surrey Ln. Dept RE1, Algonquin, IL 60102

MICROWAVE yagi antenna for MDS complete with hardware, type N connector \$49.95. **SIGNAL ELECTRONICS**, 4027 18th Avenue, Brooklyn, NY 11218

COMPLETE line of microwave television converters and accessories to suit your needs. Converters have a one year warranty backed by a 3 year reputation. Call or write for complete specifications and pricing, dealer inquiries invited. **TRITON MARKETING**, 1933 Rockaway Parkway, Brooklyn, NY 11236. (212) 531-9004

DISCOUNT TRS-80* DEALER A301 COMPUTER SPECIALISTS



FREE COMPUTER CATALOG UPON REQUEST

\$ DISCOUNT \$ on TRS-80's

26-3001 4K Color..... \$353.00
26-1062 16K III..... 865.00
24-4002 64K 1 DRIVE..... 3440.00
1-800-841-0860 TOLL FREE
MICRO MANAGEMENT SYSTEMS, INC.
Downtown Plaza Shopping Center
115 C. Second Av., S.W.
Cairo, Georgia 31728
(912) 377-7120 Co. Phone No.

PASS FCC EXAMS

The Original FCC Tests-Answers exam manual that prepares you at home for FCC First and Second Class Radiotelephone Licenses. Newly revised multiple choice exams cover all areas tested on the actual FCC exam Plus "Self-Study Ability Test". Proven! \$12.95 postpaid (Add \$2.00 for first class Air Mail) Moneyback Guarantee



COMMAND PRODUCTIONS P.O. Box 26348 E
Radio Engineering Division San Francisco, CA 94126

COMPUTER PARTS

I.C.'s: 2114L2's, \$3.40; 4116-2's, \$3.60; 2708's, \$4.90; 2716's, \$7.40; 74LS244's, \$1.00; Z80's, \$4.50; CCS S-100/16K/5MHz static RAM kit, \$200.00; TGE, Box 64068, VA Beach, VA 23464

PLANS & KITS

BUILD a frequency standard as accurate as WWV. Use to verify accuracy of your frequency counter. Complete circuit \$8.00. Send stamp for kit information. **DA PRODUCTS**, PO Box 566, Hampshire, IL 60140

FREE catalog of most sought after plus many unusual plans. **PETER-SCHMITT ENTERPRISES**, # 131, Box 07071, Milwaukee, WI 53207

COMPUTER MARKET CENTER

COMPUTER MARKET CENTER ADVERTISING RATES 1" by 1 column (1 5/8") \$55.00. 1 1/2" by 1 column (1 5/8") \$82.50. 2" by 1 column (1 5/8") \$110.00. All ads must be prepaid. Send order and remittances to Computer Market Center, **Radio-Electronics Magazine**, 200 Park Avenue South, New York, New York, 10003. Address telephone inquiries to 212-777-6400. Frequency rates are available.

TEXAS

Federated Consultants

Specializing In:
PDP8 & DATA SYSTEM 310
PDP8-A 400/BM/AKW \$2,900
PDP8-E/16KW Semi . \$3,600
PDP8-M/8 KW Semi . \$2,750
PDP8-F/16KW Core . \$2,900

100's of option modules available
Brier Spivey
214-428-5300

Hotline

214-278-4031

Purchasing

214-421-1181

Answering Service

CALIFORNIA

FREE! INFO-PAK for small computer users mailed twice a year. We sell and broker all kinds of **SMALL COMPUTER SOFTWARE** from S-100 to TRS-80. **SOFTWARE REVIEW**, 704 Solano Ave., Albany, CA 94706 (415) 527-7730.

BUY THIS SPACE

\$55.00 puts your ad in this space in front of 197,223 active Radio-Electronics readers. To place your ad write Computer Market Center, Radio-Electronics, 200 Park Avenue South, New York, New York 10003 or call 212-777-6400.

CANADA

DYNAMIC INFORMATION TECHNOLOGIES LTD.
P.O. BOX 6553 STN.A.
SAINT JOHN, N.B., CANADA
E2L 4R9 (506) 642-4260
TERMINALS, PRINTERS,
MICROCOMPUTERS
SOFTWARE.

SUPPORT
MARCH OF DIMES



MASSACHUSETTS



Radio Shack's
Model III 16K • \$859

TOLL FREE

1-800-343-8124

computer plus

Dept. R

245A Great Road

Littleton, MA

01460

THIS is only one of hundreds of unusual values... Get your **FREE CATALOG** today!

Take stock in America. Buy U.S. Savings Bonds.

CPU's & SUPPORT CHIPS

Table of CPU and support chips including Intel 8080A, 8085A, AMD 2901, etc.

RAM's

Table of RAM chips including 2114L-3, 4116-3, etc.

C/MOS

Table of C/MOS chips including 4001, 4002, 4003, etc.

TRANSISTOR SPECIALS

Table of transistor parts including 2N1303, 2N1404, etc.

UART's

Table of UART chips including AY5-1013, TR1602B, etc.

INTERFACE & DRIVERS

Table of interface and driver components including 1488, 1489, etc.

SHIFT REGISTERS

Table of shift registers including MM1402, MM1403, etc.

SPECIALS

4116-3 RAM's - 8/\$24.00
15% ALL 74LS SERIES
LEADER OSCILLOSCOPES
WE CARRY A FULL LINE OF HIGH QUALITY, LOW PRICED OSCILLOSCOPES WITH A TWO YEAR WARRANTY.

CRYSTALS \$3.45 ea.

Table of crystals including 2.000 MHz, 4.000 MHz, etc.

MINIATURE MULTI-TURN TRIM POTS

Table of trim pots including 100.5K, 10K, 20K, 250K.

SCR's

Table of SCR components including 1.5A, 3A, 35A, 110A.

TRIAC's

Table of TRIAC components including PRV 1A, 30A, 25A.

FAST RECOVERY DIODE (35ns)

Table of fast recovery diodes including 20XV 250MA DIODE.

SILICON POWER RECTIFIERS

Table of power rectifiers including PRV 1A, 3A, 12A, 50A, 125A, 240A.

7 SEGMENT DISPLAYS

Table of 7 segment displays including FSC 8024-4 digit, C.C. 8" display, etc.

TTLIC SERIES

Table of TTLIC series components including 7400, 7401, 7402, etc.

FULL WAVE BRIDGE

Table of full wave bridges including PRV 2A, 6A, 25A.

DIP SOCKETS

Table of DIP sockets including 8 PIN, 14 PIN, 16 PIN, 18 PIN.

74LS SERIES

Table of 74LS series components including 74LS00, 74LS01, 74LS02, etc.

LINEAR CIRCUITS

Table of linear circuits including LM201, LM301, LM331, etc.

REGULATORS

Table of regulators including LM317T, LM337, etc.

LOW COST PARTS

4PDT RELAY POTTER BRUMFIELD 14 pin relay, 3 amp contacts, 24 volt d.c., 120 volt a.c. coil.

FLASHER LED Litronix FRL-4403 diffused red led with built in flashing unit.

1/2 RPM MOTOR NEW SYNCHRON TIMING MOTOR 110 VAC 60 CY \$2.00 ea.

COMPUTER GRADE CAPACITORS NEW 1,700Mfd 150 VDC \$2.00, 6,400Mfd 60 VDC \$2.50, etc.

TRANSFORMERS 120 volt primaries 3 VOLTS at 200 mA \$1.25, 6 VOLTS at 500 mA \$1.25, etc.

FLAT LEVER HANDLE MINI TOGGLE SPDT SATED 6 AMPS @ 125 V, 1/4" 40 BUSHING \$1.00 each.

7-17vdc S.S. BUZZER STAR CQMB-12 Fits dip socket, CMOS compatible, Max. current 14mA.

EDGE CONNECTOR TIN SOLDERAL 156" x 200" LARGE QUANTITIES AVAILABLE \$1.35 each, 10 for \$12.50.

1N5762 DIAC SWITCH VOLT .36v min. 34 V max 38 V 4 for \$1.00.

dual gate N-FET 3SK 45 VHF, RF, AMP, MIX CMOS N-CHANNEL 2 for \$1.50.

SEND FOR FREE CATALOG!

LM 1889 TV VIDEO MODULATOR \$2.50 40 MFD 350 VOLTS 2 1/8 INCH x 3/4 INCH 2 for \$1.50.

SUB MINI L.E.D. .075" x .098" 20 mA at 1.75v 10 for \$1.00, 200 for \$18.00, etc.

ELECTRET MIKE ELEMENT SENS: -44 OHM 2 3/8 PEG REEP: 50 HZ - 20 KHZ OUT IMP: 2.2 K OHM (MAX) SUPER SMALL SIZE RISE: 2 MM x 3 MM LONG MAX OP VOL: 15 VDC OPTIMUM VOLT: 2 VDC \$5.00 EACH.

BI-POLAR L.E.D. THREE COLOR IN ONE LED. RED ON DC, GREEN ON REVERSE DC, YELLOW ON AC. 2 FOR \$1.70. L.E.D.'s RED JUMBO DIFFUSED 10 for \$1.50, GREEN JUMBO DIFFUSED 10 for \$2.00, YELLOW JUMBO DIFFUSED 10 for \$2.00.

ELECTROLYTICS AXIAL CAPACITORS 600 MFD, 100 VDC \$1.00 ea. 2.116" long 2.1 diameter \$8.00 MFD 15VDC 3.78" long 1.116" diameter \$1.00 ea 10/\$9.00.

2 TERM. L-PAD USED ON 100 WATT SPEAKER SYSTEMS AS A TWEETER FADER CONTROL \$1.50 10 for \$6.00.

SPRING LOADED TERM. ONE RED ONE BLACK QUICK CONNECT TERM. IDEAL FOR SPEAKER SYSTEMS. BLACK PHENOLIC BASE. 2 for \$1.00, 10 for \$4.00.

DPDT 12VDC ENCLOSED RELAY 10 AMP RH SERIES CONTACTS available with NO flange, can be rock-led. \$3.00 EACH 10 for \$27.50 SOCKETS \$1.00.

S.P.D.T. CENTER OFF MINI TOGGLE STANDARD MINI TOGGLE WITH RATED TERMINAL BOLDER TERMINAL 5 AMP 115VAC \$1.15 EACH 10 FOR \$10.00.

50K SLIDE POT 75e each audio taper 3 1/2 inch long x 2 3/4 inch slide.

ALL ELECTRONICS CORP. 905 S. Vermont Ave. Los Angeles, CA 90006 (213) 980-8000. TERMS: Quantities Limited, Min Order \$10.00, Add \$2.00 Shipping USA, Call Res Add \$6.00, Prompt Shipping.

SOLID STATE SALES TEL. (617) 547 7053 WE SHIP OVER 95% OF OUR ORDERS WITHIN 24 HOURS OF RECEIPT TOLL FREE 1-800-343-5230. POSTAGE: ADD 10% FOR ORDERS UNDER \$20.00, ADD 5% FOR ORDERS BETWEEN \$20.00 AND \$50.00, ADD 3% FOR ORDERS ABOVE \$50.00.

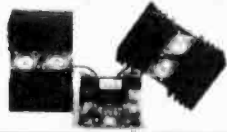
CIRCLE 37 ON FREE INFORMATION CARD

100W CLASS A POWER AMP KIT

Dynamic Bias Class "A" circuit design makes this unit unique in its class. Crystal clear, 100 watts power output will satisfy the most picky fans. A perfect combination with the TA-1020 low T.I.M. stereo pre-amp.

Specifications:

- Output power: 100W RMS into 8-ohm 125W RMS into 4-ohm
- Frequency response: 10Hz - 100 KHz
- T.H.D.: less than 0.008%
- S/N ratio: better than 80dB
- Input sensitivity: 1V max.
- Power supply: $\pm 40V @ 5 amp$



TA-1000 KIT
\$51.95
Power transformer
\$18.00 each

REGULATED VARIABLE D.C. POWER SUPPLY KIT

Uses UA723 I.C. and 2N3055 power transistor as regulator. Output voltages can be adjusted from 0-30V at an internal resistance of less than 0.005 ohm; ripple and noise less than 1 mV; with built on board LED and audible overload indicator. Kit comes with P.C. board; all electronic components, transformer, connectors; 2 panel meters for voltage and amp; a professional look metal cabinet and instructions.

Model TR-88A 0-15V D.C. 3 amp
Model TR-88B 0-30V D.C. 2 amp



\$59.50 per kit

NEW

WHISTLE ACTIVATED SWITCH BOARD

All boards are pre-assembled and tested. Your whistle to its FET condenser microphone from a distance, as far as 30 feet away (sensitivity can be easily adjusted) will turn the switch on, then latched you whistle to it again then it turns off. Ideal for remote control toys, electrical appliance such as lights, coffee pots, TV, Hi-Fi, radio or other projects. Unit works on 9V D.C.



Model 968
\$4.50 each

SUB MINI SIZE FET CONDENSER MICROPHONE

Specification:

Sensitivity: $-65dB \pm 3dB$
FEO. Response: 50 Hz - 8 KHz
Output Impedance: 1K ohm max.
Polar Pattern: Omni-directional
Power Supply: 1.5V - 10V D.C.
Sound Pressure Level: Max. 120dB
EM4RP \$2.50 ea. or 2 for \$4.50



NEW MARK III

9 Steps 4 Colors LED VU

Stereo level indicator kit with arc-shape display panel!!! This Mark III LED level indicator is a new design PC board with an arc-shape 4 colors LED display (change color from red, yellow, green and the peak output indicated by rose). The power range is very large, from $-30dB$ to $+5dB$. The Mark III indicator is applicable to 1 watt - 200 watts amplifier operating voltage is 3V - 9V DC at max 400 MA. The circuit uses 10 LEDs per channel. It is very easy to connect to the amplifier. Just hook up with the speaker output!

IN KIT FORM \$18.50

2 WATT AUDIO AMP

Pre assembled units. All you need is to hook up the speaker and the volume control. Supply voltage from 9-15V D.C. measures only 2" x 3 1/2", making it good for portable or discrete applications. Comes with hook up data.



BUY 2 FOR
\$4.99

MARK IV 15 STEPS LED POWER LEVEL INDICATOR KIT

This new stereo level Indicator kit consists of 36 4-color LED (15 per channel) to indicate the sound level output of your amplifier from $-36dB$ to $+3dB$. Comes with a well-designed silk screen printed plastic panel and has a selector switch to allow floating or gradual output indicating. Power supply is 6-12V D.C. with THG on board input sensitivity controls. This unit can work with any amplifier from 1W to 200W!

Kit includes 70 pcs. driver transistors, 38 pcs. matched 4-color LED, all other electronic components, PC board and front panel.

