SPECIAL TEAR OUT SECTION
COMPUTERDIGEST

Radio-Electronics

WHAT'S NEW IN MINI PORTABLE COLOR TV CAMERAS

$1.75 DEC. 1984

COMPUTERS - VIDEO - STEREO - TECHNOLOGY - SERVICE

New flat-panel color-TV fits in the palm of your hand

How to repair your videodisc player

Build R-E's high-performance high-power FET audio amp

Build R-E's Atari duplicator. Transfer your game cartridges to cassette tape

PLUS:

- ★ Bob Cooper on Satellite TV
- ★ New Ideas ★ Service Clinic
- ★ Equipment Reports

ENDICOTT NY 13760
326 STEIN DR
JOSEPH L OZVOLD 12#LF
585280 OVO 03265092 14 A DEC87
***************5-DIGIT 13760

48783

0 71896 48783

www.americanradiohistory.com

LEADER

Great oscilloscopes from 15 to 35 MHz with outstanding features and new low prices.

We've designed brand new low and medium bandwidth oscilloscopes and built in many features you may never have seen in similar units. Surprising? Not any more. It's exactly the kind of innovative technology and superb quality you expect from Leader.

Ever see trigger holdoff on a 20 MHz scope? Or 500 µV sensitivity?

Now Leader gives you these and so much more. Check it out:

LBO-524/LBO-524L: 35 MHz, $995/$1050
- CALIBRATED DUAL TIME BASE
- 500 µV SENSITIVITY
- 7 kV PDA 6″ CRT
- INTERNAL GRATICULE
- DELAYED SWEEP TRIGGERED FUNCTION
- VARIABLE SWEEP HOLDOFF
- ALTERNATE CHANNEL TRIGGERING
- AUTO FOCUS
- CHANNEL 1 OUTPUT

LBO-523: 35 MHz, $895
- 7 kV PDA 6″ CRT
- INTERNAL GRATICULE
- 500 µV SENSITIVITY
- VARIABLE SWEEP HOLDOFF
- ALTERNATE CHANNEL TRIGGERING
- AUTO FOCUS
- CHANNEL 1 OUTPUT

LBO-522: 20 MHz, $695
- 500 µV SENSITIVITY
- 6″ CRT
- INTERNAL GRATICULE
- ALTERNATE CHANNEL TRIGGERING
- VARIABLE SWEEP HOLDOFF
- AUTO FOCUS
- CHANNEL 1 OUTPUT

LBO-513A/LBO-514A: 15 MHz, $470/$595
- 1 mV SENSITIVITY
- 0.5 µS SWEEP SPEED
- X-Y MODE CAPABILITY

Two-year warranty. Evaluation units.

Our two-year warranty (even on the CRT) is backed by factory service depots on both coasts. Evaluation units are available to qualified customers.

Call toll-free
(800) 645-5104
In New York State
(516) 231-6900

Contact us for: information on 15 to 100 MHz and digital storage oscilloscopes; an evaluation unit; your nearest "Select" Leader distributor's name; and a full-line catalog.

For professionals who know the difference.

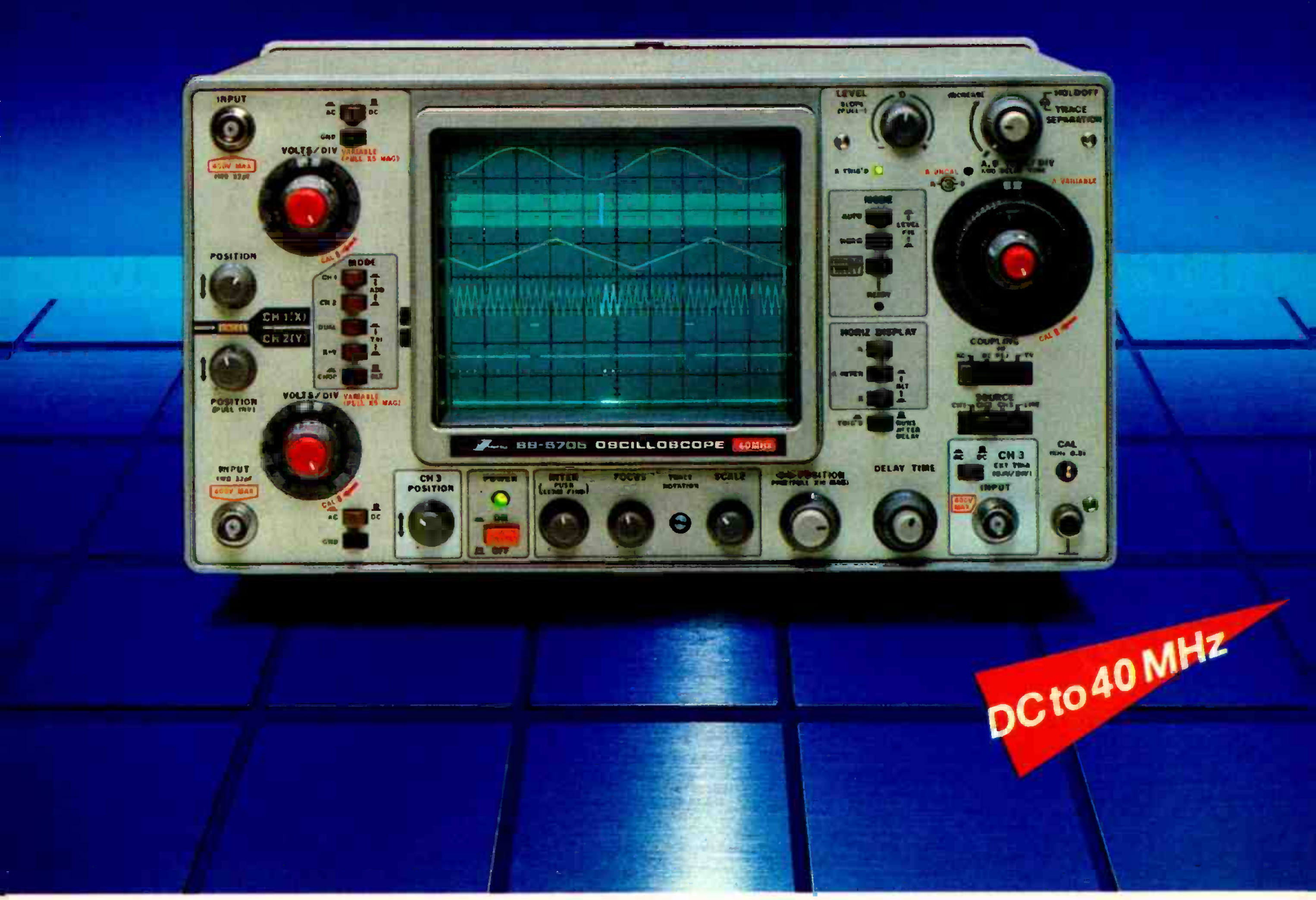
LEADER Instruments Corporation

380 Oser Avenue
Hauppauge, New York 11788
Regional Offices:
Chicago, Dallas, Atlanta, Los Angeles, Boston
In Canada call Omnitronix Ltd.
(514) 337-9500

CIRCLE 271, 272 ON FREE INFORMATION CARD

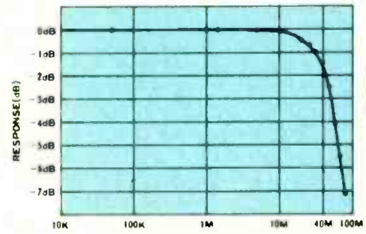
www.americanradiohistory.com

SS-5705, THE ALL-NEW 3-INPUT 6-TRACE 40 MHz OSCILLOSCOPE FROM IWATSU

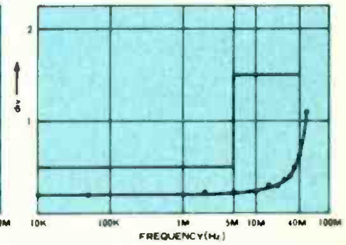


- **H and V axes accurate to within ±2 %**
- **CRT with 12 kV accelerating voltage for bright traces**
- **Three input channels, six traces:** an enlarged delayed sweep waveform can be displayed for each channel for a total of 6 simultaneous traces. Each channel has its own position control.
- **Maximum delay jitter of 1/20,000**
- **Fastest sweep rate of 10 ns/div**
- **Jitterless circuitry** for stable high frequency signals observation.
- **High sensitivity:** 1 mV/div
- **CH 1 signal output** 50 mV/div (into 50 Ω)
- **High-stability calibrator** with frequency and voltage accurate to within ±1 %.
- **Stable observation of video signals possible**
- **Traces do not shift when the attenuator is switched**
- **Pushbutton controls** for easier operability and improved reliability.
- **Accuracy guaranteed** in temperatures ranging from 10 to 35°C (50 to 95°F).
- **Variable holdoff** for triggering when observing complicated waveforms.
- **FIX triggering**
- **Beam finder**

- **Frequency response extends beyond 40 MHz rating**



- **Superb trigger sensitivity** freezes even low level signals.



- **Single sweep:** essential if waveforms are to be photographed.
- **Trace rotation control** allows compensation for inclination of traces due to terrestrial magnetism.
- **Two probes provided as standard accessories:** both switchable between 10:1 and 1:1.
- **Wide range of optional extras** for more diverse applications.
- **Compact and lightweight:** 282W x 152H x 403D mm (11-1/8" x 6" x 15-7/8"), 7.2 kg (15.9 lbs).

IWATSU

IWATSU INSTRUMENTS INC.

430 Commerce Boulevard, Carlstadt, NJ 07072 Phone: (201) 935-5220 TLX: 7109890255

CIRCLE 64 ON FREE INFORMATION CARD

www.americanradiohistory.com

NEW!

uniden®

Bearcat®

Products

Communications Electronics,™ the world's largest distributor of radio scanners, is pleased to announce that *Bearcat* brand scanner radios have been acquired by Uniden Corporation of America. Because of this acquisition, Communications Electronics will now carry the complete line of Uniden *Bearcat* scanners, CB radios and Uniden *Bandit*™ radar detectors. To celebrate this acquisition, we have special pricing on the Uniden line of electronic products.

Bearcat®† 300-E

List price $549.95/**CE price $339.00**
7-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.

Bearcat® 20/20-E

List price $449.95/**CE price $269.00**
7-Band, 40 Channel • Crystalless • Searches AM Aircraft and Public Service bands • AC/DC Priority Channel • Direct Channel Access • Delay
Frequency range 32-50, 118-136 AM, 144-174, 420-512 MHz.
Find an easy chair. Turn on your *Bearcat* 20/20 and you're in an airplane cockpit. Listening to all the air-to-ground conversations. Maybe you'll pick up an exciting search and rescue mission on the Coast Guard channel. In a flash, you're back on the ground listening as news crews report a fast breaking story. Or hearing police and fire calls in your own neighborhood, in plenty of time so you can take precautions. You can even hear ham radio transmission, business phone calls and government intelligence agencies. Without leaving your easy chair. Because you've got a *Bearcat* 20/20 right beside it.

The *Bearcat* 20/20 monitors 40 frequencies from 7 bands, including aircraft. A two-position switch, located on the front panel, allows monitoring of 20 channels at a time.

Bearcat® 210XL-E

List price $349.95/**CE price $209.00**
6-Band, 18 Channel • 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.

Bearcat® 260-E

List price $399.95/**CE price $249.00**
8-Band, 16 Channel • Priority • AC/DC
Frequency range 30-50, 138-174, 406-512 MHz.
Keep up with police and fire calls, ham radio operators and other transmission while you're on the road with a *Bearcat* 260 scanner. Designed with police and fire department cooperation, its unique, practical shape and special two-position mounting bracket makes hump mounted or under dash installation possible in any vehicle. The *Bearcat* 260 is so ruggedly built for mobile use that it meets military standard 810c, curve y for vibration rating. Incorporated in its rugged, all metal case is a specially positioned speaker delivering 3 watts of crisp, clear audio.

NEW! Bearcat® 201-E

List price $279.95/**CE price $179.00**
9-Band, 16 Channel • Crystalless • AC only Priority • Scan Delay • One Key Weather
Frequency range 30-50, 118-136 AM, 146-174, 420-512 MHz.
The *Bearcat* 201 performs any scanning function you could possibly want. With push button ease, you can program up to 16 channels for automatic monitoring. Push another button and search for new frequencies. There are no crystals to limit what you want to hear.

NEW! Bearcat® 180-E

List price $249.95/**CE price $149.00**
8-Band, 16 Channel • Priority • AC only
Frequency range: 30-50, 138-174, 406-512 MHz.
Police and fire calls. Ham radio transmissions. Business and government undercover operations. You can hear it all on a *Bearcat* 180 scanner radio. Imagine the thrill of hearing a major news event unfold even before the news organizations can report it. And the security of knowing what's happening in your neighborhood by hearing police and fire calls in time to take precautions. There's nothing like scanning to keep you in-the-know, and no better way to get scanner radio performance at a value price than with the *Bearcat* 180.

Bearcat® 100-E

The first no-crystal programmable handheld scanner.
List price $449.95/**CE price $234.00/*SPECIAL!***
8-Band, 16 Channel • Liquid Crystal Display Search • Limit • Hold • Lockout • AC/DC
Frequency range: 30-50, 138-174, 406-512 MHz.
The world's first no-crystal handheld scanner has compressed into a 3" x 7" x 1¼" case more scanning power than is found in many base or mobile scanners. The *Bearcat* 100 has a full 16 channels with frequency coverage that includes all public service bands (Low, High, UHF and "T" bands), the 2-Meter and 70 cm. Amateur bands, *plus* Military and Federal Government frequencies. It has chrome-plated keys for functions that are user controlled, such as lockout, manual and automatic scan. Even search is provided, both manual and automatic. Wow...what a scanner!

The *Bearcat* 100 produces audio power output of 300 milliwatts, is track-tuned and has selectivity of better than 50 dB down and sensitivity of 0.6 microvolts on VHF and 1.0 microvolts on UHF. Power consumption is kept extremely low by using a liquid crystal display and exclusive low power integrated circuits.

Included in our low CE price is a sturdy carrying case, earphone, battery charger/AC adapter, six AA ni-cad batteries and flexible antenna. The *Bearcat* 100 is in stock for quick shipment, so order your scanner today.

Bearcat® DX1000-E

List price $649.95/**CE price $489.00**
Frequency range 10 kHz to 30 MHz.
The *Bearcat* DX1000 shortwave radio makes tuning in London as easy as dialing a phone. It features PLL synthesized accuracy, two time zone 24-hour digital quartz clock and a built-in timer to wake you to your favorite shortwave station. It can be programmed to activate peripheral equipment like a tape recorder to record up to five different broadcasts, any frequency, any mode, while you are asleep or at work. It will receive AM, LSB, USB, CW and FM broadcasts.

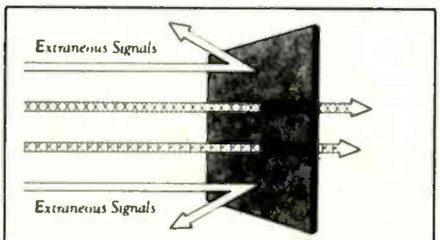
There's never been an easier way to hear what the world has to say. With the *Bearcat* DX1000 shortwave receiver, you now have direct access to the world.

Uniden® PC22-E

List price $159.95/**CE price $99.00**
The *Uniden* PC22 is a 40 channel AM remote mobile CB radio. It's the answer for today's smaller cars which don't always provide adequate space for mounting. Since all the controls are on the microphone, you can stash the "guts" in the trunk. The microphone has up/down channel selector, digital display, TX/RX indicator and external speaker jack. Dimensions: 5¾" W x 7⅞" D x 1½" H. 13.8 VDC, positive or negative ground.

QUANTITY DISCOUNTS AVAILABLE

Order two scanners at the same time and deduct 1%, for three scanners deduct 2%, four scanners deduct 3%, five scanners deduct 4% and six or more scanners purchased at the same time earns you a 5% discount off our super low single unit price.



Both Bandit™ radar detectors feature E.D.I.T.™ the Electronic Data Interference Terminator that edits-out false alarm signals.

Uniden® PC33-E

List price $59.95/**CE price $44.00**
The *Uniden* PC33 boasts a super-compact case and front-panel mike connector to fit comfortably in today's smaller cars. *Controls:* Power & Volume, Squelch; *Switches:* ANL. Other features of the PC33 include Graduated LED "S"/RF Meter, Digital channel indicator. Dimensions: 6" W x 6" D x 1⅞" H. ±13.8 VDC.

Uniden® PC55-E

List price $89.95/**CE price $59.00**
The full featured *Uniden* PC55 front-panel mike connector makes installation easier when space is a factor. It has ANL, PA-CB, Channel 9 and RF Gain switches. LED "S"/RF meter, TX lite, PA & external speaker jacks. Dimensions: 6" W x 6" D x 1⅞" H. ±13.8 VDC.

Bandit™ Radar Detectors

Now that everyone else has taken their best shot at radar detection, the Uniden Bandit™ has done them one better...with E.D.I.T.,™ the Electronic Data Interference Terminator that actually edits-out false alarm signals.

The Bandit 55, features a convenient brightness/dimmer control for comfortable day or night driving, plus a handy highway/city control for maximum flexibility wherever you drive. The Bandit 95 Remote, is a two-piece modular unit that lets you mount the long-range radar antenna behind the grill, out of view. The ultra-compact control unit can then be inconspicuously tucked under the dash or clipped to the visor. Order **Bandit 55-E** for $119.00 each or the **Bandit 95-E Remote** for $139.00 each.

OTHER RADIOS AND ACCESSORIES

FB-E-E Frequency Directory for Eastern U.S.A. $12.00
FB-W-E Frequency Directory for Western U.S.A. ... $12.00
BC-WA-E Bearcat Weather Alert™ $35.00
A60-E Magnet mount mobile antenna $35.00
A70-E Base station antenna $35.00
Add $3.00 shipping for all *accessories* ordered at the same time.
Add $3.00 shipping per scanner antenna.

BUY WITH CONFIDENCE

To ***get the fastest delivery from CE*** of any product in this ad, send or phone your order directly to our Scanner Distribution Center.™ Michigan residents please add 4% sales tax or supply your tax I.D. number. 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, acceptance and verification. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. All prices are in U.S. dollars. Out of stock items will be placed on backorder automatically unless CE is instructed differently. A $5.00 additional handling fee will be charged for all orders with a merchandise total under $50.00. Shipments are F.O.B. Ann Arbor, Michigan. No COD's. 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. Non-certified checks require bank clearance.

Mail orders to: Communications Electronics,™ Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add $7.00 per scanner, radar detector or CB or $12.00 per shortwave receiver for U.P.S. *ground* shipping and handling in the continental U.S.A. For Canada, Puerto Rico, Hawaii, Alaska, or APO/FPO delivery, shipping charges are three times continental U.S. rates. If you have a Visa or Master Card, you may call and place a credit card order. Order toll-free in the U.S. Dial 800-521-4414. In Canada, order toll-free by calling 800-221-3475. WUI Telex CE anytime, dial 671-0155. If you are outside the U.S. or in Michigan dial 313-973-8888. Order today.

Scanner Distribution Center™ and CE logos are trademarks of Communications Electronics.™ Ad # 070184-E
† *Bearcat* is a registered trademark of Uniden Corporation.
Copyright © 1984 Communications Electronics

Order Toll Free . . . call
1-800-521-4414

COMMUNICATIONS ELECTRONICS™

Consumer Products Division

818 Phoenix ☐ Box 1002 ☐ Ann Arbor, Michigan 48106 U.S.A.
Call TOLL-FREE 800-521-4414 or outside U.S.A. 313-973-8888

CIRCLE 79 ON FREE INFORMATION CARD

www.americanradiohistory.com

DECEMBER 84

Radio-Electronics
Electronics publishers since 1908

Vol. 55 No. 12

SEASON'S GREETINGS

The editors and staff of Radio-Electronics join in sending holiday greetings and our best wishes for a happy new year

As a service to readers, Radio-Electronics publishes available plans or information relating to newsworthy products, techniques and scientific and technological developments. Because of possible variances in the quality and condition of materials and workmanship used by readers, Radio-Electronics disclaims any responsibility for the safe and proper functioning of reader-built projects based upon or from plans or information published in this magazine.

www.americanradiohistory.com

COVER 1

Flat-panel color TV's have been promised for many years, but before an appropriate display for those sets could be produced, major technical problems needed to be resolved. Epson has resolved many of those problems, and the results of its efforts—a tiny pocket-sized TV—should be available soon. This month we'll look at that tiny TV, the flat-panel LCD display that it uses, and the technology that makes both possible. The story, which is part of our special video-entertainment section, begins on page 57.

NEXT MONTH

ON SALE DECEMBER 20

VERSATILE VIDEO SWITCHER
Build this project and end your video-switching problems forever.

ALL ABOUT THERMISTORS
A look at those valuable components and how to use them.

ALL ABOUT VOLTAGE COMPARATORS
Learn about voltage comparators, including window comparators, and their applications.

ATARI GAME RECORDER
More on a device that lets you store your library of games for the 2600 on cassette tape!

AND LOTS MORE!

Radio-Electronics

Hugo Gernsback (1884-1967) founder
M. Harvey Gernsback, editor-in-chief
Larry Steckler, CET, publisher

EDITORIAL DEPARTMENT
Art Kleiman, editor
Brian C. Fenton, technical editor
Carl Laron, WB2SLR, associate editor
Robert A. Young, assistant editor
Julian S. Martin, editorial associate
Byron G. Wels, editorial associate
Jack Darr, CET, service editor
Robert F. Scott, semiconductor editor
Herb Friedman, communications editor
Earl "Doc" Savage, K4SDS, hobby editor
Bob Cooper, Jr. satellite-TV editor
Robert Grossblatt, circuits editor
David Lachenbruch, contributing editor
Lou Frenzel, contributing editor
Bess Isaacson, editorial assistant

PRODUCTION DEPARTMENT
Ruby M. Yee, production manager
Robert A. W. Lowndes, editorial production
Dianne Osias, advertising production
Karen Tucker, production traffic

CIRCULATION DEPARTMENT
Jacqueline P. Weaver, circulation director
Rita Sabalis, assistant circulation director
Jacqueline Allen, circulation assistant

Cover photo by Robert Lewis

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

Microfilm & Microfiche editions are available. Contact circulation department for details.

Advertising Sales Offices listed on page 30.

Radio-Electronics, (ISSN 0033-7862) Published monthly by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Second-Class Postage paid at New York, NY and additional mailing offices. Second-Class mail authorized at Ottawa, Canada. One-year subscription rate U.S.A. and possessions $14.97, Canada $17.97, all other countries $22.47. All subscription orders payable in U.S.A. funds only, via international postal money order or check drawn on a U.S.A. bank. Single copies $1.75. © 1984 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

POSTMASTER: Please send address changes to RADIO-ELECTRONICS, Subscription Dept., Box 2520, Boulder, CO 80322.

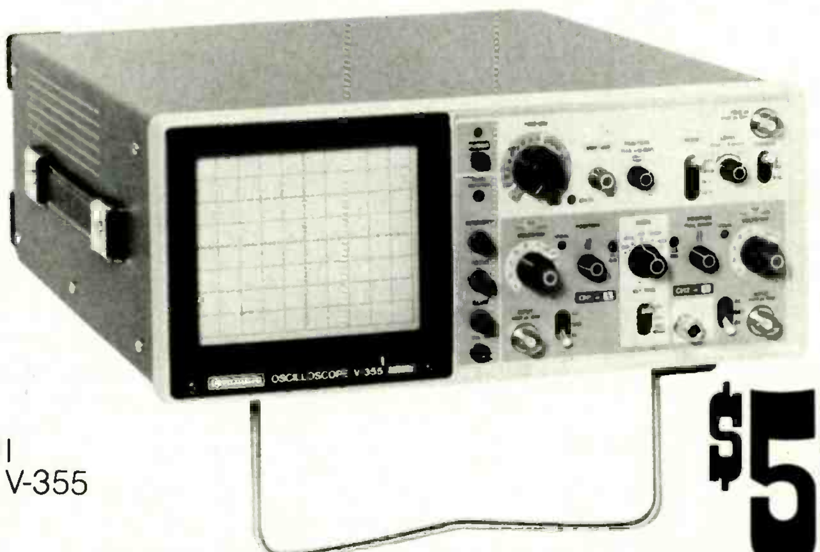
A stamped self-addressed envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.

www.americanradiohistory.com

THE MOST WANTED OSCILLOSCOPE...

HITACHI

35 MHz Dual Trace



HITACHI
Cat. No. V-355

$599.95 With Probes

OFF-THE-SHELF DELIVERY

Description Its thin, light, compact design features a large 6 inch rectangular, internal graticule CRT with percent calibrations, autofocus, scale illumination and photographic bezel.

Reward Eliminates distortion and parallax. High performance. Most cost effective scope around.

■ MASTERCARD ■ VISA ■ C.O.D. ■ MONEYORDER ■ CHECK

C.O.D.'s extra (required 25% deposit) • Add $8.50 for shipping and insurance • N.Y. State residents add appropriate sales tax

Fordham
260 Motor Parkway, Hauppauge, New York 11788

TOLL FREE
(800) 645-9518
In New York State Call 800-832-1446

www.americanradiohistory.com

WHAT'S NEWS

New "computerized home" uses TV, house wiring

General Electric has developed what may be an important step toward the fully automated home—a new electronic home-control system that uses the family television set and the electric wiring of the house to achieve its results.

The *HomeMinder* can virtually run the modern household: adjust temperatures, dim lights, turn appliances on at specific times, store messages, and display important dates and appointments. It provides in-home remote control, control away from home, and a memory that remembers things the user might forget.

The new "home controller" works through the house wiring, and TV screen visuals guide the user step by step. It will come in two versions—a unit that connects to the back of any TV set, or as a feature built into a 25-inch GE component television set.

The TV screen acts as a display, showing each room of the house, with numbered "menus" of lights and appliances, selectable by the remote control. The screen also displays simple instructions, as well as questions when the user seems unsure of the next step. Special modules tie appliances, overhead and outside lights, and the thermostat into the system via the existing house wiring.

The *HomeMinder* is expected to retail for about $500, depending on the number of modules required. Modules range from $20 to $40 each.

MODULES THAT MAKE THE *HOMEMINDER* WORK. The ApplianceMinder (left top) and LampMinder (next right) connect any lamp or appliance to the system. The Light Switch module (right) installs like a dimmer switch and connects indoor or outdoor lights to the *HomeMinder*. The Temperature Minder module (second from right) is attached under the existing thermostat and regulates heating and air conditioning. It connects to the power supply module beneath it. The MiniMinder remote control (lower left) can operate up to eight lights and appliances from any electric outlet in the home.

Radar detector makers organize against ban

Three of the country's leading radar detector manufacturers have formed RADAR (Radio Association Defending Airwave Rights) dedicated to keeping the sale and use of radar detectors legal in all 50 states. They invite other manufacturers to join them.

Since 1962, at least 40 states have tried (unsuccessfully) to pass legislation to make radar detectors illegal. In its short existence (it was founded in February 1984), RADAR has been instrumental in squelching at least twelve such attempts.

RADAR's defense is based on the fact that any state legislation prohibiting radar detectors is already preempted by Congressional mandate; the fact that police radar's capricious fallibility has been established, and the claim that a radar-detector ban would violate citizens' rights.

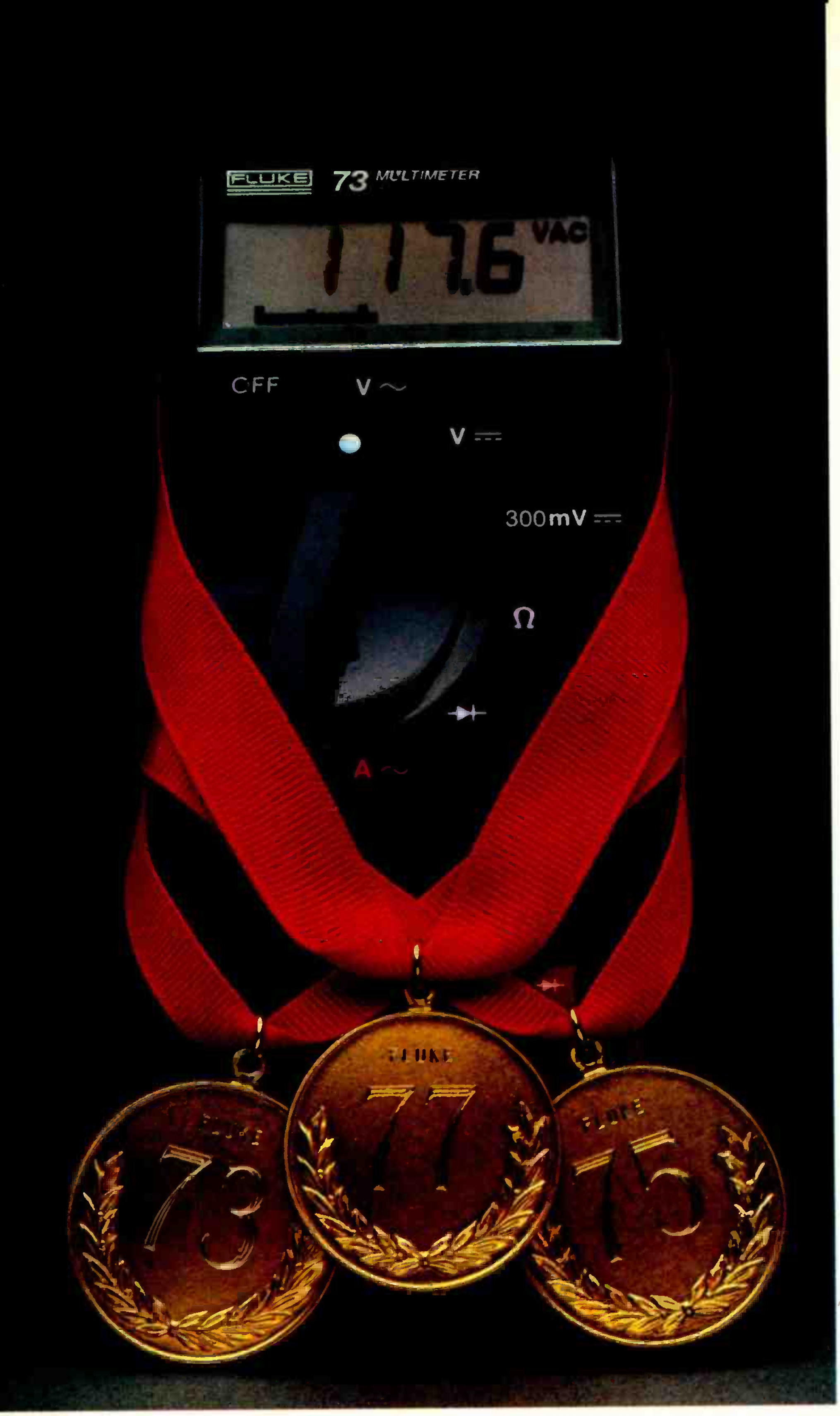
National Semiconductor breaks ground for lab

Construction has begun on a new $75 million National Semiconductor Corp. research and development center, in Santa Clara, CA. It will employ more than 500 people, and will be completed in the spring of 1985.

The research portion of the center will be devoted primarily to two advanced technology thrusts: CMOS and high-density bipolar processes. CMOS provides high speeds while consuming low power at a high level of reliability. High-density bipolar technology is being applied to classical logic applications and to VLSI products. Among those are microprocessor peripherals, hard-disk circuits, and local-area networks.

continued on page 8

www.americanradiohistory.com



Take home a world champion.

$85* gets you a technical knockout. **The Fluke 70 Series. Winners of the digital vs. analog battle.**

Since their debut, they've become the worldwide champions of the industry.

Never before have such tough, American-made meters offered so many professional features at such unbeatable prices.

Each comes with a 3-year warranty, 2,000+ hour battery life, and instant autoranging.

You also get the extra resolution of a 3200-count LCD display, plus a responsive analog bar graph for quick visual checks of continuity, peaking, nulling and trends.

Choose from the Fluke 73, the ultimate in simplicity. The feature-packed Fluke 75. Or the deluxe Fluke 77, with its own protective holster and unique "Touch Hold" function** that captures and holds readings, then beeps to alert you.

So don't settle for just a contender. Take home a world champion.

For your nearest distributor or a free brochure, call toll-free anytime **1-800-227-3800, Ext. 229.** From outside the U.S., call 1-402-496-1350, Ext. 229.

FROM THE WORLD LEADER IN DIGITAL MULTIMETERS.

FLUKE 73	FLUKE 75	FLUKE 77
$85*	$99*	$129*
Analog/digital display	Analog/digital display	Analog/digital display
Volts, ohms, 10A, diode test	Volts, ohms, 10A, mA, diode test	Volts, ohms, 10A, mA diode test
Autorange	Audible continuity	Audible continuity
0.7% basic dc accuracy	Autorange/range hold	"Touch Hold" function
2000+ hour battery life	0.5% basic dc accuracy	Autorange/range hold
3-year warranty	2000+ hour battery life	0.3% basic dc accuracy
	3-year warranty	2000+ hour battery life
		3-year warranty
		Multipurpose holster

* Suggested U.S. list price, effective July 1, 1984.
** Patent pending.

FLUKE®

Copyright © 1984, John Fluke Mfg. Co., Inc. All rights reserved. Ad No. 4701-70

www.americanradiohistory.com

WHAT'S NEWS

continued from page 6

Joint effort to end illegal phone use

An ITT Corp. task force, the Federal Bureau of Investigation (FBI), and other law enforcement agencies are engaged in a major crackdown on illegal users of the ITT Longer Distance telephone service. That service is provided to residential and business customers in 113 major metropolitan areas. To place a call on the system, customers dial a special access code, then the telephone number, and finally a confidential authorization code, which bills the call to the customer's account.

The perpetrators have been placing phone calls illegally by using authorization codes assigned to ITT customers. In one such case, an FBI investigation led to the indictment of a former ITT employee, Oliver Benner, who was charged with selling ITT's confidential authorization codes.

The indictment charges that Benner supplied the codes to a New Jersey company, which used them in a nationwide campaign to sell its products through its large telephone sales force. If convicted on all charges, Mr. Benner could be sentenced to 40 years in prison and fined up to $17,000.

Solid-state TV camera makes better pictures

A color camera using three charge-coupled devices (CCD's) instead of camera tubes has been introduced by RCA. The new camera, intended especially for news and sports coverage, can see much greater detail in rapidly moving objects and performs over a wider range of lighting conditions than tube-type cameras.

The new camera eliminates red streaks or "comet tails" behind rapidly moving lights, or "streaking" behind a fast-moving baseball. It can produce clear images in dark shadows while simultaneously handling bright lights in the same scene.

The CCD's in the new camera have 403 horizontal and 512 vertical picture elements. Under well-lit conditions, with little or no motion, resolution of the CCD and the ⅔-inch tube camera is about the same. In low light or rapid action, the CCD is markedly better.

The camera is immune to magnetic fields and acoustic interference, and is exceptionally capable of handling bright highlights.

New message service to minimize costs

A new communications service, which is expected to make it possible for small businesses to send and receive international messages for a small fraction of the cost of Telex or similar services, has been initiated by Service Systems Technology (SST) of Marina del Rey, CA and Milan, Italy.

Known as TINA International Message Service, the new system has one limitation as compared with Telex or similar services: Communication is between subscribers in U.S. or foreign "gateway cities," or more specifically, from the computer of a subscriber to the computer at his other "electronic mailbox." (There are 13 gateway cities in California, 9 in New Jersey.)

A subscriber dials a local number to get on an international network, then sends his message through a modem attached to his telephone. The network is that of INFONET, which has offices worldwide.

Cost of the service, which includes two "electronic mailboxes" and two hours of computer time, is $99.60 per month. That charge, says SST, gives subscribers the amount of service that would cost about $2200 by conventional services. Extra computer connect time is obtainable at $58.60 per hour. Extra electronic mailboxes and user I.D.'s are $10 per month.

New company to operate Landsat satellites?

The new Earth Observation Satellite Co. (EOSAT) has submitted to the Department of Commerce a proposal to operate the network of satellites now being managed by the Department's Oceanic and Atmospheric Administration (NOAA). It would also be responsible for designing, fabricating, and launching additional Landsat satellites. The new corporation is a joint venture of Hughes Aircraft Co. and RCA Corp.

The proposal calls for a 12-year program to operate the existing facilities at NASA's Goddard Space Flight Center, and to build and launch four satellites, each with advanced instrumentation and a five-year design life.

The satellites view the world with high-resolution sensors that distinguish an area only 30 meters square. They circle the earth in a polar orbit at an altitude of 438 miles, passing over practically every spot on the globe every 16 days.

They have provided governments and private industry with information about the earth's vegetation, mineral resources, and marine and atmospheric conditions. The satellites have helped predict crop and forest yields and have monitored pollution. **R-E**

www.americanradiohistory.com

OK's Hot Tip for Desoldering Problems

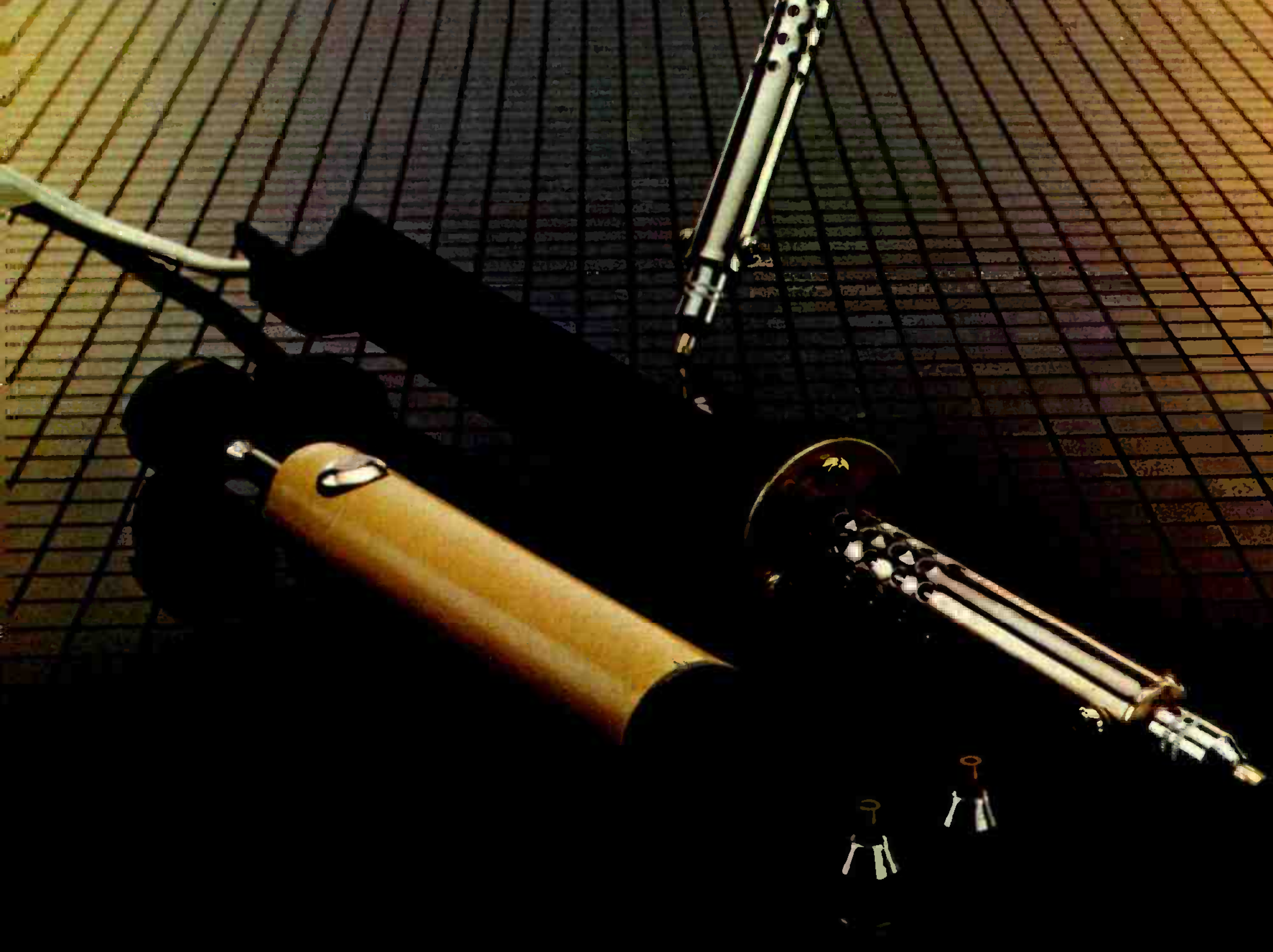
SA-6 DESOLDER IRON

Revolutionary new electric desoldering iron combines the ease and portability of a hand-held, manual, desolder pump, with performance of an industrial desolder station. This unique AC powered compact tool features portable, one-hand desoldering eliminating the need for separate soldering iron and desolder pump. No shop air required. Essential for all tool kits, field service technicians, and repairmen, as well as production applications. Vacuum chamber is easily removed for cleaning or replacement. Replacement tips available. Tool is supplied with SAT-6-059 tip; diameter .059 inch (1,5mm).

FEATURES:

- *Self contained suction power and heating element.*
- *Economical.*
- *Lightweight 4oz. (113gms).*
- *Compact size 10¼ inches (26cm).*
- *Replacement nozzles available.*

MODEL NO.	INPUT VOLTAGE	
SA-6-115	115V AC 50/60Hz	
SA-6-230	230V AC 50/60Hz	
NOZZLE	NOZZLE HOLE DIAMETER	
	INCH	MM
SAT-6-059	.059	1,5
SAT-6-070	.070	1,77



3455 Conner Street, Bronx, New York 10475, U.S.A.
Telex 125091 OK NYK. Telex 232395 OK NY UR.
Phone (212) 994-6600.

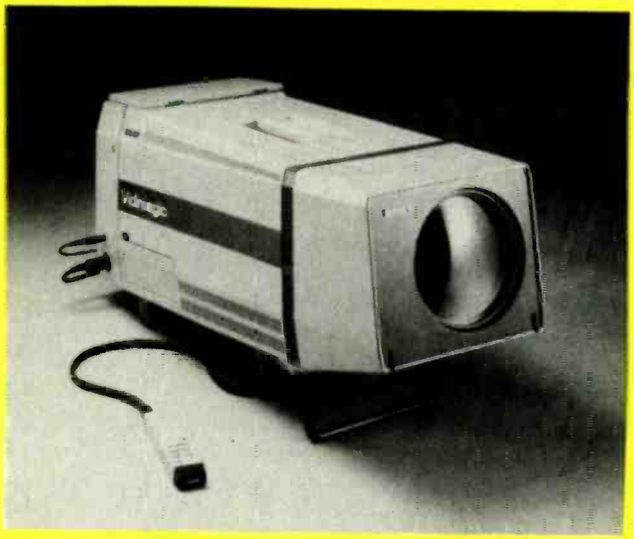
OK Industries Inc.

www.americanradiohistory.com

VIDEO NEWS

DAVID LACHENBRUCH
CONTRIBUTING EDITOR

• **New tube.** Sony's unique *Vidimagic,* which has a list price of $2,995, is an all-in-one combination of projection TV, *Betamax* VCR, 181-channel TV tuner, and PA system. Designed for the industrial-TV market and looking like a large cannister vacuum cleaner, it weighs 34 pounds. One end is a fast *f1* projection lens assembly, the other end a videocassette receptacle.



What is truly unique about *Vidimagic* is its picture tube—Sony's first *Indextron* color tube, which uses the principles of beam indexing—almost as old as shadow-mask technology but never fully developed because of the problems of circuit design, which Sony presumably has solved with IC technology. The *Indextron* uses a single gun and no shadow mask, the electron beam being directed to the proper phosphor stripe electronically. Thus, Sony says, nearly 70% of the electrons land on the screen and activate phosphors, as opposed to about 20% in a shadow-mask-type tube. *Vidimagic* is brighter than previous single-tube projection systems, requires no convergence, and can project a picture from 30 to 200 inches in diagonal measurement.

• **Toward a $995 camcorder.** The one-piece video camera-recorder combination, or camcorder, seems to be coming into its own, and manufacturers are tracking its progress very carefully. So far, all approaches appear to have some drawbacks. The *Betamovie* is a record-only machine and the tape can be played back only on a separate Beta deck. The VHS *VideoMovie* uses the small VHS-C cassette, which permits only 20 minutes of recording. The new 8mm format is non-standard and incomptatible with 1/2-inch tapes. And all camcorders so far have one thing in common—they're expensive. Most manufacturers believe that, in order to become a true mass-market product, the camcorder must use a full-sized standard 1/2-inch cassette, be capable of recording and playing back, and retail for less than $1,000. As a result, Japanese VCR manufacturers are developing such units in both Beta and VHS formats. When they come—probably in about two years—those units will be relatively stripped-down, simple-to-use machines. They will weigh somewhat more than the 5-1/2 to 6-1/2 pounds of current camcorders, and probably will record at a single speed, Beta II or VHS SP, for two hours per cassette.

• **Picture-tube chaos.** The unexpectedly high sales of color-TV sets and the proliferation of tube types have both contributed to a shortage of picture tubes throughout 1984, as the tube and glass industries work at capacity to keep up with demand. Manufacturers of glass for tube bulbs and funnels, and of metal shadow masks, are undergoing major expansions to try to keep up with demand. One of the biggest problems is the vast increase in the number of picture-tube sizes and types. There are still tubes being made in the traditional 13, 15, 19, 21, and 25-inch sizes. In addition, there are the new square-cornered versions in 14, 20, and 26 inches, with a 27-incher coming up. Then in those new sizes, there are both the rounded and the flattened faceplates. To make matters worse, there are at least three different transparencies of glass—the high-brightness 85% light transmission glass and the high-contrast 52% glass, plus the new blue-tinted glass. R-E

www.americanradiohistory.com

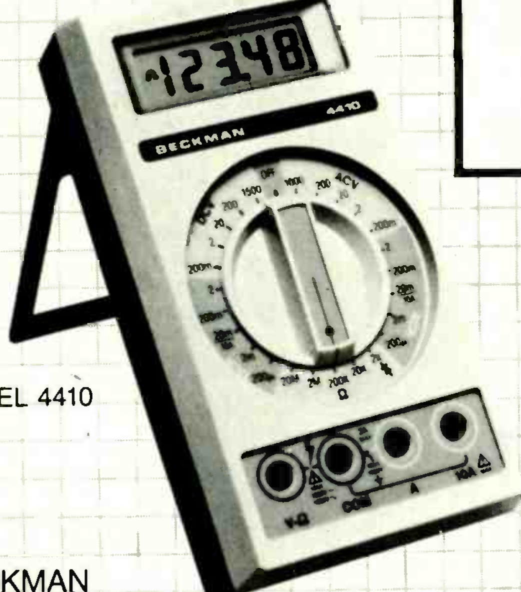
DATA PRECISION HITACHI TRIPLETT FLUKE AWS DORIC HICKOK VIZ RCA

NEW

Beckman Circuit-mate DM10

$39.95 in stock now

...Quality *and* Performance Beckman *and* 4½ Digits... True RMS



MODEL 4410

BECKMAN does it again . . . a true RMS 4½ DMM w/1 year calibrated cycle at a 3½ digit price.

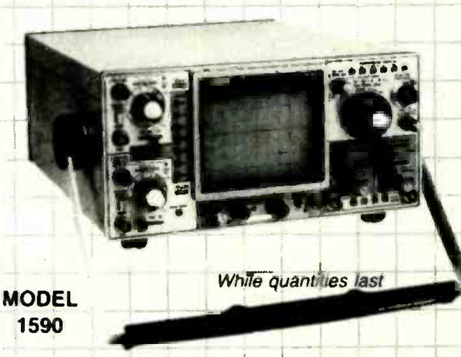
$239.00

AVAILABLE NOW!

DC V	200mV, 2V, 20V, 200V, 1500V .06%
AC V	200mV, 2V, 20V, 200V, 1000V ±0.5%
DC A	200μA, 2mA, 20mA, 200mA, 2A, 10A 0.3%
AC A	200μA, 2mA, 20mA, 200mA, 2A, 10A 0.8%
Ω	2K, 20K, 200K, 2M, 20M ±0.1%

HAPPY HOLIDAYS

B+K PRECISION 100MHz Dual Time BASE SCOPE



While quantities last

MODEL 1590

- 1mV/division sensitivity to 100MHz
- 500μ V/division cascade sensitivity
- 2ns/division sweep rate with 10 × magnifier
- Four-input operation provides trigger views or four separate inputs
- Selectable 1MΩ or 50Ω inputs
- Alternate timebase operation
- 20MHz bandwidth limiter for best view of low frequency signals
- Lighted function pushbuttons employing electronic switching with non-volatile RAM memory
- Switching power supply delivers best efficiency and regulation at lowest weight
- Selectable frequencies for chop operation

TOLL FREE HOT LINE
800-223-0474
212-730-7030
26 WEST 46th STREET, NEW YORK, N.Y. 10036

THE TEST EQUIPMENT SPECIALISTS
ADVANCE ELECTRONICS

www.americanradiohistory.com

PHILIPS KEITHLEY WESTON NLS Non-Linear Systems Simpson B+K PRECISION LEADER

77
- 0.3% Accuracy
- Manual or Autorange
- 10A + mA Range
- Beeper
- "Touch-Hold" Function

Sale **$119.95**

WE CARRY A FULL LINE OF FLUKE MULTI-METERS.
IN STOCK NOW

Sale ends Jan. 85

FLUKE SERIES 70 MULTIMETERS

• Analog Display • Rotary Knob • Volts AC & DC • Resistance to • 32 MΩ • 10 Amps • Diode Test • 3200 Counts • Fast Autoranging • Function Annunciators in Display • Power-Up Self Test • 2000 + Hour Battery Life w/ Power Down "Sleep Mode" • New Test Leads • VDE & UL Approval

$99.00

75
- 0.5% Accuracy
- Manual or Autorange
- 10A + 300 mA Range
- Beeper

$79.95

and free C70 holster **73**

- 0.7% Accuracy
- Autorange Only
- 10 Amp Only

4½ DIGIT MULTIMETERS

$349.00

MODEL 8060A

FLUKE
- Frequency measuements to 200KHz
- dB measurements
- Basic dc accuracy 0.4%; 10µV, 10 nA and 10 mΩ sensitivity
- Relative measurements
- True RMS
- High-speed Beeper

B+K PRECISION

70 MHz Dual Time Base SCOPE

MODEL 1570

$995.00

PRICE DOES NOT INCLUDE PROBES
- 1mV/division sensitivity to 70 MHz
- 500 µ V/division cascade sensitivity
- Four-input operation provides trigger view on 4 separate inputs
- Alternate time base operation
- Switching power supply delivers best efficiency and regulation at lowest weight

B+K PRECISION POWER SUPPLIES

$299.95 **MODEL 1601**
- Isolated 0-50VDC, continuously variable; 0-2A in four ranges
- Fully automatic shutdown, adjustable current limit
- Perfect for solid state servicing

$329.95 **MODEL 1650**
- Functions as three separate supplies
- Exclusive tracking circuit
- Fixed output 5VDC, 5A
- Two 0 to 25VDC outputs at 0.5A
- Fully automatic, current-limited overload protection

B+K PRECISION

INDUSTRIAL TRANSISTOR TESTER

$199.95

MODEL 520B
- Now with HI/LO Drive
- Works in-circuit when others won't
- Identifies all three transistor leads
- Random lead connection
- Audibly and visually indicates GOOD transistor

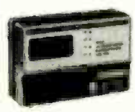
FUNCTION GENERATORS

MODEL 3010 **$189.95**
- Sine, square and triangle output
- Variable and fixed TTL outputs
- 0.1 Hz to 1MHz in six ranges
- Push button range and function selection
- Typical sine wave distortion under 0.5% from 1 Hz to 100kHz

MODEL 3020 **$319.95**

SWEEP FUNCTION
- Four instruments in one package — sweep generator, function generator, pulse generator, toneburst generator
- Covers 0.02Hz-2MHz
- 1000:1 tuning range
- Low-distortion high-accuracy outputs

CAPACITANCE METERS



$199.95

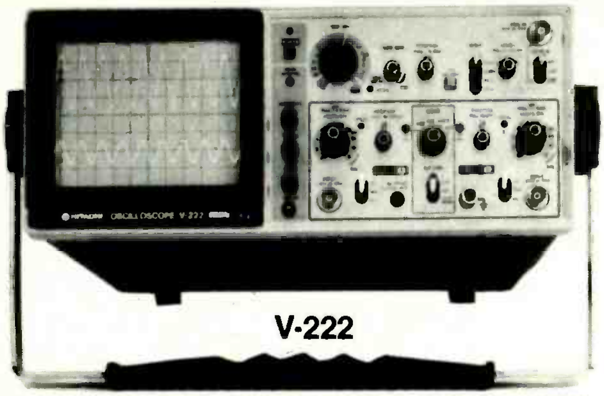
MODEL 830
- Automatically measures capacitance from 0.1pF to 200mF
- 0.1pF resolution
- 0.2% basic accuracy
- 3½ digit LCD display

$159.95

MODEL 820
- Resolves to 0.1pF
- 4 digit easy-to-read LED display
- Fuse protected against charged capacitors
- Overrange indication

www.americanradiohistory.com

DATA PRECISION · HITACHI TRIPLETT · FLUKE · AWS · DORIC · HICKOK · VIZ RCA



HITACHI

V-422 $599 95
DC to 40 MHz, 1mV/div, dual-trace, DC offset function

V-222 $499 95
DC to 20 MHz, 1mV/div, dual-trace, DC off. func., Alt. magnify function

V-212 $439 95
DC to 20 MHz, 1mV/div, dual-trace

$1,249 95
V-1050F
100 MHz Quad Trace w/delay sweep

V-650F $939 95
60 MHz Dual Trace w/delay sweep

PRICE DOES NOT INCLUDE PROBES. PROBES $50. A PAIR WHEN PURCHASED WITH SCOPE. $15 SHIPPING WITHIN CONTINENTAL U.S.

HI-PERFORMANCE PORTABLE OSCILLOSCOPES

ALL FEATURE 6" RECTANGULAR CRT
Full 2 year parts & labor warranty.

BECKMAN'S CIRCUITMATE ® ALL UNDER $100

AVAILABLE NOW. . . .

$64 95
Circuitmate DM 20—3½-digit, pocket-size multimeter; 0.8% Vdc accuracy, diode test, hFE test, conductance, 10 amps AC and DC ranges, auto-polarity auto-zero, auto-decimal

$79 95
Circuitmate DM-25—3½ digit, pocket-size multimeter; 0.5% Vac accuracy, diode test, capacitance, continuity beeper, conductance, 10 amps AC and DC ranges, auto-polarity, auto-zero, auto-decimal

$69 95
Circuitmate DM-40 — 3½-digit multimeter; 0.8% Vdc accuracy, diode test, auto-polarity, auto-zero, auto-decimal

$89 95
Circuitmate DM 45 — 3½-digit multimeter; 0.5% Vdc accuracy, diode test,continuity beeper, 10 amps AC and DC ranges, auto-zero, auto-polarity, auto-decimal

The DM73 is the smallest digital multimeter on the market. Its probe-style design makes it ideal for taking measurements in hard-to-reach test areas.

$63 95

- Small Size
- Complete Autoranging
- "Touch Hold"
- Audible continuity checking

$76 95
The DM 77 gives you the convenience of autoranging plus 10 amps ac/dc measurement capability. You simply select the function you want, and the DM 77 automatically sets the required range.

VISA

TOLL FREE HOT LINE
800-223-0474
212-730-7030
26 WEST 46th STREET, NEW YORK, N.Y. 10036

THE TEST EQUIPMENT SPECIALISTS
ADVANCE ELECTRONICS

www.americanradiohistory.com

SATELLITE TV

TVRO Evolution

BOB COOPER, JR.*
SATELLITE TV EDITOR

LAST TIME, WE LOOKED AT SOME OF THE basic elements of a TVRO. This month, we'll look at how those elements have evolved over the years.

Feed changes

Although the reflector and its mount are the first earthbound portions that the satellite signals "see," we'll start with the feed because it is positioned in front of the dish proper. The feed is a small antenna, designed (on purpose) to "see" just the surface of the dish, from which it intercepts and collects energy. The 1979/80 feed was typically built from brass, had a semi-rectangular shape, and presented little real mystery to the user. That was before "automatic feeds."

Feeds in 1979/80 had to be mechanically moved from one stationary position to another station position (turned or rotated on their own axis) when the user wished to change from one set of channels with *horizontal polarization* to another set with *vertical polarization*. To do that, without running outside to move something by hand, required that a small motor attached to the feed physically rotate the feed and the LNA it was attached to. As often as not, that small motor was a standard television antenna rotor pressed into service for that unusual function.

The 1984 feed is quite a sophisticated device. First of all, it is no longer rectangular; it is round. That round shape is supposed to match the reception abilities of the feed to the round surface of the dish. That's not hokum; it really helps.

FIG. 1

More important than the shape is the gadget inside: a tiny sensor that either moves a probe from one position (horizontal) to another position (vertical), or a non-moving ferrite material that twists the signals themselves as they pass by the ferrite.

The end result is that the user no longer has a small motor turning or twisting the LNA plus feed; he has an automatic switching system that matches the polarization of the antenna's feed system to the channel the user has tuned in.

In 1979/80, the user had to first determine what channel he wanted to tune in; then he had to decide whether that channel used horizontal or vertical polarization. Once he/she knew that, the next job was to decide which position the feed was already in and whether it needed to be rotated. If rotation was required, a cumbersome knob was turned and after 15 seconds had passed, the feed was now properly polarized. Finally, the channel/transponder could be changed!

In 1984, the viewer simply changes the transponder. Everything else is automatic. All of the control circuits are built into the receiver and the polarizer is controlled by those. Pretty neat, and exceedingy reliable.

Dish changes

It was not until early 1980 that the first firm (ADM/Antenna Development and Manufacturing) introduced a home-style dish that was designed from the ground up to be used by home TVRO's. Earlier dishes were either found in surplus-sale yards or they were the heavy-duty dishes created for commercial service. There was one interim stage in between. The very first dishes were actually fiberglass copies, struck off other fiberglass or metal dishes (as molds). ADM started from scratch with a petalized all-metal dish (like the one shown in Fig. 1) that was capable of being shipped coast to coast at reasonable shipping costs. Those that followed shortly thereafter were either copies of the original ADM or copies of older commercial-style dishes. Here's what the installer had to work with:

1) Surface accuracy or its trueness to the desired parabolic curve, was marginal. Piece antennas, such as the first ADM's, fitted together with some difficulty—primarily because of a lack of machin-

continued on page 20

*Publisher, CSD Magazine

www.americanradiohistory.com

Heathkit instruments. Some buy them for pride...some, to save money.

Whether you're pursuing a proud hobby...or earning a living, don't trust the accuracy of your measurements to anything less than Heathkit instruments.

Our kits are a little bigger, more rugged than "disposable" instruments that discourage self-servicing. Performance is superior, too. Just check the specs on our new IO-4360 Scope and IOA-4200 Time-Voltage Module.

Get to know our full line of instruments. They're built by experienced hands. Your hands. So they'll save money and help you do a better job. Heathkit instruments. Don't trust your pride or money to anything less.

Professional specs for serious users

1. IG-4244 Scope Calibrator. <1 ns rise time. 0.015% tolerance.
2. IO-4205 Dual-Trace 5 MHz Scope. 10mV/cm sensitivity.
3. IT-2232 Component Tracer. Checks circuits without power.
4. IP-2718 Power Supply. Fixed or adjustable supply. 5 to 20 VDC.
5. IG-1271 Function Generator. Sine, square, triangle waveforms. 0.1 Hz to 1 MHz.
6. IG-1277 Pulse Generator. 100 ns to 1 sec width pulses.
7. IT-5230 CRT Tester. Tests, cleans, restores CRT's.
8. IM-2264 DMM. True RMS readings. Full function meter.
9. IM-2420 Frequency Counter. 5Hz to 512 MHz. Accurate to 0.2 PPM. Includes period and frequency modes.
10. IM-2215 Hand-held DMM. Five DC ranges. Accuracy: ±0.25% of reading +1 count.
11. IT-2250 Capacitance Meter. 199.9 pF to 199.9 mF. Auto ranging.
12. IO-4360 Scope and IOA-4200 Time/Voltage Module. Triple trace, 60 MHz, <7 ns rise time. IOA-4200 controls CRT cursor and multi-function display.

Heathkit instruments.
The professional instruments.

more measurement for your money

Take another look at the instruments you should be building.

FREE
COLOR HEATHKIT CATALOG

Mail this coupon to:
Heath Company, Dept. 020-244
Benton Harbor, MI 49022

Name ______________________

Address ______________________

City ______________________

State ______________ Zip ______________

GX-395

Heathkit®
Heath Company

A subsidiary of Zenith Electronics Corporation

CIRCLE 86 ON FREE INFORMATION CARD

www.americanradiohistory.com

Learn robotics and you build this robot

New NRI home training prepares you for a rewarding career in America's newest high-technology field.

The wave of the future is here. Already, advanced robotic systems are producing everything from precision electronic circuits to automobiles and giant locomotives. By 1990, over 100,000 "smart" robots will be in use.

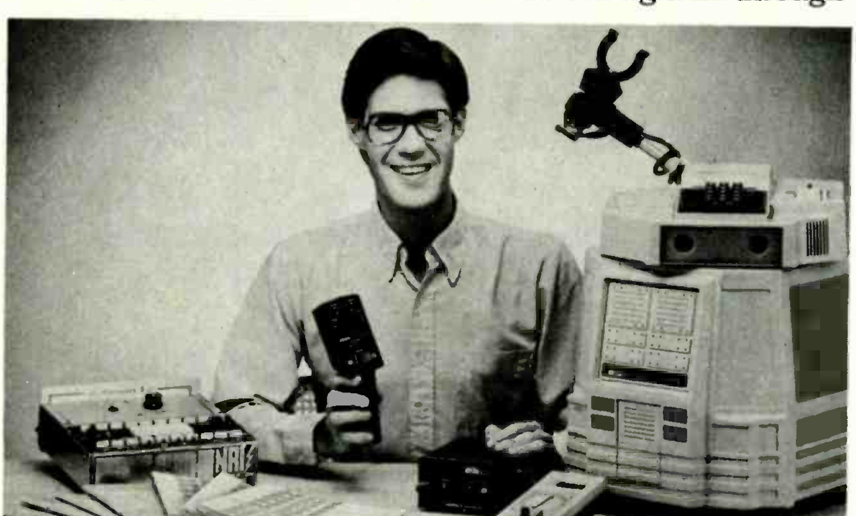
Over 25,000 New Jobs

Keeping this robot army running calls for well-trained technicians . . . people who understand advanced systems and controls. By the end of the decade, conservative estimates call for more than 25,000 new technical jobs. These are the kind of careers that pay $25,000 to $35,000 a year right now. And as demand continues to grow, salaries have no place to go but up!

Build Your Own Robot As You Train at Home

Now, you can train for an exciting, rewarding career in robotics and industrial control right at home in your spare time. NRI, with 70 years of experience in technology training, offers a new world of opportunity in one of the most fascinating growth fields since the computer.

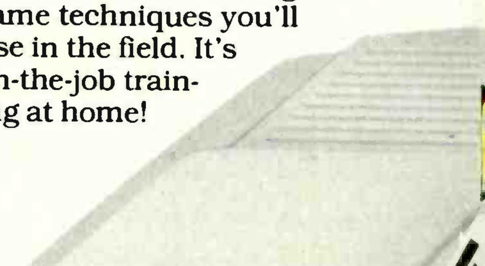
You need no experience, no special education. NRI starts you at the beginning, takes you in easy-to-follow, bite-size lessons from basic electronics right on through key subjects like instrumentation, digital and computer controls, servomotors and feedback systems, fluidics, lasers, and optoelectronics. And it's all reinforced with practical, hands-on experience to give you a priceless confidence as you build a programmable, mobile robot.



You get and keep Hero 1 robot with gripper arm and speech synthesizer, NRI Discovery Lab for electronic experimentation, professional multimeter with 3½-digit LCD readout, 51 fast-track training lessons.

Program Arm and Body Movement, Even Speech

Designed expecially for training, your robot duplicates all the key elements of industrial robotics. You learn to operate, program, service, and troubleshoot using the same techniques you'll use in the field. It's on-the-job training at home!

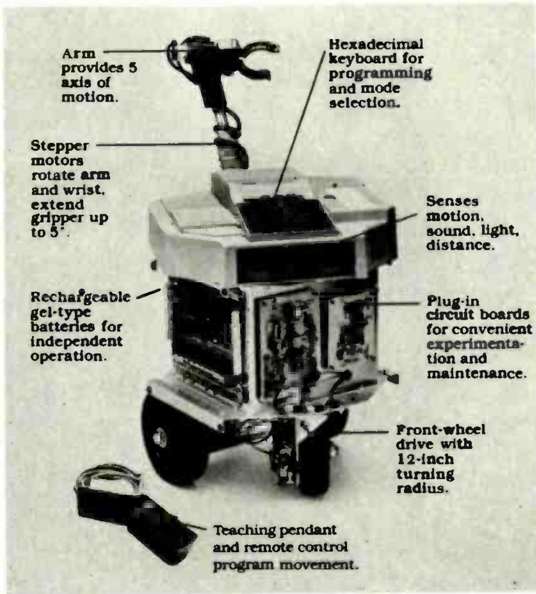


www.americanradiohistory.com

industrial control as

Building this exciting robot will take you beyond the state of the art into the next generation of industrial robotics.

You'll learn how your completely self-powered robot interacts with its environment to sense light, sound, and motion. You program it to travel over a set course, avoid obstacles using its sonar ranging capability. Program in complex arm and body movements using its special teaching pendant. Build a wireless remote control device demonstrating independent robot control in hazardous environments. You'll even learn to synthesize speech using the top-mounted hexadecimal keyboard.



Your mobile robot duplicates functions of state-of-the-art industrial units.

Training to Build a Career On

NRI training uniquely incorporates hands-on building experience to reinforce your learning on a real-world basis. You get professional instruments, including a digital multimeter you'll use in experiments and demonstrations, use later in your work. And you get the exclusive NRI Discovery Lab®, where you examine and prove out theory from basic electrical concepts to the most advanced solid-state digital electronics and microprocessor technology. Devised by an experienced team of engineers and educators, your experiments, demonstrations, and equipment are carefully integrated with 51 clear and concise lessons to give you complete confidence as you progress. Step-by-step, NRI takes you from the beginning, through today, and into an amazing tomorrow.

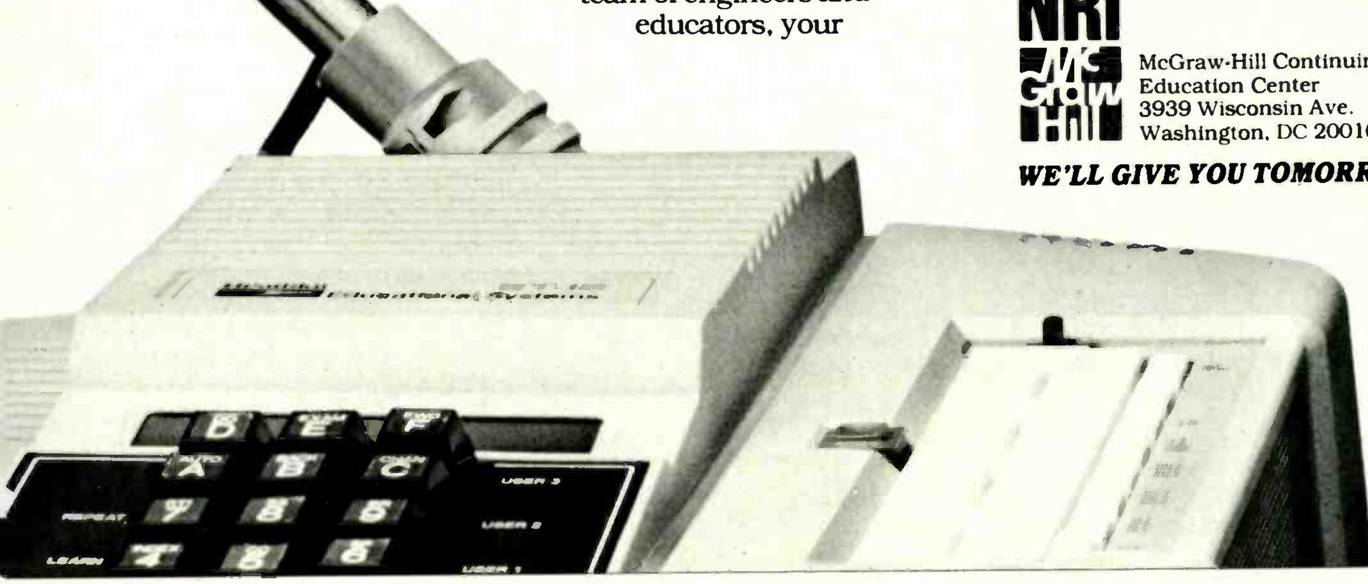
Send for Free Catalog Now

Send for NRI's big free catalog describing Robotics and Industrial Control plus over a dozen other high-technology courses. You'll see all the equipment you get in detail, get complete descriptions of every lesson, find out more about career opportunities for trained technicians. There's no cost or obligation, so send today. Your action today could mean your future tomorrow. If the card has been removed, please write us today.

NRI SCHOOLS

McGraw-Hill Continuing Education Center
3939 Wisconsin Ave.
Washington, DC 20016

WE'LL GIVE YOU TOMORROW.



www.americanradiohistory.com

SATELLITE TV

continued from page 14

ing tolerances at the manufacturer. The field installer made the pieces fit by pushing and shoving, drilling new holes and, in exasperation, rebending metal or torquing the fiberglass. In all of that, the parabolic surface, so necessary for high performance, was lost.

2) Antennas were sold without a feed; that was an add-on item and the dealer was left on his own to locate a source for feeds. When he found a feed source, his next problem was ensuring that the feed was designed to work properly with a dish that had particular focal length-to-diameter ratios. Often that did not happen, and once again, the system performance suffered.

3) Mounting systems were especially poor. The object was to have a mount that supported the dish in a rigid, stationary position, pointing *at* the desired satellite. Most mounts initially were designed to adjust the dish first in one direction (such as azimuth or side to side) and then in elevation (up and down): two separate steps.

That made it impossible for an antenna system to "track" from one satellite to another easily, since any change required two separate adjustments. The answer would be *polar* mounts, but it was later in 1980 before the first began to appear and work well.

4) The overall efficiency, a measurement of the accuracy of the parabolic surface, the design, and positioning of the feed, was seldom (if ever) over 55%. That wasn't bad; virtually all of the commercial antennas made claims no higher than that. But much better performance was coming.

5) Finally, there was the price. The early ADM established a pricing plateau, to dealer, in the $2000/$2500 region. The volume was small, and start-up costs were high. Even fiberglass knock-off antennas were almost as expensive. That was a function of many ruined-piece-parts tossed out in the process of getting those that were acceptable.

It was not a unique scenario; everything and everybody was new. Most of those designing and selling equipment were brand new to microwave; many were brand new to anything electronic. A giant learning curve was ahead.

The 1984 dish scene is much brighter. Surface accuracy is far better because computer-aided machining techniques have been applied. Feeds are generally sold with the antenna (although not always) and they are the same sophisticated devices we detailed earlier. The dealer is no longer chasing bits and parts. The antenna mounts are now mostly polar and they have evolved from large, cumbersome devices to lightweight (and usually strong) supports that allow the antennas to zip through the sky with a minimum of tracking error. Antenna range tests, done on professional test ranges, are now common and antenna (including feed) efficiencies

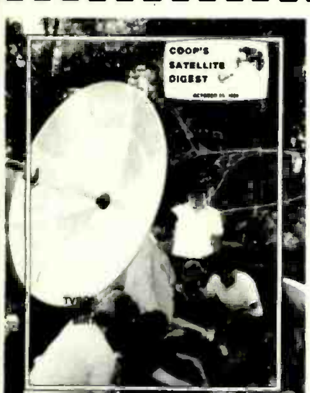
continued on page 90

SATELLITE TV/

The First Five Years!

THE MOST COMPLETE report on the mushrooming home 'TVRO' industry ever compiled, written as only the 'father of TVRO' could have prepared. More than **1000 pages** (!) tracing the complete story of home TVRO, lavishly illustrated with equipment photos, schematic diagrams, equipment analysis reports. **Bob Cooper,** the first private individual to own and operate a TVRO (1976) has collected and polished hundreds of individual reports into a unique 'collector's edition' which clearly explains the TVRO phenominon in North America. From Coop's first 20 foot 'monster' dish to the present day 5 foot 'C-band' TVROs, the fascinating growth of TVRO equipment and its legal status unfolds for you.

THIS TWO VOLUME SET totaling more than 1,000 pages is available for the first time to readers of **Radio-Electronics** at special discount pricing. **Originally sold** at $100 per two-volume set, a limited supply is now available ONLY through this advertisement. **PLUS,** you will also receive a special extraordinary bonus; the 200 page (+) **October 1984** edition of **CSD/Coop's Satellite Digest.** This very special edition of CSD is a best-seller in the TVRO industry, with the most comprehensive collection of TVRO facts and figures ever compiled. Combined with the 1,000 page 'CSD ANTHOLOGY' report, you have instant reference to **everything** you will ever need to know about the state of the home TVRO industry. It is MUST reading for every person in, or thinking about 'getting into,' **any** segment of the home TVRO world.



____ **SEND CSD ANTHOLOGY**/2 Vols. + CSD Bonus.
____ **SEND CSD** October '84 Special Issue **ONLY.**

NAME ______________ COMPANY ______________

ADDRESS ______________________________

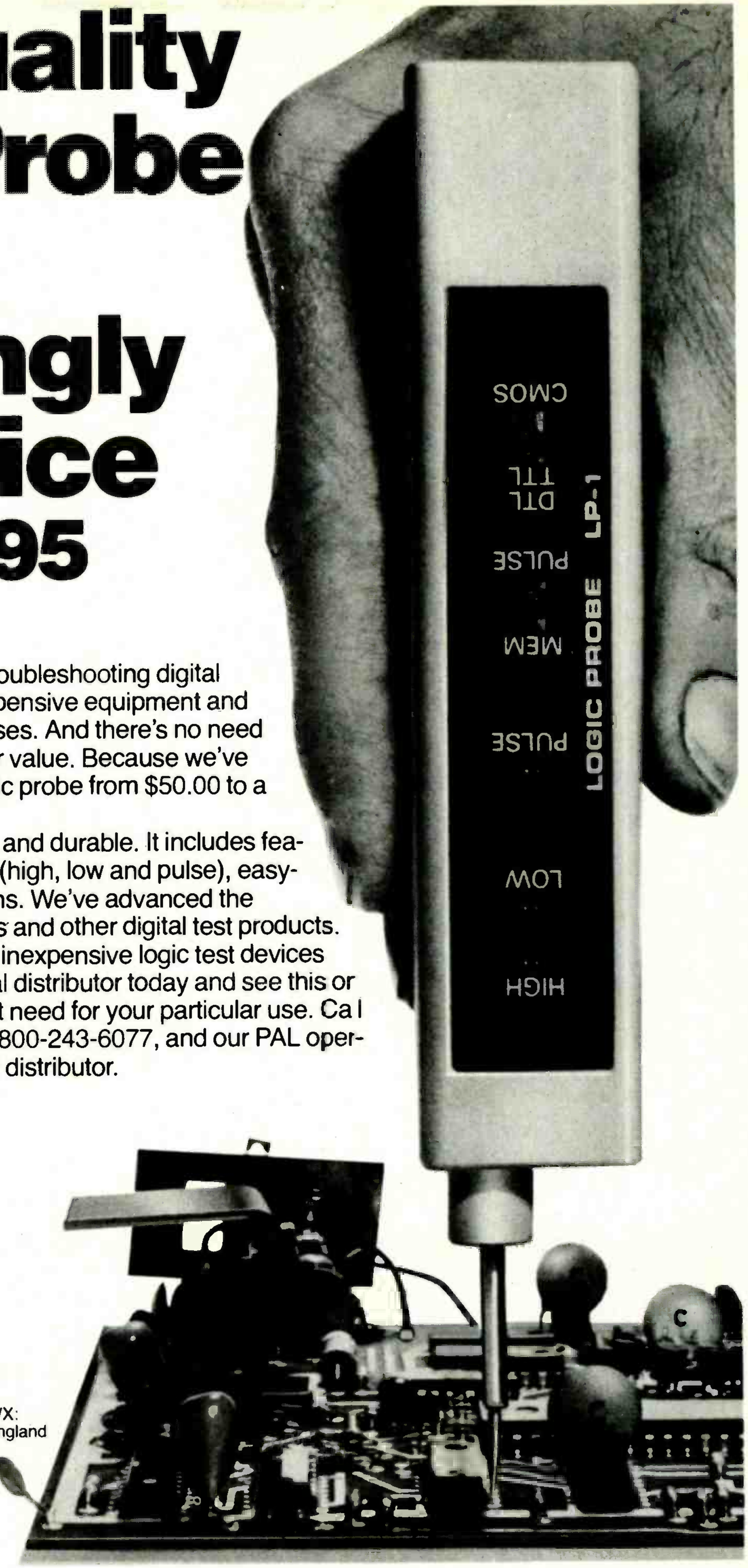
CITY ______________ STATE ______ ZIP ______

Payment: $60 US funds (Anthology + Bonus), $15 US funds CSD Oct. ONLY; payable "CSD ANTHOLOGY."

Shipping charges prepaid. Enter order to: **CSD Anthology,** Radio-Electronics Magazine, 200 Park Av. S., New York, NY 10003; or call 305-771-0505 for credit card orders ONLY.

www.americanradiohistory.com

The Quality Logic Probe At The Amazingly Low Price Of $19.95



When it comes to testing and troubleshooting digital circuitry, you no longer require expensive equipment and complex, time consuming processes. And there's no need to compromise on performance or value. Because we've reduced the price on our LP-1 logic probe from $50.00 to a very affordable $19.95.

This probe is versatile, reliable, and durable. It includes features such as readout indications (high, low and pulse), easy-to-use memory and pulse functions. We've advanced the design and the use of logic probes and other digital test products. And the LP-1 is just one of twelve inexpensive logic test devices we offer. Contact your local Global distributor today and see this or any of the other models you might need for your particular use. Call our ***Product Availability Line:*** 1-800-243-6077, and our PAL operator will direct you to your nearest distributor.

GLOBAL SPECIALTIES
An Interplex Electronics Company

70 Fulton Terrace, New Haven, CT 06512-1819
(203) 624-3103 TWX: 710-465-1227

Other Offices: San Francisco (415) 648-0611, TWX: 910-372-7992; Europe: Phone Safron-Walden, England 0799-21682, TLX: 817477.

Prices subject to change without notice.

CIRCLE 62 ON FREE INFORMATION CARD

www.americanradiohistory.com

LETTERS

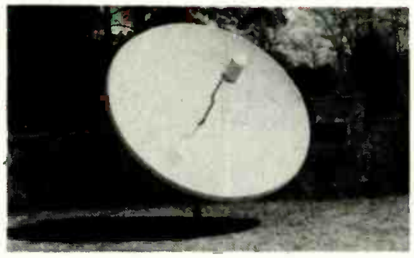
WRITE TO:

LETTERS
Radio-Electronics
200 Park Ave South
New York, NY 10003

ANOTHER TYPE OF SATELLITE DISH

I want to thank you for the fine articles by Martin Clifford, "All About Satellite TV" and "The Dish," which appeared in the June, 1984 issue.

Although I already have my dish, I enjoyed his article with one exception. The statement on page 51, ("The Dish"), which says, "All dishes are made of stainless steel or aluminum..." There are a lot of fiberglass dishes, in fact, mine is a ten-foot four-section fiberglass type, and gives perfect reception of all channels and all birds. But, if



I had it to do again, I would purchase the spun aluminum, one-section aluminum as it would be much lighter in weight.

WILBUR T. GOLSON
Baton Rouge, LA

COMPLEXITY AND ELECTRONICS

As a recent subscriber to **Radio-Electronics** I thought that my comments might be of interest. First let me say that I am not exactly the kind of subscriber you perhaps would expect to lay down $15.00 a year for your magazine. I am a non-electronics person. The reason I buy **Radio-Electronics** is that I'm interested in where we are in the "State of the Art" and what we as consumers can expect from various producers and our government, which seems to get its fingers into everything.

The article that prompted this

Versatile Lab Power Supply

EXCEPTIONAL VALUE!

Only $125.00

MODEL 3002A

• 0-30 VDC at 0-2A • Excellent Regulation • Ripple & Noise — 500 uV RMS • Built-in Short-Circuit and Overload Protection

Model 3002A features continuously adjustable current limiting and precision constant voltage/constant current operation with "automatic crossover." This lab-grade unit can also be used as a current regulated power source. Options: 10-Turn Voltage and Current Controls, $25.00 ea. (can be ordered individually).

Also available...TRIPLE MIGHTY-MITE LAB POWER SUPPLY: Three Fully Regulated DC Outputs; two 0-25V/0.5A and one fixed 5V/3A, Variable Tracking & Independent Modes, Dual Panel Meters. Other models to 60 VDC, to 12A.

***TERMS:** Check, Money Order or COD. COD's $2.00 extra. Add $3.50 for shipping & insurance in 48 states. Please contact our Sales Department for other shipping rates. Illinois residents add 7% sales tax.*

Free Literature On Request
ELECTRO INDUSTRIES
4201 W. IRVING PK., CHICAGO, IL 60641
312/736-0999

CIRCLE 54 ON FREE INFORMATION CARD

www.americanradiohistory.com

Regency Scanners

bring you all the action... as it happens!

Regency Scanners bring you the local news . . . as it happens. From bank hold-ups to three alarm fires. It's on-the-scene action. While it's happening, from where it's happening . . . in your neighborhood.

You can even listen to weather reports, business and marine radio calls. Plus radio telephone conversations that offer more real life intrigue than most soap operas. And with some models, there's even more.

The Z family

Introducing the Z series scanners from Regency. Four exciting new programmable scanners that offer you a variety of options to fit your personal needs.

First, there's the Z 10, a basic ten channel scanner that covers the six public service bands. It lets you hear your choice of over 15,000 frequencies at the touch of a finger. Or, if you prefer, locate new, active frequencies using the search function.

If you like the Z 10 but need more channels, step up to the Z 30. It gives you all the same features with a thirty channel memory and, surprise, a programmable alarm clock that stays on even when the power switch is turned off.

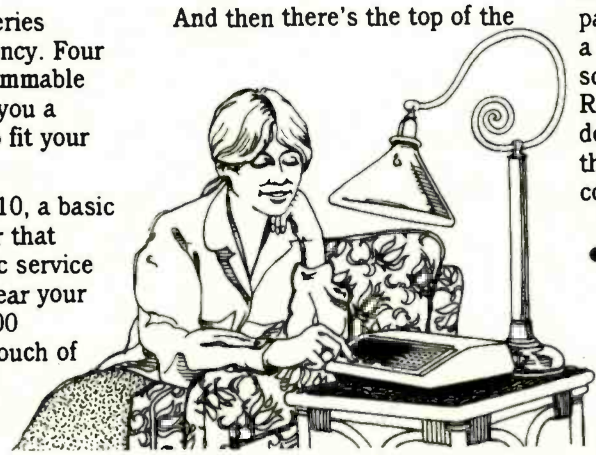
For the guy who wants to tune into the aircraft and tower transmissions, we've got the Z 45. It's got the same coverage as the Z 30 with the addition of the aircraft band with forty-five total channels.

And then there's the top of the line Z 60. It covers all the public service bands plus aircraft and FM radio broadcasts with sixty total channels.

Common to all the Regency Z scanners is a contemporary simulated wood grain cabinet and a bright, easy-to-read vacuum fluorescent display with prompting messages. They even come preprogrammed with frequencies so you can scan "right out of the box".

Backed by Regency

Regency stands behind the Z family with a full one year parts and labor warranty. And a tradition of building great scanners. So stop in your Regency dealer today for a demonstration, or write us at the address below for a full line color brochure.



Regency®
ELECTRONICS, INC.
7707 Records Street
Indianapolis, IN 46226-9989

CIRCLE 254 ON FREE INFORMATION CARD

www.americanradiohistory.com

letter is "Build this Auto Exhaust Analyzer" (**Radio-Electronics**, May 1984). I currently repair and rebuild automobile fuel-systems and can attest to the complexity of modern auto emission-devices and the government's role in fostering this expansion of electronic components in automobiles, a point I'm sure hasn't escaped your detection. The fact of the matter is that no current magazines (including yours) spend any amount of time on that increasingly complex area of electronics. For example, the General Motors Computer Command Control (CCC) has its own PROM's and I've recently wondered about the possibility of reprogramming those to modify them for performance use.

Then there's the problem area of increasingly expensive test equipment in the marketplace (i.e. $10,000–$30,000). It would be gratifying if somebody with the proper electronics experience could cover the area of electronic automotive-test-equipment. Both articles that evaluated those units, and ones that covered their repair and testing would be appreciated.

PETE KISSA
Dayville, CT

I certainly would not expect a non-electronics person to read even one issue of **Radio-Electronics.** *However, you do make your reason for being a subscriber quite clear.*

The points you raise are interesting, and certainly from my point of view, well worth exploring, but first I must touch on the reasons why very few publications other than those interested in automobile engineering would touch on the subject matters you mention. While it is fascinating to learn about the many electronic devices in the modern automobile, unless you are personally involved in the manufacturing of these devices, such knowledge has little value to slake your own curiosity. All of these elements are made and constructed to be modular replacement items, so that repairing the system does not entail very much more than unplugging one module and plugging in another.

As you must know, this also applies to European vehicles. For quite some time Volkswagen has used a fuel-injection module made by Bosch. When the 25-cent SCR in the unit breaks down, the entire module is replaced.

While I personally deplore the idea of replacing a $500.00 module for the sake of a 25-cent part, the need for a relatively unskilled mechanic to get a customer's automobile back on the road operating properly, once again makes that procedure necessary.

Incidentally, that problem exists in many other areas as well. For example, in a General Electric clothes dryer that I recently looked at, there is a simple little module that turns off the machine when the clothes are dry. It is a simple SCR that is fed a signal by a moisture sensor. The module costs $48.00. If you had the equipment and skill to service that module the chances are your parts cost would be under $3.00, and allowing 30 minutes for repair, about $22.00 in labor. Again, the repair-

Who ya gonna call

for free delivery?

PRICE BUSTERS!

***NEW LOW PRICES!**
***OVER 500 NEW ITEMS!**
***ORDER SHIPPED IMMEDIATELY!**
***FREE DELIVERY**

If order is 5lbs. or less. Good only in the continental U.S. With purchase order of $75.00 or more.

CALL TOLL FREE FOR YOUR FREE CATALOG!

1-800-543-3568 NATIONAL WATS

1-800-762-3412 OHIO WATS

IN DAYTON: (513) 252-5662

TELEX NO. 288-229

CEI Consolidated Electronics, Incorporated

705 WATERVLIET AVE., DAYTON, OHIO. 45420

CIRCLE 81 ON FREE INFORMATION CARD

www.americanradiohistory.com

man for just a few dollars more, can immediately restore operation of that machine in the customer's home by the simple replacing of the entire module.

The real question that your letter has addressed (and it's a question that many have addressed) has two reaching effects in the editorial coverage of our publication: "Even if the repair is a module replacement, does the **Radio-Electronics** *reader want to know how the module functions and how he might troubleshoot it and repair it—even though he realizes it may not be cost-effective to do so?"*

So that we may get a better feeling for our readers sentiments on those subjects, we invite our readers to write us and express their feelings on them.—Larry Steckler, Publisher

VOLTAGE ERROR

Your article, "Designing With Linear IC's," by Joseph Carr in the July 1984 issue has an error on page 55, column 3 line 2. The gain is 20 not 100. That is found from: $A_V = (R2/R1 + 1)(Ns/Np) = (2)(10/1) = 20$. The voltage mentioned later should also be 20 not 100.

WILLIAM LEFLER
Forks, WA

INTERFACE ERROR

I built the interface for the *TS1000/ZX81* described in the article "Interfacing the *ZX81*" that appeared in te July 1984 issue of **Radio-Electronics**. I found two errors that I would like to bring to your attention.

First of all, in the schematic shown in Fig. 2, the A2 output of IC8 is at pin 6, not pin 5 as shown. Secondly, in the card-edge pinout shown in Fig. 1, there are two A1 lines. The one at the bottom of the illustration (above ROMCS) should be A4.

BOB MIX
Seattle, WA

CONVENTIONAL FLOW CONFLICT

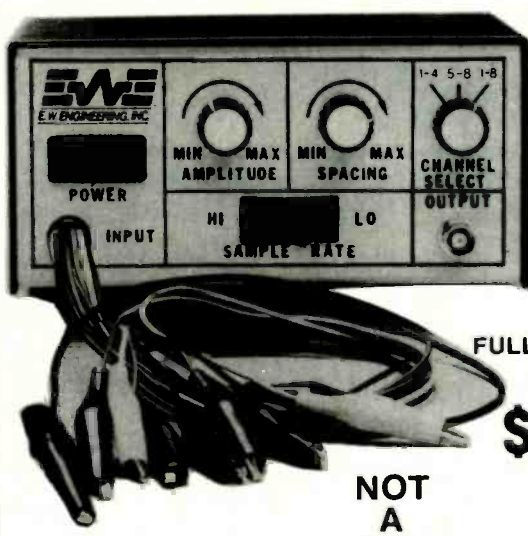
As an electronics student, I strive to find several ways to justify a point of an accepted theory. Occasionally in my reading I encounter strongly conflicting views. One case that puzzles me is the continuing use of the terms "electron flow" and "conventional flow."

I have read coverage of that topic by Jack Darr, ("Service Clinic," **Radio-Electronics**, January 1983) and other reputable writers who have attempted to explain why there are two ways to describe electrical current; however, none that I have found propose a reason why reference is still made to "conventional flow." If Benjamin Franklin's theory backing "conventional flow" is a long past proven fallacy, then why is it still referred to, and accepted by some technical writers as the proper approach to describe current flow?

CHRISTINE MOORE
O'Fallon, Missouri

There is really no conflict in theory—everyone agrees that electrons flow from negative to positive. Conventional current is just that—a convention. It is internationally agreed upon, however, and you should become comfortable with it.—Editor

VIEW 8 TRACES ON YOUR SINGLE OR DUAL TRACE SCOPE WITH THIS LOW COST DEVICE!!



Now you no longer have to spend thousands on an expensive multi-trace oscilloscope - our single trace Hitachi scope combined with this module will allow you to view up to 8 simultaneously occuring analog or digital (or both) signals in their real time and amplitude relationship. The MPX 101 may be used on any oscilloscope, whether single, dual or multiple traces. Its low cost makes it a particular favorite for designers, testers, hobbyists and repairmen who want to compare and analyze displayed signals in a timing diagram format. The controls on the front panel of the metal case allow you to vary amplitude and spacing of the displayed signals.

MODEL MPX101
FULLY ASSEMBLED & TESTED!

NOT A KIT

$99.88

FULL 1 YEAR REPLACEMENT WARRANTY

– Made In The United States –

SPECIFICATIONS

Inputs: 8 signals plus ground via 9 input leads terminated with alligator clips
Bandwidth: ± 1dB to 5 MHz
Impedance: 10.9 K
Input Voltage: ± 5V peak (diode clamped to ± 5 Volt supplies)
Output: Staircase waveform summed with input signals, 0-800 mV full scale
Step Amplitude: Variable 0 to 150 mV/ step
Signal Voltage: Variable 0 to 150 mV/step @ 5V Input
Multiplex Rate: Switch selectable, 40 KHz or 4 KHz
Impedance: 50 Ohms
Power: 105-135 VAC @ 1 V a
Dimensions: 6.25" x 3.25" x 4.75" (WxHxD)
Operating Temperature: 0-40°C
Weight: 1 lb. 10.5 oz.
Warranty: one year full replacement warranty from date of purchase
Lighted on/off power switch
Wood grain finished metal case

DISTRIBUTOR AND REPRESENTATIVE INQUIRIES INVITED

E.W. ENGINEERING, INC.

VISA, MASTERCARD, AMEX TELEPHONE ORDERS ACCEPTED!
6 Herman Drive, E. Granby, CT 06026 □ 203/651-0285

CIRCLE 61 ON FREE INFORMATION CARD

www.americanradiohistory.com

EQUIPMENT REPORTS

Paladin Solder Scooter Desoldering Tool

Desoldering doesn't have to be any more difficult than soldering.

CIRCLE 5 ON FREE INFORMATION CARD

WE THINK IT'S SAFE TO SAY THAT ANYone who has ever soldered a joint has also desoldered one—whether to correct a mistake or to replace a defective component. But if you've ever tried to use a vacuum bulb, or other hand-operated vacuum device, to desolder more than one or two components, you'll appreciate the need for a better tool. If you only desolder occasionally or usually work in the field, you don't want a large device that requires an external vacuum pump. But you still need a tool that is fast and easy to use, yet one that is small, economical,

QUALITY COMPONENTS - *NOT MAIL ORDER "SECONDS"*

Send $1.00 postage and handling for FREE COMPLETE CATALOG which includes coupon for $1.00 OFF purchase

ARIES ZERO INSERTION FORCE SOCKETS - cam actuated, true zero insertion - tin plated solder tail pins - capable of being plugged into dip sockets, including wire wrap.

Stock No.	No. of Pins	1-9	10-49	50
11055	24	4.98	$4.35	$3.90
11056	28	5.15	4.50	4.05
11057	40	6.81	5.95	5.35
11058	64	12.02	10.50	9.45

IC-KOOLERS™ from UNITRACK® dissipate over 2 watts of heat from IC's, producing longer life and better performance. Just push IC-Kooler on - heat is collected from top and bottom of IC and dissipated. Won't shake loose!

Stock No.	No. Pins in IC	Price
22225	14	$.29
22226	16	.29
22228	18-20	.29

SCREW MACHINED SOCKET PINS, loose, packaged in bags of 100. Stock No. 11310 is solder tail with gold collet tin shell. Stock No. 11311 is wire wrap with gold collet gold shell.

Stock No	Description	1 Bag	5 Bags	10 Bags
11310	Bag of 100 solder tail pins	$ 4.95	$ 4.45	$3.95
11311	Bag of 100 wire wrap pins	11.95	10.75	9.50

WILD ROVER Touch switch capsule. Operating motion is .005" without the use of a levered arm. Extremely fast on and off with low noise. Normally open - rated 115 VAC, 1.8 amp-30 milliohm resistance - .815 radius by .160 thick.

Stock No.	1-9	10 & Up
12098	$1.42	$1.28

3 X 4 Elastomeric Keyboards Each keyboard has a p.c. board, elastomeric pad with contacts, ABS bodies and double shot molded keys. Max rating: 12 VDC @ 20mA. Contact Res: less than 500 ohms. Bounce: less than 10 m sec.

Stock No	Operating Force	Key Travel	Price 1	10
11291	120±40g	2.0±.5mm	$4.95	$4.50
11292	60±40g	1.8±.5mm	3.95	3.60

TI WIRE WRAP SOCKETS Tin plated phosphor bronze contact - 3 wrap

Stock No.	No Pins	1-99	100-499	500
11301	8	$.40	$.36	$.30
11302	14	.59	.54	.45
11303	16	.64	.58	.48
11304	18	.73	.66	.55
11305	20	.99	.90	.75
11306	22	1.12	1.02	.85
11307	24	1.25	1.14	.95
11308	28	1.52	1.38	1.15
11309	40	2.05	1.86	1.55

TI LOW PROFILE SOCKETS Tin plated copper alloy 688 contact pins with gas tight seal

Stock No.	No Pins	1-24	25-99	100-999
11201	8	$.10	$.09	$.08
11202	14	.14	.13	.12
11203	16	.16	.15	.14
11204	18	.18	.17	.15
11205	20	.20	.18	.16
11206	22	.22	.20	.18
11207	24	.24	.22	.20
11208	28	.28	.26	.25
11209	40	.40	.37	.33

SUB CUB I and SUB CUB II are high quality, complete LSI Counter Modules with LCD readout. Modules plug in p.c. board (Stock No. 51071). Complete function evaluation kit (Stock No. 51070) contains p.c. board, 4.5V battery and variable frequency oscillator to supply train of count pulses. Stock No. 51070 has LATCH, RESET and TEST functions (3 buttons). P.C. board unplugs for breadboard work.

6 Digit LSI Counter Modules with LCD Readouts and Associated Mounting Assemblies

SUB CUB I

SUB CUB II

Stock No.	Description	Price
51070	Complete Function Evaluation Kit (includes batteries but does not include display counter)	$45.00
51071	Mounting P.C. Board only	7.50
51072	SUB-CUB I display counter module only	18.00
51073	SUB-CUB II display counter module only	24.00
51074	Panel Bezel Evaluation Kit for SUB-CUB II (does not include SUB-CUB II counter module)	12.00
51075	DATA SHEET	.25

SINGLE ROW SOCKETS

Strip of 25 collet sockets/pins - mount odd-center components easily. Gold plated contacts.

Both styles breakable to any number of contact positions wanted

Stock No.	1-24	25	50
10240	$1.70	$1.50	$1.30

Strip of 40 pins with single beam sockets. Tin plated contacts.

Stock No.	1-99	100	500	1000
10850	$1.09	$.90	$.82	$.72

OPCOA Single Digit Displays - Common Cathode

LEFT DECIMAL POINT RIGHT DECIMAL POINT

Stock No	Color	1	100
12082	Red	$1.12	$ .99
12085	Green	1.84	1.63
12087	Yellow	1.92	1.70
12089	Orange	2.08	1.84

Right Angle Socket for Above Displays

Stock No	1	100
11010	$1.24	$ .99

OPTEL LCD's with pins

Stock No. 47005

Stock No. 47006

Stock No. 47007

Stock No	Description	1	10
47005	3½ dig. .5"	$ 5.95	$ 5.50
47006	4 dig. .5"	5.95	5.50
47007	4 dig. .7"	11.90	11.00

The Battery Just Wrap™ Tool New battery powered tool wraps insulated wire around .025" square posts without need for pre-cutting and pre-stripping. Complete with bit and 100 ft. 30 AWG wire.

Stock No	Description	Price
13340	Battery just-wrap tool with bit and 100 ft. 30 AWG wire	$58.95
13341	Replacement bit	10.35
13342	100 ft. blue replacement wire	7.54
13343	100 ft. white replacement wire	7.54
13344	100 ft. yellow replacement wire	7.54
13345	100 ft. red replacement wire	7.54

MICRO Charts - colorful 8½" x 11" charts eliminate the need to stumble through manuals and summaries. Fully decoded - instant access - totally comprehensive - gives pin outs, cycle times, buy notes, etc., etc.

Stock No	Reference	Price
23010	Z80 CPU	$5.95
23011	8080A/8085A	5.95
23012	6502 (65XX)	5.95
23013	8048 and relatives	5.95
23014	54/7400 TTL Pinouts	5.95
23015	Basic Algorithms	5.95
23016	8086/8080A	5.95
23017	How to generalize from a sample	5.95
23018	Wordstar	5.95

PIN FORMING TOOL puts IC's on their true row to row spacing. One side is for .300 centers. Flip tool over for devices .600 centers. Put device in tool and squeeze.

ONE TOOL DOES 8 thru 40 PINS!

	Stock No.	Price
Hand Tool	11059	$12.95
NEW! ANTI-STATIC MODEL	10200	$14.95

OK MACHINE AND TOOL

IC INSERTION/EXTRACTION KIT Includes DIP IC extractors and inserters to accommodate all ICs from 14 to 40 pins. Tools that engage conductive surfaces are CMOS safe and include grounding lugs. Stock No 13309 **$41.34**

SOCKET WRAP ID Dip socket-sized plastic panels with numbered holes in pin locations. Slip onto socket before wire wrapping to identify pins. Also write on them for location, IC part number, function, etc. Simplifies initial wire wrapping, troubleshooting and repair. $1.95 per pack

13295	14 pin
13296	16 pin
13297	18 pin
13298	20 pin
13299	22 pin
13300	24 pin
13301	28 pin
13302	40 pin
13303	96 pin

THERMOPROBE: Identifies Dead Components - Replaces Volt Meters! Identify dead components which do not emit heat. Just point thermistor probe within 1/16" of board - move over components and see which are dead. Stock No. 22300 Price $21.95

Scotchflex® Breadboard Systems Basic kit comes with 24 various Dual Sockets, 40 various Plug Strips, wire and tools. Kit can be used with any of the six boards

Stock No.	Description	Price
03500	Basic Kit	$79.95
03511	Basic board, 4.5 x 5.5	19.50
03506	Intel SBC-8010 Board, 12 x 6.75	64.95
03507	Motorola M-6800 Board, 9.75 x 6	42.95
03508	S-100 Board, 10 x 5.3	36.95
03509	Z-80 Board, 7.7 x 7.5	39.95
03510	Eurocard Board, 6.3 x 3.9	21.95

SINTEC CO. 28 8th St., Box 410 Frenchtown, NJ 08825

VISA MasterCard

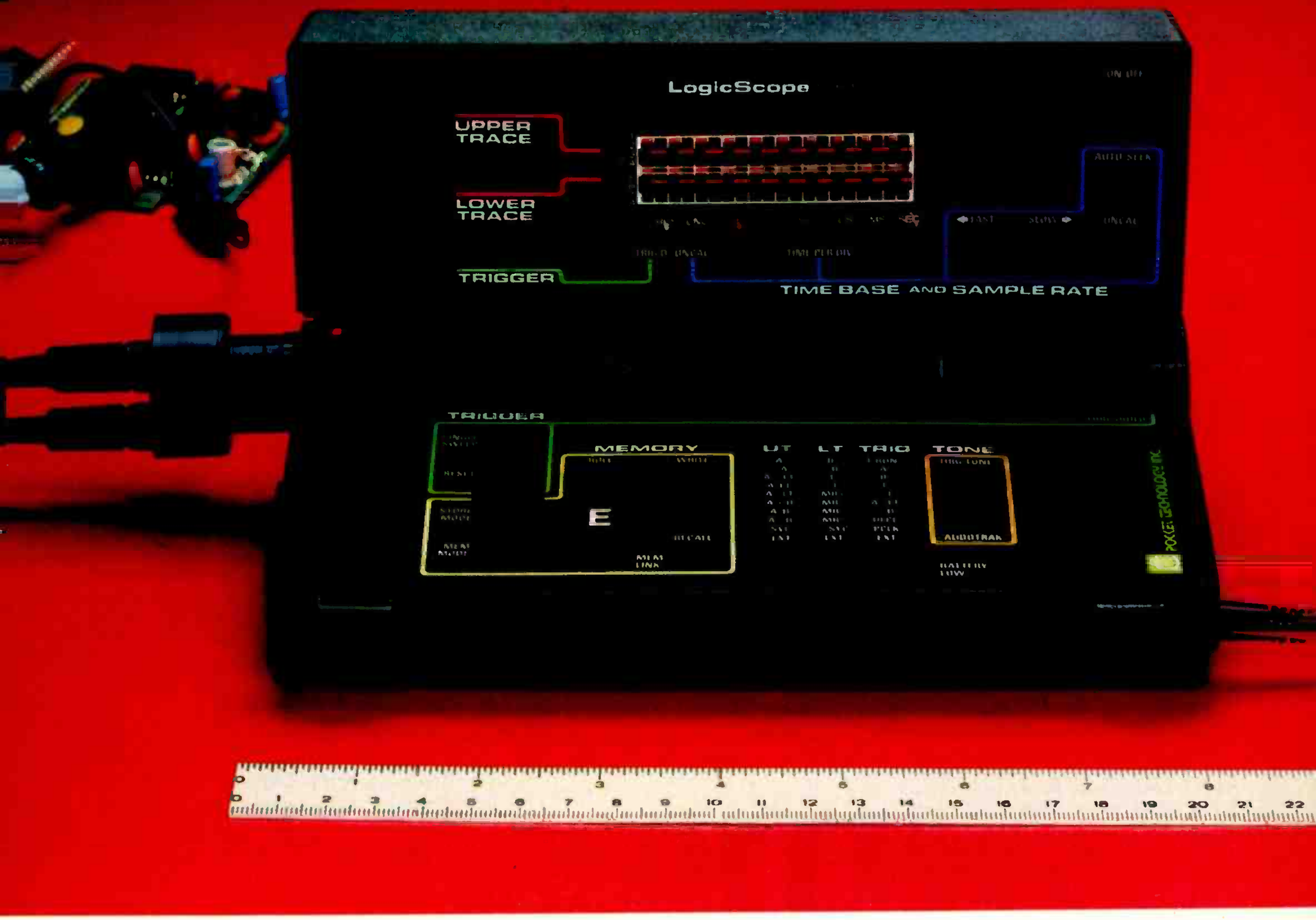
TOLL FREE 800-526-5960 in NJ (201) 996-4093

We accept VISA, MC, C.O.D., CHECK or M.O. *INCLUDE SHIPPING CHARGES 0 to $100 $3.00 $100 to $250 $4.00 over $250 $5.00

CIRCLE 73 ON FREE INFORMATION CARD

www.americanradiohistory.com

Meet Our New LogicScope 136. . . . A True Dual Trace 10 MHz Digital Storage Scope. Only $495.



True Dual Trace • 10 MHz Real Time Bandwidth • 3 Input Channels • I/O Port Digital Waveform Storage • Boolean Waveform Operations • Audio Functions 8.25 (L) x 4.5 (D) x 1.75 (H) Inches • 1.25 Pounds • 9 Volt Battery/AC Operation

Consider the LogicScope 136

- The LogicScope 136 is the next logical step in test instrumentation for you. It combines many of the features and capabilities of sophisticated logic analyzers and oscilloscopes . . . and it fits in your hand. Never before has so much technology been available in so small an instrument, at such a low price.
- The pocket-sized LogicScope 136 is made possible by a patented breakthrough in display technology. The conventional cathode ray tube has been replaced by a unique array of 400 LED's that permits simultaneous display of two digital waveforms.
- The 136 can be used for viewing single shot events, or repetitive waveforms. It can be operated in real time mode, or in memory mode which permits acquisition and storage of up to 24 128-bit waveforms. These can be recalled, logically compared (AND, OR, EXCLUSIVE OR) to other stored/input waveforms, or output to an external device via an RS 232 port.
- Its very low cost, convenience and ease-of-use make the LogicScope the ideal instrument, for designing, troubleshooting or repairing digital systems.

Consider its Engineering & Field Service Applications:

- On microprocessor-based systems, check the timing relationship of various parameters relative to the system clock and other key events. Its storage capability allows visual and logical comparison of non-repetitive waveforms to known reference signals. Output in the start-up of the digital device can be compared to reference signals to determine the operating state of the device. Questionable waveforms can be stored for analysis.
- Its light weight and small size make the LogicScope convenient to take on every service call. The 136 provides much more information for trouble shooting a digital system or peripheral than a logic probe or digital multimeter, without having to lug an oscilloscope or logic analyzer along.

Contact us for the name of your local distributor

POCKET TECHNOLOGY, INC.
7320 Parkway Drive, Hanover, MD 21076
301-796-3300

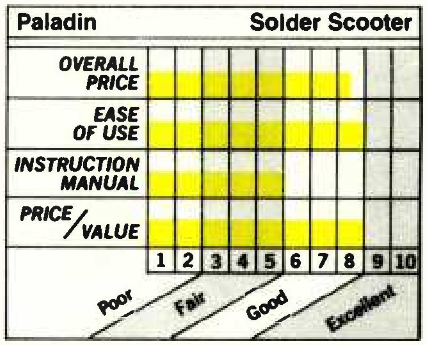
www.americanradiohistory.com

and—most important—also portable.

A tool that combines those features is the *Solder Scooter* from Paladin (3543 Old Conejo Road, #102, Newbury Park, CA 91320). OK Industries, Inc. (3455 Conner Street, Bronx, NY 10475) offers a practically identical tool. Apparently, both are made by the same company. The only differences that we saw were the color and the imprinted model number (SA-6-115 for OK's).

The main advantage of the *Solder Scooter* over those other hand desoldering tools we mentioned is that it does the work of two tools—it both melts the solder and vacuums it up. A 30-watt heating element heats up quickly; the tool is ready for use typically in about 1½–3 minutes. Recovery time after desoldering a large joint is also fast.

Operating the *Solder Scooter* requires only one hand. That's a big advantage over vacuum-bulb-type methods. You can use your free hand to hold the circuit board you're working on, or to gently pull a component off the board from the other side (or loosen up a connection). The unit is 10¼ inches long, but it's lightweight (about 4 ounces) so it's easy to handle. It fits well into a standard soldering-iron holder. The vacuum-pump part of the *Solder Scooter* is similar to desoldering pumps that you can buy separately. To "load" the pump, you push a plunger down with your thumb. A side-mounted "trigger" releases the plunger, and solder is pulled into the reservoir. The difference between the *Solder Scooter* and other hand pumps is that the solder is pulled in right through the heated tip.



The pump, along with the reservoir, can simply be unsnapped from the tool. Once removed, the cover of the reservoir can be opened and the solder simply dumped out.

Replacing the tip is as easy as cleaning the reservoir—it simply unscrews. The tip that comes with the unit has a 1.2-millimeter opening. A 1-millimeter tip is also available, and a 1.5-millimeter tip is available for larger jobs. (Paladin also sells other replacement parts for the desoldering tool, including the heater, the heat-conductor tube, O-rings, and pump assembly.) Paladin sells two versions of the *Solder Scooter*: Model PA 1707 comes with a two-wire cord and PA 1706 has a three-wire cord.

The *Solder Scooter* sells for $22.95 ($24.95 for the three-cord model.) It is well suited for low-volume applications, such as for hobbyists or field-service technicians. We should point out one more thing—in a pinch, it makes a good *soldering* iron, too. **R-E**

continued on page 30

A QUALITY TRIPLE-REGULATED POWER SUPPLY AT A LOW, LOW PRICE!!

NOT A KIT!

MODEL PS101
FULLY ASSEMBLED & TESTED!

This DC triple regulated variable power supply has all the features you could ask for plus a full 1 year guarantee. Fully adjustable from 1½ VDC to 35 VDC! Three completely independent supplies that offer many advantages! They can be either a pos. supply or a neg. supply...they can also be stacked in series so that a 5V and two 15V supplies can total a 35 VDC supply or any combination of the three...(after one of the terminals is grounded to give it a reference)...for the first time you can now purchase this American made fully adjustable power supply at a price that is one-half of what you'd expect to pay!

$119.88 FULL 1 YEAR REPLACEMENT WARRANTY

– Made In The United States –

SPECIFICATIONS

3 outputs:
Fixed 5 VDC ± 0.2V
2 variable ≤1½ V to ≥15 VDC
Polarity – floating; can be used as pos. or neg.

Ripple less than 10mV at full load,
Regulation ≤1% no load to full load,
Line Regulation <0.2% 108 VAC to 135 VAC.

Current:
Fixed supply 1.0 amp max.
Variable supplies 0.5 amp max.

Protection built in, current limiting, with thermal shutdown.
Power: 108-135 VAC.
Dimensions: 8¼" x 3¼" x 7¼" (WxHxD)
Wood grain finished metal case.
Weight: 4 lbs., 9 ozs.
Lighted on/off power switch, easy-to-read Voltmeter and large binding posts.
Warranty: one year full replacement warranty from date of purchase.

DISTRIBUTOR AND REPRESENTATIVE INQUIRIES INVITED

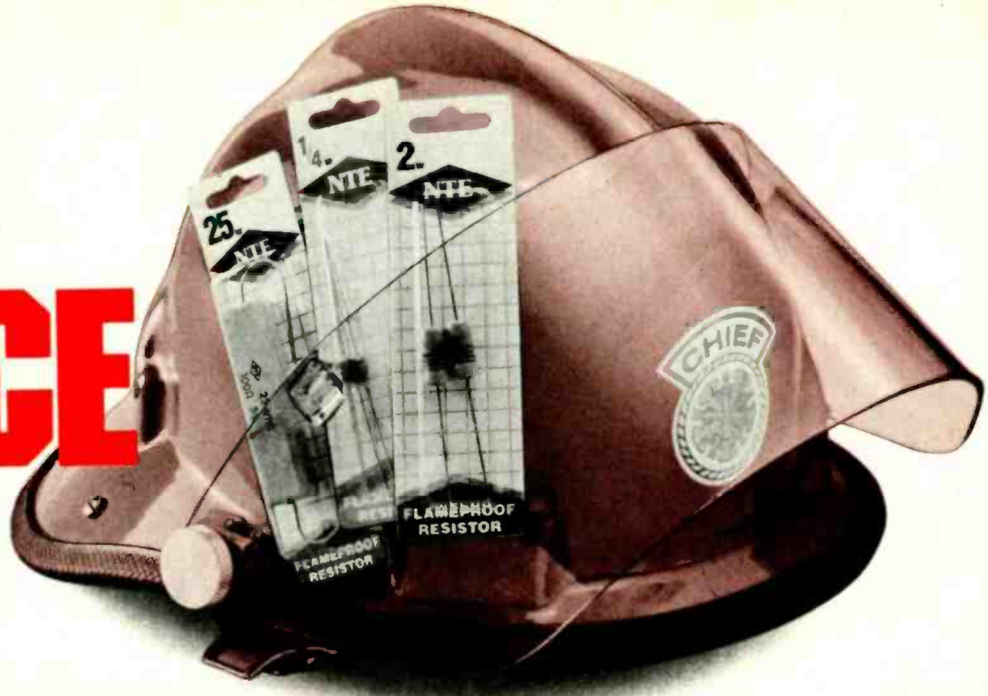
E.W. ENGINEERING, INC.

VISA, MASTERCARD, AMEX TELEPHONE ORDERS ACCEPTED!
6 Herman Drive, E. Granby, CT 06026 □ 203/651-0285

CIRCLE 267 ON FREE INFORMATION CARD

www.americanradiohistory.com

AN OUNCE OF PREVENTION.



Introducing the complete line of Flameproof Resistors from New-Tone Electronics.

NTE Flameproof Resistors are the latest addition to NTE's line of quality components. They're designed to provide you with a premium quality replacement device... that won't flame out or short even under the most severe overloads.

Our resistors range in capability from 1/4 Watts to 25 Watts with resistance values from .10 to 1.5 Megohms.

They're totally noncombustible with a metallic resistance material between a nonresistant core and a special ceramic outer cover.

NTE Flameproof Resistors are the ideal replacement components for electronic games, telecommunications, medical, data processing, military, broadcast and home entertainment equipment.

Don't take chances with your expensive equipment. Use NTE Flameproof Resistors... they handle the current.

Look for NTE's full line of quality replacement parts in the bright green polybags and cartons at your nearest distributor.

NTE™

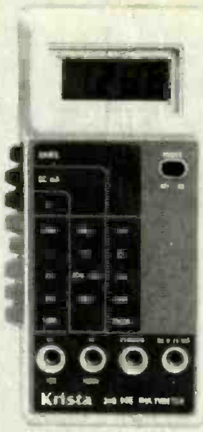
NEW-TONE ELECTRONICS, INC.

44 FARRAND STREET • BLOOMFIELD, NEW JERSEY 07003

www.americanradiohistory.com

Krista Model 30B-140 DMM

A low cost test instrument that's ideal for the hobbyist on a budget.



CIRCLE 6 ON FREE INFORMATION CARD

IN THIS SPACE WE OFTEN REPORT ON devices that represent the state-of-the-art in test-equipment technology. Those units are sophisticated, highly accurate, and, more often than not, very expensive. That's fine if you are a professional who needs the best for his work, or a dedicated hobbyist who constantly has one project or another on the bench. But what about those for whom electronics is just an occasional diversion, or those who can not afford the latest in microprocessor-controlled gear? Well, they are not out of luck. There's quite a bit out there in the way of low-cost, but quite serviceable, test equipment.

One such instrument recently came to our attention. It is the Krista (PO Box 3423, Torrance, CA 90510) model *30B-140* multimeter That unit is a hand-held digital multimeter with a ½-inch, 3½-digit LCD readout. It can measure AC and DC voltage, DC current, and resistance; there is also provision for performing a diode test. All range and function switches are located along the side of the case for easy, one-handed operation; the POWER switch is located on the front panel.

Test probes (two are supplied) connect to the unit via four front-panel connectors. Those connectors are recessed in the case, minimizing the possibility of an accidental shock.

Specifications

Turning to what the unit can do, DC voltage measurements are made over five ranges from 200-mV to 1000-volts full scale. Accuracy is specified as ±0.5% for the 200-mV range and ±0.8% for the 2-, 20-, and 200-volt ranges; it is unspecified for the 1000-volt range. The device is protected against transient overload up to ±500-volts DC and 300-volts RMS AC for ranges up to 200 volts. Overload protection for the 1000-volt scale is ±1100 volts AC or DC.

FREE

McIntosh

STEREO CATALOG and FM DIRECTORY

Get all the newest and latest information on the new McIntosh stereo equipment in the McIntosh catalog. In addition you will receive an FM station directory that covers all of North America.

SEND TODAY!

McIntosh Laboratory Inc.
East Side Station P.O. Box 96
Binghamton, N.Y. 13904-0096

RE

NAME ______

ADDRESS ______

CITY ______ STATE ____ ZIP ______

If you are in a hurry for your catalog please send the coupon to McIntosh.
For non rush service send the **Reader Service Card** to the magazine.

CIRCLE 67 ON FREE INFORMATION CARD

Gernsback Publications, Inc.
200 Park Ave. South
New York, NY 10003
(212) 777-6400
Chairman of the Board: M. Harvey Gernsback
President: Larry Steckler

ADVERTISING SALES 212-777-6400

Larry Steckler
publisher
Arlene Fishman
advertising coordinator
Lisa Strassman
credit manager
Donna Goldstein
credit associate
Naomi Matten
advertising assistant

Sales Offices

EAST/SOUTHEAST
Stanley Levitan
Radio-Electronics
200 Park Ave. South
New York, NY 10003
212-428-6037, 212-777-6400

MIDWEST/Texas/Arkansas/Okla.
Ralph Bergen
Radio-Electronics
540 Frontage Road—Suite 325
Northfield, IL 60093
312-446-1444

PACIFIC COAST/ Mountain States
Marvin Green
Radio-Electronics
15335 Morrison St.—Suite 227
Sherman Oaks, CA 91403
818-986-2001

www.americanradiohistory.com

What's New at AMERICAN SURPLUS TRADING?

"The Source" of electro-mechanical components for the hobbyist.

We warehouse 60,000 items at American Surplus Trading—expensive, often hard-to-find components for sale at a fraction of their original cost!

You'll find every part you need—either brand new, or removed from equipment (**RFE**) in excellent condition. But quantities are limited. Order from this ad, or visit our retail showroom and find exactly what you need from the thousands of items on display. Open Mon.-Sat., 9-5.

THERE'S NO RISK.
With our full 90 day warranty, any purchase can be returned for any reason for full credit or refund.

5¼" TANDON DISC DRIVES

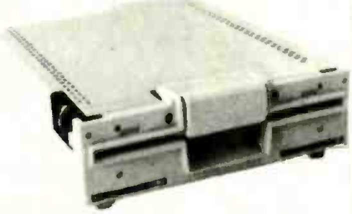
IBM Compatible

½ Ht.		
A. TM50-1	SS/DD	$ 99.50
B. TM55-2	DS/DD	179.00
C. TM55D-2	DS/DD	199.00
Full Ht.		
D. TM100-1	SS/DD	$ 99.50
E. TM100-2	DS/DD	159.00
F. TM100-1	w/o controller boards (mechanics only) $45.00	

Other 5¼" P.C. Drives

½ Ht.	G. TM55-4	DS/Quad	$199.00
Full Ht.	H. TM101-4	DS/Quad	$199.00

J. APPLE 2C DISC DRIVES



Original equipment drives. Cosmetic rejects.

$139.50 RFE

K. T.I. SILENT 700 PRINTER

Receive only. Non-impact, thermal paper. 5 x 7 matrix-80 characters per line. Printing Rate: selectable, 10/30 char. per sec. Full/Half Duplex. Interface: Serial type/RS232/C & Current loop. 300 baud rate. Dim: 14.6" x 15.25" x 4.25"

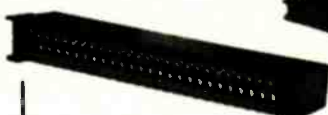
$199.00 NEW

L. TIMEX SINCLAIR 1000 COMPUTER

Factory returns. TV tested. Utilizes Z80A CPU (socketed) 2016P and other chips. Sold "as is ... NO RETURNS"

only $9.95 RFE

"D" SERIES CONNECTORS



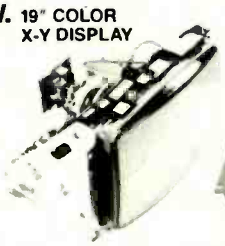
Ribbon Cable	1-99	100-up
M. IDC 15S	$3.61	$3.28
N. IDC 25S	4.03	3.69
O. IDC 37S	6.14	5.57

IDE Edge Card	1-99	100-up
P. 50-Pin	$2.96	$2.63
Q. 20-Pin	1.50	1.35

ID Sockets & Plugs

Sockets	1-99	100-up
R. IDS 26	$1.69	$1.57
S. IDS 34	1.81	1.69
T. IDS 50	2.96	2.85
Plugs		
U. IDP-20	$1.01	$ .90
V. IDP-50	2.96	2.85

W. 19" COLOR X-Y DISPLAY



Originally designed for use in Atari coin-operated games. Contains a 19VLUP22 3-gun color tube, focus and brightness controls. Has electromagnetic deflection and solid state circuitry with three "Z" amp inputs (red, green, blue). Ideal for arcade replacement or, with the addition of external circuitry, for color graphics display

$129.00 NEW

PUMPS—COMPRESSORS—BLOWERS—MOTORS—POTENTIOMETERS—COUNTERS TIMERS—RELAYS—VOLTAGE REGULATORS—POWER SUPPLIES

X. HIGH QUALITY INTELLIGENT KEYBOARD

60 Key Typewriter Layout

Utilizes 8041 8 bit microprocessor, 8243 10 expander, 2316 ROM and more. Charcoal grey key caps with sound transducer. Power requirement: 5 VDC. 26 pin header connector. Mfr: Brothers Ind. Ltd. 556-504. Full documentation.

$14.95 NEW

Y. 35 CFM SPRITE FAN®

Compact 3½". For cooling equipment where space is at a premium. Universal mounting, reversible air flow. 115VAC, 60HZ. Dim: 3¼" sq. x 1⅝"D. Rotron or equiv.

$6.95 RFE

Z. 115 CFM MUFFIN FAN®

Metal frame with 5 high-impact plastic blades. For cooling Hi Fi, electronic equipment, computers, etc. Mounts for intake or exhaust. 115VAC, 60HZ. Dim: 4¹¹⁄₁₆" x 1½"D.

$7.95 RFE

APPLE RS232 CABLE ASSEMBLIES

Grey molded connectors.
- **AA.** from DB25P to IDS26 socket
- **BB.** from DB25P to DB25P socket
- **CC.** from DB25P to DB19P socket

3 ft. long.

Your choice **$9.95 ea.**

American Surplus Trading 62 Joseph St., Moonachie, NJ 07074 (201) 939-2710

DD. COMPUTER DISC DRIVE SWITCHING POWER SUPPLY

Input: 115V AC
Output: ± 12V @ 1 amp. + 5V @ 6 amp. − 5V @ 1 amp.
Dim: 9½"L x 7"W

$29.95 NEW

FREE CATALOG of electro-mechanical devices sent with every order.

AMERICAN SURPLUS TRADING, 62 JOSEPH STREET, MOONACHIE, N.J. 07074

MINIMUM ORDER $15.

YES! Please send me the following items:

A,B,C, etc.	How Many?	Description	Price	Total

Total

Shipping and handling, we ship UPS unless otherwise specified. Add $3 plus 10% total. Canada: $3 plus P.P cost. Charge only.

Sales Tax (N.J. residents only, please add 6% of total)

ORDER TOTAL

☐ My check or money order is enclosed.
☐ Charge my credit card.
☐ Visa ☐ Master Card

RE-114

Card No

Exp Date

Signature

Telephone Area Code Number

Name

Address

City

State Zip

All inquiries and free catalog requests call 201-939-2710.

For all phone orders, call **TOLL-FREE 800-228-2028 ext. 825.** *In Nebraska, 800-642-8300 ext. 825.*

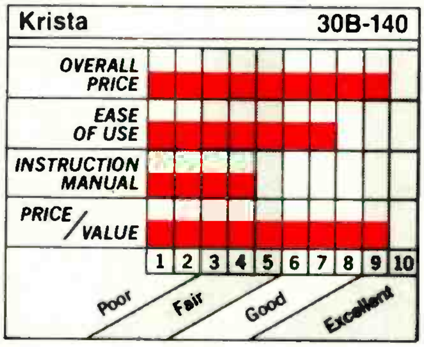
www.americanradiohistory.com

AC voltage is measured only on two ranges—200 and 1000, full scale. The claimed accuracy is ±1.2% and input signals with frequencies from 40 to 500 Hz can be handled. Overload protection is 500-volts DC and 350-volts RMS AC for the 200-volt range. For the 1000-volt range it is 1100-volts AC and DC.

DC current is measured over five ranges. Those are 200-µA, 2-mA, 20-mA, 200-mA, and 10-amps full scale. The accuracy for all current ranges is ±1.2%. Overload protection is provided via an internal 0.5-amp fuse. Maximum voltage input is 200 mV.

Finally, resistance is measured over 4 ranges. Those are 2, 20, and 200 kilohms, and 2 megohms. The claimed accuracy is ±1% on all ranges. Overload protection is provided to 250-volts DC and RMS AC. The nominal test-current produced by the meter varies from 100 µA for the 2K range to 0.3 µA for he 2-megohm range.

The unit is powered by a transistor-radio type 9-volt battery. Expected battery life is specified as up to 200 hours of continuous use. An annunciator on the LCD readout gives warning of a low-battery condition.



The accessories supplied with the unit are a set of test probes, battery, spare fuse, and the operator's manual. The six-page manual is, in all honesty, not very good. It is poorly written, most likely owing to the fact that the manual is a translation (the unit is made in Hong Kong), and provides only the barest details concerning the unit.

The unit is fairly convenient to use, and operates as claimed. We did feel that it was a bit slow. The meter takes readings at a rate of about 2.5-per-second, and it usually took several seconds for the meter to "zero-in" on a reading. It should be noted, however, that that is a characteristic common to most other digital meters.

On the plus side, the meter has a tilt stand built into the case, and the large display is easy to read under most circumstances.

The model *30B-140* is covered under a one-year warranty. Complete details concerning the warranty, including the address of the U.S. service station, are supplied on a separate card that is included with the unit.

Now we come to what has to be the best thing about the unit—the price. It sells for just $41.95, certainly an excellent price for a meter of this type.

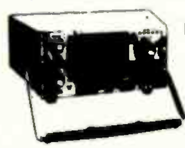
The model *30B-140* is available from your local distributor; it is also available by mail order from Fuji-Svea (PO Box 3375, Torrance, CA 90510). R-E

B+K PRECISION
Xmas Specials!
JERROLD

Jerrold Cordless Cable T.V. Converter
MODEL LCC-58 (Special)

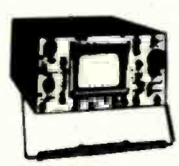
$69.95
ANY QUANTITY
Now Till Dec. 25, 1984

MODEL 1590P
REG $1995.00



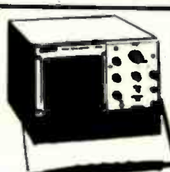
100 MHz 8-TRACE 4 CHANNEL DUAL TIME
Now $1579.95

MODEL 1560P
REG $1150.00



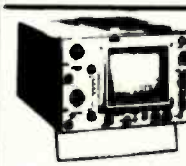
60 MHz TRIPLE TRACE
Now $899.95

MODEL 1479BP
REG $795.00



30 MHz DUAL TRACE
Now $635.00

REG $545.00
MODEL 1476A



10 MHz DUAL TRACE
Now $435.00

OMNITRON ELECTRONICS
770 Amsterdam Ave., New York, NY 10025
Write for FREE 136 page Catalog

SHIPPING CHARGES

For Orders	ADD
$25 - 100	$6.50
$100 - $500	$8.50
$500 - $750	$10.50
$750 and up	$15.00
Parcel Post	$20.00

MASTER CARD • VISA

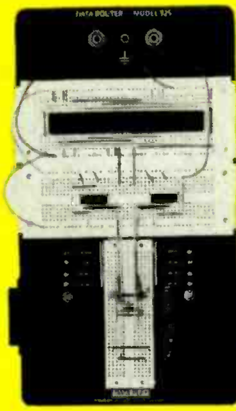
Send Purchase Order, Check, Money Order or C.O.D.
or Call Toll Free
800-223-0826
in N.Y. State (212) 865-5580

CIRCLE 262 ON FREE INFORMATION CARD

www.americanradiohistory.com

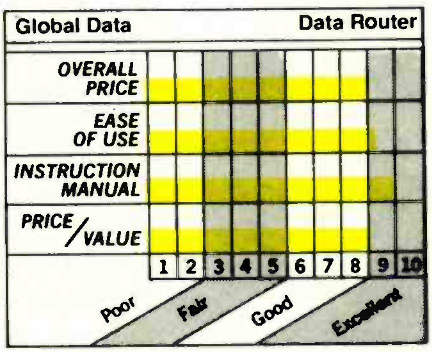
Global-Data Data Router 325 Breakout Box

If you have trouble with a non-standard RS-232 connection, this breakout box can help you solve the problem.



CIRCLE 7 ON FREE INFORMATION CARD

HAVE YOU EVER HAD TROUBLE INTERfacing a modem or printer to your computer even though the connections followed the RS-232 "standard?" Have you ever wired a custom RS-232 cable only to find that you goofed? If you use a lot of peripherals and/or several different computers, you've undoubtedly come up against those problems many times. The quickest and easiest way to find out just what the problem is—and how to go about solving it—is to use a *breakout box* such as the *Data Router 325* from Global-Data (70 Fulton Terrace, New Haven, CT 06509)



The *Data Router 325* consists basically of two 25-pin D-type connectors (one male and one female), eight LED's, and three solderless breadboards. One connector and 4 LED's (along with current-limiting resistors) are wired to either side of a solderless breadboard. Thus, by simply inserting jumper wires from one side to the other, you can feed through, cross-patch, or leave open, any of the RS-232 lines (except pin 1, which is permanently connected as a ground.)

The LED's can be used to monitor the signals on any of the control lines. Because one side of each LED is grounded, and the other side is connected through a current-limiting resistor to the solderless breadboard, simply inserting a jumper wire (between the LED and the line that you monitor) completes the connection. The RS-232 standard pin assignments are printed on one side of the breadboard—that is most certainly a convenience.

Along with the breadboard that is used to make the RS-232 and LED patches, there are two additional breadboards. Those extra breadboards are what set the *Data Router 325* apart from other breakout boxes we've seen. One breadboard (with 0.3-inch center-channel spacing) can be used for standard DIP IC's, and other components, while the other breadboard, (with 0.6-inch center-channel spacing) can be used for larger (even 40-pin!) IC's! So the *Data Router* can be a very convenient way to test out your data buffer or serial-to-parallel converter. Three color-coded binding posts are located above the two extra breadboards so you can conveniently bring outside power to your breadboarded circuits.

The *Data Router 325* sells for about $107. While that may seem expensive for a breakout box, remember that you're getting both a breakout box *and* ample solderless-breadboard space. If you believe that time is money—and if you've ever spent hours discovering that a manufacturer decided to include some non-standard features in his RS-232 configuration—you can begin to see its value. R-E

EKI

ELECTRONIC KITS INTERNATIONAL, INC.
(Formerly PPG Electronics)

NEW!

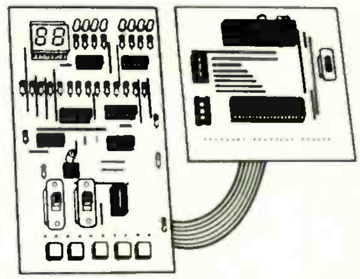
EKI
MICRO-MENTOR™

Build your own Microprocessor System while learning about the latest technology with the New EKI Microprocessor Course. With this up-to-date course you will completly build, step-by-step, a useful Microprocessor System. This system uses the 8085 microprocessor chip and the 8155 support chip. You will learn how microcomputers work and how to program your system using machine language. You will also be able to interface your system with the EKI Speech Synthesizer Interface Board, enabling your system to talk to you!

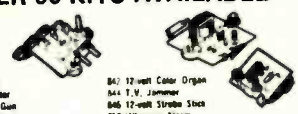
COMPLETE COURSE WITH MICROPROCESSOR SYSTEM KIT
only
$129.95

Speech Synthesizer Kit
$89.95

DISCOUNTS AVAILABLE TO EDUCATORS



OVER 50 KITS AVAILABLE



KIT #
801 Pocket Dice
802 Signal Injector
803 Space War Gun
804 Metal Detector
805 Logic Probe
806 Burglar Alarm
808 Decision Maker
809 LED Pendulum Metronome
811 Double Decision Maker
812 Siren Oscillator
814 Robot Blinker
816 Mini-stick
818 Fish Caller
820 Shimmer Lights
821 Christmas Tree
822 One Channel Color Organ
824 Automatic Siren
826 Fuzz Box
828 9-Volt Power Supply
830 Multi-purpose Power Supply
834 Color Organ 3-channel, 1-control
836 3-channel, 4-control Color Organ
840 Variable Strobe Light
842 12-volt Color Organ
844 T.V. Jammer
846 12-volt Strobe Stick
850 Whisper Alarm
852 Combination Lock/Alarm Control
856 Electronic Tennis
858 Digital Roulette
860 5-24 Volt Regulated Power Supply
861 Big Sound Portable Organ
862 Full-wave Motor Speed Control
866 Digital Slot Machine
868 Digital Dice
870 Nerve Tester
876 6-digit Digital Clock
878 Digital Bird
880 12-volt, 2-amp Regulated Power Supply
882 Musical Horn
884 Sound Activated Color Organ, 1-channel
886 Audio Amp/Intercom
888 Librarian Tormentor
890 Stop-action Timing Tester
892 Telephone Hold Button
894 Phaser Gun/Sound Generator
898 Binary Clock

FREE
CATALOG OF ALL KITS
Available nationwide at your local electronics store.
(Or send $1.00 shipping & handling to address below.)

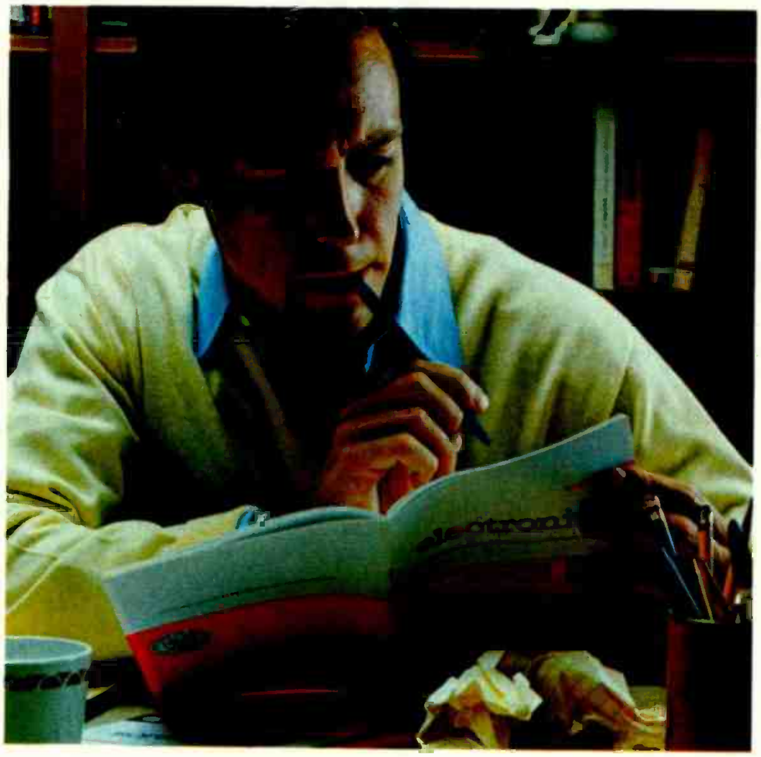
EKI ELECTRONIC KITS INTERNATIONAL, INC.
791 RED ROCK ROAD
ST. GEORGE, UTAH 84770
Call TOLL FREE
1-800-453-1708
For store nearest you.

Special Prices for Educators

CIRCLE 99 ON FREE INFORMATION CARD

www.americanradiohistory.com

Learning electronics is no picnic.



At any level it takes work and a few sacrifices. But with CIE, it's worth it.

www.americanradiohistory.com

Whoever said, "The best things in life are free," was writing a song, not living a life. Life is not just a bowl of cherries, and we all know it.

You fight for what you get. You get what you fight for. If you want a thorough, practical, working knowledge of electronics, come to CIE.

You can learn electronics by spending some hard-working time at home. Or, would you rather go bowling? Your success is up to you.

At CIE, you *earn* your diploma. It is not handed to you simply for putting in hours. But the hours you do put in will be on your schedule, not ours. You don't have to go to a classroom. The classroom comes to you.

Why electronics training?

Today the world depends on technology. And the "brain" of technology is electronics. Every year, companies the world over are finding new ways to apply the wonders of electronics to control and program manufacturing, processing...even to create new leisure-time products and services. And the more electronics applications there are, the greater the need will be for trained technicians to keep sophisticated equipment finely tuned and operating efficiently. That means career opportunities in the eighties and beyond.

Which CIE training fits you?

Beginner? Intermediate? Advanced? CIE home study courses are designed for ambitious people at all entry levels. People who may have:

1. No previous electronics knowledge, but do have an interest in it;
2. Some basic knowledge or experience in electronics;
3. In-depth working experience or prior training in electronics.

You can start where you fit and fit where you start, then go on from there to your Diploma, an Associate Degree if you want it, and career.

Many people can be taught electronics.

There is no mystery to learning electronics. At CIE you simply start with what you know and build on it to develop the knowledge and techniques that make you a specialist. Thousands of CIE graduates have learned to master the simple principles of electronics and operate or maintain even the most sophisticated electronics equipment.

CIE specializes in electronics.

Why CIE? CIE is one of the largest independent home study schools that specializes in electronics. Nothing else. CIE has the electronics course that's right for you.

Learning electronics is a lot more than memorizing a laundry list of facts about circuits and transistors. Electronics is interesting! It is based on recent developments in the industry. It's built on ideas. So, look for a program that starts with ideas and builds on them. Look to CIE.

Programmed learning.

That's exactly what happens with CIE's Auto-Programmed® Lessons. Each lesson uses famous "programmed learning" methods to teach you important principles. You explore them, master them completely, before you start to apply them. You thoroughly understand each step before you go on to the next. You learn at your own pace.

And, beyond theory, some courses come fully equipped with electronics gear (the things you see in technical magazines) to actually let you perform hundreds of checking, testing, and analyzing projects.

Experienced specialists work closely with you.

Even though you study at home, you are not alone! Each time you return a completed lesson, you can be sure it will be reviewed, graded, and returned with appropriate instructional help. When you need additional individual help, you get it fast and in writing from the faculty technical specialist best qualified to answer your question in terms you can understand.

CIE offers you an Associate Degree.

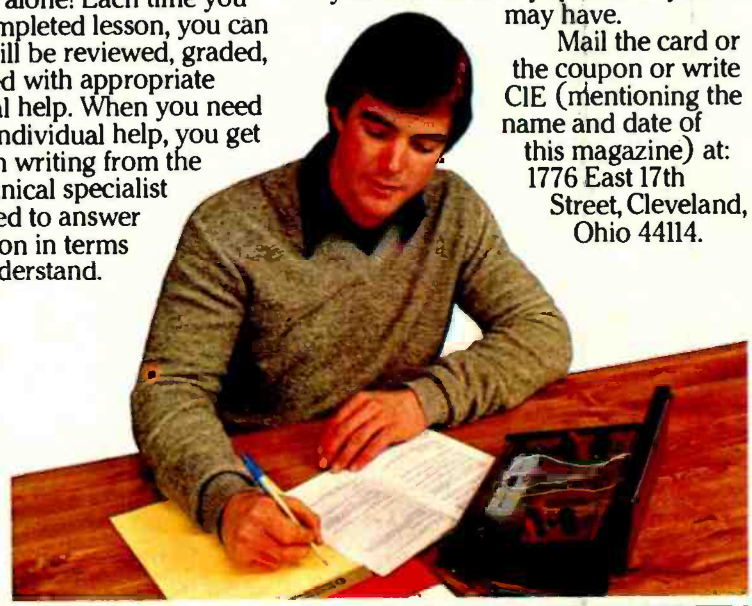
One of the best credentials you can have in electronics—or any other career field—is a college degree. That's why CIE gives you the opportunity to earn an Associate in Applied Science in Electronics Engineering Technology. Any CIE career course can offer you credit toward the degree...more than half of the number needed in some cases.

You can also prepare for the government-administered FCC (Federal Communications Commission) Radiotelephone License, General Class. It can be a real mark in your favor...government-certified proof of your specific knowledge and skills.

Today is the day. Send now.

Fill in and return the postage-free card attached. If some ambitious person has removed it, cut out and mail the coupon. You'll get a FREE school catalog plus complete information on independent home study. For your convenience, we'll try to have a CIE representative contact you to answer any questions you may have.

Mail the card or the coupon or write CIE (mentioning the name and date of this magazine) at: 1776 East 17th Street, Cleveland, Ohio 44114.



RE 98

CIE **Cleveland Institute of Electronics, Inc.**
1776 East 17th Street, Cleveland, Ohio 44114
Accredited Member National Home Study Council

YES...I want to learn from the specialists in electronics—CIE. 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 ______________ Area Code/Phone No. _____ / ______________

Check box for G.I. Bill bulletin on Educational Benefits: ☐ Veteran ☐ Active Duty

MAIL TODAY!

www.americanradiohistory.com

New from B&K-PRECISION

Auto/manual ranging DMMs

from $75

Model 2806
- Autoranging on volts and ohms
- Manual ranging on amps
- 0.7% DC accuracy
- 500 hour battery life
- Continuity test beeper
- Diode check
- Transient and overload protected
- High energy fuse

Model 2807 $115
Manual or autoranging on volts and ohms with 0.5% DC accuracy.

Model 2816 $150
Same features as 2807 with 0.25% DC accuracy.

For more information contact your B&K-PRECISION distributor or write for specifications.

B+K PRECISION
DYNASCAN CORPORATION
6460 West Cortland Street
Chicago, Illinois 60635 • 312/889-9087
International Sales, 6460 W. Cortland St., Chicago, IL 60635
Canadian Sales: Atlas Electronics, Ontario
South and Central American Sales, Empire Exporters, Plainview, NY 11803

NEW PRODUCTS

CIRCLE 8 ON FREE INFORMATION CARD

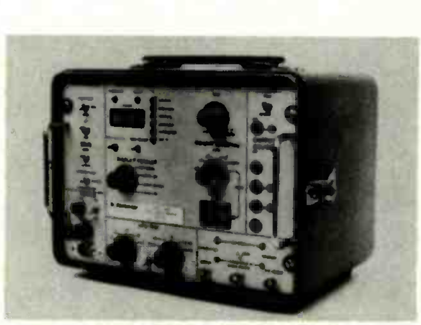
SATELLITE RECEIVER, model *SR5000,* has infrared remote control and dual-microprocessor circuitry that allows the user to preset satellite positions, polarity, and skew, audio-subcarrier frequencies, and tuning voltages into memory. The programmed information can then be selected from the unit's front panel or the full-function remote-control unit. Additional remote-control functions include volume control with mute, direct or scan channel-selection, and video fine tuning.

A special feature of the model *SR5000* is that it uses a block down-converter instead of the single-conversion type. One of the chief advantages of using a block converter is that it allows the user to install a multiple receiver system.

The model *SR5000* is priced at $699.95.— **Regency Electronics,** 7707 Records St., Indianapolis, IN 46226.

TEST SET, model *273A,* is a lightweight, rugged portable error-rate test set. It has a self-contained receiver and transmitter, permitting complete testing for digital-transmission systems or other components such as T1 and T1C carrier, T1 Outstate, Lenkurt Duobinary Carrier, Multiplexed T Carrier and digital-radio systems.

The model *273A* features a checkout with an output bit rate of 1.544 megabits/second ± 50 bits/second in the T1 mode and 3.152 MB/s ±50 bits/second in the T1C mode. It operates over a temperature range of 0°C to +50°C.



CIRCLE 9 ON FREE INFORMATION CARD

The transmitter portion of the instrument provides an internally generated test signal and four T1 compatible outputs, with a 1,048,575 bit quasi-random sequence identical to that provided

CIRCLE 77 ON FREE INFORMATION CARD

www.americanradiohistory.com

KENWOOD

...pacesetter in amateur radio

R-11 portable receiver

R-11

Kenwood's R-11 is the perfect "go anywhere" portable receiver. It covers the standard AM and FM Broadcast bands, plus nine additional short wave bands. The R-11's selectivity is greatly enhanced by the use of double conversion on short wave frequencies above 5.95-MHz. High sensitivity coupled with a dual antenna system (telescopic and ferrite core) allow it to reach out and bring in those distant stations from all over the world.

Simplicity of operation is enhanced by a band-spread type tuning control. Electronic band switching, with LED band indicator, along with a tuning meter to indicate received signal strength, combine to provide you with superior listening capability. Safety Hold-Release switch prevents accidental station loss. Large front mounted speaker provides excellent sound quality. Tone switch adjusts for high, low and voice transmission.

Optional HS-7 micro-head phones allow for private listening pleasure.

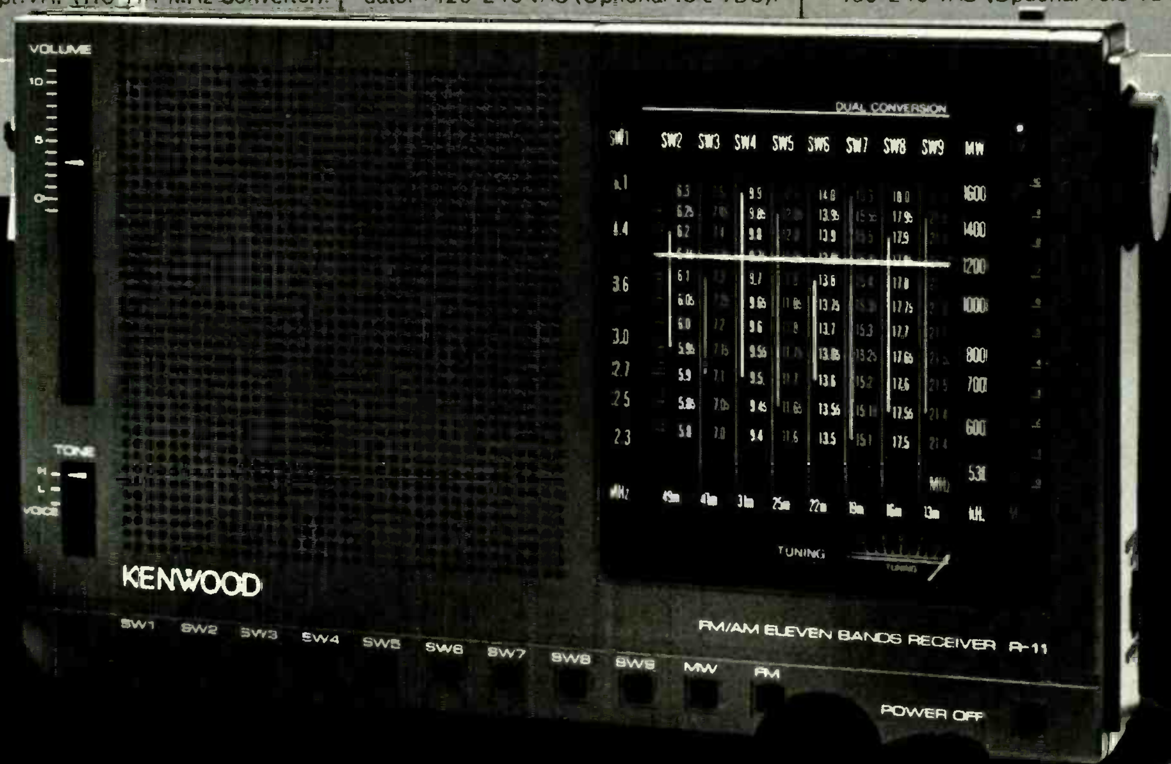
All this along with a record output jack, external antenna terminal and a rugged and attractive carrying case make the R-11 portable receiver the perfect travel companion!

More information on the Kenwood receivers is available from authorized dealers of Trio-Kenwood Communications 1111 West Walnut Street, Compton, CA 90220.

R-2000 Top-of-the-line general coverage receiver • 150 kHz to 30 MHz • Ten memories • Dual 24-hr clock with timer • Scanning • 100-240 VAC (Opt. 13.8 VDC) • Opt. VHF (118-174 MHz converter).

R-1000 High performance receiver • 200 kHz—30 MHz • digital display/clock/timer • 3 IF filters • PLL UP conversion • noise blanker • RF step attenuator • 120-240 VAC (Optional 13.8 VDC).

R-600 General coverage receiver • 150 kHz—30 MHz • digital display • 2 IF filters • PLL UP conversion • noise blanker • RF attenuator • front speaker • 100-240 VAC (Optional 13.8 VDC).



www.americanradiohistory.com

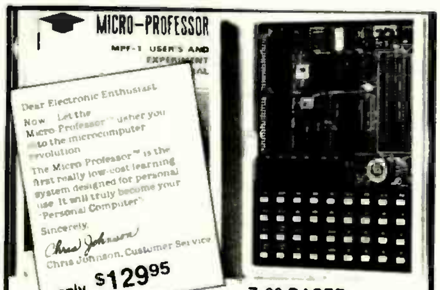
Balldriver®
HEX KEYS
Turn any standard Hex Socket screws the easy way.
- FULL TURNS IN TIGHT LOCATIONS
- BALL SIZE GIVES UNIVERSAL JOINT ACTION EFFECT
- OPERATE FROM DIFFERENT ANGLES

BLX 12 Set-Inch Sizes: .050, 1/16, 5/64, 3/32, 7/64, 1/8, 9/64, 5/32, 3/16, 7/32, 1/4, & 5/16.
BLX 9mm Set-Metric Sizes: 1.5, 2, 2.5, 3, 4, 5, 6, 8 & 10mm.

Alloy Steel • Heat Treated • Industrial Quality
Manufacturer Free Replacement Guarantee

Yes, send me
___ Set(s) BLX 12 at $17.00 each
___ Set(s) BLX 9mm at $19.30 each
☐ check/money order enclosed
☐ Visa ☐ MasterCharge
Acct. No. ________ Exp ________
Signature ________
☐ Yes, I would like a FREE catalog
Name ________
Street ________
City ________ State ____ Zip ____

G&S TOOLS RR1•Box 249 Monticello•MN 55362
For orders under $30, add $2 shipping/handling
Allow 2-3 wks. for delivery. 4-5 wks. if paid by check. Sorry, no C.O.D. orders. MN. residents add 6% sales tax.
CIRCLE 273 ON FREE INFORMATION CARD



only $129.95
Z-80 BASED
MICROCOMPUTER
A superb learning tool for students, instructors, hobbyists.
Nothing else needed. Just plug in and start learning! Complete experimenters manual, easy instructions. 18 experiments. Fully expandable for Z80-CTC, Z80-PIO, EPROM, Breadboarding and prototyping. Invest with confidence. Now only $129.95, two for only $239.95.
Full money back guarantee!
plus-FREE GIFT
☐Check this box for FREE Z-80 Microprocessor Programming and Interfacing textbook when you order within 7 days. $12.95 value.
ETRONIX
Dept. RE124 14803 N.E. 40th Redmond, WA 98052
For immediate action call TOLL FREE: 1-800-426-1044
NAME ________
ADDRESS ________
CITY ________ ST ____ ZIP ____
☐ VISA ☐ MSTCRD EXP ____
ACCT. NO. ________
Include $4.00 Postage & Handling
CIRCLE 111 ON FREE INFORMATION CARD

by Bell Systems *J98710R* T1 quasi-random signal source. The receiver operates independent of the transmitter. It performs bipolar-violation-detection on any signal and bit-error-detection while working in conjunction with its own quasi-random transmitter or equivalent source.

The model *273A*, with a one-year warranty, is priced at $2750.00. — **MR Associataes, Inc.,** 162 Great Road, Acton, MA 01720.

MICROCASSETTE CLEANER, model *79000*, is non-abrasive and represents an adaptation of the Allsop "wet" cleaning system to the requirements of the tiny components of the microcassette recorder. As in the standard-size version, cleaning felts and solution work together to remove oxides and other impurities from not only the

CIRCLE 10 ON FREE INFORMATION CARD

head, but the capstan and pinch roller as well. The cleaning cassette is simply inserted in the recorder and activated like an ordinary microcassette. The package includes two cleaning cassettes and a ½-oz. bottle of cleaning solution. The suggested retail price of the model *79000* is $9.95.—**Allsop, Inc.,** PO Box 23, Bellingham, WA 98227.

MINIATURE SOLDER IRONS, model *C* and model *G*, feature non-charring thermoplastic handles and long-lasting pretinned iron-plated slide-on tips. Safe for even the most delicate electronics components, they are grounded directly from the tip through a flexible, 6-foot cord and a 3-prong molded plug.

CIRCLE 11 ON FREE INFORMATION CARD

To change or replace tips on either model, the user simply removes the old tip and slides on one of the more than 40 styles presently available. The model *C* is priced at $15.95; the model *G* costs $17.95, including a pretinned iron-plated number 2 chisel tip.—**M.M. Newman Corporation,** 148 Linden Street, Suite 105, Wellesley, MA 02181.

RF DOPPLER SENSOR model *PD-245* is a UHF device that can be used in a variety of security and home-convenience applications.

The device emits a beam angle of 120° and will sense objects or personnel moving in this field at a range adjustable from 5 to 25 feet

CIRCLE 12 ON FREE INFORMATION CARD

or more, depending upon the specific application. The field is not restricted by non-metallic surfaces and the unit can thus "see" through wooden doors, glass windows, etc. Upon detection, an internal triac will energize a 120-volt AC load (up to 250 watts) for an adjustable duration of from 3 to 90 seconds.

The model *PD-245* can be used as a "hands-off" switch to turn on

www.americanradiohistory.com

lamps; in alarm applications to energize a siren or bell, as well as many other applications. It comes with a six-month warranty and is priced at $69.96. — **Sentrynet Company,** PO Box 1208, Evanston, IL 60204.

COMMUNICATIONS RECEIVER, Bearcat model *DX1000,* is microprocessor-controlled and features direct-access keyboard tuning. Frequency coverage is continuous from 10 kHz to 30 MHz, including all shortwave bands, longwave, standard broadcast band (AM), amateur-radio broadcasts, and even the marine band.

CIRCLE 13 ON FREE INFORMATION CARD

A ten-station memory makes it possible to store favorite frequencies for instant recall—or for faster "band scanning" during important openings. The digital display measures frequencies to 1 kHz, or at the touch of a button, doubles as a two time-zone, 24-hour digital quartz clock. A built-in timer can wake the user to a favorite station, or can be programmed to activate a tape recorder to record up to 10 broadcasts, in any frequency or mode, while the user is asleep or at work.

The model *DX1000* has a suggested retail price of $599.95. — **Electra Company,** 300 East County Line Road, Cumberland, IN 46229.

METER, the Tenma Combination DMM/DCM meter, has transistor DC current-gain tester. Users can easily read voltage, current, resistance, capacitance, and h_{FE} on the clear ½-inch 3½-inch digit LCD display. The color-coded panel allows user to easily identify the function and range settings.

Safety features include overload protection, single fusing (with

CIRCLE 14 ON FREE INFORMATION CARD

spare fuse inside), and stress-relief test leads. The Tenma Combination DMM/DCM meter comes in a convenient carrying case, with alligator clip h_{FE} leads, and has a one-year warranty. It is battery operated, and the LCD readout indicates low-battery condition. It is priced at $74.95. —**MCM Electronics,** Centerville, OH.

RADIO/CASSETTE PLAYER, model *5770,* features both Dolby "B" and DNR noise reduction for an improvement in signal-to-noise ratio on tape of up to 20 dB. The DNR noise reduction also functions on AM and FM for an improvement of up to 10 dB S/N. Other features include a dual-function fader (for 4-speaker control on the internal amplifier or for controlling 2 external amplifiers on the line-level

CIRCLE 15 ON FREE INFORMATION CARD

outputs), program search on tape, auto-reverse with precision motorized tape-load and key-eject, electronic-governed DC servo tape motor, SDC ceramic tape head, 6-station memory, and up and down frequency seek. There is also signal-actuated stereo blend, an interference-absorption circuit on FM, automatic FM sensitivity control with local/distant range switch, separate bass and treble slide controls, and front-panel illumination.

The model *5770* is priced at $399.95.—**Autotek,** 1447 Carolan Ave., Burlingame, CA 94010 **R-E**

SUPER LONG PLAY TAPE RECORDERS

10 Hour Model — $95.00*
14 Hour Model — $159.00*

Modified Panasonic Slimline. high quality. AC-DC Recorders provide 5 or 7 continuous hours of quality recording & playback on each side of cassette for a total of 10 or 14 hours depending on model. Built-in features include • Voice level control. • Digital counter, etc. TDK DC 180 Cassette Furnished.

PHONE RECORDING ADAPTER

Records calls automatically. All Solid state connects to your telephone jack and tape recorder. Starts recording when phone is lifted. Stops when you hang up. $24.50* FCC APPROVED

VOX VOICE ACTIVATED CONTROL SWITCH

Solid state. Self contained. Adjustable sensitivity. Voices or other sounds automatically activate and control recorder. Uses either recorder or remote mike. $24.95*

*Add for ship & hdlg. Phone Adapter & Vox $1.50 ea. Recorders $4.00 ea. Cal. Res. add tax. Mail order. VISA M/C, COD's OK. Money Back Guarantee. Qty. disc. avail.. Dealer inquiries invited. Free data.

AMC SALES INC. Dept A 9335 Lubec St., Box 928, Downey, CA 90421 (213) 869-8519

CIRCLE 108 ON FREE INFORMATION CARD

SAVE BY BUILDING OUR RACK MOUNT STUDIO EQUIPMENT

QUADRAFUZZ — for separate frequency bands of distortion are mixed for the smoothest fuzz you've ever heard. no. 6720 .... $39.88

HYPERFLANGE/CHORUS — the cleanest, widest range, most versatile flanger anywhere at any price. no. 6750 .... $149.95

VOCODER — unmatched performance in a versatile, low cost rack package. no. 6710 .... $99.95

HOT SPRINGS — user's agree, short of studio plate systems, you won't find a better reverb at any price. no. 6740 .... $59.95

ADD $3 SHIPPING FOR EACH KIT ORDERED

Innovative, cost effective designs by Craig Anderton in easy to assemble kits from:

PAiA Electronics, Inc.