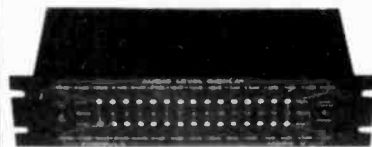


MARK IV KIT \$31.50

NEW

MARK V 15 STEPS LED POWER OUTPUT INDICATOR KIT

All functions same as Mark IV but this is with heavy duty aluminum front plate and case. Can be easily slot into the front panel of your auto, truck or boat. Operates on 12V D.C.



\$41.50 EACH KIT

BATTERY POWERED FLUORESCENT LANTERN

MODEL 888 R

FEATURES

- Circuitry: designed for operation by high efficient, high power silicon transistor which enable illumination maintain in a standard level even the battery supply drops to a certain low voltage.
- 9" 6W cool/daylight miniature fluorescent tube.
- 8 x 1.5V UM-1 (size D) dry cell battery.
- Easy sliding door for changing batteries.
- Stainless reflector with wide angle increasing lamination of the lantern.



\$10.50 EA

30W + 30W STEREO HYBRID AMPLIFIER KIT

It works in 12V DC as well! Kit includes 1 PC SANYO STK-043 stereo power amp. IC LM 1458 as pre amp, all other electronic parts, PC Board, all control pots and special heat sink for hybrid. Power transformer not included. It produces ultra hi-fi output up to 60 watts (30 watts per channel) yet gives out less than 0.1% total harmonic distortion between 100Hz and 10KHz.



\$32.50 PER KIT

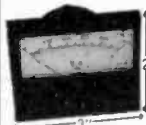
5W AUDIO AMP KIT

2 LM 380 with Volume Control
Power Supply 6 18V DC
ONLY \$6.00 EACH



TWO IN ONE PANEL METER D.C. VOLTAGE AND AMP IN ONE

D.C. Volts reads 0-50
D.C. Amp reads 0-3
Meter case made of black plastic with a white scale plate and glass window.



#ST-680 \$12.50 EACH

SPECIAL 0.5" LED ALARM CLOCK MODULE

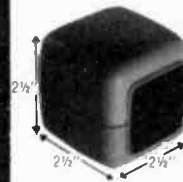
ASSEMBLED! NOT A KIT!

Features: • 4 digits 0.5" LED Displays • 12 hours real time format • 24 hours alarm audio output • 59 min. countdown timer • 10 min. snooze control.



ONLY \$7.00 EACH
SPECIAL TRANSFORMER FOR CLOCK
\$2.50

CUBO CLOCK CASES



All brand new top quality plastic cases, originally designed for Cubo clocks. Case comes with top and bottom cover with a detachable front red filter for LED readouts. This can be used for many projects such as LED CLOCK, VU METER, LIGHT BOX, FREQ. COUNTER, ETC.
3 Attractive Colors
(white, lime green or orange)

BUY 3 FOR ONLY \$2.50

TV GAME BOARD

PLAYS 4 GAMES: TENNIS; HOCKEY; HANDBALL AND JAI-ALAI.

All boards complete with all parts ready to play. Requires 6C size batteries and a small speaker for sound effects. The boards were surplus from a famous game manufacturer. They will play on all US standard black and white or color TV sets.

Regular price for these games were \$39.50 each
OUR PRICE ONLY \$6.50 EACH

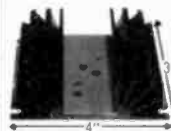


PART #57456



TENNIS JAI-ALAI
HOCKEY HANDBALL

MULTI-FINS HEAT SINK



Ideal for high power output. Holes predrilled for 1 to 3 transistor. Made of aluminum with ten radiating fins.

2 FOR \$4.50

PROFESSIONAL FM WIRELESS MICROPHONE

TECT model WEM-16 is a factory assembled FM wireless microphone powered by an AA size battery. Transmits in the range of 88-108MHz with 3 transistor circuits and an omni-directional electric condenser. Element built-in plastic tube type case; mike is 6 1/4" long. With a standard FM radio, can be heard anywhere on a one-acre lot; sound quality was judged very good.

\$16.50



FOR DECODER BUILDERS

Pre-Drilled PC Board	\$17.50
Torroid Coils (Set of 4)	\$ 3.00
Multi Turn Trim-Pots 10K ohm	\$ 2.50
Trimmer Capacitor 6-35pF	\$ 0.60
MC1358	\$ 2.50
MC1350	\$ 2.00
MC1330	\$ 3.50
RC1458	\$ 1.00
LM380	\$ 1.80
LM340T-15	\$ 1.20
NE565	\$ 2.00

We also have transformer, capacitors set, resistors set antenna transformer. Please call for price.

LCD CLOCK MODULE!

• 0.5" LCD 4 digits display • X'tal controlled circuits • D.C. powered (1.5V battery) • 12 hr. or 24 hr. display • 24 hr. alarm set • 60 min. countdown timer • On board dual back-up lights • Dual time zone display • Stop watch function.

NIC1200 (12 hr) ON SALE
NIC2400 (24 hr) \$16.99 EACH



SANYO UHF VARIATOR TUNER

For UHF CH 14-83

Tuning voltage + 1V to + 28V D.C. Input impedance 75 OHM. I.F. band width 7-16 MHz. Noise figure 11.5 dB MAX. Size 2 3/4" x 1 1/4" x 3/4". Supply voltage 15V D.C. Sound I.F. = 58.0 MHz. Video I.F. = 62.5 MHz



All units are brand new from Sanyo.
MODEL 115-B-405A
\$35.00 EACH

FLUORESCENT LIGHT DRIVER KIT



With Case Only
\$6.50 Per Kit

12V DC POWERED
Lights up 8 ~ 15 Watt Fluorescent Light Tubes. Ideal for camper, outdoor, auto or boat. Kit includes high voltage coil, power transistor, heat sink, all other electronic parts and PC Board. Light tube not included!

SUPER FM WIRELESS MIC KIT — MARK III



FMC-105
\$11.50 PER KIT

This new designed circuit uses high FET transistors with 2 stages pre amp. Transmits FM Range (88-120 MHz) up to 2 blocks away and with the ultra sensitive condenser microphone that comes with the kit, allows you to pick up any sound within 15 ft. away! Kit includes all electronic parts, OSC coils, and P.C. Board. Power supply 9V D.C.

PRESS-A-LIGHT SELF GENERATED FLASHLIGHT

EXCLUSIVE!! \$3.95 ea
Model F-179



Never worry about battery, because it has none! Easy to carry in pocket and handy to use. Ideal for emergency light. It generates its own electricity by squeezing grip lever. Put one in your car, boat, camper or home. You may need it some time!

ELECTRONIC DUAL SPEAKER PROTECTOR



Cut off when circuit is shorted or over load to protect your amplifier as well as your speakers. A must for OCL circuits.

KIT FORM
\$8.75 EA.

"FISHER" 30 WATT STEREO AMP



Super Buy
Only \$18.50

MAIN AMP (15W x 2)
Kit includes 2 pcs. Fisher PA 301 Hybrid IC all electronic parts with PC Board. Power supply ± 16V DC (not included). Power band with (KF 1% ± 3dB). Voltage gain 33dB. 20Hz - 20KHz.

SPACE WAR SOUND GENERATOR BOARD



Brand new preassembled module for a toy factory. The board gives out 6 different selectable space sound with LED light effect. Sounds include UFO take-off, space gun blast, wave, and space chime. 7 LED on the board will work with the sound. Requires 9V battery to operate. Speaker not included.
SPECIAL \$3.99 EACH SPEAKER \$1.25 EACH

ELECTRONIC PIEZO BEEP BUZZER



Unique surplus 7/8" Dia. piezo ceramic disc on circuit board gives a distinct high freq. buzz. Unit contains an I.C., 2 caps, 6 resistors and is already preassembled. Requires 9V battery to operate.
SPECIAL 2 FOR \$2.99

2 BIT COUNTER, WARBLE PULSE ALARM BOARD



This new assembly easily converts to a counter, stop watch, warble and pulse alarm generator by adding a few components. We supply the data and typical applications. Requires 9V battery to operate.
SPECIAL 2 FOR \$1.99

AUDIO OUTPUT dB METER



Meter made of clear plastic with a silver white face plate. Scale reads from -20 +3dB. Meter also comes with an internal dial light.
MODEL: 6F-3
\$6.50 EACH

BATTERIES

PK/\$10.00
2 PK/\$19.00



NICKEL CADMIUM BATTERY PACK 'D' SIZE

ILLUSTRATED LESS COVER

Output: 3.6 Volts @ 3.0 Amp/Hour. Consists of three each, 1.2 Volt "D" size Nickel Cadmium Cells stacked and plastic film encapsulated. Tabs are provided at each end for electrical connections. The individual cells can be cut apart if desired. Rated recharge rate is 30 mA, 14-18 hours. Size: 1 1/4" dia. x 7" long. New. Shpg. Wt. each pack, 1 lb.



9V RECHARGEABLE NI-CD BATTERY

Replace all 006P type 9V battery
Model: GC9
BRAND NEW \$4.50 EACH

NI-CD BATTERY SALE



12V Pack 450 MZ/HR Size 3" x 1" x 2" \$8.00 PER PACK
4 AA Pack 450 MA/HR \$3.50 PER PACK

All above batteries are used but late date code and we guarantee to take back all bad ones for exchange.

GELCELL 6V 9AMP/HR SEALED LEAD ACID RECHARGEABLE BATTERY



Sealed construction permits this battery to be operated in any position. Recharge rate 2.15 amp max. for 14-16 hours. All brand new. Limited quantities. Size of battery 4 1/4" x 2 3/4" x 5 1/2".
\$16.50 each

ELECTRONIC PIN BALL MACHINE



That sounds and plays like the real thing. All units are brand new but without the case. Functions of the game include double flipper control, kicker control, 1-4 players, 3 speed ball control, tilt switch, automatic score, extra bonus cave and many more. All solid state with LED panel, no moving parts. Requires 9V battery to operate, speaker not included.

A perfect gift for yourself or friends.
SPECIAL \$8.99 EACH
SPEAKER \$1.25 EACH

ULTRASONIC SWITCH KIT



Kit includes the Ultra Sonic Transducers, 2 PC Boards for transmitter and receiver. All electronic parts and instructions. Easy to build and a lot of uses such as remote control for TV, garage door, alarm system or counter. Unit operates by 9-12 DC. \$15.50

COMPLETE TIME MODULE



0.3" digits LCD Clock Module with month and date, hour, minute and seconds. As well as stop watch function! Battery and back up light is with the module. Size of the module is 1" dia. Ideal for use in auto panel, computer, instrument and many others!
\$8.95 EACH

SOUND ACTIVATED SWITCH



All parts completed on a PC Board SCR will turn on relay, buzzer or trigger other circuit for 2 - 10 sec. (adjustable). Ideal for use as door alarm, sound controlled toys and many other projects. Supply voltage 4.5V 9V D.C. 2 for \$3.00

REGULATED DUAL VOLTAGE SUPPLY KIT

±4 30V DC 800 MA adjustable, fully regulated by Fairchild 78MG and 79MG voltage regulator I.C. Kit includes all electronic parts, filter capacitors, I.C., heat sinks and P.C. board.
\$12.50 PER KIT

AA SIZE NI-CD SPECIAL SALE 4 FOR \$6.00

RECHARGEABLE BATTERIES LIMITED QUANTITY AVAILABLE

SUB MINIATURE TOGGLE SWITCH 6 AMP 125V A.C.

SPDT	\$1.20
SPDT MOMENTARY	\$1.40
DPDT	\$1.80
DPDT MOMENTARY	\$1.80
DPDT (CENTER OFF)	\$2.20
3PDT	\$2.20
3PDT (CENTER OFF)	\$2.50
4PDT	\$2.80
4PDT (CENTER OFF)	\$3.80

POWER SUPPLY KIT

0-30V D.C. REGULATED
Uses UA723 and ZN3055 Power TR output can be adjusted from 0-30V, 2 AMP. Complete with PC board and all electronic parts. Transformer for Power Supply 2 AMP 24V x 2 \$8.50



0-30 Power Supply \$10.50 each

FLASHER LED

Unique design combines a jumbo red LED with an IC flasher chip in one package. Operates directly from 5V-7V DC. No dropping resistor needed. Pulse rate 3Hz @ 5V 20mA.



2 for \$2.20

BIPOLAR LED RED/GREEN

2 colors in one LED, green and red, changes color when reverse voltage supply. Amazing!
2 FOR \$2.20

ELECTRONIC SWITCH KIT

CONDENSER TYPE
Touch On Touch Off
uses 7473 I.C. and 12V relay
\$5.50 each



1 WATT AUDIO AMP

All parts are pre-assembled on a mini PC Board. Supply Voltage 6 9V D.C. SPECIAL PRICE \$1.95 ea.



LOW TIM DC STEREO PRE-AMP KIT TA-10 20

Incorporates brand-new D.C. design that gives a frequency response from 0Hz - 100KHz ± 0.5dB! Added features like tone defeat and loudness control let you tailor your own frequency supplies to eliminate power fluctuation!
Specifications: • T.H.D. less than .005% • T.I.M. less than .005% • Frequency response: DC to 100KHz ± 0.5dB • RIAA deviation: ± 0.2dB • S/N ratio: better than 70dB • Sensitivity: Phono 2MV 47K/Aux. 100MV 100K • Output level: 1.3V • Max. output: 15V • Tone control: bass ± 10dB @ 50Hz/treble ± 10dB @ 15Hz • Power supply: ± 24 D.C. @ 0.5A
Kit comes with regulated power supply, all you need is a 48V C.T. transformer @ 0.5A.
ONLY \$44.50
X'former \$4.50 ea.



SOLID STATE ELECTRONIC BUZZER

Mini size 1" x 3/4" x 3/4"
Supply voltage 1.5V - 12V
Ideal for Alarm or Tone Indicator



FORMULA INTERNATIONAL INC.

5/81

SHIPPING AND HANDLING CHARGES	
Under \$50.00 purchase	1.00
Over \$50.00 purchase	2.00

Outside California
Outside Calif. (Includes Mexico & Canada)
Express
Minimum Order \$18.00/C. Calif. Residents Add 6% Sales Tax.
Phone Orders Accepted on Visa or MC ONLY, NO C.O.D./Store Hours 10-7 Mon. thru Sat.

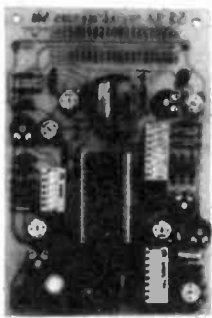
Send \$1.00 For Detailed Catalogue

12603 CRENSHAW BLVD. MAWTHORNE, CA 90250
PHONE: (213) 973-1921 • (213) 678-5182

BULLET ELECTRONICS

P.O. BOX 401244R
GARLAND, TX. 75040
214 • 278-3553

Sound Effects Kit \$18.50



The SE-01 is a complete kit that contains all the parts to build a programmable sound effects generator. Designed around the new Texas Instruments SN78477 Sound Chip, the board provides banks of MINI DIP switches and pots to program the various combinations of the SLF Oscillator, VCO, Noise, One Shot, and Envelope Controls. A Quad Op Amp IC is used to implement an Adjustable Pulse Generator, Level Comparator, and Multiplex Oscillator for even more versatility. The 3" x 5" PC Board features a prototype area to allow for user added circuitry. Easily programmed to duplicate Explosions, Phaser Guns, Steam Trains, or almost an infinite number of other sounds. The unit has a multiple of applications. The low price includes all parts.

assembly manual, programming charts, and detailed 76477 chip specifications. It runs on a 9V battery (not included). On board 100mW amp will drive a small speaker directly, or the unit can be connected to your stereo with incredible results! (Speaker not included). 76477 is included. Available separately for \$3.15 each.