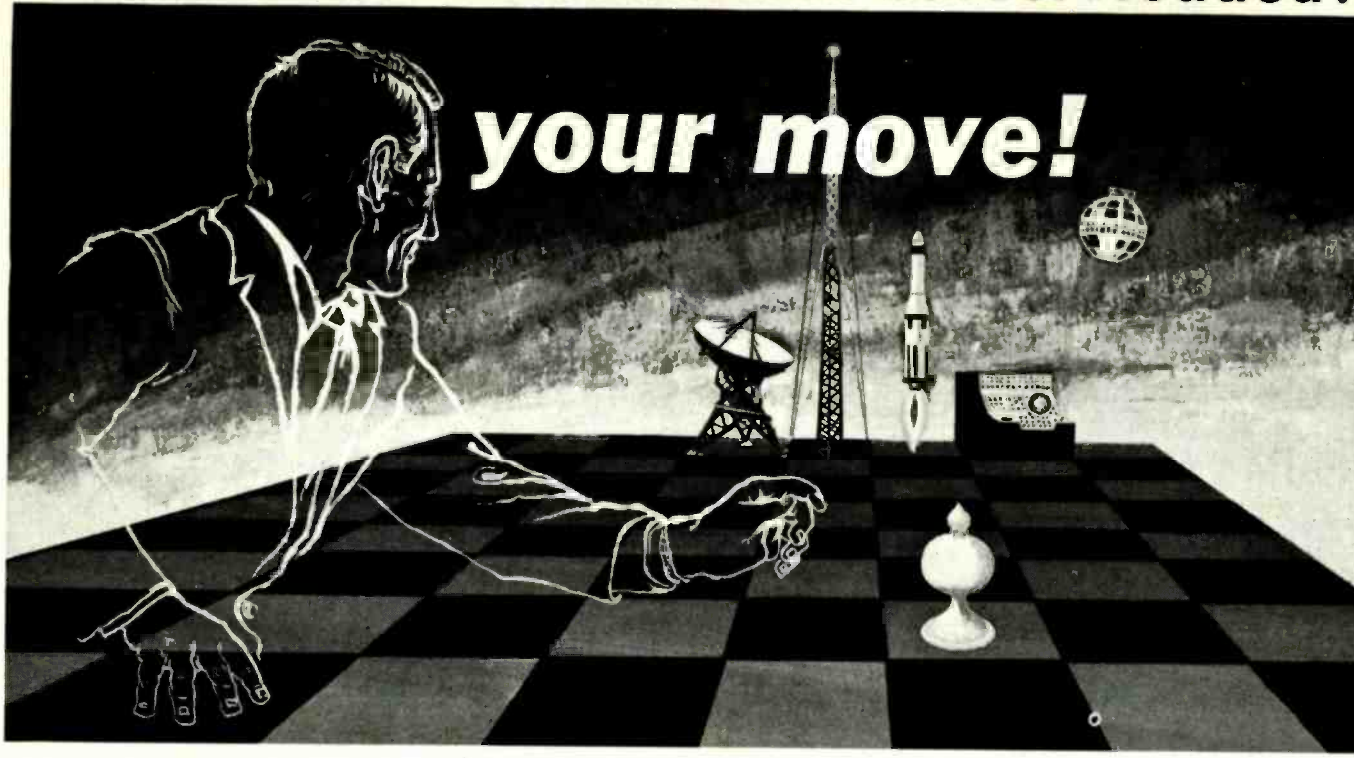
Direct mail orders and inquiries to: Dept. 11R
1020 W. Wilshire, Oklahoma City, OK 73116 · (405)843-9626
Ask for your free catalog.

CHARGE TO VISA OR MC TOLL-FREE
1-800-654-8657 9AM to 5PM CST MON-FRI

CIRCLE 90 ON FREE INFORMATION CARD

www.americanradiohistory.com

Where's Your ELECTRONICS Career Headed?



The Move You Make Today Can Shape Your Future

Yes it's your move. Whether on a chess board or in your career, you should plan each move carefully. In **electronics**, you can *move ahead* faster and further with a

B. S. DEGREE

Put professional knowledge and a COLLEGE DEGREE in your electronics career. Earn your degree through independent study at home, with Grantham College of Engineering. No commuting to class. Study at your own pace, while continuing your present job.

The accredited Grantham non-traditional degree program is intended for mature, fully employed workers who want to upgrade their careers . . . and who can successfully study electronics and supporting subjects through

INDEPENDENT STUDY, AT HOME

Free Details Available from:

Grantham College of Engineering
10570 Humbolt Street
Los Alamitos, California 90720

Independent Home Study Can Prepare You

Study materials, carefully written by the Grantham staff for independent study at home, are supplied by the College, and your technical questions related to those materials and the lesson tests are promptly answered by the Grantham teaching staff.

Recognition and Quality Assurance

Grantham College of Engineering is accredited by the Accrediting Commission of the National Home Study Council.

•

All lessons and other study materials, as well as communications between the college and students, are in the English language. However, we have students in many foreign countries; about 80% of our students live in the United States of America.

Grantham College of Engineering R-12-84
10570 Humbolt Street, Los Alamitos, CA 90720

Please mail me your free catalog which explains your B.S. Degree independent-study program.

Name________________ Age______

Address______________________

City________ State________ Zip______

www.americanradiohistory.com

High-Power FET Audio Amplifier

REINHARD METZ

Get high performance and high fidelity from this FET stereo amplifier. It feels equally at home in your living room or in a disco!

YOU'VE PROBABLY ALWAYS WANTED TO own a high-performance, high-power stereo amplifier. If you don't have one, there are two likely reasons why: You are not sure you need that much power and you are deterred by the cost. But these days, with the increasing popularity of digital audio disc players, there is a new motivation for owning a high-power amplifier that can faithfully reproduce a wide dynamic range without distortion. And while the cost of commercial high-power amplifiers is still high, we'll describe a very high-performance design that you can build at a reasonable cost. Just what do we mean by "high performance?" Table 1 summarizes the characteristics of our design.

One of the most important features of the design is the use of power MOSFET output transistors in a complementary configuration. Those transistors, by themselves, eliminate a number of the problems usually associated with their bipolar counterparts.

The highly desirable characteristics of power MOSFET's for audio amplifiers have been recognized for a few years. However, for many years only N-channel devices were available—only recently have their P-channel counterparts appeared at reasonable prices, making it possible to design amplifiers with remarkable performance but little complexity.

As we'll see shortly, MOSFET's aren't the only transistors used in the amplifier. Ahead of the output stage, a fully complementary bipolar design combines simplicity with high performance.

Why MOSFET's?

Although the evolution of power MOSFET's has primarily been (and still is) fueled by power-supply applications, there are a couple of reasons why MOSFET's make ideal devices for audio-amplifier output stages. First, they allow the design of amplifiers with very wide bandwidths, high slew rates, low distortion, and straightforward simplicity. Also, MOSFET's lack a secondary-breakdown mechanism. (Secondary breakdown in bipolar devices is a localized heating effect in which "hot spots" develop under high-current conditions. A hot spot then conducts even more current, creating more heat, which, in a positive-feedback manner, may lead to a catastrophic destruction of the device.)

Because of secondary breakdown, bipolar devices must be operated within a "safe" area that often falls far short of the device's stated static current and power-dissipation characteristics. Safe-operation-area limiter circuits (whose misoperation has often been notorious) must be used in bipolar circuits. Because MOSFET's do not exhibit secondary breakdown, simpler and more reliable designs can be used.

www.americanradiohistory.com

TABLE 1—SPECIFICATIONS

Power output:
250 watts/channel into
a 4- or 8-ohm load

Frequency response (−3dB):
5 Hz to 1.1 MHz @ 1 watt
5 Hz to 330 kHz @ 250 watts

Distortion:
< 0.05% IM to 250 watts
< 0.05% THD 20 Hz–20 kHz

Signal-to-noise ratio:
> 100 dB

Damping factor:
> 500 to 1 kHz with 8-ohm load

Risetime:
< 0.5 µs @ 80 volts P-P

Slew rate:
> 160 volts/µs

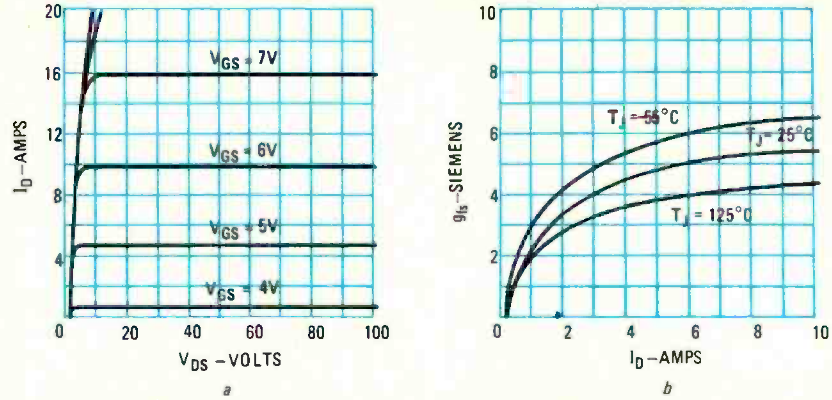


FIG. 1—MOSFET CHARACTERISTICS. Shown in *a* are the typical output characteristics of the IRF630. Shown in *b* is the typical transconductance as a function of drain current for the same device.

The characteristics of the MOSFET's used in this amplifier are shown in Fig. 1. They are, of course, voltage-controlled devices. When the gate-to-source voltage, V_{GS}, drops below about 3.5 volts, the drain-to-source current, I_D, quickly drops to zero. That is called the *gate threshold voltage*, V_T. Above V_T, the *transconductance* (or transfer admittance) builds up to an asymptotic value, averaging about 3 amps of drain current per volt increase in gate-to-source voltage, V_{GS}. (Measured with V_{DS} constant, $\Delta I_D/\Delta V_{GS}$ = 3 siemens)

A look at the circuit

The stereo power amplifier consists of four main stages: input, voltage-amplifier, inverter/driver, and output. Since the MOSFET outputs are the center of attraction, we'll begin there and work our way backward. The amplifier schematic (for one amplifier channel) is shown in Fig. 2.

Transistors Q21 through Q28 are the N- and P-channel MOSFET power output transistors. Each one is capable of contributing a minimum of 6 amps of the output current for peak current requirements. Since the output transistors are in a common-source configuration, the output stage can have voltage gain, and the transistors must be biased with respect to the supply rails. The major advantage of that approach is that the bipolar driver-stage does not have to swing very much voltage, but the outputs may swing from rail to rail. (A common-drain output stage would require the driver to swing the entire output-voltage range which, with bias, would mean that either a pair of separate higher-voltage supplies would be required for the drivers, or that the output would not swing from rail to rail. That

PARTS LIST

All resistors ¼-watt, 1% unless otherwise indicated. (5% types—values shown in parenthesis—can be substituted
R1—10,000 ohms, audio-taper potentiometer
R2—2050 (2000) ohms
R3, R4, R13, R14—10,500 (10,000) ohms
R5, R6, R11, R12, R22—100 ohms
R7—2490 (2400) ohms
R8—500 ohms, potentiometer
R9—2470 (2700) ohms
R10, R29—100,000 ohms
R15, R16—1000 ohms, 2 watts
R17, R18—1000 ohms
R19—5000 ohms, 10-turn potentiometer
R20—8660 (8200) ohms
R21—1500 ohms, 2 watts
R23–R26—511 (510) ohms
R27, R28—2000 ohms, 5 watts
R30—50 (47) ohms
R31–R38—24.9 (24) ohms
R39—162 (160) ohms
R40—5110 (5100) ohms, ½ watt
R41—4.64 (4.7) ohms
R42—4.64 (4.7 or 5) ohms, 10 watts

Capacitors
C1—10 µF, Mylar film
C2—220 pF, ceramic disc
C3, C4, C11—150 pF, ceramic disc
C5—220 µF, 63 volts, electrolytic
C6—8 pF, ceramic disc
C7—0.1 µF, 50 volts ceramic disc
C8, C9—0.1 µF, 100 volts, ceramic disc
C10—1500 pF, 50 volts, ceramic disc
C12–C15—100 µF, 100 volts, electrolytic
C16, C17— 25,000 µF, 75 volts, electrolytic (Sprague 253G075CF2A or similar)

Semiconductors
Q1–Q4—2N5210
Q5–Q8—2N5087
Q9—ECG289A
Q10—ECG290A
Q11, Q12, Q17, Q18—ECG129
Q13–Q16—ECG128
Q19—ECG373
Q20—ECG374
Q21–Q24—IRF9630
Q25–Q28—IRF630
Q29—ECG123AP
BR1—25 amps, 400 PIV bridge rectifier
D1, D2—1N4148
D3–D5—1N4002
D6, D7, D21—1N4735A 6.2 volts, 1 watt, Zener
D8–D11, D23—1N4750A 27 volts, 1 watt, Zener
D12, D13—1N4737A, 7.5 volts, 1 watt Zener
D14, D15—1N4738A 8.2 volts, 1 watt Zener
D16—1N4728A 3.3 volts, 1 watt Zener

Other components
L1—1 µH (15 turns of No. 16 wire wound on R42—see text)
NE1, NE2—Neon bulbs, 110 volts
F1—5 amps, fast-blow fuse
F2–F5—6 amps, fast-blow fuse
F6—10 amps, fast-blow fuse
T1—106 volts, center-tapped power transformer
S1—SPST power switch
J1—Phono jack for input

Miscellaneous
Heat Sinks, Wakefield 512 series, 2×7 inches or equivalent; TO-5 heat sinks for Q12, Q13, Q15, and Q18; chassis; handles; fuse holders; capacitor clamps; power cord; input jacks; binding posts; wire; hardware; insulators, etc.

The following items are available from A&T Labs, Box 552, Warrenville, Illinois, 60555: Etched, drilled, plated-through PC boards, $22 each; Power transformer, $69 each; Set of 8 matched power FET's, $66; Drilled heatsink (type 512), $27. Add 5% shipping and handling, 12% for transformer. Illinois residents include 5¼% sales tax.

www.americanradiohistory.com

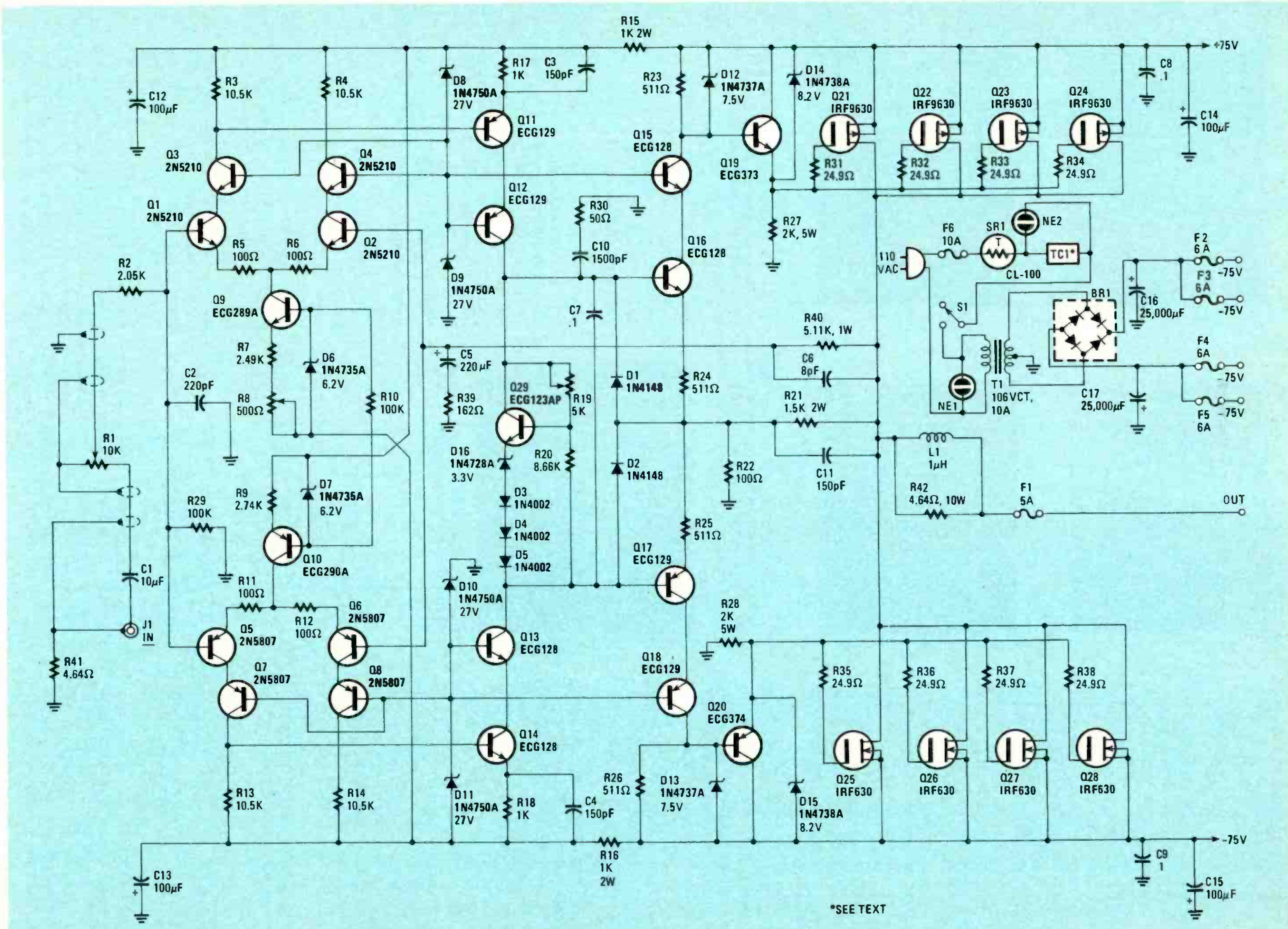


FIG. 2—AMPLIFIER SCHEMATIC for one channel. The power supply shown is sufficient for two channels. While not necessary for home use, the optional thermal cut-out device and inrush limiter shown should be used, for example, in a disco.

www.americanradiohistory.com

would make the stage operate far less efficiently.) The relatively high gate-capacitance of the power MOSFET's is also somewhat easier to drive in the common-source configuration.

Resistors R31 through R38 help to suppress the parasitic oscillations that might otherwise occur with the extremely fast transistors used. Zener diodes D14 and D15 limit the amount of drive available to the output. Finally, L1 and R42 serve to isolate the amplifier output from capacitive loads at very high frequencies.

The inverter/driver stage consists of Q15 through Q20. Its purpose is to deliver bias and drive signals to the FET output stage. Their basic requirement is to sit at about 3.5 volts with respect to the source, increasing about .3 volt per ampere of output current. Transistor Q29 forms a conventional voltage multiplier, which, in this case, multiplies the voltage across D3, D4, and D5 and D16 to about 7 volts. The 7-volt bias is presented to the bases of Q16 and Q17, which form the bottom transistors of a pair of complementary cascode amplifiers.

An output-stage gain of 10 is set by R21, R22, R25, and R26. Therefore, the voltage generated by Q29 is split in half and reflected up against the two supply rails as a pair of bias voltages across R23 and R26. Those voltages, along with the AC drive-signals from the previous stage, are passed along to emitter followers Q19 and Q20, which have the high-current drive capacity required by the gate capacitance of the output devices. Using cascode stages here, as well as in the input and voltage-gain sections, serves the dual purpose of splitting the emitter-collector voltage and power drops among two transistors per rail, while increasing the open-loop frequency response of the amplifier.

The voltage-gain stage consists of transistors Q11 through Q14, again configured as complementary cascode amplifiers. The collector loads for Q12 and Q13 are essentially the input impedance of Q16 and Q17. That is in the neighborhood of 50K, leading to a stage gain of about 50 (the quotient of 50K and R17 or R18). Capacitors C3 and C4 increase the frequency response of the stage. Zener diodes D8, D9, D10 and D11 set the base voltages for the upper transistors in the cascodes.

Now we'll look at the input stage, which consists of Q1 through Q8. Those transistors are connected as complementary-cascode differential amplifiers, supplied by current-sources Q9 and Q10. The gain is set at about 100 by the ratios of R3 to R5 and R13 to R11.

Resistor R8 is used to zero the output voltage by varying the collector currents of Q1–Q4, compensating for any V_{BE} offsets that may exist in Q1, Q2, Q5, and Q6. That is important, because with an extremely low output-impedance such as

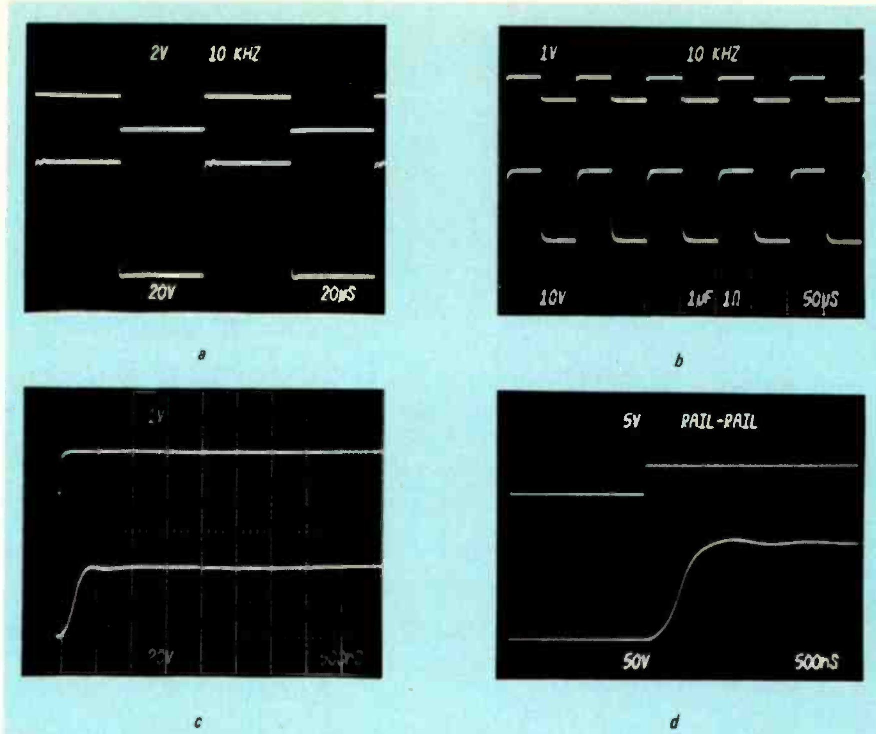


FIG. 3—AMPLIFIER RESPONSE CHARACTERISTICS. *A* shows the response to a 10-kHz squarewave input at 150 watts into an 8-ohm load, while *b* shows the response into a 1-ohm, 1µF load. Shown in *c* and *d* are the step responses at 50 watts and full output, respectively (both with input filter C2 removed). Note the excellent slew-rate and risetime capabilities.

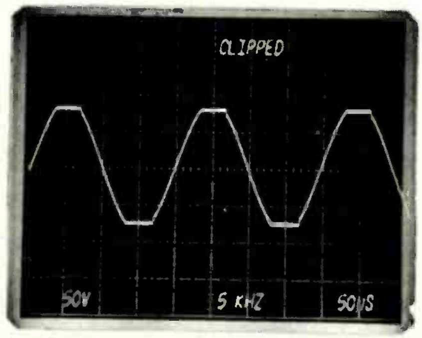


FIG. 4—FULL-POWER OUTPUT with a 5-kHz sinewave input. Note the clipping level is about ±75 volts.

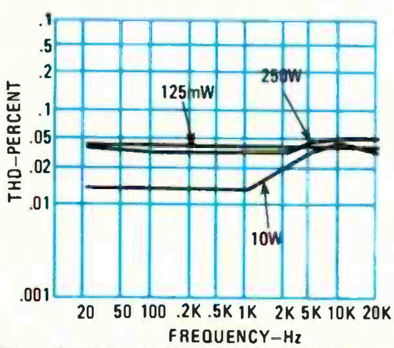


FIG. 5—TOTAL HARMONIC DISTORTION (THD) at 1 kHz.

this amplifier has, even very low output offsets (in the tens of millivolts) can deliver many amps into a short.

The overall voltage-gain of the amplifier is set at about 30 by the ratio of R40 to R39. A 3-dB rolloff is set at about 3 Hz by C5. High-frequency compensation is provided by C10, R30, C6, and C11.

Some optional components are shown in the schematic, notably in the power-supply section. First, there is TC1, the thermal cutout made by Elmwood sensors (1655 Elmwood Ave., Cranston, RI 02907). It is normally closed, and opens at 70°C. Another optional component is SR1, an inrush limiter made by Keystone (Thermistor Div., St Marys, PA 15857). For home applications, those shouldn't be necessary. However, if you plan to run the amplifier continuously at high power (in a disco, for example), you should include all the protection you can.

Amplifier performance

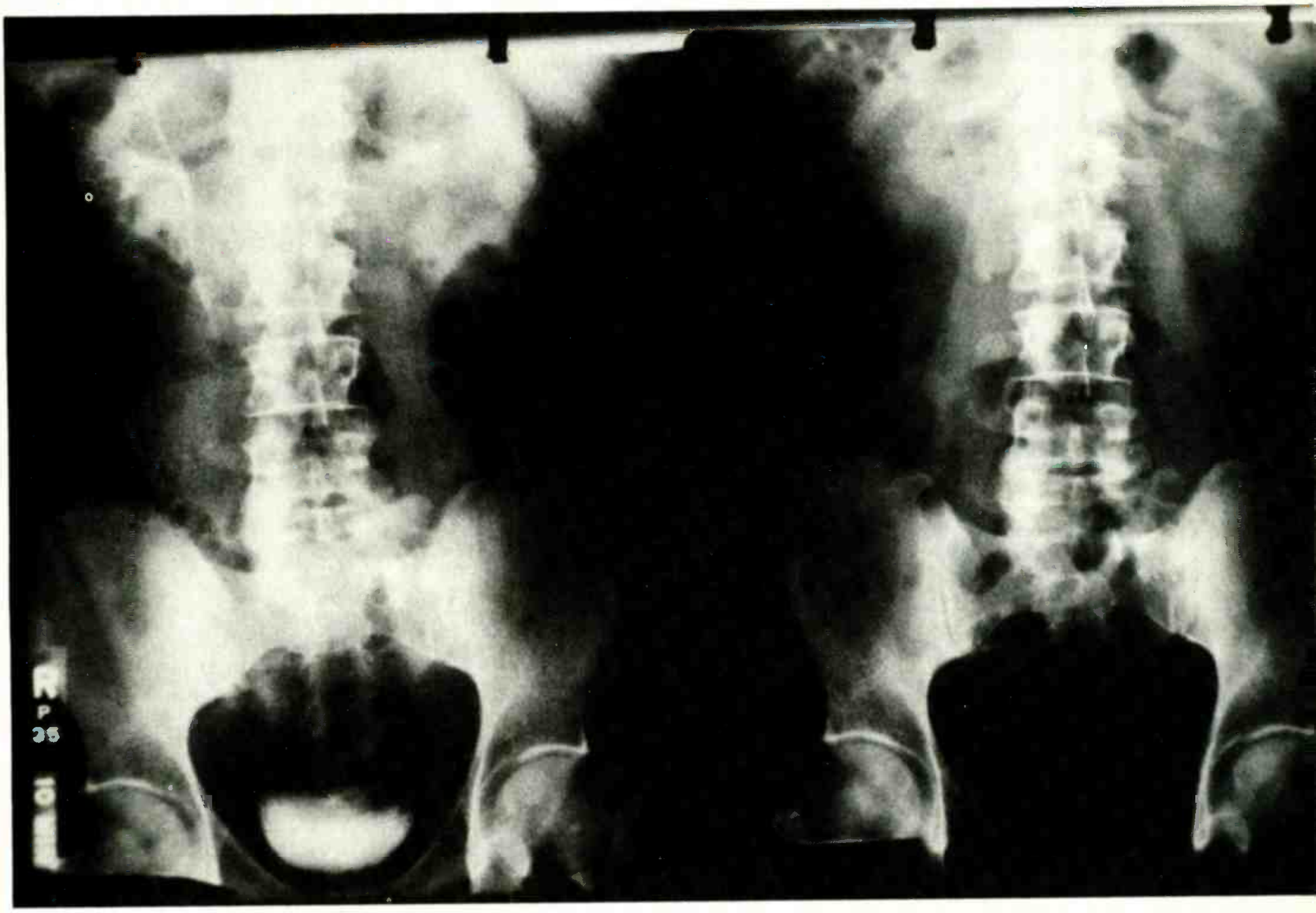
Some of the response characteristics of the amplifier are shown in the oscilloscope photographs in Fig. 3. For example, in Fig. 3-a we see the response to a 10-kHz squarewave at 150 watts into 8 ohms. Figure 3-b shows the response with a 1-ohm, 1-µF load. Figures 3-c and 3-d show the step response at 50 watts and full output, respectively. (Those two risetime tests were made with input-filter capacitor C2 removed.) Figure 4 shows the full-power output with a 5-kHz sinewave input. Figure 5 shows the total harmonic distortion from less than 1 watt to 250 watts at 1 kHz.

Unfortunately, that's all we have room for this time. Whe we continue, we'll show you how to build the amplifier and provide the foil patterns that are essential for the successful completion of the project. **R-E**

www.americanradiohistory.com

ALL ABOUT

Electronics In Medical Imaging



A look at three advanced medical-imaging techniques and the role that electronics plays in them.

RAYMOND M. FISH, Ph.D, M.D.

Part 2 IN OCTOBER'S ISSUE, we explained the principles of X-ray, conventional, and computerized tomography, fluoroscopy, digital subtraction angiography, and ultrasound. This month we'll turn our attention to three other valuable medical-imaging techniques—those are nuclear medicine, nuclear magnetic resonance, and positron emission tomography.

Nuclear medicine has been in clinical use for several decades, in contrast to nuclear magnetic resonance (NMR) and positron emission tomography (PET). NMR and PET are not in general use in all parts of the country, but they do hold out the promise of improved medical care in the future.

Nuclear medicine

In nuclear medicine, a radioactive substance is put in the body. Which particular substance is used depends upon which part of the body is being examined; that's because different parts of the body absorb different radioactive materials differently. The resulting radiation can then be measured and imaged electronically. Arrays of sensitive radiation detectors are used so that the patient is exposed to as little radiation as possible. If the radiation is to be taken up by a tumor, larger amounts of radioactive material may be given in an attempt to selectively destroy the cancer.

The radioactive materials are called radioisotopes or radionuclides. Those substances are radioactive varieties of normally stable elements. The radioactive form of the element is unstable and emits radiation such as alpha, beta, or gamma rays. Most radioisotopes used in medical imaging emit gamma rays.

The radioactive substance may given to a patient by mouth, intravenously, or by inhalation (breathing), depending on the test being done. The material travels to a site in the body that selectively absorbs it. A scan is then performed to image the organ or tissue that has absorbed the radioactive substance.

A nuclear medicine scan can be performed by one or more radiation detectors that move across the body over a period of several minutes or by a stationary array of detectors. The radiation detected at each

www.americanradiohistory.com

point near the patient is measured and stored in a computer memory. When the entire area of interest has been scanned, a composite picture of radiation intensity is produced electronically. Today most nuclear medicine imaging is done with gamma or scintillation (light-producing) detectors using a fixed array of detectors. When scintillation detectors are used, the light from the detectors can produce a photographic image directly, eliminating the need for a computer.

In the body, different tissues and organs selectively absorb and concentrate different radioactive materials. For example, in the thyroid, iodine is normally selectively absorbed and concentrated. Radioactive I-131 is similarly concentrated in the thyroid. Tumors and other abnormal areas in the thyroid will absorb more or less of the radioactive material, depending on the function of the abnormal tissue. When scanned and imaged, valuable diagnostic information about the abnormal thyroid tissue can be obtained. A thyroid scan is shown in Fig. 1.

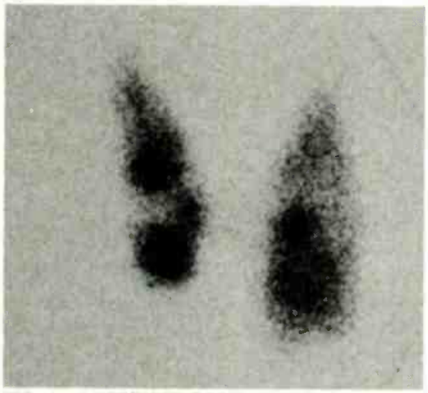


FIG. 1—A THYROID SCAN. Note the areas of increased and decreased radioactive iodine concentration.

Some isotopes are substituted for another element of similar chemical properties. For example, strontium 85 is taken up in sites of active bone formation in place of calcium. There are several reasons why one would want to be able to image new bone formation. For instance, some tumors cause the breakdown and reformation of bone and some fractures cannot be seen with usual X-rays, but new bone formation occurs at the fracture site. Figure 2 shows a bone scan made with technetium-99m pyrophosphate, a substance that has replaced strontium in clinical use.

Certain cells in the liver and spleen are responsible for clearing waste substances from the blood; those cells form the reticuloendothelial system. Those cells will selectively ingest radioactive substances such as technicium labeled colloid. As the reticuloendothelial cells are fairly well distributed throughout the liver and spleen, imaging the liver and spleen will detect areas that are being replaced by abnormal material such as tumors, infections, or blood clots following injury. Figure 3 shows a normal liver-spleen scan.

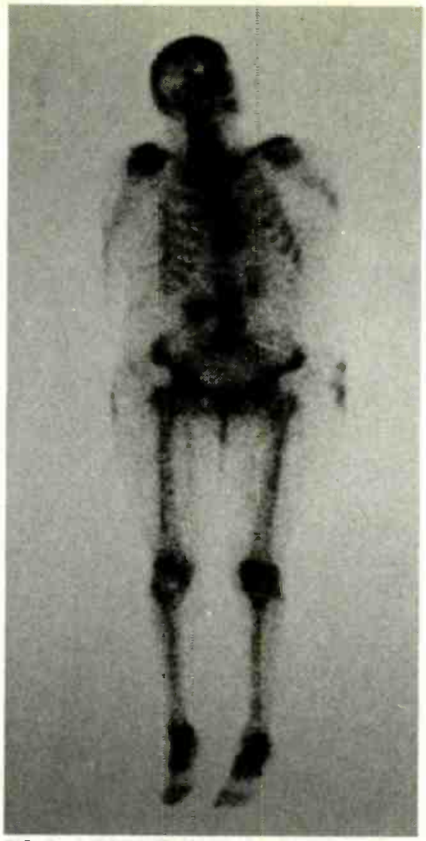


FIG. 2—A BONE SCAN. Such a scan can sometimes show information that is missed on standard X-rays.

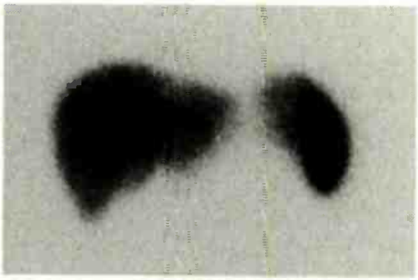


FIG. 3—A LIVER-SPLEEN SCAN. If the proper radioactive substance is used, it is easy to spot any areas that are abnormal. This scan shows a normal liver and spleen.

About 10% of the technetium-99m sulfur colloid particles used for imaging the liver and spleen go to the bone marrow. A scan showing a decrease in the normal uptake of radioactivity in the bone marrow would indicate a tumor or other abnormality in the area.

The lungs can be imaged by having the person inhale radioactive material or by injecting radioactive material into the bloodstream. In the first case, the inhalation scan, radioactivity is evenly distributed throughout the lung unless the airway is blocked. In the second method, the perfusion scan, radioactivity is distributed throughout the lung everywhere except where circulation of blood is blocked. There are many diseases, however, where either or neither method will work because the airway, the circulatory system, or both, are blocked. For example, swallowing a foreign body may just block the airway. A blood clot to the lungs would interrupt just circulation. Pneumonia or a slowly growing tumor would tend to block both.

Technetium 99-m derivatives can be used to scan the brain. They are injected into a vein and travel to areas of the brain where blood circulation is normal. That is helpful in detecting tumors, lack of circulation, collections of blood, and infection. That technique has limitations, however, because tumors normally would have to be at least one centimeter in diameter if they are to be seen. Thus, brain scans are used relatively infrequently these days.

To image the living heart, two radioactive substances are commonly used: thallium-201 and technetium-99m. Thallium is picked up by muscle in which circulation is normal. Technetium-99m, when bound to albumin, remains in the blood and permits the movement of larger amounts of blood to be observed. Thus, thallium will show blood flow in the heart muscle itself, something that is often disturbed by coronary artery disease or a myocardial infarction (heart attack). Any decrease in heart-muscle blood supply (coronary artery perfusion), whether to the entire heart or just to a localized area, can be observed. The scan can be performed during or after exercise to show partial coronary artery blockages.

Nuclear magnetic resonance

Nuclear magnetic resonance (NMR) was discovered in 1946 and has been used since then in chemistry and physics to identify and determine the structure of molecules. The first two-dimensional NMR images were made in the early 1970's.

For medical applications, the molecular structure of tissues determines the NMR image that is formed. Blood flow in the area also plays a part in determining the image seen in an NMR scan. The primary advantage of the technique is that structures and phenomenon that would not show well on X-ray or computerized tomography will often be seen by an NMR scan. Such structures include certain tumors, inflamed tissue, and changes caused by the amount of metabolism (energy usage) of tissue.

Another advantage of NMR is that it uses no ionizing radiation. Instead, NMR imaging depends on the behavior of molecules in mixed magnetic and RF fields. Atomic nuclei with an odd number of protons or neutrons possess spin. Because of that, those nuclei have a small magnetic field. Thus, the nuclei can be thought of as spinning electrical charges that generate magnetic fields.

www.americanradiohistory.com

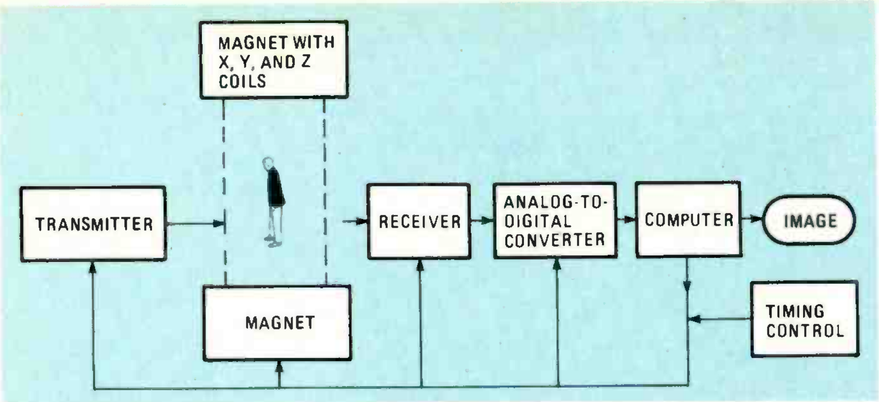


FIG. 4—IMAGING SYSTEM used to perform a nuclear magnetic resonance (NMR) scan. To obtain a three-dimensional image, the scanning is done by varying a magnetic field and analyzing the received RF signals that result.

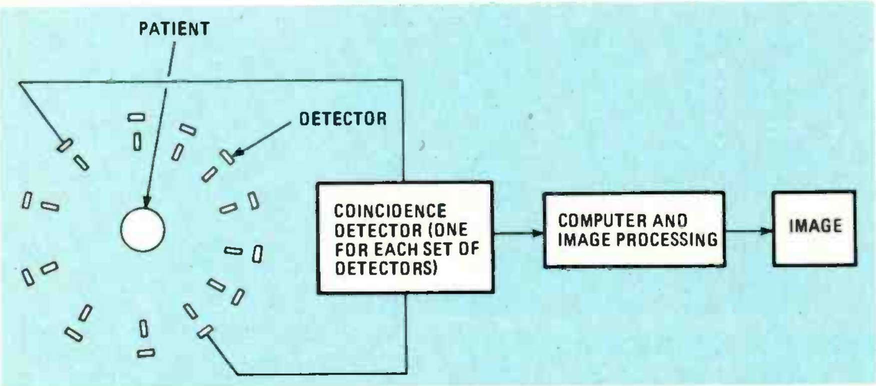


FIG. 5—POSITRON emission tomography (PET) scanning. Coincidence detectors, spaced 180° apart, detect when a positron and electron collide, creating two gamma rays that are emitted in opposite directions (180° apart). From those emissions, using computer techniques, an image of a positron-emitting region can be produced.

When placed in an externally applied static magnetic field, a force is exerted on the nuclei because of the interaction of the two magnetic fields. That force tends to align the nuclei with the applied field. The nuclei will rotate about the field direction (precess) at a frequency that depends on the strength of the applied magnetic field. That frequency is called the precession frequency. If an alternating radio-frequency field at the precession frequency is superimposed on the magnetic field, the nuclei will absorb energy from the RF field.

The nuclei in the magnetic field absorb energy only if the RF field is at a discrete resonant frequency. At that resonant frequency, the magnetic moments of the nuclei become aligned against the applied static magnetic field. The resonant frequency is determined by the chemical composition of the tissue that is being examined.

When the RF field is removed, the nuclei in the excited state revert to the more stable state and emit RF energy. The amount of time it takes for the nuclei to return to their stable state (relaxation time), varies depending on the chemical composition of the tissue. For instance, some cancer cells have longer relaxation times than normal cells. Using computer techniques, those relaxation times can be used to generate an image (see Fig. 4).

To obtain an image, spatial information must be obtained. That is accomplished by several methods. One involves varying the magnetic field with position. That, in turn, causes the resonant frequency to vary with position. To obtain images in three dimensions, sequences of different magnetic field pulses are used, usually applied along x, y, and z axes. To image a thin cross section of tissue, an RF field perpendicular to the plane of the slice is used.

It is difficult to produce the required magnetic fields because they must be several thousand times stronger than the earth's magnetic field (the stronger the field the better the image) and large enough to enclose a human body. Thus, NMR machines are sure to be expensive.

Even so, the technique is promising and useful. For instance, NMR is capable in some cases of detecting brain tumors and changes due to multiple sclerosis that were not seen by a CAT scan.

Positron emission tomography

Positron emission tomography (PET) involves the use of isotopes that decay by emitting positrons. The isotopes include flourine-18, oxygen-15, nitrogen-13, and carbon-11. Those isotopes are attached to metabolically active compounds. The compounds are taken up at certain areas in the body, depending on the functioning of the body.

When an isotope emits a positron, the positron collides with a nearby electron, destroying both but causing two gamma rays to be emitted; those rays travel in opposite (180° apart) directions.

An array of detectors around the person is used to detect those gamma-ray emissions (see Fig. 5). Typically 50 such detectors are used; those are rotated about the patient. Computer techniques are then used to reconstruct images of the radiation-emitting areas.

One of the first metabolically active compounds used in PET scanning was 2 deoxy-D-glucose (2 DG). That chemical is transported through the blood/brain barrier and is used as a source of energy by the brain. By bonding a positron-emitting isotope to that chemical, various areas of the brain can be imaged and the effects of drugs, disease, or mental disorder can be observed. Similarly, other metabolically active compounds are used to study other organs and tissues in the body.

The advantages of PET and NMR is that those techniques can produce images based in part upon the chemical makeup and functioning of the body. In contrast, most X-rays show only the structure of the body. New uses for PET and NMR are still being developed. **R-E**

"Want to hear my secretary in stereo?"

www.americanradiohistory.com

This will be coming to you when you subscribe to **Radio-Electronics**

- **HELPFUL CONSTRUCTION ARTICLES...**
  - Test Equipment
  - Hi-Fi Accessories
  - Telephone Accessories
  - Music Synthesizers
  - Computer Equipment
  - Automotive Equipment
  - Intruder Alarms-Home & Car
  - Video Accessories
- **NEWS ON NEW TECHNOLOGY**
  - Computers
  - Microprocessors
  - Satellite TV
  - Teletext
  - Automotive Electronics
  - Speech Synthesizers
  - IC Applications
- **FASCINATING "HOW TO DO IT" ARTICLES...**
  - Build Your Own Projects
  - Make Your Own PC Boards
  - Wiring Techniques
  - Soldering and Desoldering
  - Design and Prototyping

- **HOW YOU AND THE COMPUTER CAN BE FRIENDS...**
  - Getting Started
  - Programs, Circuit Design, Games
  - A/D-D/A Interfacing
  - Peripheral Equipment
- **NEW AUDIO DIMENSIONS FOR YOUR PLEASURE...**
  - Noise-Reduction Devices
  - How to Connect that Extra Add-On
  - Hi-Fi Accessories
  - New Technology
- **TV WONDERS FOR YOUR FUTURE...**
  - Latest Receivers and Circuits
  - The Home Entertainment Center
  - Projection TV Today
  - Satellite TV Receivers
  - Jack Darr's Monthly Service Clinic
  - Service Problems and Solutions
- **REGULAR MONTHLY FEATURES**
  - DESIGNERS NOTEBOOK by Robert Grossblatt
  - HOBBY CORNER by "Doc" Savage, K4SDS
  - STATE-OF-SOLID-STATE by Bob Scott
  - WHAT'S NEWS, new products, stereo news
  - VIDEOGAMES, new products, game reviews and NEW IDEAS, STEREO PRODUCTS, NEW COMPUTER PRODUCTS FOR HOME/JOB and MUCH MORE!

Radio-Electronics covers all aspects of the fast moving electronics field...featuring
COMPUTERS • VIDEO • STEREO
TECHNOLOGY • SERVICE
COMMUNICATIONS • PROJECTS

Get it all!

Subscribe today to **Radio-Electronics!** Don't miss a single issue and...you save as much as $20.03 off the single-copy price.

When you select one of the subscription offers listed on the handy coupon—you'll be assured of having your copy reserved, even if it sells out on the newsstand. Make sure you get all the excitement in every issue of **Radio-Electronics**, every month, by filling in and mailing the coupon, today.

Mail to: Radio-Electronics
P.O. Box 2520, Boulder, CO 80322

7HM44

Every Month!
Get the Best—Mail Today!

☐ 1 Year - **12 issues only** $11.97 (You save $9.03 off the single-copy price.)
☐ 2 Years - **SAVE MORE! - 24 issues -** $21.97. (Save $20.03 off the single-copy price.)

☐ Payment Enclosed
☐ Bill Me

Name ______________________________
(please print)

Address ______________________________

City ______________ State ______________ Zip Code ______________

Offer Valid In U.S. and Canada Only
Allow 6-8 weeks for delivery of first issue.

Canada—Add $3.00 per year
Offer Valid in U.S. Funds Only

www.americanradiohistory.com

Video Radio-Electronics Entertainment

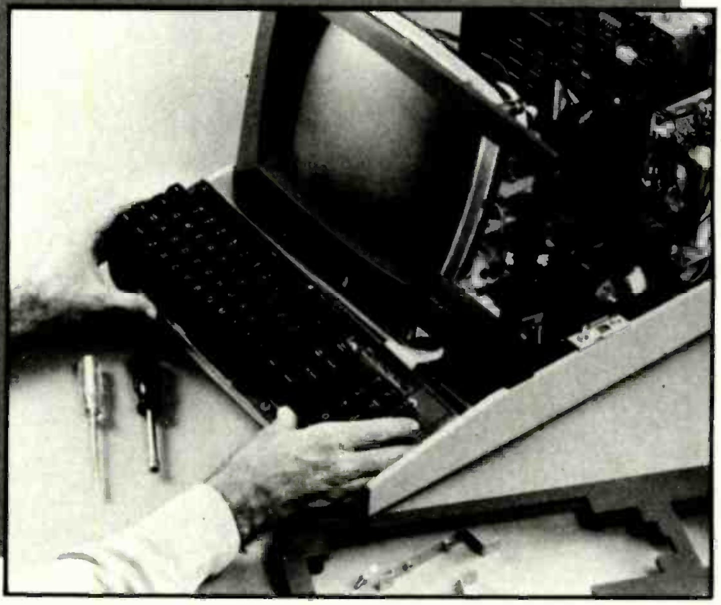
DECEMBER 1984

Flat Panel Color TV
Servicing Videodisc Players
Lightweight Video Cameras

www.americanradiohistory.com

In Computer Electronics...

NTS INTRONIC™ HOME TRAINING GIVES YOU THE EDGE



The competition for High-Technology careers is strong, and the rewards are great. Give yourself the edge you need by training with NTS.

NTS INTRONIC home training provides you with a special kind of "Hands-On" experience that prepares you better, develops your skills faster. You advance as quickly as you wish, working with actual circuits, diagrams, schematics, and state-of-the-art hardware. There are a dozen different NTS programs in electronics to help you develop and reach your potential. They range from basics to advanced areas in several fields. And the ALL-NEW NTS course catalog spells it all out. It's free, and does not obligate you in any way. Send for it today.

A GROWTH INDUSTRY

High-Technology is a growth industry. The evidence is clear, and most observers predict a steady expansion due to a relatively strong flow of investment capital into computers, electronics and precision instruments. Sales of computers alone will reach an estimated ten million units this year. This means challenges and new employment opportunities, especially in servicing and maintenance. Computer servicing skills can best be learned by working directly on field-type equipment. NTS electronic hardware is selected and developed especially for the training program with which it is associated. You learn by doing, by assembling, by performing tests and experiments, covering principles of computer electronics, microprocessor trouble-shooting, and circuitry.

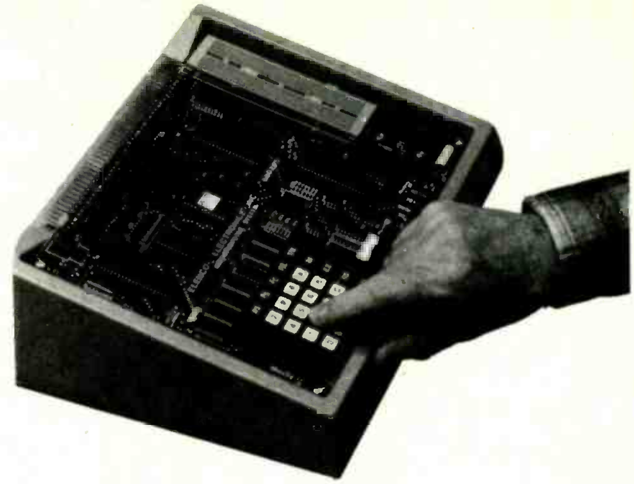
MICROCOMPUTERS

NTS offers three programs in computer electronics. You will receive training covering solid-state devices, digital logic circuitry, and the fundamentals of the computer itself. Instruction includes micro-control technology and detailed operation of microcomputers. These courses will prepare you for entry-level in many facets of the computer industry such as field service and customer engineering as well as programming. In addition to written texts your course includes the NTS/HEATH disc-drive computer which you assemble as part of the training process. The assembly and use of the computer will serve to reinforce practical application of principles.

www.americanradiohistory.com

MICROPROCESSOR TECHNOLOGY

The field of industrial and microprocessor technology encompasses the application of electronic microprocessor control principles. Your course takes you from fundamentals of digital electronics and associated circuitry through the application of the microprocessor as a control device. You will learn how to move and manipulate instructions and information. The microprocessor trainer included in your course is a microcomputer system designed as a practical tool for learning the use of software and hardware techniques utilized in the linking of microprocessors to various systems.

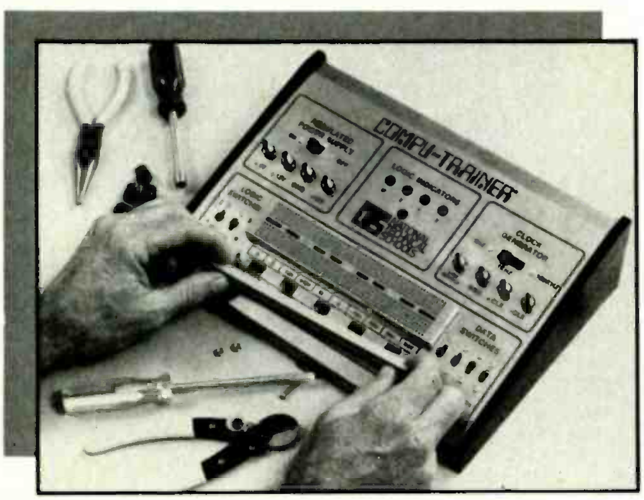


DIGITAL ELECTRONICS

The NTS Compu-Trainer is a fascinating solid-state device which you will build in order to perform over ninety logic circuit experiments. These experiments serve to emphasize an area of electronics which is essential to the understanding of state-of-the-art control equipment; they are also extremely important to those wanting to pursue a career in computer servicing. Separate courses involving the Compu-Trainer are also available in Microcomputer Servicing and Digital/Analog Electronics.

ROBOTICS & VIDEO TECHNOLOGY

Other NTS courses cover a wide range of specialization. In Robotics, the NTS/Heath Hero I is included to train you in robotic applications in manufacturing processes. In Video technology, a new course features the advanced NTS/Heath Z Chassis "Smart Set" color TV with computer space command remote control and space phone. This is an excellent program for those interested in a career in video servicing with microcomputer basics.



EARN CEU CREDITS

America's industrial giants are turning more and more frequently to home study as an effective way to upgrade employee skills. You benefit from the experience NTS has gained in its 79 years as a leader in technical training. The skills and experience gained in the building of kits and test equipment provide you with training that cannot be duplicated. And, depending on the program you select, you can earn up to 30 CEU credits for successful completion. Complete details included in the catalog.

Use the mail-in card or fill out and mail the coupon. Indicate the field of your choice. (One, only please.) FREE full color catalog will be sent to you by return mail.

NATIONAL TECHNICAL SCHOOLS Dept 206-124
4000 South Figueroa Street, Los Angeles, CA 90037
Please send FREE color catalog on course checked below:

- ☐ Robotics
- ☐ Computer Electronics
- ☐ Digital Electronics
- ☐ Video Technology
- ☐ Auto Mechanics
- ☐ Home Appliances
- ☐ Air Conditioning/Solar Heating

Name ______ Age ______
Address ______ Apt. ______
City ______ State ______
Zip ______ Phone ( ) ______

☐ Check if interested ONLY in classroom training in Los Angeles
☐ Check if interested in G.I. Bill Information.

NO OBLIGATION

NATIONAL TECHNICAL SCHOOLS

TECHNICAL TRADE TRAINING SINCE 1905
Resident and Home-Study Schools
4000 So. Figueroa St., Los Angeles, CA 90037

www.americanradiohistory.com

"Thanks a lot RCA, for this useful tool. SK is super!"

—Bob Lucas, TESA NEWS of St. Louis

In a 35-year electronic servicing career, Bob Lucas has seen many components come and go. Too many. That's why he recommends the RCA SK Guide to Reliable Replacement Semiconductors. The Guide not only clears up the confusion, but also offers hands-on advice to technicians when and where they need it.

Bob Lucas calls the SK Guide's Cross Reference Directory "a very important reference." He points out that even without a schematic diagram, a technician can find a suitable replacement for a defective part just by cross-referencing a part number. (2,300 RCA SK devices replace over 193,000 industry types.)

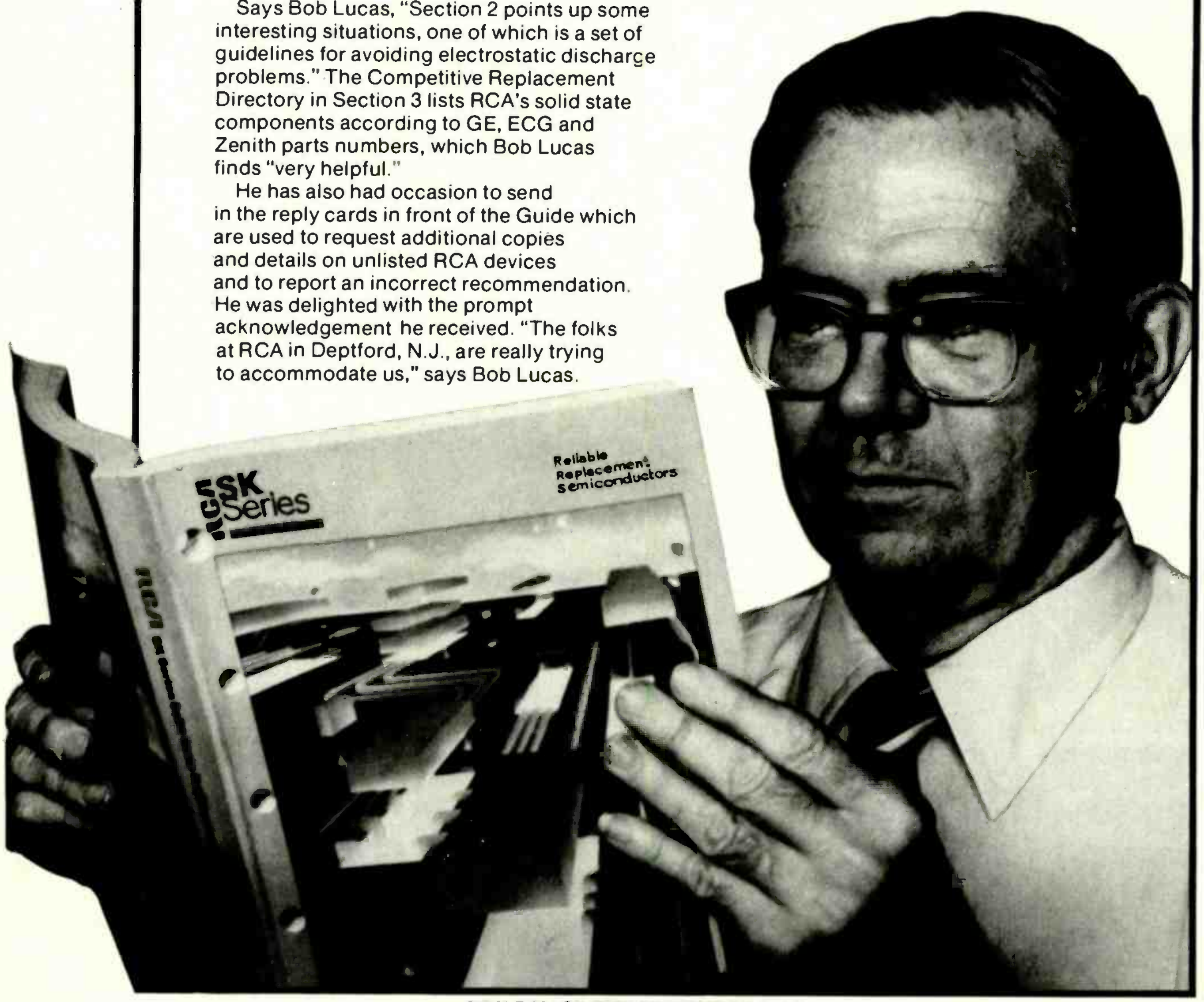
Says Bob Lucas, "Section 2 points up some interesting situations, one of which is a set of guidelines for avoiding electrostatic discharge problems." The Competitive Replacement Directory in Section 3 lists RCA's solid state components according to GE, ECG and Zenith parts numbers, which Bob Lucas finds "very helpful."

He has also had occasion to send in the reply cards in front of the Guide which are used to request additional copies and details on unlisted RCA devices and to report an incorrect recommendation. He was delighted with the prompt acknowledgement he received. "The folks at RCA in Deptford, N.J., are really trying to accommodate us," says Bob Lucas.

Pick up a copy of RCA's SK Guide to Reliable Replacement Semiconductors (SKG202C) at your local RCA SK Distributor or write to Sales Promotion Services, RCA Distributor and Special Products Division, 2000 Clements Bridge Road, Deptford, N.J. 08096. Who knows? Maybe we'll ask you to write our next ad!

RCA

Distributor and Special Products Division



CIRCLE 261 ON FREE INFORMATION CARD

www.americanradiohistory.com

Flat Panel Color TV

A practical flat-panel color display has long been a dream. Now, thanks to a recent breakthrough, that dream has come true. Here's a look at that breakthrough, and the revolutionary TV that makes use of it.

CARL LARON, ASSOCIATE EDITOR

MOST READERS OF RADIO-ELECTRONICS are familiar with the first generation of flat-panel LCD-TV's that began appearing during the past year. While they represented a significant step forward in technology, they left a bit to be desired in terms of performance. Among other things, those displays suffered from blurring; images seemed to flow across the screen, leaving comet-like trails behind. Also, up to now, the displays were available in black-and-white versions only.

Those drawbacks have been eliminated, however, in a new development recently announced by Epson (23530 Hawthorne Blvd., Suite 100, Torrance, CA 90505). That development is a flat-panel, *color*, liquid-crystal display with a very fast response time. In fact, despite its lower resolution, the quality of the picture that can be produced by the Epson display is comparable to that of a CRT.

A flat-panel display

In the CRT that we are all familiar with, the picture is created by sweeping an electron beam across a phosphor-coated screen in response to a video signal. In the display developed by Epson, on the other hand, the picture is generated by rows of pixels (picture elements). Each pixel is switched on and off by a microscopic thin-film transistor. The pixels in the Epson display are not phosphors, however, but are liquid crystals.

Liquid crystals are long organic molecules with the optical properties of both liquids and solids. In the display, the liquid-crystal material is sandwiched between two polarizers whose transmission axes are orthoganal (separated by 90 degrees) to each other. When no electric field is present, the condition shown in Fig. 1-a, the liquid crystal molecules are arranged so that the one nearest the front polarizer is parallel to that polarizer's transmission axis, and the one nearest the rear polarizer is parallel to that polarizer's transmission axis. The successive layers of molecules twist gradually through the 90 degrees between the front and rear polarizers. Light that enters through the rear polarizer is twisted 90 degrees by the liquid crystal molecules and passes out the front polarizer.

But when an electric field is present, as shown in Fig. 1-b, the molecules stand on end, parallel to the electric field. Since then the light is no longer twisted, light that passes through the rear polarizer is absorbed by the front polarizer.

Before a successful liquid-crystal display could be created, some relatively difficult technical problems needed to be solved. For one thing, conventional liquid crystals, the kind used in watch and calculator displays, switch relatively slowly. (By switch, we mean change from their twisted to their untwisted orientation when an electric field is applied, and back again when it is removed.) That problem was solved through the development of a liquid-crystal that reacted faster to the presence or absence of an electric field.

Incidently, the blurring that is a common problem of earlier LCD-TV displays is caused by slow switching times; Epson's display switches fast enough to totally eliminate such blurring.

Other significant problems were the low contrast of liquid-crystal displays and the fact that most were capable of only producing dark images on a light background or light images on a dark back-

www.americanradiohistory.com

color image is created by selectively exciting red, blue, and/or green phosphors arranged in a tight matrix.

In the Epson system, color is created through the use of color filters. Tiny red, blue, and green filters are placed in a tight matrix pattern, and the entire arrangement is placed in front of the LCD. The matrix is arranged so that one of the colored filters is placed in front of each TFT (pixel).

Let's see how the system works. If, for instance, a red area is to be created, the TFT's at the blue and green filters are turned on, preventing light from passing through them. In the meantime, light continues to pass freely through the red filter. Conversely, if blue is desired, the TFT's at the red and green filters are turned on; if green is desired, the TFT's at the blue and red filters are turned on.

Colors can, of course, be combined to produce others. White is created by turning off all of the pixels in an area, thus allowing all of the colors through. Black is created by turning on all of the pixels, thus blocking all light. A full gamut of other colors and shades (see Fig. 3) can be created by selectively turning on or off the various pixels in a region.

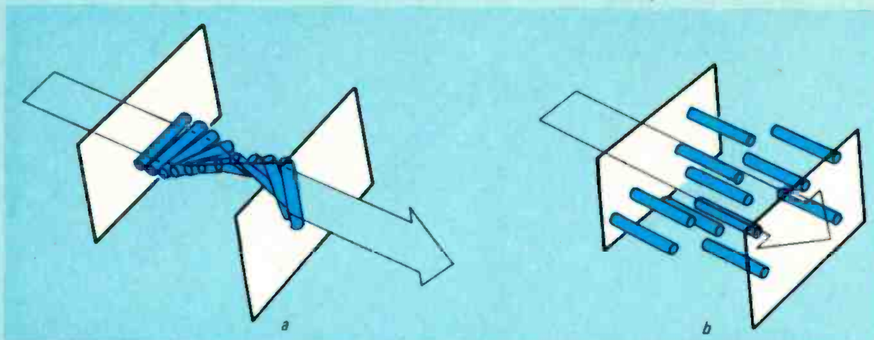


FIG. 1—WHEN NO ELECTRIC FIELD is present, the liquid-crystal molecules twist the light 90 degrees, thus allowing it to pass through the front polarizer as shown in *a*. When an electric field is applied, the molecules no longer twist the light so that the light is absorbed by the front polarizer as shown in *b*.

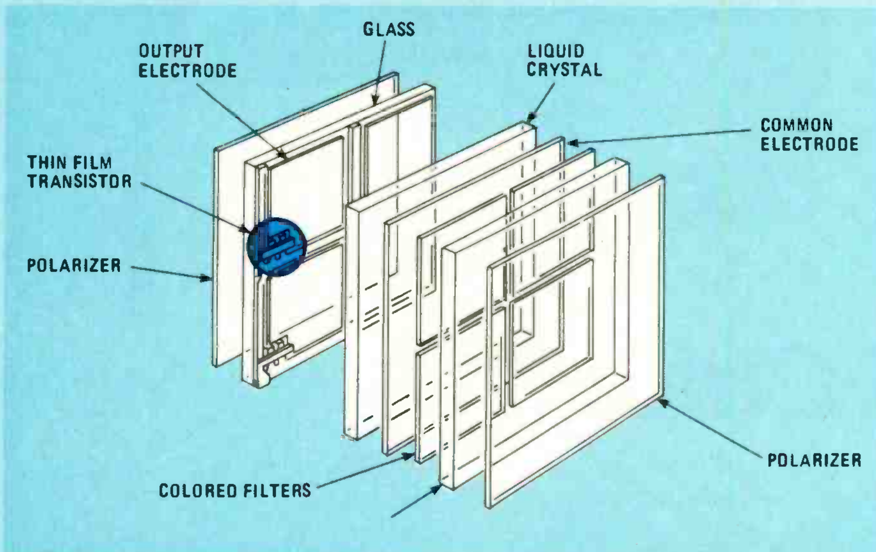


FIG. 2—THE EPSON DISPLAY consists of a rear horizontal polarizer, liquid-crystal cell, and front vertical polarizer. The electric field is applied using a unique system consisting of thin-film transistors and a common electrode.

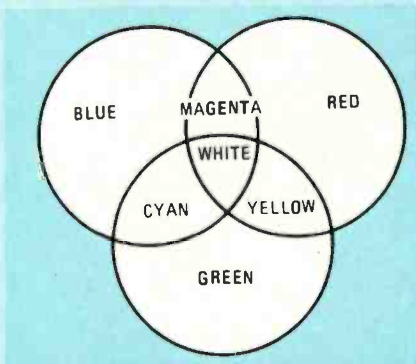


FIG. 3—A WIDE VARIETY OF COLORS and shades can be created using various combinations of red, green, and blue.

ground.

The solutions

Prior to the development of Epson's display, multiplexing was used in liquid-crystal display devices to control the thousands of pixels needed to generate an image. In multiplexing, rows of electrodes are placed on one side of the liquid crystal, while columns of electrodes are placed on the other; the junctions where the rows and columns crossed would correspond to a pixel.

To turn on a pixel, control pulses would be fed in rapid succession to each row. Those pulses would turn on selected electrodes in that row. Meanwhile, all of the column electrodes would be pulsed simultaneously. While the voltage generated by the column electrodes would be insufficient to affect the liquid crystal molecules, when the column and selected-row electrodes are both pulsed, the voltage level is sufficient to effect the liquid crystal molecules and they respond.

That technique has a serious drawback—poor contrast. The reason for it is that the time-weighted average on-off voltage ratio is very low, which means that the difference between the black and white levels is not very great.

Epson's solution to that problem is a technique called "active-matrix addressing." In it, the 240 row and 220 column electrodes are all placed on a single glass substrate. On the opposite side of the display is a common electrode.

At each row and column junction, a *T*hin *F*ilm *T*ransistor (TFT) is located. Those transistors, made from polycrystalline silicon, turn on whenever a pixel is to be activated. Which pixels are to be turned on is controlled by the driver circuitry of the device. Through the use of TFT's, each pixel receives the full voltage required for turn-on. As that voltage is no longer a time-weighted average, the on-off ratio is much higher than in multiplexed devices, resulting in good contrast levels. A diagram of Epson's LCD system is shown in Fig. 2.

Adding color

Once the problem of devising a suitable monochrome display was solved, the next step was the addition of color. The approach taken was not unlike that used in conventional color CRT's. In those, the

The *Elf*

Epson's first application of its new technology is its *Elf* flat-screen TV (see Fig. 4). According to the manufacturer, that tiny color TV should be on store shelves by the time you read this.

The Epson *Elf* is almost transistor-radio sized, measuring 3.15 × 6.3 × 1.22 inches, and weighs just 1.1 pounds. The set features a 2-inch, diagonal-measured screen. The heart of the device is the new flat-panel LCD unit, which is shown in Fig 5 and described above.

The tiny TV can be powered from any one of three power sources. Those are either standard or rechargable "AAA"-sized cells, an AC power adaptor, or a car-battery adaptor.

Among the user controls are TINT, COLOR, and BRIGHTNESS. All VHF and UHF TV channels can be received, and

www.americanradiohistory.com

FIG. 4—THE EPSON *ELF* is as small as a paperback book, weighs just over one pound, and can operate indoors or out. It makes use of Epson's flat-screen color liquid-crystal display.

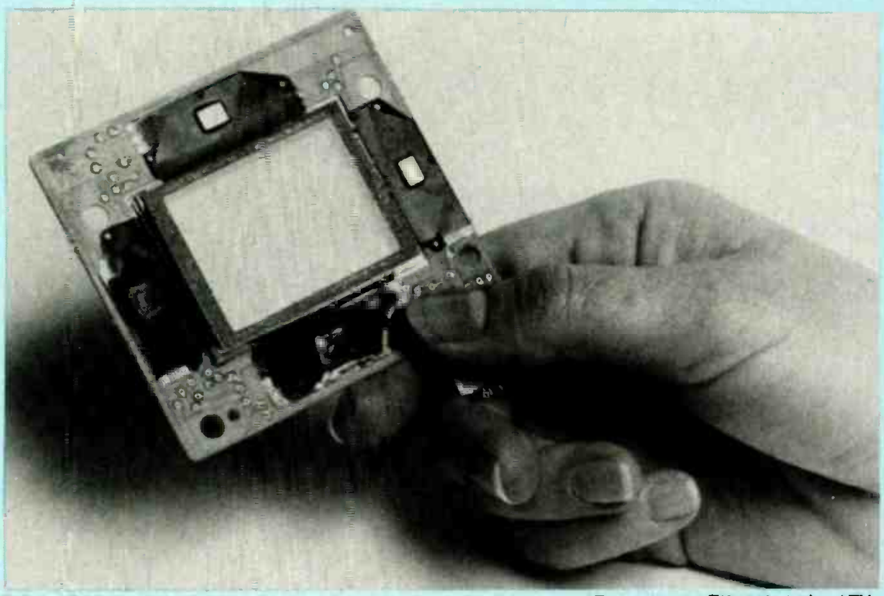


FIG 5—THIS FLAT-SCREEN color liquid-crystal display is the heart of Epson's new *Elf* pocket-sized TV.

channel selection is done via a slide-rule type tuner. There is also an earphone jack that allows the use of a standard earphone or mono headset for private viewing.

When used outdoors, conventional TV's are faced with the problem of poor contrast due to the high ambient light levels. But because the *Elf* uses a backlighted display, a unique feature turns the tables on that troublesome problem. The rear of the unit can be opened, allowing the sun's rays to be used as the light source for the backlighted LCD. That greatly improves viewing in outdoor settings. When the back is opened, a switch allows you to turn off the set's internal light source (it's no longer needed) to conserve batteries.

The *Elf* comes with a number of standard accessories. Those include an AC adaptor, mini-earphone, handstrap, soft carrying case, and a 27-inch telescopic antenna. Optional accessories include car-battery adaptor and a rechargable battery pack. There is also a fold-out tilt stand in the rear.

After spending some time with the unit, our overall impressions of it are very favorable. This set has advanced the state-of-the-art of LCD imaging manyfold. The picture produced is far better than those produced by previous LCD devices. The addition of color is also a major step forward.

In fairness, however, we must point out that the image is nowhere near as sharp as that produced by a comparable-sized CRT display. That reduced resolution is, of course, caused by the fact that far fewer pixels are used to create the image in the LCD. Even so, the image was extremely watchable. The color reproduction was true and the contrast level was acceptable for viewing even in a brightly lit office.

Other aspects of the set are pretty much what you would expect in a set of this type. Sound quality is definitely not "hi-fi," but it is adequate. The level of the audio is quite sufficient for personal listening in all but the noisiest environments. For those, you would want to use an earphone or a headset anyway. Although we tried the unit out in the "concrete canyons" of Manhattan, with all of the reception problems that that entails, the overall quality of the picture and sound was good on all receiveable VHF and UHF channels. There were a few "birdies" (spurious signals) generated by the unit when tuning between the high and low VHF bands, but those were inconsequential.

Whenever a product makes use of a technological breakthrough, you would expect the initial price to be high. The Epson *Elf* is no exception. The suggested list price of the unit at the time of this writing was $500. As with any other new technology, however, expect prices to fall as more units are sold and the costs of production go down.

The size of the display used in the *Elf* was not selected primarily because of the current popularity of small-screen personal TV's. The cost of the display is directly related to its size. Thus, although a set with a somewhat larger display (up to about 5-inches) is within the current technology, the cost of such a display would make the set too expensive to market practically at the present time.

Eventually, of course, those costs, too, will come down. Once they do, the applications for the Epson display are almost limitless. Indeed, company reasearchers are looking at a number of future products, including a flat-panel liquid-crystal TV that could be hung on a wall like a picture. While such a set is still many years away, the development of products like the *Elf* have brought it a little closer to realization. **R-E**

www.americanradiohistory.com

Lightweight Video Cameras

Confused about the new lightweight cameras? Here's a guide that will help you sort things out.

CARL LARON, ASSOCIATE EDITOR

A GREAT DEAL OF ATTENTION HAS BEEN focused of late on the coming of the camcorder. While those one-piece video-camera/videocassette-recorder combinations offer the consumer a great deal of convenience, they force a trade-off in terms of versatility. Some require a separate deck for playback, others require the use of limited-length tapes. As for the 8mm camcorders, the future of the standard they use is very much in doubt.

There is another choice for those seeking a lightweight alternative. That is a combination consisting of a lightweight (typically 5 to 8 pounds without battery) portable VCR and one of the new generation of ultra-lightweight cameras. In this article we are going to take a close look at that new generation of cameras.

Miniaturizing video camera

Manufacturers have taken many different routes to arrive at today's downsized portable video camera, but the key technological difference between cameras is the type of pickup they use—either tube or solid-state.

Most cameras still use tube-type pickups such as the Saticon, Newvicon, etc. The difference in the new cameras is the size of the pickups. Earlier cameras used 1- and ⅔-inch tubes; the new generation of cameras use ½-inch and even ⅓-inch tubes. That reduction in size translates into a considerable reduction in overall camera size and weight as the pickup is the largest and heaviest component in a tube-pickup camera.

One possible drawback to using a smaller pickup is that the smaller the tube the poorer the horizontal resolution. Horizontal resolution is a specification that refers to the number of horizontal lines that the camera uses to create its image. The fewer the lines, the poorer the resolution (or sharpness) of the picture. It is important to note that even the best videocassette recorders are capable of horizontal resolutions of only 250 lines or so. However, most video cameras, even those with the smallest pickups, offer resolutions that are that high or better. That means that, at least as far as home video is concerned, the limiting factor on resolution is the recorder, not the camera.

Figure 1 shows a block diagram of the signal-processing circuitry of a popular tube-pickup video camera, JVC's *GX-N7*. As is shown, the signal from the pickup is filtered and separated into luminance (Y) and chrominance (R − Y) and (B − Y) signals. Those signals are then combined to form an NTSC-compatible output.

Also shown in Fig. 1 is a block diagram of JVC's *Auto Color Tracking System*; that is an automatic white-balance system. Just to backtrack a little for those who may not be familiar with the purpose of such a system, a camera's ability to reproduce colors is strongly affected by the type of light it is used in (indoor vs. outdoor, etc.). Video cameras use a variety of schemes to compensate for that. Some use switch-selectable presets to choose between indoor/outdoor and/or cloudy/sunny conditions. Often when presets are used, a variable WHITE-BALANCE control is provided for "fine tuning." In more advanced cameras, white balance is adjusted automatically. In some, all you need do is point the camera at a white surface, press an automatic white balance switch, and the camera takes care of the rest. It is important in those systems to be sure to go through that procedure any time the ambient light changes.

In the newest of cameras, such as the JVC unit, depressing a switch is not nec-

www.americanradiohistory.com

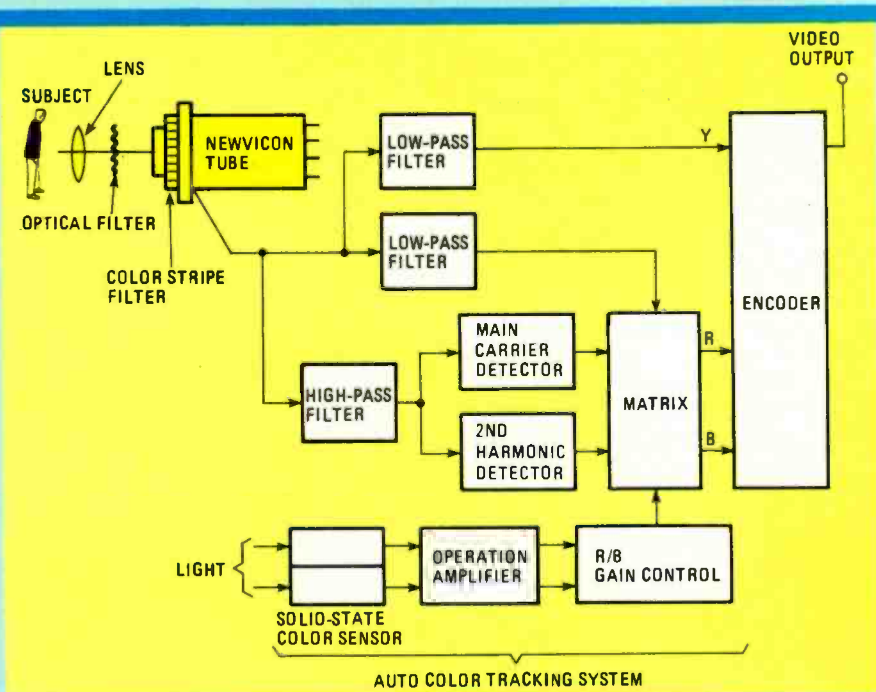


FIG. 1—THE JVC *GX-N7*. Analog signal processing is used to derive the luminance (Y) and chrominance (R − Y and B − Y) signals.

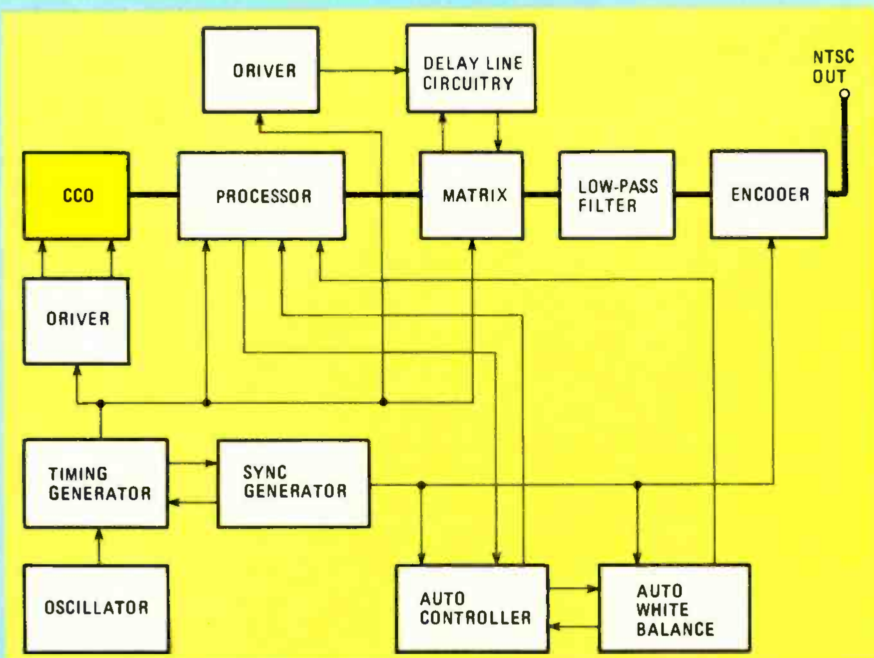


FIG. 2—BLOCK DIAGRAM of the signal-processing circuitry in the Sony *CCD-G5*. The video signal path, from pickup to camera output, is indicated by the bold line.

essary. Instead, a sensor on the camera detects any changes in light. In Fig. 1, the sensor is a pair of color-sensitive photodiodes. Those are used to analyze the red and blue components of the light. Information from the photodiodes is amplified and then fed to the color-processing circuitry, which in turn biases the color signals for accurate color-reproduction under the prevailing ambient-light conditions. Those systems are given a variety of names by their manufacturers—for instance, auto color tracking (as above) or continuous automatic white balance.