New! Doomsday Alarm

If you have trouble sleeping and you would like the rest of the neighborhood to share your misery then this little kit will be for you! There is no way to accurately describe the unearthly howls, screams and tones that come out of this kit. Four separate tone oscillators are mixed, cancelled and stepped at a varying rate. 10 Watts of crazy sounds. A great fun kit or a practical burglar alarm. Complete with PC board and all necessary components less speaker. For 6-12 VDC.

9.95 ORDER DA-01
KIT

7 Watt Audio Amp Kit \$5.95

SMALL, SINGLE HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS COMPATIBLE WITH SE-01 SOUND KIT

Overvoltage Protection Kit \$6.95

Protect your expensive equipment from overvoltage conditions. Every computer should have one! Works with any fused DC power source from 10 to 20 volts up to 25 amps.

Super Value Power Transformer

Well made, open frame transformer with mounting ears. Build a +5 and ±12 supply with inexpensive parts. Free schematics of several designs. Primary 117VAC. SEC #1 15VAC @ .5A SEC #2 15 VAC @ .5A SEC #3 8VAC @ 2.5A.

ORDER: **BET-0006**
\$2.95 Each
SPECIAL BONUS: Order 2 Get free 723 voltage regulator IC!

- NO C.O.D.'s
- SEND CHECK M.O. OR CHARGE CARD NO.
- PHONE ORDERS ACCEPTED ON VISA AND MASTERCARD ONLY.
- ADD 5% FOR SHIPPING
- TX, RI, IL, ADD 5% STATE SALES TAX
- ALL FOREIGN ORDERS ADD 30% FOR SHIPPING CHARGES.
- U. S. FUNDS ONLY.
- (214) 278-3553

The Greatest Breakthrough In Electronic Music Ever!

The Super Music Maker
REVISION 2
\$24.95
(Basic Kit)



Does not include speaker switches or 2708 PROM.

Now you can play hundreds of songs using the Bullet Super Music Maker. The unit features a single factory programmed microprocessor IC that comes with 20 pre-programmed short tunes. By adding the additional PROMS (2708's) the system can be expanded to play up to 1000 notes per PROM. Just think... a compact electronic instrument that will play dozens, hundreds or even thousands of selections of music. The kit comes with all electronic components (less the PROM), and a drilled, plated and screened PC Board which measures 4" x 4". The 7 watt amplifier section is on the same PC board and drives an 8 ohm speaker (not included), from a whisper to ear splitting volume. Since the unit works on 12 VDC or 12 VAC, vehicle or portable operation is possible. What do you get for \$24.95? Everything but a speaker, transformer, case, switches, and PROM. Additional 2708 albums containing popular tunes are available for \$15.00 each or you can program your own PROMS using information provided with the kit instructions. Lists of available PROM albums are available on request. (Note: Unit plays electronic music one note at a time, it is not possible to play chords or a melody with harmony simultaneously.)

- Envelope control gives decay to notes.
- "Next tune" feature allows sequential playing of all songs
- On board inverter allows single voltage (+12) operation.

OPTIONAL ACCESSORIES

DIP Switches	One 8 pos., One 5 pos. (Can be directly soldered to PC Bd. to access tunes)	2.00/Set
Rotary Switches	Two 5 position (For remote wiring to PC Bd. to access tunes)	2.50/Set
Attractive Plastic Case		6.50
Waipug Transformer	(For operation on 117VAC house voltage)	3.00

AY3-8910 PROGRAMMABLE SOUND GENERATOR

The AY3-8910 is a 40 pin LSI chip with three oscillators, three amplitude controls, programmable noise generator, three mixers, an envelope generator, and three D/A converters that are controlled by 8 BIT WORDS. No external pots or caps required. This chip hooked to an 8 bit microprocessor chip or Bus (8080, Z80, 6800 etc.) can be software controlled to produce almost any sound. It will play three note chords, make bams, whistles, sirens, gunshots, explosions, bleats, whines, or grunts. In addition, it has provisions to control its own memory chips with two IO ports. The chip requires +5V @ 75ma and a standard TTL clock oscillator. A truly incredible circuit.

\$12.95 w/Basic Spec Sheet (4 pages)

60 page manual with S-100 Interface Instructions and several programming examples, \$3.00 extra

MANY OTHER COMPONENTS AND KITS AVAILABLE IN OUR COMPLETE CATALOG. CALL OR WRITE FOR FREE CATALOG.

apple II plus

With 48K of memory!

\$1199.

With the purchase of the APPLE II select from the below! SPECIAL PRICING!

- Basic printer... \$599
- Disk II w/cont... 585
- Orsk II... 475
- Set Printer Cd... 175
- SupRMud... 23
- Way IO Select... 33
- Video IO 12"... 119
- Firmware Card... 19
- UH to RCA Cable... 5

apple II / apple II plus

With 64K of memory!

\$1415.

APPLE INTERFACE CARDS

- CONTROLLER PORTS 1.00
- COMMUNICATIONS 2.00
- DUP II CONTROLLER 1.00
- SYSTEM BASIC PROGRAMS 1.00
- SOFTWARE PROGRAMS 1.00
- PARALLEL PRINTER 1.00
- PROTECTOR 1.00

COLOR



\$397.00 MONITOR 13"

VISICALC

FOR: APPLE & ATARI

\$130.00

5 or more \$120.00

74LS00	.26	74LS155	1.15
74LS02	.26	74LS158	.75
74LS03	.26	74LS160	.95
74LS04	.26	74LS161	.85
74LS08	.28	74LS162	.95
74LS09	.28	74LS163	1.60
74LS10	.28	74LS164	.85
74LS20	.26	74LS165	.85
74LS21	.28	74LS170	1.75
74LS22	.26	74LS174	.75
74LS26	.49	74LS175	.75
74LS27	.26	74LS190	.75
74LS30	.28	74LS193	.95
74LS32	.32	74LS195	.95
74LS38	.32	74LS196	.85
74LS42	.65	74LS221	1.40
74LS48	.78	74LS240	1.65
74LS51	.25	74LS241	1.65
74LS54	.35	74LS243	1.45
74LS74	.38	74LS244	1.45
74LS75	.80	74LS245	2.25
74LS83	.44	74LS253	.95
74LS85	.95	74LS257	.95
74LS88	.95	74LS258	.95
74LS90	.69	74LS259	2.85
74LS93	.69	74LS279	.44
74LS107	.45	74LS283	1.00
74LS112	.38	74LS293	1.85
74LS113	.48	74LS298	1.20
74LS122	.48	74LS366	.95
74LS123	.95	74LS367	.55
74LS126	.69	74LS368	.55
74LS138	.69	74LS373	1.39
74LS151	.44	74LS374	1.39
74LS153	.44	74LS386	.65

APPLE EXPANSION KIT

16K Memory Add-On
SEE BODY ADD-ON KIT INCLUDES INSTRUCTIONS

\$39.00



video 100
\$129
12" Leader Corp

apple clock/calendar

\$124.95
Second time zone, hours, day-of-week, month, day, year
On board battery with one year life.
Uses CMOS 555 crystal controlled.
California Computer Systems



BUY FIVE OR MORE FOR... \$10.95 each

CONCORD COMPUTER PRODUCTS

1971 SOUTH STATE COLLEGE ANAHEIM, CALIF. 92806
VISA MASTERCARD CHECK OR M.O. NO C.O.D. CAL RES ADD 6%
MINIMUM ORDER \$10.00
ADD \$1.50 FOR FRT ON ORDERS UNDER \$50
5% IF OVER \$50
(714)937-0637

SN7400N	20	SN7440N	22	SN74141N	69
SN7402N	22	SN7442N	57	SN74151N	65
SN7404N	22	SN7443N	78	SN74153N	65
SN7408N	24	SN7445N	78	SN74154N	1.25
SN7410N	22	SN7451N	20	SN74155N	80
SN7412N	28	SN7454N	20	SN74157N	69
SN7413N	35	SN7474N	32	SN74160N	95
SN7414N	49	SN7475N	32	SN74161N	.65
SN7416N	29	SN7482N	1.05	SN74163N	.85
SN7417N	29	SN7492N	.50	SN74164N	87
SN7423N	28	SN7493N	.48	SN74165N	87
SN7425N	25	SN7495N	.60	SN74174N	.95
SN7430N	23	SN7496N	.70	SN74175N	69
SN7437N	29	SN74122N	.39	SN74180N	75
SN7439N	24	SN74136N	.95	SN74181N	1.15

MSM5832 MICROPROCESSOR REAL-TIME CLOCK

The MSM5832 is a monolithic, metal gate CMOS integrated circuit that functions as a real-time clock/calendar for use in bus oriented microprocessor applications. The on-chip 32 7488 HZ crystal controlled oscillator time base is counted down to provide addresses 0-11 (0 data of SECONDS, MINUTES, HOURS, DAY OF WEEK, DATE, MONTH AND YEAR. Data as well as is controlled by 4 bit address chip select 0-3 read/write and hold inputs. Other functions include 12M/24M format selection, leap year identification and manual 30 second correction.



\$745
IQ120 \$689

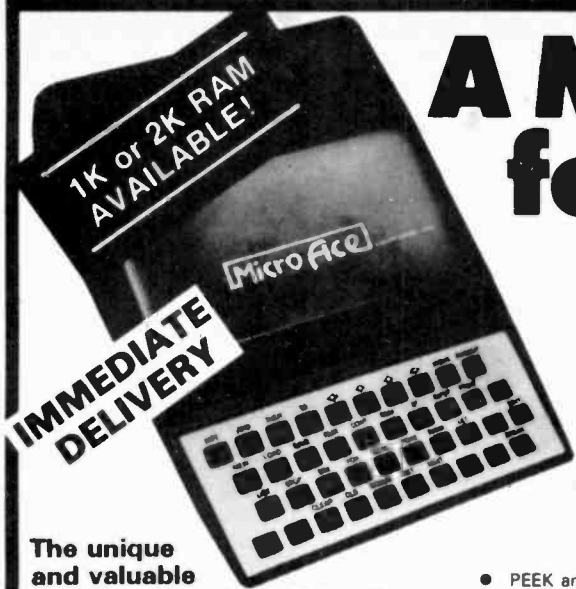
TRS 80

16K Memory Add-On
\$4395
KIT CONTAINS DIP SWITCHES AND DETAILED INSTRUCTIONS



No "Glitches", Surges Or Interference
THE MSM5832 TURNS AN ORDINARY OUTLET INTO A CONTROLLED FILTERED POWER SOURCE FOR UP TO EIGHT DEVICES
\$4395

A Microcomputer for everyone at a Micro Price



The **MicroAce** - a new generation of miniature computers
A COMPLETE COMPUTER for \$149.00 for 1K Kit
 Post and Packing FREE
 (Add 6% Tax for Shipments inside California)



The unique and valuable components of the MicroAce

The MicroAce is not just another personal computer. Quite apart from its exceptionally low price, the MicroAce has two uniquely advanced components: the powerful BASIC interpreter, and the simple teach yourself BASIC manual.

The unique versatile BASIC Interpreter offers remarkable programming advantages:

- Unique 'one-touch' key word entry: the MicroAce eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.
- Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately. This prevents entry of long and complicated programs with faults only discovered when you try to run them.
- Excellent string-handling capability — takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison). The MicroAce also has string input — to request a line of text when necessary. Strings do not need to be dimensioned.
- Up to 26 single dimension arrays.
- FOR/NEXT loops nested up to 26.
- Variable names of any length.
- BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- Exceptionally powerful edit facilities, allows modification of existing program lines.
- Randomise function, useful for games and secret codes, as well as more serious applications
- Timer under program control.

- PEEK and POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine.
- High-resolution graphics with 22 standard graphic symbols.
- All characters printable in reverse under program control.
- Lines of unlimited length.

'Excellent value' indeed!

For just \$149.00 (including handling charge) you get everything you need to build a personal computer at home... PCB, with IC sockets for all ICs; case; leads for direct connection to a cassette recorder and television (black and white or color); everything!

Yet the MicroAce really is a complete, powerful, full-facility computer, matching or surpassing other personal computers at several times the price.

The MicroAce is programmed in BASIC, and you can use it to do quite literally anything, from playing chess to managing a business.

The MicroAce is pleasantly straightforward to assemble, using a fine-tipped soldering iron. It immediately proves what a good job you've done: connect it to your TV ... link it to the mains adaptor ... and you're ready to go.

Fewer chips, compact design, volume production-more power per Dollar!

The MicroAce owes its remarkable low price to its remarkable design: the whole system is packed on to fewer, newer, more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system, and monitor. And the MicroAce 1K byte

RAM (expandable to 2K on board) is roughly equivalent to 4K bytes in a conventional computer — typically storing 100 lines of BASIC. (Key words occupy only a single byte.)

The display shows 32 characters by 24 lines. And Benchmark tests show that the MicroAce is faster than all other personal computers.

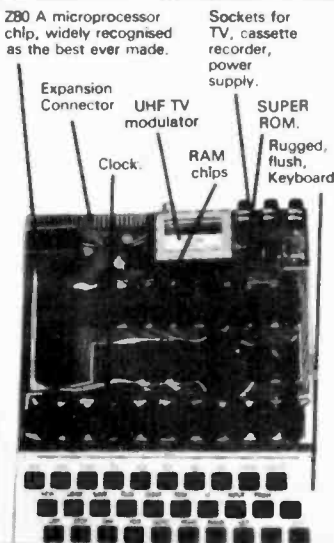
No other personal computer offers this unique combination of high capability and low price.

The MicroAce teach-yourself BASIC manual.

If the features of the BASIC Interpreter mean little to you—don't worry. They're all explained in the specially-written book *free* with every kit! The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming—from first principles to complex programs. (Available separately—purchase price refunded if you buy a MicroAce later.) A hardware manual is also included with every kit.

The MicroAce Kit:
\$149.00 with 1K COMPLETE
\$169.00 with 2K

Demand for the MicroAce is very high: use the coupon to order today for the earliest possible delivery. All orders will be despatched in strict rotation. If you are unsuccessful in constructing your kit, we will repair it for a fee of \$20.00, post and packing FREE. Of course, you may return your MicroAce as received within 14 days for a full refund. We want you to be satisfied beyond all doubt — and we have no doubt that you will be.