Of course, the biggest breakthrough in small-size pickup devices is the solid-state CCD (*C*harge *C*oupled *D*evice) or MOS (*M*etal *O*xide *S*emiconductor) pickup. The cost of those devices has now dropped to the point where it is practical to use them in consumer products. As a result, those pickups are beginning to appear in home video cameras.

One such video camera is the Sony CCD-G5. The pickup used in that camera is a CCD with a mosaic color filter. The size of the CCD used in the Sony unit is 10.7 × 9.3 mm, and the imaging area is 8.8 × 6.6 mm, which yields a 2 × 3 picture format. The picture itself is made up of 384 horizontal and 491 vertical picture elements (pixels). While that number of pixels is relatively low (the CCD used in the Sony *Mavica* camera is 570 × 488 pixels), the cameras circuitry still allows for a horizontal resolution of greater than 250 lines.

Another fundamental difference in the Sony camera (or any camera with a solid-state pickup) is that the signal processing is digital (not analog as it is in tube-pickup cameras) in nature. A block diagram of the camera is shown in Fig. 2. Let's follow the main signal path though the camera, as indicated by the bold line in Fig. 2, to see how the camera handles the required signal processing. Light that reaches the CCD is converted into an electrical signal and fed to the processor circuitry. In the processor, sample-and-hold circuits are used to separate out the component color signals. Those are passed to the matrix circuitry. In the matrix, switched sample-and-hold circuits and 1H (1 horizontal line) delay lines are used to synthesize the chrominance and luminance signals from the color signals. Finally, the chrominance and luminance signals are fed to a low-pass filter and then to the encoder circuitry, which mixes them with a sync signal to form an NTSC (or PAL) compatible output.

What of the relative merits of tube versus solid-state pickups? Tubes offer better performance in low-light situations and, at least until now, were less expensive. Solid-state pickups, on the other hand, are small, allowing for smaller camera sizes, and have lower power requirements. They are also sturdier than tubes, less susceptible to streaking, and require no warm-up time.

Of course, smaller pickups don't tell the entire story behind the miniaturization of home video cameras. Manufacturers are continuously finding ways of compressing more and more circuitry into smaller and smaller areas. In addition, creative packaging has played a major role in reducing the size of video cameras.

www.americanradiohistory.com

Consider, for instance, the Konica *CV-301* shown in Fig. 3. Despite its amazingly stubby profile (2.6-inches wide × 8.9-inches high × 4.8-inches deep), it uses a ½-inch *tube* pickup. The secret is the position of the tube. It is mounted *vertically* and located in the handle of the camera. Light from the lens is directed to the front of the pickup by a mirror.

FIG. 3—KONICA'S *CV-301* sports a stubby profile despite using a tube pickup. That is possible because of the location of the pickup—it is mounted vertically in the handle.

Features

Later on, we are going to look at some of the lightweight cameras that are currently available, their specifications, and the features that they offer. We've already touched upon some of those features (automatic white balance, for instance), but it would be helpful if we took a look at what the other relevant features and specifications are, and which ones are most important.

The camera's lens is the unit's "window to the world." The terms used to describe a video camera's lens are identical to those used to describe a still camera's lens. The width of the camera's aperture, which is adjustable, is measured in *f*-stops; the wider the aperture the smaller the *f* number. The maximum aperture is an important parameter of lens performance as it is an indication of the maximum amount of light that can be admitted and is provided for all lenses.

Of course, the proper aperture opening depends on the amount of ambient light. Almost all video cameras have autoexposure, which means that the camera sets the proper aperture automatically. That feature is often referred to as auto iris. For flexibility, a manual override of that feature, though not provided on all cameras, is desirable. In place of a manual override, some manufacturers provide a "backlight compensation" switch. That switch acts to open the aperture an additional 1½ *f*-stops.

Almost all cameras come with zoom lenses. Zoom lenses are lenses in which the focal length (amount of magnification) can be varied. The range of the zoom can be specified in one of several ways—a power of magnification (i.e. 6×), the ratio of highest-to-lowest focal lengths (i.e. 6:1), or the range of focal lengths (i.e. 8.5 mm–51 mm). Zooms can be power or manual. Power zooms are desirable because they allow for a smoother transition between focal lengths during taping. Manual zooms, on the other hand, add less weight to the camera.

Lenses can be either permanently mounted or detachable. Most cameras with detachable lenses use a C-type lens mount, one of the most popular of the photographic lens mounts. Because of that, in cameras with detachable lenses, any photographic lens that uses a C-mount can be used in place of the lens supplied by the manufacturer.

If you plan to do any close-up work, be sure that your lens has a "macro" setting. You will find that most do.

Viewfinders come in two types—electronic and optical. Electronic viewfinders are, in essence, small TV monitors. They allow the taper to see exactly what is being recorded by the camera. Due to the cost and weight that a color viewfinder would entail, nearly all are black-and-white. Optical viewfinders use the TTL (*T*hrough *T*he *L*ens) system used by modern SLR still cameras. The major drawback of that system is that the image seen is not precisely the same as the one recorded; often the image area recorded is significantly smaller. If the taper does not account for that, the result is cut-off heads or left-out friends. On the other hand, optical viewfinders are much less expensive and add much less weight to the camera. All viewfinders, be they electronic or optical, provide information, usually via LED's, on the camera's operating parameters. Those parameters most often include such things as whether or not the recorder is operating, low light, and low power.

Optical viewfinders do have one other major advantage over electronic ones—they are easier to focus. That's why one of the most popular of the video camera "bells and whistles" is auto focus. The autofocus system can be fooled, however, if, for instance, there are several objects in the camera's field of view. Some cameras also offer a "focus-free" setting. In that setting the video camera works much like an *Instamatic* or similar fixed-lens camera. That is, a large "depth of field" is selected so focusing is not needed. Be warned, however, that while most objects will appear to be reasonably in focus, they won't necessarily be razor sharp.

Almost all cameras provide some means of controlling a VCR. Those controls most often consist of record/pause and review switches. The review switch allows you to replay in the viewfinder a scene that already has been recorded. Of course, that would only be available on a camera with an electronic viewfinder.

When talking video camera specifications, the two most often mentioned are minimum illumination and horizontal resolution. Minimum illumination refers to the lowest usable ambient light-level for satisfactory recording; it is measured in lux. Horizontal resolution refers to the number of horizontal scanning lines in the picture. When comparing horizontal resolution, it would bear to remember, as stated previously, that the maximum resolution for a VCR is about 250 lines. Thus cameras with higher horizontal resolutions would not necessarily provide more detailed pictures.

Now, let's take a look at some of today's tiny video cameras.

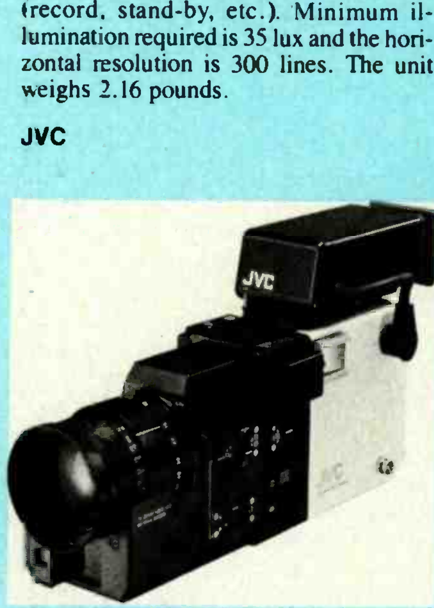
General Electric

General Electric (Video Products Division, Portsmouth, VA 23705) offers its lightweight (2 pounds) *Mini-Cam* (model number *ICVC5032E*). Among its features are auto focus, fade-in/fade-out, 6:1 power zoom, permanently mounted *f*1.4 lens with a macro focusing (to one inch), auto iris with backlight switch, automatic white balance, and an electronic viewfinder. The camera uses a ⅓-inch Newvicon pickup and has a minimum illumination requirement of 30 lux.

Hitachi

Hitachi (401 West Artesia Blvd., Compton, CA 90220) offers the *VK-C1500* MOS color-video camera. As indicated, rather than a tube, this camera uses a MOS pickup. The permanently mounted *f*1.2 lens has a 6× zoom and a macro setting. The automatic iris has a manual override. Among the camera's other features are a continuously automatic white-balance control and an electronic viewfinder with in-the-viewfinder LED's to indicate low-light and low-power conditions, and the mode of the recorder (record, stand-by, etc.). Minimum illumination required is 35 lux and the horizontal resolution is 300 lines. The unit weighs 2.16 pounds.

JVC



JVC *GX-N7*.

www.americanradiohistory.com

JVC (41 Slater Drive, Elmwood Park, NJ 07407) offers two lightweight models. The lightest of those is the 2.2-pound *GX-N4*. That camera uses a ½-inch Newvicon pickup and features an electronic viewfinder with in-the-viewfinder LED indicators. Color balance is handled via two (indoor/outdoor) switch-selectable presets. The automatic iris offers backlight compensation. The standard lens is *f*1.2, has a 6:1 zoom ratio (manual), and offers a macro setting. The lens is removable, but the mount used is a non-standard one. To use 35-mm SLR lenses, a special optional adaptor must be purchased. Minimum illumination is 10 lux and horizontal resolution is more than 270 lines.

The *GX-N7* is a similar unit but adds many "bells and whistles." Among those are auto focus (an infrared method is used), fade-in/fade-out, and continuously automatic white-balance (called "Auto Color Tracking" by JVC). The *GX-N7* weighs 2.4 pounds.

Among the options available from JVC is a character generator for titling. That device can be used with either camera.

Konica

Konica (440 Sylvan Ave., Englewood Cliffs, NJ 07632) is one of the many highly-regarded SLR camera manufacturers entering the home-video market. Their offering is the 1.6-pound *CV-301*. That camera uses a TTL optical viewfinder (an electronic viewfinder is an optional accessory) with in-the-viewfinder LED indicators and a ½-inch Cosvision pickup tube. The *f*1.5 lens is permanently mounted and offers a 3:1 (10 mm–30 mm) zoom. Color balance is handled via four switch-selectable presets. The minimum illumination is 35 lux and the horizontal resolution is more than 270 lines.

Magnavox

Magnavox (a division of NAP Consumer Electronics, Interstate 40 and Straw Plains Pike, PO Box 6950, Knoxville, TN 37914) offers two models. The *VR8275BK* weighs 2.2 pounds. The pickup is a ½-inch Newvicon tube. The lens is *f*1.2 and features a 6× manual zoom. Standard 35-mm lenses can also be used via a bayonet mount. Features include automatic iris, electronic viewfinder, and continuous automatic white-balance. Minimum illumination is 10 lux and horizontal resolution is 270 lines.

The *VR8276BK* weighs 2.4 pounds and adds auto focus and fade-in/fade/out.

Among the options offered by Magnavox is a character generator for titling.

Minolta

Minolta (101 Williams Drive, Ramsey, NJ 07446) is another long-established SLR manufacturer. Their entry into the home-video market is the *K-500S*. The pickup used is a ½-inch Saticon tube. The viewfinder is of the optical TTL variety. The permanently mounted *f*1.2 lens has a 4× zoom, macro setting, and "free focus" setting. The automatic iris has a backlight-compensation control. The white-balance is continuously automatic. Minimum illumination is 10 lux. The unit weighs less than two pounds.

MINOLTA *K-500*.

Panasonic

Panasonic (One Panasonic Way, Secaucus, NJ 07094) offers two models. The *PK450* weighs 2.5 pounds. It features auto focus, 6× power zoom, automatic iris with backlight compensation, electronic viewfinder, and automatic white-balance. The pickup is a ⅓-inch Newvicon tube. The *f*1.2 lens has a macro setting. Minimum illumination is 20 lux.

The *PK410* weighs in at approximately 2 pounds. It has a 6:1 power zoom, *f*1.4 lens, electronic viewfinder, ⅓-inch Newvicon pickup, automatic color balance, fade, and an automatic iris with backlight compensation. Minimum illumination is 30 lux.

Quasar

Two models are available from Quasar (9401 W. Grand Ave., Franklin Park, IL 60131). The *VK704XE* weighs just two pounds. It uses a ⅓-inch Newvicon pickup. The *f*1.4 lens is permanently mounted and features a macro setting. Among the features are a 6:1 power zoom, automatic white-balance control, fade-in/fade-out, electronic viewfinder with in-the-viewfinder LED's, and automatic iris with backlight compensation control. The minimum illumination is 30 lux and the horizontal resolution is 260 lines.

The *VK714XE*, which weighs 2.4 pounds, adds infrared autofocus and a time and date display, and upgrades the lens to *f*1.2.

RCA

RCA's (30 Rockefeller Plaza, New York, NY 10020) *Small Wonder* (model *CKC020*) uses a solid-state MOS pickup. The *f*1.2 lens is permanently mounted and has a macro setting for focusing as close as ⅜-inch. The power zoom has a 6:1 ratio. The electronic viewfinder has LED indicators to alert the operator to low-light, low-battery, and record mode. The automatic iris has a manual override. Both constant automatic white-balance and four switch-selectable white-balance presets are provided. The camera weighs 2.2 pounds and requires a minimum illumination level of 35 lux.

Sanyo

Sanyo (1200 Artesia Blvd., Compton, CA 90220) offers a pair of interesting cameras. Their models *VSC700/VSC800* (the only difference between the two is that the *VSC800* adds auto focus to the basic model) are styled to resemble 35mm still cameras. The units weigh 2⅜ pounds. The pickup used is an MOS semiconductor. The C-mount, *f*1.2 lens has a 15mm–75mm power zoom and a macro setting. The electronic viewfinder can be positioned for ease of use. The cameras' horizontal resolution is greater than 260 lines and the minimum required illumination is 28 lux.

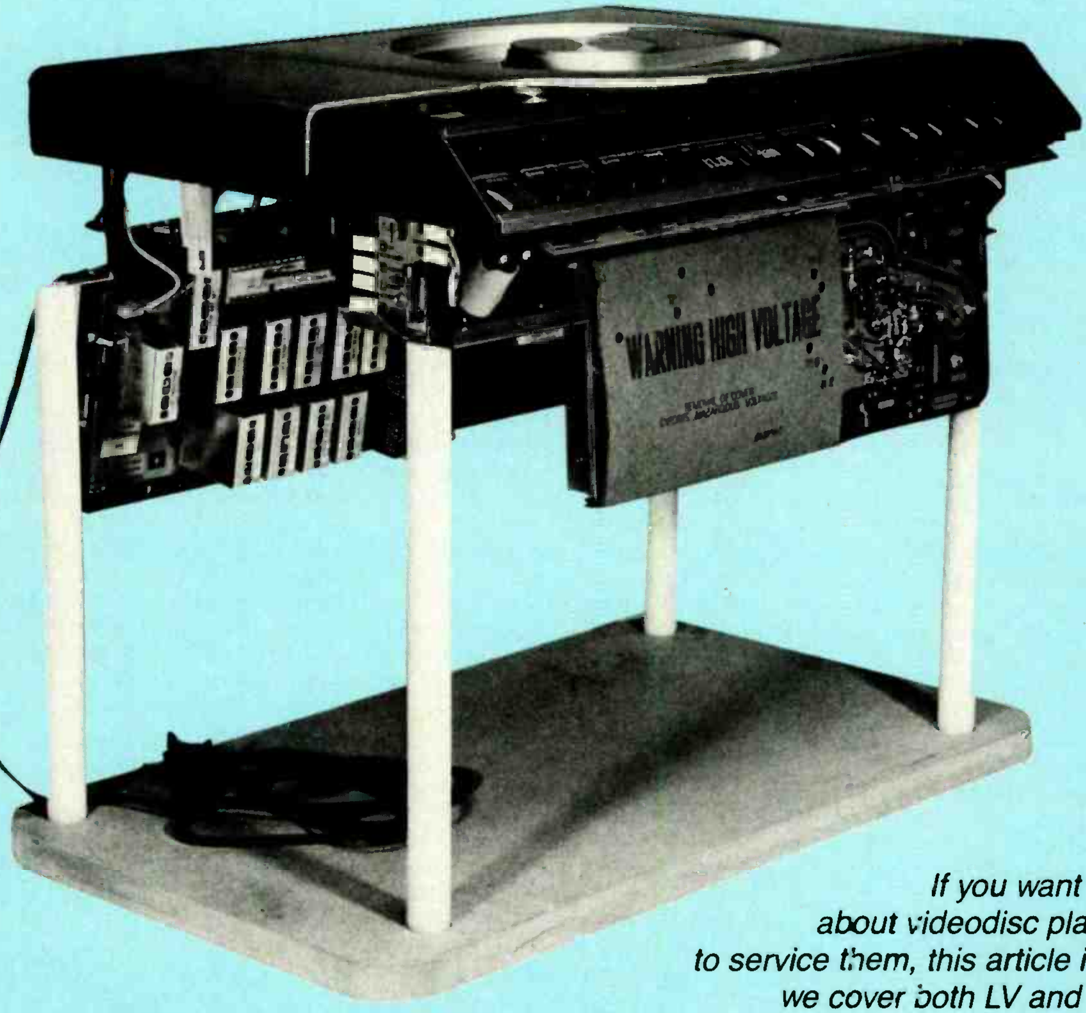
Sony

Sony's (Sony Drive, Park Ridge, NJ 07656) CCD-G5 video camera weighs 2.25 pounds. It features a solid-state CCD pickup. The unit is equipped with a permanently mounted *f*1.4 lens with a macro setting. The power zoom has a 6:1 ratio. The electronic viewfinder includes in-the-viewfinder white-balance and low-light indicators. Other features include automatic white balance with indoor/outdoor presets and fade-in/fade-out. The minimum illumination is 30 lux and the horizontal resolution is 250 lines. **R-E**

SONY *CCD-G5*.

www.americanradiohistory.com

Servicing Videodisc Players



JOHN LENK

If you want to learn more about videodisc players and how to service them, this article is for you. In it we cover both LV and CED players.

NOW THAT WE'VE SHOWN YOU HOW TO service VCR's (**Radio-Electronics**, Dec. 1983, Jan. and Feb. 1984), its time to try our hand at videodisc player service. As in the case of VCR's, servicing videodisc players takes all the expertise required to service a TV set and/or record player, and then some. Actually, videodisc-player electronic circuits are relatively simple compared to VCR's and most TV's. However, the mechanical functions of a typical videodisc player are substantially more complex than those of a record player or phonograph. An improper mechanical adjustment can not only put a videodisc player out of operation, but can result in permanent damage to the player and/or disc.

Don't let that frighten you away from videodisc player service. If you follow the procedures in the service manuals you should have no trouble. However, it helps if you understand the "what" and "why" of the procedures. That is one area where the manufacturer's service literature is often somewhat fuzzy. Many service-manual writers simply assume that you know all about how videodisc players operate, just as you do TV sets and record players. Hopefully that will be the case when you have read this article from beginning to end.

Let us start by reviewing how videodisc players, both LV and CED, operate. Note that LV (also called LaserVision or laser video) and CED (capacitance electronic disc) are the two most common types of home-entertainment videodisc players.

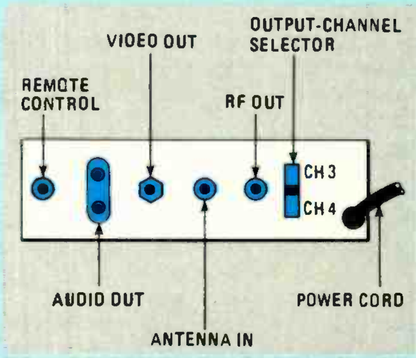


FIG. 1—REAR PANEL of a typical videodisc player showing the input/output connectors.

www.americanradiohistory.com

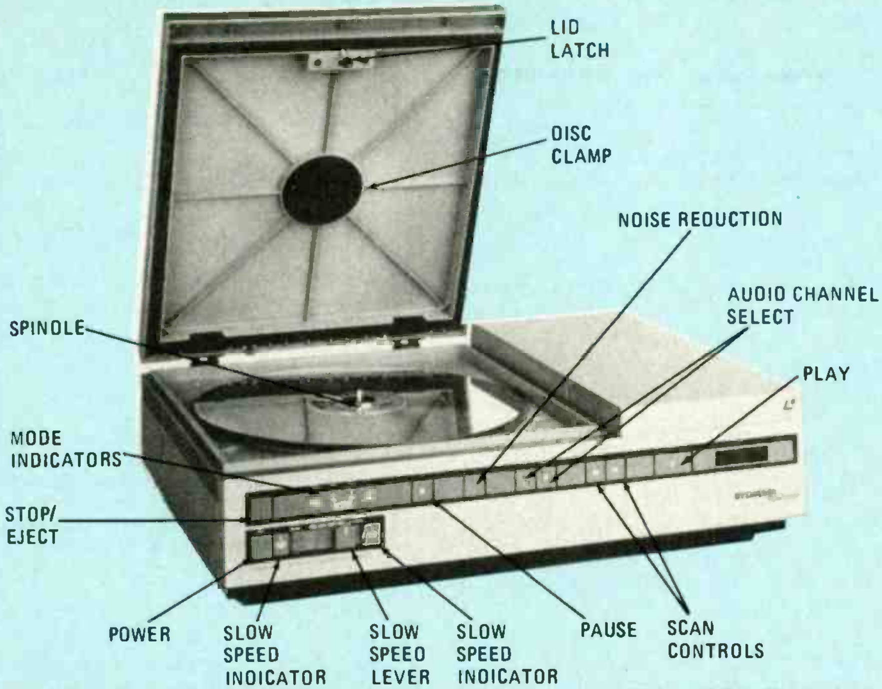


FIG. 2—CONTROLS AND FEATURES of a typical LV videodisc player. While details will vary from machine to machine, the controls and features shown here will be found on most LV videodisc players.

There is a third system, VHD (video high density), with its companion AHD (audio high density) that has not quite gotten off the ground, so we will not cover it here. Also, we will not go into full circuit descriptions or mechanical details for any videodisc player here. (To do so would require a book of at least 350 pages.) But we will go through videodisc player functions so you can understand the theory-of-operation sections found in some service literature.

The videodisc player

Videodisc players are very specialized forms of phonographs or record players that play pre-recorded discs carrying both picture and sound through any standard TV set. The picture can be either black-and-white or color. The sound can be monaural on all players, and stereo on some players (and even two-channel independent or bilingual on some players).

The LV player uses a *reflective optical pickup system*, developed by NV Philips in the Netherlands and MVA Inc. The LV system was called "video long play" at one time, and was introduced in the United States in 1978.

The CED player uses a *capacitance pickup system* developed by RCA Laboratories, and was introduced in 1981.

With either system, the player circuits function to convert picture/sound information recorded on the disc into electrical signals used to modulate an RF unit (also know as a VHF modulator). In the simplest of terms, the RF unit is a miniature TV-broadcast station operating on an unused TV channel (typically Channel 3 or 4). The output of the RF unit in the player is fed to a TV set. The videodisc spins at a high rate of speed compared to a conventional audio record, and uses either a *light beam* (LV) or *capacitance* (CED) pickup.

CED versus LV

There are similarities between CED and LV. For example, both systems use a plastic disc rotating on a turntable. In both systems, the player picks up information represented by changes in the disc surface, and converts the information into signals for playback on the TV set. The two systems use FM for both the video and audio signals. Each disc also has a spiral track to carry the information, rather than a series of circular tracks.

Plastic discs for the LV system are coated with metal on one side (the recorded surface), and then bonded with the metal inside for protection. Carbon is added to a CED disc to make the disc conductive. A lubricant is also added to the CED disc because the CED system has grooves for stylus tracking. That makes the CED system simpler (no servo tracking is required for CED) but does cause disc wear.

Quality standards for both systems require that the discs be relatively defect-free, flat, and stable with time and temperature changes, and have an acceptable signal-to-noise ratio. All players must be mechanically balanced, and must also accommodate imperfect mass-produced discs. All three systems can step the pickup backward and forward one or more track widths, for repeat play or rapid search. In addition, every disc includes a code in the signal recorded so that features not included in every type of player, such as automatic search, can be added.

In spite of the basic similarities, the systems differ not only in the pickup technique (optical versus capacitive) but also in the format in which the information is encoded, and in the method by which information is tracked on the disc. Other differences include disc size, material, rotation speed, and signal-protection schemes. We will talk about those difference as we go along. For now, let us consider the connections between a videodisc player and the TV set.

Connecting the player

All connections to the player are usually made via the rear panel. Figure 1 shows how a rear panel of a typical videodisc player might appear.

The ANTENNA IN connector (generally a 75Ω coax type) is connected to the antenna or cable nut. The CHANNEL 3/4 VHF OUT connector (also 75Ω) is connected to the antenna input of the TV set. That permits the TV set to be connected to either the antenna (for off-the-air TV program reception), or to the player (for videodisc program play) depending on the setting of a front-panel switch.

In addition to the Channel 3/4 modulated-RF output, most videodisc players also provide audio outputs (for use with stereo systems) and a baseband video output) The baseband video output is for connection to a video monitor or a TV set equipped with a video input.

Some videodisc players also have a CONTROL connector that allows for the connection of an external device (such as a remote-control unit) for wired electronic control of the player. In other players, an infrared (IR) control is used. As in the case of a conventional TV set, no cable or other direct physical connection is required when an IR remote-control is used.

The LV system

Now that we have reviewed the operation of videodisc players in general, let us go into a bit more detail on the LV system. We start with a description of the user

www.americanradiohistory.com

controls and major features found on a typical LV player, such as the one shown in Fig. 2. Keep in mind that while we'll be discussing the controls for a particular player, the same or similar controls are found on all LV players.

In use, you place the videodisc over the turntable and spindle as you do a phonograph record. The turntable is coupled directly to a motor that rotates the disc at the proper speed.

When you close the lid, a magnetic *disc clamp* holds the disc on the spindle automatically to ensure stable rotation.

The disc is placed over the *objective lens*, which is the key part of the player that reads the signal recorded on the disc. Note that the objective lens surface must be kept clean in order to maintain optimum performance. Generally, the player is shipped from the factory with a lens cap over the lens. (Note that the objective lens can not be seen in Fig. 2 due to the presence of a disc on the turntable.)

The *playback mode indicator* lights are located above individual control buttons, and turn on when the corresponding mode is selected.

You press the STOP/EJECT button to cut off operation and to open the lid.

You press the POWER button to turn the power on and off. The red indicator above that control turns on when power is on.

The *slow indicators* are used to indicate slow motion play.

You use the SLOW SPEED lever to adjust the speed of slow motion play. At its normal speed, the videodisc is played at a rate of 30 frames-per-second. At its slowest speed, the videodisc is played at a rate of 1 frame-per-second. The SLOW SPEED control is used to vary the playing speed between those extremes.

You press the PAUSE button to temporarily halt disc operation. Operation stops on the last frame played when that button is pressed, and no video image is reproduced on the TV screen. The PAUSE mode is released by pressing the PAUSE button again.

Some videodiscs are recorded using CBS's *CX* noise-reduction system. The NOISE REDUCTION button is pressed to activate the player' noise-reduction system for those discs.

The two AUDIO CHANNEL SELECT buttons are on/off controls for the two audio channels.

The SCAN controls are used to quickly locate a specific part of the program.

The PLAY button is pressed to begin playing a videodisc, or to resume playing after another playback mode is selected.

Although LV players are not difficult to operate, the basic operating procedures are different from those of a typical audio record player or phonograph (and from those of a CED player, which we'll discuss in next month's article). The following is a quick run-through for operation of a "typical' LV player. Keep in mind that you must study the literature for the particular player you are servicing.

To install and remove an LV videodisc on a typical player, press the POWER switch to turn on the player. Press the STOP/EJECT button to release the lid latch. Open the lid, *being careful not to force the lid beyond the normal fully-open position*. With the label of the side you want to play facing up, place the disc on the turntable. (When that is done, the "recorded" side is facing down so that it can be scanned by the objective lens.) Be sure that the center hole of the disc stays in the convex spindle. Shut the lid firmly. The disc clamp on the underside of the lid holds down the disc magnetically. The videodisc is now ready to play.

To remove the disc, press the STOP/EJECT button, open the lid carefully, hold the disc by *both edges*, and lift the disc from the turntable. Replace the disc in its jacket after use.

To start a typical LV player, turn on the power to the player, TV set, and stereo system (if you are reproducing the audio signal through a stereo, which happens to be one of the big selling features of the better videodisc players). Next, install a disc and close the lid. Most LV players cannot operate unless the lid is closed completely. Tune the TV to the channel (3 or 4) chosen via the player's rear-panel CHANNEL SELECTOR switch (see Fig. 1). Now (if all is well) the STAND BY indicator will begin flashing when the PLAY button is pressed. After a few seconds, the turntable reaches the proper rotation speed, the laser beam begins picking up the signal from the disc, and the video picture appears on the TV screen.

Although the following notes apply specifically to the player of Fig. 2, they also apply generally to all LV players.

When an extended play disc (CLV) is being played, special functions such as still/step, slow play, fast play, frame number search, etc., do not operate on most players.

If you try to operate an LV player without a disc, or if the unrecorded side of a disc is facing down, turntable rotation stops automatically.

When the player is used for the first time, adjust the FINE TUNING control of the TV set for the best picture quality. (This is also a good starting point if you are faced with a "poor picture quality" symptom.)

If the player fails to respond to a command, or continues to show some unusual characteristics, turn off the unit via the POWER switch, and then start the operating sequence again.

Moisture condensation may impair operation of a videodisc player. Watch for any sudden changes in temperature, particularly when you move the player from one location to another.

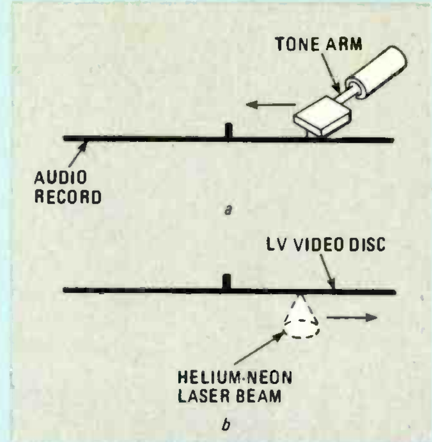


FIG. 3—A PHONOGRAPH RECORD, as shown in *a* is played from the outside in, with the pick-up, consisting of a tone arm and needle, resting on the top of the disc. As shown in *b*, a videodisc is played from the inside out, with the pickup being a laser focused on the underside of the disc.

Most LV players have such operating functions as pause, scan, slow, still/step, frame-number display, chapter-number display, and fast operation. We will not go into those here since the functions are unique to each player model. But you should be aware of the functions, *before* you start to service any player. You could spend hours trying to troubleshoot a function that does not exist.

LV videodiscs versus audio records

Figure 3 compares the familiar audio record playing technique with the LV videodisc. Audio records are played with a phonograph needle on top of the record. The beginning of the record is at the outside edge, and the needle moves inward as the music is played. The LV videodisc is played from the bottom with a light beam. The beginning of the LV disc is near the center, and the light beam moves outward toward the edge as the program plays. The light beam is generated by a helium-neon laser inside the player.

The light beam is focused up on the bottom of the disc through an objective lens. That lens is located in the player under the disc. As the disc is played from beginning to end, the lens moves from near the center to the outside edge of the disc. The light beam actually reflects off microscopic *pits* beneath the bottom surface of the disc. Those pits are coded with the picture and sound information.

Each disc side contains thousands of separate pictures. The rapid playback of those pictures creates the program on the TV screen. Each picture is numbered, and a 5-digit "picture number" can be displayed in the upper left portion of the TV screen. That feature allows any given portion of the program to be located easily. Also, some videodisc programs have two or more segments. Each segment is called a chapter, and a 1- or 2-digit-chapter number can be displayed on the screen

www.americanradiohistory.com

instead of the picture number.

In addition to the picture, two channels of high-fidelity sound are recorded on most LV videodiscs. Either one or the sum of both channels may be played through the TV set. Those sound channels are also available at the rear panel (Fig. 1).

LV is called the non-contact, pick-up system since LV uses a laser beam, and there is no physical contact between the pickup and disc. (That is in contrast to CED where there is some physical contact). When the laser beam strikes a series of pits, the light is reflected back into the system, and the variations of the reflected light are converted into the reproduced signal.

CAV versus CLV

The *standard play* LV videodisc, also known as the CAV or *constant angular velocity* disc, spins at the same constant speed of 1800 rpm from the inner circumference to the outer circumference, and provides a maximum of 30 minutes playing time per side. On a CAV disc, one video-picture frame is recorded for each revolution. That makes possible several features (stop or still picture, stable visual pictures during scan or search, true slow motion, etc.) when CAV discs are played.

Although the extended play LV disc, also known as the CLV or *constant linear velocity* disc, does not offer the additional operating features, CLV does provide a maximum playing time of one hour per side. With CLV, the rotation speed varies from 1800 rpm at the inner circumference to 600 rpm at the outer circumference.

Most LV players will play either CAV or CLV discs, and automatically detect which type of disc is being played, without resetting of controls by the user.

LV microprocessor control

Most LV videodisc players have some form of microcomputer or microprocessor control. That provides a number of push-button-selected operating features, such as still picture, slow motion, etc. On many LV players, there is also a feature called the *frame number random access* that finds a specific frame automatically by frame number within 15 seconds. The LV videodisc has a maximum of 54,000 "tracks" in a continuous spiral from the inner to the outer circumference. On a CAV disc, the signal for one video-picture frame is recorded on one track covering one full revolution. Beginning at the inside circumference, each frame is recorded along with the frame number.

Audio

Audio is recorded on the videodisc in the form of two separate FM signals. That makes either stereo or two-channel independent (such as bilingual) sound possible. Typical AF response is 40 Hz to 20 kHz, with an S/N ratio of 60 dB, and a total harmonic distortion of 0.5% or less. The S/N ratio can be increased to about 70 dB when a special noise-reduction system, *CX*, is used. Not all LV discs are recorded with *CX* and, on most LV players, you must operate a control to select *CX* operation. As a point of reference, the quality of stereo reproduction from an LV player is generally comparable to conventional phonograph records or FM broadcasts (but not to digital audio discs).

LV characteristics

An LV videodisc is composed of thousands of circular tracks making up a continuous spiral from the inside of the disc to the outside. Each track is a series of pits. Light reflected from inside a pit is less bright than light from the spaces between the pits. Thus, the intensity of the light is modulated as the videodisc rotates.

The intelligence encoded on the disc results in three FM signals: 8.1-MHz FM, modulated with the composite video (including the chroma or color signal); 2.3-MHz FM, modulated with the audio from one of the audio channels (channel I), and 2.8-MHz FM, modulated with the audio from the other audio channel (channel II). Each of the sound carriers has a maximum deviation of ±100 kHz. The 8.1-MHz video FM carrier has a deviation of 1.7 MHz (7.6 MHz at the sync tips to 9.3 MHz at the white peaks). However, the bandpass of the 8.1-MHz video carrier extends from below 4 MHz up to above 12 MHz in order to include all necessary sidebands.

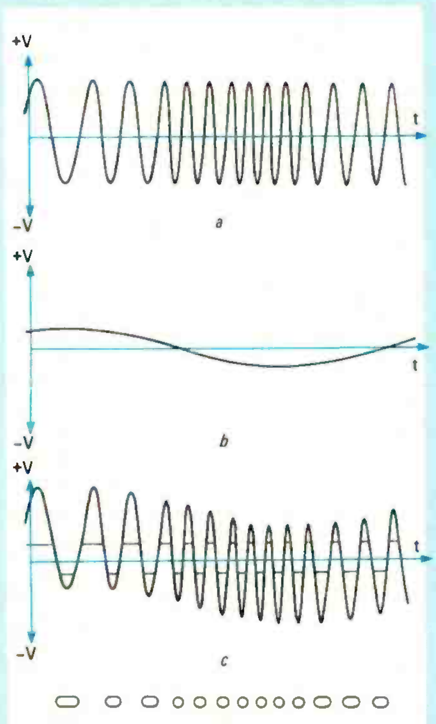


FIG. 4—AN 8-MHz video signal (*a*) is pulse-width modulated by an FM sound carrier (*b*), and the resultant signal is clipped (*c*) and used to create the pits (*d*).

Video Entertainment

Figure 4 shows how the 8-MHz FM video signal is pulse-width modulated by one of the sound carriers. Each of the sound FM carriers pulse-width modulate the 8.1-MHz carrier to create the actual resultant signal that becomes encoded on the disc. The resultant signal in Fig. 4 is clipped and used to create the pits in the disc. Note that waveform can cause the length of the pits, and the spacing between the pits, to vary.

In addition to the play tracks, special tracks called *lead-in* and *lead-out* tracks (at the inner and outer diameters of the disc) are coded so that the focused laser beam does not move beyond them. When the lead-out tracks are reached, the laser automatically moves back to the lead-in tracks and stops.

Tracking

Tracking of the laser over the disc is a very important part of LV-player operation. It also is probably the cause of most service problems. Two types of tracking are involved: radial and tangential. Both are shown in Fig. 5. Radial tracking refers to keeping the light beam centered on the LV videodisc tracks. Without some form of radial tracking, the light beam can drift between the tracks, resulting in a lost picture. Radial movement of the beam is always perpendicular to the tracks. Tangential tracking refers to keeping the beam in line with the track. That direction of movement is necessary to compensate for momentary speed errors of the track passing over the beam.

In the LV system, both radial and tangential tracking is done by means of two moveable mirrors, as described next.

FIG. 5—TANGENTIAL TRACKING (*a*) and radial tracking (*b*) of the laser on an LV videodisc. Note the spiral tracking pattern.

LV player functions

The heart of the LV system is the *slide assembly*, also known as the *sled*: the sled

www.americanradiohistory.com

contains the laser and the optical system. A slide drive-motor moves the entire slide assembly beneath the disc as the program is played. The laser generates a red light beam that passes through an optical divider. The beam is then deflected by the automatic tracking mirror up into the objective lens. The objective lens focuses the beam into a tiny point on the bottom of the disc. The beam is reflected by the disc surface.

The reflected beam follows the same path back through the objective lens and automatic tracking mirrors to the optical divider. The reflected beam is then separated from the original beam and sent to the light-sensitive diodes (photodiodes). The diodes conduct a current that varies according to the amount of light falling on the diode surface. Since the reflected beam is intensity modulated by the pits on the disc surface, the diodes recreate the FM signal that was recorded on the disc.

The diodes also create a focus error-voltage if the disc gets too close or too far from the objective lens (which can move up or down to follow movements of the disc, and thus maintain correct focus). That keeps the light beam focused if the disc is warped or otherwise distorted. The focus error-voltage is applied to the focus servo that controls the objective lens movement.

The diodes also generate a radial error-voltage if the beam tends to drift off the track. That radial error-voltage is applied to the radial tracking mirror servo that moves the radial tracking mirror to bring the beam back to the track center.

The FM signal generated by the diodes (as the beam passes over the pits) is applied to the signal processing electronics where the FM signal is demodulated. The demodulated FM is a composite video and audio signal (similar to that shown in Fig. 4) that is applied to the RF-modulator unit. The RF modulator places the composite video and audio on an RF carrier of the correct frequency for either TV Channel 3 or 4. The resultant TV RF signal passes through an automatic antenna switch to the VHF antenna terminals of the TV set. When the player is off, the regular external antenna is automatically connected to the TV set.

In addition to the single audio signal that is applied to the FM modulator, two separate audio signals are supplied to the left and right audio jacks on the rear panel of the player.

The signal-processing circuitry also generates an rpm error-voltage, which is derived from the horizontal scan rate, and is proportional to errors in the turntable motor speed. The rpm error-voltage is applied to a PLL motor-control servo that, in turn, controls the speed of the turntable motor.

The signal-processing circuitry also generates the tangential error-voltage, which is proportional to the momentary speed errors in the tracking. Such errors are caused by slightly elliptical tracks, or an offset center hole in the disc. The tangential error-voltage is applied to the tangential tracking-servo that moves the tangential-tracking mirror.

There are two tracking mirrors, one for radial tracking and one for tangential tracking. Those mirrors are part of the optical system, which we will discuss next.

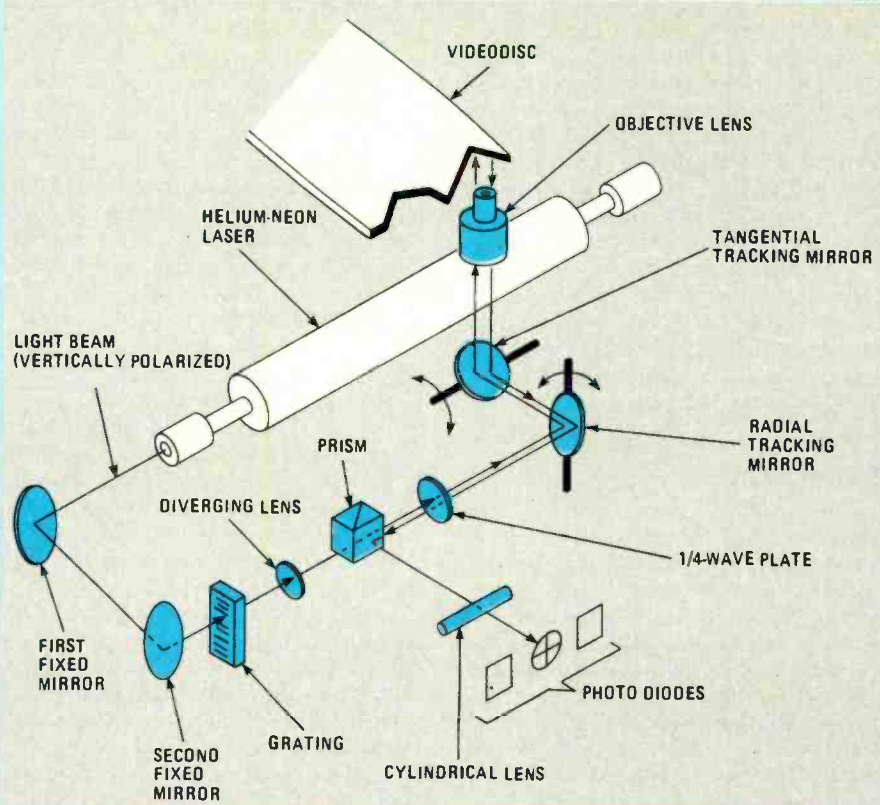


FIG. 6—PRIMARY COMPONENTS of a LV videodisc player's optical system.

The optical system

Figure 6 shows the basic components of the LV player optical system. All of those components are mounted on the slide assembly below the videodisc. The optical system uses components that are affected by the polarity of light. The laser beam is vertically polarized. The first optical component encountered by the vertically polarized light beam is the first fixed mirror, which reflects the beam around a corner to the second fixed mirror. In turn, the second fixed mirror reflects the beam around another corner, and onto the grating, which is a piece of optical glass with several fine etched horizontal lines. The grating divides the beam into three beams: a center or main beam and two secondary beams (above and below the main beam). The secondary beams are less bright then the main beam.

The center or main beam is used to read the tracks on the disc, while the secondary beams are used for tracking. The three beams, or light bundle, from the grating is applied to a prism through a diverging lens that focuses the beam to the correct size to completely fill the aperture of the objective lens. As the beam exits the end of the prism, the beam passes through a quarter-wave plate that changes the beam into a circularly-polarized beam that is reflected off the tracking mirrors into the objective lens.

The objective lens is similar to a microscope and focuses the beam into an extremely fine spot on the disc surface. The reflected beam from the disc is intensity modulated by the pits, which have a depth equal to one-quarter wavelength of the laser beam. Since the lightwave consumes one-quarter of a wavelength going into the pit, and another one-quarter wavelength coming out, the beam reflected by the pits is one-half wavelength out-of-phase with the light at the surface. A cancellation effect takes place and reduces the beam intensity as the beam passes over a pit.

The reflected beam follows the identical path as the beam from laser to disc (incident beam) all the way back to the prism. However, on the return trip, the reflected beam is polarized opposite to the incident beam (the reflected beam is horizontally-polarized as the beam passes through the quarter-wave plate).

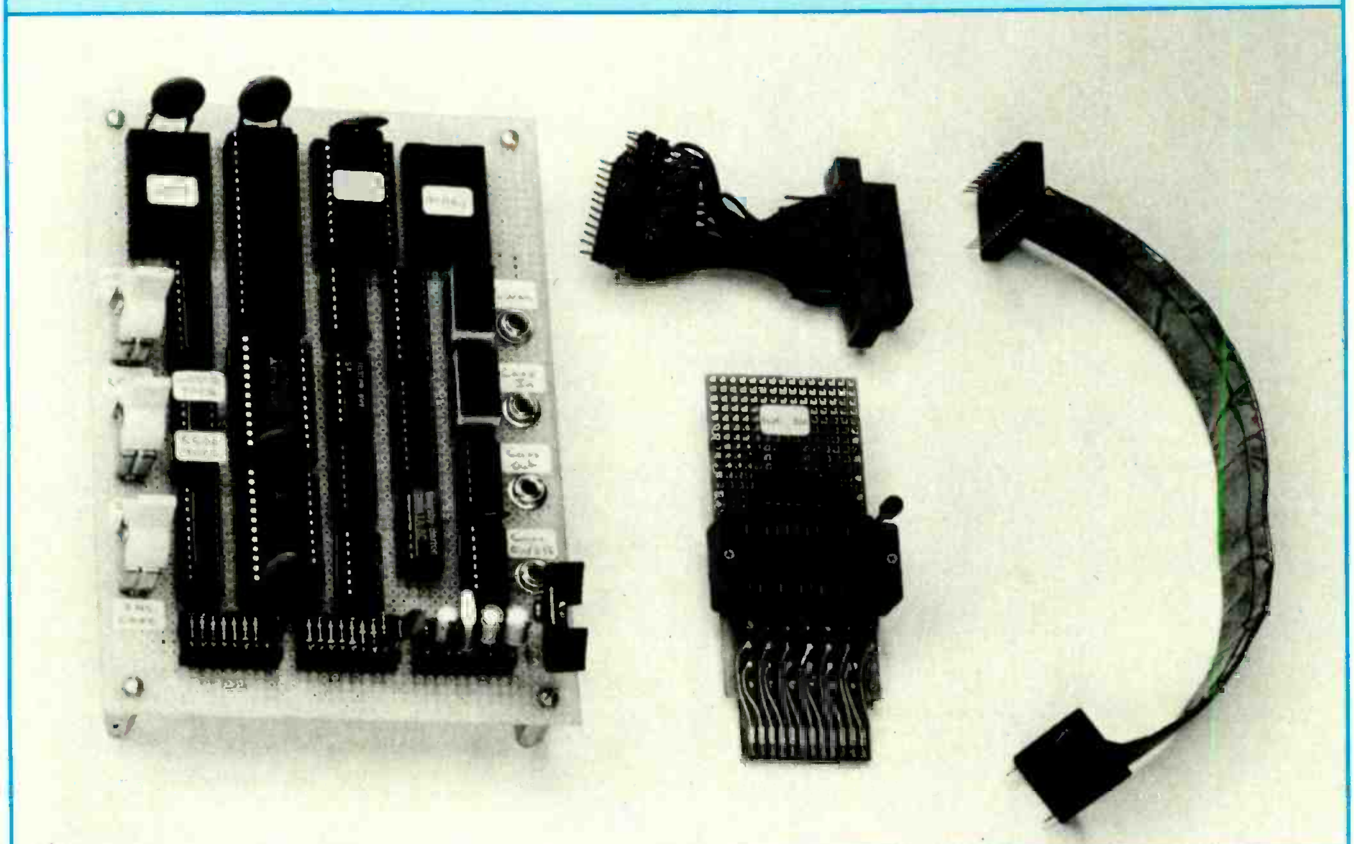
Unfortunately, that's all we have room for this time. When we continue next month, we'll finish our discussion of the LV system by examining more carefully the system used to focus the laser precisely on the videodisc. Following that, we'll take a detailed look at how the CED system works. **R-E**

www.americanradiohistory.com

DID YOU EVER WISH THAT YOU COULD make copies of game cartridges for your Atari *2600*? Well, with the circuit we'll describe, you can! We'll show you how to record the contents of your cartridges on cassette tape—and how to load the game back into the *2600*. Before we get into the details of the circuit, let's review some basics.

ATARI Game Recorder

GUY VACHON and DAVID A. CHAN



Store your library of Atari videogame cartridges on cassette tapes!

As you probably know, a videogame is just a simplified home computer—one that has been dedicated to the specific task of playing games. Keep in mind, though, that the videogame operates much the same as any computer—the electronic circuits that make up the machine (the hardware) execute instructions that make up the game (the software).

The software is stored, of course, in the game cartridge, which consists simply of ROM (*R*ead-*O*nly *M*emory). As its name implies, you cannot change the contents of ROM—that type of memory can be read but not written to.

If a videogame is just a simple home computer, as we stated earlier, you might wonder why the programs stored in the ROM cartridges cannot be stored on magnetic tape or floppy disks like programs for other home computers. Well, they can! But videogames like the Atari *2600* lack the necessary hardware to record them. And that's what this article is all about.

The basic approach

Our approach will be to copy the contents of the ROM cartridge into RAM. (That's *R*andom-*A*ccess *M*emory, also known as read/write memory.) Once we have the game program in RAM, we can then copy it to cassette tape.

Figure 1 shows a very basic block diagram of what we need: the videogame, a game cartridge (ROM), a cassette player, RAM, and a control device, which allows us to correctly direct the flow of data. For example, the first step in copying a game cartridge is to load the contents into RAM. Then the contents of RAM is transferred to cassette tape much in the same way that many home computers save programs on cassette. (The Timex Sinclair *1000*, is one example.) When we want to play the game, we reload it from cassette to RAM. We get the *2600* to think that the RAM is just a game-cartridge ROM by setting the READ/WRITE input of the RAM to READ and connecting its other inputs and outputs to the *2600* just as if it were ROM.

We can also make tape-to-tape copies easily using that scheme. Once we load the program from cassette into RAM, we can simply dump the RAM contents to another tape.

www.americanradiohistory.com

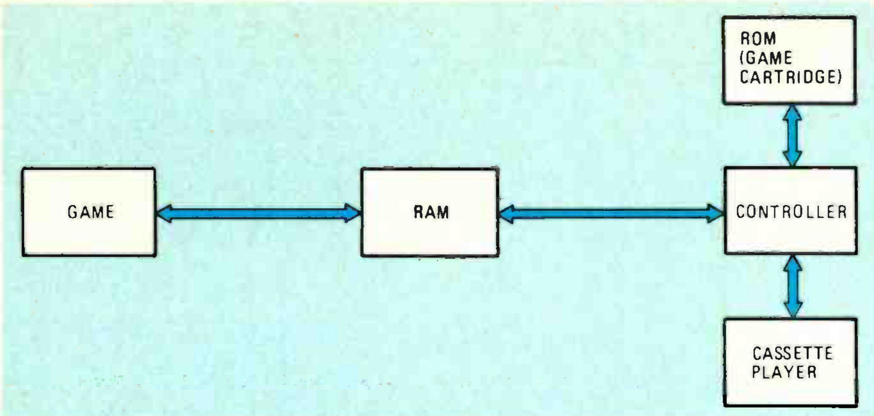


FIG. 1—A CONTROLLER IS NEEDED to properly direct the flow of data from the game cartridge ROM to the computer's RAM, from the cassette player to the RAM, etc.

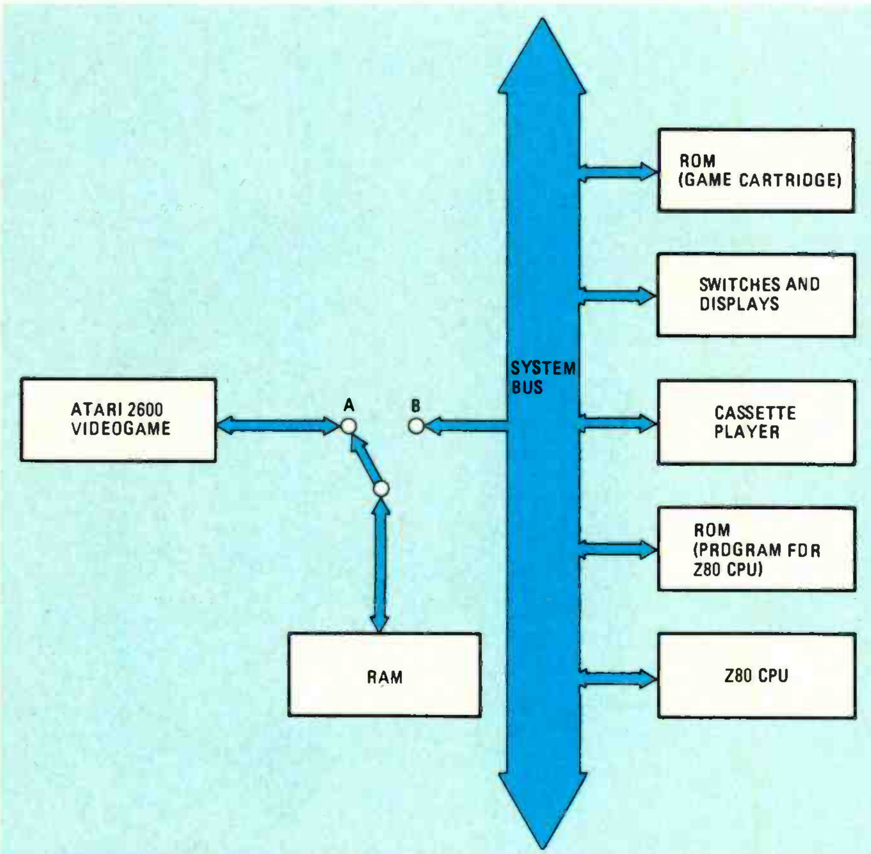


FIG. 2—A DEDICATED, SIMPLIFIED COMPUTER. This block diagram gives a basic idea of what we need to record the contents of Atari *2600* videogame cartridges.

A dedicated computer

If you're familiar with home computers—even the cheapest models that you can buy for under $50—you know that they have all the capabilities we need. We could approach the problem by modifying a computer to do exactly what we want. But that is not the way we will go. Instead, we will build our own dedicated, simplified computer.

A block diagram of the computer that we need is shown in Fig. 2. When the switch is in position "B," the *2600* is out of the picture and we're left with only our dedicated computer. It sees the game cartridge and RAM as part of its memory. It can transfer data from the ROM cartridge to the RAM, and it can store and retrieve programs from tape. The game cartridge is not the only ROM: Another block of ROM holds what can be thought of as the operating system of our computer. It contains the instructions that tell the Z80 CPU how to perform the appropriate data-transfer tasks.

Note that also "hanging from the bus" of our computer are switches and displays that are used for I/O. By setting the switches, we can give the computer certain commands. The displays let the computer tell us what it is doing.

When the switch shown in Fig. 2 is moved to position "A," the Atari *2600* videogame uses the RAM simply as if it were ROM. So, for example, after you loaded the RAM with a program contained from cassette, you would flip the switch to position "A" so that the *2600* could see it.

Game-recorder computer hardware

Let's look at the hardware that we'll use to help us record game cartridges. Figure 3 shows the schematic of the computer/recorder. As you can see, the computer is structured around the Z80 bus. Connected to the bus, directly or through buffers, are all the computer's components: the Z80 microprocessor (IC3), the RAM (IC11–IC13), and the I/O devices (S1–S5, DISP1, DISP2, cassette output, game cartridge connector, etc.). We can also see IC10, the ROM that contains the program for our computer.

Most of the components of our computer are used in the usual fashion. In other words, the ROM and RAM is used just as it is in any given home computer. The cartridge connects directly to the bus and, as far as our computer is concerned, seems to be another several kilobytes of addressable memory. That same technique of memory-mapped I/O is used to drive the seven-segment displays and to interface with the tape recorder.

Note that we do not use BCD-to-seven-segment decoders to drive our LED displays. Instead, the Z80 CPU has control over the segments and turns them on or off as needed to represent hexadecimal digits 0–F and an error message of three horizontal bars. But we're getting a little ahead of ourselves. What is important here is that, as far as the Z80 is concerned, the displays are "write only" memory locations. Information encoded in the common seven-segment display format is sent to the display at their locations. The information is latched with the $\overline{\text{WRITE}}$ signal from the Z80 just like any other memory location. The same method is used for the tape-recorder interface. A 1 is latched to send a high-level voltage to the tape and a 0 is latched to send a low-level voltage.

The last major component of the computer is the interface to the Atari *2600*. That interface is essentially made up of IC4, IC5, and IC6—three 74LS244 octal buffers with three-state outputs. By looking at the direction of the buffers, you can see that the dedicated computer accepts addresses from the Atari game and outputs data to it. (Remember: That's just what ROM does!) The buffers are enabled by the $\overline{\text{BUS ACKNOWLEDGE}}$ signal (pin 23) from the Z80 (IC3).

When we want the *2600* to play a game, we simply close the SETUP/PLAY switch, S6, which brings the Z80's $\overline{\text{BUS REQUEST}}$ line (pin 25) low. Thus, the *2600* actually does DMA (*D*irect *M*emory *A*ccess) on the computer when requested by you through the SETUP/PLAY switch.

www.americanradiohistory.com

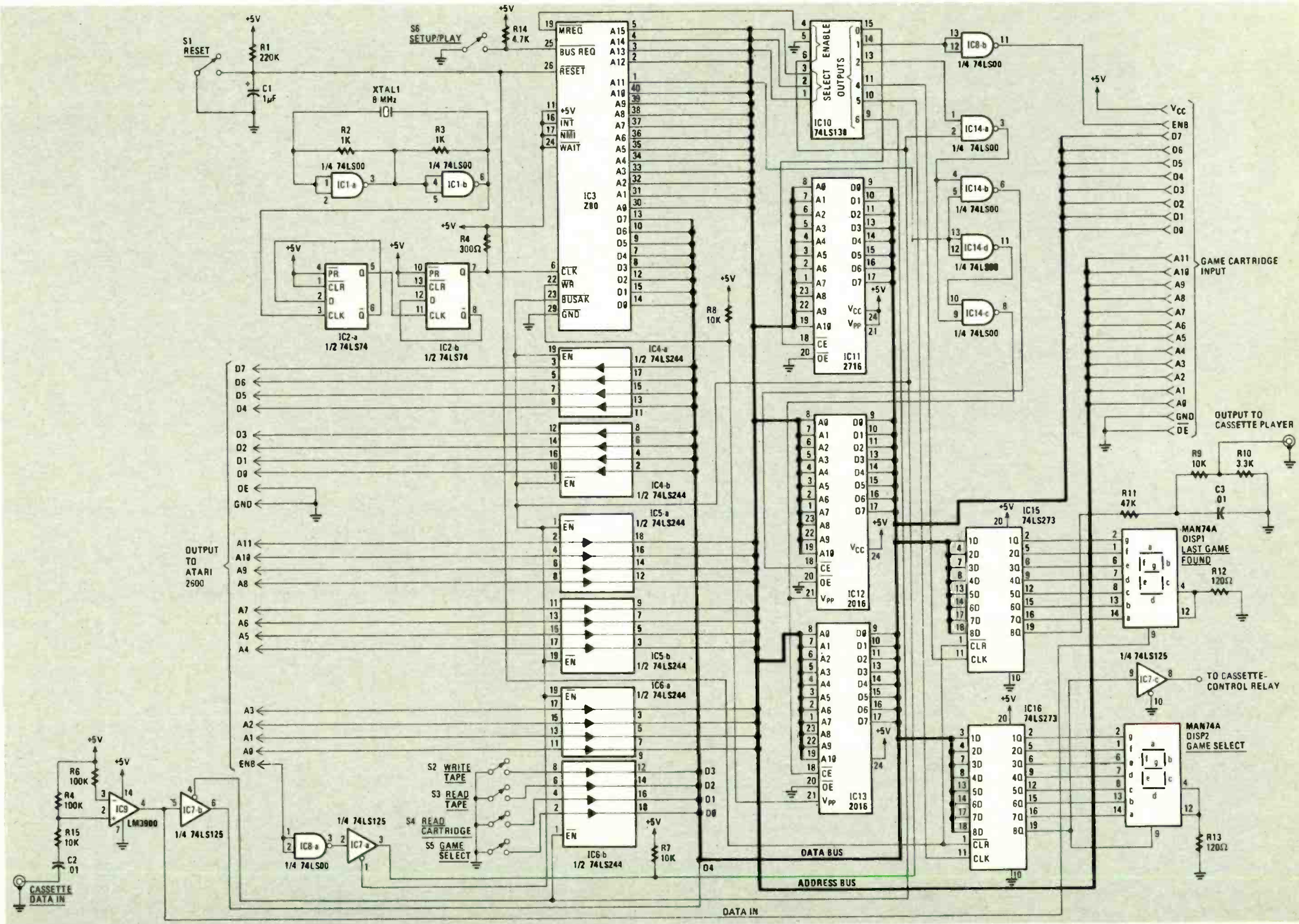


FIG. 3—A Z80 MICROPROCESSOR, along with the ROM-held operating system make up the heart of our computer/recorder. The game-cartridge ROM, LED displays, and cassette input/output are memory mapped.

www.americanradiohistory.com

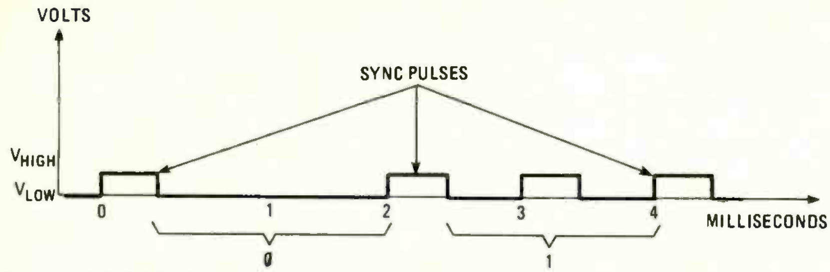


FIG. 4—SYNC PULSES, 2 milliseconds apart, are used to make sure that—even with slight changes in tape speed—the computer will be able to correctly read a tape. Data pulses are sent between the sync pulses: the sequence "Ø1" is shown above.

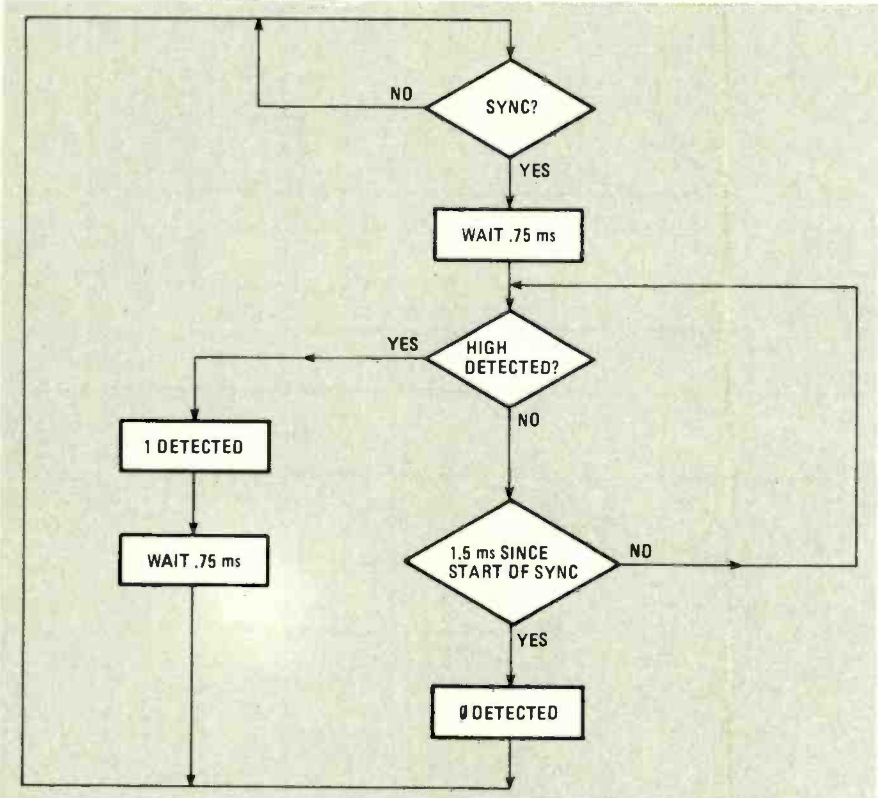


FIG. 5—THE CASSETTE-READ ALGORITHM. Rather than using hardware, software is used for timing operations.

PARTS LIST

All resistors are ¼-watt, 5%, unless otherwise specified.
R1—220,000 ohms
R2, R3—1000 ohms
R4—330 ohms
R5, R7–R9—10,000 ohms
R6, R15—100,000 ohms
R10—3300 ohms
R11—47,000 ohms
R12, R13—120 ohms
R14—4700 ohms
Capacitors
C1—1 μF, 10 volts, electrolytic
C2, C3—.01 μF, ceramic disc
Semiconductors
IC1, IC8, IC14—74LS00 quad 2-input NAND gate
IC2—74LS74 dual D-type flip-flop
IC3—Z80 microprocessor
IC4–IC6—74LS244 octal buffer
IC7—74LS125 quad bus buffer
IC9—LM3900 quad op-amp
IC10—74LS138 3-to-8 line decoder
IC11—2716 EPROM containing the computer's operating system
IC12, IC13—2016 2K × 8 static RAM
IC15, IC16—74LS273 octal D-type flip-flop
DISP1, DISP2—MAN74A
S1–S6—SPST switches
XTAL—8 MHz

Cassette input/output

Reading the ROM, of course, isn't the only job of our computer/recorder—we must write the contents of the ROM into tape. We'll do that by outputting one bit at a time by sending different voltage waveforms to the microphone input of the tape recorder. The bit to be output is put on data line D8, which is stored in IC16 (a 74LS273 D-type flip-flop), which is clocked by the $\overline{MREQ}$ line of the Z80. (Note that the output of IC7-c can be used to switch a relay to control your cassette player through its REMOTE input. That is, of course, optional.)

We will not only send pulses to represent zero bits and one bits—we'll also send out synchronization pulses. Those pulses are 0.25 milliseconds wide and are sent every 2 milliseconds, regardless of whether a 1 or 0 is being written. Those sync pulses are used to ensure that if the tape recorder speed varies slightly, our computer will be able to keep track. A data bit will be represented by a pulse—or the lack of a pulse—between the sync pulses. Figure 4 shows what the sequence "Ø1" would look like. As we can see there, a "Ø" is represented by no pulse between sync pulses, and a "1" is represented by a pulse.

Each instruction for the *2600* consists of 8 bits. We will add a parity bit to be able to detect if a program has been misrecorded or when a recording has degraded and has errors. Therefore, the contents of a game-cartridge ROM are stored as follows:

- Header (2000 zeros)
- End of header (4 ones)
- Name tag (4 bits)
- Contents of location 1 (8 bits)
- Parity for location 1 (1 bit)
- Contents of location 2 (8 bits)
- Parity for location 2 (1 bits)

That continues until all the ROM's contents are stored.

The header serves two purposes: It separates programs and provides an audible tone to detect where the program begins. (If you listen to the tape, you will hear a high pitch tone for the header. The program itself sounds like high- and low-noise.) The name tag allows you to save several programs on one cassette, and to search for those programs.

Reading the ROM contents from tape is also done one bit at a time. The computer/recorder constantly monitors what is coming out of the tape and can tell whenever the output is high or low. The sync (and data) pulses are detected by waiting for the level to go from low to high.

Detecting those pulses doesn't require much hardware. The proper timing can be implemented by counting machine cycles in a loop that does nothing. The algorithm is illustrated by the flowchart in Fig. 5.

As you can see from the flowchart, the algorithm for cassette operation is very simple: Wait for the sync pulse to appear then wait .75 millisecond and start looking for the data pulse. If the data pulse isn't seen within 1.5 milliseconds, assume that a Ø was recorded, and wait for the next sync pulse. If a data pulse *is* found, assume a 1 was recorded. Then wait 0.75 milliseconds and start looking for the next sync bit.

When we continue next time, we'll take a closer look at the software. Then we'll give you some construction hints. **R-E**

www.americanradiohistory.com

DESIGNING WITH LINEAR IC'S

This month, we'll learn about voltage-controlled amplifiers, integrators, and differentiators.

JOSEPH J. CARR

Part 7 IN THIS INSTALLMENT of "Designing with Linear IC's we will examine three circuits that we've previously overlooked but are nonetheless very important. Those are the voltage-controlled amplifier (VCA), integrator, and differentiator. As for the latter two circuits, interestingly most of the designs that are usually published do not work. We'll show you why, then provide a design that *does* work.

Voltage-controlled amplifier

A voltage-controlled amplifier (VCA) allows you to set the amplifier's gain via a control voltage. In a way, the VCA is much like the automatic gain-control (AGC) amplifiers found in receivers and certain electronic instruments. One of the most common AGC and/or VCA circuits is shown in Fig. 1. The circuit can be built either from discrete components as shown, or be obtained in IC form (the RCA CA3028, for example).

In the circuit shown, Q1 and Q2 form a differential pair. The output of the circuit can be taken from either collector, or differentially between the collectors. The input designations assume single-ended output from the collector of Q2.

The collector-emitter currents for Q1 and Q2 (I1 and I2, respectively) are derived from I3. We can thus control the gain of the circuit by controlling the collector current of Q3. Of course, that current is determined by the voltage at the base of Q3, which is applied via terminal V_C and divided down by the voltage divider consisting of R1 and R2.

Fig. 2 shows a VCA built from an operational transconductance amplifier (OTA), the RCA CA3080. Recall from our earlier discussion that an OTA has a transfer function that relates an output current to an input voltage. The gain is expressed in units of transconductance (G_M). The voltage gain (A_V) is determined by the product of G_M and the load resistance R_L. The value of G_M, on the other hand, is set by a bias current I_{ABC}, where $G_M = 19.2I_{ABC}$.

The bias current is set by control voltage V_C and resistor R6. The current is maximum (i.e. 0.5 mA) when $V_C = 0$, and minimum when $V_C = -15$ volts. The maximum transconductance, then, will be (19.2)(0.5 mA) = 9.6 millisiemans = 0.0096 siemans. The voltage gain, therefore is $G_M R1$ = (0.0096 siemans)(10^4 ohms) = 96. The voltage gain will therefore change from 0 to almost 100 as V_C varies from −15 volts up to 0 volts.

Integrators

An integrator is a circuit that will produce an output that is proportional to the time average of the input signal. In other words, the circuit performs the mathematical operation known as integration.

The simplest form of integrator is the R-C network shown in Fig. 3. That circuit may be more familiar to you as a low-pass filter. While it does perform that function, it also does, as we'll soon see, a bit more.

In the circuit of Fig. 3, when voltage V_{IN} is applied, a current flows in the resistor to charge the capacitor. Assuming that any load resistors connected across the capacitor are extremely large compared with R1, output voltage V_O reflects the accumulated capacitor charge, and is proportional to the integral of V_{IN}.

There are a number of problems with the simple circuit of Fig. 3, but most of

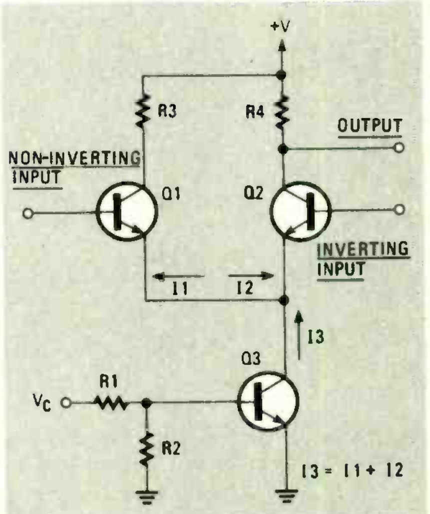


FIG. 1—ONE OF THE MOST COMMON VCA circuits. The differential amplifier can be formed from discrete components as shown, or obtained in IC form.

those are solved by the Miller integrator of Fig. 4.

The Miller integrator consists of a resistor in series with the inverting input of an op-amp, and a capacitor in the feedback loop of the IC. The capacitor charges under the influence of output voltage V_O. The transfer function for the circuit is given by:

$$V_O = \frac{-1}{RC}\int V_{IN}\,dt$$

where V_O is the output voltage, V_{IN} is the input voltage, R is the resistance in ohms, C is the capacitance in farads, and dt denotes integration over time.

The "gain" of the integrator is controlled by the product RC, which is called the time-constant of the integrator. The general rule is to make RC much larger than the period of the waveform applied to V_{IN}.

There is a problem associated with the time-constant, however. Notice that the R-C (time constant) term is in the denominator. Since that product can be very low, gain can be very high. Consider, for example, the case where R = 100,000 ohms and C = .001 µF (i.e. 10^{-9} farads). There the time constant is equal to (10^5

www.americanradiohistory.com

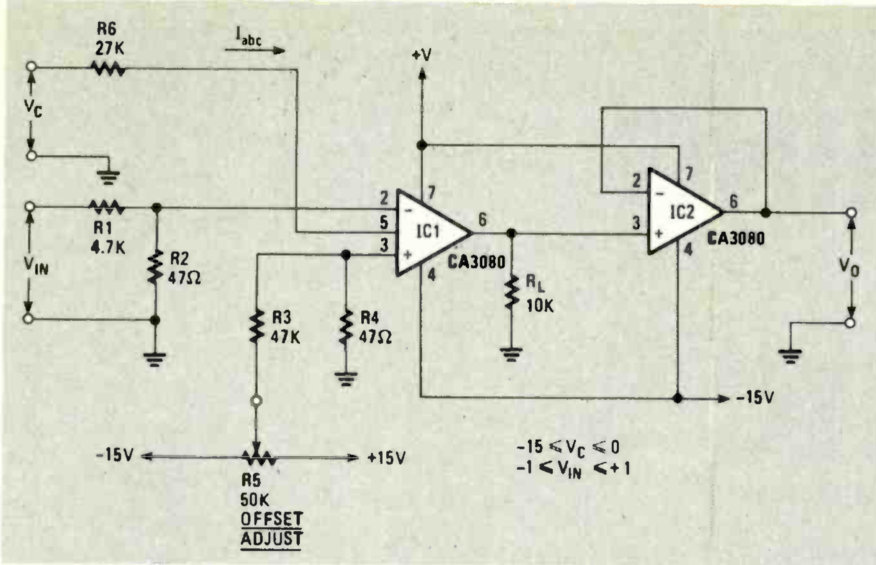


FIG. 2—THIS VOLTAGE-CONTROLLED AMPLIFIER is built using operational transconductance amplifiers. By varying V_C, the gain of the circuit can be made to vary from 0 to 96.

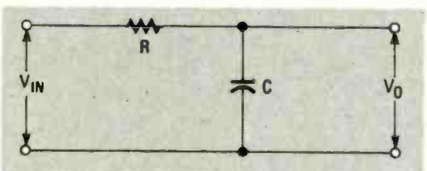


FIG. 3—SIMPLE INTEGRATOR CIRCUIT. It may be more familiar to you as a low-pass filter.

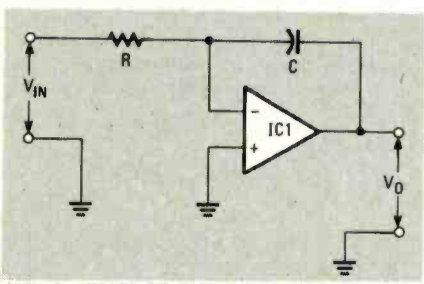


FIG. 4—MANY OF THE DEFICIENCIES of the simple integrator are solved by the Miller integrator shown here.

ohms)(10^{-9} farads) = 10^{-4} seconds. That also results in a gain of 10,000 ($1/10^{-4}$ = 10,000).

What does such a high gain mean in practical terms? It means that very small values of V_{IN} can saturate the integrator in short order! The maximum output permitted, assuming positive and negative supply voltages of 12, will be about 10 volts. If we applied a 10-millivolt DC signal to V_{IN}, therefore, the output voltage rising at a rate of $V_{IN}/RC = 0.01/10^{-4} = 100$ V/S will hit the 10 volt saturation limit in 0.1 second! If there is an input offset potential on the op-amp, or if the signal erroneously contains a DC offset (e.g. from the offset voltage of a previous stage), then the integrator output will rapidly rise to the saturation limit. Of course, shorter time constants than 10^{-4} seconds (0.1 milliseconds) will make the integrator saturate even more quickly.

There seems to be several rules for designing op-amp integrators. Those are to use an op-amp with low input-offset voltages, remove (where possible) erroneous DC offset potentials in V_{IN}, provide offset nulling for the integrator, and use the longest R-C time constant practical in designing the integrator.

The integrator in Fig. 4 is the circuit usually published in texts, and it does not work nicely for the reasons given above. With a typical 741 op-amp for example, typical input offsets cause V_O to rise to V_O(max) so rapidly that you might think the op-amp was shorted! With judicious selection of an op-amp, the modified circuit shown in Fig. 5 works a lot better.

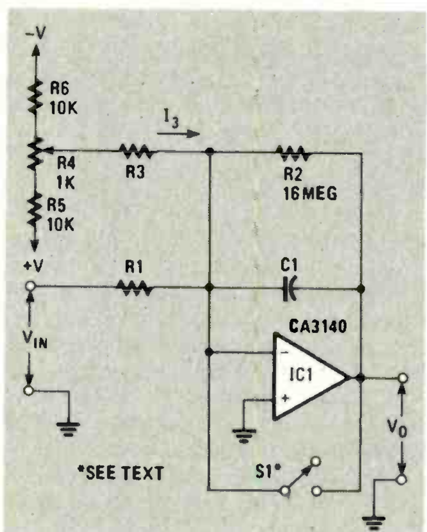


FIG. 5—A PRACTICAL INTEGRATOR. With careful op-amp selection, the circuit shown here will perform well.

The selection of an op-amp can be critical, and not all is as it appears in the data sheets. While working on another project, the author ran a series of tests on op-amps to find those best suited for use in intergrator circuits. A test circuit was built that allowed different op-amps to be plugged-in for the test. The integrator used a time constant of 0.1 second, and an input voltage, V_{IN}, of 0. In an ideal integrator, V_O should remain zero. It was found that 741 devices saturated in an average of 2 seconds. The so-called "premium" 725 devices saturated in an average of 5 seconds (still too fast). Other high-priced premium-grade devices saturated in 2-8 seconds. Those rates, it was found, were too fast to easily counteract with the usual null circuit (R3–R6 in Fig. 5). Devices with MOSFET or JFET input transistors behaved themselves much better. Saturation times with those tended to be 20–30 seconds, or more. In the end, we selected the non-premium, low-cost, CA3140 BiMOS op-amp (RCA) as the best device for the integrator design.

The "integration" components in Fig. 5 are R1 and C1; everything else in the circuit is there to "fix problems." The electronic CMOS switch, S1, for example, allows us to dump charge from C1. That charge comes from two sources: previous integrations and output offsets. Switch S1 must be momentarily closed immediately prior to each operation. That switch may be electronic CMOS, mechanical, or a relay. If C1 is very large, however, beware of exceeding the current rating of CMOS switches.

Resistor R2 shunts the integrator capacitor. The purpose of R2 is to keep C1 from being charged by certain offset voltages. Without R2, the output signal zero-baseline will rise to saturation. In one test, we applied a 1-Hz sinewave to V_{IN} and watched the output sinewave climb off the oscilloscope screen. Normally, a symmetrical sinewave will not show any DC component at all at the output of an ideal integrator.

The value of R2 is found by experimentation. If it is too high, then the circuit won't work; if it is too low, then the integrator will act like an ordinary inverting follower with a frequency compensating capacitor across R2! The value 16 megohms was found reasonable with CA3140 op-amps.

What output drift exists is easily counteracted using the null circuit (R3–R6). The input voltage V_{IN} should be zero when that circuit is adjusted. Each time R4 is adjusted, close S1 momentarily to discharge C1. Use either an oscilloscope or sensitive analog DC voltmeter to monitor V_O; select ever more sensitive ranges as you adjust R4 in order to maximize the change in V_O.

In some cases, R4 may have to have a lower value (100–1000 ohms) in order to obtain better control resolution. In all cases, R3–R6 should have a low temperature coefficient.

www.americanradiohistory.com

Integrator calibration

There are cases where we need some means of scaling or calibrating the output of the integrator. That is done by inputting a function whose integral has a uniform slope over time and then calculating that slope. Two functions have integrals that are appropriate for that purpose: a squarewave and a constant voltage.