Z80 A microprocessor chip, widely recognised as the best ever made.

Sockets for TV, cassette recorder, power supply.

Expansion Connector UHF TV modulator SUPER ROM. Clock. RAM chips Rugged, flush, Keyboard

Your MicroAce kit contains...

- Printed circuit board, with IC sockets for all ICs.
- Complete components set, including all ICs—all manufactured by selected world-leading suppliers.
- New rugged keyboard, touch-sensitive, wipe-clean.
- Ready-moulded case.
- Leads and plugs for connection to domestic TV and cassette recorder. (Programs can be SAVED and LOADED on to a portable cassette recorder.)
- Mains adaptor of 600 mA at 9VDC nominal unregulated.
- FREE course in BASIC programming and user manual.

JOIN THE REVOLUTION - DON'T GET LEFT BEHIND - ORDER YOUR MICRO ACE NOW!!

Send Check, Money Order or quote your Credit Card No. to:
MicroAce 1348 East Edinger, Santa Ana, California, Zip Code 92705.
 or phone (714) 547 2526 quoting your Credit Card Number.

Quantity	Description	Unit Price	TOTAL
	MicroAce Kit 1K	\$149.00	
	MicroAce Kit 2K	\$169.00	
	Manual	\$10.00	
	1K Upgrade Kit	\$29.00	
Shipments inside California add 6% TAX		TOTAL	

- Amex.
- Diners
- Check
- Money Order
- Master Charge
- Visa

Card No. _____
 Exp. Date _____

Name _____
 Address _____
 City _____ State _____ Zip _____

TECHNICIANS WHO USED TO BUY THE BIG NAMES NOW BUY THE BIG NAME IN LOW PRICES.

ERS 152	\$1.20
ERS 154	\$1.80
ERS 165	\$3.35
ERS 180	\$4.40
ERS 195A	\$2.00



ERS 236	\$2.30
ERS 238	\$4.35
ERS 291	\$1.30
ERS 703A	\$1.35
ERS 712	\$2.25

Smart technicians who want Exact Replacement Semiconductors with prices that let them in on the profits are turning to ERS. A new and comprehensive series of guaranteed quality semi's directly distributed by MCM. ERS prices are lower because MCM cuts out the expensive middleman, and most parts are sent right to you United Parcel within 24-hours of

your call on the toll-free hotline. And ERS quality is backed by a replacement or money-back guarantee.

Let yourself in on the profits. Order ERS directly from MCM today, or call and ask for our complete ERS replacement parts list.

Distributed directly by MCM. Call Toll-Free Number for Immediate UPS delivery.

1-800-543-4330 National Watts  **1-800-762-4315** Ohio Watts
CIRCLE 56 ON FREE INFORMATION CARD

TRS-80 color computer complete 16K memory conversion kit for 4K system \$59.95, instructions only \$12.00. **CULPEPER COMPUTER**, 502-C South East St, Culpeper, VA 22701

BOOST CB/HAM modulation/range. Free plans/kits catalog. "SKIPPER", Box 130-F5, Paradise, CA 95969

FREE KIT Catalog

FUNCTION GENERATOR KIT \$59.95 contains TEST & EXPERIMENTER'S EQUIP.
Auto-Ranging Cap-meter kit \$79.95
Phone 415-447-3433
Write or Phone for FREE CATALOG. Average 1 minute Saturday call is 21¢.

DAGE SCIENTIFIC INSTRUMENTS
BOX 1054R LIVERMORE CA 94550

DECODE Morse and RTTY signals off the air with new Morse-a-Word or RTTY reader. Morse keyboard also available. Kits or factory wired. Send for details. **MICROCRAFT**, Box 513R, Thiensville, WI 53092 (414) 241-8144.

PCB as low as 15¢ sq-in. Free drilling. **INTERNATIONAL ENTERPRISE**, 6452 Hazel Circle, Simi Valley, CA 93065

2716 EPROM \$11 programmer, hardware software plans. Send \$9. **CARTIER**, 6844 Nashville Road, Lanham, MD 20801

HIGHLY PROFITABLE ONE-MAN ELECTRONIC FACTORY

Investment unnecessary, knowledge not required, sales handled by professionals. Ideal home business. Write today for facts! **Postcard will do. Barta-RE-M, Box 248, Walnut Creek, CA 94597.**

PC boards, G-10 C-clad. Prototypes and production runs. Full services. Quantity discounts upon request. Free details. **NADC ELECTRONICS**, P.O. Box 8836 Detroit, MI 48224

TRS-80 color computer Morse code decoder program cassette \$15.00. **FRANK LYMAN**, 12 Reservoir St., Cambridge, MA 02138

EXPERIMENT with new SN76488 sound chip. Console plans including pinout overlay \$1.00. **HOLMES**, 5451 Meadow Cir., Huntington Beach, CA 92649.

SAVE 90%. Build your own minicomputer. Free details. **DIGATEK**, 2723 W. Butler Dr., Suit E, Phoenix, AZ 85021

G.I. surplus test equipment. Top quality, low prices. Free list. **DISCOUNT PHOTO**, 435 Bath Street, Santa Barbara, CA 93101

SOLID state sump pump control, ends switch failure. Plans, \$5.00. P.O. Box 519, Mentor, OH 44060

TELEPHONE bugged? Uncle listening? Don't be Watergated! Latest countermeasures \$1.00. **NEGGEY ENGINEERING**, Pennsboro, WV 26415

BUILD Scopebox—eight trace storage oscilloscope, for fraction of a month's rent, display on any TV. For the information and A.N. send \$5.00 refundable toward purchase of parts. **CONCORD INSTRUMENTS**, P.O.B. 1044, Melville, NY 11747

UNIQUE electronic plans: telephone memory dialer, stores 32 numbers, \$4.00. **Negative ion generator**, easy to build, \$4.00. Buy both for \$8.00 and we'll send a third set free! Plans include detailed instructions and PC patterns. Parts and kits available. For more information, send SASE. **COLLINS ELECTRONICS**, Box 6424 San Bernardino, CA 92412

KILL obnoxious loud TV commercials automatically. Complete plans, \$5.00. **BRIDGES**, 1248 N. Denver, Tulsa, OK 74106

PROJECTION TV. . . . Convert your TV to project 7 foot picture. Results equal to \$2,500 projector. Total cost less than \$20.00. Plans & lens \$16.00. Illustrated information free. **MACROCOMGI** Washington Crossing, PA 18977

PRINTED circuit boards from sketch or artwork. Kit projects. Free details. **DANOCINTHS INC.**, Box 261, Westland, MI 48185

FREE catalog IC's semis, parts. **CORONET ELECTRONICS**, 649A Notre Dame W., Montreal, Que, Canada H3C 1H8 US inquiries

PALOMAR—pride—exclusive repair facility. Factory trained technicians—all work guaranteed. **PALOMAR/PRIDE ELECTRONICS**, 1320 Grand, San Marcos, CA 92069 (714) 744-0720

AMBIENCE synthesizers and decoders, spatial expanders. Use with present stereo or use to convert to quad. Complete plans \$5.00. Kits and wired boards available. **EXODUS**, 51 Plymouth Rd., Malden, MA 02148

TELEVISION alignment—in minutes—while observing revolutionary pattern on screen. Check RF, IF, video, instantly! So simple and inexpensive it's incredible. Complete plans \$6.00. Free details. **EZ-LIGN**, Box 2702R, Clearwater, FL 33517

SURVEILLANCE, inexpensive video camera and junk TV. Schematics, sources, detailed instructions, \$2.00. **VIDEO WATCH**, 4232 Carey, Fort Worth, TX 76119

PRINTED circuit boards. Especially for the beginner. Make them yourself. Proven simplicity. **COVAL**, Dept RE5, 20706 Kirby, Champaign, IL 61820

ATV Research ...specialists in CCTV and computer monitors!

Video monitors - color & B/W • TV Cameras, kits, parts & plans • Video-to-RF modulators
• Free catalog. Phone or write. (402) 987-3771

13-RE Broadway Dakota City, NE. 68731


MICROWAVE HORN ANTENNA KIT

High Gain & Directivity — Easy Assembly
Kit with Assembly Instructions \$39.95*

Down Converter Board with Instructions \$14.95 (with Antenna purchase only)

MICROTENNA ASSOCIATES
2335 South 2000 West, Salt Lake City, Utah 84119

Check or M.O. only — Allow 2-4 Weeks Delivery (Cost includes shipping)
*Utah Residents Please Add 5% Sales Tax



ramsey

the first name in Counters!



9 DIGITS 600 MHz \$129⁹⁵ WIRED

SPECIFICATIONS:

Range: 20 Hz to 600 MHz
 Sensitivity: Less than 10 MV to 150 MHz
 Less than 50 MV to 500 MHz
 Resolution: 0.1 Hz (10 MHz range)
 1.0 Hz (60 MHz range)
 10.0 Hz (600 MHz range)
 Display: 9 digits 0.4" LED
 Time base: Standard-10,000 mHz, 1.0 ppm 20-40°C
 Optional Micro-power oven-0.1 ppm 20-40°C
 Power: 8-15 VAC @ 250 ma

PRICES
 CT-90 wired, 1 year warranty \$129.95
 CT-90 Kit, 90 day parts war-
 ranty 109.95
 AC-1 AC adapter 3.95
 BP-1 Nicad pack + AC
 Adapter/Charger 12.95
 OM-1, Micro-power Oven
 time base 49.95
 External time base input 14.95

The CT-90 is the most versatile, feature packed counter available for less than \$300.00! Advanced design features include: three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally, an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

7 DIGITS 525 MHz \$99⁹⁵ WIRED



SPECIFICATIONS:

Range: 20 Hz to 525 MHz
 Sensitivity: Less than 50 MV to 150 MHz
 Less than 150 MV to 500 MHz
 Resolution: 1.0 Hz (5 MHz range)
 10.0 Hz (50 MHz range)
 100.0 Hz (500 MHz range)
 Display: 7 digits 0.4" LED
 Time base: 1.0 ppm TCXO 20-40°C
 Power: 12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as: three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty \$99.95
 CT-70 Kit, 90 day parts war-
 ranty 84.95
 AC-1 AC adapter 3.95
 BP-1 Nicad pack + AC
 adapter/charger 12.95

7 DIGITS 500 MHz \$79⁹⁵ WIRED



PRICES:

MINI-100 wired, 1 year warranty \$79.95
 MINI-100 Kit, 90 day part warranty 59.95
 AC-Z Ac adapter for MINI-100 3.95
 BP-Z Nicad pack and AC adapter/charger 12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range: 1 MHz to 500 MHz
 Sensitivity: Less than 25 MV
 Resolution: 100 Hz (slow gate)
 1.0 KHz (fast gate)
 Display: 7 digits, 0.4" LED
 Time base: 2.0 ppm 20-40°C
 Power: 5 VDC @ 200 ma

8 DIGITS 600 MHz \$159⁹⁵ WIRED



SPECIFICATIONS:

Range: 20 Hz to 600 MHz
 Sensitivity: Less than 25 mv to 150 MHz
 Less than 150 mv to 600 MHz
 Resolution: 1.0 Hz (60 MHz range)
 10.0 Hz (600 MHz range)
 Display: 8 digits 0.4" LED
 Time base: 2.0 ppm 20-40°C
 Power: 110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty \$159.95
 CT-50 Kit, 90 day parts warranty 119.95
 RA-1, receiver adapter kit 14.95
 RA-1 wired and pre-programmed (send copy of receiver schematic) 29.95

DIGITAL MULTIMETER \$99⁹⁵ WIRED



PRICES:

DM-700 wired, 1 year warranty \$99.95
 DM-700 Kit, 90 day parts warranty 79.95
 AC-1, AC adaptor 3.95
 BP-3, Nicad pack + AC adapter/charger 19.95
 MP-1, Probe kit 2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include: 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3 1/2 digit, 1/2 inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts: 100uV to 1 KV, 5 ranges
 DC/AC current: 0.1 uA to 2.0 Amps, 5 ranges
 Resistance: 0.1 ohms to 20 Megohms, 6 ranges
 Input impedance: 10 Megohms, DC/AC volts
 Accuracy: 10.1% basic DC volts
 Power: 4 °C cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

\$29.95 Kit \$39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug \$ 7.95
 High impedance probe, light loading 15.95
 Low pass probe, for audio measurements 15.95
 Direct probe, general purpose usage 12.95
 Tilt bail, for CT 70, 90, MINI-100 3.95
 Color burst calibration unit, calibrates counter
 against color TV signal. 14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

\$34.95 Kit \$44.95 Wired

ramsey electronics, inc.
 2575 BAIRD RD. • PENFIELD, NY 14526

PHONE ORDERS
 CALL 716-586-3950

TERMS

Satisfaction guaranteed - examine for 10 days. If not pleased, return in original form for refund. Add 5% for shipping - insurance to a maximum of \$10. Overseas add 15%. COD add \$2. Orders under \$10. add \$1.50. NY residents add 7% tax.

CIRCLE 6 ON FREE INFORMATION CARD

INTERNATIONAL ELECTRONICS UNLIMITED

TTL

10% OFF ON \$25.00
15% OFF ON \$50.00

7400	\$.48	7464	.30	74155	.50
7401	.18	7465	.30	74156	.64
7402	.18	7470	.49	74157	.60
7403	.18	7472	.32	74158	.75
7404	.20	7474	.18	74160	.70
7405	.25	7475	.49	74161	.79
7406	.20	7576	.49	74162	.85
7407	.20	7480	.35	74163	.85
7408	.27	7482	.25	74164	.85
7409	.27	7483	.85	74166	.85
7410	.18	7485	.50	74170	1.50
7415	.29	7486	.42	74173	1.25
7416	.20	7489	1.75	74174	1.05
7417	.20	7490	.59	74175	.85
7420	.20	7491	.64	74176	.70
7425	.39	7492	.59	74177	.70
7426	.35	7493	.35	74180	.35
7427	.25	7494	.59	74181	1.85
7430	.25	7495	.35	74182	.35
7432	.20	7496	.35	74189	.50
7437	.20	74105	.48	74190	1.15
7438	.18	74107	.35	74191	1.15
7440	.18	74121	.35	74192	.50
7441	.59	74122	.39	74193	.79
7442	.35	74123	.39	74194	.85
7443	.55	74125	.50	74195	.69
7444	.60	74126	.50	74196	.80
7445	.50	74132	.75	74197	.55
7446	.59	74141	.35	74198	1.40
7448	.59	74145	.50	74199	1.25
7450	.18	74148	1.25	74200	3.75
7451	.22	74150	1.35	74279	.65
7453	.18	74151	.50		
7454	.18	74153	.35		
7460	.18	74154	1.45		

CMOS

10% OFF ON \$25.00
15% OFF ON \$50.00

4000 Series	CMOS				
4000	\$.25	4020	1.14	4050	.45
4001	.39	4021	.95	4051	1.15
4002	.25	4022	.95	4066	.79
4006	.95	4023	.30	4069	.39
4007	.39	4024	.75	4071	.29
4008	.95	4025	.22	4072	.39
4009	.46	4027	.59	4073	.39
4010	.45	4028	.85	4078	.39
4011	.55	4030	.59	4081	.39
4012	.25	4035	.95	4082	.30
4013	.59	4040	1.15	4518	1.25
4014	.95	4041	1.20	4528	1.50
4015	.95	4042	.95	4585	1.50
4016	.64	4043	.85	4901	.59
4017	1.08	4046	1.69		
4018	.95	4049	.45		

VOLTAGE REGULATORS

LM320T-5	Negative 5 V reg	(7905)	1.19
LM320T-12	Negative 12 V reg	(7912)	1.19
LM320T-15	Negative 15 V reg	(7915)	1.19
LM340T-5	Positive 5 V reg	(7805)	1.19
LM340T-8	Positive 8 V reg	(7808)	1.19
LM340T-12	Positive 12 V reg	(7812)	1.19
LM340T-15	Positive 15 V reg	(7815)	1.19

LINEAR CIRCUITS

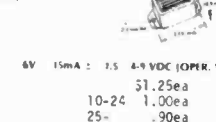
10% OFF ON \$25.00
15% OFF ON \$50.00

LM300H	.30	LM565N	.55
LM301CN	.28	LM565H	1.39
LM302H	.28	LM566H	1.69
LM304H	.30	LM566CN	1.45
LM307CN	.32	LM567CN	1.19
LM307H	.40	LM703H	.59
LM308CN	.45	LM703CN	.39
LM309H	1.05	LM709H	.29
LM309K	1.15	LM710H	.45
LM310CN	.75	LM711H	.55
LM310H	.75	LM723H	.59
LM311CN	.39	LM723H	.49
LM318CN	1.45	LM733H	.45
LM319H	1.20	LM739H	.45
LM320K-5	.95	LM741CN	.29
LM320K-5-2	.95	LM741	.29
LM320K-15	.95	LM741CH	.45
LM322H	.45	LM747H	.79
LM324H	1.19	LM747N	.69
LM339H	.25	LM748CN	.25
LM340K-6	.95	LM1310N	2.50
LM340K-8	.95	LM1414N	.35
LM340K-12	.95	LM1456CN	1.29
LM340K-15	.95	LM1456CN	.55
LM340K-24	.95	LM1496H	.89
LM370N	.95	ULN2208	.79
LM372N	1.25	ULN2209	.79
LM376CN	.30	CA3046N	1.29
LM380N	1.19	CA3081N	1.25
LM380CN	.45	CA3082N	1.25
LM381N	1.75	LM3900N	.45
LM392N	1.75	LM7524H	.45
LM395K	.49	LM7525N	.45
LM396CN	.79	LM7535	.99
LM397CN	.99	80388	3.79
ME546A	1.79	75450N	.35
ME550A	1.25	75451CN	.35
LM555CN	.45	75452CN	.35
LM556N	.79	75453CN	.35
LM680N	2.95	75451N	.75
		75452N	.89

SOCKETS — LOW PROFILE HOLDER TAIL

ea		100	
8 pin	.20	.18 pk-10	.16ea
14 pin	.25	.21 pk-10	.19
16 pin	.26	.22 pk-10	.20
18 pin	.32	.28 pk-8	.26
24 pin	.40	.45 pk-3	.38
28 pin	.65	.60 pk-3	.55
40 pin	.75	.70 pk-2	.63

MINIATURE SOLDER STATE ELECTRONIC BUZZER



DIPSWITCH — 4 sw

8 pin DIP SPST

1-9	\$1.65ea
10-24	1.55ea
25-	1.49ea

DIPSWITCH — 8 sw

16 pin DIP SPST	
1-9	\$2.10ea
10-24	1.95ea
25-	1.85ea

DIPSWITCH — 10 sw

20 pin DIP SPST

1-9	\$2.00ea
10-25	2.05ea
25-	1.95ea

POWER SUPPLY KIT

±5V, ±12V, ±15V regulated power supply using a 115V/250V CT transformer, 3- LM320 and 3- LM320T regulators to supply the above voltages. Heat sink provided for ±5V.

PARTS INCLUDED:
Transformer
3 regulators
8 board
4 diodes
Capacitor 1000 uf
Capacitor 500 uf
3 capacitors 10 uf

ea \$17.50
10- 16.00
25- 15.00
Shipping

REGULATED POWER SUPPLY KIT PS-2

Uses ±5V and ±12V TO-220 regulators. Kit includes PC Board (1 11/16" x 3"), Rectifiers, 7805 & 7812 Regulators, Capacitors & Heat Sinks. Transformer not included. Fits PCB slots of Hammond Case 15910GY.

\$6.00ea
10- 5.50ea
25- 5.00ea

WALL MOUNT TRANSFORMER

117V/12VAC	250ma	60hz	\$3.75
117V/12VAC	1 amp	60hz	4.95

HAMMOND PLASTIC CASES

15918GY	4.40" X 2.44" X 1.22"	grey	\$3.35
15918BU	4.75" X 2.56" X 1.56"	blue	4.10
15919GY	6.00" X 3.15" X 2.00"	grey	4.85

BREADBOARD

10-24	\$1.25 ea
100-	1.05ea
	.95ea

UNIVERSAL BREADBOARD

CLOCK CHIPS

5316	4 digit, 12-24hr, alarm		\$2.95
	50-60hz, 40 pin		
5375AA	4 digit, 12-hr, alarm		\$2.95
	60hz, 24 pin		

CERAMIC CAPACITORS

1pf	22pf	56pf	120pf	270pf	.001uf	.0047uf	.030uf
5pf	27pf	68pf	150pf	390pf	.01uf	.1uf	.050uf
7pf	33pf	82pf	180pf	470pf	.0015uf	.015uf	.1uf
10pf	47pf	100pf	220pf	600pf	.003uf	.022uf	
1pf - .050uf							
Total EA.	PK-10	PK-100	EA.	PK-10	PK-100		
1-1000	\$.20	\$.95	6.50	.25	1.25	9.00	
1000-	.20	.85	6.00	.25	1.10	8.00	

CERAMIC CAPACITOR KIT

CK-C2 5ea. of the above values \$11.50
CK-C3 10ea. of the above values 20.50

POLYESTER FILM CAPACITORS — 100V ± 10%

.001uf	EA.	PK-10	PK-100	EA.	PK-10	PK-100	
.001uf	.15	.95	6.50	.033uf	\$.20	1.00	10.00
.002uf	.15	.95	7.50	.047uf	.20	1.15	10.50
.003uf	.15	.95	7.50	.1uf	.30	1.30	12.00
.0047uf	.15	.95	7.50	.15uf	.35	1.75	13.50
.0068uf	.15	.95	7.50	.22uf	.40	2.55	20.00
.01uf	.15	.95	7.50	.33uf	.45	2.75	25.00
.015uf	.15	.95	7.50	.47uf	.50	3.50	30.00
.022uf	.15	.95	7.50				

POLYESTER CAPACITOR KIT

5 ea of the above values \$14.95

TANTALUM CAPACITORS solid dipped ± 20%

.1uf/35V	.30	.25	4.7uf/16V	.38	.30	22uf/16V	.50	.40
.22uf/35V	.30	.25	4.7uf/25V	.45	.35	22uf/35V	.60	.55
.33uf/35V	.30	.25	6.8uf/6V	.35	.28	33uf/6V	.55	.45
1uf/20V	.30	.25	6.8uf/16V	.45	.39	33uf/10V	.60	.50
1.5uf/20V	.30	.25	10uf/20V	.42	.35	47uf/6V	.60	.50
2.2uf/20V	.35	.25	15uf/6V	.42	.35	47uf/15V	.65	.55
2.2uf/35V	.38	.28	15uf/20V	.50	.40	56uf/6V	.85	.75
3.3uf/35V	.40	.30						

TANTALUM CAPACITOR ASSY.

5 ea. of above — \$37.50

DISCRETE LED'S

JUMBO LED
.20" dia. diffused

Red, Clear or White	10/51.00	25/52.25	100/58.00
Green or Yellow	7/51.00	25/53.25	100/510.45

SUPERMATURE LED
.125" dia, diffused

Red or Clear	10/51.00	25/52.25	100/58.00
Green or Yellow	7/51.00	25/53.25	100/510.45

LED MOUNTING CLIP & RING FOR .20" — JUMBO LED

10/S \$1.25			
25/S \$2.75			
100/S \$7.00			

LED DISPLAYS

.4" ORANGE LED DISPLAY	\$1.19ea
7 segment RHD	10/57.95
MAN461D — common anode	25/57.50
MAN464D — common cathode	100/565.00

.4" ORANGE overflow 1

MAN4630 — common anode	\$4.00ea
	10/53.50

.3" RED LED DISPLAY

7 segment RHD	\$9.9ea
XAN72 (MAN72 equiv) common anode	10/57.95
	25/517.50
	100/565.90

.6" RED LED DISPLAY

7 segment RHD	\$1.25ea
XAN6940 — common cathode	10/51.50
	25/526.50
	100/598.00

TRANSISTORS

ea	pk/10	pk/25	pk/100	pk/1000	
MPSA06	\$.25	\$1.65	\$3.25	\$12.00	\$100.00
2N2222A	.45	3.50	8.00	29.00	265.00
2N3055	.55	5.00	11.75	45.00	420.00
2N3904	.25	1.65	3.25	12.00	100.00
2N3906	.25	1.65	3.25	12.00	100.00

DIODES

1N4148 (1N914)	400ma	15/51.00	100/55.00	1000/540.00
1N4001 50VPIV		12/51.00	100/57.00	1000/560.00
1N4007 1000VPIV		10/51.25	100/511.00	1000/510.00

CARBON FILM RESISTORS.

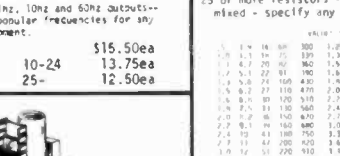
1/4 watt (R, Ohm R25)

.095" dia X .250" long (body)	1/4 & 1/2 watt
1/2 watt (R, Ohm R25)	
.146" dia X .354" long (body)	

total quantity ea pk-10 pk-25 pk-100 pk-1000

1-999	5.10	4.5	2.00	
1000-	.10	.40	1.80	15.00
5000-	.10	.30	1.70	14.50
10000-	.10	.25	1.55	13.00

CRYSTAL CONTROLLED TIME BASE KIT



PARTS INCLUDED:
LM3389 divider
4049 buffer
2-4018 counter
1-12pf var. cap
470f cap
1uf cap
2-120ohm res
1 10mm res
3.57954 khz crystal
PC board (1 5/8" x 3")

Produces accurate 1hz, 10hz and 50hz outputs—three of the most popular frequencies for any piece of test equipment.

10-24 \$15.50ea
25- 13.75ea
25- 12.50ea

REGULATED POWER SUPPLY KIT PS-3

Uses ±5V and ±12V TO-220 Regulators. Kit includes PC Board (1 1 1/4" x 2 3/8"), Rectifier Bridge, 7805 & 7812 Regulators, Capacitors and Heat Sinks. Transformer not included. Fits PCB slots of Hammond Case 15918BU.

\$7.50ea
10- 7.00ea
25- 6.50ea

METAL FILM RESISTORS,

METAL FILM 1/4 watt

RM60 (R, Ohm CR860FV) 1/4 watt	1/4 watt
Low temp coef — 50ppm/°C	
.094" dia X .355" long (body)	
color banded	

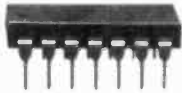
total quantity ea pk-10 pk-25 pk-100 pk-250

Radio Shack is America's Parts Place™

No Minimum Order! No Waiting! Low Prices!

100% Prime CMOS ICs

Low As **89¢**



- Static-Protected "B" Series
- Pin-Out Diagram & Specs Included

Type	Cat. No.	Each
4001	276-2401	.99
4011	276-2411	.89
4013	276-2413	1.19
4017	276-2417	1.99
4027	276-2427	1.19
4511	276-2447	1.99
4059	276-2449	.99
4050	276-2450	.99
4066	276-2466	1.59
4070	276-2470	.99

LS-Series ICs Low As **79¢**

Pin-Out Diagram & Specs Included

Type	Cat. No.	Each
74LS00	276-1900	.79
74LS02	276-1902	.79
74LS04	276-1904	.79
74LS08	276-1908	.79
74LS32	276-1915	.89
74LS73	276-1918	.99
74LS74	276-1919	.79
74LS75	276-1920	.99
74LS90	276-1923	1.19
74LS123	276-1926	1.49
74LS151	276-1929	1.09
74LS157	276-1930	1.19
74LS161	276-1931	1.59
74LS164	276-1932	1.59
74LS175	276-1934	1.39
74LS193	276-1936	1.69
74LS367	276-1835	1.59



Time/Temp Module

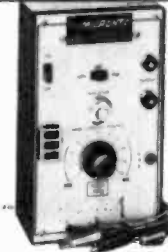
Reg. 24.95

20% Off! 19⁸⁸

Pre-Wired and Feature-Packed

Variable-brightness LED display reads 12/24-hour time, temperature in C or F. 24-hour alarm drives a speaker directly. Has 10-minute snooze and 59-minute sleep functions—get ambitious and add "clock radio" features to a stereo or TV! 1 3/4" x 3 3/4" x 1 1/2". Includes instructions which specify parts for DC operation. Requires three resistors, temp. sensor and power transformer. 277-1006 Sale 19.88

LM334 Sensor. 276-1734 2.29 Power Transformer. 273-1530 5.99



Transistor Checker

16⁹⁵

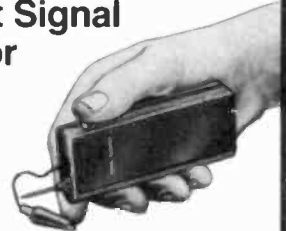
A "Must" for Your Test Bench

Tests all types, in or out of circuit. Indicates relative current gain, "opens," "shorts" and permits matching. Has output for external meter or scope. With instructions. Requires one "C" battery. 22-024 16.95

Pocket Signal Injector

5⁴⁹

It's a Real Timesaver



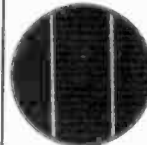
Produces a signal rich in harmonics for testing all stages from antenna to speaker. Has On/Battery condition indicator. With leads and instructions. Requires two "AA" batteries. 22-4033 5.49



Dual-Gate MOSFET

1⁵⁹

3N211. For RF mixer, amplifier and oscillator use to 450 MHz. 360 mW max. TO-72 case. 276-2045 1.59



Solar Cell

9⁹⁹

High-efficiency 3" diameter cell delivers 0.42V at 1 amp (0.42-ohm load) in full sunlight. 276-123 9.99



Unique LEDs

Low As **1²⁹**

TriColor. Red on DC, green on reverse DC, yellow on AC! 276-035 1.39
Red Flasher. CMOS IC and LED in one package 3-5VDC. 276-036 1.29

Phototransistor



89¢

TTL compatible, similar to FPT-100. Sensitive, with fast response time. 276-130 89¢

50 Type 1N914 Silicon Diodes



Long Leads **1⁹⁸**

Switching time low as 4 ns. Ideal for logic circuits. PRV: 90V. 276-1620 Pkg. of 50/1.98

VMOS Power FETs

Low As

1⁵⁹

Diode-Protected Gate
VN10KM. 1W diss. TO-92 + case. 276-2070 1.59
VN67AF. 15W diss. TO-202 case. 276-2071 2.49

"Noise" IC



2⁶⁹

With Data

MM5837. 17-bit shift register with built-in clock. White or pink noise from an 8-pin DIP. 276-1768 2.69

16K Hobby RAM



29% Off!