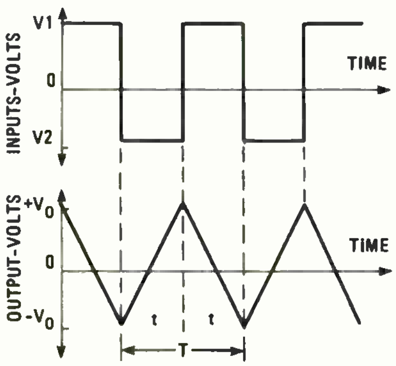


FIG. 6—IF A SQUAREWAVE is input to an integrator, the output will be a triangular wave.

When a squarewave (see Fig. 6-a) is input to an integrator, the resulting output is a triangular wave (see Fig. 6-b). (Note that for a positive input, the output is the negative integral, as is indicated by the circuit's transfer function.) Assuming a symmetrical input, that is $|V1| = |V2|$, the slopes of the ramps that make up the triangular wave are equal to $2V_O/t$, where t is equal to ½ the period (T) of the input squarewave. It is then a simple matter to measure V_O and calculate that slope.

Figure 7 shows a calibrating circuit for

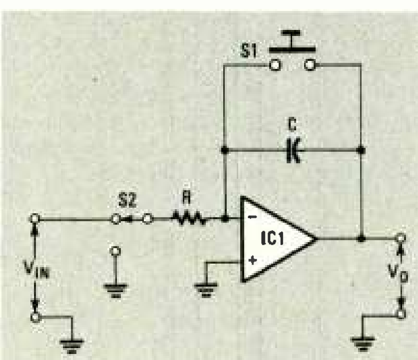


FIG. 7—WITH THIS CIRCUIT, a constant voltage can be used to calibrate an integrator.

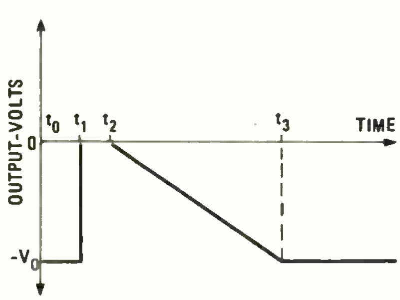


FIG. 8—WHEN A CONSTANT VOLTAGE is input to the calibration circuit of Fig. 7 in the manner described in the text, this output will result.

use when the input is a constant voltage; the resulting output is then a ramp. Initially, the inverting input of the op-amp is grounded via S2. Before starting the test, close S1 to discharge C1; that is done at time t1 (see Fig. 8), but don't allow a lot of time to pass before starting the test. A voltage is then applied to the inverting input via S2 for a fixed period of time (t2 to t3). That will cause the output to decrease uniformly (ramp) from zero down to $-V_O$, which is the output voltage at t3. The input is then grounded via S2 and V_O is measured. The slope of the ramp can then be found from $V_O/(t3 - t2)$.

Differentiators

A differentiator is a circuit whose output is a derivative of the input. In other words, the output voltage is proportional to the rate-of-change of the input signal.

Differentiation and integration are inverse functions of each other. If we apply a time-varying signal, $V_{IN}(t)$, to the input of an integrator, and then apply the integrator output signal to the input of an equivalent differentiator, we should find the differentiator output to be the same as $V_{IN}(t)$—with a little propagation-delay phase-shift.

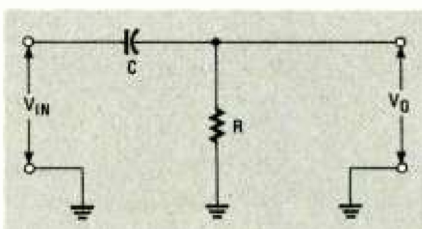


FIG. 9—A SIMPLE DIFFERENTIATOR. The circuit may be more familiar to you as a high-pass filter.

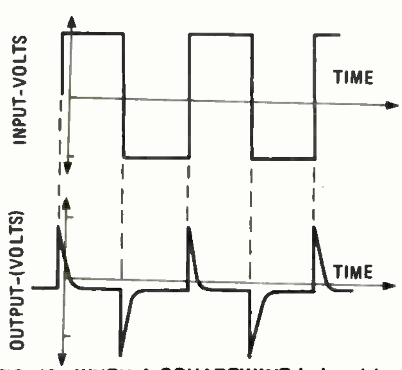


FIG. 10—WHEN A SQUAREWAVE is input to a differentiator, the output is a series of voltage spikes.

The simplest form of differentiator is the R-C network shown in Fig. 9. Note that that circuit may be more familiar to you as a high-pass filter.

The operation of the differentiator on squarewaves is shown in Figure 10. The squarewave is characterized by areas of constant amplitude (zero rate-of-change) sandwiched between edges with extremely rapid rates of change. The result is a spike-like output wave that is positive for positive-going edges, and negative for negative-going edges. Those spikes will be very broad for long time constants (compared with signal periods), and very thin for very short time constants. A differentiator time constant should be short compared with signal periods.

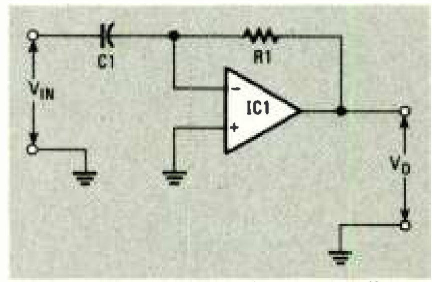


FIG. 11—ALTHOUGH THIS IS a classic differentiator, the circuit tends to be unstable under some circumstances.

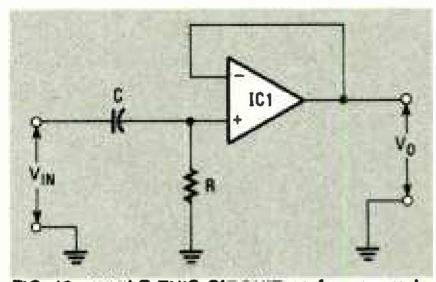


FIG. 12—WHILE THIS CIRCUIT performs much better than the one shown in Fig. 11, it is used only in limited applications.

Two forms of active operational amplifier differentiators are shown in Figs. 11 and 12. The inverting version shown in Fig. 11 is the classic differentiator, and will produce an output potential of:

$$V_O = -R1C1\frac{dV_{IN}}{dt}$$

Unfortunately, the circuit of Fig. 11 tends to be a little unstable (i.e. it will "ring") under some circumstances. In a moment, we will see how to "fix" that problem.

The circuit of Fig. 12 merely uses a noninverting operational amplifier (unity gain) to buffer the R-C differentiator output. That circuit is simple, produces a low output impedance for the R-C differentiator, and is generally well-behaved.

Even so, the circuit is not frequently used. More common is a "fixed" version of the circuit in Fig. 11; that circuit is shown in Fig. 13. Two extra components are used to stabilize the circuit: R2 and C2.

A frequency-response plot of that circuit is shown in Figure 14. As is shown, the frequency response of the amplifier (A_{VOL}) is flat from DC to some frequency, at which the gain begins to roll off at a rate of −6 dB/octave. In order to achieve stability, we will want the curve $1/\beta$ to

www.americanradiohistory.com

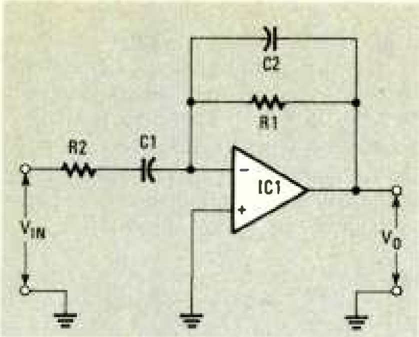


FIG. 13—AN IMPROVED VERSION of the differentiator shown in Fig. 11.

differentiators is that the high-pass filter nature of the R-C networks means that gain increases with frequency. Hence, high frequency noise in active differentiators can be vicious. Capacitor C2 is used to prevent that problem, which creates curve 1/β3. The value of that capacitor should be found using the following formula:

$$C_2 = \frac{1}{2\pi f_4 R1}$$

Capacitor C2 will provide integrator action at frequencies above f_4, and differentiator action at frequencies below f_4.

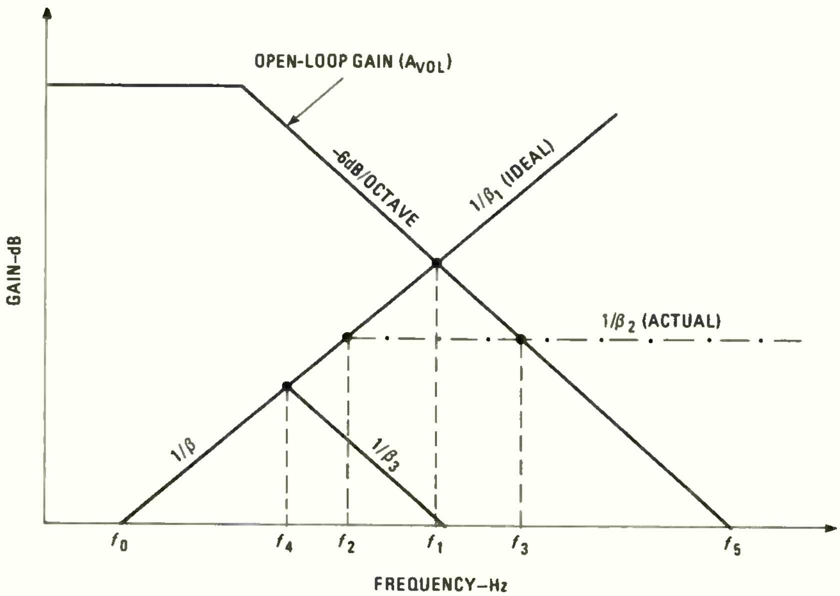


FIG. 14—FREQUENCY RESPONSE plot of the differentiator shown in Fig. 13. Note that the frequency response of the circuit is flat from DC to some frequency, at which point it rolls off at a rate of −6dB/octave.

intersect A_{VOL} with a net slope between them of less than −12dB/octave. (Note: β is the feedback attenuation factor introduced by R1 and C1). Since the net slope between A_{VOL} and 1/β is high, the circuit may tend to oscillate. We must modify the feedback frequency response to make the feedback curve like 1/β2; that is the function of resistor R2, which is in series with C2. We want R2 to introduce a frequency response breakpoint at f_2. If f_1 is the frequency at which the ideal curve 1/β, intersects A_{VOL}, then f_2 must be 3.16 times lower than f_1 (i.e. $f_2 = f_1/3.16$). The minimum value of R2 that will accomplish that trick is given by:

$$R2 = \frac{3.16}{2\pi f_1 C1}$$

Combining constants yields:

$$R2 = \frac{0.503}{f_1 C1}$$

In general, minimum values for R2 fall in the range of 40 ohms to 500 ohms (although that is not absolute).

Another problem often seen in active differentiators is that the high-pass filter nature of the R-C networks means that gain increases with frequency.

Differentiator calibration

The output signal from the differentiator is proportional to the rate of change of the input signal in volts per second. We can calibrate the differentiator using a function with constant-slope ramps.

One such function is a triangular wave. A triangular waveform has two constant-slope edges, one positive and the other negative. Since the usual op-amp differentiator is an inverting circuit, the output will be a positive voltage for a negative-going ramp, and a negative voltage for positive-going ramps. Thus, a triangle input signal will produce a squarewave output. If the amplitude of the input signal is V1, and the period T, then the rate-of-change of each slope is V1(½ T), assuming a symmetrical triangle wave. The amplitude of the output squarewave is 0 to $+V_O$ for the negative ramp, and 0 to $-V_O$ for the positive ramp.

A linear ramp can also be used for differentiator calibration. Such a ramp could be generated by inputting a known constant voltage to a Miller integrator. The differentiator output will be a constant voltage that is proportional to the ramp slope.

If we want the output signal quantified, then we will have to provide some means to vary V_O for calibration purposes; a variable-gain inverting follower will do the trick nicely and will also flip the polarity so that positive outputs are obtained for positive inputs and negative outputs are obtained for negative inputs.

Let's look at a practical example. Differentiators are used in a wide variety of biomedical applications. One of those is as an arterial pressure amplifier. Assume that the leading edge of a human arterial blood-pressure waveform, P(t), has a rate of change (dP/dt) that's on the order of 5 × 10^3 mmHg/second (mmHg is millimeters of mercury). A typical arterial pressure amplifier has an output voltage scale factor of 10mV/mmHg, so it will have a rate-of-change output, dV_O/dt, that's equal to:

$$\frac{dv_o}{dt} = \frac{S \times 10^3 \text{ mmHg}}{\text{second}} \times \frac{10\text{mV}}{\text{mmHg}} \times \frac{1\text{V}}{10^3\text{mV}}$$

$$= \frac{5 \times 10^3 \times 10 \times 1}{10^3} = 50 \text{ volts/second}$$

The differentiator output voltage is:

$$V_O = -RC\frac{dV_o}{dt}$$

$$V_O = -RC \text{ (50 volts/second)}$$

We can vary the value of R and C (those are the components used to determine the time constant of the circuit, such as R1 and C1 in the differentiator of Fig. 13), and the gain of any following amplifiers, to produce a value of V_O that is easily displayed on, say, a strip-chart recorder. Suppose our strip-chart recorder has a plus-or-minus 1-volt input range, and we want one volt to represent 5 × 10^3 mmHg/second. The R-C time constant should be:

$$RC = V_O/\text{(50 volts/second)}$$

$$= \frac{\text{(1 second)(1 volt)}}{\text{(50 volts)}} = \frac{1}{50}$$

$$= 0.02 \text{ seconds}$$

Once we have a value for our R-C time constant, we need to find a combination of R and C that is appropriate. Let C = 0.1 μF (a tentative guess) and calculate R:

$$R = \frac{.02}{C}$$

$$= \frac{.02}{1 \times 10^{-7}} = 200{,}000 \text{ ohms}$$

We can, therefore, build our differentiator using a 200,000-ohm resistor and a 0.1 μF capacitor. **R-E**

www.americanradiohistory.com

NEW IDEAS

Contrast meter for photography buffs

IF YOU'RE AN AMATEUR PHOTOGRAPHER who enjoys developing his own pictures, you have probably found it necessary to choose the right paper to fill certain requirements. If you're among the fortunate few who can afford a densitometer, then you have nothing to worry about. But if you're like most of us and cannot afford that piece of equipment, then perhaps this easy-to-build substitute is for you.

Contrast meter

Figure 1 is a schematic of a contrast meter that can used to help you choose the right grade of paper for your photographic needs. The circuit, built from readily available parts, will work well with almost any photocell and 1-mA panel meter you choose.

The circuit is powered by a dual 15-volt power supply. If you have trouble in getting the parts to build the power supply, then the design can be modified to use a dual 12-volt supply by changing the values of resistors R1, R6, and R7 to 8200 ohms, 180 ohms, and 560 ohms respectively. The only critical components are resistors R3 and R4, which should be tested to ensure a good 1:3 ratio.

How it works

One leg of the photocell (R1) is tied to the +15-volt supply and the other end is connected to ground through resistor R2, forming a voltage-divider network. The non-inverting input of the 741 op-amp, IC1, is tied to the junction formed by R1 and R2, while its inverting input is grounded through resistor R3. When switch S1 is pressed, another divider network is formed, reducing the the voltage applied to the inverting input of the op-amp (more on that later).

When light hits the photocell, its resistance begins to decrease causing a greater voltage drop across R2 and a higher voltage to be presented to the non-inverting input of IC1. That causes IC1 to output a voltage proportional to the its two inputs.

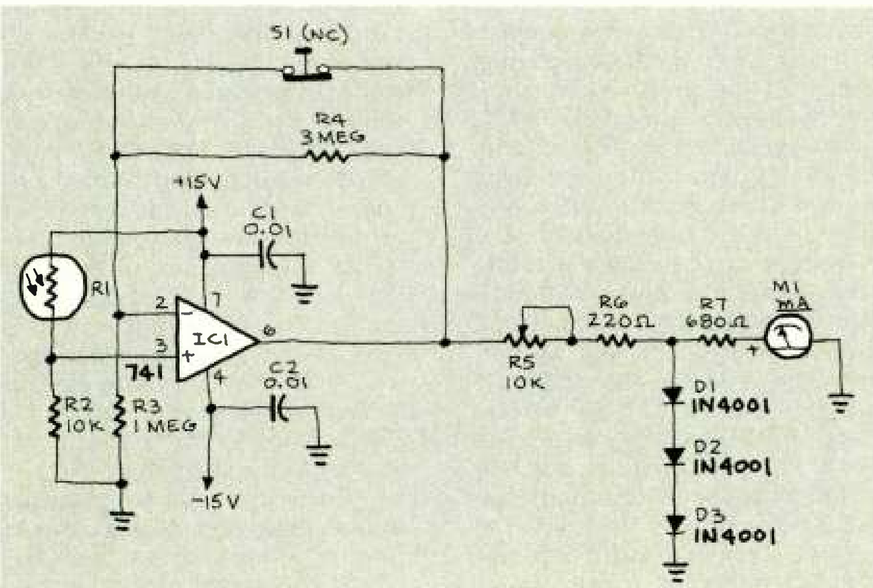


FIG. 1

The circuit gives a meter reading that depends on the intensity of light hitting photocell R1; therefore, R1 should be mounted in a bottle cap so that the light must pass through a 3/16-inch hole. Potentiometer R5 is used to adjust the circuit for the negative you're working with.

The diode chain, D1–D3, is used to protect the meter in case direct room light hits the photocell. If the dark resistance of the cell is less than about 1 megohm, it may be necessary to use four diodes, in-

continued on page 88

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, for U.S. residents only, Panavise will donate their *model 333*—The Rapid Assembly Circuit Board Holder, having a retail price of $39.95. It features an eight-position rotating adjustment, indexing at 45-degree increments, and six positive lock positions in the vertical plane, giving you a full ten-inch height adjustment for comfortable working.

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 has 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**

www.americanradiohistory.com

HOBBY CORNER

How target games work

EARL "DOC" SAVAGE,
HOBBY EDITOR

THERE ARE A NUMBER TARGET GAMES on the market that use light beams instead of physical projectiles to test one's aim. One of our readers, I. Barditch (MO), wants to know how they work.

Well, Mr. Barditch, rather than just giving you the actual schematic of a commercial product, I'll outline the principles behind those devices to give you some insight on how to go about building your own.

The "gun" (of whatever type) sends a pulse of light when it is fired. The light source can be a regular flashlight bulb, which—if the pulse is extremely short—can be overloaded beyond its normal supply voltage without destroying the bulb. A lens is used to focus the light from the source into a relatively narrow beam.

On the receiving end, you may also find a lens. That lens does two things: It helps prevent stray light from hitting the sensor and triggering a false "hit," and it also focuses the incoming beam on a photodetector.

Figure 1 shows a basic photodetector circuit. The detector itself can be any one of three devices. A cadmium-sulfide photocell will do the job, but that device has a slow response time. You could also use a photodiode or phototransistor. (They work well in this application.) Each device passes current when struck by light.

If the current requirements of the load aren't too great, you could simply connect the load in series with the detector. In the light, the detector would pass current and allow the load (whatever it might be) to operate. Most applications, however, require some type of switching arrangement.

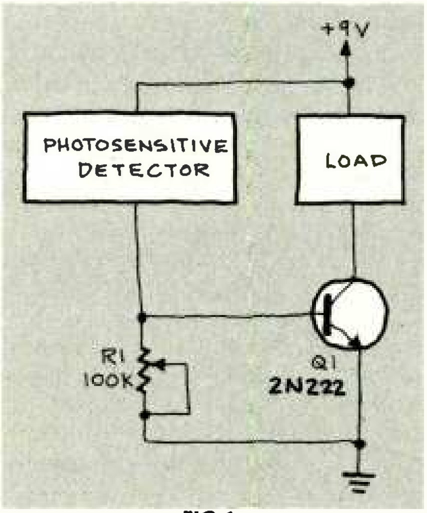


FIG. 1

In Fig. 1, transistor Q1 acts as a switch to energize the load. When the base is at or near ground potential, the transistor is turned off and therefore passes no current. However, when the base potential swings in the positive direction, the transistor is turned on and allows current to flow. Potentiometer R1 regulates the switching point of the transistor and therefore acts as a sensitivity control.

The load can be almost anything from a lamp, to a row of LED's, to a sound generator. If the actual load requires a higher voltage or current than available, transistor Q1 may be used to turn on a relay (about 500 ohms at 6–8 volts). The relay, in turn, would control motors, lamps, TV, a sound system, and so on.

If you want to control a device that has heavy current requirements (like a large motor), the little relay could be used to turn on a larger relay, which would then handle the heavy load.

One more point regarding Fig. 1: If you want the circuit to turn on in the absence of light, all you have to do is reverse the positions of the detector and the potentiometer in the circuit.

Well, Mr. Barditch, you should be able to take it from there and build a game or almost any other light-controlled device. Good luck!

Current flow

Back in April's "Hobby Corner" we talked about testing transistors. One reader took me to task for talking about "electron flow." And several others admitted to some confusion about the positive-to-negative and negative-to-positive action used to describe current flow. So, let's see if we can straighten things out. (This effort to simplify and clarify may be repetitious to those who are well versed in this area. If so, just read along and realize that the following is not meant for you!)

First, a bit of pertinent background: Back in the old days (read that as pre-transistor), we in electronics always spoke of electron flow as going from negative to positive. From the action of tubes, especially, it was more than obvious that electricity consisted of the flow of electrons.

Electricians, on the other hand, were equally sure that current flowed from positive to negative. Many an argument took place over the question of who was right. Finally, a compromise of sorts was reached: It was decided that electrons flowed from negative to

www.americanradiohistory.com

VOL. 1 No. 8 December 1984

COMPUTER DIGEST

NEW KIND OF MAGAZINE FOR ELECTRONICS PROFESSIONALS

BIOBOX

Build this Biodfeedback Monitor and use your computer to keep calm.

A GERNSBACK PUBLICATION

GADGETS AND GIZMOS

How to inexpensively expand your computer's capability.

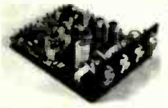
PATCHING WORDSTAR

How to modify WordStar to access the special functions of your MX-80

www.americanradiohistory.com

60W + 60W O.T.L. AMP

Stereo pre-amp + tone control + power amp. All in on unit, fully assembled! Compact in size: 7"x4¾"x2½". Can be fitted into most cabinets. Power transistors using 25C1667 X 4 to give a max output of 60W + 60W (8Ω)
• Frequency response: 20Hz ~ 85KHz(−1dB) • Total harmonic distortion: 0.02% (1KHz) • Signal Noise Ratio: 88 dB (open loop) • Tone control: 100 Hz ± 16 dB 10 KHz ± 14dB • Dynamic range: 60 dB • Power Supply: 48V ~ 70V 5 Amp. • Filter Capacitor: 4700 μ 75V or better.



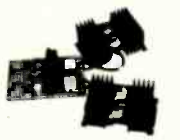
MODEL: SA-4520
Assembled Model $39.95
Transformer (Optional).... $22.50
Filter Capacitor 4700μF 75V (Optional) .... $6.50 ea.

★ REDUCED PRICE ★
LOW T.I.M. TRANSISTORS 100W + 100W

• Employs Hitachi low noise I.C. for pre-amp • Max. output 16 V P-P (non distortion) • With hi-low filter, and tone defeat circuit • Rear power amp with short circuit protection • Giant heat sink for maximum results • Tone controls ± 14dB • All components (except pots for volume, and tone controls) are pre-assembled, the quality is guaranteed. • Power supply DC ± 35V-50V

MODEL: SA802C
Fully Assembled $75.00
Transformer (Optional).... $22.50 ea.
Filter Capacitor 4700μF 75V (Optional) .... $6.50 ea.

100 WATTS
CLASS A POWER AMP KIT
$49.50



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 TIM stereo pre-amp.
Specifications • Output power 100W RMS into 8Ω. 125W RMS into 4Ω • Frequency response 10Hz-100KHz • THD less than 0.01% • S/N ratio better than 80dB • Input sensitivity 1V max. • Power supply ±40V at 5A.
Power Transformer (Optional) $24.00

NOW WITH ON-BOARD LED LEVEL DISPLAY

★ SPECIAL ★
Excellent Price!
Model 001-0034
$29.50 per Kit
Transformer
$10.50 ea.

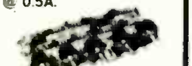
TA-322 30 WATTS TOTAL 15W + 15W STEREO AMP KIT

This is a solid state all transistor circuitry with on board stereo pre-amp for most microphone or phone input. Power output employs a heavy duty Power Hybrid IC. Four built on board controls for, volume, balance, treble and bass. Power supply requires 48VCT 2.5A transformer. THD of less than 0.1% between 100Hz-10KHz at full power (15 Watts + 15 Watts loaded into 8Ω).

LOW TIM DC STEREO PRE-AMP KIT TA-1020

Incorporates brand-new DC design that gives a frequency response from 0-100KHz ±0.5dB. Added features like tone defeat and loudness control let you tailor your own frequency supplies to eliminate power fluctuations!
Specifications: ● THD/TIM less than .005% ● Frequency response DC to 100KHz ±0.5dB ● RIAA deviation ±0.2dB ● S/N ratio better than 70dB ● Sensitivity: Phone 2mV 47KΩ, Aux 100mV 100KΩ ● Output level 1.3V ● Max output 15V ● Tone controls; Bass ±10dB @ 50Hz, Treble ±10dB @ 15Hz ● Power supply ±24VDC @ 0.5A. Kit comes with regulated power supply. All you need is a 48VCT transformer @ 0.5A.

Only $44.50
Transformer
$4.50 ea.



MAGNETIC HEAD EQUALIZER

• Standard RIAA curve for all kinds of magnetic heads • 3 stages crossover circuit for best results • Output voltage guaranteed to be stable without any oscillation • Power Supply: 24 V.D.C.

MODEL: MA-142
Part #370-370............. $6.95 ea.

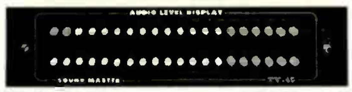
STEREO MICRPHONE AND ECHO MIXER FOR STEREO AMPLIFIER SYSTEM

The circuitry employs all integrated circuits, BBD type echo circuit, echo time can be adjusted (max. .30 Msec.) Also with a microphone preamp on the board. Fully assembled.

MODEL: MX205
Part #370-0360 .... $29.95 ea.

20 STEPS LED TRI COLOR LEVEL INDICATOR KIT

This new stereo level indicator kit consists of 40 3-color LED's to indicate sound level output of your amplifier from −57dB to 0dB. Comes with an attractive silk screen printed panel. Has selector switch to allow floating or gradual output indicating. Kit includes all parts. Front panel and power supply.



MODEL: TY-45 .... $29.50 per Kit

0—15V 2 AMP VARIBLE DC POWER SUPPLY KIT

All solid state circuitry with high efficiency power transitor 2SD388 and IC voltage regulator MC1733. Output voltage can be adjusted from 0-15V at 2A current limited. Internal resistance is less than 0.005Ω, ripple and noise less than 1mV, dual on panel meters for voltage and current reading, also with on board LED and audible over load indicator. Kit comes with pre-drilled PC Board, instructions, all necessary electronic components, transformer and a professional looking metal cabinet. The best project for school and the most useful instrument for repairmen. Build one today!

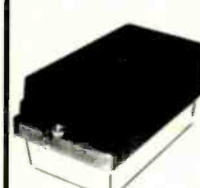
MODEL: TR 100
$59.50 ea.

INFRA-RED BEAM REMOTE CONTROL SWITCH KIT

This infra-red Control switch can be used to control appliances on/off up to 500 watts.

Has effective control up to 30 feet. No antenna needed. Kit comes with transmitter and receiver unit, case and all components.
Easy to build!
MODEL TK-41 KIT .... $19.95 ea.

DISK BOX



HOLDS 100 PCS. 5¼" DISKETTES WITH REMOVABLE TOP AND LOCKS

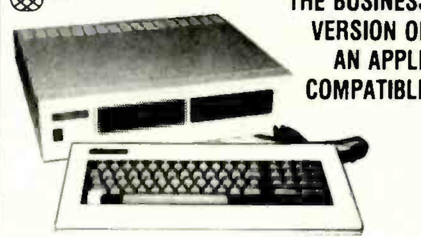
$14.95

pinecom™ 64K STARTER SYSTEM

with: 64K Computer Unit (expandable to 192K)
12" Green Monitor
Monitor Cable
1 Disk Drive
1 Disk Controller Card
1 Auto Center Joystick
10 Double Density Diskettes
1 'SOFTAPPLE' Software
1 'Know Your Apple' Software

for all these goodies, you only pay **$699.00**
Computer Unit only $399.00

pinecom™ DP-64E
THE BUSINESS VERSION OF AN APPLE COMPATIBLE



APPLE II + COMPATIBLE!
DP-64E
$1099.00
Without Disk Drives and 80 Column Card
$599.00

FEATURES
Dual Processors Can Run Both Applesoft and CP/M Programs.
64K On Board Memory Expandable to 192K.
80/40 Column Display w/Soft Switch.
Dual Slim Disk Drives Built In.
Detached Keyboard w/Numeric Keypad.
Auto Repeat on Every Key and Cursor Control.

APPLE COMPATIBLE COMPUTER PRODUCTS

ADD ON CARDS	
AUTOTERM 80 Column Card w/Siftswitch	$89.00
80 COLUMN CARD (Videx Compatible)	69.00
SOFTSWITCH for 80 Column Card	35.00
Z80 CARD (CP/M)	69.00
16K RAM CARD w/Cable (Language Card)	49.00
16K RAM CARD (Language Card) Cabless	39.00
PARALLEL PRINTER CARD (Universal)	59.00
GRAPHIC PRINTER CARD Supports Most Printers	89.00
PRINTERFACE CARD (Practical Peripheral)	69.00
SERIAL INTERFACE CARD (RS-232 Card)	59.00
SUPER SERIAL INTERFACE CARD	120.00
DISK CONTROLLER CARD	45.00
DISK CONTROLLER CARD 3.2/3.3 Auto Select	55.00
EPROM WRITER CARD (2716/2732/2764)	75.00
128K RAM CARD	199.00
TTL IC TESTER CARD (for Known/Unknown TTL IC's)	160.00
RGB COLOR INTERFACE CARD	89.00
PAL SYSTEM TV INTERFACE CARD	45.00
R.F. MODULATOR (NTSC Channel 3 & 4)	12.95
COPY CARD (Wildcard Compatible)	55.00
6809 INTERFACE CARD	170.00
DISK DRIVES	
MITAC Full Height (Shugart)	$160.00
FORMULA Half Height Drive	160.00
AUSUKA SLIM (w/Opto Sensor)(Blue Label)	225.00
MONITORS	
IBM STYLE 12" Amber Monochrome	$150.00
TATUNG 13" Hi-Res Color (same make for IBM)	$440.00
EA 12" Green, Hi-Resolution	99.00
EA 12" Amber, Hi-Resolution	120.00
AMDEK VIDEO 300 12" Green, Hi-Resolution	145.00
AMDEK VIDEO 300A 12" Amber, Hi-Resolution	165.00
AMDEK COLOR I 13" Color	290.00
GORILLA 12" Green, Hi-Resolution	99.00
OTHER PRODUCTS	
TILTABLE MONITOR STAND (for 12"/13" Monitors)	$18.00
DISKETTE HOLEPUNCH (Conv. Disk to Double Side)	8.99
DISKETTE BOX w/Keylock (Holds 100 5¼" Disks	16.50
POWER STRIPE w/Surge Supressor & switch, 6 Outlets	19.95
APPLE FAN w/Surge Surpressor & Switch, 2 Outlets	29.00
HEAVY DUTY JOYSTICK w/Auto Center and Fine Trim	29.00
GENERIC BRAND DISKETTES S.S.D.D. (Box of 10)	16.50
DISK BOX Holds 50 Diskettes	14.95
DISK BOX with Lock Holds 100 Disks	14.95
DATALIFE DISKETTES S.S.D.D. (Box of 10)	28.00
DYSAN DISKETTES S.S.D.D.	29.00

For Outside U.S.A. Purchases, Order Direct from Our Hong Kong Office.
PINEAPPLE COMPUTER PRODUCTS (HK) LTD.,
L-55 Peninsula Centre, Mody Rd. East, Tsim Sha Tsui East, Kowloon, Hong Kong. Telex: 50026 LTCAL HX.

FORMULA INTERNATIONAL INC.
12603 Crenshaw Blvd., Dept. B, Hawthorne, CA 90250
For information (213) 973-1921 • Orders Only (outside Calif.) (800) 672-8758

IBM is a registered trade mark of IBM.
CPM is a registered trade mark of Digital Research.

MINIMUM ORDER $10.00. CA Residents add 6.5% Sales Tax. Phone orders accepted on VISA or Mastercard only. No COD's. Prices subject to change without notice.

SHIPPING AND HANDLING CHARGES

	Under $50.00 Purchase	Over $50.00 Purchase
Inside CA	10%	5%
Outside CA	15%	10%
Outside USA	25%	20%

STORE HOURS
Mon.-Fri 10am-7pm
Sat. 10am-6pm

PLEASE NOTE: A 15% restocking charge will be made to customer for all returned merchandise.

CIRCLE 112 ON FREE INFORMATION CARD

www.americanradiohistory.com

CONTENTS

see page 7

Vol. 1 No. 8 December 1984

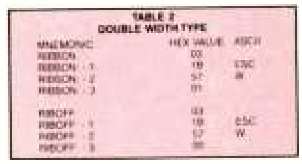


TABLE 2
DOUBLE WIDTH TYPE

MNEMONIC	HEX VALUE	ASCII
RIBBON	[illegible]	
RIBBON - 1	1B	ESC
RIBBON - 2	57	W
RIBBON - 3	01	
RIBOFF	[illegible]	
RIBOFF - 1	1B	ESC
RIBOFF - 2	57	W
RIBOFF - 3	00	

see page 15

ON THE COVER

While we're not making any medical claims, biofeedback monitoring seems to help lots of people attain calm. By computerizing the results, you can keep a constant check on how well you're doing. **See page 11.**

www.americanradiohistory.com

EDITORIAL

Platonic dialectic and the computer

■The next generation of computers will have the ability to reason.

Don't expect anything particularly massive at first, for principals have to be explored and tried. But if you tell tomorrow's computer that "All fish live in the water," and that "The trout is a fish," the computer will be able to answer the question "Where do trout live?" by saying "in the water."

This is done by inference. The new generation of computers will indeed be able to draw an inference from information it is supplied, and if you carry this out to extremes, massive changes can be expected.

For one thing, today's modern, up-to-the-minute computer will be archaic by comparison. Just as we now compare masses of memory from one computer to another, we will, in the future, be comparing levels of inference. There isn't the least doubt that tomorrow's computers will have the ability to solve, by inference, more and more complex equations. And the more-complex the equation, the better the computer. Another parameter—inference level—will be added to the vast store of requirements that we compare when purchasing a new computer system.

If you stop and think about it for a moment, the applications for inference are legion. In business, in science, why there's hardly an area where sound, logical reasoning can't make a viable, important contribution. Give such a computer the basic elements of a story plot and let it go to work, and it can spit out a 50,000 word novel in the twinkling of an eye! A physician can feed in a series of symptoms, and the computer can make one or more possible diagnoses. "What if" considerations take on a whole new meaning.

According to a recent news story in the New York Times, the reality of this is almost upon us, and is the goal of the 1990's.

With all of this, I am reminded of a class in Basic Philosophy that I took in college, and the proposition was posed as follows: "All fish swim. Some men swim."

What was the logical conclusion? Of course (incorrectly) it's... "Some men are fish."

Byron G. Wels

Byron G. Wels
Editor

ComputerDigest is published monthly as an insert in Radio-Electronics magazine by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Second-Class Postage Paid at New York, N.Y. and additional mailing offices. All rights reserved. Printed in U.S.A.

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.

COMPUTER DIGEST

Hugo Gernsback (1884-1967) founder
M. Harvey Gernsback, editor-in-chief
Larry Steckler, CET, publisher
Art Kleiman, editorial director
Byron G. Wels, editor
Brian C. Fenton, technical editor
Carl Laron, associate editor
Robert A. Young, assistant editor
Ruby M. Yee, production manager
Robert A. W. Lowndes, production associate
Dianne Osias, production assistant
Karen Tucker, production assistant
Jacqueline Weaver, circulation director
Arline R. Fishman, advertising coordinator

Gernsback Publications, Inc.
200 Park Ave. South
New York, NY 10003
Chairman of the Board: M. Harvey Gernsback
President: Larry Steckler

ADVERTISING SALES 212-777-6400
Larry Steckler
Publisher

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

MIDWEST/Texas/Arkansas/Okla.
Ralph Bergen
Radio-Electronics
540 Frontage Road—Suite 325
Northfield, Illinois 60093
312-446-1444

PACIFIC COAST
Mountain States
Marvin Green
Radio-Electronics
15335 Morrison St., Suite 227,
Sherman Oaks, CA 91403
818-986-2001

www.americanradiohistory.com

LETTERS

More and better

I wanted to cast a positive vote for your magazine, which I enjoy very much. I'd like to see more space devoted to it each month. How soon will ComputerDigest become a "stand-alone" magazine?—Mark Matson, San Bernardino, CA.

We're really trying Mark, but unless we get sufficient advertising support to warrant standing alone, it might be some time! The reader response has been absolutely wonderful however.

Same authors?

I've noticed that—for the most part—you use the same authors much of the time. I don't quibble about it, for the articles are superlative. I was just wondering.—Frank Sutton, Wilmington, Del.

If you start recognising some of the names, rest assured that it's only because they're good—and prolific.

Reads editorials

I don't know how other people read your magazine, I suppose that they always begin with articles that catch their fancy first, then go on to others. Me? I read editorials. Your last one, about the future being here today, really struck home. I'm now hard at work on that project, and will have a submission for you shortly. I'm anxious to see what others come up with, too.—Martin Friedkin, Kalamazoo, MI.

Thanks Martin, we're anxious to see what you come up with!

More info

I'm relatively new to computing and saw your magazine at a friend's home. I don't actually own a computer myself as yet, and was wondering if you could provide me with some information on what to buy?—Charles Horst, Bloomfield, NJ

Charley, that's a tough one. But you're doing the right thing. Read ComputerDigest and ask around. You can't fill yourself with too much information!

Loaded question

Here's a loaded question for you. My young son is getting deeply involved with computers at school, and I assume that this is good. But how do I keep up with him? He asks questions now that I just can't answer!—Fred Steen, Detroit, MI.

Fred, try an adult education course in computers. You'll catch up, and who knows? Might even develop a brand-new interest for yourself!

COMPUTER PRODUCTS

For more details use the free information card inside the back cover

PROTOTYPING CIRCUIT BOARD, model *4613-3,* allows use of both wire-wrap and solder interconnections to speed interface design for IBM *PC* or *XT* microcomputers. The model *4613-3* has power and ground buses surrounding the component area on both sides of the board. Plated-through holes, on 0.1-inch centers, mount up to 91 16-pin DIP'S.

CIRCLE 21 ON FREE INFORMATION CARD

Form and plug-compatible with IBM cards, the board may be installed in any expansion slot in the IBM *PC* or *XT.* A 31/62-contact card-edge connector with nickel-gold-plated fingers mates with the IBM system bus. The contacts are chamfered at 45 degrees for easy insertion. The board also has a dedicated area, predrilled to mount 9-, 15-, 25-, or 37-pin miniature connectors for external input/output. A connector-mounting bracket, with cutouts for all four connector sizes, relieves strain on the connector pins.

The model *4613-3* is priced at $40.28. It comes with complete instructions, including IBM bus signal conventions.—**Vector Electronic Company,** 12460 Gladstone Avenue, Sylmar, CA 91342.

MICROCOMPUTERS, Morrow Inc.'s model *MD1E* and model *MD3E* are economy-model business/personal computers aimed at users whose primary application needs are for word-processing software.

The model *MD1E* features one double-sided, double density 5.25-inch disk drive and *NewWord* word-processing software. The model *MD3E* features two double-sided, double-

CIRCLE 22 ON FREE INFORMATION CARD

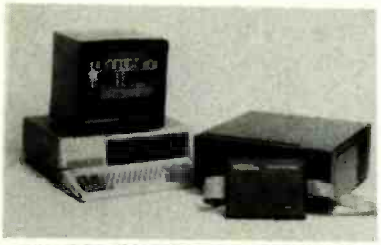
density 5.25-inch disk drives, *NewWord* word-processing software, and the *Correct-It* spelling checker. Both systems come with a full-featured terminal and detachable keyboard.

The model *MD1E* is priced at $999.00; the model *MD3E* costs

www.americanradiohistory.com

$1499.00.—**Morrow, Inc.,** 600 McCormick Street, San Leandro, CA 94577.

EMULATOR PORT, the Kontron PC Interface *KPCI*, turns the IBM *PC/XT* into a universal development system for the design, test, debugging, and im-



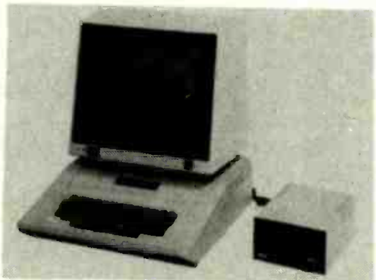
CIRCLE 23 ON FREE INFORMATION CARD

plementation of hardware and software for most microprocessor devices. The *KPCI* package consists of hardware and a set of software tools, including a cross-assembler, linker, emulator software, and additional CP/M utilities. For operation, the *KPCI* requires an IBM PC/XT with monitor and DOS. A Kontron emulator subsystem and Pascal compiler are optional.

The *KPCI* is priced at $1500.00.—**Kontron Electronics,** 630 Price Avenue, Redwood City, CA 94063.

COLOR-DISPLAY MONITOR, model *SC-100*, is a 13-inch CRT monitor with 90° inline, 0.65-mm dot pitch, and an audio speaker with earphone jack. The model *SC-100* is compatible with Apple *II*, Apple *IIe*, Atari *800*, Commodore *64*, VIC*20*, IBM, PCjr., TI*99*, and many others.

The model *SC-100* has a resolution of 280 lines horizontal and 300 lines



CIRCLE 24 ON FREE INFORMATION CARD

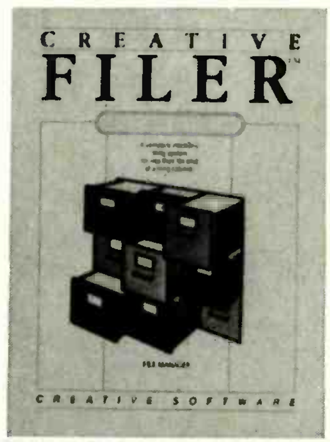
vertical; display format of 1000 characters (5 × 7 dots, 40 × 25), and many other features. It generates 16 different colors. The sound is from a one-watt amplifier coupled to an internal mini speaker.

The model *SC-100* is $329.00.—**Sakata USA Corporation,** 651 Bonnie Lane, Elk Grove Village, IL 60007.

SOFTWARE SERIES, *Creative Writer, Creative Filer,* and *Creative Calc* are designed for use with IBM, Apple, and Commodore *64* home computers.

Creative Writer has all the standard word-processing functions. Documents can be composed, edited, saved, retrieved, and printed. The program is especially slanted for composing memos, letters, and reports that can be detailed by using data obtained from *Creative Filer* and *Creative Calc*.

Creative Filer is an electronic filing system that simplifies data management. Consumers can create computerized index cards on the screen in any format and then add, modify, delete, or browse through alpha-numerically stored data. An added feature allows report formats to be created, to which any stored data can be applied.



CIRCLE 25 ON FREE INFORMATION CARD

Creative Calc is a spreadsheet that simplifies any mathematical process. Numbers are entered and results automatically calculated and displayed on the screen. If a number is changed, *Creative Calc* changes all other related figures to fit the new format. It can be used to summarize and analyze household expenses, plan investments, and play "what-if" with various tax options.

The three programs are priced at $49.95 each.—**Creative Software,** 230 East Caribbean Drive, Sunnyvale, CA 94089.

Don't Miss This Surplus Buy Of The Year!!

TEKTRONICS GRAPHIC TERMINAL 4012

- Fully Operational
- Fast RS-232 Serial I/O
- Bistable Storage Display
- Full ASCII Char. Set
- 1024 x 780 Pt. Display
- Industry Standard

U.S. built, found in sophisticated CAD/CAM Systems & other applications. 96 Char. ASCII Keyboard, Selectable Baud Rate & other control features. Originally sold $6725.

$999.00

FANTASTIC SURPLUS BARGAINS!

SHUGART "MINI-FLOPPY" DRIVES
Check These...
SA-400
SA-400L
SA-850
SA-901
SA-1004

AS LOW AS $49.00

Diablo's Highest Quality O.E.M. Daisy Printers

HYTYPE-I I 1355WP

NOW ONLY $449.00

- Uses Xerox Metal Wheels or Plastic Wheels
- Original OEM Interface (Diablo Interface)
- Requires ± 15V @ 5A & 5VDC @ 5A
- Positional access to 1/120" Horiz." 1/48" Vertical"
- USED BY XEROX, WANG & OTHERS
- Heavy Duty Printwheel Motor and 15" Frame

SAVE $100.00

Spare P.C. Board Set (6 P.C. Cards)	$295.00
Spare Printwheel carrier assembly	229.00
Serial & Parallel Interface for Above	295.00
Power Supply	49.00

Prices do not include packaging and shipping.
Write or Call for Our Latest Flyer NOW!!!

Computer Products & Peripherals Unlimited
WAREHOUSE: 18 Granite St., Haverhill, Mass. 01830
MAIL ORDERS: Box 204, Newton, New Hampshire 03858
617/372-8637
Sorry No Collect Calls
MasterCard & VISA Accepted

CIRCLE 56 ON FREE INFORMATION CARD

www.americanradiohistory.com

GIZMOS

Here's a look at cheap gizmos and expensive gadgets for extra computer power.

HERB FRIEDMAN

■With few exceptions, most of the low-cost personal computers are designed to marry the user to the manufacturer through unusual interfacing, or by providing odd-ball features that can be secured only by using the manufacturer's own peripherals and accessories. While the computer might be jam-packed with programming features such as extended BASIC, graphics, color and sound, getting the end product out of the computer is often difficult if you don't use the manufacturers own peripherals—which are usually overpriced for what you get.

An IBM PC, on the other hand, is possibly the most expensive personal computer system. The basic package consists of the keyboard, 64K of RAM and a cassette I/O—you must add expensive plug-in interfaces and a monitor just to get a visual display. The price of an IBM soars from about $1350 (for the basic package) to well over $3000 if you include disk drives.

But regardless what kind of computer you have, if it's a popular brand such as the Atari, Commodore, Radio Shack or IBM, or almost any IBM-compatible, you can usually do things at much less expense by using the gizmos and gadgets available from what are called *aftermarket* or *third party* vendors. Keep in mind, however, that accessories from aftermarket vendors might not provide all or similar features to those of the manufacturer's own hardware.

Adapters

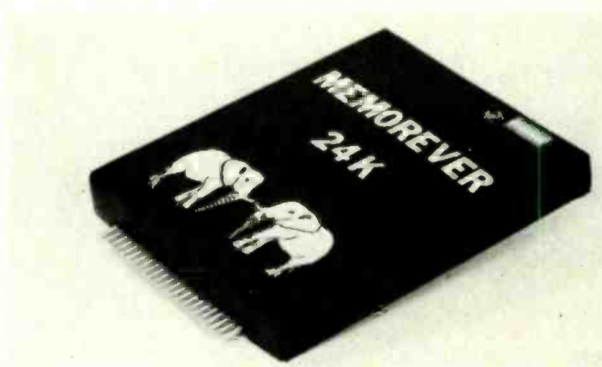
One of the best-known Commodore serial-to-parallel adapters is the *The Connection* (Micro Ware, 1342 Rt. 23, Butler, NJ 07405). It is priced well under $100. Connected between the computer and the printer, it converts the non-RS-232 serial output of the Commodore 64 and VIC-20 computers to standard Centronics parallel, which permits you to print the ASCII character set on any daisy, matrix, or ink-jet printer that has a Centronics-type input. If the special graphics are important to you, check with the manufacturer of the adapter because they often have specific models for emulating the Commodore graphics.

A similar adapter called the *Ape Face*, (Digital Devices Corp., Suite 127, 151 Sixth St., Atlanta, GA 30313) is available for Atari computers. Again, it converts the non-standard Atari printer output to standard Centronics.

It's a different story if you plan on using one of the

THE CONNECTION, FROM MICROWORLD, connects the RS-232 serial output of the Commodore 64 or the VIC-20 to standard Centronics parallel so you can print standard ASCII on any Centronics-input printer.

APE FACE from Digital Devices Corp., converts a non-standard Atari printer output to standard Centronics.



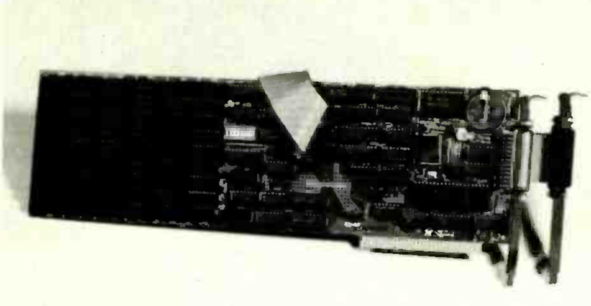
24K MEMORY EXPANSION for the VIC-20 with a built-in lithium battery to keep the memory non-volatile is available from Memotron.

www.americanradiohistory.com

TIGERTRONICS MODEL 770 plugs into the Color Computer's serial input/output and converts serial data to a Centronics-type output.

low-cost parallel printers with a CoCo: They won't work together without some form of accessory RS-232-to-parallel conversion interface. Again, several well-under-$100 RS-232 serial-to-parallel adapters such as the *Tigertronics Model 770* (Tigertronics, Inc., 1501 Pine St., Oxnard, CA 93030) are available. They plug into the CoCo's serial I/O—which is also the printer port—and convert the serial data to a Centronics-type output for parallel printers. None of the Color Computer printing adapters we know of will make the necessary conversions for emulating the Radio Shack printer graphics. If you need Color-Computer graphics you must use the appropriate Radio Shack printer. Connecting a printer to an IBM-compatible computer is normally expensive because a plug-in board with a serial or parallel printer output is required: A printer output port is not part of the basic computer configuration. However, several multi-function plug-in boards are available which include both parallel and serial I/O.

For example, if you're upgrading the memory in an IBM-compatible you might want to consider using a board such as the Tecmar *CAPTAIN* (Tecmar, Inc., 6225 Cochran Rd., Solon, OH 44139-3377), which provides both a memory upgrade and both serial and parallel ports. If you start adding up the cost of the memory expansion and I/O of an aftermarket board you'll probably find the total is several hundred dollars less than if you purchased the individual IBM modules, even though the cost of the multi-function board is somewhere in the range of $225-$350.



THE CAPTAIN from Tecmar provides a memory upgrade and both serial and parallel ports.

Modems

In order to access a database through the dial-up telephone system you need a modem between the computer and the telephone system. Unfortunately, most of the home/family/small-business computers don't have a standard RS-232 I/O, so it's extremely difficult to connect a standard modem. While most manufacturers sell a proprietary modem for their computer, if you want to enjoy the convenience features of the more common high-performance models—such as the auto-dialing and auto-answer of the Hayes Smartmodem—it can't usually be done unless you connect some kind of interface that provides an RS-232 I/O for the computer. It doesn't make any difference whether the interface matches the TTL logic of the user port (where the game cartridges are plugged in) or the special disk-drive serial port as long as the end product is a standard RS-232 I/O that supports all the "bells and whistles" of RS-232 accessories. Just such a device is the *VIC20/C64 RS-232 Interface* (Omnitronix, Box 12309, Seattle, WA 98111), which plugs into a VIC-20 or Commodore 64's TTL user port and provides an RS-232 I/O that supports pins 2 through 8, 20 and 22...all independent of the others.

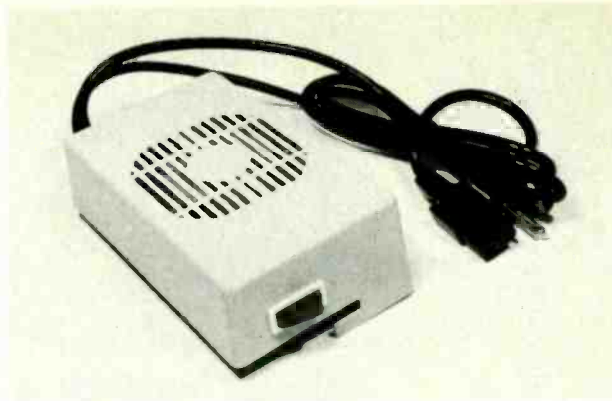
If you're interested in writing your own applications programs on a Color Computer, consider using a *mouse* to control the screen functions. Formerly available only for the most expensive personal computers such as Apple's Lisa and the IBM-compatibles, a *mouse* can now be used with a CoCo by simply plugging it in and loading a control program.

While we normally tend to associate memory upgrades with the expensive IBM-compatible computers, they are also available for the least-expensive computers, in particular, the Commodore VIC-20 and the Commodore 64.

The basic VIC-20 comes with only 5K of RAM, which can't do very much unless you're experienced at

THE VIC20/C64 RS-232 interface from Omnitronix plugs into a TTL user port and provides true RS-232 I/O.

www.americanradiohistory.com



FITTING OUTSIDE the Apple's cabinet, this fan unit from Jameco helps keep things nice and cool.

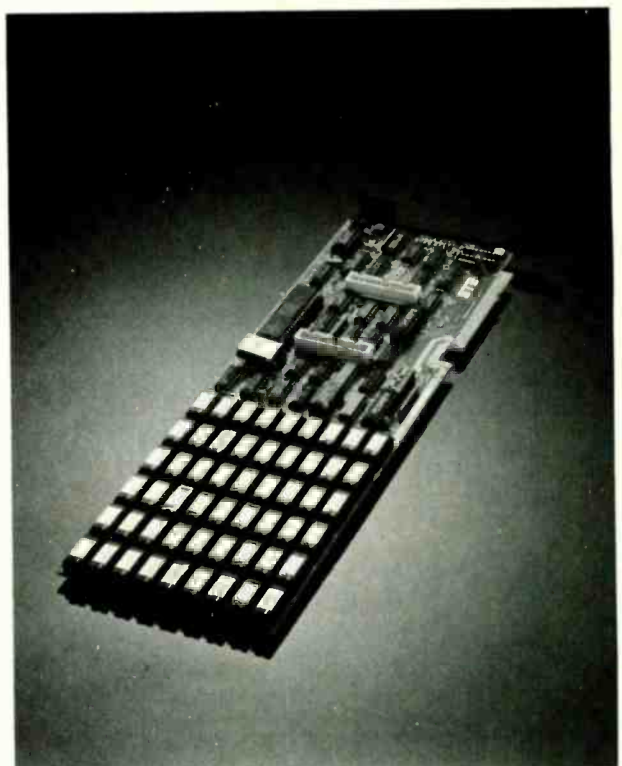
writing very tight code. Commodore's own memory upgrades are expensive; aftermarket memory enhancements are often a better value, or, sometimes, something special. For example, Memotron (Box 714, McPherson, KS 67460) sells a *non-volatile* 24K memory expansion for the VIC-20. A built-in lithium battery keeps your program or data "live" after the computer's power is turned off. If you have already partially upgraded your VIC-20's RAM, say with an additional 8K, you can utilize a RAMAX Jr. (Apropos Technology, 1071 Avenida Acaso, Camarillo, CA 93010) plug-in memory expansion board that brings the total memory up to 32K. One of the best accessories for low-cost computers is often nothing more than a cooling fan, usually mounted on the outside of the cabinet. Almost without exception, even on the hottest of summer days, the openings in a computer's cabinet provide a sufficient air flow to keep the internal ambient temperature within safe limits. But the internal temperature can increase sharply when the computer is upgraded with extra internal memory, printer drivers and other accessories not originally provided in the basic purchase, and the "extra" heat can be no end of problems: intermittent memory failures and disk errors, blown fuses, etc. Accessory cooling fans and blowers are available for just about all computers which lend themselves to user-installed upgrades. For example, there is no end to the number and kinds of cooling fans for the Apple II computers. Most are similar to the unit from Jameco Electronics (1355 Shoreway Rd., Belmont, Ca 94002), which fits on the outside of the Apple's cabinet.

Regardless of what kind of computer you have, if it didn't come with an integral fan, an add-on might prove to be the best investment you can make. If nothing else, on a muggy, soggy day it moves the air around inside the cabinet and keeps moisture from settling out on the components and on the sockets.

Higher prices

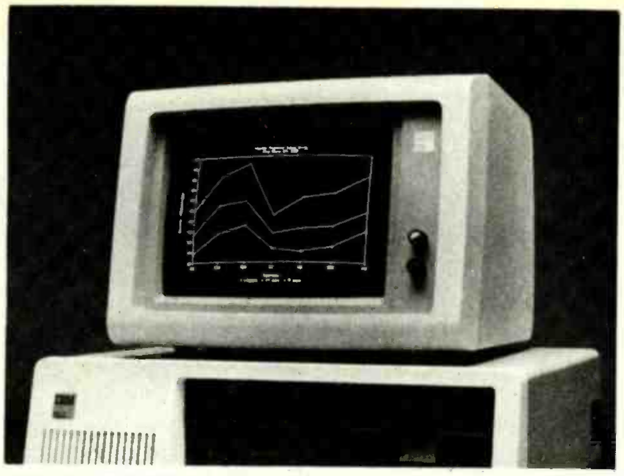
Moving along to the very high-priced gadgets brings us to accessories designed for IBM-compatible computers. Just about any accessory you can think of is made available by aftermarket vendors; and if what you want isn't available today, wait until tomorrow. Leading the list of IBM-compatible accessories are the *memory upgrades*, which are often combined with some other necessary features generally sold as a separate plug-in module. For example, the *RIO PLUS* board (STB Systems, Inc., 601 North Glenville, Suite 125, Richardson, TX 75081) can be loaded with 64K to 348K RAM, has a serial port for a printer or modem, a parallel port, a game port, and a battery operated clock/calendar that remembers the date and time even when the computer is turned off. And if the RIO PLUS doesn't have enough RAM for your needs, you can add a 512K *piggyback* board for a total upgrade of 768K RAM. Or maybe you're into graphics but aren't ready for the

IF YOU UPGRADED your VIC-20's RAM with an additional 8K, add a Ramax Jr. from Apropos Technology, and up it to 32K.



The R10 PLUS from STB SYSTEMS can be loaded with 64K to 348K RAM, boasts a serial port for a printer, a parallel port, a game port, and a battery-operated clock/calendar.

www.americanradiohistory.com

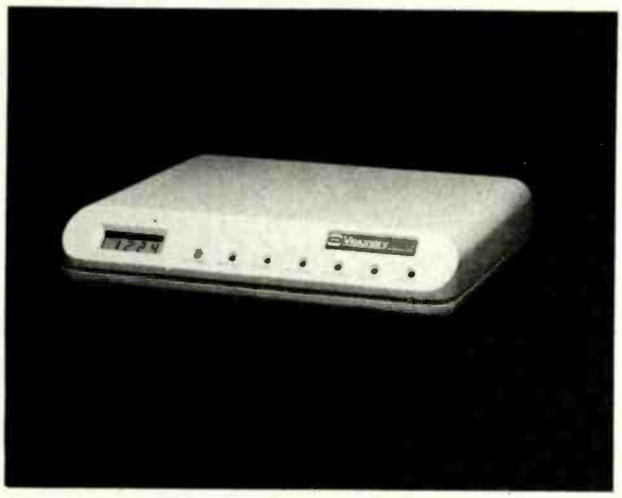


THE HERCULES GRAPHIC CARD from Hercules Computer Technology delivers high-resolution graphics on both monochrome and color monitors.

COMPUTER ACCESS CONTROL from Anchor Pad International uses encoded magnetic cards to restrict access to a computer, display, drive or printer.

extra expense of an RGB color monitor: monochrome would be just fine for your Lotus 1-2-3 graphics. Then look into something called a HERCULES graphic card (Hercules Computer Technology, 2550 Ninth St., Berkely, CA 94710). It delivers high-resolution graphics on both monochrome and color monitors. Many of the RAM upgrade plug-ins can have their memory partitioned to serve as an independent printer spooler, or as a RAMdisk. For those of you unfamiliar with the term, a *RAMdisk* is a block of volatile RAM that emulates a floppy or hard disk, but unlike the mechanically-delayed access of a disk's files, the RAMdisk response is almost instantaneous. As a general rule, the user creates a mirror image of the desired disk data or program in the RAMdisk, which is assigned a drive identifier, such as "M:," "C:," etc. As far as the computer is concerned the RAMdisk is a conventional disk drive that is accessed the same as a mechanical drive, except the response is instantaneous. Most RAM upgrades require a software routine to partition the memory for use as a spooler or RAMdisk.

While we're on the subject of theory, how about a modem such as the *Visionary 1200* (Visionary Electronics, 141 Parker Ave., San Francisco, CA 94118), which has 48K of non-volatile CMOS RAM, its own microprocessor, an internal clock, auto-answer, auto-dial, redial, auto-log on, and data capture. It operates completely independent of the computer. On-board software allows the unit to send and receive messages (data) automatically, even when the host computer is switched off. You can load its memory with data and program the modem to transmit at a specific time, or have the modem turn itself on and receive and store data—which you later load into the computer at your leisure. But whether your computer is a budget special or an IBM-compatible with every imaginable accessory, when you come down to the nitty-gritty, it's the software and data that has the real value.



THIS MODEM FROM VISIONARY ELECTRONICS has 48K of non-volatile RAM, its own microprocessor, an internal clock, auto-answer, auto-dial, redial, lots of other goodies.

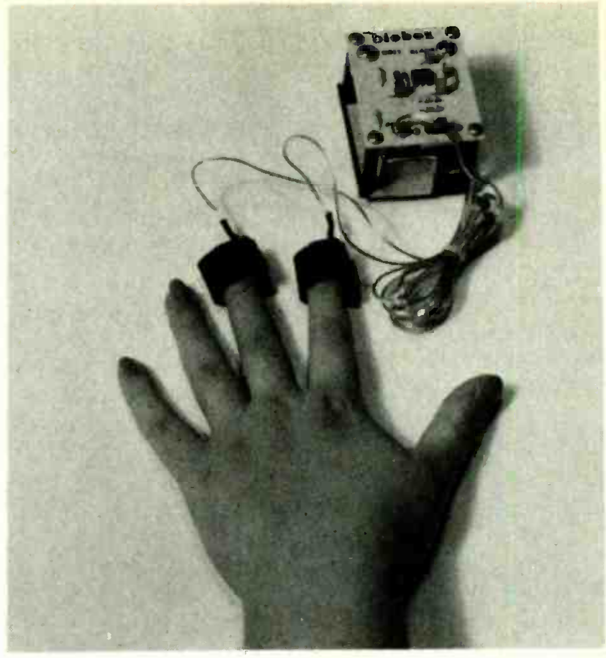
Protecting the computer

One of the ways to protect individual data and/or restrict general access to a computer is with a device called a Computer Access Control ($100-$300 from Anchor Pad International, Inc., 3224 Thatcher Ave., Marina Del Rey, CA 90291.) It uses either a key or a system of encoded magnetic cards (resembling a credit card) to allow only authorized persons access to a computer, display, disk drive, or printer.

The list of gizmos and gadgets for personal computers is almost endless. We have just touched on a few unusual ones. Between the low-cost accessories for the home and family computers and the *budget-busters* for the IBM-compatibles is just about anything you can imagine. The major difficulty is usually finding where to purchase what you need because the computer stores stock just a fraction of the available accessories—and they are primarily for the most popular computers. But dogged determination will usually uncover exactly the accessory or peripheral you're looking for—though in some instances be prepared to mortgage the old homestead. Except for the gizmos intended for home and family computers, upgrading accessories don't come cheap.

www.americanradiohistory.com

BUILD THE BIO-BOX



You can build this biofeedback monitor for your TRS Model I or Model III.

JIM BARBARELLO

■Biofeedback uses an electric device to monitor certain bodily functions and relays how those functions are changing. As you consciously vary your behaviour (thoughts, mood, etc.) you can immediately see how your efforts are affecting your level of tenseness. With practice, you can learn which variations help you to reduce stress. Knowing this, you can practice conscious control of those emotions.

We're not claiming any medical benefits, but it is accepted that biofeedback can help control everyday minor stress. Practice, and it may be able to help you too.

What we're offering here is a hardware biofeedback interface for your Model I or Model III with associated software that allows you to use the interface and document the results of your trials in a tabular format. The interface (called the BioBox) is simple and inexpensive to build. It monitors the changes in galvanic skin resistance (GSR) between two adjacent fingers on one hand. GSR is a measure of your level of excitation or tenseness. The BioBox is battery powered for safety, requires no modification of the Model I and can be used on the Model III as well. (See the section on "Model III differences.")

The hardware

We'll call the GSR R_{BIO} and measure it with two probes connected to the BioBox. Look at the schematic

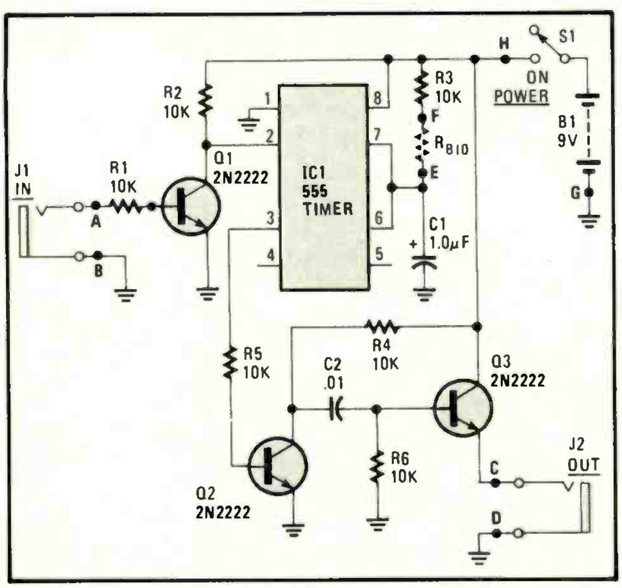


FIG.1—SCHEMATIC DIAGRAM FOR THE BIOBOX shows the relative simplicity of the circuit. The entire unit is built on a printed circuit board.

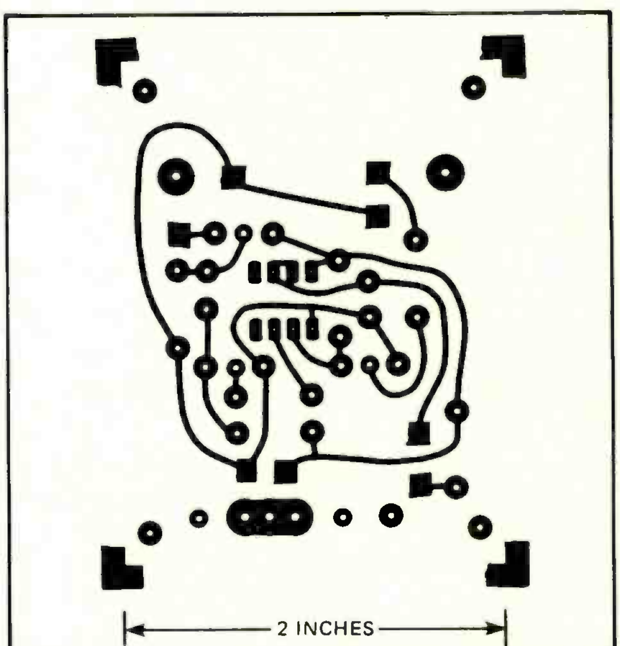


FIG.2—LAYOUT OF THE PRINTED CIRCUIT BOARD is shown full-size for those who want to construct their own.

www.americanradiohistory.com

diagram, Figure 1. The BioBox receives its input from the AUX (large grey) connector on the cassette cable, and provides its output to the cable's EAR (black) connector. Under software control, a short, positive-going pulse is provided to J1. This pulse is inverted by Q1 to trigger IC1 (a 555 timer IC). In the configuration shown, pin 3 of IC1 immediately rises to 9 volts. It stays there for roughly C1 × (R3 + R_{BIO}) seconds (where R3 and R_{BIO} are in megohms, and C1 is in microfarads). After this time, pin 3 returns to zero volt.

At the junction of R4 and Q2's collector, the voltages appear exactly opposite of those at IC1, pin 3. Thus, when the timing cycle starts, C2 sees zero volts. When the timing cycle ends, C2 sees a positive transition to 9 volts. C2 and R6 form a differentiator which converts the positive transition (step) into a positive, short duration pulse. Note that the emitter of Q3 has a 100-ohm resistor connected to it. This resistor is actually in the Model I but forms an electrical part of the BioBox. Q3 acts as an emitter follower, providing sufficient current to the low impedance (100 ohm) load. This positive pulse provided through J2 signals the computer that the timing cycle is complete.

The time between the positive pulse to the BioBox and the positive pulse back to the computer is directly proportional to the values of R3, C1 and R_{BIO}. Since R3 and C1 are constant, any change in duration is a direct result of a change in R_{BIO}. When R_{BIO} decreases, (with increased sweating caused by tension), the duration between pulses is shorter. When R_{BIO} increases (with increased calm), the duration is longer. So the duration is a measure of level of calmness. All we need is a software controller to send out the pulse to the AUX connector and count until it senses a pulse at the EAR connector. The resultant count can then be used in a BASIC program to determine the current level of tension.

Building the BioBox

The BioBox circuit can be constructed on a perfboard, project board or using the printed circuit board of Figure 2. The PCB is recommended, since it produces the best results. Once the PCB has been fabricated, install all components as shown in Figure 3 being sure to observe the orientations of C1, IC1, Q1, Q2 and Q3. Next attach J1, J2, S1 and B1 as shown in Figure 4. The unit may be housed in any suitable case,

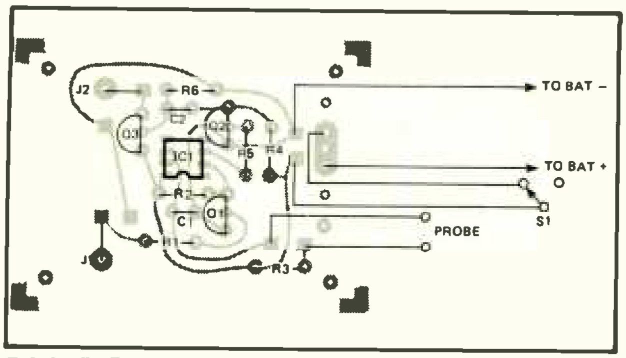


FIG.3—THE COMPONENT SIDE of the printed circuit board is also the panel for the BioBox. Parts placement and locations are shown here.

with the jacks and switch available for use.

The last item to be constructed (and perhaps the most important) is the bioprobe set. It consists of two identical bioprobes which are attached to the index and middle fingers of one hand. Its purpose is to make electrical contact with the skin surface. You will require one package of self-sticking hook-and-loop fasteners, five feet of #24 AWG stranded speaker wire (two-conductor zip cord), two #4-40 × ¼-inch machine screws, two # 4-40 nuts, four #6 washers, a small piece of ordinary aluminum foil and an X-Acto knife. The Velcro comes with two sets of hook-and-loop (*Velcro*) fasteners, each three inches by one inch. To begin, "unzip" about seven inches of the wire and tie a knot at the end of the separation. Now cut a 1-¼-in. × ¾ in. piece of the Velcro loop material. Cut one of the "hook" pieces to 3-in. × ¾in. Using the knife, cut a ⅛-in. square in one of the short ends of each of the pieces just formed (See Figure 5.)

Take a 3-inch × 2-inch piece of aluminum foil and fold it in half, then in half again to form a piece 1-½-in. × 1-inch. Fold each side over ⅛-inch to a final size of ¾-inch × 1-¼-inch. Remove the backing paper from the loop piece of Velcro and place the aluminum foil on the sticky surface so the ⅛-inch folds contact the surface.

On the end of the hook piece where you cut out the square, measure back ½-inch and make a cut in the backing paper only, so that the half-inch piece of backing paper can be removed. Leave the rest of the backing paper intact. Now place the loop piece on the exposed self-stick surface of the hook piece so the ⅛-inch squares align and the aluminum foil is in the middle. (See Figure 6).

Puncture the aluminum foil within the square, but do not remove the aluminum. We only want a hole that will pass a screw Insert a screw through the square so that the screw head rests against the hook piece. Place a single washer over the end of the screw. Strip ¾-inch of insulation from the end of one of the separated wires, and wrap the exposed wire around the screw. Place another washer over the screw so that the

PARTS LIST (All resistors ¼-watt 10%)
R1—R6—10,000 ohms
Capacitors
C1—1µF, 10 volts electrolytic
C2—0.01µF, 10 volts, ceramic disc
Semiconductors
IC1—555 Timer
Q1–Q3—2N2222 or PN2222A NPN Silicon Transistor
Other Components
S1—SPST Slide Switch (Radio Shack 275-406)
B1—9-volt battery
J1, J2–miniature phone jacks
Miscellaneous: 5 feet #24AWG Stranded speaker wire, hook-and-loop fasteners, aluminum foil, two #4-40 × ¼-inch machine screws, #4-40 hex nuts, 4 #6 flat washers, PC-board, cabinet, etc.

www.americanradiohistory.com

insulation comes right up to the washer. Secure this assembly with one nut, but do not rotate the screw while tightening the nut. The foil makes contact with the screw and we do not want to break this contact.

Remove the remaining backing paper from the hook piece. Continually touch the sticky surface so the oils from your hand render it "unsticky." For a faster removal of the stickiness, simply apply a bit of ordinary talcum powder and rub it in.

Repeat these steps to make another bioprobe exactly like the first. Strip ¼-inch of insulation from the free end of the zip cord. Pass this end through an opening in your case and attach either conductor to either of the two remaining holes in the PCB. Snap a nine-volt battery into place at B1, place S1 to the OFF position and reinstall the circuit in your case.

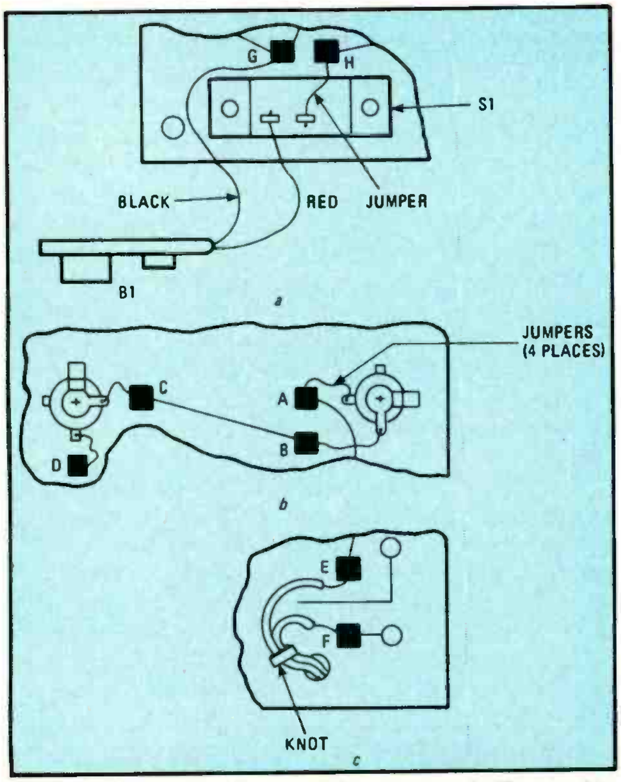


FIG.4—JUMPER REQUIREMENTS are shown in Figures 4A, B, and C. Refer to text for full details and explanations.

The BioBox software

There are two separate elements of software. The first is the machine language subroutine utility. The second is a BASIC program that uses the information provided by the machine language subroutine to perform the biofeedback monitor/human interface.

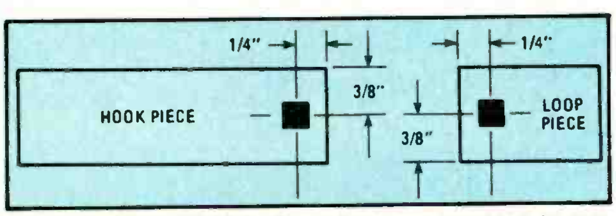


FIG.5—FINGER PROBE dimensions are provided in this drawing. Refer to the text for additional details.

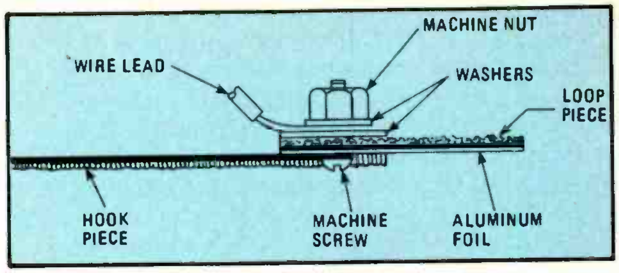


FIG.6.—TO FASTEN, tighten the nut without turning the screw head. Do not tear the foil.

Program Listing shows the machine language subroutine for the Model 1. This subroutine is also contained in DATA values of our BASIC program where, during operation, it will be POKEd into protected memory and called upon via the BASIC USR function. If you're not interested in how it works, you can skip the next section.

Program Listing Table 1 has been ORGed (originated) at 0, since it contains relocatable code and can be placed anywhere in memory. Line 110 disables any interrupt, such as the disk system 25-millisecond real time clock. Lines 120 through 170 send out a positive pulse of sufficient duration to trigger the BioBox.

Next, we initialize our variables. Line 180 sets the DE register pair to 1. This is our counting increment, which will be added to the HL register pair (initialized to zero in line 190). We loop through line 200-240. Each time through, we check to see if a pulse has been sensed from the BioBox. If not, we increment HL and then check to see if it has incremented past FFFFH to 0 (causing a carry). This would occur if the timing cycle took too long, or a fault had occurred. If there has been no carry, we loop back to J1 and continue monitoring.

If a pulse has been sensed, or a carry produced, we proceed to J2 where any interrupts are re-enabled (line 250). Finally, we call the ROM routine at OA9AH to transfer our count to the BASIC program.

Let's review

Chances are that if you're like most people who build projects from magazines such as this, you like to work carefully and slowly, and you should. In this issue, you have been given all of the construction details and some of the rationale behind the BioBox. What you will be getting in the next (January) issue, will be Program Listing II and detailed information on how best to use the BioBox.

Working slowly and carefully, you should be well-able to compelte the construction by the time you receive the next issue of this magazine. However, we suggest that you assemble the parts, put the unit together, and look it over carefully for such things as solder bridges, excess rosin, and other problem-causing trivia. Stranded wires, such as those that connect the probes to the circuit board, have a way of escaping, and an almost-invisible strand can cause trouble later on.

An interesting point

You might find it interesting to note that since the BioBox operates on galvanic change in skin resistance, it

www.americanradiohistory.com

also makes an excellent lie detector, which can be a lot of fun at parties. While we certainly do not recommend its use as a professional polygraph, the principles are identical and if you establish a line of questions that are designed to elicit humorous information, the BioBox can indeed be an amusing diversion for your guests.

Toward that end, we recommend that you do not simply "breadboard" the unit, but assemble it as carefully and as professionally as you can. Making it look more professional will enable it to command more respect and more credibility.

Other applications

As you work with the unit, other applications are bound to occur to you, and are worth consideration. As an example, since the probes measure skin resistance, it is conceivable that a pair of metal prods could be attached to these, the prods implanted in the potting soil of a plant, and you should be able to thereby indicate when the plant needed additional water.

The important value of the BioBox is that it enables you not only to record, but to store the results of any input information, for recall at any time in the future.

It's a computer accessory that is truly limited only by your own imagination, and one that you will put to excellent use many, many times.

Model III differences

In Program Listing 1, line 140 checks the cassette "ear" input and looks for the number 255. On the Model III, the number we are looking for is 233. So, in line 80 of the Basic program (Program Listing 2, which we'll show you next month), change the second "255" to "233" (i.e.- 80 DATA 0, 0, 219, 255, 254, 233...). This, of course will decrease the checksum, so modify line 50 by changing the number "3647" to "3625."(i.e IF K<>3625 THEN...). Finally, the Model III will display a right bracket instead of an up arrow. So change the declaration of T$ in line 140 to T$=CHR$(94)+"TENSE." With these changes made, the BioBox is compatible with the Model III.