9⁹⁵

16-Pin Reg. DIP 13.95
4116 Dynamic. 100% prime. 16,384x1 bits. 1 ms refresh. 276-2505 Sale 9.95

Submini SPDT DIP Relay



2⁹⁹

5VDC Coil

For PC board and DIP sockets. Contacts: 1A at 125VAC. 56-ohm coil. 3/8" x 3/8" x 7/16". 275-216 2.99

Mercury Bulb Switch

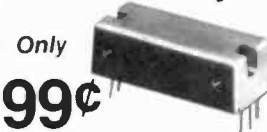


NEW!

1¹⁹

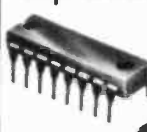
Gravity actuated—tilt to close circuit. 5A at 125VAC. Style may vary. 275-027 1.19

DPST 12VDC Reed Relay



Only **99¢**
Encapsulated. For low-power circuits. Contacts: 0.5A at 125VAC. Coil: 375 to 800 ohms. 1 1/8" x 9/16" x 7/16". 275-229 99¢

Top-Octave IC



44% Off!

3⁸⁸

Reg. 6.99
Build a keyboard instrument or musical doorbell using this 16-pin DIP. With data. 276-1790 3.88

Rhythm IC

33% Off!

4⁴⁴

Reg. 6.59
Build an "electronic drum set" using this 16-pin DIP. Six combinable patterns. With data. 276-1785 Sale 4.44

Start Your Next Project at The Shack®

Radio Shack®

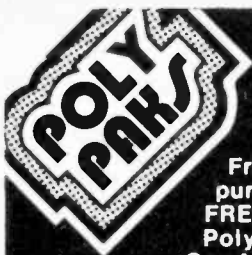
A DIVISION OF TANDY CORPORATION • FORT WORTH, TEXAS 76102
OVER 7500 LOCATIONS IN 40 COUNTRIES

Prices may vary at individual stores and dealers

CIRCLE 9 ON FREE INFORMATION CARD

MAY 1981

107



Free!

Look at this fantastic offer from Poly Paks!!

Free Premium offer with every \$20 purchase. Your order today will give FREE tools for tomorrow! Here's how Poly Paks Free Premium offer works: One free premium with your \$20 order. Two free premiums with your \$40 order. Three free premiums with your \$60 order.

VEEDER-ROOT 6 DIGIT COUNTER

ONLY
\$4.98
2 for \$9.00

Non-resettable, 6-Digit counters run from 0 to 999999. Electro mechanical assembly requires 115 VAC, 60 Hz, 6 watts. Speed: 1000 counts/minute. 3/8" x 2" window reveals black digits on white background. Gray, wrinkle finish metal case measures 3-1/4 x 2-1/2 x 1-5/8". 10" insulated wire leads have quick-connect type spade terminals.



Cat No. 5113 QTY.



12.5 VOLT
600 mA
NICKEL CAD
BATTERY PAK

\$12.49
2/\$24

- 10 "AA" Size Cells Connected in Series
- Comes In 2-7/8" x 1-1/8" x 2" Insulated Plastic Case. (Picture Shown Less Top Half of Case)
- Easily Accessible Top Mounted Solder Tab Leads

Cat No. 6676 QTY.

GIANT SOLAR DISCS



Cat. No.	Size	Rating	VDC	Price
<input type="checkbox"/> 3788	3 1/2"	1 amp	.5	\$ 8.95
<input type="checkbox"/> 5075	4"	1 amp	.5	\$10.95

"BLOCK" FANS



- 115 VAC • 15 WATTS
- ONLY 4-11/16" SQ.
- 1-1/2" DEEP!
- 75 CFM OR BETTER

Cat. No. 3108 QTY.

\$11.88 2/\$23

60 WATT 3-WAY CROSSOVER NETWORK



Crossover freq: 700 Hz. ± 4000 Hz. Attenuation char: 12 db/oct. Power: 60 watts (max.) 8 ohms impedance. Four heavy copper coils are mounted on a 5-1/16" x 3-7/8" board, with mounting holes on 3-1/2 x 4" cts. Terminals have spade lug connectors, 1-1/2" high.

Cat No. 6339 QTY.

\$10.88



PIEZO ELECTRIC TWEETER HORN
SOLID STATE
3-1/4"

- No Voice Coil!
- No Crossover Network!
- Frequency Range: 4000 - 40,000 Hz.
- High Impedance, Exceeds 8 Ohms @ 100K Hz.
- Handles 55 Watts Peak, 35 Watts RMS

ONLY **\$8.88** 2/\$17

Cat No. 5656 QTY.



"SPACE SHOT" AUDIO GAME BOARD
Provides Authentic "Outer Space" Sound Effects

- Sound Effects include: Rocket Blast, Phaser Fire, Space Man Breathing, "Clear the Launch Pad" Alarm Gong, Even 21st Century Music!
- Requires 8 Ohm Speaker and 9V Transistor Radio Type Battery.
- Size 4-1/2" x 1-3/4" x 1"

\$4.49 2/\$8

Cat No. 6707 QTY.

"CHROMA STROBE" 3 CHANNEL COLOR ORGAN KIT



Plug in three floodlites, or colored lites and watch them dance to the rhythm, pitch and volume. Low, mid-range and highs are separated and displayed on individual channels. Variable intensity control for each channel. Easy to assemble with step-by-step instructions.

\$28.50 2/\$57

Cat No. 4025 QTY.

12 VDC 10 AMP POWER SUPPLY

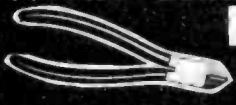


Converts 115VAC to 12VDC to 10 Amps fully regulated! Supplies up to 18 Amp surge. Dual transistor regulation with Motorola 2N3055 and 2N3773 for maximum dependability. Less than 100 mv ripple, regulation better than 5%. Extra large heat sink for ULTRA COOL operation. Front panel on/off switch, fuse, and indicator lamp for fingertip control. 8 1/2" x 8 1/2" x 4" high.

\$59.95

Cat No. 5541 QTY.

CUTTING PLIERS



LONG NOSE PLIERS



7-PC. NUTDRIVER SET



FREE!!
Premiums

POLY PAKS

P.O. BOX 942, RE-5
S. LYNNFIELD, MA. 01940

Total Amount of Order \$ _____

SHIPPING AND HANDLING: U.S., ADD \$3; FOREIGN, ADD \$7. MASS. RES. ADD 5% SALES TAX.

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

Enclosed is CHECK, MONEY ORDER
Charge my MASTERCARD VISA

ACCT. # _____ EXP. DATE _____

Order By Phone 1-617-245-3828

ORDERING INSTRUCTIONS • Indicate Quantity in Box Near Item Desired
• Complete Coupon Section • Cut Out Ad and Send to Poly Paks, Inc.

Send me your FREE catalog

4Kx16 MEMORY BOARD with 64 IC chips (2102) in sockets. Super deal at \$50 the complete board.

\$29 AUTO SECURITY SYSTEM alarm system \$7.00

SANYO UHF VARACTOR TUNER	25.00
SOUND GENERATOR IC	\$1.00 ea 6/5.00
SHUGART FLEX DISC DRIVE 5 1/4 inch	150.00
SHUGART FLEX DISC DRIVE 8 inch	200.00
PORTABLE ULTRASONIC ALARM	15.00
MOTOROLA VIDEO MONITOR 12 inch	85.00
MOTOROLA VIDEO MONITOR 9 inch	40.00

The above two monitors accept composite video signal
BALL VIDEO MONITOR 12 inch w/power supply 50.00
The above monitor requires comp video circuitry

DATA STATION CONSOLE w/keyboard 9 inch monitor, power supply. Logic boards broken. \$80
Send for details on this one.

TOUCH PAD solid state w/LSI chip. Bell system compatible. For computers & phones \$24.00
12 VOLT GEL-CELLS 2.5 AH \$14.00 5 AH \$17.00
12 INCH CRT bonded face plate. New with specs. Made for computers. \$35.00

WALKY TALKIES Govt surplus used condition. 47-55.4 mc range. With schematics. Govt AN/PRC-6 \$25 each 2 for \$45. Ant. \$5 each

ASCII KEYBOARD parallel \$50
RED LED's 10 for \$1.00

MIN ORDER \$10.00

Shipping extra on all merchandise

Meshna Inc., PO Box 62, E. Lynn, Mass. 01904

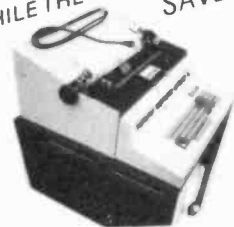


CIRCLE 12 ON FREE INFORMATION CARD

COMPUTER HOBBYIST SPECIALS!

WHILE THEY LAST!!!!
SAVE!!

Daisy Wheel Terminals



RS-232, used, off-lease. Features Diablo Hytype 1 printer, up to 30 CPS, plot & text modes, dual pitch and much, much more. Includes data, operation manual, schematics. "As-is" machines may need some service.

TESTED & FUNCTIONAL "AS-IS" ONLY
Add \$40 for Hdlg. and Pkg. NOW ONLY **\$1299.00** **\$899.00**
Pay Shipping When Delivered. ea

This Month's Specials

SHUGART SA901 8" Floppy Disk Drive	\$210.00 ea.
Used, whole, untested. Data & schematics included	2/*399.00
SHUGART SA400 Mini Floppy, 5 1/4"	\$159.00 ea.
Used, whole, untested. Data & schematics included	2/*299.00
CDC9400 (MPIBR-803) 8" Floppy Drive	\$210.00 ea.
Soft sector'd. Used, whole, untested. Data & schematics included	2/*399.00
12" VIDEO MONITOR Motorola #XM-351	\$95.00 ea.
80x24 or 16x64 display. Requires only Composite Video input & 110-230VAC, 50-60 Hz. Tested, functional & guaranteed. Data and schematics included	
9" VIDEO MONITOR Motorola #XM-227	\$79.00 ea.
Same characteristics as above 12" video. Tested, functional and guaranteed. Data & schematics included	

Prices Do Not Include Shipping Costs

Write or Call for our Bargain-Packed PERIPHERAL FLYER!!
Prices are Subject to Change on All Items

CFR Associates, Inc.

MAIL ORDERS: 03858
PHONE ORDERS: 617/372-8536
WAREHOUSE: 18 Granite Street Haverhill, Mass. 01830
Sorry, No Collect Calls
MasterCharge & VISA Welcome

16K

Memory

8/\$19.95

4116 200ns

NEC

Mostek

ALL MERCHANDISE 100% GUARANTEED!

CALL US FOR VOLUME QUOTES

LS SERIES

74LS00	32	74LS155	1.19
74LS01	28	74LS156	.95
74LS02	38	74LS157	.79
74LS03	32	74LS158	.82
74LS04	35	74LS160	.94
74LS05	28	74LS161	.99
74LS08	38	74LS162	.99
74LS09	38	74LS163	.99
74LS10	32	74LS164	.99
74LS11	29	74LS165	.99
74LS12	29	74LS166	2.40
74LS13	38	74LS168	1.79
74LS14	99	74LS169	1.79
74LS15	35	74LS170	1.89
74LS20	26	74LS173	.82
74LS21	30	74LS174	1.19
74LS22	34	74LS175	1.09
74LS26	40	74LS181	2.19
74LS27	35	74LS190	1.35
74LS28	49	74LS191	1.31
74LS30	35	74LS192	.88
74LS32	39	74LS193	.98
74LS33	54	74LS194	1.80
74LS37	78	74LS195	1.39
74LS38	39	74LS196	.82
74LS40	25	74LS197	.82
74LS42	79	74LS221	1.28
74LS47	78	74LS240	1.89
74LS48	78	74LS241	1.89
74LS51	35	74LS242	1.89
74LS54	35	74LS243	1.89
74LS55	32	74LS244	1.79
74LS73	44	74LS245	2.89
74LS74	48	74LS251	1.32
74LS75	58	74LS253	.89
74LS76	50	74LS257	.89
74LS78	59	74LS258	.89
74LS83	90	74LS259	2.89
74LS85	1.23	74LS260	.68
74LS86	45	74LS266	.68
74LS90	70	74LS273	1.69
74LS92	82	74LS275	3.39
74LS93	71	74LS279	.59
74LS95	1.11	74LS283	1.03
74LS96	86	74LS290	1.25
74LS107	43	74LS293	1.99
74LS109	49	74LS295	1.99
74LS112	48	74LS298	1.24
74LS113	48	74LS352	1.59
74LS114	55	74LS353	1.59
74LS122	55	74LS363	1.39
74LS123	99	74LS365	.99
74LS134	2.99	74LS366	.99
74LS125	99	74LS367	.99
74LS126	88	74LS368	.99
74LS132	69	74LS373	1.85
74LS136	58	74LS374	1.81
74LS138	79	74LS377	1.48
74LS139	79	74LS385	1.90
74LS145	79	74LS395	1.65
74LS148	1.39	74LS390	1.90
74LS151	79	74LS393	1.90
74LS153	79	74LS395	1.69
74LS154	2.39	74LS670	2.20

SPRING MEMORY SALE

RAMS		100pcs	EPROMS		100pcs
2101	(450ns)	2.49	1702	(1us)	4.95
2102-1	(450ns)	.99	2708	(450ns)	4.95
21102-1	(450ns)	1.29	2758(5v)	(450ns)	9.95
2111	(450ns)	2.99	2716(5v)	(450ns)	7.95
2112	(450ns)	2.99	2716-1(5v)	(350ns)	12.95
2114	(450ns)	2.95	TMS2516	(450ns)	9.95
2114L-2	(200ns)	8/29.95	TMS2716	(450ns)	9.95
2114L-3	(300ns)	8/24.95	2732	(450ns)	29.95
4027	(250ns)	4.95	3.95	2732	(450ns)
4116-15	(150ns)	8/21.95	2.65	TMS2532	(450ns)
4116-20	(200ns)	8/19.95	2.35	TMS25L32	(450ns)
4116-30	(300ns)	8/18.99	2.29	TMS2564	(500ns)

NEED YOUR ORDER SHIPPED TODAY?

THEN CALL TOLL FREE

800-538-5000
IN CALIF.

800-662-6233

BEFORE YOU BUY, CALL US. WE WILL BEAT ANYONE'S PRICES

6800

6800	11.75
6810	4.60
6820	5.75
6821	6.40
6828	9.95
6834	19.95
6850	5.75
6852	5.75
6875	6.95

8080

8080A	3.95
8085A	12.95
8212	2.75
8214	5.25
8216	2.75
8224	2.95
8226	3.49
8228	4.95
8238	5.50
8251	6.95
8253	12.95
8255	6.50
8257	16.95
8259	14.95
8275	49.95
8279	15.95

Z80

Z80	9.95
Z80A	12.95
Z80-CTC	7.65
Z80-DMA	18.00
Z80-PO	7.60
Z80-SIO/2	27.50
Z80-SIO/9	20.50

MISC.

1771-B01	24.95
3242	9.95
AY5-013	4.99
8T26	2.49
8T28	2.49
8T97	1.69
8T98	1.69

T.V. CIRCUITS

MC1330	1.89
MC1350	1.29
MC1358	1.79
LM380	1.29
LM565	.99
LM741	.29
LM1310	1.90
LM1800	1.99
LM1889	2.49

7400 SERIES

7400	.19	7450	.19	74123	.59
7402	.19	7472	.29	74151	.69
7404	.24	7473	.34	74153	.59
7406	.29	7474	.35	74154	1.49
7407	.29	7475	.49	74156	.69
7408	.24	7476	.35	74157	.69
7410	.19	7483	.65	74161	.79
7420	.19	7486	.35	74163	.89
7430	.19	7490	.49	74164	.89
7432	.29	7491	.69	74173	1.39
7440	.19	7492	.59	74174	.89
7442	.49	7493	.49	74175	.89
7445	.69	7496	.74	74176	.89
7446	.69	74100	1.19	74192	.79
7447	.59	74107	.34	74193	.79
7448	.69	74121	.34	74196	.79

IC SOCKETS

8 pin ST	10/1.29	8 pin WW	.59
14 pin ST	10/1.29	14 pin WW	.69
16 pin ST	10/1.29	16 pin WW	.69
18 pin ST	10/1.29	18 pin WW	.99
20 pin ST	10/1.29	20 pin WW	1.09
22 pin ST	10/1.29	22 pin WW	1.39
24 pin ST	10/1.29	24 pin WW	1.49
28 pin ST	10/1.29	28 pin WW	1.69
40 pin ST	10/1.29	40 pin WW	1.99

ST = SOLDDERTAIL WW = WIREWRAP

VOLTAGE REG'S

7805T	.89	7905T	.99
7812T	.89	7912T	.99
7815T	.99	7915T	1.19
7824T	.99	7924T	1.19
7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
78L05	.69	79L05	.79
78L12	.69	79L12	.79
78L15	.69	79L15	.79

TRANSISTORS

2N2222	10/1.00	100/8.99
2N3904	10/1.00	100/8.99
2N3906	10/1.00	100/8.99
2N3055	.79	10/6.99

CMOS

4001	.35	4024	.99	4070	.49
4002	.39	4025	.29	4071	.49
4007	.25	4027	.65	4072	.49
4009	.49	4040	1.29	4081	.39
4010	.49	4042	.99	4093	.99
4011	.35	4046	1.79	4098	2.49
4012	.29	4047	2.49	4503	.69
4013	.49	4049	.49	4508	3.95
4016	.59	4050	.69	74C04	.39
4017	1.19	4050	1.39	74C14	1.49
4020	1.19	4056	.79		
4023	.29	4069	.39		

LINEAR

LM301v	.34	LM556	.69	LM1488	1.39
LM308v	.98	LM565	.99	LM1489	1.39
LM309K	1.49	LM566v	.49	LM1800	1.99
LM311v	.64	LM567v	.29	LM1889	2.49
LM317t	2.29	LM723	.49	LM3900	.59
LM318v	1.49	LM733	.98	75451v	.39
LM323k	4.95	LM741v	.29	MC1330v	1.89
LM324	.59	LM747	.79	MC1350v	1.29
LM339	.99	LM748v	.59	MC1358	1.79
LM377	2.29	LM1310	.90		
LM380	1.29	LM1414	.59		
LM555v	.39	LM1458v	.69		

T = TO-220 V = 8 pin K = TO-3

LEDS

Jumbo Red	10/1.00
Jumbo Green	6/1.00
Jumbo Yellow	6/1.00
5082-7760 43°C	.79
MAN74 3°C	.79
MAN72 3°C	.99

DIP SWITCHES

4 position	.99
5 position	1.02
6 position	1.06
7 position	1.09
8 position	1.14



JDR MICRODEVICES, INC.

1101 South Winchester Blvd.
San Jose, California 95128
800-538-5000 408-247-4852

TERMS: Include \$2.00 for shipping, \$10.00 minimum order. Send SASE for complete catalog. Bay Area Residents add 6 1/2% sales tax Calif. Residents add 6% sales tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice. Foreign orders add suff. postage.

SPECIALS cont'd

16K dynamic RAMs 8 for \$24.50

Volume buying does it again: these are top quality, high speed, low power RAMs suitable for expanding memory in TRS-80[™] I/II/III and Color Computers, Heath H89, Apple, newer PETs, etc. Backed by one year limited warranty. Add \$3 for two dip shunts and conversion instructions for TRS-80[™] I.

™/® is a trademark of the Tandy Corporation

MISCELLANEOUS

4511 BCD to 7 seg decode/drvr	3/\$2
4512 8 channel data selector	4/\$2
5101 CMOS 1K low power memory	10/\$17.50
1000 uF 35V axial capacitor	10/\$2.00
10,000 uF 10V axial capacitor	5/\$2.00
S-100 card edge connectors	10/\$29.50
Resistor asst. (cut & bent leads)	1000/\$5
RCA phono jacks - these are super quality, closed circuit jacks that are the best we've seen in years.	
American made.	20/\$1.95
2102 low power 1K static RAM	10/\$9.90
General purpose silicon signal diodes	50/\$2
GT5306 NPN darlington, min gain 17000.	
25V 200 mA, TO92 package	100/\$8.95
NPN transistor similar 2N3904	100/\$7.95
PNP transistor similar 2N3906	100/\$8.95
4N28 opto-coupler 6 pin minidip,	
MCT-2/IL-1 pinout	5/\$2
SN76477 complex sound generator	1/\$2.50
Opto-isolator Grab Bag 50 mixed opto-isolators from a major manufacturer. Unmarked 6 and 8 lead minidips include single and dual types with diode, transistor, and darlington outputs. Test them yourself and save! Not recommended for beginners.	50/\$4

TERMS: Cal res add tax. Allow 5% shipping, excess refunded. Orders under \$15 add \$2 handling. VISA[®] and Mastercard[®] orders for 16K RAMs only call (415) 562-0636, 24 hrs. Include street address for UPS. Prices subject to change without notice, limited quantity on most items.

FREE CATALOGUE: Find out more about our exceptional product line. For 1st class delivery, add 41 cents in stamps; foreign orders add \$2 (refundable with order).

GODBOUT

ELECTRONICS
BOX 2355, OAKLAND AIRPORT CA 94614

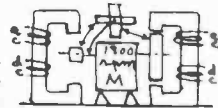
CIRCLE 40 ON FREE INFORMATION CARD

AMAZING ELECTRONIC PROJECTS and PRODUCTS:

Lasers Super Powered, Burning Cutting, Rifle, Pistol Pocket. See in Dark—Shotgun Directional Mike—Unscramblers—Giant Tesla—Stunwand—TV Disrupter—Energy Producing, Surveillance, Detection, Electrifying, Ultrasonic, CB, Auto and Mech. Devices, Hundreds More—All New Plus INFO UNLTD PARTS SERVICE. Catalog \$1. Information Unlimited, Dept. R8 Box 716 Amherst, N.H. 03031.

\$500 PRIZE

for most efficient generator with NO relative motion between coil and magnet to skirt Lenz's law. For details see end of page 1118, 7 Mar. '80 Science — or send 60¢ and SASE to J.W. Ecklin, 6143K Edsall Rd., Alexandria, VA 22304.



WRITE FOR McGEE'S SPEAKER & ELECTRONICS CATALOG

1001 BARGAINS IN SPEAKERS

Tel.: 1 (816) 842 5092

1961 MCGEE STREET KANSAS CITY, MO. 64108

39¢ ADD \$2.50 FOR POSTAGE

30 CHANNEL CABLE TV CONVERTER

FREE! UNUSUAL 96 PAGE ELECTRONIC PARTS & IDEAS CATALOG!

ORDER No. 171AE047
ETCO ROUTE 9N, PLATTSBURGH, N.Y. 12901
Tel.: (518) 561-8700.

LONG PLAY 10 HOUR TAPE RECORDER

Top quality AC-DC cassette recorder, modified to provide 5 continuous hours of recording and playback of true fidelity, distortion-free sound on each side of cassette for a total of 10 hours. Unit has many special built-in features. TOK D-C180 cassette supplied.



ONLY \$125.00*

PHONE RECORDING ADAPTER

Record incoming and outgoing calls automatically with this all solid state unit connected to your telephone jack and tape recorder. Starts recording when phone is lifted. Stops when you hang up, making a permanent record. Easily installed. No monthly charges. FCC APPROVED \$24.50*



VOX VOICE ACTIVATED CONTROL SWITCH

Solid state. Self contained. Excellent adjustable sensitivity. Voices or other sounds activate and control recorder. Uses recorder mike or remote mike.



2 1/4 x 1 3/4 x 3/4" \$24.95*

Phone call Adapter \$24.50*, VOX \$24.95* (* plus \$1.00 ea. shipping & handling), 10 hr. Recorder \$125.00* (* plus \$4.00 shipping & handling). California residents add tax. Mail Order, VISA, M/C, cod's okay, quantity discounts available. Money back guar. Free data.

AMC SALES, Dept. 19 9335 Lubec St., Box 928 Downey, CA 90241, Phone (213) 869-8519

CIRCLE 11 ON FREE INFORMATION CARD

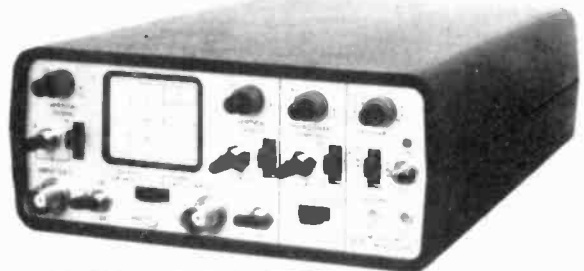


Portable Oscilloscopes

15 MHz Triggered Miniscope Model MS-15

15 MHz Dual Trace Triggered Miniscope Model MS-215

30 MHz Dual Trace Triggered Miniscope Model MS-230



New Touch/Test 20 Multimeter

A portable/bench-type meter that tests and measures 10 electrical parameters, 20 functions & 45 ranges.

MEASURES:

AC and DC Voltage AC and DC Current Resistance Temperature, °C & °F Conductance Capacitance Performs diode/transistor and continuity tests

FEATURES

Touch selection and control of functions, ranges and power. Large (0.55" high) LED readout. In-circuit test capabilities. Size: 2.9" H x 6.4" W x 7.5" D. Weighs less than 3 lbs.

Order with Confidence and get the Fordham Advantage!

Call for our prices **TOLL FREE (800) 645-9518**

in N.Y. State call (516) 752-0050

FORDHAM

855 Conklin St. Farmingdale, N.Y. 11735



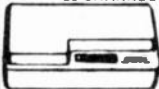
Master Charge BankAmericard VISA COD Money Order Check COD's extra

CIRCLE 52 ON FREE INFORMATION CARD

ETCO

CABLE TV CONVERTERS AND OTHER GOOD STUFF!

SMASHING ALL SALES RECORDS - OUR NEW 30 CHANNEL CABLE TV CONVERTER!



Converts mid & super band cable channels for viewing on your TV set.
No. 333A3047

39⁹⁵
\$34.95 ea / 5

HOT NEW IMPORT! REMOTE CONTROL 30 CHANNEL CABLE TV CONVERTER!



Includes remote TV on/off switch and fine tuning control!
No. 333A3078

89⁹⁵
\$79.95 ea / 5
\$74.95 ea / 10

ETCO MKII WIRELESS - THE ULTIMATE CABLE TV CONVERTER!



Set TV to channel 3 and the hand held remote control does it all!
No. 333A3008

189⁰⁰

VIDCOR 2000 CONVERTER ELIMINATES PROBLEMS WHEN TAPING FROM CABLE TV



Restores your VCR's capability for programming. It stores remote channel control. Enables videotaping of one cable program while switching another.
No. 333V2000

89⁹⁵

UNUSUAL FACTORY SURPLUS MID-BAND - SUPER-BAND CABLE TV TUNER



Converts cable channels to a common IF frequency. Experimenters - built cable converters, decoders, etc. With schematic No. 333V3482

19⁹⁵
\$17.50 ea / 10

FACTORY SURPLUS UHF TUNERS



Brand new production surplus. All solid state. Ideal for experimental work. Includes cable TV converter, etc. No. 333V3008

4⁹⁵
\$3.95 ea / 10

MINIATURE FM WIRELESS MICROPHONE



Hides in the palm of your hand. Reception on any standard FM radio or receiver.
No. 333V3482

29⁹⁵
\$27.50 ea / 5
\$24.95 ea / 10

QUARTER-MILE WIRELESS MICROPHONE & RECEIVER SYSTEM



FCC approved crystal controlled carrier, make & receiver. All battery operated. Electrical wide range response. VU meter.
No. 333V3488

69⁹⁵
\$49.95 ea / 5

ETCO GENERAL PURPOSE TUBE TESTER



IN KIT FORM. Checks for leakage, shorts, emission. 7 pin octal, loctal, compacton, nu-vistor. In portable case.
No. 333T148

49⁹⁵
\$49.95 ea / 5

DUMPING! NORELCO ENDLESS LOOP CASSETTES!



Impossible to find at any price!
3 minutes - No. 333V3488
6 minutes - No. 333V3488

4⁹⁵
\$4.48 ea / 10

IN STOCK - THE MURA CORDLESS TELEPHONE SYSTEM!



Answer & originate calls with this wire free microtelephone. 400 ft. range! Rechargeable battery. No number recall! Paging feature! Use with other Mura systems.
No. 333V3734

144⁸⁸
\$129.95 ea / 5

SALE OF QUARTZ BATTERY OPERATED CLOCK MOVEMENTS!