Well, it looks as though we've run out of space for this issue, but don't be concerned. In our next issue (January, 1985) we'll finish the article with the necessary program listings and software plus more information on how to use the unit.

That's going to give you a full month to work on your BioBox, assemble all of the parts and put it all together: We'll be talking about it some more.

PROGRAM LISTING 1

```
             00010        ;BIOBOX MACHINE
                          LANGUAGE DRIVER
             00020        ;(REQUIRES BIOBOX
                          HARDWARE).
             00030        ;VERSION 1.0 - 19 FEB 1983
BF04         00040     ORG  48900   ;FOR 32K
BF04 F3      00050     DI           ;DISABLE 25 MS
                                    INTERRUPT
BF05 3E01    00060     LD   A, 1    ;"AUX" OUT TO
BF07 D3FF    00070     OUT  (255),A ; 0.8 V D.C.
BF09 0640    00080     LD   B,64    ;KEEP IT THERE
BF0B 10FE    00090 JMP DJNZ JMP     ;FOR AWHILE.
BF0D 3E00    00100     LD   A,0     ;RETURN "AUX"
                                    OUT
BF0F D3FF    00110     OUT  (255),A ;TO 0.4 V D.C.
BF11 110100  00120     LD   DE,1    ;INCREMENTOR
BF14 210000  0130      LD   HL,0    ;COUNT
                                    STORER
BF17 DBFF    00140 J1  IN   A, (255);CHECK "EAR"
                                    IN.
BF19 FEFF    00150     CP   255     ;TRIGGER
                                    SENSED?
BF1B 2803    00160     JR   Z, J2   ;IF SO, DONE.
BF1D 19      00170     ADD  HL,DE   ;OTHERWISE,
                                    HL=HL+1
BF1E 30F7    00180     JR   NC,J1   ;COUNT<65536
BF20 FB      00190 J2  EI           ;RE-ENABLE
                                    INTERRUPTS
BF21 C39A0A  00200     JP   0A9AH   ;RETURN HL TO
                                    USR VAR.
0000         00210     END
00000 TOTAL ERRORS
J1      BF17 00140   00180
J2      BF20 00190   00160
JMP     BF0B 00090   00090
```

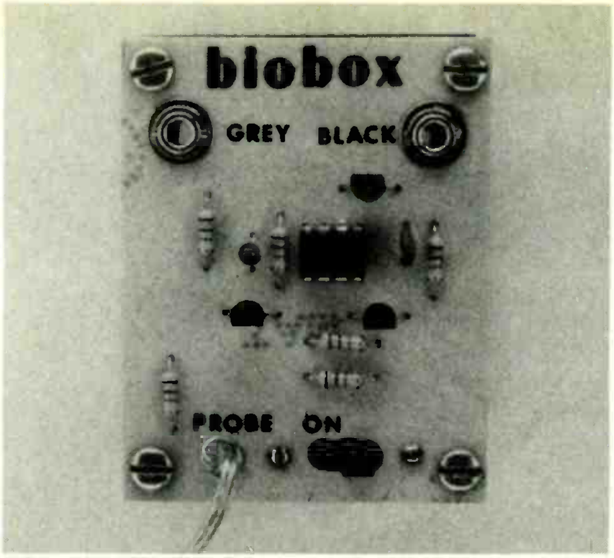
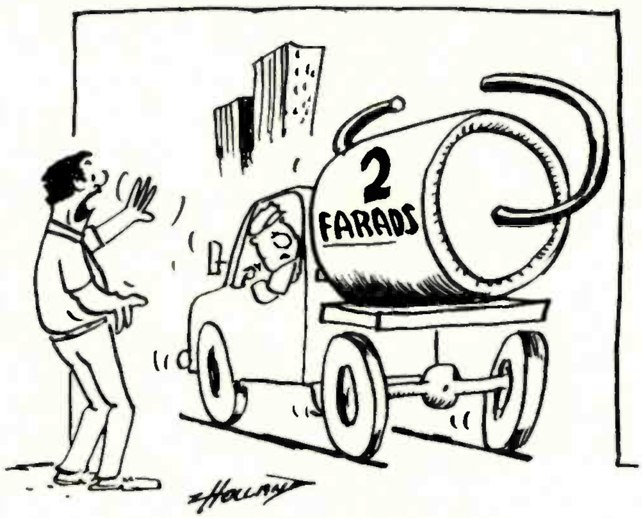


FIG. 7—LOOKING HEAD-ON at the completed BIOBOX, you get a clear idea of where the parts are located, and what the finished project should look like.



"Hold it! I said two MICRO *farads!"*

www.americanradiohistory.com

PATCHING WORDSTAR

***You can use the INSTALL program to modify or "patch" Wordstar* for use with your Epson MX-80 printer.**

KIRK VISTAIN

■I bought the Epson *MX-80* printer because it offered such features as superscripts, subscripts, italic and double-width, features that I really wanted. But these were not even listed as options in the WordStar program. Despite all my efforts, the printer kept ignoring my requests for these.

Now, after a few keystrokes and some concentrated effort, I'm getting what I paid for, and all it took was a little "patching."

An applications program, such as *WordStar*, is made up of many lines of numbers and mnemonics (English-like names for variables, such as DEL1 for Delay 1), called code. When we use a special program to change some of this code, we are said to be "patching."

Fortunately, *WordStar* comes with an INSTALL program. This allows us to easily customize a system. Unfortunately, trying to figure out how to do this from reading the "documentation" is frustrating unless you have a degree in computer science.

Desired modifications

I basically wanted to access five special Epson MX-80 functions from within *WordStar*. According to the printer manual I could enable them with the following ASCII (American Standard Code for Information Interchange) characters (See Table 1).

To make things more interesting, we'll find that the ASCII codes used to control the printer must be converted to their hexadecimal (base 16) values before being entered into the patch areas. Don't let this intimidate you. I'll list both ASCII and hex values for all the functions.

Of course, any text fed to the printer is also in ASCII. So how does it know when to interpret the code as text, and when as a command? Well, some ASCII characters are specifically reserved for control. But there aren't enough of those to cover all Epson options.

TABLE 1

FUNCTION	ON	OFF
1. Compressed type	S1	DC2
2. Double Width type	ESC W 1	ESC W 0
3. Italics	ESC 4	ESC 5
4. Superscript	ESC 2 0	ESC H
5. Subscript	ESC S 1	ESC H

So we have to use the escape (ESC) code. Its hexadecimal value is 1B. By prefixing this number at the head of an ASCII command string, we tell the printer to interpret the next character as a command. How does the Epson know when to exit the command mode? We include this information as the first number in the patch. Let's begin.

Making the changes

To begin with, we'll assume that you have a properly installed *WordStar* program for your machine. Make a copy of it using the facilities of your operating system. Never make changes to the distribution disk! You should be running an installed copy, and the original should be filed away. We are now going to alter one of those copies.

Load the *WordStar* INSTALL program. It will ask you whether you want a normal, first-time installation. You answer "NO" and are given four choices. B or C will be the correct answer. You will then be prompted to give the file name of the pre-installed *WordStar* to be modified. This is usually WS.COM. You will then be asked to name the new version.

Something like WSA.COM would do nicely.

You will then see several menus in succession and be asked to designate your terminal type, etc. Since you are modifying an otherwise working program, you should answer "U" which indicates "no change." Continue until you reach the query "Are modifications to *WordStar* now complete?" Answer "No."

This enables the patcher routine. Individual patch locations are identified by a mnemonic followed by a colon. For example, PALT: is the entry point for the alternate type patch. If you don't use a colon, you'll get an error message.

An actual patch consists of a string of numbers. The first one usually designates how many others are to follow. The rest are ASCII or other special codes. Remember that all the numbers are entered in hexadecimal, or base 16 format. Decimal numbers will not be recognized by *WordStar*. See Table 2.

TABLE 2
DOUBLE WIDTH TYPE

MNEMONIC	HEX VALUE	ASCII
RIBBON:	03	
RIBBON:+1	1B	ESC
RIBBON:+2	57	W
RIBBON:+3	01	
RIBOFF:	03	
RIBOFF:+1	1B	ESC
RIBOFF:+2	57	W
RIBOFF:+3	00	

We used the ribbon-change area for double-width type. We won't be needing that function on a dot-matrix printer. The Epson manual, Appendix B, incorrectly lists 61H as the code; 57H is the correct one.

Use of double-width type requires you to adjust line lengths to account for half as many characters horizontally. Also, the double-width command is a toggle, which means that the first invocation turns it on,

www.americanradiohistory.com

TABLE 3 ITALIC TYPE		
MNEMONIC	HEX	ASCII
USR1:	02	
USR1:+1	1B	ESC
USR1:+2	34	4
ROLUP:	02	
ROLUP:+1	1B	ESC
ROLUP:+2	35	5
ROLDOW:	02	
ROLDOW:+1	1B	ESC
ROLDOW:+2	35	5

the second off. This is unlike some other features which require different commands for on and off. (Table 3.)

Now a ^PQ will turn on italics and either a ^PT or ^PV will turn it off. Although you might have thought we would use the ROLUP and ROLDOW patches for scripting, since they correspond to *WordStar* commands for these functions, it doesn't work.

Subscripts and superscripts

Scripting on the Epson is done with a special type font. This font is enabled with an "ESC S n" string where "n" determines whether a "sub" or "super" is printed. If "n" is "0" printing occurs at the top of the line. If non-zero, printing occurs at the bottom. An "ESC H" turns either off. See Table 4.

TABLE 4		
MNEMONIC	HEX	ASCII
USR2:	03	
USR2:+1	1B	ESC
USR2:+2	53	S
USR2:+3	01	
USR3:	03	
USR3:+1	1B	ESC
USR3:+2	53	S
USR3:+3	00	
USR4:	02	
USR4:+1	1B	ESC
USR4:+2	48	H

Compressed type

Our next change will be to the alternate type patch area, called PALT:, where we'll install the compressed type option. On the Epson MX-80, an ASCII SI (Shift In) enables compression and DC2 (Device Control 2) shuts it off. The patch in Table 5 will accomplish this.

TABLE 5		
MNEMONIC	HEX	ASCII
PALT:	01	
PALT:+1	0F	SI
PSTD:	01	
PSTD:+1	12	DC2

Also, this is the only patch for which we don't use the escape code. When the MX-80 gets the Shift In (SI) command, it starts to print in italics. The Device Control 2 (DC2) code shuts italics off.

I forgot to initialize the printer before each test run. Functions set in one test would remain in the printer's memory and interfere with the next printing run in unpredictable ways. I needed to turn the printer off and back on again, which would have reset all functions.

Fortunately, there is a way to do this automatically. We patch the printer initialization area, which sends out a code to reset all special functions and TOF (Top Of Form), at the beginning of any printing run. It also sets the printhead to the left margin of the paper. It's just as if you'd turned the printer power off and then on again, but it's done in the software. Refer to Table 6.

TABLE 6		
MNEMONIC	HEX	ASCII
PSINIT:	05	
PSINIT:+1	1B	ESC
PSINIT:+2	40	
PSINIT:+3	1B	ESC
PSINIT:+4	4F	O
PSINIT:+5	0D	CR

New *WordStar* printer commands

Now that we've modified WordStar, we need to use the following codes, some of which are different from those for which *WordStar* is initially set. All of the commands in Table 7 are accessed from the *WordStar* printing menu, so must be preceeded by ^P.

TABLE 7	
COMPRESSED TYPE	A
STANDARD TYPE	N
DOUBLE-WIDTH TOGGLE	Y
ITALIC ON	Q
ITALIC OFF	T or V
SUPERSCRIPT ON	E
SUBSCRIPT ON	W
SUB/SUP/DOUBLE OFF	R

THIS IS DOUBLE WIDTH TYPE.
THIS IS ITALIC TYPE. THIS IS COMPRESSED TYPE.
THIS IS A SUPERSCRIPT THIS IS A SUBSCRIPT.

FIG.1—WHEN YOU COMPLETE the patching job, you'll find that your Epson MX-80 printer and the *WordStar* program can provide even more printing versatility.

See Figure 1 for samples of the results.

These modifications to WordStar ought to help you get the most from its partnership with the versatile Epson MX-80 printer. There are even more patches which can help you customize *WordStar* to match your own needs. But that's another story.

www.americanradiohistory.com

positive (called *electron flow*), and current flowed from positive to negative (known as *conventional current flow*). The electricians were happy because we stopped giving them a hard time. We were also happy because they made similar accommodations.

These days, most textbooks covering the subject usually refer to the direction of current flow as going from positive to negative, and that's convention most widely accepted in electronics. However, my own point of view is that it doesn't matter which current convention you use. If it works for you, why worry about it? But when you talk to other people, try to stick to conventions. *Current* flows from positive to negative (even though *electrons* flow from negative to positive).

Tracking the sun

Last year, (June, 1983) "Hobby Corner" carried some suggestions for a control circuit for tracking the sun with a solar collector. Now one of our readers has volunteered to communicate directly with others interested in that subject about his own system. If you would like information on the system, write: Jim Huskey, Box 26 Gate Circle, Lexington, NC 27292. Thanks, Jim, for the offer.

Radio

One of the more popular fields in your inquiries is radio—CB, ham, etc. Tim Martin (NY) and George Boone (VA) sent in the most recent letters about radio. Perhaps my answer to them will help others of you who are radio hobbyists.

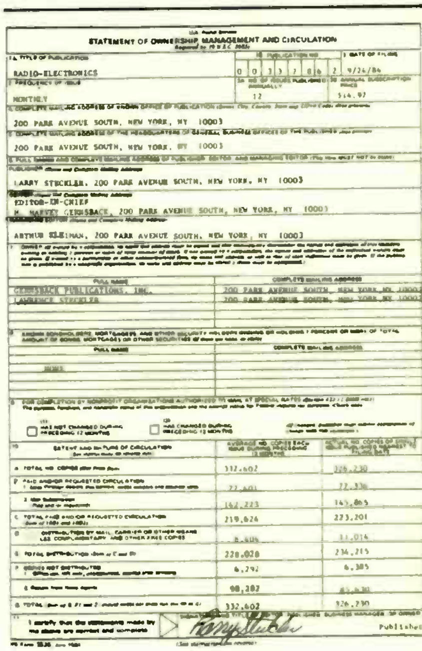
Tim is having difficulty adjusting his antenna with an SWR/watt meter. The process does seem straightforward but it can get tricky, especially on a mobile installation. A grid-dip meter can do the job, but using that instrument can be even trickier. My own preference is a simple field-strength meter: You can hardly go wrong with that little beauty.

George, on the other hand, is looking for schematics and instructions on constructing simple CW (Morse code) transmitters and receivers for use on the ham bands. He would also like to know where to purchase used equipment. One source of used equipment is any "hamfest;" you'll find plenty of stuff there, but be sure it functions to your satisfaction before parting with your hard-earned money!

I don't want to sound like a broken record but Tim and George should check the publications of the ARRL (American Radio Relay League, Newington, CT 06111). That is the best single source I know for information useful to radio hobbyists. Their books range from the general to the specific, and from the highly technical down to good solid information for the electronics beginner.

Your local library should have some of the ARRL publications. If they don't, or their selection is too limited, be advised that you don't have to be a member of the ARRL to ask them to send you a list. (Donald Mitchell and Victor Ducot, have you guys been paying attention there in California and Puerto Rico?)

By the way, that local library (or the larger one in a nearby city) is an excellent place to go when you are looking for construction information on some specific device. Until you can build up your own library of back issues of magazines, look through theirs. You may be surprised at what you'll find. Oh yes, check out past issues of **Radio-Electronics** first! **R-E**


STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

Title of publication	Publication no.	Date of filing
RADIO-ELECTRONICS	0 0 3 3 7 8 6 2	9/26/84

Frequency of issue	No. of issues published annually	Annual subscription price
MONTHLY	12	$14.97

200 PARK AVENUE SOUTH, NEW YORK, NY 10003

200 PARK AVENUE SOUTH, NEW YORK, NY 10003

LARRY STECKLER, 200 PARK AVENUE SOUTH, NEW YORK, NY 10003

EDITOR-IN-CHIEF
M. HARVEY GERNSBACK, 200 PARK AVENUE SOUTH, NEW YORK, NY 10003

ARTHUR KLEIMAN, 200 PARK AVENUE SOUTH, NEW YORK, NY 10003

Full name	Complete mailing address
GERNSBACK PUBLICATIONS, INC.	200 PARK AVENUE SOUTH, NEW YORK NY 10003
LAWRENCE STECKLER	200 PARK AVENUE SOUTH, NEW YORK NY 10003

Full name	Complete mailing address
NONE	

Extent and nature of circulation	Average no. copies each issue during preceding 12 months	Actual no. copies of single issue published nearest to filing date
A. Total no. copies	332,602	326,230
B. Paid and/or requested circulation 1.	77,401	77,336
2. Mail subscription	142,223	145,865
C. Total paid and/or requested circulation	219,624	223,201
D. Distribution by mail, carrier or other means, samples, complimentary, and other free copies	8,404	11,014
E. Total distribution	228,028	234,215
F. Copies not distributed 1.	6,292	6,385
2.	98,282	85,630
G. Total	332,602	326,230

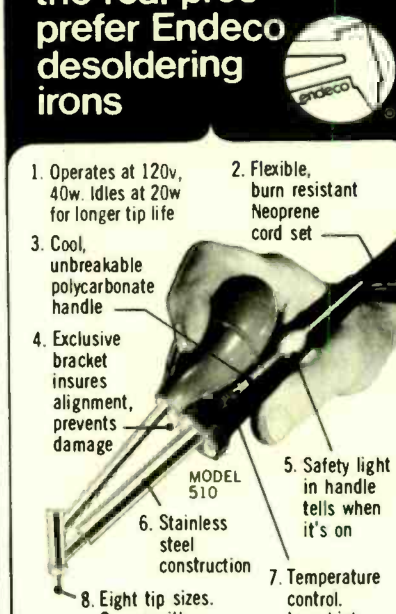
I certify that the statements made by me above are correct and complete — Publisher

Be an FCC LICENSED ELECTRONIC TECHNICIAN!

No costly School. No commuting to class. The Original Home-Study course that prepares you for the FCC Radiotelephone license exam in your spare time! An FCC Government license is your "ticket" to thousands of exciting jobs in Communications, Radio & TV, Mobile two-way, Microwave, Computers, Radar, Aerospace and more. You don't need a college degree to qualify, but you do need an FCC License. **No need to quit your job or go to school!** You learn how to pass the FCC License exam at home at your own pace with this easy-to-understand, proven course. It's easy, fast and low cost! GUARANTEED PASS — You get your FCC License or money refunded. Write for free details. Soon you could be on your way to being one of the highest workers in the electronics field. **Send for FREE facts now. MAIL COUPON TODAY!**

COMMAND PRODUCTIONS
FCC LICENSE TRAINING, Dept. 90
P.O. Box 2223, San Francisco, CA 94126
Rush FREE facts on how I can get my FCC License in spare time. No obligation. No salesman will call.
NAME
ADDRESS
CITY STATE ZIP

9 reasons why the real pros prefer Endeco desoldering irons



See your distributor or write . . .

Enterprise Development Corp.
5127 E. 65th St • Indianapolis IN 46220
PHONE (317) 251-1231

www.americanradiohistory.com

DESIGNER'S NOTEBOOK

A simple solution to switch debouncing

ROBERT GROSSBLATT

SOME OF THE BIGGEST HEADACHES that show up in circuit design have absolutely nothing to do with electronics. That is, after you've spent all kinds of energy in taming electrons, the time comes when you have to connect the circuit to the outside world, and that's when the real trouble begins! Mechanical switching of electronic circuits is always an "iffy" business; and any designer who doesn't know that couldn't possibly recognize the symptoms, much less, solve the problem.

The most common causes of circuit "insanity" is what the data books refer to as *input-signal conditioning* or what the rest of the world calls debouncing. No mechanical switch is perfect, no matter how well it's made. As a result, pushing down on that little red button is going to generate more than one pulse. Any circuitry that's being triggered by that pulse is going to do exactly what it was designed to do—respond to each pulse it "sees."

There are all sorts of schemes to handle the problem. For one, you can use more expensive non-mechanical switches, or simply redesign the front-end of your circuit to respond to only one pulse. But the easiest way is to debounce the switch. There are dedicated IC's that can be used for that purpose but, as with most other things, there's an easier way.

Debouncing circuits

The basic idea behind all switch debouncers is to put some type of isolating circuit between the switch and the circuit being triggered. The job of the extra circuit is to output one (and only one) pulse no matter how many bounces it "sees" from the switch. You can use anything from a flip-flop to a 555 timer (set up as a one-shot), but the problem can be handled a lot easier with inverters.

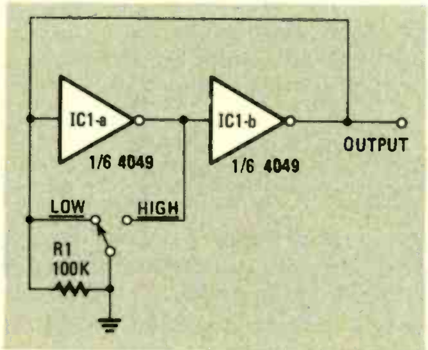


FIG. 1

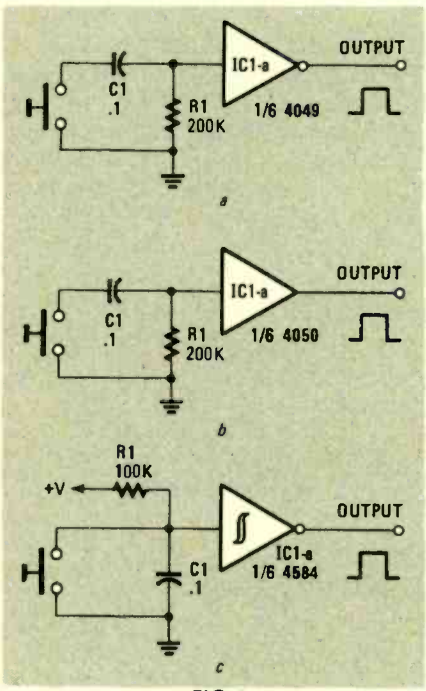


FIG. 2

The most straightforward approach is to build a simple latch like the one in Fig. 1. Throwing switch S1 one way or the other will change the state of the output. Since there's always some period of time during which no connection is made, resistor R1 is added to keep the circuit from glitching when the switch is thrown. That circuit is ideal for applications where you want to switch from one state to another. Even the noisiest single-pole, double-throw switch can be used because the resistor acts as a temporary storage device while the switch is being thrown.

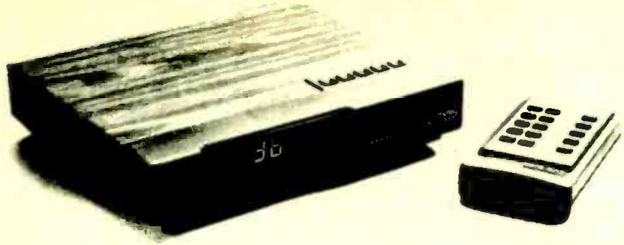
The real problem appears when you want to use momentary (push-button) switches. That's because those switches are notoriously noisy, and if you don't take several precautions, they can screw up the operation of any circuit—no matter how well it's designed. Fortunately, there are two simple circuits that can take care of the problem.

The circuits in Fig. 2 are *half monostables* or edge detectors made from a single gate. The only difference between Figs. 2-a and 2-b are the gates: One is inverting and the other non-inverting. (We'll get to Fig. 2-c in a moment.)

As you can see, the way the circuit responds depends on which end of the supply rail is tied to the resistor. The capacitor integrates the incoming switch bounces and causes the gate to change states. The capacitor then starts to discharge through resistor R1, and the gate (IC1) doesn't change back until its threshold voltage has been reached.

If you're still in the design stage of your circuit, you can add an ex-

www.americanradiohistory.com



CABLE-TV PRICE SLASH!

ITEM	OUTPUT CHANNEL (Circle the one used on your system)		REG.	NOW	QTY.	PRICE
JERROLD 400 CONVERTER (58 CH.)	CH. 2	CH. 3	109.00	**90.00**	......	....
(10 or more)	CH. 2	CH. 3	82.00	**75.00**	......	....
JERROLD 450 CONVERTER (66 CH.)	CH. 2	CH. 3	134.00	**105.00**	......	....
(10 or more)	CH. 2	CH. 3	110.00	**90.00**	......	....
EAGLE COMTRONICS 400 MHz CONVERTER	CH. 2	CH. 3	109.00	**90.00**	......	....
(10 or more)	CH. 2	CH. 3	82.00	**75.00**	......	....
SB ADD-ON UNIT	CH. 2	CH. 3	129.00	**99.00**	......	....
(10 or more)	CH. 2	CH. 3	79.00	**58.00**	......	....
BRAND NEW SB TRIMODE COMPLETE UNIT	CH. 2	CH. 3	Please call for price quotes and details.		......	....
SB TRIMODE CONVERSION KIT	CH. 2	CH. 3			......	....
MINICODE (N-12)	CH. 2	CH. 3	109.00	**89.00**	......	....
(10 or more)	CH. 2	CH. 3	79.00	**56.00**	......	....
MINICODE (N-12) VARISYNC	CH. 2	CH. 3	119.00	**99.00**	......	....
(10 or more)	CH. 2	CH. 3	86.00	**62.00**	......	....
C-1000 ADD-ON (COMPATIBLE—ALL ZENITH SYSTEMS)	CH. 2	CH. 3	260.00	**225.00**	......	....
(5 or more)	CH. 2	CH. 3	220.00	**185.00**	......	....
MLD-1200-3	CH. 3 ONLY		129.00	**99.00**	......	....
(10 or more)	CH. 3 ONLY		85.00	**58.00**	......	....

IMPORTANT: **WHEN CALLING FOR INFORMATION —**
Please have ready the make and model # of the equipment used in your area.
Thank You

Name ______________________ **Sub-Total** ....
Street ______________________ **Shipping** ....
City/State/Zip ______________________ **TOTAL** ....
Phone Number Area Code ________ Number ____________

Sale of Descramblers may be prohibited in some states. If in doubt, check with local authorities. No Ohio orders accepted.

MUST BE SIGNED AND RETURNED WITH YOUR ORDER

I understand that the purchase of these cable T.V. products does not authorize their use on any cable T.V. system. I agree to obtain the proper authorization from local officials or cable company officials in my area.

Signed ______________________

Add $2.00 per unit shipping or call for specifics. Payment is accepted by money order or Cashier's check only. COD's & credit cards are *not* accepted as our low prices prohibit their use.

Transamerican Cable Distributors

449 BROADWAY AVE. • BEDFORD, OHIO 44146 • (818) 956-5839

Please—No Collect Calls

www.americanradiohistory.com

tra IC to the board and get six (pushbutton) switch debouncers or three double-pole, double-throw debouncers. Doing the same thing with circuitry that's already in the circuit-board stage is a bit more difficult; you'll have to make a small "outrigger" board for the inverters. Remember that almost any inverting logic will do the job, so hunt around your design to see if you have any unused gates.

The values for the passive components depend on the type of switches you're using. In general, you should make sure that the output pulse is much longer than the switch bouncing. A good rule of thumb is to aim for at least a ten-to-one ratio. An output pulse width of 10 milliseconds should handle most bounce problems quite nicely. The values given in Figs. 2-a and 2-b should work for most applications. Just remember that the inverting gate will change the polarity of the input pulse, and the non-inverting one will preserve the polarity.

Although you can use any high-gain inverter to make a half monostable, the best all around choice is the Schmitt trigger. Not only do they have enough "zip" to respond properly, but its built-in hysteresis means you can get longer output pulses.

Half monostables use the capacitor as an integrator, but you can also use it as a "sponge" to absorb extra pulses from the switch, as shown in Fig. 2-c. When the switch is open, the input to the gate is held high, forcing the output of the IC low. If there's bouncing when the switch is closed, the R-C time constant keeps the glitching from affecting the output state of the gate. Just as we saw earlier, though, make sure that the time constant is going to be at least ten times the bounce time.

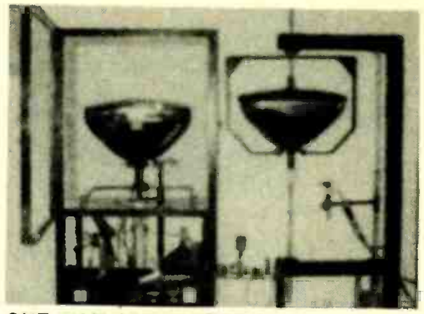
A lot of bench time has been wasted because pulses from a "bouncing" switch were masquerading as some other, more serious problem.

One more thing: It's been a couple of months since I started the one-gate design contest in August, and so far the number of entries has been disappointing. So, let's get with it you guys! **R-E**

Radio-Electronics mini-ADS

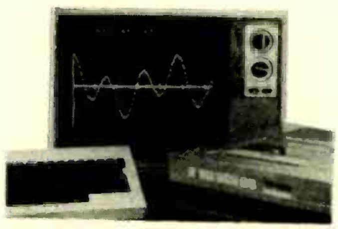
TUNE "THE HIDDEN SIGNALS" ON SATELLITE TV—"Secret signals on the birds". A new technical book covering the reception of: stereo subcarriers - telephone channels, - world news service, -teleprinter news, - radio channels, - stock market services - teletext - single channel per carrier - plus many other satellite hidden signals. The equipment, how it can be used, etc. Fully illustrated, just published. **$14.95** plus $1.75 S & H. **Universal Electronics, Inc., 4555 Groves Road - Suite 3-C, Columbus, Ohio 43232.**

CIRCLE 276 ON FREE INFORMATION CARD



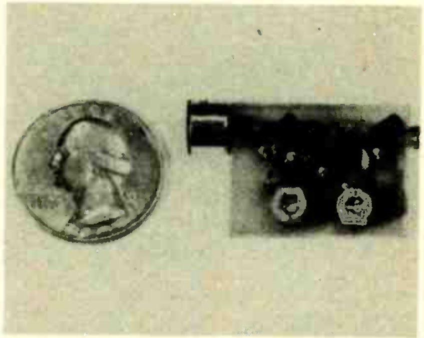
ONE MAN CRT FACTORY, easy operation. Rebuild CRT's for tv's, bus. machines, monitors, scopes, etc. Color, b&w, 20mm, foreign or domestic. 3×6 ft. space required. Profits??? Average CRT rebuilding costs—$5. Sell for $100 = $95 profit; × 5 CRT's = $475 daily; × 5 days = $2375 weekly profit. Higher profits overseas. Investigate this opportunity today. We service the entire world Contact: **CRT Factory, 1909 Louise St., Crystal Lake, Il. 60014, (815) 459-0666.**

CIRCLE 80 ON FREE INFORMATION CARD



Convert Your T.V. to a High Quality Monitor/Receiver... The TRVM kit permits Dual Mode operation on transformer isolated B&W or Color Sets • Features High Resolution Direct Video • Up to 80 characters per line • Wide Bandwith • Easy installation • Low cost...**$34.95**...DVM-1 kit with Audio available for "Hot Chasis" sets...**$64.95.** Both kits usable with computers, VCR's and Video Cameras **VAMP Inc, Box 411 Los Angeles, California 90028 (213) 466-5533**

CIRCLE 252 ON FREE INFORMATION CARD



THE MOST EXCITING KIT YOU WILL EVER BUILD The model WAT-50 miniature FM transmitter uses a 4-stage circuit NOT to be confused with a simple wireless microphone. Up to 1 mile range. So sensitive, it will pick-up a whisper 50 feet away! Use with any FM radio. Complete kit only **$29.95** tax incl. FREE SHIPPING. **DECO INDUSTRIES, BOX 607, BEDFORD HILLS, NY 10507.**

CIRCLE 263 ON FREE INFORMATION CARD

FREE 1984 ELECTRONIC TOOL & INSTRUMENT CATALOG is packed with over 5,000 quality technical products for assembling, testing and repairing electronic equipment. All products fully illustrated with photographs, detailed descriptions and pricing to allow for easy ordering by phone or mail. Most orders are shipped within 24 hours. 100% satisfaction guarantee. **CONTACT EAST, 7 Cypress Drive, Burlington, MA 01803. (617)272-5051.**

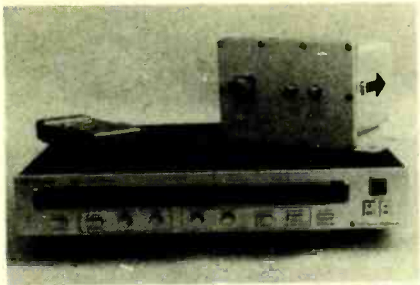
CIRCLE 55 ON FREE INFORMATION CARD

NEW 24" or 30" SHEET METAL FORMER—New 3-in-1 **SHEAR-BRAKE-ROLL** machine w/6" male & removable female dies now in 24" bench or 30" floor models. A complete in-house R & D shop at ⅓ the cost. Over 1200 worldwide, large and small government/educational/industrial users. Call for literature and prices today! **PACIFIC ONE CORP., Ste K417, 513 Superior, Newport Beach, CA 92663. (714) 645-5962 TELEX 4996168, ans bk "4996168 POC NPT".**

CIRCLE 118 ON FREE INFORMATION CARD

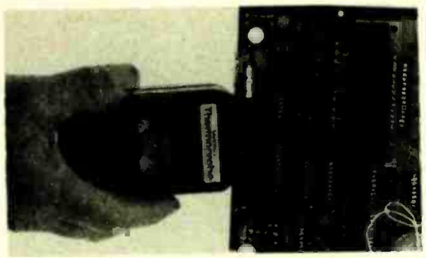
www.americanradiohistory.com

Radio-Electronics mini-ADS



SATELLITE TELEVISION RECEIVER SEMIKIT with dual conversion downconverter. Features infrared remote control tuning, AFC, SAW filter, RF or video output, stereo output, Polorator controls, LED channel & tuning indicators. Install six factory assembled circuit boards to complete. **Semikit $400.00.** Completed downconverter add **$100.** Completed receiver and downconverter add **$150. JAMES WALTER SATELLITE RECEIVER, 2697 Nickel, San Pablo, CA 94806. Tel 415-724-0587.**

CIRCLE 124 ON FREE INFORMATION CARD

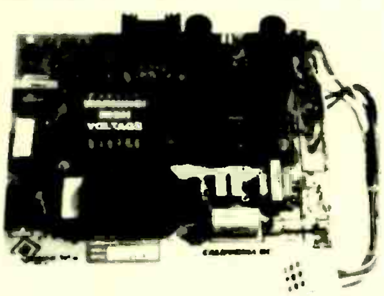


THERMOPROBE—QUICKLY IDENTIFIES DEAD PC BOARD COMPONENTS. Locates **DEAD** resistors, transistors, IC's, diodes, and transformers without direct contact, in seconds. Operating active components radiate heat, dead components don't. **THERMOPROBE** is sensitive to 1/25° F change in temperature. A must for your workbench or field service. Order #209TM. ONLY **$19.95** + $2.50 shipping. NY Res. add tax. **BUYUS, INC., Dept. RE124, 10 White Birch Dr., Ossining, NY 10562. VISA or MASTERCARD (914) 762-4799.**

CIRCLE 53 ON FREE INFORMATION CARD

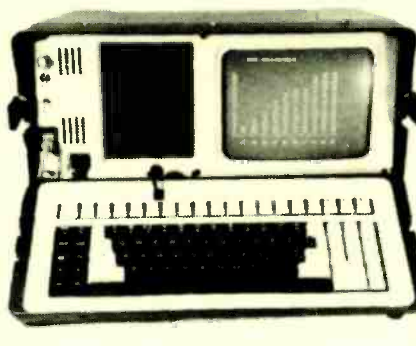
SUBSCRIPTION TV MANUAL. This information packed book details the methods used by subscription TV companies to scramble and descramble video signals. Covers the Sinewave, Gated Pulse, SSAVI system, and the methods used by most cable companies. Includes circuit schematics, theory, and trouble shooting hints. **Only $12.95** plus **$2.00** first class P&H. **ELEPHANT ELECTRONICS INC., (formally Random Access) Box 41770-R, Phoenix, AZ 85080.**

CIRCLE 120 ON FREE INFORMATION CARD



California-DC Regulated Switching Power supply +5v dc @ 5 amp + 12v dc @ 2.8 amp +12v dc @ 2 amp −12v dc @ .5 amp 115-230v ac input, fused. EMI filtered. Removable DC Power Harness and Schematics included. 7.4″ × 6.2″ × 1.7″ ht. Visa/MC/M.O./check; when clears. **$37.50 ea. (Free shipping in U.S.) 1-800-327-7182/305-830-8886. Power Plus, 130 Baywood Ave., Longwood, Fl. 32750.** (Call for quantity price).

CIRCLE 125 ON FREE INFORMATION CARD



ZORBA 64K PORTABLE COMPUTER 9″ Green or Amber CRT. Two 400 K DSDD Drives. CP/M 2.2 Operating System. **$799.00. Gemini Electronics, Inc., 130 Baywood Ave., Longwood, FL 32750. 1-800-327-7182, 305-830-8886.**

CIRCLE 278 ON FREE INFORMATION CARD

MAE-3, YAGI MICROWAVE ANTENNA — High quality up to 60 dB gain 1.9-2.5 GHZ-50 mile range possible clear TV picture, pre assembled probe with down converter, 1.9-2.5GHZ, power supply and RF amplifier, 1.9-2.5GHZ, 30dB gain, with co-ax cable included. All mounting hardware, for fast and easy installation. Special **$89.95.** Available by phone or mail order only. Check or money order, 5% Shipping and Handling on all orders. **KASHIWAGI ELECTRONICS CORP., 3801 W. Oakey Blvd., Las Vegas, Nevada 89102, 702-876-1709**

CIRCLE 270 ON FREE INFORMATION CARD

TELTONE'S TRK-957 KIT makes breadboarding a low-power, central office quality DTMF detection system easy and inexpensive. The included M-957 receiver decodes 12 or 16 digits and operates from 5 to 12V dc. Its sensitivity, wide dynamic range, noise immunity, and low power consumption are ideal for telephone switching, computer and remote control applications. Only $24.75. **To order, call: TELTONE, 1-800-227-3800, etx. 1130.**

CIRCLE 122 ON FREE INFORMATION CARD

IntelliBurner EPROM-EEPROM & MICRO-CONTROLLER PROGRAMMER $299 Communicates through the serial port of any personal computer. Use your PC's modem software to read, verify, or program all popular EPROMs, EEPROMs and 87xx series micro controllers. Custom software included for IBM, CP/M or Radio Shack PCs. Other programmers from **$149.** Bare PC boards with software from **$39. ROSS CUSTOM ELECTRONICS, 1307 Darlene Way #A12, Boulder City, NV 89005. 702-293-7426.**

CIRCLE 251 ON FREE INFORMATION CARD

TIMEX/SINCLAIR 1000, 1500, 2068, ZX81, SPECTRUM Hardware & Software for all computers: **NEW!** Floppy disk interface. Std format. Order FLOPPY: $200. **PRTR I/F**—A Centronics parallel printer interface. Order PRTIF: $50. **ASM/DSM**—A full featured assembler/disassembler. Oder ASMDSM: $40. **ALSO AVAILABLE**—Cables for all our products. Write for prices and descriptions. When ordering, specify type of computer. Cash, check, or C.O.D. only. Send to: **Research Service Laboratories, P.O. Box 19124, OKC, OK 73144.**

CIRCLE 274 ON FREE INFORMATION CARD

www.americanradiohistory.com

STATE OF SOLID STATE

Power op-amp IC's

ROBERT F. SCOTT,
SEMICONDUCTOR EDITOR

POWER OP-AMPS ARE RELATIVELY NEW arrivals on the semiconductor scene, and they've brought with them several interesting applications. One such device is the L272 dual, power op-amp from SGS. A pinout of that device is shown in Fig. 1-a, and a schematic of one op-amp contained in the package is shown in Fig. 1-b.

Housed in a 16-pin, power-DIP package, the IC is intended for various applications including servo amplifiers and power supplies. The L272 can operate from either single or split power-supplies ranging from 4- to 28-volts DC. Its output current can range up to 1 ampere. Other pertinent electrical characteristics are given in the table in Fig. 2.

The wide voltage range of the L272, along with its current-handling capabilities, make the unit ideal for controlling low-voltage DC motors. Therefore, it should find many uses in the fields of remote control and robotics. The data sheet includes such applications as a motor current control and a bidirectional DC-motor control (with or without microprocessor-compatible inputs).

Figure 3 shows a circuit using the L272 that's designed as a position control for automobile headlights. However, it may be used along with a surplus gear-motor for positioning heavy ham or CB beam antennas. And if you're interested in building satellite TVRO equipment, the circuit might be used in a motor-drive system to aim the antenna dish at various satellites.

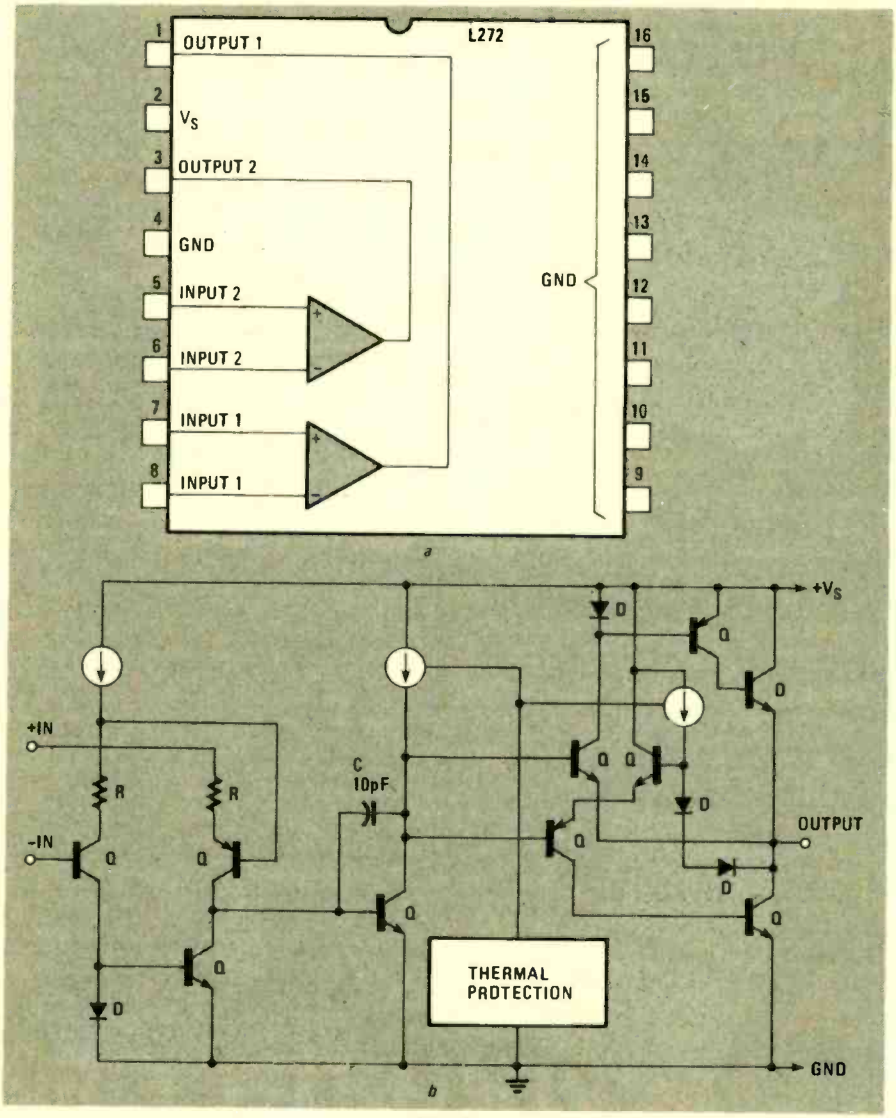


FIG. 1

The circuit is a bridge arrangement with two voltage-divider networks. The non-inverting input (pin 7) of IC1-a is connected to one divider network through switch S1 (the position-selector switch). The non-inverting input of IC1-b at pin 6 is connected to a second resistor string through switch S2 (which is driven by the positioning motor).

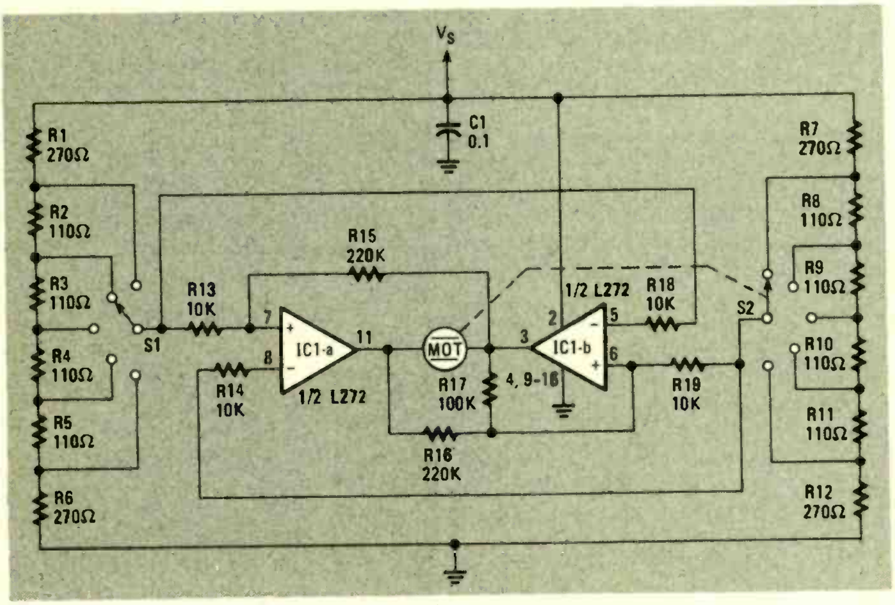
When identical voltages are applied to the two non-inverting inputs of the op-amps, the bridge is balanced and the motor is at rest. When the bridge balance is upset

www.americanradiohistory.com

L272

	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_S	SUPPLY VOLTAGE		4		28	V
I_d	QUIESCENT DRAIN CURRENT			5.5	12	mA
I_b	INPUT BIAS CURRENT			0.5	25	μA
V_{OS}	INPUT OFFSET VOLTAGE			15		mV
I_{OS}	INPUT OFFSET CURRENT			50	250	nA
SR	SLEW-RATE	$G_V = 1$		1		V/μs
B	GAIN-BANDWIDTH PRODUCT			350		kHz
V_O	OUTPUT VOLTAGE SWING	$f = 1$ kHz, $I_p = 0.1A$ $I_p = 0.5A$		23 22.5		V P-P
R_I	INPUT RESISTANCE		500,000			Ω
G_V	VOLTAGE GAIN (OPEN LOOP)			70		dB
S_N	INPUT NOISE VOLTAGE	B = 10 TO 10,000 Hz		5		μV
I_N	INPUT NOISE CURRENT	B = 10 TO 10,000 Hz		200		pA
CMR	COMMON MODE REJECTION			70		dB
SVR	SUPPLY VOLTAGE REJECTION	$f_{RIPPLE} = 100$ Hz SINGLE SUPPLY SPLIT SUPPLY		70 62		dB dB
T_{SD}	THERMAL SHUTDOWN JUNCTION TEMPERATURE			160		°C

*$V_S = 24V$, $T_{AMB} = 25°C$ UNLESS OTHERWISE SPECIFIED



(by changing the position of S1), the motor turns in the direction that brings the bridge back into balance and moves the controlled device into the position selected by S1. For more information and/or data sheets write: **SGS-ATES Semiconductor Corp.**, 1000 East Bell Rd., Phoenix, AZ 85022.

Four-channel analog switches

Dual four-channel analog switches, the LM1037 and 1038, for source selection in stereo-audio equipment and for use in a wide range of industrial, automotive, multiplexing, and sampling applications have recently been announced by National Semiconductor Corp.

The LM1037 units have four control inputs to select any one of four possible stereo-input signals. All channels are muted internally when no input is selected. Electronic controls simplify the routing of audio signals, and allow DC selection with low noise and low distortion. The high-input and low-output impedances make the LM1037 advantageous when compared to CMOS types.

The LM1038 is similar to the LM1037, except that it is designed to be controlled by a microprocessor.

Available in 18-pin plastic DIP's, the LM1037 sells for $2.00 in 100 piece lots, while the LM1038 sells for $2.30.—**National Semiconductor Corp.**, 2900 Semiconductor Drive, Santa Clara, CA 95051. R-E

SEE YOUR DEALER TODAY
FROM
Firestik ANTENNAS ACCESSORIES
HERE'S A TIP THAT'S PERFECT!
AM/FM AUTO RADIO AND CB
'Firestik' II
GOLDEN SERIES
BARE-HANDS TUNABLE
"NO TOOLS NEEDED"
HIGH PERFORMANCE ANTENNAS
ALSO ANTENNAS FOR CORDLESS TELEPHONES MONITOR SCANNERS
Dealer & Distributor Inquiries Invited
SEND FOR FREE CATALOG
'Firestik' Antenna Company
2614 East Adams Phoenix, AZ 85034
Name
Street
City
State Zip
Serving the CB and Communications Market Since 1962.
5-YEAR REPLACEMENT WARRANTY
CIRCLE 100 ON FREE INFORMATION CARD

Cable Television
ExtraVision
In-Band Gated-Sync Descrambler
Fully Assembled and Tested
$89.99
General Instrument
LCC 58 Digital Converter
with Remote Control
$119.99
General Instrument
LCC 58 Remote Control
$29.99
ExtraVision MTV
Stereo Adapter
$19.99
ExtraVision/LCC 58
Package Includes ExtraVision
with LCC 58 Converter
$189.99
Telephone Orders
203-724-5548
VISA
master charge
ExtraVision Products
CIRCLE 268 ON FREE INFORMATION CARD

www.americanradiohistory.com

SERVICE CLINIC

Helpful flyback tests

JACK DARR
SERVICE EDITOR

YOU'VE OFTEN HEARD ME SAY, "I GET BY with a little help from my friends." Never was that statement more true than now! I've received a letter from a (very smart) reader, John P. Chalupski (MD), who has worked out a handy procedure for testing flyback transformers—the heart of the horizontal deflection circuit. (See Fig. 1.)

His letter said he wished he had a *flybacker*—a 16-kHz oscillator with a meter to read grid current—like the one described in October 1974's "Service Clinic." Not having a flybacker, he devised his own test procedure to use with the test equipment he had on hand (scope and function generator).

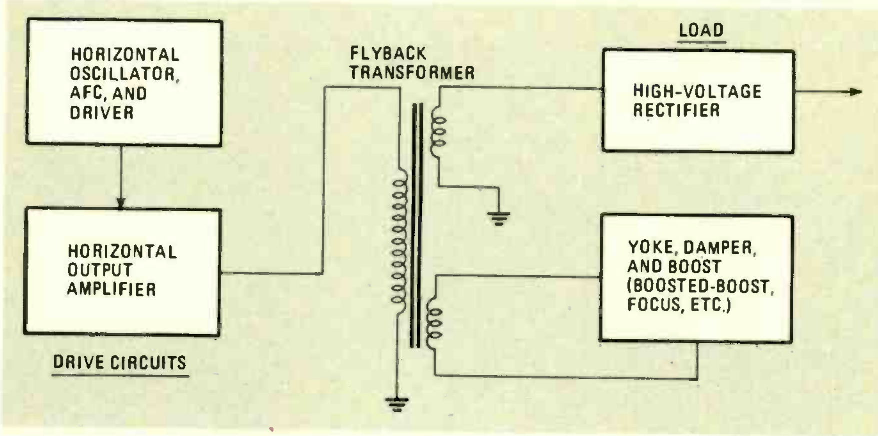


FIG. 1

Flyback test procedure

What John did was to substitute an audio function-generator and scope for the flybacker. He hooked the function generator across the output tube plate and high-voltage rectifier—evidently he had a generator with either a built-in sweep, or one that could be swept by applying a low AC-voltage across the VCO. The scope was hooked across the generator output.

While sweeping through 10 kHz to about 100 kHz, he noted that the resonant points (as seen on the scope) showed that the bad flyback, or the one he suspected of being bad, had fairly sharp resonant peaks at around 71 kHz. The good flyback that he had tested prior to that showed a much broader peak at the same frequency. When he took out the damper tubes, both flybacks showed the same thing: You guessed it—a shorted damper tube!

It should also be possible to make a similar test without using a swept signal by simply sweeping manually with an AC voltage. To do so, turn the function generator's dial through the same range (10 to 100 kHz) with the scope connected at the same place (across the terminal). You'll see a bar pattern on the screen, but you will not need to synchronize the sweep of the scope with it. Simply note the amplitude of the signal and find the resonant points (where the pattern increases in height; sometimes it will become more square).

He mentioned that this test can be made with only a scope and an audio-signal source that's variable over the necessary range. Also, if you don't have a scope, any good AC voltmeter will show the peaks, and that's all you need. He also said that this couldn't be used to check for a shorted winding.

This is a good example of one of those faithful readers who are smarter than I am (I'd say that includes roughly, 93% of them)! So keep those cards and letters coming folks! They are really appreciated.

Checking shorted windings

While John's procedure cannot be used to test for shorted windings in a flyback transformer, there is, however, a simple way to do so. (I found this one in the book that discussed the operation of the flybacker.) Simply hook your function generator up to the flyback and observe the scope trace, or reading (on the flybacker). Now, pick up that little coil of solder that you have on the bench and unwind about 3–4 inches. Now slip it around the core of the suspected bad flyback, then pull the ends together and pinch.

That makes a closed loop (one shorted turn) around the core. The reading on the flybacker should drop to zero, and the curve on the scope should vanish. If it does, that's a normal reaction with this test. It shows that you have no shorted windings. But if there is little or no change in your reading, then you've got a problem.

www.americanradiohistory.com

What's happening here is that the solder coil is placing an AC short across the transformer, which lowers the Q of the circuit and causes a bad reading. But if the transformer is already shorted, the solder-coil will have little or no effect on the circuit. That's a difficult problem to detect with ordinary test instruments such as ohmmeters and voltmeters because the DC continuity of the circuit will check out OK, but it won't work with the normal AC drive.

You can, however, measure the small resistance of the little windings, provided you have an extremely accurate digital VOM. I would recommend that you use needle-point test prods to ensure that you're able to get through any flux or whatever else might be on the terminal. Sharp tips allow you to get right down to the bare solder so you can get an accurate reading.

By using the test procedure worked out by John, and then doing the shorted-turns test (with a loop of solder) while observing changes in the scope pattern to see if it goes to a straight line, you can tell if the flyback or some other component is causing the problem. If when doing the shorted-turns test, the scope shows a very narrow range of movement of the tuning dial, the transformer is OK. The broad peak can be identified in the same way.

Since we're talking about flybacks anyway, this seems to be as good a time as any to tell you about a letter I received long ago from a man who had this complaint about a TV set he was working on.

The letter said that with the set's horizontal oscillator plugged in, the fuse would blow right away, but if oscillator was pulled out, the fuse wouldn't blow. From the symptom, I speculated that the cause of the problem was an AC short (and told him so).

Not long after that, I received another letter from that person saying that I was absolutely right. He had found that one winding of the flyback was shorted to the other. Again I wrote saying that, to me, it sounded as though the short were in the leads out of the winding! He wrote back again and said, "Darned if you weren't right again!"

The key to locating the trouble was the almost normal current without any drive, and the overload of current with drive. The DC path was alright, but when an AC drive signal was put on it, the AC saw a dead short. So, remember that it's possible to have an AC short in circuits of that type without showing any indication using regular ohmmeter tests.

Finally, I'd like to thank all the good people who sent get-well cards. You can be sure that they were much appreciated. R-E

SERVICE QUESTIONS

THE EASY SOLUTION

On a Systems 3 Zenith, I found several components shorted, including the output transistor. I replaced them, plugged the set in, and bang! The output transistor blew, taking out a fast recovery diode. Any help will be appreciated.—O.R., Virginia Beach, VA

I hate to rain on your parade, but replacing the 9-160 module in its entirety will save you time, money, and also your sanity.

MOMENTARY SYNC-PROBLEM

This MGW Magnavox chassis B5-O4, will drop out of sync momentarily, causing a flash in the picture, and then go back in sync. That happens every 10 minutes. Any suggestions?—W. K., Columbus, OH

Of all the information you sent with your letter, the bit that deserves the most attention is the slowly rising voltage you get at R504 and C505. That's the point of AFC correction, and any changes in its potential will affect the horizontal frequency. As you describe it, I suspect something is causing a slow buildup and then a sudden discharge. Check all the components between the oscillator base back to, and including, the dual-diodes. Measure those resistors out of circuit! Don't ignore the R-C network returning the pulse from the flyback! R-E

cable tv

DESCRAMBLER PARTS

We stock the exact parts and PC Board for Radio Electronic's February Article on building your own Cable TV Descrambler.

#701 PARTS PACKAGE $29.95
Includes all the original resistors, capacitors, diodes, transistors, integrated circuits, coils and IF transformers (BKAN-K5552AXX).

#702 PC BOARD $12.95
Original etched & drilled *silk-screened* PC Board used in the article.

#704 AC ADAPTOR $12.95
(14 volts DC @ 285MA)

Both #701 & #702 .... $39.00

FREE!! Reprint of Radio Electronics Article on Building Your Own Cable TV Descrambler with any purchase.

Add $4.00 Postage & Handling

TOLL FREE
1-800-227 8529 (Orders Only)
1-617-339-5372 (Information)

J & W ELECTRONICS, INC.
P.O. Box 800
Mansfield, MA 02048

CIRCLE 65 ON FREE INFORMATION CARD

CABLE T.V. DESCRAMBLERS

Model AN-3*
Jerrold Compatible
Works with any CH-3 Converter. 59.95 EA.

Other Models to choose from

*Similar to SB-3

QUANTITY DISCOUNTS • VISA • MASTERCHARGE
CHECK • MONEY ORDER • C.O.D.

HUDSON CABLE COMPANY
P.O. Box 9179
Niskayuna, New York 12309
(518) 382-5349

CIRCLE 266 ON FREE INFORMATION CARD

www.americanradiohistory.com

$100,000.00 CABLE TV CONVERTER
LIQUIDATION

- 60 Channel Capacity
- P.L.L. Tuning
- 6 Channel Memory
- TV On-Off Feature
- Infra-Red Wireless Remote Control

ONLY $59.95

- 10% Off On All Quantities Over 50
- Available Only While Quantities Last
- Warranty Restricted to 15 Days After Receipt of Goods
- Allow 2 Weeks for Personal Checks to Clear

– SPECIAL –

- Factory Re-Furbs Available at $49.95 Each With Full Guarantee

SUNSET CABLE
1 Madison Street • East Rutherford NJ
(201) 777-6733
Master Charge • C.O.D. • Visa

CIRCLE 257 ON FREE INFORMATION CARD

DON'T FORGET

USE YOUR READER SERVICE CARD

Call or Write Us for Your Crystals
- just one or hundreds -
for Communications
for Industrial Use
for Your Technology

You will get
- Cost Savings
- Prompt Service
- High Stability

Serving Crystal Users Since 1958

JAN CRYSTALS
P.O. Box 16017, Fort Myers, Florida 33906
All Phones (813) 936-2397

CIRCLE 104 ON FREE INFORMATION CARD

Qualitone

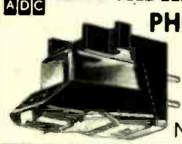
MONTHLY SPECIALS
MINIMUM ORDER $35.00

MEMOREX T120 VHS VIDEO CASSETTE

5.39 EA.
No. Q20 MINIMUM 12 (MULTIPLES OF 12)

VIDEO TAPE STORAGE BOX (FOR VHS FORMAT) 90¢ EA.
No. Q47 MINIMUM 48

ADC XLM MK III PHONO CARTRIDGE
WITH STYLUS, MOUNTING HARDWARE AND DISPLAY BOX



9.90 EA.
No. Q48

WE SELL TO THE DEALER ONLY!
C.O.D. ORDERS - 800-431-2490
FOR FULL LINE 164 PAGE CATALOG PLEASE USE BUSINESS CARD OR LETTERHEAD

QUALITONE INDUSTRIES INC.
DEPT. C - 696 LOCUST ST. - BOX 214
MT. VERNON, NEW YORK 10552

CIRCLE 264 ON FREE INFORMATION CARD

NEW IDEAS

continued from page 77

stead of the three shown, to get a full scale reading. If the internal resistance of the meter is less than 90 ohms, you may only need two diodes.

The density range of the negative can be expressed as the logarithm (log) of the light intensity (I) through the clearest (shadow) area minus the log of I through the densest (highlight) area. In the form of an equation: density range $= \log(I_s/I_h)$.

TABLE 1

DENSITY RANGE		Paper Grade
(I_s)	(I_h)	
>1.4	<4	0
1.2–1.4	4–6	1
1.0–1.2	6–10	2
0.8–1.0	10–16	3
0.6–0.8	16–25	4
<0.6	>25	5

By using a simple table of antilogs, you can avoid the need of a log amplifier to determine the correct paper grades corresponding to the specific density ranges.

To use the contrast meter, focus the negative in the enlarger with the lens diaphragm wide open. Then place the photocell under the lightest portion of the negative. Using potentiometer R5, adjust the meter for full-scale deflection. Now, without changing the setting, place the photocell beneath the darkest portion of the negative and read the meter. If the meter now shows less than ten percent of the full-scale reading, it may prove to be very difficult to read accurately.

When that happens, it will be necessary to push switch S1. Pressing S1 removes the short across resistor R4. Because R4 is three times the value of R3, only ¼ the voltage applied to that leg of the circuit will appear at the inverting input of the op-amp, resulting in a reading four times as great. Now simply divide that reading by 4 and compute the ratio of the first and second measurements. And then refer to Table 1 to find the right paper grade for that negative.

—Phillip W. Albro

www.americanradiohistory.com

MARKET CENTER

CLASSIFIED RATES

15 word minimum: $37.50, $2.50 per word commercial; $30.00 $2.00 per word personal. Expanded type ad, $3.75 per word. Ads set in all bold-face type at 20% premium. Ads set with background screen at 25% premium. Display ads 1" × 2¼" - $270.00; 2" × 2¼" - $540.00; 3" × 2¼" - $810.00. General Information: frequency rates and prepayment discounts are available. Payment must accompany order. Copy subject to publishers approval. Must be typewritten or printed. First word set in all capitals and boldface: Advertisers using P.O. Boxes **must supply permanent address and telephone numbers.** Orders are not acknowledged. They wiill appear in the next available issue after receipt. Copy to be in our hands on the 20th of the third month preceding the date of the Issue (i.e. August issue closed May 20th. When normal closing date falls on Saturday, Sunday or a holiday issue closes on preceding working day. Send order and remittance to **Classified Advertising Radio-Electronics, 200 Park Avenue South,New York, New York 10003. For your convenience a simplified order form is provided on this page.**

DESCRAMBLERS

AMERICAN—CANADIAN

New Satellite Descramblers

C-1000 / ZENITH TYPE

Descrambles "over the air" and "cable" sync suppressed active video inversion signals

Ready to go C-1000 ..... 379.95
Complete Kit C-1000K 274.95
Printed Circuit & Manual 24.95

C-100 / JERROLD TYPE

Cable Descrambler for in-band gated suppressed systems

Ready to go C-100 ..... 119.95
Complete Kit C-100K 54.95

SEND $2 FOR COMPLETE INFORMATIVE CATALOG TO DETERMINE WHAT TYPE YOU NEED

Buy 1 kit Get 2nd kit at ½ price

J & D ENGINEERING
P.O. Box 6099
Falmouth, Maine 04105
(617) 837-8431
Dealers Wanted
Special Quantity Pricing
COD's—OK

All J & D products are engineered, not copied, all are guaranteed 90 days & we stand behind our products where others fail to

FOR SALE

CABLE-TV Secrets—the outlaw publication the cable companies tried to ban. HBO, Movie Channel, Showtime, descramblers, converters, etc. Suppliers list included. $8.95. **CABLE FACTS,** Box 711-R, Pataskala, OH 43062.

RESISTORS ¼W&½W5% 3 cents. 1%metalfilms, precision custom wirewounds, $1.00 refundable to: **JR INDUSTRIES,** 5834-B Swancreek, Toledo, OH 43614.

FREE catalog featuring scanner accessories, carrier/subcarrier detectors, voice scramblers, unusual kits. **CAPRI ELECTRONICS,** Route 1R, Canon, GA 30520.

THE Intelligence Library—Restricted technical information & books on **electronic surveillance, surveillance-device schematics, lock-picking, investigation, weapons, identification documents, covert sciences,** etc. The **best** selection available. **Free brochures. MENTOR,** (Dept. Z), 135-53 No. Blvd., Flushing, NY 11354.

CABLE-TV equipment, notch filters for "beeping" channels. Information $1.00. **GOLDCOAST,** PO Box 63/6025 RE, Margate, FL 33063.

RF parts/Motorola transistors. MRF454 $16.00, MRF455 $12.00. Catalog available. **RF PARTS CO.,** 1320-4 Grand, San Marcos, CA 92069. (619) 744-0720.

RECONDITIONED test equipment. $1.00 for catalog. **JAMES WALTER TEST EQUIPMENT,** 2697 Nickel, San Pablo, CA 94806.

DIGITALKER Speech Synthesizer has 136 word vocabulary. Interfaces with parallel port of your computer. PCB and plans $12.00. **JIM RHODES, INC.** 1025 Ransome Lane, Kingsport, TN 37660.

WHOLESALE MATV/CATV equipment, antenna, accessories, cartridges, radios, speakers, wires. (718) 897-0509, **D&WR,** 68-12 110 Street, Flushing, NY 11375.

LATEST bug-detection equipment for home or office. Literature, $1.00. **CLIFTON,** Box 220-X, Miami, FL 33168.

NLA OBS, Panasonic, GE, Admiral, 50% off net. **TROY TV,** 76 Second, Troy, NY 12180.

BIGGEST TI-99/4A selection. Newest exciting software and hardware bargains. Hard to get items. Send for free catalog. Fast service. **DYNA,** Box 690, Hicksville, NY 11801.

WANTED: RCA, Cunningham, Western Electric, Genalex, Telefunken, GE, Sylvania, McIntosh, Marantz, Altec, JBL, Tannoy: **Tubes,** amplifiers, speakers. (713) 728-4343, **MAURY,** 11122 Atwell, Houston, TX 77096.

TOP-quality imported, domestic kits, surplus, discount electronics, computer components. Free catalog. **TEKTRASONIX,** 175 Fifth Ave., Suite 3194, N.Y., NY 10010.

CABLE-television facts and secrets. Now you can get the informative publication that CATV companies have been unsuccessfully trying to get banned for 15 years. Movie Channel, HBO, and Showtime converters, etc. Send $8.75 to: **CABFAX,** P.O. Box 091196, Bexley, OH 43209.

TUBES, new, unused. Send self-addressed, stamped envelope for list. **FALA ELECTRONICS,** Box 1376-2, Milwaukee, WI 53201.

FREE Pay-TV reception. "How-To" book. HBO, Showtime, Cinemax. $4.95. **DIPTRONICS,** Box 80 (R4), Lake Hiawatha, NJ 07034.

CABLE-TV converters and descramblers. Low prices, dealers wanted. Send $5.00 for catalog. **R & M DISTRIBUTORS,** Box 266-1, Boston, MA 02190, (617) 871-5838

CONVERTERS all types for all systems. Lowest prices anywhere, quantity discounts, dealer inquiries accepted. Send $1.00 for catalog, **PG VIDEO CORP.,** PO Box 296, Latham, NY 12110. (518) 274-6593.

AUTOMOTIVE Security Catalog. 1984, 24-page color catalog. $2.00. **ASE,** Dept. 1, PO Box 382, Plainview, NY 11803.

COMPUTER hacking: Learn how it's perpetrated and prevent it! Details free: **A.T.I.S.,** 61 Gatchell, Buffalo, NY 14212.

RADAR JAMMER!

- **Causes speed radar guns to read out either: —a percentage of your true speed, or whatever speed you dial in**
- Activated by your Escort and most other detectors
- Especially effective against instant-on radar
- Operates on both X and K bands (not FCC approved)
- **MONEY-BACK GUARANTEE,** if not satisfied.

WARNING: The device described in this literature is not legal for use against police radar.

Complete literature & plans package, send $14.95 to:

Philips Instrument Design Co. Inc.
9513 S.W. Barbur. Blvd. #109S. Portland. OR. 97219
VISA and M/C order line: (503) 626-6764

COMMODORE 64 and VIC-20, 21. Free programs, PUBLIC DOMAIN INC., PO Box 190 K, West Milton, OH 45383.

SURPLUS test equipment, RF and Power, B&K, Leader, Simpson, Tektronix, catalog $2.00, **R.C.S.,** Box 1382, Washington, D.C. 20013.

DESÇAMBLERS for downconverters. High gain. Send $2.00. **RB ELECTRONICS,** PO Box 643, Kalamazoo, MI 49005.

USED book list: Electronics, physics, mechanical, mathematics, computers. 37 cents stamps: **SOFTWAVE COMMUNICATIONS,** 1515 Sashabaw, Ortonville, MI 48462.

CABLE- TV converters, Zenith, Scientific Atlanta, Jerrold, Oak, others available. Fast service, **UNITED ELECTRONICS SUPPLY,** PO Box 1206, Elgin IL 60121. (312) 697-0600.

CONVERTER, UHF to channel four. Featuring AFC and fully assembled, trapped and aligned hi-gain IF for clear pictures. Plug in 2" × 5" PC kit for both sinewave and gated sync. Complete with case including shipping **UPS** $295.00. Free Information. **VISTA,** 717 Front Street, Lisle, IL 60532.

FREE catalog, 99 cent kits—audio, video, **TV,** computer parts. **ALLKIT,** 434 West 4th Street, West Islip, NY 11795.

CB Sams 1 thru 214 $3.50 each, Sencore CB-42 Digital analyzer recalibrated $500.00. Complete Sencore DVM-32 $60.00, **(816) 444-7566,** 19 East 56th Street, Kansas City, MD 64113.

NEWEST cable-TV facts, Manual includes: theory, schematics of popular descramblers and converters, secret techniques and more. $11.00 cash. Free CATV equipment catalog. **ELECTRON,** Box 169, 17 No. State Street, Room 1222, Chicago, IL 60602.

GUARANTEED quality surplus for less! Free flyer. **ELECTRONIX LTD.,** 3214 South Norton, Sioux Falls, SD 57105.

CORDLESS phone owners. Increase distance, reduce static on 1.7/49MHz phones. Details $1.00 refundable. **HP PHONES,** Box 273, Mesa, AZ 85201.

DELUXE cable/UHF converters. Zenith, SSAVI-1—$199.95. Zenith Cable—$229.95. Jerrold, Oak and others available. Dealers wanted. $2.00 catalog—**UNITED ELECTRONIC SUPPLY,** Box 1323, Elgin, IL 60121-0119. (312) 697-0600.

COCO owners—Free color computer software and hardware catalogue. **SPECTRUM,** Box 9866, San Jose, CA 95157-0866.

INDIVIDUAL photofact folders. No. 1 to no. 1400, $3.00 postpaid. **LBT,** 414 Chestnut Lane, East Meadow, NY 11554.

CANADIANS. Pay-TV and satellite descramblers for all areas. Send $1.00 for details to **F.T. ELECTRONICS,** Box 2126, Niagara Falls, NY 14302.

This is an expanded type ad. Notice the increased visibility. Yes, you'll pay a premium for this kind of ad. But it will help your ad stand out from the rest. For ordering information, see top of Market Center listing.

TECNICA 140 channel cable converter fully remote sound and video unit only $149.00. **Jerrold** LCC58 converter only $79.00. **Jerrold** DRZ450 converter 90 channel auto tuning only $89.00. All units carry full manufacturers' warranty specials while they last. For catalog send $3.00. Thanks. **REDCOAT ELECTRONICS,** 104-20 68th Drive, Forest Hills, NY 11375, (212) 459-5088.

UNBELIEVABLE low prices. No surplus: Memories, microprocessors, linear, melody IC's. **We have what others haven't.** Catalogue—$2.00. **K. BOUFAL—ELECTRONICS CONSULTANT.** 244 Fitzwater Street, Philadelphia, PA 19147.

This ad is set with a background screen. Notice how it stands out on the page: It incurs a 25% premium charge. Perhaps your next ad could have a screen background. For more information, see top of Market Center listing.

www.americanradiohistory.com

BIKE COMPUTER
Useful and fun accessory for anyone! Battery operated portable unit with large LCD displays. Provides the following data: actual speed, distance travelled, time of day, stopwatch, peak speed, clock/alarm, pacer with ghost rider, destination speed, average speed, target time, target distance, ETA, and distance remaining. Adjusts for any tire size. Complete working unit (less batteries). An $80.00 value! Hurry, quantities are limited.
C6272 $19.95
SPECIAL!!

NICAD BATTERY ZAPPER KIT
This is one of the most useful and money saving kits you can buy! The Nicad Zapper kit repairs those nicads that you no longer use because they won't recharge. Many nicads quit taking a charge after a period of time because they grow internal "Whiskers". The only way to make them take a charge again is to "blow" these "whiskers". This small kit operates from 6VDC (4 AA cells, etc.), and produces 300VDC which it applies momentarily to the nicad to "blow the whiskers" without damaging the battery. Repairs about 90% of nicads in sizes from AA to C cells. After zapping, the nicad is ready to be fully charged again and again (just like it did when it was new). The nicad zapper produces absolutely amazing results! Stop throwing those expensive nicads away! The kit comes with all parts, PC board and instructions (less batteries and case).
C6278 $14.95
NEW

XENON STROBE WARNING FLASHER KITS
We have the largest selection of warning flasher kits available anywhere. Each of these small but powerful kits produce continuous flashes of brilliant white light from high output xenon strobe tubes. Great for cyclists, hikers, joggers, RC planes, model rockets, alarms, boaters, etc. Each kit comes with all parts, strobe tube, PC board and instructions (less battery and case). We have the following types available (each has a straight xenon tube except for the 9V unit which uses a horseshoe tube).

OPERATING VOLTAGE	PC BOARD SIZE	STOCK NO.	PRICE
1.5V	2 1/4" x 1 1/8"	C6268	$11.95
3V	2" x 1 11/16"	C3207	7.95
6V	2" x 2"	C3808	8.49
9V	1 7/8" x 1 1/2"	C5175	12.95
12V	3" x 1"	C6241	13.95

NEW

PAC TEC ELECTRONIC ENCLOSURE NEW
Professional looking case is great for instruments and projects. Black textured plastic finish with removable end panels. Size: 8"W x 6 1/4"D x 2 1/2"H. C6006 $8.95

BOX OF ELECTRONICS C6282 $10
Super surprise of resistors, capacitors, IC's, transistors, sub-assemblies, diodes, switches, pots, etc. in a 6"x6"x5" box. Lots of "Goodies"! Note; because of shipping costs we can only ship this via UPS.

3 CHANNEL COLOR ORGAN KIT
Handles up to 200W per channel and up to 25W input. Complete with all parts and pc board.
C4530 $9.50

PIEZOELECTRIC TRANSDUCER
Same type used in many electronic games to emit sound effects. Consists of ½" square crystal mounted to 1" metal disc. Frequency response: approx. 100HZ to 30KHZ.
C6251 $1.00

CHANEY electronics inc.
P.O. BOX 27038
DENVER, COLORADO 80227
303-781-5750

Phone Orders 303-781-5750
• Minimum AD Order $9.00
• Please include $2.00 for postage (UPS)
• VISA MC accepted
• Phone orders are welcome

Send for our free catalog of unique items

CIRCLE 109 ON FREE INFORMATION CARD

UHF Descramblers. Gated, sinewave, Zenith. Low prices! Free information. Catalog $1.00. Dealers wanted! Visa/MasterCard. AIS SATELLITE, Box 1226-S, Dublin, PA 18917, (215) 249-9411.

NOTCH filter for Cable-TV. Channels 2-6, 14-22, A-I. Send $20.00 for sample and quantity price list. Specify channel. Money back guarantee. **CATV**, PO Box 17621, Plantation, FL 33318.

TROUBLESHOOT faster using Circuit Scanners®. Diagnose easily by non-technical comparison of displayed waveform. Checks active and passive components, assists in locating leaky semiconductors. Two models available CS 200, stand alone unit with waveform. Storage, $150.00. CS100 interfaces with oscilloscope, $89.95. User manual only $5.00. Send check or money order to: **CIRCUIT WORKS,** PO Box 2566, Culver City, CA 90231.

RESISTORS ⅛W & ¼W 1% 5 cents. 10 million in stock. Also other sizes. $1.00 Refundable to: **G. COLLIER,** 2227 Dufour Ave., Redondo Beach, CA 90278. (213) 370-3352.

BEST prices: CB equipment, radar dectectors, telephones, scanners. Free list. **CRS,** 1578 Central Avenue, Yonkers, NY 10710.

WALKMAN style headphones $7.00. Piezo super tweeter, 40,000 Hz $8.00. **JAMES FIGIELSKI,** PO Box 42, Florham Park, NJ 07932. No checks.

SINEWAVE descrambler model MC-3. Non-working-new units, supplied with schematic, $29.95 each 2/$49.95. **HUDSON CABLE COMPANY,** Box 9179 Niskayuna, NY 12309. (518) 382-5349.

COMMODORE 64 and VIC 20 new! Now you can have synthesized voice at an affordable price. Voice 1 complete allophone synthesis. Kit $29.95, assembled $39.95. Protect your computer with V-Guard kit $14.95, assembled $19.95. Inquires to **IRC,** PO Box 60, Mason, OH 45040.

VOICE synthesizer. Timex TS2068/1000. ML-Program has large expandable vocab., excellent sound. 16.95pp. **TAD PAINTER,** Box 166055, Irving, TX 75016.

COMPUTER display enhancer only $49.50. Visa accepted. (201) 627-0290, **COMPONENTS CORP.,** Denville, NJ 07834.

IC's at low prices! 74LS374, 74LS245, MC6800 $1.95! MC1488, MC1489 2/99 cents! LM741 TO5 or minidip 5/99 cents! 5 volt 2716, Z80A-SIO, Z80A-PIO, 6802 $1.95! TMS2716 99 cents! Guaranteed IC's removed from sockets. Pay by MasterCard, Visa. Free catalog. **ERM,** 27 Water St., Wakefield, Mass 01880. (617) 246-3550.

CABLE-TV products. Jerrold, Hamlin, and Oak converters. Send $3.00 for information. **ADDITIONAL OUTLET CORP.,** 1041 W. Commercial Blvd., Ft. Lauderdale, Fla. 33309.

UHF, CABLE-TV UNITS

ZENITH VHF/UHF "Super Z" kit in stock (also works on Zenith cable units, Z-TAC) only 179.95. Put a sting in those faraway UHF stations with our 25dB preamp kit, the "Scorpion" $22.95. Large quantity discounts on cable units, N-12's, SB, MLD-1200's, filters. We buy surplus parts, excess inventory. We now have over a ¼ of million dollars in parts stocked, resistors/capacitors/coils/IC's/many more. Check out our low prices. Dealers give us a call on quantity pricing. Will ship anywhere. FOB/Balt. C.O.D. welcome. Carte Blanche/Diner's Club accepted. UPS daily. Add 3% shipping. Maryland residents 5% state tax. Credit card orders, information, C.O.D.'s and dealer pricing call (301) 574-7882 or 7883. Call or write for free catalog to: S.E. CORPORATION, PO 9534, Baltimore, MD 21237.

THE BEST PLACE to BUY, SELL or TRADE NEW and USED EQUIPMENT
NUTS & VOLTS MAGAZINE
BOX 1111-E • PLACENTIA, CA 92670
(714) 632-7721
Join Thousands of Readers Nationwide Every Month
ONE YEAR U.S. SUBSCRIPTIONS
$10.00 - 3rd Class • $15.00 - 1st Class
$35.00 • Lifetime • 3rd Class

NUTS & VOLTS
HAM GEAR
COMPUTERS
SOFTWARE
SCANNERS • OPTICS
TEST EQUIPMENT
MICROWAVE
SATELLITE
AUDIO VISUAL
NEW PRODUCTS
COMPONENTS • KITS
ANTIQUE ELECT.
PUBLICATIONS
PLANS • SERVICES

SATELLITE TV

continued from page 20

in the 65 to 70% region are common; that means more gain from the antenna by a dB or two than their 1979/80 counterparts. Finally, the price per antenna has dropped dramatically with our equivalent 10 footer in 1984 selling for one quarter or so of its 1979/80 price. All of that has happened for all of the obvious reasons:

1) Volume has gone way up (*as many as* 500,000 new terminals this year, no less than 20% of which should be of the 10-foot size);

2) Those people who started out building antennas years ago have caught up with the learning curve and every part of the antenna system is now approaching state-of-the-art capabilities.

Satellite changes

There is one more factor, perhaps the most important factor of all, to consider. Virtually all of the satellites that were providing our primary TVRO services in 1979/80 have been retired, and replaced by newer satellites. That has had a dramatic effect on TVRO performance.

Newer satellites are more powerful (as much as 9 watts versus the older 5-watt maximum) and because they are newer, they are "run harder." As satellites grow older, their operators (RCA, Hughes, Western Union, etc.) become more conservative in the operations; 5-watt "capable" transponders are backed off so their actual operating power may be closer to 4 or even 3 watts. That is done without fanfare or announcement and the unaffiliated TVRO system owner simply sees weaker pictures and naturally blames his own terminal.

The higher-power satellites have led to the use of smaller and smaller dishes with success. Recent TVRO industry trade shows have seen a proliferation of dishes in the 4- to 6-foot region; some of which deliver excellent pictures on as many as 30 to 40 channels (a function, as always, of where the user is located since satellite signals continue to be strongest in the center of the boresight; that's the central midwest in the U.S.).

Law changes

Finally, there is the law. TVRO users have been called "pirates" from the very beginning. That there might be close to 900,000 pirates as 1985 dawns does not change the label.

Something else will; *legislation*. Several influential Senators (i.e. Goldwater from Arizona) and Congressmen have introduced a pair of bills in both houses of Congress; bills that establish *Satellite Viewing Rights*. Those bills made excellent progress during 1984, an election year when such new bills seldom do anything but get a number assigned. When the bills are passed (and their eventual passage seems assured because of the excellent efforts of the trade association SPACE) home TVRO viewers (and equipment sellers) will find the "illegal" aspect of their operations a thing of the past. **R-E**

TAKE CARE OF YOUR LUNGS. THEY'RE ONLY HUMAN.

AMERICAN LUNG ASSOCIATION
The Christmas Seal People

Space contributed by the publisher as a public service

www.americanradiohistory.com

WE HAVE QUALITY PARTS, DISCOUNT PRICES AND *FAST* SHIPPING!

TRANSFORMERS

120 volt primaries

5.6 VOLTS @ 750 MA	$3.00
6 VOLTS @ 150 MA	$1.25
12 VCT @ 200 MA	$2.00
18 V. @ 650 MA	$3.50
18 VOLTS @ 1 AMP	$4.50
24 VOLTS @ 250 MA	$2.50
24 VCT @ 1 AMP	$4.50
42 VCT @ 1.2 AMP	$4.50

RS-232 EXTENSION

9 LINE CONNECTED LINES 1 THROUGH 8 & 20. DB25 MALE TO FEMALE. 10 FEET SHIELDED.
$11.00 EACH

MIKE CONNECTOR

5 CONDUCTOR IN-LINE PLUG AND CHASSIS MOUNT JACK. TWIST LOCK STYLE. SAME AS SWITCHCRAFT 12CL5M.
$2.50 PER SET

7 CONDUCTOR RIBBON CABLE

SPECTRA-STRIP RED MARKER STRIP. 28 GA STRANDED WIRE.
$5.00 PER ROLL (100 FT.)

REVERBERATION UNIT

$7.50 EACH

ACCUTRONICS COIL SPRING TYPE UNITS. USED IN ELECTRONIC ORGANS TO PROVIDE ACOUSTIC DELAY SOUND EFFECTS. INPUT IMPEDANCE 8 OHMS, OUTPUT IMPEDANCE 2250 OHMS. 4 1/2" x 16 3/4" x 1 1/16"

SOUND AND VIDEO MODULATOR FOR T.I. COMPUTER

T.I. # UM1381-1. DESIGNED FOR USE WITH T.I. COMPUTERS. CAN BE USED WITH VIDEO SOURCES. BUILT-IN A/B SWITCH. CHANNEL 3 OR 4 SELECTION SWITCH. OPERATES ON 12 VDC. HOOK UP DIAGRAM INCLUDED.
$10.00 EACH

WALL TRANSFORMER

ALL ARE 115 VAC PLUG IN

4 VDC @ 70 MA	$2.00
6 VDC @ 100 MA	$2.50
6 VDC @ 500 MA	$5.00
9 VAC @ 1 AMP	$3.00
15 VAC @ 300 MA	$3.00
16.5 VAC @ 10 VA	$3.50
17 VAC @ 500 MA	$4.00

MULTI-SWITCHES

3 STATION NON-INTERLOCKING

3 - 2PDT SWITCHES. EACH OPERATES INDEPENDENTLY. 1 3/4" BETWEEN MOUNTING CENTERS.
$1.75 EACH

5 STATION INTERLOCKING

MADE BY ALPS. 3 - 2PDT AND 2 - 6PDT SWITCHES ON FULLY INTERLOCKING ASSEMBLY. 3 1/4" BETWEEN MOUNTING CENTERS.
$2.50 EACH

5 STATION NON-INTERLOCKING

SAME AS ABOVE, EXCEPT EACH SWITCH OPERATES INDEPENDENTLY.
$2.50 EACH

METER 0 - 15 V.D.C.

THIS 2-1/4" SQUARE METER MEASURES 0-15 VDC.
$4.50 EACH

SUB-MINIATURE D TYPE CONNECTOR

SOLDER TYPE SUB MINIATURE CONNECTORS USED FOR COMPUTER HOOK UPS.

DB-15 PLUG	$2.75
DB-15 SOCKET	$4.00
DB-15 HOOD	$1.50
DB-25 PLUG	$2.75
DB-25 SOCKET	$3.50
DB-25 HOOD	$1.25

"PARALLEL" PRINTER CONNECTOR

SOLDER STYLE 36 PIN MALE USED ON "PARALLEL" DATA CABLES.
$5.50 EACH

I.D.C. MALE

SAME AS ABOVE. WILL PRESS FIT ON STANDARD RIBBON CABLE.
$8.00 EACH

COMMUNICATION MICROPHONE

NEW C.B. STYLE MIKE WITH PUSH S.P.D.T. SWITCH.
$5.00 EACH

PUSHBUTTON POWER SWITCH

DOUBLE POLE POWER SWITCH PUSH-ON, PUSH-OFF.
$1.00 EACH

SWITCHES MINI-PUSH BUTTON

S.P.S.T. MOMENTARY NORMALLY OPEN 1/4" BUSHING
35¢ EACH
10 FOR $3.25
100 FOR $30.00
SPECIFY COLOR: RED, BLACK, WHITE, GREEN, YELLOW.

2K 10 TURN

MULTI-TURN POT
SPECTROL #MOD 534-7161
$5.00 EACH

EDGE CONNECTORS

ALL ARE .156" SPACING

10 PIN EDGE CONNECTOR

TRW #50-10-A-20 $2.00 EACH

18/36 GOLD

SOLDER EYELET $2.00 EACH

22/44 TIN

P.C. STYLE. NO MOUNTING EARS
$1.50 EACH 10 FOR $14.00

22/44 GOLD

PC. STYLE $2.00 EACH 10 FOR $18.00

28/56 GOLD

28/56 GOLD PLATED CONTACTS .156 CONTACT SPACING.
$2.50 EACH 10 FOR $22.00

PHOTO-FLASH CAPACITORS

170 MFD 330 VOLT

1 1/8" × 7/8"
2 FOR $1.50 10 FOR $7.00

750 MFD 330 VOLT

2" HIGH × 1 1/4" DIA
$1.25 EACH 10 FOR $11.00

120V INDICATOR

NEON INDICATOR. RATED 120 V 1/3 W. MOUNTS IN 5/16" HOLE ... RED LENS.
75¢ EACH
10 FOR $7.00
100 FOR $65.00

SOLID STATE RELAY

HEINEMANN ELECTRIC #101-5A-140-5 AMP
CONTROL: 3-32VDC
LOAD: 140VAC 5 AMPS
SIZE: 2" X 1" X 3/4" HIGH
$5.00 10 FOR $45.00

SPRING LEVER TERMINALS

TWO COLOR CODED TERMINALS ON A STURDY 2 3/4" × 3 3/4" BAKELITE PLATE. GREAT FOR SPEAKER ENCLOSURES OR POWER SUPPLIES.
$1.00 EACH 10 FOR $9.00

2 CHANNEL LIGHT ORGAN

EASILY HOOKS INTO STEREO SPEAKERS AND ALLOWS 110 VAC LIGHTS TO DANCE WITH MUSIC. TWO SEPARATE 110 VAC OUTPUTS FOR HIGH AND LOW FREQUENCY AUDIO SIGNALS. USE TWO ORGANS FOR STEREO...
$6.50 PER UNIT
COLOR LIGHT STRING AVAILABLE $1.75 EA

FREE! FREE! FREE! SEND FOR NEW LARGER! 48 PAGE CATALOG FREE! FREE! FREE!

LINE CORDS

TWO WIRE

6' 18ga TWO WIRE
3 FOR $1.00

THREE WIRE

18 INCH 18ga THREE WIRE
2 for $1.00
8 FOOT 18ga THREE WIRE
$2.00 EACH

KEY ASSEMBLY

5 KEY

$1.00 EACH
CONTAINS 5 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 3 3/4" LONG.

6 KEY

$1.25 EACH
CONTAINS 6 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 4 1/4" LONG.

ROTARY SWITCH

1 POLE 6 POSITION
1 1/4" DIA x 1 1/2" HIGH
75¢ EACH 10 for $6.00

COMPUTER GRADE CAPACITORS

2,000 mfd. 200 VDC	1 3/4" DIA. × 5" HIGH	$2.00
3,600 mfd. 40 VDC	1 3/8" DIA. × 3 3/4" HIGH	$1.00
6,400 mfd. 60 VDC	1 3/8" DIA. × 4 1/4" HIGH	$2.50
22,000 mfd. 40 VDC	2" DIA. × 6" HIGH	$3.00
31,000 mfd. 15 VDC	1 3/4" DIA. × 4" HIGH	$2.50
72,000 mfd. 15 VDC	2" DIA. × 4 3/8" HIGH	$3.50
185,000 mfd. 6 VDC	2 1/2" DIA. × 4 1/2" HIGH	$1.50

CLAMPS TO FIT CAPACITORS 50¢ ea.

SLIDE POTS

100K linear tape
2" LONG
1 5/8" TRAVEL 75¢ EACH

500K linear taper
2 7/8" LONG
1 3/4" TRAVEL 75¢ EACH

DUAL 100K audio taper
3 1/2" LONG
2 1/2" TRAVEL $1.50 EACH

L.E.D.'S

STANDARD JUMBO DIFFUSED

RED	10 FOR $1.50
GREEN	10 FOR $2.00
YELLOW	10 FOR $2.00

FLASHER LED

5 VOLT OPERATION RED JUMBO SIZE
$1.00 EACH

BI POLAR LED

2 FOR $1.70

LED HOLDERS

TWO PIECE HOLDER FOR JUMBO LED
10 FOR 65¢ 200 FOR $10.00

CLEAR CLIPLITE HOLDER

MAKE LED A FANCY INDICATOR. CLEAR.
4 FOR $1.00

SOLDERING IRON STAND

SPRING STEEL IRON HOLDER ON WEIGHTED BASE.
$5.00 EACH

RELAYS

MINIATURE 6 VDC RELAY

SUPER SMALL SPDT RELAY. GOLD COBALT CONTACTS. RATED 1 AMP AT 30 VDC. HIGHLY SENSITIVE. TTL DIRECT DRIVE POSSIBLE. OPERATES FROM 4.3 TO 6 V. COIL RES. 220 OHM.
1 3/16" × 13/32" × 7/16"
AROMAT # RSD-6V
$1.50 EACH 10 FOR $13.50

13 VDC RELAY

CONTACT: S.P.N.C. 10 AMP @ 120 VAC. ENERGIZE COIL TO OPEN CONTACT.
COIL: 13 VDC 650 OHMS
SPECIAL PRICE $1.00 EACH

4 PDT RELAY

- 14 pin style
- 3 amp contacts
- 24 volt d.c. or 120 volt a.c. coil
- Used but fully tested

$1.70 EACH
specify coil voltage
LARGE QUANTITIES AVAILABLE
SOCKETS FOR RELAY 50¢ each

CRYSTALS

CASE STYLE HC33/U

2 MHZ	COLORBURST 3579.545 KC
$3.50 EACH	$1.00 EACH

METAL OXIDE VARISTOR

G.E. # V82ZA12
50 VOLTS. NOMINAL D.C. VOLTAGE 5/8" DIAMETER.
2 FOR $1.50

BATTERY OPERATED SMOKE DETECTOR

BRK MODEL #79R UL APPROVED
9 VOLT BATTERY OPERATION FOR CEILING OR WALL MOUNT.
$8.00 EACH 2 FOR $15.00

TRANSISTORS

2N706	4 FOR $1.00
2N2222A	3 FOR $1.00
PN2222	4 FOR $1.00
2N2904	3 FOR $1.00
2N2905	3 FOR $1.00
2N2907	3 FOR $1.00

MINIATURE TOGGLE SWITCHES

ALL ARE RATED 5 AMPS @ 125 VAC

S.P.D.T. (on-on) — P.C STYLE. NON-THREADED BUSHING. 75¢ EACH 10 FOR $7.00

S.P.D.T. (on-on) — SOLDER LUG TERMINALS. $1.00 EACH 10 FOR $9.00 100 FOR $80.00

S.P.D.T. (on-off-on) — SOLDER LUG TERMINALS. $1.00 EACH 10 FOR $9.00 100 FOR $80.00

S.P.D.T. (on-off-on) — NON-THREADED BUSHING. P.C STYLE. 75¢ EACH 10 FOR $7.00

S.P.D.T. (on-on) — P.C LUGS. THREADED BUSHING. $1.00 EACH 10 FOR $9.00 100 FOR $80.00

D.P.D.T. (on-on) — SOLDER LUG TERMINALS. $2.00 EACH 10 FOR $19.00 100 FOR $180.00

3 1/2" SPEAKER

8 OHM IMPEDANCE, FULL RANGE SPEAKER. 8 OZ MAGNET. 4" DIAGONAL MOUNTING CENTERS.
$2.50 EACH
10 FOR $20.00

SOLID STATE BUZZER

STAR #SMB-06L. 6 VDC. TTL COMPATIBLE.
$1.00 EACH
10 FOR $9.00

POWER SUPPLY W/PRE-AMP

THIS SUPPLY WAS USED TO POWER AN 8 TRACK/CASSETTE UNIT. IT WILL SUPPLY APPROX. 18 VDC AND INCLUDES A SMALL PRE-AMP TO BOOST SIGNAL LEVEL. RCA PLUGS FOR LINE IN/OUT.
$4.50 EACH

TOLL FREE ORDERS ONLY
1-800-826-5432
(ORDER ONLY)
(IN CALIFORNIA: 1-800-258-6666)
ALASKA, HAWAII, OR INFORMATION
(213) 380-8000

ALL ELECTRONICS CORP.

905 S. VERMONT AVE. P.O. BOX 20406 LOS ANGELES, CA 90006

NEW LOCATION 6228 SEPULVEDA BLVD. VAN NUYS, CA 91411

QUANTITIES LIMITED
MINIMUM ORDER $10.00
USA: $2.50 SHIPPING
FOREIGN ORDERS INCLUDE SUFFICIENT SHIPPING
CALIF. RES. ADD 6 1/2%
NO C.O.D.!

CIRCLE 107 ON FREE INFORMATION CARD

www.americanradiohistory.com

PLANS AND KITS

PRINTED-circuit boards. Quick prototypes, production, design, reflow solder. Send print or description for quote to **KIT CIRCUITS,** Box 235, Clawson, MI 48017.

HI-FI speaker kits, auto speaker systems and speaker components from the world's finest manufacturers. For beginners and experts. Free literature. **A & S SPEAKERS,** Box 7462R, Denver, CO 80207 (303) 399-8609.

CABLE-TV converters: Jerrold, Hamlin, SB-3, AN-3, Mini-Code, Zenith & more. UHF converters: Deluxe II sinewave kits $95.00, gated pulse add/on $70.00. Complete units $195.00, with gated pulse $255.00. (Quantity discounts.) Repairs of all converters & cable boxes. Send SASE (54 cents postage) or call for info. 1 (312) 637-4408. **HIGGINS ELECTRONICS,** 6014 W. Nelson, Chicago, IL 60634. **No Illinois orders accepted.**

REVERBERATION FOR ORGANS

Solid state with controls for reverberation and room size.

EVERY ORGAN SHOULD OWN ONE. *Send for free flyer—*

DEVTRONIX ORGANS, INC.
6101 WAREHOUSE WAY
SACRAMENTO, CALIFORNIA 95826 Dept. B

PROJECTION TV...Convert your TV to project 7 foot picture...Results comparable to $2,500.00 projectors...Total cost less than $30.00...Plans and 8" lens $19.95...Illustrated information **free. MACROCOMA-GD,** Washington Crossing, PA 18977. Creditcard orders 24 hours, (215) 736-3979.

DESCRAMBLERS for Westar and Comstar Satellites. Also Deluxe II UHF sinewave kit, $140.00. Semikit $180.00. Information $3.00. **SOUTH FLORIDA SATELLITE,** Box 523153, Miami, FL 33152.

Active

The One Stop Electronic Shop!

Call Toll FREE 1-800-343-0874

In the United States:

Mail Orders	Boston	Seattle
P.O. Box 8000	133 Flanders Road	13107 Northup Way
Westborough, Mass.	Westborough, Mass.	Bellevue, Wash.
01581	01581	98004
(Mass) (617) 366-0500	(617) 366-9684	(206) 881-8191

In Canada:

Montréal	Toronto	Downsview
5651 Rue Ferrier	14 Carlton Street	86 St. Regis Cr. N.
Montréal, Québec	Toronto, Ontario	Downsview, Ontario
H4P 1N1	M5B 1K5	M3J 1Y8
(514) 731-7441	(416) 977-7692	(416) 630-0400
Ottawa	**Calgary**	**Vancouver**
1023 Merivale Road	3220-5th Ave. N.E.	3070 Kingsway
Ottawa, Ontario	Bay 2	Vancouver, B.C.
K1Z 6A6	Calgary, Alberta	V5R 5J7
(613) 728-7900	T2A 5N1	
	(403) 235-5300	(604) 438-3321

Visit your nearest Active store, call, write or circle the Reader Service Card for your copy of Active's new catalog.

CIRCLE 51 ON FREE INFORMATION CARD

WIDE stereo ambience for your component audio system. Inexpensive locally available parts. Circuit details $6.00. **ROBERT SINCLAIR,** 12215 L.B.J. Freeway, Suite 334, Garland, TX 75041.

SSAVI kit repair. Our technicians are experts at troubleshooting the FV-3, FV-4, FV-5, and Super-Z kits for $95.00 plus $5.50 postage & handling. **UHF preamp kit**—25dB of gain, 75 ohm input/output price $25.95. **UHF/VHF/FM amplifier**—24dB of gain, 75 ohm input/output and **completely assembled** for $39.95. MD residents add 5%. **HOWARD RESEARCH AND DESIGN,** Box 204, Ellicott City, MD 21043, (301) 465-8116.

HERO-1 RS232C software/hardware interface. 110-1200 baud upload/download utility. $55.00 U.S. **MasterCard/Visa. DAYCO ENTERPRISES,** Box 3374 Clearwater B.C., Canada V0E 1N0.

This ad is set with a background screen. Notice how it stands out on the page. This ad incurs a 25% premium charge. Perhaps your next ad could have a screen background. For ordering information, see top of Market Center listing.

CRYSTAL radios! Plans! Kits! Plans and catalog $3.00. **COUNTRY CRAFTS INC.,** Box 310, Edgewood, NM 87015.

CATALOG: Hobby, CB, broadcasting! Linears, transmitters, bugs, scramblers, downconverters, antennas, modifications, more! **PANAXIS,** Box 130-F12, Paradise, CA 95969.

NEW! Sensational sound quality! Factory assembled module converts mono to stereo, or enhances stereo with two distinct modes. Gives 3dB gain, .1% THD, between 30-20kHz. $44.95 plus $2.50. California add 6.5%. **SINETRON,** Box 661571, Sacramento, CA 95866.

DESCRAMBLER kits repaired for February's issue $24.00 parts & labor, $2.50 S&H, for details send $1.00 (offer void in Massachusetts.) 6-8 weeks returns, **NORTH EASTON ELECTRONICS,** PO Box 534, North Easton, MA 02356.

SPEECH synthesizer—unlimited vocabulary. Schematics and programs for Apple, VIC, Comm 64, color computer, TRS80, $6.00. **Talking Clock** for VIC, Comm 64, $3.00. All Radio Shack parts. **MICROTALK,** 39 Raymond St., Providence, RI 02908.

DIGITAL Klock kit plays 1-of-12 melodies each quarter hour. Displays time, date, and other features. Send $2.50 for assembly plans and pricing to **KERBER KLOCK KO.,** 36117 Hillcrest, Eastlake, OH 44094.

COMPUTER—laser disk interface, build your own. Schematics, parts list and sample program $12.00. **IRATA,** 2562 East Glade, Mesa, AZ 85204.

QUALITY printed-circuit boards. 15 cents sq-in. Free drilling. Quantity discounts. **INTERNATIONAL ENTERPRISE,** 6452 Hazel Circle, Simi Valley, CA 93063.

DESCRAMBLER plans. New design decodes gated sync suppressed signals—newest pilotless method. Circuit boards, most parts from Radio Shack. Detailed theory, drawings, schematics, instructions $14.95 plus $2.00 shipping. **DIRIJO CORP,** Box 212, Lowell, NC 28098.

TUBES $2.49. Large inventory including rare types. SASE brings lists. **ADNF,** 6690 7 Mile, S. Lyon, MI 48178.

INVENTORS!

IDEAS have value! Ever think of an idea, forget it, and see it later on the market? Many people don't forget, act quickly, and are rewarded by American industry. Write down your idea! We offer free disclosure registration and initial consultation regarding your idea's potential value. Call or write without delay for your free information package. **AMERICAN INVENTORS CORPORATION,** 82 Broad Street, Dept. RE, Westfield, MA 01086, (413) 568-3753. A fee based marketing company. Offices coast to coast.

REEL-TO-REEL TAPES

AMPEX professional series open reel tape, 1800-or 2400-feet on 7-inch reels, used once. Case of 40, $45.00. 10½ × 3600 feet and cassettes available. MasterCard/Visa. **VALTECH ELECTRONICS,** Box 6-RE, Richboro, PA 18954 (215) 322-4866.

www.americanradiohistory.com

ADVANCED COMPUTER PRODUCTS

SEND $2.00 for 1984 CATALOG

RAM UP-GRADES

64K D RAM (4164-200nS)
9 pcs for $50.00

16K D RAM (4116-200nS)
8 pcs for $12.95

REPEAT OF SELL-OUT
58 Key Unencoded Keyboard

$19.95 ea.

This is a new 58 key terminal Keyboard manufactured by a major manufacturer. It is uncoded with SPST keys unattached to any PC board. Solid molded plastic base measures 11" x 4".

Unencoded Key Pad

15 key Keypad with 1-10 keys and tab, return, (-), (.) and (,).

Only **$9.95 ea.**

STEPPER MOTOR

Operates by applying 12VDC in one direction and then reversing polarity (or square wave). Uses 12VDC, Clock Wise Rotation, Rated 3 RPM at 4 P.P.S. with a 5 degree stepping angle.

ACP Price **$3.95**
10 for $34.95

RS232 SIGNAL TESTER

COEX RS232 LINE TESTER
(7) LED Indicators

Only **$24.95**

Other Styles Also Available

UV "EPROM" ERASER

Model DE-4
$89.95
Holds 4 EPROM's at a time.

Model S-52T $325.00

CONNECTORS

DB25P (RS232)	$2.95
DB25S Female	3.25
Hood	1.49
Set with Hood, Sale	6.95
25/50 S/T, Apple	3.95
25/50 W/W, Apple	4.95
31/62 S/T, IBM	4.95
31/62 W/W, IBM	5.95
50/100 W/W, S-100 Connector	4.95
50/100 S/T, S-100 Connector	3.95

CORCOM FILTER

Popular CORCOM Filter
6 amps **$4.95**
Compatible Line Cord Add $3.50

SWITCHER SPECIAL

by ASTEC

Originally designed for the Apple III

+5 @ 4.0A
−5 @ .25A
+12 @ 2.5A
−12 @ .30A

only **$49.95**

MICROPROCESSORS

68000	$47.95	6504	$6.75	8749	$49.95
6800	3.95	6505	8.95	8755	39.95
68B00	10.50	6507	9.95	Z-80	3.75
6802	7.50	8035	8.95	Z-80A	4.30
68B02	20.95	8039	11.95	Z-80B	9.50
6803	18.50	8080	3.50	Z8001	44.95
6808	13.50	8085	4.75	Z8002	49.95
6809E	12.95	8085A-2	11.00	F-83850	19.95
68B09E	27.95	8086	29.95	2650	18.95
6809	11.50	8087	199.00	1802	5.95
68B09	27.95	8088	29.95	8008-1	16.95
6502	4.75	8089	84.95	2901	6.95
6502A	6.50	8741	34.95	2901A	8.50
6502B	9.75	8748	39.95	Z8671	37.95

WE STOCK IN DEPTH
CALL FOR VOLUME PRICING

EPROMS

1702	$4.25	2732	$4.75	2764-250	$7.75
2708	3.85	2732-250	8.25	2764-200	16.50
2758	4.95	2732-200	9.95	68764	39.95
2716	3.85	2732A4	6.75	68766	41.95
2716-1	5.75	2732A	9.75	27128	27.95
TMS2716	7.50	2732A2	13.00	5203AQ	14.50
TMS2516	6.25	2764	6.75	5204Q	13.50
TMS2532	5.75				

STATIC RAMS

2101	$2.75	2147	$4.75	5516	$11.95
2102-1	.99	2016-200	4.95	6116-4	4.95
2102L-4	1.29	2016-150	5.95	6116-2	8.75
2102L-2	1.49	2016-100	6.95	6116LP-4	5.90
2111	2.75	4044-4	3.95	6116LP2	10.95
2112	2.89	4044-2	6.50	Z6132	32.50
2114	1.49	4118	9.50	HM6264	47.50
2114L-2	1.89	5514	3.50	6167	9.95

DYNAMIC RAMS

MK4027	$1.85	4116-200	$1.49
UPD410	8.95	4164-200	5.95
UPD411	4.95	4164-150	6.75
MM5280	2.95	MC6605	8.50
MM5290	1.49	TMS4164-15	8.50
MM5298	1.49	41256	79.95

WE STOCK MOST OBSOLETE RAMS.
CALL FOR YOUR HARD TO FIND PARTS.

8000 SUPPORT

8155	$9.95	8238	$4.75	8271	$74.95
8156	9.95	8243	5.50	8272	37.50
8202	23.50	8250	10.50	8275	34.95
8203	36.50	8251	5.95	8279	8.95
8205	3.25	8251A	9.95	8279-5	9.95
8212	1.95	8253	6.50	8282	7.95
8214	4.50	8253-5	9.95	8283	7.95
8216	1.95	8255	5.95	8284	7.95
8224	2.20	8255A	9.95	8286	7.95
8226	2.75	8257	7.25	8287	7.95
8228	3.35	8257-5	9.95	8288	24.95
8237	18.50	8259	7.25	8289	48.50
8237-5	21.50	8259-5	37.50		

6500 SUPPORT

6520	$4.25	6532	$9.75	6545A	$26.50
6522	6.75	6532A	11.75	6551	11.50
6522A	8.50	6545	21.50	6551A	12.95

6800 SUPPORT

6810	$2.75	68B40	$17.95	68B50	$5.75
68B10	6.75	6843	31.50	6852	5.50
6820	4.25	6844	25.00	6860	7.75
6821	3.75	6845	14.75	6875	6.25
68B21	6.75	68B45	17.50	6880	2.50
6828	12.50	6847	11.75	68047	22.95
6840	12.50	6850	3.50	68488	19.50

Z-80 SUPPORT

Z80CTC	$3.95	Z80DART	$10.75	Z80ASIO/1	$12.50
Z80ACTC	4.75	Z80ADART	10.95	Z80SIO/2	11.50
Z80BCTC	9.75	Z80BDART	18.95	Z80ASIO/2	12.50
Z80PIO	3.95	Z80SIO/0	11.50	Z80BSIO/2	36.00
Z80APIO	4.75	Z80ASIO/0	12.50	Z80SIO/9	11.50
Z80BPIO	12.50	Z80SIO/1	11.50	Z80ASIO/9	12.50

CRT CONTROLLERS

6845	$14.75	8275	$34.95
68B45	17.50	7220	89.50
6847	11.50	COM5027	17.95
HD46505SP	15.75	COM5037	22.00
MC1372	6.75	8350	39.95
TMS9918	39.95	6545	21.50

DATA ACQUISITION

DAC01	$5.95	ADC0800	$15.25
DAC08	7.50	ADC0804	3.95
DAC100	7.50	ADC0809	4.95
DAC0800	4.95	ADC0817	9.95
DAC0808	2.95	MC3470	4.95
DAC1020	8.95	1408L6	1.50
DAC1022	5.95	1408L8	2.95
F9708	4.95	DAC86EX	8.95

MISC. HI-TECH

MM5740AAC	9.95	3341FIFO	$4.75
AY5 2376	13.75	2513-001UC	9.50
AY5 3600	13.75	2513-002LC	9.50
UPD7201	29.95	7107CPL	11.50
ULN2003	2.25		

WE STOCK 74HC & 74C CMOS

DISK SUPPORT

1691	$16.95	2791	$49.50
1771	16.00	2793	49.50
1791	22.95	2795	55.50
1793	25.95	2797	55.50
1795	27.95	6843	31.50
1797	44.50	8272	36.00
2143	18.95	UPD765A	36.00

PALS

PAL10H8	$3.75	PAL14L4	$3.95
PAL12H6	3.95	PAL16L8	9.95
PAL14H4	3.95	PAL16R8	7.75
PAL10L8	3.95	PAL16R6	7.75
PAL12L6	3.95	PAL16R4	7.75

INTERFACE

75188	$1.19	8T95	$ .85
75189	1.19	8T96	.85
8T26	1.75	8T97	.85
8T28	1.85	8T98	.85
8T31	2.75	75150	1.50
9636	3.75	75154	1.50
9637	3.75		

FUNCTION GEN.

MC4024	$3.75	LM566	$1.95
8038	3.75	XR2206	3.75

CLOCK CHIPS

MM5369	$3.50	MM58174	$10.95
MM58167	11.95	MSM5832	3.95

UARTS/USRTS

AY5-1013A	$3.95	2350	$9.75
AY5-1014A	6.75	8250	12.50
AY5-1015	6.75	IM6402	7.75
TR1602A	3.75	IM6403	8.75

OSCILLATORS

1.000	$10.95	8.000	$10.95
1.8432	10.95	10.000	10.95
2.000	10.95	12.000	10.95
4.000	10.95	16.000	10.95
5.000	10.95	18.432	10.95
5.0688	10.95	19.6608	10.95
6.000	10.95	20.000	10.95
6.144	10.95	22.1184	10.95

BAUD RATE GEN.

MC14411	$11.50	COM5016	$15.95
BR1941	10.50	COM8116	11.95
34702	12.75	MM5307	11.95

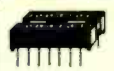
SOUND CHIPS

76477	$3.50	MC3340	$1.95
76488	5.90	SC-01 Votrax	39.95
76489	8.50	DT1050/ Digitalker	34.95
AY38910	8.95		
AY38912	12.50	MM54104	14.95

ZERO INSERT SOCKETS

14PIN21F	$5.75	24PIN21F	$7.95
16PIN21F	5.95	28PIN21F	9.50
18PIN21F	7.75	40PIN21F	10.75
20PIN21F	7.95	64PIN21F	19.95

SOCKETS



LOW PROFILE SOCKETS (TIN)

	1-24	24-49	50-100
8 pin LP	.16	.15	.14
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.29	.27	.24
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
40 pin LP	.60	.59	.58

3L WIREWRAP SOCKETS (GOLD)

	1-24	25-49	50-100
8 pin WW	.55	.54	.49
10 pin WW (Tin)	.65	.63	.58
14 pin WW	.75	.73	.67
16 pin WW	.80	.77	.70
18 pin WW	.95	.90	.81
20 pin WW	1.15	1.08	.99
22 pin WW	1.45	1.35	1.23
24 pin WW	1.35	1.26	1.14
28 pin WW	1.60	1.53	1.38
40 pin WW	2.20	2.09	1.89

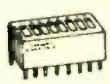
LINEAR

78H05K	$5.95	LM1414N	$1.90
78M06	1.49	LM1458CN/N	.49
78M G	1.49	MC1488N	.99
LM106AH	2.95	MC1489N	.99
LM300H	.99	LM1496M	.89
LM301CN	.35	LM1556N	1.50
LM304H	1.98	LM1820N	.95
LM305H	1.89	LM1850N	.95
LM306H	3.25	LM1889N	3.10
LM307CN	.29	LM2111N	1.75
LM308CN	.98	LM2900N	.99
LM309K	1.49	LM2901N	2.50
LM310CN	1.25	LM2917N	2.95
LM311D/CN	.89	CA3013T	2.19
LM312H	1.75	CA3018T	1.99
LM317T	1.70	CA3021T	3.49
LM318CN	1.49	CA3023T	2.99
LM319N/H	1.25	CA3035T	2.75
LM320K-XX*	1.35	CA3039T	1.29
LM320T-XX*	1.39	CA3046N	1.29
LM320H-XX*	1.25	CA3053N	1.49
LM323K	4.95	CA3059N	3.19
LM324N	.95	CA3060N	3.19
LM337K	5.95	CA3062N	4.95
LM338K	6.95	CA3065N	1.49
LM339N	.95	CA3080T	1.29
LM340K-XX*	1.75	CA3081N	1.69
LM340T-XX*	1.25	CA3082N	1.69
LM340H-XX*	1.25	CA3083N	1.55
LM344H	1.95	CA3086N	.80
LM348N	1.20	CA3089N	2.99
LM350K	5.60	CA3096N	3.49
LM358CN	.98	CA3097N	1.99
LM360N	1.49	CA3130T	1.30
LM372N	1.95	CA3140T	1.19
LM376N	3.75	CA3146N	2.49
LM377N	2.75	CA3160T	1.19
LM380CN/N	1.25	CA3190N	1.95
LM381N	1.79	CA3410N	.59
LM383T	1.95	MC3423N	1.49
LM386N	1.25	MC3460N	3.95
LM387N	1.40	SG3524N	3.95
LM390N	1.95	CA3600N	3.39
NE531V/T	3.75	LM3900N	.59
NE555V	.39	LM3905N	1.19
NE556N	.98	LM3909N	.98
NE561T	19.95	LM3914N	3.75
NE565N/H	1.25	LM3915N	3.95
NE566H/V	1.75	LM3916N	3.75
NE567V/H	1.50	RC4131N	2.95
NE592N	2.75	RC4136N	1.10
LM702H	1.99	RC4151N	3.70
LM709N/H	.29	RC4194TK	4.95
LM710N/H	.75	RC4195TK	5.40
LM711N/H	.39	ULN2001	1.25
LM715N	1.95	ULN2003	1.50
LM723N/H	.65	SN75450N	.59
LM733N/H	.98	SN75451N	.35
LM739N	1.15	SN75452N	.49
LM741CN/H	.33	SN75453N	.49
LM741CN-14	.19	SN75454N	.49
LM747N/H	.75	SN75491N	.89
LM748N/H	.39	SN75492N	.89
LM760CN	2.95	SN75493N	.89
LM1310N	1.90	SN75494N	.89
MC1330	1.95	TL494CN	4.20
MC1350	1.95	TL496CP	1.65
MC1358	1.75	TL497	4.95

74S00

74S00	$ .39	74S124	$3.69	74S244	$2.99
74S02	.43	74S133	.54	74S251	1.35
74S03	.45	74S134	.66	74S253	1.35
74S04	.89	74S135	1.15	74S257	1.29
74S05	.52	74S136	1.69	74S258	1.29
74S08	.49	74S138	1.99	74S260	.75
74S09	.49	74S139	1.29	74S280	2.79
74S10	.42	74S140	.73	74S287	2.99
74S11	.42	74S151	1.29	74S288	2.55
74S15	.42	74S153	1.29	74S373	3.10
74S20	.42	74S157	1.29	74S374	3.10
74S22	.42	74S158	1.29	74S387	2.75
74S30	.42	74S160	2.79	74S471	7.95
74S32	.49	74S174	1.49	74S472	7.95
74S38	1.19	74S175	1.49	74S473	7.95
74S40	.49	74S188	2.69	74S474	9.95
74S51	.42	74S194	1.89	74S475	9.95
74S64	.46	74S195	1.89	74S570	5.75
74S65	.46	74S196	1.89	74S571	5.75
74S74	.99	74S240	2.75	74S572	8.95
74S86	.72	74S241	2.75	74S573	8.95
74S112	.72	74S242	2.99	74S940	2.90
74S113	.72	74S243	2.99	74S941	2.90
74S114	.72				

DIP SWITCHES



2 Position	$ .99	7 Position	$1.39
4 Position	1.19	8 Position	1.49
5 Position	1.29	9 Position	1.65
6 Position	1.35	10 Position	1.69

MUFFIN® FAN

The dependable, low cost, largest selling fan for commercial cooling applications.

- 105cfm free air delivery
- 4.68" sq. x 1.50" deep.
- Weight - 17 oz.

SPECIAL PURCHASE
$9.50 ea.

7400

7400	$ .19	7475	$ .38	74161	$ .69
7401	.19	7476	.34	74162	.69
7402	.19	7479	4.60	74163	.69
7403	.19	7480	.49	74164	.69
7404	.19	7482	.95	74165	.69
7405	.23	7483	.45	74166	1.20
7406	Call	7485	.55	74167	2.95
7407	Call	7486	.35	74170	1.49
7408	.24	7489	1.75	74172	4.75
7409	.19	7490	.35	74173	.69
7410	.19	7491	.45	74174	.69
7411	.24	7492	.45	74175	.69
7412	.24	7493	.35	74176	.69
7413	.29	7494	.69	74177	.69
7414	.49	7495	.50	74179	1.34
7416	Call	7496	.69	74180	.75
7417	Call	7497	2.90	74181	1.75
7420	.19	74100	2.90	74182	.75
7421	.35	74107	.24	74184	2.25
7422	.29	74109	.37	74185	2.25
7423	1.19	74116	1.25		
7425	.29	74121	.29		
7426	.29	74122	.39	74190	1.15
7427	.25	74123	.45	74191	1.15
7429	.45	74125	.39	74192	.75
7430	.18	74126	.44	74193	.75
7432	.29	74128	.59	74194	.75
7437	.25	74132	.45	74195	.68
7438	.29	74136	.75	74196	.75
7439	1.19			74197	.75
7440	.19	74141	.65	74198	1.29
7441	.79	74142	2.95	74199	1.29
7442	.45	74143	4.50	74221	1.19
7443	.95	74144	2.95	74251	.69
7444	.65	74145	.59	74273	1.05
7445	.79	74147	1.69	74276	1.89
7446	.79	74148	1.19	74279	.75
7447	.65	74150	1.09	74283	1.40
7448	.79	74151	.49	74284	3.69
7450	.19	74152	.67	74285	3.69
7451	.19	74153	.49	74290	.89
7453	.19	74154	1.19	74298	.95
7454	.19	74155	.69	74365	.65
7459	.25	74156	.78	74366	.65
7460	.23	74157	.49	74367	.65
7470	.29	74158	1.65	74368	.65
7472	.29	74159	2.49	74390	1.45
7473	.29	74160	.79	74393	1.90
7474	.34			74490	1.90

74LS00

74LS00	$ .26	74LS113	$ .39	74LS245	$2.99
74LS01	.25	74LS114	.39	74LS247	1.10
74LS02	.25	74LS122	.49	74LS248	1.10
74LS03	.25	74LS123	1.19	74LS249	1.19
74LS04	.69	74LS124	2.75	74LS251	1.40
74LS05	.25	74LS125	.69	74LS253	1.40
74LS08	.25	74LS126	.49	74LS257	.85
74LS09	.25	74LS132	.59	74LS258	.98
74LS10	.25	74LS136	.49	74LS259	2.95
74LS11	.39	74LS138	.59	74LS260	.65
74LS12	.33	74LS139	.59	74LS261	2.49
74LS13	.39	74LS145	1.25	74LS266	.59
74LS14	.59	74LS148	1.49	74LS273	1.75
74LS15	.33	74LS151	.99	74LS275	4.40
74LS20	.26	74LS153	.99	74LS279	.59
74LS21	.29	74LS154	1.70	74LS283	.99
74LS22	.29	74LS155	1.19	74LS290	.99
74LS26	.29	74LS156	1.49	74LS293	.99
74LS27	.29	74LS157	1.49	74LS295	1.10
74LS28	.29	74LS158	1.49	74LS298	1.19
74LS30	.25	74LS160	1.49	74LS324	1.75
74LS32	.33	74LS161	1.49	74LS347	1.95
74LS33	.55	74LS162	1.49	74LS348	1.95
74LS37	.35	74LS163	1.49	74LS352	1.19
74LS38	.39	74LS164	1.49	74LS353	1.19
74LS40	.25	74LS165	1.49	74LS363	1.49
74LS42	.59	74LS166	2.48	74LS365	.99
74LS47	.79	74LS168	1.15	74LS366	.99
74LS48	.79	74LS169	1.15	74LS367	.99
74LS51	.25	74LS170	1.99	74LS368	.99
74LS54	.29	74LS173	.89	74LS373	2.99
74LS55	.29	74LS174	.89	74LS374	2.99
74LS73	.39	74LS175	.89	74LS375	.69
74LS74	.99	74LS181	2.20	74LS377	1.95
74LS75	.39	74LS190	1.15	74LS385	1.95
74LS76	.39	74LS191	1.15	74LS386	.65
74LS78	.45	74LS192	.98	74LS390	1.95
74LS83	.59	74LS193	.98	74LS393	1.95
74LS85	.69	74LS194	1.15	74LS395	1.70
74LS86	.39	74LS195	.95	74LS399	2.35
74LS90	.57	74LS196	.89	74LS424	2.95
74LS92	.49	74LS197	.89	74LS668	1.75
74LS93	.59	74LS221	1.15	74LS670	2.29
74LS95	.79	74LS240	1.99	81LS95	1.69
74LS96	.89	74LS242	1.99	81LS96	1.69
74LS107	.39	74LS243	1.99	81LS97	1.69
74LS109	.39	74LS244	1.99	81LS98	1.69
74LS112	.39	25LS2521	2.95	25LS2569	4.95

CMOS

4000	$ .29	4037	$1.95	4089	$2.95
4001	.24	4040	.75	4093	.45
4002	.24	4041	.75	4094	2.95
4006	.79	4042	.65	4098	2.29
4007	.25	4043	.65	4099	1.85
4008	.95	4044	.69	14408	12.95
4009	.39	4046	.80	14409	12.95
4010	.39	4047	.89	14410	12.95
4011	.24	4048	.99	14412	12.95
4012	.24	4049	.35	14415	8.95
4013	.35	4050	.34	14419	4.95
4014	.75	4051	.75	4501	.39
4015	.39	4052	.75	4502	.95
4016	.35	4053	.75	4503	.62
4017	.65	4055	3.95	4505	8.95
4018	.79	4056	2.95	4506	.75
4019	.39	4059	9.25	4507	.95
4020	.69	4060	.85	4508	1.25
4021	.69	4066	.39	4510	.79
4022	.69	4069	.28	4511	.79
4023	.25	4070	.35	4512	.79
4024	.59	4071	.28	4514	1.18
4025	.25	4072	.28	4515	1.79
4027	.45	4073	.28	4516	1.45
4028	.65	4075	.28	4518	.85
4029	.75	4076	.75	4520	.75
4030	.45	4077	.35	4555	.95
4031	3.25	4078	.35	4556	.99
4032	2.15	4081	.29	4566	2.25
4034	1.91	4082	.29	80C95	1.50
4035	.79	4085	.95	80C97	1.25

★ CRYSTALS ★

32.768KHz	$1.95	2.4576	$2.95	5.7143	$2.95	14.318MHz	$2.95
1.000MHz	3.75	3.2768ZMHz	2.95	6.000MHz	2.95	15.000MHz	2.95
1.842MHz	3.75	3.5795MHz	1.95	6.144MHz	2.95	16.000MHz	2.95
2.000MHz	2.95	4.000MHz	2.95	6.5536MHz	2.95	18.000MHz	2.95
2.010MHz	2.95	5.000MHz	2.95	8.000MHz	2.95	18.432MHz	2.95
2.097152MHz	2.95	5.0688MHz	2.95	10.000MHz	2.95	32.000MHz	2.95

TOLL FREE
800-854-8230
TWX
910-595-1565

Mail Order: P.O. Box 17329 Irvine, CA 92713
Retail: 1310B E. Edinger, Santa Ana, CA 92705
(714) 558-8813
542 W. Trimble, San Jose, CA 95131
(408) 946-7010

TERMS: MO, Cashier's Check, Bank Wire. Personal checks allow 2 weeks for processing. Include Drivers License and credit card #s Visa, AMEX, CB add 3% service charge. Add 3% shipping & handling or $2.50, whichever is greater. Add 10% for foreign orders or US Parcel Post. Include Telephone number. NO CODs. Prices subject to change without notice. Some items subject to prior sale. We reserve the right to substitute manufacturer. Retail prices may vary.

CIRCLE 106 ON FREE INFORMATION CARD

www.americanradiohistory.com

DON'T BLAME THE SOFTWARE!

Our Isolators eliminate equipment interaction, clean up interference, curb damaging power line spikes and lightning bursts.

ISO-1 ISOLATOR
3 isolated sockets; quality spike suppression; basic protection. . $81.95

ISO-3 SUPER-ISOLATOR
3 dual isolated sockets; suppressor; commercial protection. $122.95

ISO-17 MAGNUM ISOLATOR
4 quad isolated sockets; suppressor; laboratory grade protection. . $213.95

ESP® Electronic Specialists, Inc.
171 S. Main, Natick, MA 01760 (617) 655-1532
Toll Free Order Desk 1-800-225-4876
MasterCard, VISA, American Express

CIRCLE 60 ON FREE INFORMATION CARD

SATELLITE TELEVISION

UNSCRAMBLE secret satellite channels watch all the good stuff. Plans $19.95—kits $169.95—complete units $395.00—Details and order forms $3.00. **SCRAMCO,** 8688 Royal Drive, Noblesville, IN 46060.

SATELLITE-TV receiver breakthrough! Build your own system and save! Instruction manuals, schematics, circuit boards! Send stamped envelope: XANDI, Box 25647, Dept. 21F, Tempe, AZ 85282.

MULTI channel microwave antennas, highest quality, low prices, dealers welcome. D.T. compact $38.00, PT-1 $48.00, SR-1 $65.00, D.T. grid $69.00, PTS-33 $75.00, all units complete. **DAISY TENNA,** Box 42010, Phoenix, AZ 85080, (1-800) 874-9033.

GEARMOTORS for motorized satellite antenna projects, 110VAC, 101RPM: $32.50 plus $4.00 shipping. **Actuators** 36VDC, 18": $139.00 plus $10.00 shipping. **TEM,** 22518 97th, Corcoran, MN 55374. (612) 498-8014.

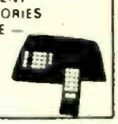
SATELLITE TV VIEWERS
Get the most complete weekly listings.
Send $1 for sample copy.
Satellite TV Week
P.O. Box 308E, Fortuna, California 95540
800-358-9997 (U.S.) • 800-556-8787 (Calif.)
707-725-2476 (all others)

ENJOY SATELLITE TV
Save money with easy, guaranteed, do-it-yourself antenna plans / kits. Electronic knowledge not necessary. Send $1.00 for catalog or $8.95 for 1984 "Consumer Guide to Satellite Television."
GFI-D9
Box 9108
Missoula, MT 59807

SATELLITE TV! Lowest prices, absolutely complete systems! Major brands. Free information. Complete installation/programming guide $3.00. Dealers wanted. Visa/MasterCard. AIS SATELLITE, Box 1226-R, Dublin, PA 18917, (215) 249-9411.

PCB for Satellite Stereo Project in October article is now only $15.00. **JIM RHODES, INC.,** 1025 Ransome Lane, Kingsport, TN 37660.

CABLE CONVERTERS & DESCRAMBLERS
HAMLIN OAK JERROLD
SCIENTIFIC SYLVANIA ZENITH
ALL TYPES OF CABLE TV EQUIPMENT
MICROWAVE ANTENNAS & ACCESSORIES
— FREE ILLUSTRATED BROCHURE —
— CALL OR WRITE —
H.M.R. SALES
221 E. CAMELBACK #1
PHOENIX, AZ 85012
(602) 993-0398



NEWSLETTERS

ELECTRONIC Systems Newsletter is a monthly publication written especially for the electronics hobbyist/experimenter. Fascinating projects, new ideas, sources. Free details. **AF PUBLISHING,** Dept. R2, PO Box 524, So. Hadley, MA 01075.

APPLE SOFTWARE

ELECTRONICS made easy for Apple II users with Mentor, the proven theoretical circuit design package. Excellent learning aid too. $174.95. **KORSMEYER ELECTRONIC DESIGN, INC.,** 5701 Prescott, Lincoln, NE 68506, (402) 483-2238.

FREE KIT Catalog
FUNCTION GENERATOR KIT $59.95
Auto-Ranging Cap-meter kit $79.95
Phone 209-772-2076
Write or Phone for FREE CATALOG
contains TEST & EXPERIMENTER'S EQUIP.
DAGE SCIENTIFIC INSTRUMENTS
BOX 144 VALLEY SPRINGS CA 95252

NEW ORLEANS AND WM. B. ALLEN

UP TO 25% OFF
ON
LARGEST FULL LINE INVENTORY OF
HAND HELD METERS
FOR EXAMPLE

FLUKE 73	$ 75
FLUKE 75	$ 88
FLUKE 77	$115
FLUKE 8020B	$170
FLUKE 8021B	$139
FLUKE 8022B	$126
FLUKE 8024B	$174
SOAR SX220	$ 22
SOAR ME540	$ 44

AS CLOSE AS YOUR TELEPHONE
CALL TOLL FREE FOR SAME DAY SHIPMENT ON
DISCOUNT PRICED TEST EQUIPMENT
18 LEADING MANUFACTURERS IN INSTRUMENTATION INCLUDING HUNTRON

UP TO 28.5% OFF
ON
HITACHI SCOPES
SAVE UP TO $480

V212	20MHz	(SAVE $164)	$ 451
V222	20MHz	(SAVE $191)	$ 524
V422	40MHz	(SAVE $246)	$ 679
V650F	60MHz	(SAVE $257)	$ 938
V209	20MHz	(SAVE $250)	$ 692
V1050F	100MHz	(SAVE $343)	$1252
V089	Vectorscope	(SAVE $480)	$1204
V099	Waveform	(SAVE $468)	$ 882

All Prices Include FREE $50 Probe

WM. B. ALLEN SUPPLY CO.
ALLEN SQUARE
300 BLOCK NORTH RAMPART, NEW ORLEANS, LA 70112

CALL TOLL FREE
800 535-9593
LOUISIANA 800 462-9520

CIRCLE 103 ON FREE INFORMATION CARD

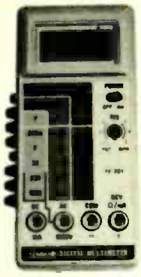
www.americanradiohistory.com

mcm ELECTRONICS

WE HAVE WHAT YOU NEED AT THE PRICES YOU WANT!

CALL TOLL FREE 1-800-543-4330

(IN OHIO, 1-800-762-4315)

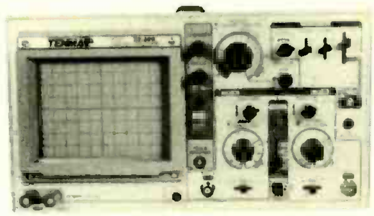


TENMA®

3½ DIGIT LCD MULTIMETER

- DC input impedance 10M ohm
- Diode and HFE Transistor tests
- Overload protection
- Auto polarity
- 2 year limited Warranty

#72-050 $39.80



TENMA®

20MHZ DUAL TRACE OSCILLOSCOPE

Two High Quality 10:1 probes included. Backed by our 2 year limited warranty. For specifications see MCM Catalog #9 page 118.

#72-320 $389.95

TENMA® COMBINATION DMM/CAPACITANCE METER

(With Transistor Gain Tester)

- User can easily read Voltage, AC and DC current, resistance up to 20M ohms, capacitance up to 20 microfarad, and HFE on a clear ½ inch, 3½ digit LCD display
- 2 year limited Warranty

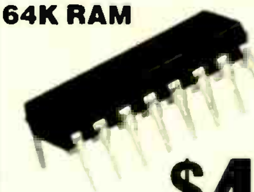
#72-045 $74.95 each

$69.95 (2 or more)

LOGIC PROBE WITH MEMORY

- Multi-family compatibility—DTL TTL HTL CMOSIC
- Detects pulses as short as 50 nanoseconds

#72-190 $19.95



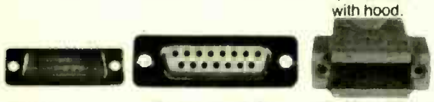
64K RAM

4164-150NS $4.60 (min 9)

RS232 SERIES: "D" CONNECTORS

PLUG SOCKET *HOOD

*All hardware is furnished with hood.



Type	Order #	1-9	10-49	50-up
9 Pin Plug	83-210	$1.39	$1.19	$ .90
9 Pin Socket	83-215	1.49	1.29	.95
9 Pin Hood	83-220	.99	.90	.70
15 Pin Plug	83-225	1.79	1.59	1.29
15 Pin Socket	83-230	2.00	1.89	1.55
15 Pin Hood	83-235	1.00	.95	.75
25 Pin Plug	83-240	2.20	1.95	1.45
25 Pin Socket	83-245	2.89	2.59	1.79
25 Pin Hood	83-250	1.29	1.15	.75

36 PIN PARALLEL CONNECTOR

- Centronics® type
- Solder type
- Gold plated contacts

#83-310

$3.95 (1-9)

$3.55 (10-49)

$2.75 (50-up)

FLOPPY DISK STORAGE CASE

- Mini diskette library case
- Superior quality padded vinyl construction
- Holds 10 5¼" diskettes
- 7" x 7" x 1¾"
- Reinforced bindings for added strength
- Clear plastic index pocket for easy labeling

#83-160

$3.75 (1-9)

$3.25 (10-49)

$2.95 (50-up)

SURGE PROTECTOR OUTLET STRIP

- 6 outlets
- 4 switched, 2 unswitched
- Illuminating rocker switch
- Fuse protected
- Protects sensitive digital circuits in today's computers
- Protects programs from data errors
- 6 amp

#83-255

$18.95 (1-9)

$14.95 (10-up)

DISK DRIVE CONTROLLER CARD

- Interfaces 2 drives to Apple II and Apple II+
- Display packaged
- Easy installation instructions included

#83-265

$44.50 (1-3)

$39.95 (4-up)

OSCILLOSCOPE PROBE KIT

- Bandwidth: 10:1 position: 100MHZ at—3dB into 20pF
- Rise Time: 10:1 position less than 3.5_{NS} nominal
- Kit contains: 10" earth lead, retractable hook, Ic test tip, insulator, BNC adaptor and trimming tool.

#72-010

$26.95 (1-4)

$24.95 (5-up)

BE SURE TO CALL FOR YOUR FREE 128 PAGE CATALOG!

OVER 4,500 ITEMS!!

We Also Have... a full line of: test equipment, computer accessories, telephone accessories, speakers, television parts, flybacks, yokes, switches, fuses, lamps, capacitors, resistors, cartridges, styli, wire, CATV equipment, and many more. **Over 4,500 items AT THE LOWEST PRICES AROUND!**

Terms:

- $10 minimum order. $1.00 charge for orders under $10.
- $20 minimum charge card order.
- Orders shipped UPS C.O.D.
- Most orders shipped within 24 hours.
- Sales office open 8:30am to 6:00pm, Saturdays 10:00am to 3pm, EST

mcm ELECTRONICS

858 East Congress Park Drive
Centerville, Ohio 45459
513-434-0031

We have the Largest Selection of Original Japanese Semiconductors in the Country!

SOURCE NO. RE-4

CI... FREE INFORMATION CARD

www.americanradiohistory.com

MOTOR BONANZA!!

12 TO 28 VDC USED ON LARGE 14" TAPE DECKS INCLUDING REEL AND CAPSTAN MOTORS. HIGH TORQUE, LOW-MED SPEED, LONG LIFE, QUIET OPERATION. REMOVED FROM EQUIPMENT, WE GUARANTEE THEM TO RUN LIKE NEW. MANY DIFFERENT STYLES ORDER 2 OR MORE OF ONE TYPE, WE'LL PICK YOU THE SAME STYLE.

SMALL	MEDIUM	LARGE
$15	$20	$25
WT 4 LB	WT 11 LB	WT 15 LB

ROBOT DRIVE

$4.95 K-9000 WT 2 LB

GREAT DRIVE FOR POWERING UP TO 25 LBS OF ROBOT! DRIVE IS 4-1/2 X 4-1/2 X 2-3/4, HAS TWO 3/8 X 1-1/4 SHAFTS INDIVIDUALLY DRIVEN BY 2 0-6 VDC MOTORS WITH GEAR REDUCTION. A MAGNETIC CLUTCH LINKS THE TWO MOTORS FOR POSITIVE STRAIGHT AHEAD TRACKING, AND PROVISION FOR AN OPTICAL PICKUP ALLOWS PRECISE CONTROL.

Disk Drive Cabinet

WT 2 LB C-0405 $12.95 10/$118

ALUMINUM CABINET DESIGNED TO HOLD ONE FULL SIZE OR 2 HALF HEIGHT 5-1/4" DRIVES. STYLE & BEIGE COLOR COORDINATE WITH APPLE COMPUTERS, BUT THEY LOOK GREAT WITH ANY SYSTEM. OVERALL SIZE IS 6 X 3-1/2 X 8-1/2" DEEP. MFR'S SURPLUS, MADE TO SELL FOR MUCH MORE $.

300 BAUD MODEM PC BOARDS

NEW UNUSED INDUSTRIAL QUALITY. BOTH FEATURE RS-232 INPUTS TO TIE TO YOUR COMPUTER AND PHONE LINE OUTPUTS. JUST ADD A SIMPLE POWER SUPPLY. SUPPLIED WITH DATA

ANSWER ONLY
5 LED'S FOR CARRIER DETECT, OFF-HOOK, TX, RX, AND DSR INDICATION. 4-3/4 X 8". PRE-WIRED EDGE CONN. RS-232S CONN. MODULAR PHONE JACK. CAN BE CONVERTED TO ORIGINATE ONLY BY ADJUSTING TONES. M-2500 $49

ANSWER/ORIGINATE
CRYSTAL-CONTROLLED, JUMPER SELECT FOR ALL FUNCTIONS INCLUDING ANSWER ORIGINATE. 6-1/2 X 12" OVERALL. M-2510 $59

BOTH WT 1 LB

THE RETURN OF THE SON OF WONDER CAP!

40 V 5500 MFD 99¢ ea. C-2579
10/$9 100/$84 1000/$750.

MEPCO AXIAL 'LYTIC PRICED TO SELL! VERY SMALL SIZE FOR THE HIGH CAPACITY AND VOLTAGE, ONLY 1" DIA X 3-5/8" LONG. — WT 0.3 LB —

CASSETTE DRIVE MOTOR

WT 0.5 LB M-2280 $2.95

MATSUSHITA MYT-5A03 13 VDC ✱ ADJUSTABLE GOVERNOR FOR CONSTANT SPEED ✱ SHOCK MOUNTED ✱ 1-3/4 DIA X 1-3/8 HIGH ✱

DISK DRIVE MOTOR

$19.95 M-2280 WT 2.5 LB

BODINE TYPE KYC-41 1800 RPM, 115 VAC 60 HZ SYNCHRONOUS MOTOR AS USED ON MOST 8" DISK DRIVES. LIST PRICE 125.00. 1/100 HP, CAPACITOR START.

LM 317 T

1.2V TO 37V ADJUSTABLE REGULATOR 99¢ 1.5 A OUTPUT

2-R'S AND 2-C'S ARE ALL YOU NEED TO BUILD A REGULATED ADJUSTABLE POWER SUPPLY.

74LS197

65¢

PRESETTABLE 40 MHZ BINARY COUNTER/LATCH HI-SPEED PROGRAMMABLE COUNTER IS GREAT FOR PRE-SCALING, DIVIDE BY 'N' COUNTERS

DATA SHEET 25¢

Tape Transport

X-1235 WT 2 LB $3.95

COMPLETE TRANSPORT INCLUDES HEAD, MOTOR, ALL MECHANICS. NO ELECTRONICS. NEW, 8 TRACK. GREAT FOR TALKING DOORBELLS, ROBOTS, ETC.

ELECTRONIC BARGAINS

IF YOU'RE NOT ON OUR MAILING LIST, YOU'RE MISSING OUTSTANDING BUYS ON THE FINEST IN ELECTRONIC PARTS FOR THE BUILDER. IN 8 YEARS OVER 250,000 HOBBYISTS HAVE DISCOVERED WHERE TO FIND USEFUL, UNIQUE OR DOWNRIGHT STRANGE ELECTRONICS AT GIVEAWAY PRICES.

WHY NOT SEND FOR OUR CATALOG TODAY — IT'S FREE!

TV Switch Box DPDT

THIS BABY HAS 2 INPUTS AND TWO OUTPUTS LABELED RF IN, CONV IN, CONV OUT, AND TV. A SINGLE SWITCH THEN SELECTS EITHER PREMIUM OR NORMAL VIEWING, REPLACING 2 COAXIAL SWITCHES THAT ARE USUALLY REQUIRED. FOUR 'F' CONNECTORS FOR 75 OHM USE.

A-2605 WT 0.5 LB $2.75

400 V 12 A SCR C126D

95¢

NICE DEAL ON A HEFTY TO-220 POWER TAB SCR, RATED 12 A RMS AT 400 VOLTS.

DIAMONDBACK ELECTRONICS COMPANY

PO BOX 12095
SARASOTA, FL. 33578

Phone Orders (813) 953-2829

CONTINENTAL US ADD $1.60 FOR THE FIRST LB & 50¢ FOR EACH ADDITIONAL LB. FLA ADD 5% TAX. WEST COAST ADD $1.80 FOR THE FIRST POUND & 50¢ FOR EACH ADDITIONAL POUND.

MAIL ORDER $7 MINIMUM
COD & CREDIT CARD $15 MINIMUM

CIRCLE 265 ON FREE INFORMATION CARD

SINE WAVE PUBLICATIONS

TROUBLE shooting manual includes alignment, antenna hookup, improvements, $8.00. Patent secrets information on authorization, control, $3.00. Both, $10.00. **SIGNAL**, Box 2512, Culver City, CA 90231.

BUSINESS OPPORTUNITIES

U.S. $8.00 including disk thousand name brand programs for Apple IBM-PC details. **RELIANT**, PO Box 33610, Sheungwan, Hong Kong.

BUY direct from Taiwan/Hong Kong. Details $1.00. Refundable. **TONY COLUCCI**, 56 Central Blvd., Merrick, NY 11566.

MECHANICALLY inclined individuals desiring ownership of small electronics manufacturing business—without investment. Write: **BUSINESSES**, 92-R, Brighton 11th, Brooklyn, NY 11235.

PROJECTION TV...Make $$$'s assembling projectors...Easy...Results comparable to $2,500.00 projectors...Your total cost less than $20.00... **Plans, 8" lens** & dealer's information $17.50... Illustrated information **free... MACROCOMA GDX**, Washington Crossing, PA 18977. Creditcard orders 24 hours (215) 736-2880.

BIG PROFITS ELECTRONIC ASSEMBLY BUSINESS

Start home, spare time. Investment knowledge or experience unnecessary. BIG DEMAND assembling electronic devices. Sales handled by professionals. Unusual business opportunity.

FREE: Complete illustrated literature
BARTA, RE-O Box 248
Walnut Creek, Calif. 94597

ELECTRONICS booklets. How to repair UHF descramblers and microwave downconverters. Make money fixing telephones. Built scrambler telephones and security devices. $12.00 each. Information $3.00. **SOUTH FLORIDA TELECOM**. Box 523153, Miami FL 33152.

MICROWAVE TV ANTENNA SYSTEMS

Freq. 2.1 to 2.7 GHz · 34 db Gain +

COMPLETE SYSTEMS:
(as Pictured)

Commercial 40" Rod Style	$99.95
Parabolic 20" Dish Style	$79.95

COMPONENTS

Down Converters (either style)	$34.95
Power Supplies (12V to 16V. DC+)	$24.95
Data Info (Plans)	$ 9.95

LIFETIME LIMITED WARRANTY PARTS & LABOR

CALL OR WRITE FOR KITS, PARTS, OR MORE INFORMATION

Shipping & Handling Add $5.00
We Repair Most Types Down Converters & Power Supplies

Phillips-Tech Electronics
P.O. Box 34772
Phoenix, AZ 85067
(602) 987-8972

Special Quantity Pricing
Dealers Wanted

MasterCard VISA COD'S

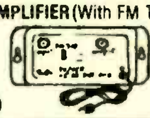
CIRCLE 116 ON FREE INFORMATION CARD

ELECTRONIC PARTS - KITS - ACCESSORIES
RETAIL/WHOLESALE/SURPLUS
HOBBIESTS ✱ EXPERIMENTERS ✱ TECHNICIANS ✱ REPAIRMEN

CAPACITORS - All types & values......
RESISTORS - Standard values ....
IC'S - Popular linear & CMOS ....
POTS - PC mt., pannel mt., etc........
SWITCHES - Mini-toggle (AMF 5A/120 vac)
SPDT........1.00 ea.
DPDT........1.50 ea.
REGULATORS - 7851 (8.5V), 7812, 7815, 7818 .... .75 ea.
CHOKES - 15μh, 33μh, 100μh, 1mh ... .50 ea.
OUTOOOR MATCHING TRANSFORMER .... 2.00 ea.
A-B SWITCH .... 3.00 ea.

UHF ANTENNA
4 BAY BOW-TIE
BEST-BUY FOR UNDER $50.00!
$14.95 ea./3 FOR $40.00
(Mounting Hardware Included)

UHF/VHF/FM ANTENNA AMPLIFIER (With FM Trap)
HIGH GAIN!
(25 DB AVERAGE)
✱✱✱ **A GREAT BUY!** ✱✱✱
$22.95 ea./3 FOR $60.00



SPEAKERS:

3" × 5" (8 Ohm, 2W)	$1.50 ea./3 for $4.00
3" (Round)	$1.00 ea./3 for $2.50

TRANSFORMERS:

120/20 vac.	$4.00 ea./3 for $10.00
120/12 VDC Wallpack	$4.00 ea./3 for $10.00

STEREO AMP. HOBBY KIT
(GREAT FOR TINKERING) $7.00 ea.

MUCH, MUCH, MORE!!!!

CURRENT SPECIALS

SEMICONDUCTORS:
1330 Generic (No mrking.) .80 ea.
LM386N .50 ea. or $35.00/100
NE564 2.00 ea.
565 Generic .70 ea.
1349 Generic 1.00 ea.
7815(House #).50 ea. or $35.00/100
CAPACITORS:
470 μf Rad. Lytic .50 ea. or $10/100
2200 uf Axial Litic 1.00 ea.
5-50 pf Trimcap .65 ea. or $50/100
RESISTORS/POTS:
Resistor assortments (mixed values)
¼ Watt $2.00/100
½ Watt $5.00/100
1 Watt $10.00/100
25K CRL Vert. PC Trimpots .30 ea.
20K Pot (Bourns 3386 type) .50 ea.
5K Pannel Mt. Pot + Knob .75 ea.

MUCH MORE!!!
SEND FOR FREE FLYER

X-TRA SPECIALS

7805 Regulator............ .50 ea.
.01 μf Mono Caps (50V) $12.00/100
.047 μf Mono Caps (50V) $12.00/100
Indoor Matching Transformer .50 ea.

ANY SIZE ORDER PUTS YOU ON OUR MAILING LIST. YOU WILL RECEIVE OUR UPDATED CATALOGS FREE OF CHARGE OR OBLIGATION.

TERMS

Check, Money Order or COD
Minimum Order $10.00
Add $2.50 S&H/$4.00 COD
IL. add 7% Sales Tax
(Allow 2-3 wks. for personal checks)
Phone 10 AM - 5 PM
Chicago Time

NEW DEAL ELECTRONICS
3462 N. PULASKI
CHICAGO, IL. 60641
(312) 286-0908

CIRCLE 275 ON FREE INFORMATION CARD

www.americanradiohistory.com

DIGI-KEY CORPORATION

1-800-344-4539

AK., HI., 218-681-6674

VISA

NATIONAL SEMICONDUCTOR • PANASONIC • AAVID • CHEMWIK • ATLANTIC DIODES • ARIES • PLESSEY • MOLEX • AAVID • E. F. J. • OK MACHINE • UNGAR • GC CHEMICALS • NATIONAL SEMICONDUCTOR • PANASONIC •

QUALITY — Name brand products from nationally recognized manufacturers.

SERVICE — Computerized order processing and inventory control.

SAVINGS — Volume Discounts • OEM Quantity Pricing • Toll Free 800 Number

CHEMICALS • ARIES • PLESSEY • MOLEX • MACHINE • DIAMOND TOOL • UNGAR • GC CHEMICALS • AS INSTRUMENTS • D-K • A P PRODUCTS • DIAMOND TOOL • UNGAR • GC CHEMICALS • ARIES • CHEMICALS • ARIES • PLESSEY • MOLEX •

MasterCharge

DIGI-KEY — DIGI-KEY — DIGI-KEY — The Big DIGI-KEY Discount makes a Big Price Difference (SEE BELOW) — DIGI-KEY — DIGI-KEY

INTEGRATED CIRCUITS

Linear — 4000 CMOS — Micro. — Interface — Memory — A/D & D/A

1% Metal Film Resistors

½ Watt • Temperature Coefficient: 100 ppm/°C

Dielectric Withstanding Voltage: 500V — Max. Voltage: 500V

Standard Resistor Values from 10 to 1.00M ohms

STANDARD RESISTOR VALUE TABLE

How To Order: Take any standard resistor value and add an "F" to it. Order by quantity and price listed below.

5% Carbon Film Resistors

5% Carbon Film Resistor Values (In Ohms)

4116 200 nsec 16,384x1 D Ram

Prime Parts As Low As $1.[illegible] Each

Part No.	8	32	128	512	1024
4116N-ND	15.12	57.12	215.00	806.40	1397.75
5280N-ND	15.12	57.12	215.00	806.40	1397.75
Price Each	1.[illegible]	1.785	1.[illegible]	1.575	1.365

SILICON RECTIFIERS

Cat. No.	Description	Pkg.	10	100	1000	10,000
1N4001	1 Amp 50 PIV	DO41	.80	7.00	60.00	510.00
1N4002	1 Amp 100 PIV	DO41	.80	7.00	60.00	540.00
1N4003	1 Amp 200 PIV	DO41	.80	7.50	64.00	563.00
1N4004	1 Amp 400 PIV	DO41	.80	7.90	68.00	588.00
1N4005	1 Amp 600 PIV	DO41	1.00	8.00	74.00	675.00
1N4006	1 Amp 800 PIV	DO41	1.00	9.00	80.00	641.00
1N4007	1 Amp 1000 PIV	DO41	1.50	12.00	100.00	710.00
1N4148	Ultra Fast Switching Diode (1N914 equiv)	DO41	.60	5.00	32.00	270.00

3 AMP SILICON RECTIFIER

Part No.	Description	Pkg.	1	10	100	1,000
1N5400	3 Amp 50PIV	Plastic	.28	2.56	22.80	198.50
1N5401	3 Amp 100PIV	Plastic	.29	2.70	24.00	210.00
1N5402	3 Amp 200PIV	Plastic	.31	2.83	25.20	220.00
1N5404	3 Amp 400PIV	Plastic	.33	2.97	26.40	231.00
1N5405	3 Amp 600PIV	Plastic	.38	3.15	28.00	246.00
1N5407	3 Amp 800PIV	Plastic	.40	3.60	32.00	280.00
1N5408	3 Amp 1000PIV	Plastic	.50	3.80	32.00	280.00

Silicon Transistors

TEXAS INSTRUMENTS I.C. SOCKETS

Body — 94 V-0 polyester with Copper Alloy contacts. Accommodates standard IC leads up to .014" thick and .025" wide. Contact is designed and oriented to the insulator to grasp the broad "face" of the IC lead, allowing for low insertion and high retention forces. Socket is designed to achieve maximum density on boards.

SOLDER TAIL DIP SOCKETS

- Single beam
- Low profile
- YOUR CHOICE: TIN OR GOLD*

TIN PLATED SOLDER TAIL — GOLD INLAY SOLDER TAIL

WIRE WRAP DIP SOCKETS

- Standard profile
- Universal mounting and packaging capabilities
- YOUR CHOICE: TIN OR GOLD*
- TEXAS INSTRUMENTS QUALITY

TIN PLATED WIRE WRAP — GOLD INLAY WIRE WRAP

TEXAS INSTRUMENTS GOLD EDGEBOARD CONNECTORS

Solder Tail — Solder Eye — Wire Wrap

RELIABLE, COST-EFFICIENT CONTACT DESIGN

H4 SERIES .100" x .200" EDGEBOARD CONNECTORS

H4 SERIES .125" x .250" EDGEBOARD CONNECTORS

H4 SERIES .156" x .200" EDGEBOARD CONNECTORS

ELECTRONIC HARDWARE KIT — CAT. NO. — $14.95

PANASONIC ELECTROLYTIC KIT

150 CAPACITORS — ASSORTMENT OF 15 POPULAR CAPACITORS — Cat. No. P6200-Kit — ONLY $35.95

Panasonic LS Series

Miniature Aluminum Electrolytic Capacitors

PANASONIC V-SERIES

Stacked Metallized Film Capacitors

DISC CAPACITORS

Panasonic Ceramic Disc Capacitors

NEW! KIT — 310 DISC CAPACITORS — CAT. NO. DH-KIT — ONLY $24.95

NPO TYPE

PANASONIC METALLIZED POLYESTER CAPACITORS

NEW! KIT — CAT. NO. — ONLY $54.95

PLESSEY MINI BOX

140 CAPACITORS — ASSORTMENT OF 14 POPULAR "MINI-BOX" CAPACITORS — CAT. NO. 3050P-Kit — ONLY $35.95

PANASONIC RESIN DIPPED TANTALUM CAPACITORS

NEW! KIT — 100 TANTALUM CAPACITORS — CAT. NO. T-KIT — ONLY $54.95

Panasonic TSW Series

Large Aluminum Electrolytic Capacitors

AMP CHAMP CONNECTORS

Digi-Key Part No.	No. of Pins	Recep. tacle or Plug	Mounting Description	Price
A1500	24	P	Cable Screw Lock	$3.40
A1501	36	P	Cable Screw Lock	3.70
A1502	24	P	Cable Bail Lock	3.57
A1503	36	P	Cable Bail Lock	3.80
A1504	24	R	Cable Screw Lock	3.40
A1505	36	R	Cable Screw Lock	3.70
A1506	24	R	Cable Strain Relief	1.[illegible]
A1507	36	R	Cable Strain Relief	1.[illegible]
A1508	24	R	Panel, Screw, Bail	3.57
A1509	36	R	Panel, Screw, Bail	3.80
A1520			T Handle Wire Insertion Tool	5.30
A1510	24	R	PC Board Vertical	7.25
A1511	36	R	PC Board Vertical	8.02
A1512	24	R	PC Board Edge	7.62
A1513	36	R	PC Board Edge	8.65
A1514	24	R	PC Board Right Angle	8.37
A1515	36	R	PC Board Right Angle	[illegible]

Latch Type Connectors

Digi-Key Part No.	No. of Pins	Recep. tacle or Plug	Mounting Description	Price
A1560	24	P	Screw Lock	$8.52
A1561	24	P	Bail Lock	8.72
A1562	36	P	Screw Lock	9.42
A1563	36	P	Bail Lock	9.62
A1564	24	R	Screw or Bail	8.52
A1565	24	R	Panel, Screw, Bail	8.72
A1567	36	R	Screw or Bail	9.42
A1568	36	R	Panel, Screw, Bail	9.62

MOUNTING HARDWARE AVAILABLE SEPARATELY.

The Digi-Key volume discount and service charges are simple to apply. Most items sold by Digi-Key may be combined for a volume discount. Items that are not discountable are identified by the suffix-ND following the part number. After writing your order, total all of the discountable items and apply the appropriate discount. To this subtotal, add the non-discountable items. Then add the service charge. We pay all shipping and insurance to addresses in the U.S.A., Canada and Mexico when check or money order accompanies order.

WHEN ORDERING BY PHONE, CALL 1-800-344-4539 (AK, HI, call 218-681-6674) By mail send your order to: DIGI-KEY, Highway 32 South, Thief River Falls, MN 56701

You may pay by check, money order, Master Charge, VISA or C.O.D. **DIGI-KEY GUARANTEE:** Any parts or products purchased from Digi-Key that prove to be defective will be replaced or refunded if returned within 90 days from receipt with a copy of your invoice. **"PRICES SUBJECT TO CHANGE WITHOUT NOTICE."**

SERVICE CHARGES		VOLUME DISCOUNT	
0.00-$ 9.99	Add $2.00	$ 0.00-$ 99.99	NET
10.00-$25.00	Add $0.75	$ 100.00-$249.99	Less 10%
25.00-$49.99	Add $0.50	$ 250.00-$499.99	Less 15%
50.00-$99.99	Add $0.25	$ 500.00-$999.99	Less 20%
100.00 & Up	No Charge	$1000.00 & Up	Less 25%

CIRCLE 82 ON FREE INFORMATION CARD

www.americanradiohistory.com

DoKay

COMPUTER PRODUCTS, Inc.