Accuracy of 1 min. / year up to 4 years operation on 1 alkaline C cell imported from West Germany. No. 333V3881

9⁹⁵
\$8.95 ea / 5

20 AMP REGULATED 12VDC POWER SUPPLY!



13.8 wtc no load. 12.5 vdc full load. Easily handles ham station marine radio. 55B lineers up to 400w P.E.P. Brand new factory sealed cartons. No. 333V3884

59⁸⁸
\$48.95 ea / 5

OUR LATEST 96 PAGE FASCINATING CATALOG (jam packed with unique items, electronic bargains and unusual offers. Write or circle the information card number below)



RUSH YOUR ORDER TODAY TO ETCO ELECTRONICS NORTH COUNTRY SHOPPING CENTER PLATTSBURGH, N.Y. 12561

Check with order, please. Visa & Mastercard OK. (Sorry, no C.O.D.). Add 15% for UPS & Handling (E-cass refunded). N.Y. State residents add 7% sales tax. Dealer & Export inquiries invited. Our telephone order desk never closes. Call 1-516-661-8700

ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

Free Information Number Page

11	AMC Sales	110
—	ATV Research	104
28	Active Electronics	93
61	Advanced Electronics	90
—	Advanced Electronics	25,42, 74-75
8	Advanced Computer Products	102-103
49	Albia Electronics	80
37	All Electronics	96
13	American Antenna	Back Cover
45	Ampower	85
34	Ancrona	111
46	B & K Precision	13
—	Bagnall Electronics	91
—	Karel Barta	104
2	Beatcat	2
—	Bullet Electronics	100
—	CIE, Cleveland Institute of Engineering	18-21
29	CFR, Associates	108
33	Cambridge Learning	83
20	Channelock	36
10	Chaney Electronics	92
—	Cascade Labs	112
44	Communications Electronics	73
—	Command Productions	92
—	Cook's Institute	92
38	Concord Electronics	100
18	Jan Crystals	77
—	Dage Scientific	104
35	Digi-Key Corp.	97
—	JW, Ecklin	110
—	Edu Cal Publications	82
22	Electronics Book Club	27
—	Electronic Technology Today	85
3	Etco	110-112
—	Fair Radios	112
39	Fluke	7
51,52	Fordham	26,77
7	Formula International	98-99
54	Global Specialties	37
—	Global TV	91
40	Godbout	110
—	Grantham College of Engineering	78
55	Hal-Tronix	112
14,15	Heath	17, 39-41
—	Information Unlimited	110
21	International Components Corp.	88
24	International Crystal Mfg. Co.	38
47	International Electronics Unlimited	106
4	JDR, Microdevices	109
5	Jameco Electronics	94-95
62	Keystone Electronics	38
56	MCM, Electronic Parts	104
64	Magnavox	43
12	Meshna Inc.	108
—	McGee Radio	110
27	Micro Ace	101
—	Micro Management	92
—	Microtenna	104
63	Midland Electronics	81
—	NRI, Schools	8-11
—	NTS, National Technical Schools	28-31
58	Netronics R & D Ltd.	87
41	Non-Linear Systems	15
59	Omega Sales	24
17	Paccom	78
36	Panasonic	33
19	Paia Electronics Inc.	90
—	Philips ECG Inc.	89
26,30	Poly Paks	77, 108
25	Quietrole Company	38
53	RCA	22-23, 32, 44
9	Radio Shack	107
6	Ramsey Electronics Inc.	105
23	HW, Sams	79
—	Subtronics	1
57	Shure Brothers	Cover 3
32	Solid State Sales	96
31	Sony Video	35
—	Spacecoast Research	91
—	Surplus Center	91
42	Trio-Kenwood Communications Inc.	34
43,60	Triplet	Cover 2
16	Vaco	5
—	Wersi	79

Govt. SURPLUS ELECTRONIC EQUIPMENT CATALOG

New ITEMS . . . New BARGAINS!
FREE UPON REQUEST!
Send today for FREE copy of NEW CATALOG WS-81. Address Dept. RE
FAIR RADIO SALES
1016 E. EUREKA • Box 1105 • LIMA, OHIO • 45802

Electronic Design Lab CA-18

Save money, time, and trouble with a design lab!

- Two EXP300 breadboards • Sloping metal cabinet
- Variable square wave generator .5Hz-20KHz
- T.T.L and C.M.O.S. outputs
- Power supplies fixes 5V-1/2 amp output variable dual tracking regulator 0-15V ±, current ± 200M.A., all supplies short circuit proof, noise and ripples less than 20M V.
- Four logic level indicators • Four data switches
- Excellent for schools teaching electronics, students, hobbyists, engineers and technicians. For testing, prototyping, modifications, circuit changes, ideas, and testing I.C.'s

Write for a FREE brochure. Complete design lab \$99.95, kit only \$89.95. Shipping and handling (U.P.S.) \$5.00. We will ship C.O.D.
CASCADE LABS, 1261 Sunny Shore Drive
Camano Island, Washington 98292 • (206) 221-7483

ELECTRONIC KITS FROM HAL-TRONIX

2304 MHZ DOWN CONVERTERS. TUNES IN ON CHANNELS 2 TO 7 ON YOUR OWN HOME T.V. HAS FREQUENCY RANGE FROM 2000 MHZ TO 2500 MHZ. EASY TO CONSTRUCT AND COMES COMPLETE WITH ALL PARTS INCLUDING A DIE-CAST ALUM CASE AND COAX FITTINGS, REQUIRE A VARIABLE POWER SUPPLY AND ANTENNA (Antenna can be a dish type or coffee can type depending on the signal strength in your area.)

2304 MOD 2 (Basic / Pre-amp) \$79.95
2304 MOD 3 (Hi-Gain Pre-amp) \$89.95

POWER SUPPLY FOR EITHER MODEL ABOVE IS AVAILABLE COMES COMPLETE WITH ALL PARTS, CASE, TRANSFORMER, ANTENNA SWITCH AND CONNECTORS \$29.95

***** PREAMPLIFIERS *****

HAL PA-19—1.5 mhz to 150 mhz. 19db gain operates on 8 to 18 volts at 10ma. Complete unit \$8.95.
HAL PA-1.4—3 mhz to 1.4 ghz. 10 to 12 db gain operates on 8 to 18 volts at 10ma. Complete unit \$12.95.

(The above units are ideal for receivers, counters, etc.)

16 LINE TOUCH TONE DECODER KIT WITH P.C. BOARD AND PARTS \$69.95
12 LINE TOUCH TONE DECODER KIT WITH P.C. BOARD AND PARTS \$39.95
16 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS . . . \$39.95
12 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS . . . \$29.95

MANY, MANY OTHER KITS AVAILABLE

Send 15¢ stamp or S.A.S.E. for information and flyer on other HAL-TRONIX products. To order by phone, 1-313-285-1782.

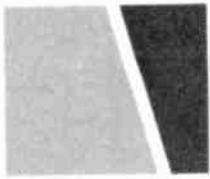
HAL-TRONIX
P.O. Box 1101
Southgate, MI 48195

SHIPPING INFORMATION: ORDERS OVER \$20.00 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE INDICATED. ON ORDERS LESS THAN \$20.00 PLEASE INCLUDE ADDITIONAL \$1.50 FOR HANDLING AND MAILING CHARGES.

RADIO-ELECTRONICS

CIRCLE 3 ON FREE INFORMATION CARD

CIRCLE 55 ON FREE INFORMATION CARD



fact: the 10 most common nuisances in PA can be cured. permanently. instantly.

These 10 problem solvers in your toolbox are like 10 new tricks up your sleeve. Or 10 hours of saved time. Or money in the bank. They tailor the sound, match the lines, smooth out the peaks, fill in the valleys, make molehills out of troubleshooting mountains. Snap one in. Out go the hassles. Without soldering, or splicing, or internal equipment modifications:

Problem:	Solution:	
Input Overload	A15A	Microphone Attenuator prevents input overload. Ideal where very strong signals are applied to a microphone input.
Phasing	A15PR	Phase Reverser reverses the phase of a balanced line without modification of equipment.
Low-Frequency Noise	A15HP	High Pass Filter provides a low-frequency microphone cutoff to reduce unwanted low-frequency noises and proximity effect.
High-Frequency Noise	A15LP	Low Pass Filter provides high-frequency cutoff to reduce objectionable high-frequency noises.
Lack of Presence	A15PA	Presence Adapter adds voice-range intelligibility and extra brilliance.
Sibilance	A15RS	Response Shaper provides excellent sibilance filtering; flattens microphone response.
Line Level to Mic Input	A15LA	Line Input Adapter converts balanced low-impedance microphone input to line level input.
Matching/ Bridging/Isolating	A15BT	Bridging Transformer, a balanced unit, matches balanced or unbalanced devices of different impedances.
Troubleshooting	A15TG	Tone Generator produces a continuous 700 Hz low-impedance microphone level signal — extremely useful in setting-up and troubleshooting lines. Helps check levels, connections, mixer inputs, and cables. Allows one man to do the work of two!
Microphone Impedance Matching	A95 and A97	Series Line Transformers make it possible to connect low-impedance lines to mid- and high-impedance inputs (or vice-versa). Completely reversible. Solves problems of excessive high-frequency loss and objectionable hum.

Shown Actual Size: 114mm (4½ in.) long x 19mm (¾ in.) diameter.



Send for the free Shure brochure, AL280F



Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204, In Canada: A. C. Simmonds & Sons Limited
Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

CIRCLE 57 ON FREE INFORMATION CARD

In one year our **K40™** antenna has become the largest selling CB antenna in the world!

1. It's more expensive ...

2. It's made better...

3. It's proven best!

\$42.50

suggested retail

And when you pay more, you expect more!

MORE PERFORMANCE:

The K40 is guaranteed to transmit further or receive clearer than any antenna it replaces. We know it will. We've tested it with 771 CB'ers just like you for one year.

MORE FLEXIBILITY:

You can fit your K40 to any mounting surface. It will fit any vehicle you'll ever own! That includes choppers, dune buggies, gutters, mirror mounts, luggage racks, trunks, hatchbacks, through roofs, semis, pick ups and RV's.

MORE QUALITY:

It's not imported. It's not made in Taiwan, Korea or Japan. It's American made in an American town. It's made with better materials that cost more and by professional people we pay more. And we designed it right here in the U.S.A.

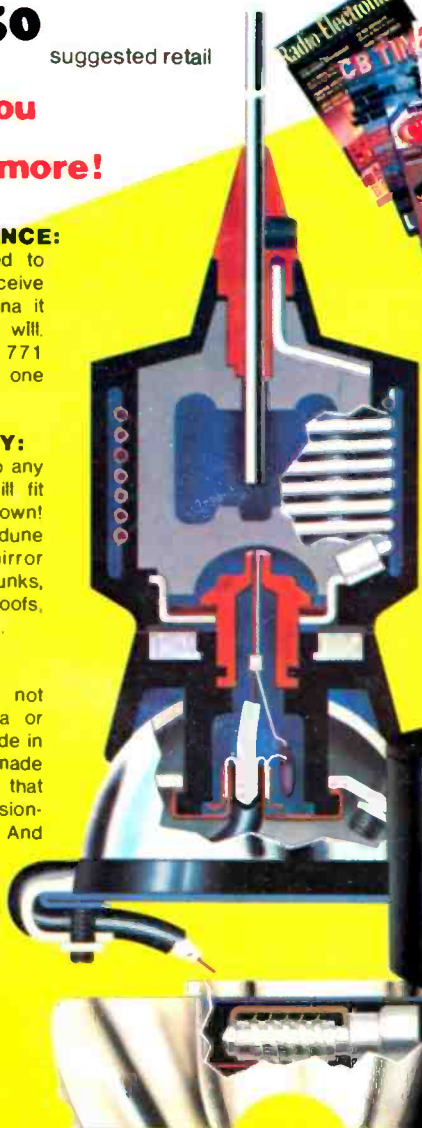
*Including optional mounts at extra cost.

...This Antenna is so DYNAMITE you receive a ...

DOUBLE GUARANTEE

GUARANTEE I: The K-40 will transmit farther and receive more clearly than the antenna it replaces or the customer will receive a prompt and full refund from the Registered K-40 Dealer who installed and tuned it.

GUARANTEE II: Unconditionally guaranteed for 12 months. Guaranteed against cracking, chipping or rusting. Guaranteed against mechanical failure. Guaranteed against electrical failure. Guaranteed against accidental breakage. No exclusions. No gimmicks. For a full 12 months.



CB TIMES: "... it's not often that a product bursts onto the market scene, dominates and improves CB'ing for everyone. American Antenna and the K40 are doing it—repeated tests showed the K40 could out-perform the major competitive brands."

RADIO-ELECTRONICS: "The results of our tests showed that, in three different positions of the monitoring receiver, the model K40 equaled or out-performed the competitive antenna. Apparently, American Antenna's advertising is not merely Madison Avenue showmanship."

PERSONAL COMMUNICATIONS: "... an impressive 95% of the trials, the K40 out-performed the existing mobile antennas. We had to try one for ourselves. ... in every case, the K40 either equaled or out-performed its competitor."

"No ifs, ands, or buts! The K40 Antenna from American Antenna would have to be just about the best antenna around."

CB MAGAZINE: "Introduced in October, 1977, the K40 quickly became the top seller and in mid 1978, became the number one selling antenna in the nation."

...Here's what CB'ers all across the country said.

ANTENNA SPECIALISTS: "... truck driver and CB'er for 10 years ... 50% further than my M410 'Big Momma'!"

—J.H. Collett, 207 McFee, Bastrop, LA

AVANTI: "I'm an electronic technician with a Second Class FCC license ... I was able to transmit 70% further and tune the SWR 75% lower than my Avanti!"

—H.R. Castro, VRB, Monserrante D-67, Salinas, Puerto Rico

PAL: "... 20% better in transmission and reception than my 5/8 wave Pal Firestick."

—John A. Blum, Box 446, Zellenolpe, PA

SHAKESPEARE: "... I've been a CB'er for three years and the K40 is the best I've ever had. Better in reception and transmission than my Shakespeare."

—H. Bachert, Jr., 15 King Rd., Park Ridge, NJ

HUSTLER: "Compared to my Hustler XBLT-4, the K40 can consistently transmit 40% further and the reception was better. The K40 is the perfect way to complete a CB system."

—Jerome R. Brown, 7800 S. Linder, Burbank, IL

(SPECIAL NOTE) IF YOU'RE A BEGINNER:

Our K40 Dealers will be happy to sell you any of the older style and less expensive antennas that are great bargains for a beginning CB'er.

AMERICAN ANTENNA
ELGIN, IL 60120

© COPYRIGHT AMERICAN ANTENNA 1979

K40
POWER!

... Sold exclusively by 3500 American K40 Dealers throughout the U.S. & Canada.

CIRCLE 13 ON FREE INFORMATION CARD