ORDER TOLL FREE

(800) 538-8800

(CALIFORNIA RESIDENTS)

(800) 848-8008

VISA MasterCard

STATIC RAMS

2101	256 x 4 (450ns)	1.90
5101	256 x 4 (450ns) (cmos)	3.90
2102-1	1024 x 1 (450ns)	.88
2102L-4	1024 x 1 (450ns) (LP)	.98
2102L-2	1024 x 1 (250ns) (LP)	1.45
2111	256 x 4 (450ns)	2.45
2112	256 x 4 (450ns)	2.95
2114	1024 x 4 (450ns)	.98
2114-25	1024 x 4 (250ns)	1.18
2114L-4	1024 x 4 (450ns) (LP)	1.20
2114L-3	1024 x 4 (300ns) (LP)	1.30
2114L-2	1024 x 4 (200ns) (LP)	1.40
2125	1024 x 1	2.48
2147	4096 x 1 (55ns)	4.90
TMS4044-4	4096 x 1 (450ns)	3.45
TMS4044-3	4096 x 1 (300ns)	3.95
TMS4044-2	4096 x 1 (200ns)	4.45
MK4118	1024 x 8 (250ns)	8.90
TMM2016-200	2048 x 8 (200ns)	4.10
TMM2016-150	2048 x 8 (150ns)	4.90
TMM2016-100	2048 x 8 (100ns)	6.10
HM6116-4	2048 x 8 (200ns) (cmos)	4.70
HM6116-3	2048 x 8 (150ns) (cmos)	4.90
HM6116-2	2048 x 8 (120ns) (cmos)	8.90
HM6116LP-4	2048 x 8 (200ns) (cmos)	5.90
HM6116LP-3	2048 x 8 (150ns) (cmos)(LP)	6.90
HM6116LP-2	2048 x 8 (120ns) (cmos)(LP)	8.85
Z-6132	4096 x 8 (300ns) (Qstat)	33.95
HM6264P-15	8192 x 8 (150ns) (cmos)	38.95
HM6264LP-15	8192 x 8 (150ns) (cmos)	48.95

LP = Low Power Qstat = Quasi-Static

DYNAMIC RAMS

TMS4027	4096 x 1 (250ns)	1.95
UPD411	4096 x 1 (300ns)	1.95
MM5280	4096 x 1 (300ns)	1.85
MK4108	8192 x 1 (200ns)	1.90
MM5298	8192 x 1 (250ns)	1.80
4116-200	16384 x 1 (200ns)	.79
4116-150	16384 x 1 (150ns)	1.20
2118	16384 x 1 (150ns) (5v)	4.90
4164-250	65536 x 1 (250ns)	4.45
4164-200	65536 x 1 (200ns) (5v)	5.00
4164-150	65536 x 1 (150ns) (5v)	5.00

5V = Single 5 Volt Supply

EPROMS

1702	256 x 8 (1us)	4.45
2708	1024 x 8 (450ns)	2.48
2758	1024 x 8 (450ns) (5v)	5.90
2716	2048 x 8 (450ns) (5v)	2.85
2716-1	2048 x 8 (350ns) (5v)	5.90
TMS2516	2048 x 8 (450ns) (5v)	5.45
TMS2716	2048 x 8 (450ns)	6.95
TMS2532	4096 x 8 (450ns) (5v)	5.90
2732	4096 x 8 (450ns) (5v)	4.45
2732-250	4096 x 8 (250ns) (5v)	8.90
2732-200	4096 x 8 (200ns) (5V)	10.85
2764	8192 x 8 (450ns) (5v)	8.45
2764-250	8192 x 8 (250ns) (5v)	7.45
2764-200	8192 x 1 (200ns) (5v)	16.45
TMS2564	8192 x 8 (450ns) (5v)	16.95
MC68764	8192 x 8 (450ns) (5v) (24 pin)	38.95
27128	16384 x 8 Call	24.95

5v = Single 5 Volt Supply

74LS00

74LS00	.23	74LS125	.48	74LS260	.58
74LS01	.24	74LS126	.48	74LS266	.54
74LS02	.24	74LS132	.58	74LS273	1.45
74LS03	.24	74LS133	.58	74LS275	3.30
74LS04	.23	74LS136	.38	74LS279	.48
74LS05	.24	74LS137	.88	74LS280	1.85
74LS08	.27	74LS138	.54	74LS283	.58
74LS09	.28	74LS139	.54	74LS290	.88
74LS10	.24	74LS145	1.15	74LS293	.88
74LS11	.34	74LS147	2.45	74LS295	.98
74LS12	.34	74LS148	1.30	74LS298	.88
74LS13	.44	74LS151	.54	74LS299	1.70
74LS14	.58	74LS153	.54	74LS323	3.45
74LS15	.34	74LS154	1.85	74LS324	1.70
74LS20	.24	74LS155	.68	74LS352	1.25
74LS21	.28	74LS156	.68	74LS353	1.25
74LS22	.24	74LS157	.64	74LS363	1.30
74LS26	.28	74LS158	.58	74LS364	1.90
74LS27	.28	74LS160	.68	74LS365	.48
74LS28	.34	74LS161	.64	74LS366	.48
74LS30	.24	74LS162	.68	74LS367	.44
74LS32	.28	74LS163	.84	74LS368	.44
74LS33	.54	74LS164	.68	74LS373	1.35
74LS37	.34	74LS165	.94	74LS374	1.35
74LS38	.34	74LS166	1.90	74LS377	1.35
74LS40	.24	74LS168	1.70	74LS378	1.13
74LS42	.48	74LS169	1.70	74LS379	1.30
74LS47	.74	74LS170	1.45	74LS385	1.85
74LS48	.74	74LS173	.68	74LS386	.44
74LS49	.74	74LS174	.54	74LS390	1.15
74LS51	.24	74LS175	.54	74LS393	1.15
74LS54	.28	74LS181	2.18	74LS395	1.15
74LS55	.28	74LS189	8.90	74LS399	1.45
74LS63	1.20	74LS190	.88	74LS424	2.90
74LS73	.38	74LS191	.88	74LS447	.38
74LS74	.34	74LS192	.78	74LS490	1.90
74LS75	.38	74LS193	.78	74LS624	3.95
74LS76	.38	74LS194	.68	74LS640	2.15
74LS78	.40	74LS195	.68	74LS645	2.15
74LS83	.58	74LS196	.78	74LS668	1.65
74LS85	.68	74LS197	.78	74LS669	1.85
74LS86	.38	74LS221	.88	74LS670	1.45
74LS90	.54	74LS240	.94	74LS674	9.80
74LS91	.88	74LS241	.98	74LS682	3.15
74LS92	.54	74LS242	.98	74LS683	3.15
74LS93	.54	74LS243	.98	74LS684	3.15
74LS95	.74	74LS244	1.25	74LS685	3.15
74LS96	.88	74LS245	1.45	74LS688	2.35
74LS107	.38	74LS247	.74	74LS689	3.15
74LS109	.38	74LS248	.96	74LS783	23.95
74LS112	.38	74LS249	.96	81LS95	1.45
74LS113	.38	74LS251	.58	81LS96	1.45
74LS114	.38	74LS253	.58	81LS97	1.45
74LS122	.44	74LS257	.58	81LS98	1.45
74LS123	.70	74LS258	.58	25LS2521	2.75
74LS124	2.85	74LS259	2.70	25LS2569	4.20

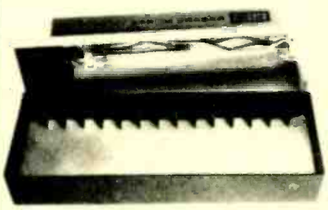
CRT CONTROLLERS

1771	14.95	2797	84.85
1791	23.95	6843	33.95
1793	25.95	8272	38.95
1795	28.95	UPD765	38.95
1797	48.95	MB8876	23.95
2791	79.95	MB8877	25.95
2793	79.95	1691	16.95
2795	84.95	2143	17.95

DISC CONTROLLERS

1771	14.95	2797	84.95
1791	23.95	6843	33.95
1793	25.95	8272	38.95
1795	48.85	UPD765	38.85
1797	48.95	MB8876	28.95
2791	78.95	MB8877	33.85
2793	79.85	1691	16.95
2795	84.85	2143	17.95

QUV-T8/1 EPROM Eraser



QUV-T8/1 Economy Model: Low cost EPROM eraser in plastic enclosure. The UV element is in the lid and you place the EPROMS in the bottom half. No timer or switch option.

- Erases up to 8 EPROMS in 15 - 20 minutes.
- 12,000 uWatts at 1" distance.
- 90-Day Warranty

49.95

6500

1 MHZ		2 MHZ	
6502	4.90	6502A	6.90
6504	6.90	6522A	8.90
6505	8.90	6532A	10.95
6507	9.90	6545A	28.95
6520	4.30	6551A	10.95
6522	6.90	**3 MHZ**	
6532	8.90	6502B	9.90
6545	21.50		
6551	10.85		

6800

68000	58.95	6860	8.90
6800	3.90	6862	10.95
6802	7.90	6875	6.90
6808	12.90	6880	2.20
6809E	18.95	6883	21.95
6809	10.95	68047	23.95
6810	2.90	68488	18.95
6820	4.30		
6821	3.20	**1 MHZ**	
6828	13.95	68B00	9.95
6840	11.95	68B02	21.25
6843	33.95	68B09E	28.95
6844	24.95	68B09	28.95
6845	13.95	68B10	6.90
6847	10.95	68B21	6.90
6850	3.20	68B45	18.95
6852	15.70	68B50	5.90

8000

8035	5.90	8089	88.95
8039	6.90	8155	6.90
INS-8060	18.95	8155-2	7.90
INS-8073	48.95	8156	6.90
8080	3.90	8185	28.95
8085	5.90	8185-2	38.95
8085A-2	10.95	8741	38.95
8086	28.95	8748	49.95
8087	199.00	8755	23.95
8088	38.95		

8200

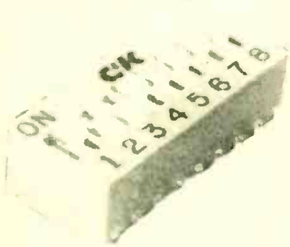
8202	23.95	8255-5	5.20
8203	38.95	8257	7.90
8205	3.45	8257-5	8.90
8212	1.75	8259	6.85
8214	3.80	8259-5	7.45
8216	1.70	8271	75.00
8224	2.20	8272	38.95
8226	1.75	8275	28.95
8228	3.45	8279	8.90
8237	18.95	8279-5	9.00
8237-5	20.95	8282	6.45
8238	4.45	8283	6.45
8243	10.95	8284	14.95
8250	16.95	8286	6.45
8251	4.45	8287	6.45
8253	6.90	8288	24.00
8253-5	7.90	8289	48.95
8255	4.45	8292	16.95

Z-80

2.5 MHZ		4.0 MHZ	
Z80-CPU	3.90	Z80A-CPU	4.29
Z80-CTC	3.95	Z80A-CTC	4.90
Z80-DART	10.95	Z80A-DART	9.95
Z80-DMA	13.85	Z80A-DMA	12.85
Z80-PIO	3.95	Z80A-PIO	4.29
Z80-SIO/0	11.95	Z80A-SIO/0	12.95
Z80-SIO/1	11.95	Z80A-SIO/1	12.95
Z80-SIO/2	11.85	Z80A-SIO/2	12.85
Z80-SIO/9	11.85	Z80A-SIO/9	12.95

6.0 MHZ		ZILOG	
Z80B-CPU	9.85	Z6132	33.95
Z80B-CTC	12.85	Z8671	38.95
Z80B-PIO	12.95		
Z80B-DART	12.95		

DIP SWITCHES



4 POSITION	.84
5 POSITION	.89
6 POSITION	.89
7 POSITION	.94
8 POSITION	.94

1984 – THE IC MASTER –

Your ticket to fast and easy IC selections

$ 89.95

INTERFACE CHIPS

8T26	1.54	8T98	.88
68T26	1.84	DM8131	2.90
8T95	.88	DP8304	2.24
8T96	.88	DS8835	1.94
8T97	.88	DS8836	.98

CRYSTALS

1.0000 MHz	3.69	8.0000 MHz	2.69
1.8432 MHz	3.69	10.0000 MHz	2.69
2.0000 MHz	2.69	10.7386 MHz	2.69
2.0972 MHz	2.69	12.0000 MHz	2.69
2.4576 MHz	2.69	14.3182 MHz	2.69
3.2768 MHz	2.69	15.0000 MHz	2.69
3.5795 MHz	2.69	16.0000 MHz	2.69
4.0000 MHz	2.69	17.4300 MHz	2.69
4.1943 MHz	2.69	18.0000 MHz	2.69
4.9160 MHz	2.69	18.4320 MHz	2.69
5.0000 MHz	2.69	19.6608 MHz	2.69
5.0688 MHz	2.69	20.0000 MHz	2.69
5.1680 MHz	2.69	22.1184 MHz	2.69
5.2429 MHz	2.69	32.0000 MHz	2.69
5.7143 MHz	2.69	36.0000 MHz	2.69
6.0000 MHz	2.69	48.0000 MHz	2.69
6.1440 MHz	2.69	49.4350 MHz	2.69
6.4000 MHz	2.69	49.8900 MHz	2.69
6.5536 MHz	2.69		

32.768 KHz...... 1.69

CRYSTAL CLOCK OSCILLATORS

PART NO.	FREQUENCY	PRICE
1.000	1.0000 MHz	9.95
1.843	1.8432 MHz	9.95
2.000	2.0000 MHz	9.95
4.000	4.0000 MHz	9.95
8.000	8.0000 MHz	9.95
10.000	10.0000 MHz	9.95
16.000	16.0000 MHz	9.95
18.432	18.4320 MHz	9.95
19.660	19.6608 MHz	9.95
20.000	20.0000 MHz	9.95
32.000	32.0000 MHz	9.95

VOLTAGE REGULATORS

7805T	.74	7905T	.84
78M05C	.34	7908T	.84
7808T	.74	7912T	.84
7812T	.74	7915T	.84
7815T	.74	7924T	.84
7824T	.74	7905K	1.44
7805K	1.34	7912K	1.44
7812K	1.34	7915K	1.44
7815K	1.34	7924K	1.44
7824K	1.34	79L05	.78
78L05	.68	79L12	.78
78L12	.68	79L15	.78
78L15	.68	LM323K	4.90
78H05K	8.90	UA78S40	1.90
78H12K	8.90		

C,T = TO-220 K = TO-3 L = TO-92

CIRCLE 110 ON FREE INFORMATION CARD

www.americanradiohistory.com

IC SOCKETS
(1 to 99)

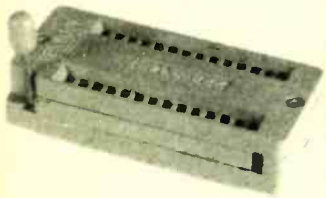
8 pin ST	.12	8 pin WW	.58
14 pin ST	.14	14 pin WW	.68
16 pin ST	.16	16 pin WW	.68
18 pin ST	.19	18 pin WW	.98
20 pin ST	.28	20 pin WW	1.04
22 pin ST	.29	22 pin WW	1.34
24 pin ST	.29	24 pin WW	1.44
28 pin ST	.39	28 pin WW	1.64
40 pin ST	.48	40 pin WW	1.94

ST = Soldertail WW = Wirewrap

ZIF SOCKETS

16 pin ZIF	5.90
24 pin ZIF	7.90
28 pin ZIF	8.90

ZIF = TEXTOOL (Zero Insertion Force)



DISKETTES 5¼"
– ATHANA –

SS/SD 15.90
SS/DD 16.90
DS/DD 22.90

SOFT SECTOR with HUB RING

BULK 5¼" DISKETTES
(NO LABEL)

SS/DD ... 10 for 14.90
100 up 139.00
(Lifetime Warranty)

The FLIP SORT™
The new Flip Sort™ has all the fine qualities of the original with some added benefits: a new design and 50% greater capacity. Holds 75 diskettes and the price is now lower than ever— **$16.95**

The Flip Sort PLUS™
The new Flip Sort PLUS™ adds new dimensions to storage. Its smoked acrylic elegance holds over 100 diskettes with all the features you expect from the Flip Sort Family— **$24.95**

IBM ACCESSORIES

MEMORY EXPANSION KIT

4164 150ns
9 for $45.00

MULTIFUNCTION CARD

- 64K to 384K RAM
- Parallel Port
- Serial Port
- Clock Calendar
- Software Included
- 1-Year Warranty

$249.95

MEMORY CARD

- Expandable to 512K
- Fully compatible with IBM software
- Fully compatible w/IBM diagnostic utilities
- Serial Port Available
- 1-Year Warranty

$199.95

—VUTEK—
Color • Parallel • Serial Card

- Full bit-mapped Color Graphics
- Printer Port (LPT1, LPT2, LPT3)
- Serial Port (Com1, Com2)
- IBM PC, XT and Portable compatible
- Full software compatibility
- Compatible with Lotus 1-2-3, Multi-Plan and Flight Simulator
- Full 2-Year Warranty Parts and Labor

$299.00

DISK DRIVES

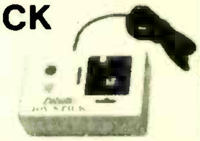
Tandon TM100-2	DS/DD	199.00
Teac FD-55B	DS/DD	159.00

KEYBOARD EXTENSION CABLE
$19.95

APPLE ACCESSORIES

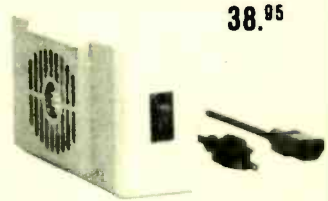
80 Column Apple II+	149.95
80 Column Apple IIE	129.95
Z80 Apple II+	89.00
Z80 Apple IIE	89.00
16K Card	39.95
Cooling Fan	38.95
Power Supply	74.95
Joystick	29.95
RF Modulator	13.95
Disk Drive	199.00
Controller Card	59.95
Paddles	7.95

APPLE COMPATIBLE JOYSTICK



29.95

COOLING FAN
38.95



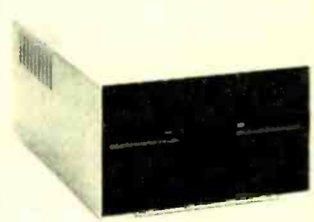
APPLE COMPATIBLE POWER SUPPLY
74.95

- Powers Apple type systems
- +5V @ 5A +12V @ 3A −5V @ .5A −12V @ .5A
- Includes instructions

16K RAM Card – Apple II+
- 2-Year Warranty

Assembled & Tested 39.95

APPLE COMPATIBLE DISK DRIVE



199.00

- Shugart mechanism, made in U.S.A.
- Directly replaces Apple Disk II
- Fully compatible with Apple Controller or other Apple compatible controllers.
- One Year Warranty

micromax

VIEWMAX-80 149.95
- 80 Col. card for Apple II+
- Video Soft Switch
- Inverse Video
- 2 Year Warranty

VIEWMAX-80e 129.95
- 80 Col. card for Apple IIE
- 64K RAM Expandable to 128K

64K RAM Upgrade 40.00

Reg. Power Supply
Model 4A/PS (99/4)
3 DC Outputs:
12V @ .4A, +5V @ 1.1A
−5V @ .2A Highly Filtered

6.95

TERMS: Minimum order $10.00 For shipping and handling, include $2.50 for UPS ground or $3.50 for UPS Blue (air). For each additional air pound, add $1 for UPS Blue shipping and handling. California residents must include 6% sales tax. Bay area and LA residents include 6½% sales tax. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturers. All merchandise subject to prior sale.

CALL for VOLUME Quotes

HOURS: Mon. – Fri. 7:30 to 5:00
Saturdays 10:00 to 3:00

VISIT OUR RETAIL STORE
2100 De La Cruz Blvd
Santa Clara, CA 95050
(408) 988-0697

ALL MERCHANDISE IS 100% GUARANTEED

Telex: 756440

DoKay

www.americanradiohistory.com

CPU's & SUPPORT CHIPS

82C43	10.00	8237	16.00
AMD2901	8.95	8238	3.95
6502	4.75	8250	10.95
6800	2.50	8251	8.00
6803L	12.95	8253	8.00
6809	8.95	8255A-5	8.00
6810	4.00	8257	8.00
6821	4.50	8259	8.00
6845	13.95	8275	24.50
6850	3.50	8279-5	6.95
6875	4.50	8288	17.00
8035	8.95	8355	12.95
8085A	10.00	TMS9927NL	8.95
8086	22.50	68000L8	39.50
8155	8.00	Z80A CPU	4.75
8202	19.95	Z80B CPU	9.00
8205	6.50	Z80A CTC	4.60
8212	3.00	Z80A DART	9.00
8214	4.50	Z80A P10	4.50
8216	3.00	Z80A S10	10.95
8226	3.50		

INTERFACE & DRIVERS

AY5-1013A	3.75
AY3-1015D	5.75
1488	.90
1489	.90
TR1602B	3.95
BR1941L	8.95
3341A	2.95
AY5-3600PRO	9.95
CRT5037	18.95
MM5307	7.95
MM5369	2.50
8130	2.50
8830	2.50
8833	2.50
8834	2.00
8837	2.00

SHIFT REGISTERS

MM1402	1.75
MM1403	1.75
MM1404	1.75
MM5013	2.50
MM5055	2.50
MM5056	2.50
MM5057	2.50
MM5058	2.50
MM5060	2.50

DISC Controllers

1771 .. 16.50 1795 .. 35.00
1791 .. 25.00 1797 .. 35.00
1793 .. 35.00 D765C . 19.00

RAM's

21L02-3	.90
2101A-4	1.50
2112-1	1.95
2114-2	1.40
2118-4	2.80
2147-3	2.50
3242	6.00
TMS3409	1.75
MK4027-3	1.75
TMS4050NL	2.95
MK4096-11	1.25
4108-3	1.50
4116-15	1.25
4118-4	4.00
4164-15	6.00
MK4802	5.95
Z6104-4	2.50
6116-3	6.75
8118-12	4.95

ROM's

TPB18S42	3.50
82S126	1.95
82S130	1.95
TPB28S166	9.50
82S181	6.95
74S474	3.95
2708	3.75
2712B	22.50
2716 + 5V	3.75
TMS2532	6.25
2732A	6.95
2764	7.50
3628A-3	3.00
6331	1.95
7643-5	3.95
8256-5	1.25
AM9214C	2.96

NO. 30 WIRE WRAP WIRE SINGLE STRAND
100' $1.40

CRYSTALS

1.843 8.000
2.000 6.144
3.000 8.000
3.579 10.000
4.000 18.000
5.000 18.432
20.000

3.00 ea.

EPOXY GLASS VECTOR BOARD

1/16" thick with 1/10" spacing
4½" x 6½" $1.95

SCR's

	1.5A	6A	35A
100	.35	.40	1.40
200	.40	.50	1.80
400	.60	.70	2.40
600	.80	1.00	3.60

TRIAC's

PRV	1A	10A	25A
100	.35	.60	1.40
200	.50	.80	1.90
400	.70	1.00	2.60
600	1.00	1.20	3.60

C/MOS

74C00	.50	74C921	3.50	4026	1.25	4071	.30
74C02	.40	4001	.30	4027	.45	4072	.30
74C04	.40	4002	.30	4028	.70	4076	.80
74C10	.40	4006	.85	4029	.75	4077	.50
74C14	.60	4007	.30	4030	.40	4081	.30
74C20	.40	4008	.90	4034	1.75	4082	.30
74C32	.40	4009	.40	4035	.85	4093	.70
74C42	1.20	4010	.45	4040	.75	4099	1.75
74C76	.75	4011	.30	4041	.75	4501	.95
74C83	1.20	4012	.30	4042	.85	4503	.65
74C86	.40	4013	.35	4043	.85	4506	.75
74C154	3.00	4014	.75	4044	.80	4510	1.20
74C157	1.70	4015	.40	4046	.90	4511	.85
74C161	1.10	4016	.40	4047	.95	4514	1.20
74C174	1.10	4017	.75	4049	.35	4515	1.60
74C175	1.10	4018	.75	4050	.35	4516	1.50
74C192	1.40	4019	.40	4051	.80	4518	.85
74C193	1.40	4020	.75	4052	1.00	4520	.80
74C901	.40	4021	.75	4053	.80	4528	1.10
74C903	.80	4022	.75	4060	.70	4529	1.40
74C907	.90	4023	.35	4066	.40	4538	1.60
74C915	1.10	4024	.66	4068	.40	4539	1.50
		4026	.30	4069	.35	4583	.90
				4070	.40	4586	.75

74S SERIES

74S00	.35	74S74	.50	74S163	1.75
74S02	.35	74S86	.50	74S174	.90
74S03	.35	74S89	2.00	74S175	.90
74S04	.35	74S112	.50	74S181	3.00
74S05	.35	74S124	2.20	74S182	2.00
74S08	.35	74S133	.45	74S189	1.60
74S10	.35	74S135	.85	74S194	1.30
74S11	.35	74S138	.80	74S195	1.30
74S15	.35	74S139	.80	74S240	2.00
74S20	.35	74S151	.90	74S257	.90
74S30	.35	74S157	.90	74S260	.75
74S32	.40	74S158	.90	74S373	2.00
74S42	.85	74S161	1.75	74S374	2.00
74S51	.35				

2114-4. . . . $1.00
4116-25. . . $ .75
4164-2. . . . $5.00
4164-15. . . $6.00

6264-15
$39.00

HM 50256
$39.00

2N3820 P FET .... $ .45
TIS 73 N FET .... $ .45
2N2646 UJT .... $ .45
ER 900 TRIGGER DIODES .... 4/$1.00
2N 6028 PROG. UJT .... $ .65

DISC CAPACITORS

.1UF 16V ..... 10/$1.00 ..... 100/$8.00
.01UF 35V ..... 16/$1.00 ..... 100/$5.00

PRINTED CIRCUIT BOARD

4" x 6" DOUBLE SIDED EPOXY BOARDED 1/16" THICK
$.60 ea. .... 5/$2.60

50 PIN EDGEBOARD CONN.

50 PIN EDGEBOARD CONN. 3.95
40 PIN EDGEBOARD CONN. 3.00
34 PIN EDGEBOARD CONN. 3.00
26 PIN EDGEBOARD CONN. 2.50
60 PIN RIBBON CABLE CONN. 4.00
50 PIN RIBBON CABLE CONN. 3.50
40 PIN RIBBON CABLE CONN. 3.00
34 PIN RIBBON CABLE CONN. 2.75
26 PIN RIBBON CABLE CONN. 2.50
20 PIN RIBBON CABLE CONN. 2.00

TRANSISTOR SPECIALS

2N1307 PNP GE TO-5 .... $ .40
2N404A PNP GE TO-5 .... 3/$1.00
HEP G6014 — PNP GE TO-3 .... $ .85
TIP 111 .... $ .50 TIP 145 .... $1.35
2N6233 NPN SWITCHING POWER $1.95
MRF-8004 CM RF TRANSISTOR NPN .... $ .75
2N4908 PNP Si TO-3 .... $1.00
TIP 2955 PNP Si .... $ .70
2N2222 NPN Si TO-18 .... 7/$1.00
2N2907 PNP Si TO-18 .... 7/$1.00
2N3055 NPN Si TO-3 .... $ .60
2N3904 NPN Si TO-92 .... 7/$1.00
2N3906 PNP Si TO-92 .... 7/$1.00
2N6109 PNP Si TO-220 .... $ .55
TIP 31B NPN Si TO-220 .... $ .40
TIP 32B PNP Si TO-220 .... $ .40
TIP 34 PNP Si .... $ .95
TIP 121 PNP Si U84 .... $ .60
TIP 141 NPN Si U87 .... $1.00
BU205 .... $1.75
DPS2000 — DUAL POWER DARL. $3.95
MJE3055T .... $ .60

TTL IC SERIES

7400	.20	7474	.35	74163	.70
7401	.20	7475	.45	74164	.85
7402	.20	7476	.35	74165	.85
7403	.20	7480	.45	74166	1.00
7404	.30	7483	.50	74170	1.50
7405	.30	7485	.60	74173	.75
7406	.40	7486	.35	74174	.90
7407	.60	7489	1.90	74175	.90
7408	.25	7491	.50	74176	.75
7409	.25	7492	.50	74180	1.90
7410	.20	7493	.50	74181	2.00
7411	.25	7494	.60	74182	.90
7412	.25	7495	.55	74190	.80
7413	.35	7496	.60	74191	.80
7414	.50	74107	.60	74192	.80
7420	.20	74116	1.20	74193	.80
7425	.30	74121	.30	74194	.80
7426	.30	74122	.45	74195	.80
7427	.30	74123	.50	74196	.75
7430	.20	74125	.45	74199	1.25
7432	.30	74126	.45	74221	1.25
7437	.30	74145	.60	74273	1.00
7438	.30	74148	1.20	74279	.70
7440	.20	74150	1.35	74365	.65
7442	.50	74151	.55	74367	.65
7445	.60	74153	.55	74390	.90
7446	.70	74154	1.50	75325	1.50
7447	.70	74155	.75	75492	1.00
7448	.70	74157	.55	9601	1.00
7450	.20	74160	.85	8T26	1.10
7472	.35	74161	.70	8T28	1.10
7473	.35	74162	.70	8T98	1.10

LINEAR CIRCUITS

DAQ08EQ	3.75	LM380	1.20	LM1310	1.40
TL062CP	.96	LM384	1.60	LM1391	1.00
TL064CN	1.50	LM386	1.00	1456	.80
TL072	1.25	LM387	1.25	1458	.50
TL084	1.50	LM393	.75	LM1808	1.75
LM201	.75	LF398A	3.00	AD2700LD	4.95
LM301/748	.50	LM555	.50	LM2901	.95
LM307	.45	LM556	.90	CA3018	1.95
LM308	.66	558	1.75	CA3078AT	1.50
LM310	1.10	565	.90	CA3080	1.00
LM311	.75	566	1.25	CA3089E	1.75
LM318	1.25	567	.85	CA3094	1.30
LM319	1.30	NE592	.95	CA3130	1.00
LM324	.75	709C	.80	CA3140	1.00
LM339	.90	LM710	.60	CA3822	.75
LM348	.90	711CH	.40	LM3909	.80
LF351	.80	733	.95	4136	.85
LF353	1.25	741CH	.60	N5596A	1.50
LF355	.90	741CV	.40	8700CJ	5.95
LM358	.70	747	.50	LM13080	.95
LM370	1.60	CA758	1.75		
LM377	1.60	LM798CT	.60		

TOGGLE SWITCHES

108D — SPDT — 1.00
208D — DPDT — 1.40
208P — DPDT — CENTER OFF 1.80

IN4148 (IN914) 15/1.00

L1411-IR DETECTOR .... 3/$1.00
FP 100 PHOTO TRANS .... $ .50
RED LED's .2" .... 8/$1.00
YEL, GREEN or AMBER LARGE LED's .2" .. 6/$1.00
RED-GREEN BIPOLAR LED .... $ .90
RED-YELLOW BIPOLAR LED .... $ .90
MLED92 IR LED .... $ .40
MRD148 PHOTO DARL. XTOR .... $ .50
MCT2 OPTO ISOLATORS .... $ .60
1 WATT ZENERS: 3.3, 4.7, 5.1, 5.6, 6.8, 8.2, 9.1, 10, 12, 15, 18, or 22V .... 6/$1.00

FULL WAVE BRIDGE

PRV	2A	6A	25A
100			1.40
200	.80	1.30	2.20
400	1.00	1.65	3.30
600	1.30	1.90	4.40

12V DC RELAYS TTL SIZE
S.P. 1200 ohm coil .75
D.P. 400 ohm coil .95

SILICON POWER RECTIFIERS

PRV	1A	3A	12A	50A	125A	240A
100	.06	.14	.35	.90	5.00	6.00
200	.08	.17	.50	1.30	7.00	9.00
400	.09	.25	.65	1.50	10.00	12.00
600	.11	.30	.80	2.00	13.00	15.00
800	.13	.35	1.00	2.50	16.00	18.00
1000	.20	.45	1.25	3.00	20.00	26.00

74LS SERIES

74LS00	.30	74LS109	.40	74LS241	.95
74LS01	.30	74LS112	.40	74LS242	1.00
74LS02	.30	74LS113	.40	74LS243	1.00
74LS03	.30	74LS114	.40	74LS244	1.25
74LS04	.35	74LS123	.75	74LS245	1.40
74LS05	.35	74LS125	.60	74LS246	1.40
74LS08	.35	74LS126	.60	74LS247	.75
74LS09	.35	74LS132	.60	74LS248	1.00
74LS10	.30	74LS136	.40	74LS251	.60
74LS11	.35	74LS137	.90	74LS253	.60
74LS12	.35	74LS138	.60	74LS257	.60
74LS13	.45	74LS139	.60	74LS258	.60
74LS14	.50	74LS147	2.20	74LS259	1.75
74LS15	.35	74LS151	.55	74LS260	.60
74LS20	.30	74LS153	.55	74LS266	.55
74LS21	.30	74LS155	.70	74LS273	1.50
74LS22	.30	74LS156	.70	74LS279	.50
74LS26	.30	74LS157	.65	74LS280	1.70
74LS27	.30	74LS158	.60	74LS283	.70
74LS28	.35	74LS160	.70	74LS290	.90
74LS30	.30	74LS161	.65	74LS293	.90
74LS32	.35	74LS162	.70	74LS298	.90
74LS37	.35	74LS163	.65	74LS320	2.00
74LS38	.35	74LS164	.70	74LS323	3.50
74LS40	.30	74LS165	.70	74LS365	.60
74LS42	.50	74LS166	1.75	74LS366	.60
74LS47	.75	74LS170	1.30	74LS367	.60
74LS51	.30	74LS173	.70	74LS368	.60
74LS54	.30	74LS174	.55	74LS373	1.30
74LS73	.40	74LS175	.55	74LS374	1.30
74LS74	.40	74LS181	2.00	74LS377	1.30
74LS75	.40	74LS190	.90	74LS386	.45
74LS76	.40	74LS191	.90	74LS390	1.10
74LS83	.60	74LS192	.80	74LS393	1.10
74LS85	.70	74LS193	.80	74LS446	2.00
74LS86	.40	74LS194	.65	74LS398	2.50
74LS90	.55	74LS195	.70	74LS541	2.25
74LS92	.55	74LS196	.75	74LS625	1.75
74LS95	.75	74LS197	.75	74LS668	1.60
74LS96	.85	74LS221	.90	74LS670	1.25
74LS107	.40	74LS240	.95	81LS98	1.40

DIP SWITCHES

CTS 206-4 — 4 POSITION .75
CTS 206-7 — 7 POSITION .95
CTS 206-8 — 8 POSITION .95
CTS 206-10 — 10 POSITION 1.25

REGULATORS

78L12 .... $ .40
LM305G .... $ .75
LM317T $1.35
320T 5, 12, 15 or 24 .... $ .85
323K (LA1405) $1.75
LM337T $1.95
LM338K $5.75
340T-5, 6, 8, 9, 12, 15, 18 or 24V .... $ .75
723 .... $ .50
LAS1412 + 12V3A $3.95

DIP SOCKETS

8 PIN	.10	22 PIN	.25
14 PIN	.15	24 PIN	.25
16 PIN	.18	28 PIN	.35
18 PIN	.20	40 PIN	.40
20 PIN	.25		

TANTALUM CAPACITORS

.22UF 35V	5/$1.00	15UF 16V	3/$1.00
.47UF 35V	5/$1.00	30UF 6V	5/$1.00
.68UF 35V	5/$1.00	33UF 15V	$ .50
1UF 20V	5/$1.00	47UF 20V	$ .85
2.2UF 20V	5/$1.00	68UF 16V	$1.00
3.3UF 20V	4/$1.00	200UF 20V	$1.75
4.7UF 35V	4/$1.00	150UF 16V	$1.30
6.8UF 20V	4/$1.00	330UF 10V	$1.75
10UF 20V	— $ .40		
22UF 10V	— $ .30		

WIRE WRAP SOCKETS

14 PIN — .45
16 PIN — .50
18 PIN — .65
20 PIN — .90
24 PIN — 1.10
28 PIN — 1.25
40 PIN — 1.80

20KV DIODES 250 ma. $1.95

DB CONNECTORS

DB9P - $2.00 DB25P - $2.40
DB9S - 3.00 DB25S - 3.20
HOODS - 1.10 HOODS - 1.10

MULTI-TURN TRIM POTS

50 OHM, 100 OHM, 1000 OHM, 5K, 10K, 20K — 3/$2.00

POSTAGE RATES
ADD 10% FOR ORDERS UNDER $25.00
ADD 5% FOR ORDERS BETWEEN $25.00 & $50.00
ADD 3% FOR ORDERS ABOVE $50.00

TERMS FOB CAMBRIDGE, MASS. SEND CHECK OR MONEY ORDER. MINIMUM TELEPHONE, C.O.D. PURCHASE ORDER OR CHARGE $20.00. MINIMUM MAIL ORDER $5.00

SEND $.25 FOR OUR CATALOG FEATURING TRANSISTORS & RECTIFIERS 145 HAMPSHIRE ST., CAMBRIDGE, MASS. 02139

SOLID STATE SALES
P.O. BOX 74D
SOMERVILLE, MASS. 02143

TEL. (617) 547-7053
WE SHIP OVER 95% OF OUR ORDERS WITHIN 24 HOURS OF RECEIPT
TOLL FREE 1-800-343-5230
FOR ORDERS ONLY

CIRCLE 74 ON FREE INFORMATION CARD

This is an all BOLD FACE ad. Notice its enhanced appearance on the page. Your ad can look like this one. Order the next ad as a BOLD-FACE ad. The premium is 20%.

YOUR own radio station! AM, FM, cable, licensed, unlicensed, transmitter kits! Write: **BROADCASTING**, Box 130-F12, Paradise, CA 95969.

SECURITY alarm industry booming. Get in now. Tremendous demand. Employment—business terrific. Insider's information, $2.00 (redeemable), **SECURITY**, PO Box 1456-NE, Grand Rapids, MI 49501.

PICTURE tube rebuilding equipment. Buy/sell, new/used machinery. Full training. **CHICAGO TELEVISION**, 633 North Semoran Blvd., Orlando, FL 32807, (305) 281-1260.

This ad is set with a background screen. Notice how it stands out on the page. This ad incurs a 25% premium charge. Perhaps your next ad could have a screen background.

ELECTRO-VOICE DEALER

MICROPHONES stocked, low prices, C.O.D. shipment. Mixers, speakers, speaker components, Harman-Kardon. **RICK MARDER**, (201) 561-8123.

DO-IT-YOURSELF TV REPAIR

NEW!...Repair any TV...Easy. Anyone can do it. Write, **RESEARCH**, Rt. 3, Box 601 BR, Colville, WA 99114.

EDUCATION & INSTRUCTION

FCC Commercial General Radio Telephone License correspondence course. 60 lessons for $89.50. Payment plan. Results guaranteed! Details free. **AMERICAN TECHNICAL INSTITUTE**, Box 201, Cedar Mountain, NC 28718.

CB EQUIPMENT

PALOMAR/Pride electronics—exclusive repair facility. Service—update—improvements on these and similar equipment. **PALOMAR-PRIDE REPAIR**, 1320-4 Grand, San Marcos, CA 92069 (619) 744-0720.

WANTED

OLD tubes: 2A3, 10's, 45's, 50's, 80's, 81's, 211, 242, 845, VT-52, VT-62. **WESTERN ELECTRIC EQUIPMENTS**: (818) 576-2642, David, POB 832, M-Park, CA 91754

SCANNERS

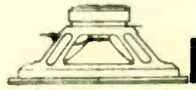
SCANNERS—discount prices Bearcat BC-100 $279.99; Bearcat 210XL $214.99; Bearcat 300 $335.99; Regency MX3000 $186.99; JIL SX100 $138.99; JIL SX200 $269.99; Bearcat 20/20 $275.99; Spectrum radar detector $214.99; plus $3.00 shipping. Free discount catalog. Lowest prices anywhere on scanners, radar detectors, marine radios, two-way accessories. **SCANNER WORLD**, 10-RE New Scotland, Albany, NY 12208 (518) 436-9606.

GRAPHIC EQUALIZERS, ETC.

NOISE eliminators, expanders, power meters, others. Twelve-24 bands/channel equalizers from $89.00 Kit see **R-E** 5-6/78, 2/80, 3-4/81. Catalog: **SSS**, 856R Lynnrose, Santa Rosa, CA 95404. (707) 546-3895.

CABLE TV

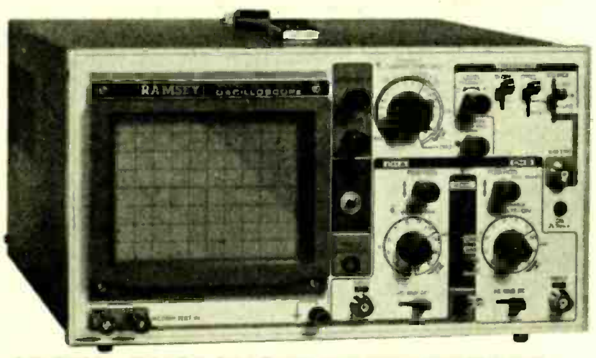
DEALERS wanted: Channel 2, 3, and 4 notch filters. **Money back guarantee.** Send $15.00 for sample and quantity price list. Specify channel(s). **LEE KURTZ**, PO Box 291394, Davie, FL 33329.

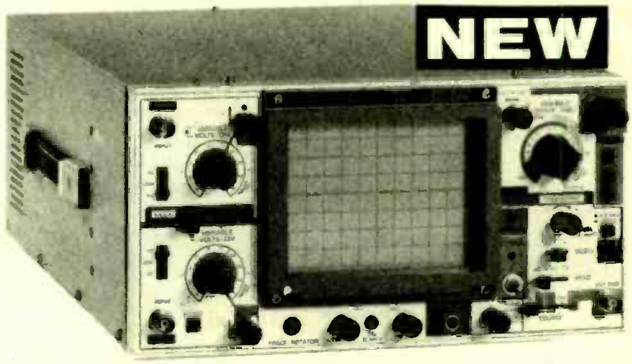


WRITE FOR
McGEE'S
SPEAKER & ELECTRONICS CATALOG
1001 BARGAINS IN SPEAKERS
Tel.: 1 (816) 842 5092
1901 McGEE STREET KANSAS CITY, MO. 64108

www.americanradiohistory.com

RAMSEY — THE FIRST NAME IN ELECTRONIC TEST GEAR





20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit for resistor, capacitor, digital circuit and diode testing. • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • front panel trace rotator • Z axis • high sensitivity x-y mode • regulated power supply • built-in calibrator • rock solid triggering

$399.95* high quality hook on probes included

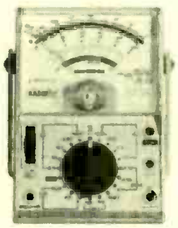
*USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for insured surface mail

45 MHz DUAL SWEEP OSCILLOSCOPE

The Ramsey 625 is a dual time base, delayed sweep unit that includes a built-in signal delay line to permit clear viewing during very short rise times of high frequency waveforms. Other features include, variable trigger holdoff • 20 calibrated sweep time ranges from 0.5 s/div to 0.2 μS/div. • fully adjustable sweep time • X5 sweep magnification • five trigger sources: CH1, CH2, LINE EXTernal and INTernal (V mode) • front panel x-y operation, Z axis input • sum difference of CH1, and CH2 waveforms displayed as single trace • sweep gate and sweep output • auto focus • single sweep

$799.95* high quality hook on probes included

*Same as unit to left.



RAMSEY D-1100 VOM MULTITESTER

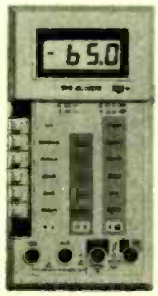
Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

$19.95 test leads and battery included

NEW RAMSEY 1200 VOM MULTITESTER

Check transistors, diodes and LEDs with this professional quality meter. Other features include: decibel scale • 20K volt metering system • 3½" mirrored scale • polarity switch • 20 measuring ranges • safety probes • high impact plastic case

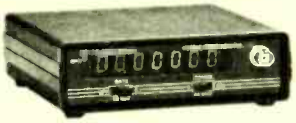
$24.95 test leads and battery included



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • in-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$49.95 test leads and battery included



CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95 wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95 wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM oven timebase 59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95 wired includes AC adapter

BP-4 nicad pack 8.95

CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95 wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95 wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95

PS-2 AUDIO MULTIPLIER

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

$49.95 wired

PS-2 kit $39.95

PR-2 COUNTER PREAMP

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

$44.95 wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95 wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

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

VISA MasterCard

PHONE ORDERS CALL 716-586-3950

TELEX 466735 RAMSEY CI

TERMS: • satisfaction guaranteed • examine for 10 days; if not pleased, return in original form for refund • add 6% for shipping and insurance to a maximum of $10.00 • overseas add 15% for surface mail • COD add $2.50 (COD in USA only) • orders under $15.00 add $1.50 • NY residents add 7% sales tax • 90 day parts warranty on all kits • 1 year parts & labor warranty on all wired units.

RAMSEY ELECTRONICS, INC.
2575 Baird Rd.
Penfield, N.Y. 14626

CIRCLE 70 ON FREE INFORMATION CARD

www.americanradiohistory.com

7400

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
SN7400N	14	.29	SN7474N	14	.39	SN74159N	24	1.95
SN7401N	14	.29	SN7475N	16	.45	SN74160N	16	.59
SN7402N	14	.29	SN7476N	16	.39	SN74161N	16	.59
SN7403N	14	.29	SN7479N	14	4.95	SN74162N	16	.59
SN7404N	14	.35	SN7480N	14	.89	SN74163N	16	.59
SN7405N	14	.49	SN7482N	14	1.49	SN74164N	14	.69
SN7406N	14	.59	SN7483N	16	.55	SN74165N	16	.69
SN7407N	14	.59	SN7485N	16	.59	SN74166N	16	.69
SN7408N	14	.29	SN7486N	14	.39	SN74167N	16	2.95
SN7409N	14	.35	SN7489N	16	2.25	SN74170N	16	1.59
SN7410N	14	.29	SN7490N	14	.49	SN74172N	24	4.95
SN7411N	14	.29	SN7491N	14	.79	SN74173N	16	.85
SN7412N	14	.49	SN7492N	14	.45	SN74174N	16	.59
SN7413N	14	.39	SN7493N	14	.45	SN74175N	16	.59
SN7414N	14	.49	SN7494N	14	.89	SN74176N	14	.79
SN7416N	14	.49	SN7495N	14	.49	SN74177N	14	.79
SN7417N	14	.59	SN7496N	16	.49	SN74179N	16	1.49
SN7420N	14	.19	SN7497N	16	3.25	SN74180N	14	.69
SN7421N	14	.59	SN74100N	24	1.95	SN74181N	24	1.95
SN7422N	14	.59	SN74104N	14	1.19	SN74182N	16	1.05
SN7423N	16	.69	SN74105N	14	1.19	SN74184N	16	2.29
SN7425N	14	.39	SN74107N	14	.29	SN74185N	16	2.29
SN7426N	14	.39	SN74109N	16	.39	SN74190N	16	.69
SN7427N	14	.25	SN74116N	24	1.49	SN74191N	16	.69
SN7428N	14	.59	SN74121N	14	.29	SN74192N	16	.69
SN7430N	14	.35	SN74122N	14	.39	SN74193N	16	.69
SN7432N	14	.39	SN74123N	16	.55	SN74194N	16	.69
SN7433N	14	.49	SN74125N	14	.49	SN74195N	16	.49
SN7437N	14	.25	SN74126N	14	.49	SN74196N	14	.75
SN7438N	14	.49	SN74132N	14	.59	SN74197N	14	.75
SN7439N	14	.79	SN74136N	14	.69	SN74198N	24	1.19
SN7440N	14	.19	SN74141N	16	.89	SN74199N	24	1.19
SN7441N	16	.89	SN74142N	16	3.95	SN74221N	16	1.19
SN7442N	16	.45	SN74143N	24	3.95	SN74251N	16	.79
SN7443N	16	1.25	SN74144N	24	3.95	SN74273N	20	1.95
SN7444N	16	1.25	SN74145N	16	.65	SN74276N	20	2.49
SN7445N	16	.69	SN74147N	16	1.29	SN74279N	16	.79
SN7446N	16	.75	SN74148N	16	.89	SN74283N	16	1.39
SN7447N	16	.75	SN74150N	24	1.49	SN74284N	16	2.95
SN7448N	16	.75	SN74151N	16	.49	SN74285N	16	2.95
SN7454N	14	.19	SN74152N	14	.49	SN74365N	16	.55
SN7459N	14	.35	SN74153N	16	.99	SN74366N	16	.55
SN7460N	14	.39	SN74154N	24	1.49	SN74367N	16	.55
SN7470N	14	.39	SN74155N	16	.49	SN74368N	16	.55
SN7472N	14	.39	SN74156N	16	.59	SN74390N	16	1.49
SN7473N	14	.39	SN74157N	16	.49	SN74393N	14	1.49

74LS

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
74LS00	14	.29				74LS244	20	1.29
74LS01	14	.29				74LS245	20	1.49
74LS02	14	.35	74LS132	14	.65	74LS251	16	.59
74LS03	14	.29	74LS133	16	.59	74LS253	16	.59
74LS04	14	.39	74LS136	14	.39	74LS257	16	.59
74LS05	14	.35	74LS138	16	.59	74LS258	16	.59
74LS08	14	.35	74LS139	16	.59	74LS260	14	.59
74LS09	14	.35	74LS145	16	1.19	74LS266	14	.49
74LS10	14	.35	74LS147	16	1.95	74LS273	20	1.49
74LS11	14	.35	74LS148	16	1.79	74LS279	16	.49
74LS14	14	.59	74LS151	16	.59	74LS280	14	1.95
74LS15	14	.35	74LS153	16	.59	74LS283	16	.69
74LS20	14	.29	74LS154	24	1.49	74LS299	20	2.95
74LS21	14	.35	74LS155	16	.69	74LS322	20	3.95
74LS26	14	.29	74LS156	16	.69	74LS323	20	3.95
74LS27	14	.35	74LS157	16	.69	74LS347	16	.79
74LS28	14	.39	74LS158	16	.59	74LS352	16	1.09
74LS30	14	.39	74LS160	16	.69	74LS353	16	1.09
74LS32	14	.39	74LS161	16	.69	74LS365	16	.49
74LS37	14	.35	74LS162	16	.69	74LS366	16	.49
74LS38	14	.39	74LS163	16	.69	74LS367	16	.49
74LS42	16	.49	74LS164	14	.69	74LS368	16	.49
74LS47	16	.89	74LS165	16	.89	74LS373	20	1.49
74LS51	14	.29	74LS168	16	1.19	74LS374	20	1.49
74LS73	14	.39	74LS169	16	1.49	74LS375	16	.69
74LS74	14	.49	74LS170	16	1.49	74LS386	14	.39
74LS75	16	.45	74LS173	16	.69	74LS393	14	1.19
74LS76	16	.39	74LS174	16	.69	74LS399	16	1.49
74LS85	16	.89	74LS175	16	.69	74LS490	16	1.95
74LS86	14	.39	74LS181	24	2.49	74LS533	20	1.95
74LS90	14	.55	74LS190	16	.79	74LS534	20	1.95
74LS92	14	.55	74LS191	16	.89	74LS540	20	1.49
74LS93	14	.59	74LS192	16	.79	74LS541	20	1.49
74LS96	16	.89	74LS193	16	.89	74LS640	20	2.19
74LS107	14	.39	74LS194	16	.69	74LS641	20	2.19
74LS109	16	.39	74LS195	16	.59	74LS645	20	2.19
74LS112	16	.45	74LS196	14	.89	74LS670	16	1.49
74LS114	14	.39	74LS197	14	.89	74LS688	20	2.95
74LS122	14	.49	74LS221	16	1.09	81LS95	20	1.49
74LS123	16	.79	74LS240	20	1.09	81LS96	20	1.49
74LS125	14	.59	74LS241	20	.99	81LS97	20	1.49
74LS126	14	.59	74LS243	14	1.09	81LS98	20	1.49

74S/PROMS*

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
74S00	14	.35				74S241	20	1.95
74S02	14	.35				74S242	14	2.19
74S03	14	.35	74S114	14	.55	74S243	14	2.19
74S04	14	.45	74S124	16	2.75	74S244	20	2.19
74S05	14	.45	74S132	14	1.89	74S251	16	.99
74S08	14	.45	74S133	16	.45	74S253	16	.99
74S09	14	.39	74S135	16	.89	74S257	16	.99
74S10	14	.35	74S136	14	1.39	74S258	16	.99
74S11	14	.35	74S138	16	.89	74S260	14	.79
74S15	14	.35	74S139	16	.89	74S273	20	2.39
74S20	14	.35	74S140	14	.69	74S280	14	1.89
74S22	14	.35	74S151	16	.99	74S287*	16	1.79
74S30	14	.35	74S153	16	.99	74S288*	16	1.79
74S32	14	.45	74S157	16	.99	74S299	20	5.95
74S37	14	.99	74S158	16	.99	74S373	20	2.49
74S38	14	.89	74S160	16	2.29	74S374	20	2.49
74S51	14	.35	74S169	16	4.29	74S387*	16	1.95
74S64	14	.39	74S174	16	1.09	74S471*	20	4.95
74S65	14	.39	74S175	16	1.09	74S472*	20	4.95
74S74	14	.55	74S188*	16	1.75	74S473*	20	4.95
74S85	16	1.99	74S194	16	1.49	74S570*	16	2.95
74S86	14	.55	74S195	16	1.49	74S571*	16	2.95
74S112	16	.55	74S196	14	1.49	74S572*	18	4.95
74S113	14	.55	74S240	20	1.95	74S573*	18	4.95

CA—LINEAR

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
CA3010H		1.09				CA3130E	8	1.19
CA3039H		1.25	CA3081N	16	1.15	CA3140E	8	.85
CA3046N	14	.99	CA3082N	16	1.15	CA3160H		1.79
CA3059N	14	2.95	CA3083N	16	1.15	CA3160E	8	1.49
CA3060N	16	2.95	CA3086N	14	.85	CA3161E	16	1.79
CA3065E	14	1.49	CA3089N	16	1.95	CA3162E	16	6.95
CA3080E	8	.99	CA3096N	16	1.75	CA3189E	16	2.79
						CA3401N	14	.59

CD—CMOS

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
CD4001	14	.29				CD4503	16	.69
CD4002	14	.29				CD4506	16	1.29
CD4006	14	.89	CD4041	14	.69	CD4507	14	1.19
CD4007	14	.29	CD4042	16	.69	CD4508	24	1.95
CD4008	16	.89	CD4043	16	.79	CD4510	16	.85
CD4009	16	.59	CD4044	16	.79	CD4511	16	.85
CD4010	16	.49	CD4046	16	.89	CD4512	16	.85
CD4011	14	.29	CD4047	14	.89	CD4514	24	1.49
CD4012	14	.29	CD4048	16	.59	CD4515	24	1.49
CD4013	14	.39	CD4049	16	.39	CD4516	16	.89
CD4014	16	.89	CD4050	16	.39	CD4518	16	.89
CD4015	16	.39	CD4051	16	.79	CD4519	16	.59
CD4016	14	.49	CD4052	16	.89	CD4520	16	.89
CD4017	16	.79	CD4053	16	.79	CD4526	16	1.19
CD4018	16	.79	CD4056	16	2.95	CD4528	16	1.19
CD4019	16	.49	CD4059	24	3.95	CD4529	16	1.69
CD4020	16	.75	CD4060	16	.89	CD4531	16	.89
CD4021	16	.75	CD4066	14	.45	CD4538	16	1.49
CD4022	16	.75	CD4068	14	.39	CD4541	14	1.49
CD4023	14	.29	CD4069	14	.35	CD4543	16	1.19
CD4024	14	.69	CD4070	14	.29	CD4562	14	6.95
CD4025	14	.29	CD4071	14	.29	CD4566	16	2.95
CD4026	16	1.59	CD4072	14	.29	CD4583	16	2.49
CD4027	16	.45	CD4073	14	.29	CD4584	14	.59
CD4028	16	.69	CD4077	14	.35	CD4723	16	1.19
CD4029	16	.79	CD4078	14	.49	CD4724	16	1.19
CD4030	14	.39	CD4081	14	.29	MC14410	16	8.95
CD4034	24	1.79	CD4093	14	.49	MC14411	24	11.95
CD4035	16	.79	CD4094	16	1.95	MC14412	16	7.95
CD4040	16	.75	CD4098	16	1.95	MC14433	24	17.95
(More in Catalog)			CD4099	16	1.89	MC14572	16	1.19

74F00 NEW 74ALS00

Part No.	Pins	Function	Price
74F00	14	Quad 2-Input NAND Gate	.69
74F02	14	Quad 2-Input NOR Gate	.75
74F04	14	Hex Inverter	.89
74F08	14	Quad 2-Input AND Gate	.75
74F10	14	Triple 3-Input NAND Gate	.79
74F32	14	Quad 2-Input OR Gate	.79
74F74	14	Dual D Flip-Flop	.85
74F86	14	Quad Exclusive OR Gate	1.15
74F109	16	Dual JK Positive Edge Flip-Flop	.95
74F138	16	Expandable 3/8 Decoder	1.69
74F157	16	Quad 2-Input Multiplexer	1.69
74F158	16	Quad 2-Input Multiplexer (Inv.)	1.69
74F193	16	4-Bit Up/Down Binary Counter	5.29
74F240	20	Tri-State Octal Line Driver (Inverting)	3.75
74F244	20	Tri-State Octal Line Driver	3.49
74F257	16	Tri-State Quad 2-Input Multiplexer	1.79
74F373	20	Tri-State Octal Latch	4.89
74F374	20	Tri-State Octal D Flip-Flop	4.59

Part No.	Pins	Function	Price
74ALS00	14	Quad 2-Input NAND Gate	.59
74ALS02	14	Quad 2-Input NOR Gate	.59
74ALS04	14	Hex Inverter	.59
74ALS08	14	Quad 2-Input AND Gate	.59
74ALS10	14	Triple 3-Input NAND Gate	.59
74ALS30	14	8-Input NAND Gate	.59
74ALS32	14	Quad 2-Input OR Gate	.65
74ALS74	14	Dual D Flip-Flop	.79
74ALS109	16	Dual JK Pos. Edge Flip-Flop	.79
74ALS138	16	Expandable 3/8 Decoder	1.25
74ALS240	20	Tri-State Octal Line Driver (Inverting)	2.25
74ALS244	20	Tri-State Octal Line Driver	2.25
74ALS245	20	Octal Bus Transceiver (Non-Inv)	2.59
74ALS373	20	Tri-State Octal Latch	2.59
74ALS374	20	Tri-State Octal D Flip-Flop	2.59

MICROPROCESSOR COMPONENTS

MICROPROCESSOR CHIPS

Part No.	Pins	Function	Price
D765AC	40	Floppy Disk Controller	19.95
D3242	28	Addr. Multiplexer & Refresh Counter	7.95
TMS5501	40	Synchronous Data Interface (SRC)	14.95
Z80, Z80A, Z80B, Z8000 SERIES			
Z80	40	CPU (MK3880N) (780C) 2MHz	2.95
Z80-CTC	28	Counter Timer Circuit	3.49
Z80-DART	40	Dual Asynchronous Rec./Trans.	8.95
Z80-DMA	40	Direct Memory Access Circuit	12.49
Z80-P10	40	Parallel I/O Interface Controller	3.49
Z80-S10/0	40	Serial I/O (TxCB and RxCB Bonded)	11.49
Z80-S10/1	40	Serial I/O (Lacks DTRB)	11.49
Z80-S10/2	40	Serial I/O (Lacks SYNCB)	11.49
Z80-S10/9	40	Serial I/O	11.49
Z80A	40	CPU (MK3880N-4) (780C-1) 4MHz	3.49
Z80A-CTC	28	Counter Timer Circuit	4.49
Z80A-DART	40	Dual Asynchronous Rec./Trans.	9.95
Z80A-DMA	40	Direct Memory Access Circuit	12.95
Z80A-P10	40	Parallel I/O Interface Controller	3.95
Z80A-S10/0	40	Serial I/O (TxCB and RxCB Bonded)	11.95
Z80A-S10/1	40	Serial I/O (Lacks DTRB)	11.95
Z80A-S10/2	40	Serial I/O (Lacks SYNCB)	11.95
Z80A-S10/9	40	Serial I/O	11.95
Z80B	40	CPU (MK3880N-6) 6MHz	8.95
Z80B-CTC	28	Counter Timer Circuit	11.95
Z80B-DART	40	Dual Asynchronous Rec./Trans.	19.95
Z80B-P10	40	Parallel I/O Interface Controller	10.95
Z8001B	48	CPU Segmented (10MHz)	79.95
Z8002B	40	CPU Non Segmented (10MHz)	59.95
6500/6800/68000 SERIES			
6502	40	MPU with Clock (1MHz)	4.95
6502A	40	MPU with Clock (2MHz)	6.49
6502B	40	MPU with Clock (3MHz)	8.95
6520	40	Peripheral Inter. Adapter	3.95
6522	40	Peripheral Inter. Adapter	5.49
6551	28	Async. Comm. Interface Adapter	10.95
6800	40	MPU	2.95
6802CP	40	MPU with Clock and RAM	7.95
6809	40	CPU — 8-Bit (On-Chip Oscillator)	8.95
6809E	40	CPU — 8-Bit (External Clocking)	9.95
68B09E	40	CPU — 8-Bit (Ext. Clocking) 2MHz	14.35
68B10	24	128x8 Static RAM (2MHz)	5.95
6821	40	Peripheral Inter. Adapt. (MC6820)	2.95
68B21	40	Peripheral Interface Adapter (2MHz)	5.95
6845	40	CRT Controller (CRTC)	14.95
68B45	40	CRT Controller (CRTC) 2MHz	19.95
6850	24	Asynchronous Comm. Adapter	3.95
6860	24	0-600bps Digital MODEM	7.95
68000L8	64	MPU 16-Bit (8MHz)	39.95
68488P	40	General Purpose Int. Adapter	9.95
8000/80000 SERIES			
8031	40	Control Oriented CPU w/RAM & I/O	14.95
8035	40	MPU — 8-Bit	5.95
8039	40	CPU — Sgl. Chip 8-Bit (128bits RAM)	5.95
8040N-6	40	CPU (256 bytes RAM)	9.95
8060	40	CPU — 8-Bit NMOS	14.95
8070N	40	CPU (64 bytes RAM)	19.95
8073N	40	CPU w/Basic Micro Interpreter	29.95
8080A	40	CPU	3.95
8085A	40	CPU	4.95
8086-2	40	CPU 16-bit 8MHz	24.95
8087	40	Arithmetic Processor	189.95
8088	40	CPU 8/16-Bit	19.95
8155	40	HMOS RAM I/O Port-Timer	6.95
8156	40	RAM with I/O Port and Timer	8.95
8205	16	Hi Speed 1 out of 8 Binary Decoder	3.95
8212	24	8-Bit Input/Output (74S412)	2.95
8224	16	Clock Generator/Driver	2.95
8228	28	System Cont./Bus Driver (74S428)	4.95
8237-5	40	High Perf. Prog. DMA Cont. (5MHz)	19.95
8238	28	System Controller (74S438)	4.95
8243	24	I/O Expander for 48 Series	4.95
8250N	40	Async. Comm. Element	10.95
8251	28	Prog. Comm. I/O (USART)	4.95
8251A	28	Prog. Comm. Interface (USART)	7.95
8253	24	Prog. Interval Timer	6.95
8255	40	Prog. Peripheral I/O (PPI)	4.95
8255A-5	40	Prog. Peripheral I/O (PPI) 5MHz	7.95
8259	28	Prog. Interrupt Control	5.95
8272	40	Sgle/Dble Density Floppy Disk Cont.	19.95
8274	40	Multi-Protocol Serial Cont. (7201)	29.95
8279	40	Prog. Keyboard/Display Interface	6.95
8282	20	Octal Latch	8.95
8284	18	Clock Generator/Driver	6.95
8286	20	Octal Bus Transceiver	7.95
8287	20	Octal Bus Transceiver (Inverted)	7.95
8288	20	Bus Controller	19.95
8303	20	8-Bit Tri-State Bi-Directional Trans.	3.49
8304	20	8-Bit Bi-Directional Receiver	3.49
8310	20	Octal Latched Peripheral Driver	3.95
8741	40	8-Bit Univ. Peripheral Interface	29.95
8748	40	HMOS EPROM MPU	39.95
8749	40	MPU 8-Bit (EPROM Version of 8049)	39.95
8755	40	16K EPROM with I/O	39.95
80186-6	68	High Integration 16-Bit MPU	99.95

DISK CONTROLLERS

Part No.	Pins	Function	Price
INS1771-1	40	Single Density	16.95
FD1791	40	Single/Dual Density (Inv.)	24.95
FD1793	40	Single/Double Density (True)	26.95
FD1795	40	Dual Density/Side Select (Inv.)	26.95
FD1797	40	Dual Density/Side Select (True)	29.95

SPECIAL FUNCTION

Part No.	Pins	Function	Price
DS0026CN	8	Dual MOS Clock Driver (5MHz)	1.95
INS2651	28	Communication Chip	7.95
MC3470P	18	Floppy Disk Read Amp System	4.95
MM5321N	18	TV Camera Sync. Generator	9.95
MM54240N	24	Asynchronous Transmitter/Receiver	5.95
MM58167AN	24	Microprocessor Real Time Clock	8.95
MM58174AN	16	Micro Compatible Time Clock	8.95
MM5369AA/N	8	Prog. Oscillator/Divider (60Hz)	1.79
MM5369EST	8	Prog. Oscillator/Divider (100Hz)	1.95

DYNAMIC RAMS

Part No.	Pins	Function		Price
1103	18	1024x1	(300ns)	.99
4027	16	4096x1	(250ns)	1.49
4116N-2	16	16,384x1	(150ns)	1.39 — 8/10.95
4116N-3	16	16,384x1	(200ns)	1.15 — 8/8.95
4116N-4	16	16,384x1	(250ns)	.89 — 8/6.95
4164N-150	16	65,536x1	(150ns)	5.19 — 8/40.95
4164N-200	16	65,536x1	(200ns)	4.95 — 8/38.95
MM5261	18	1024x1	(300ns)	.35 — 8/1.95
MM5262	22	2048x1	(500ns)	.18
MM5270	18	4096x1	(250ns) MK4096	4.95
MM5280	22	4096x1	(200ns) 2107	3.95
MM5298-3	16	8192x1	(200ns)	.59
41256	16	262,144x1	(200ns)	31.95

STATIC RAMS

Part No.	Pins	Function		Price
2101	22	256x4	(450ns) 8101	1.95
2102	16	1024x1	(350ns)	.89
2102-2L	16	1024x1	(250ns) L.P. (91L02)	1.49
2111	18	256x4	(450ns) 8111	2.49
2112	16	256x4	(450ns) MOS	2.49
2114N	18	1024x4	(450ns)	1.29 — 8/9.95
2114N-L	18	1024x4	(450ns) L.P.	1.95 — 8/13.95
2114N-2	18	1024x4	(200ns)	1.39 — 8/10.95
2114N-2L	18	1024x4	(200ns) L.P.	1.69 — 8/13.49
2147HN	18	4096x1	(70ns)	4.49
2148HN	18	1024x4	(70ns)	4.95
TMS4045	18	1024x4	(450ns)	3.95
TMS40L47-45	20	1024x4	(450ns)	1.95
5101	22	256x4	(450ns) CMOS	3.95
MM5257	18	4096x1	(450ns) 4044	4.95
HM6116P-2	24	2048x8	(120ns) CMOS	7.95
HM6116LP-2	24	2048x8	(120ns) L.P. CMOS	8.95
HM6116P-3	24	2048x8	(150ns) CMOS	4.95
HM6116LP-3	24	2048x8	(150ns) L.P. CMOS	6.49
HM6116P-4	24	2048x8	(200ns) CMOS	4.75
HM6116LP-4	24	2048x8	(200ns) L.P. CMOS	5.49
HM6264P-12	28	8192x8	(120ns) CMOS	37.95
HM6264LP-12	28	8192x8	(120ns) L.P. CMOS	39.95
HM6264P-15	28	8192x8	(150ns) CMOS	34.95
HM6264LP-15	28	8192x8	(150ns) L.P. CMOS	37.95
Z6132 (?) / 2?LS00	16	256x1	(80ns) L.P.	3.95
7489	16	16x4	(50ns) 3101	2.25
74C921	18	256x4	(250ns) CMOS	5.95
74C930	18	1024x1	(250ns) CMOS (6518)	5.95
74S189	16	16x4	(35ns) 93405	2.95
74S289	16	16x4	(35ns) 3101	2.95
82S10	16	1024x1	(50ns) O.C. (93415)	3.95
82S25	16	16x4	(50ns) O.C. (74S289)	2.25

PROMS/EPROMS

Part No.	Pins	Function		Price
1702A	24	256x8	(1μs)	3.95
2708	24	1024x8	(450ns)	3.95
2708-5	24	1024x8	(550ns) SM00246	3.49
TMS2516	24	2048x8	(450ns) 2716	4.95
TMS2532	24	4096x8	(450ns) MMC2532	5.49
TMS2564	28	8192x8	(450ns)	10.95
TMS2716	24	2048x8	(450ns) 3 voltage	7.95
2716	24	2048x8	(450ns)	3.95
27C16	24	2048x8	CMOS	14.95
2716-1	24	2048x8	(350ns)	5.49
27160-5	24	2048x8	(550ns)	3.75
2732	24	4096x8	(450ns)	4.95
2732-20	24	4096x8	(200ns)	10.95
2732A-20	24	4096x8	(200ns) 21V	11.49
2732A-25	24	4096x8	(250ns) 21V	7.19
2732A-45	24	4096x8	(450ns) 21V	6.49
27C32A-30	24	4096x8	(300ns) 21V (CMOS)	22.95
2764-20	28	8192x8	(200ns) 21V	14.95
2764-25	28	8192x8	(250ns) 21V	7.19
2764-45	28	8192x8	(450ns) 21V	6.49
27C64	28	8192x8	CMOS 21V	22.95
MCM68764	24	8192x8	(450ns) 21V	24.95
27128-25	28	16,384x8	(250ns) 128K Eprom 21V	21.95
27256-25	28	32,768x8	(250ns) 256K Eprom (14V)	99.95
74S188	16	32x8	PROM O.C. (6330-1)	1.75
74S287	16	256x4	PROM T.S. (6301-1)	1.79
74S288	16	32x8	PROM T.S. (6331-1)	1.79
74S387	16	256x4	PROM O.C. (6300-1)	1.95
74S471	20	256x8	PROM T.S. (6309-1)	4.95
74S472	20	512x8	PROM T.S. (6349-1)	4.95
74S473	20	512x8	PROM O.C. (6348)	4.95
74S474	24	512x8	PROM T.S. (DM87S296N)	4.95
74S475	24	512x8	PROM O.C. (6340)	4.95
74S476	18	1024x4	PROM T.S.	6.95
74S478	24	1024x8	PROM T.S.	9.95
74S570	16	512x4	PROM O.C. (6305)	2.95
74S571	16	512x4	PROM T.S. (6306)	2.95
74S572	18	1024x4	PROM O.C. (6352)	4.95
74S573	18	1024x4	PROM T.S. (82S137)	4.95
82S23	16	32x8	PROM O.C. (27S18)	2.95
82S115	24	512x8	PROM T.S. (27S15)	9.95
82S123	16	32x8	PROM T.S. (27S19)	2.95
82S126	16	256x4	PROM O.C. (27S20)	2.95
82S129	16	256x4	PROM T.S. (27S21)	2.95
82S130	16	512x4	PROM O.C. (27S12)	3.95
82S185	18	2048x4	PROM T.S. (TBP24S81)	9.95
82S191	24	2048x8	(80ns)	14.95
DM87S181N	24	1024x8	PROM T.S. (82S181)	9.95
DM87S184N	18	2048x4	PROM O.C. (82S184)	9.95
DM87S185N	18	2048x4	PROM T.S. (82S185)	9.95
DM87S191N	24	2048x8	PROM T.S. (82S191)	14.95

DATA ACQUISITION

Part No.	Pins	Function	Price
DC10		Mostek DC/DC Converter +5V to -9V	2.95
ADC0801	20	8-Bit A/D Converter (1/4LSB)	14.95
ADC0803	20	8-Bit A/D Converter (±1/2LSB)	4.95
ADC0804	20	8-Bit A/D Converter (1LSB)	3.49
ADC0808	28	8-Bit A/D Conv. w/8-Channel Analog	9.95
ADC0809	28	8-Bit A/D Converter (8-Ch. Multi.)	4.49
ADC0816	40	8-Bit A/D Conv. w/16-Channel Analog	14.95
ADC0817	40	8-Bit A/D Converter (16-Ch. Multi.)	9.49
DAC0806	16	8-Bit D/A Converter (0.78% Lin.)	1.95
DAC0807	16	8-Bit D/A Converter (MC1408-7)	1.49
DAC0808	16	8-Bit D/A Converter (MC1408-8)	2.25
DAC0830	20	8-Bit Up D/A Conv. (.05% Lin.)	5.95
DAC0831	20	8-Bit Up D/A Conv. (.10% Lin.)	4.49
DAC1000	24	10-Bit D/A Conv. Micro. Comp. (0.05%)	7.95
DAC1008	20	10-Bit D/A Conv. Micro. Comp. (0.20%)	6.95
DAC1020	16	10-Bit D/A Conv. (0.05% Lin.)	7.95
DAC1022	16	10-Bit D/A Conv. (0.20% Lin.)	5.95
DAC1222	18	12-Bit D/A Conv. (0.20% Lin.)	6.95
DAC1230	20	12-Bit Up D/A Conv. (.05% Lin.)	14.95
DAC1231	20	12-Bit Up D/A Conv. (.10% Lin.)	13.95
AY-5-1013A	40	30K Baud UART (TR1602)	3.95

Low Profile (Tin) Sockets

Part No.	1-9	10-99	100-up
8 pin LP	.16	.14	.13
14 pin LP	.17	.15	.14
16 pin LP	.19	.17	.16
18 pin LP	.26	.24	.23
20 pin LP	.30	.27	.25
22 pin LP	.31	.28	.26
24 pin LP	.33	.30	.28
28 pin LP	.40	.37	.35
40 pin LP	.49	.46	.43

Soldertail (Gold) Standard

Part No.	1-9	10-99	100-up
8 pin SG	.39	.35	.29
14 pin SG	.49	.45	.39
16 pin SG	.55	.49	.45
18 pin SG	.65	.59	.51
20 pin SG	.75	.65	.59
22 pin SG	.79	.69	.65
24 pin SG	.79	.69	.65
28 pin SG	.95	.85	.75
36 pin SG	1.25	1.15	.99
40 pin SG	1.39	1.25	1.15

Wire Wrap Sockets (Gold) Level #3

Part No.	1-9	10-99	100-up
8 pin WW	.55	.49	.45
10 pin WW	.69	.65	.59
14 pin WW	.75	.69	.65
16 pin WW	.79	.72	.65
18 pin WW	.95	.85	.75
20 pin WW	1.19	1.09	.95
22 pin WW	1.29	1.19	1.05
24 pin WW	1.35	1.19	1.09
28 pin WW	1.69	1.55	1.39
36 pin WW	1.89	1.79	1.69
40 pin WW	2.29	1.85	1.79

Header Plugs (Gold)

Part No.	1-9	10-99	100-up
14 pin HP	.65	.59	.55
16 pin HP	.69	.65	.59
24 pin HP	1.15	.99	.89

Header Covers

Part No.	1-9	10-99	100-up
14 pin HC	.15	.13	.12
16 pin HC	.19	.17	.15
24 pin HC	.29	.25	.22

$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6½% Sales Tax
Shipping — Add 5% plus $1.50 Insurance
Send S.A.S.E. for Monthly sales Flyer!

Spec Sheets — 30¢ each
Send $1.00 Postage for your
FREE 1985 JAMECO CATALOG
Prices Subject to Change

MasterCard

Mail Order Electronics · Worldwide
Jameco ELECTRONICS

VISA®

1355 SHOREWAY ROAD, BELMONT, CA 94002

12/84 ***PHONE ORDERS WELCOME — (415) 592-8097 Telex: 176043***

Digitalker™

DT1050 — Applications: Teaching aids, appliances, clocks, automotive, telecommunications, language translations, etc.

The DT1050 is a standard DIGITALKER kit encoded with 137 separate and useful words, 2 tones, and 5 different silence durations. The words and tones have been assigned discrete addresses, making it possible to output single words or words concatenated into phrases or even sentences. The "voice" output of the DT1050 is a highly intelligible male voice. Female and children's voices can be synthesized. The vocabulary is chosen so that it is applicable to many products and markets.

The DT1050 consists of a Speech Processor Chip, MM54104 (40-pin) and two (2) Speech ROMs MM52164SSR1 and MM52164SSR2 (24-pin) along with a Master Word list and a recommended schematic diagram on the application sheet.

DT1050 Digitalker™ . . . . $34.95 ea.
MM54104 Processor Chip . . . . $14.95 ea.

DT1057 - Expands the DT1050 vocabulary from 137 to over 260 words. Includes 2 ROMs and specs.
Part No. DT1057 . . . . $24.95 ea.

INTERSIL

Part No.	Pins	Function	Price
7045IPI	28	CMOS Precision Timer	14.95
7045EV/Kit	28	Stopwatch Chip, XTL (Evaluation Kit)	19.95
7106CPL	40	3½ Digit A/D (LCD Drive)	10.49
FE0203D		3½ Digit LCD Display for 7106 & 7116	14.95
7106EV/Kit	40	IC, Circuit Board, Display (Evaluation Kit)	46.95
7107CPL	40	3½ Digit A/D (LED Drive)	10.95
7107EV/Kit	40	IC, Circuit Board, Display (Evaluation Kit)	46.95
7116CPL	40	3½ Digit A/D LCD Dis. HLD.	10.95
7201IIUS		Low Battery Volt Indicator	2.25
7205IPG	24	CMOS LED Stopwatch/Timer	14.95
7205EV/Kit	24	Stopwatch Chip, XTL (Evaluation Kit)	16.95
7206CJPE	16	Tone Generator	4.95
7206CEV/Kit	16	Tone Generator Chip, XTL (Evaluation Kit)	7.95
7207AIPD	14	Oscillator Controller	5.95
7207AEV/Kit	14	Freq. Counter Chip, XTL (Evaluation Kit)	8.49
7215IPG	24	4 Func. CMOS Stopwatch CKT	16.95
7215EV/Kit	24	4 Func. Stopwatch Chip, XTL (Evaluation Kit)	19.49
7216AIJI	28	8 Digit Univ. Counter C.A.	31.49
7216DIPI	28	8 Digit Freq. Counter C.C.	21.49
7217IJI	28	4 Digit LED Up/Down Counter C.A.	10.95
7217AIPI	28	4 Digit LED Up/Down Counter C.C.	9.95
7224IPL	40	LCD 4½ Digit Up Counter DRI	10.95
7226AEV/Kit	40	5 Function Counter Chip, XTL (Evaluation Kit)	99.95

30009 1983 INTERSIL Data Book (1356 pgs.) $9.95

74HC High Speed CMOS

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
74HC00	14	.59	74HC139	16	1.05	74HC245	20	2.59
74HC02	14	.59	74HC147	16	1.29	74HC251	16	.99
74HC03	14	.89	74HC151	16	.99	74HC253	16	1.09
74HC04	14	.59	74HC153	16	1.09	74HC257	16	.99
74HCU04	14	.69	74HC154	24	2.65	74HC259	16	1.69
74HC08	14	.59	74HC157	16	.99	74HC266	14	.89
74HC10	14	.59	74HC158	16	.99	74HC273	20	2.79
74HC11	14	.69	74HC160	16	1.39	74HC280	14	4.59
74HC14	14	.89	74HC161	16	1.39	74HC299	20	5.59
74HC20	14	.59	74HC162	16	1.39	74HC366	16	2.59
74HC27	14	.59	74HC163	16	1.39	74HC367	16	2.59
74HC30	14	.69	74HC164	14	1.35	74HC373	20	2.69
74HC32	14	.79	74HC165	16	2.15	74HC374	20	2.69
74HC42	16	1.09	74HC166	16	2.49	74HC390	16	1.59
74HC51	14	.89	74HC173	16	1.29	74HC393	14	1.59
74HC58	14	.89	74HC174	16	1.09	74HC533	20	2.69
74HC73	14	.79	74HC175	16	1.09	74HC534	20	2.69
74HC74	14	.79	74HC190	16	1.59	74HC595	16	3.19
74HC75	16	.99	74HC191	16	1.59	74HC688	20	3.59
74HC76	16	.79	74HC192	16	1.49	74HC4024	14	1.75
74HC85	16	1.69	74HC193	16	1.49	74HC4040	16	1.49
74HC86	14	.75	74HC194	16	1.19	74HC4060	16	1.49
74HC107	14	.79	74HC195	16	1.19	74HC4075	14	.59
74HC109	16	.79	74HC221	16	2.95	74HC4078	14	.59
74HC112	16	.79	74HC237	16	1.49	74HC4511	16	1.95
74HC123	16	2.29	74HC240	20	2.29	74HC4514	24	4.19
74HC125	14	1.75	74HC241	20	2.29	74HC4538	16	2.59
74HC132	14	1.29	74HC242	14	2.15	74HC4543	16	3.75
74HC137	16	1.59	74HC243	14	2.15			
74HC138	16	1.19	74HC244	20	2.29			

74HCU04 is unbuffered. All others are buffered.

74C—C/MOS

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
74C00	14	.29				74C240	20	1.95
74C02	14	.35				74C244	20	1.95
74C04	14	.35	74C107	14	.79	74C373	20	2.29
74C08	14	.35	74C151	16	2.19	74C374	20	2.29
74C10	14	.35	74C154	24	3.25	74C901	14	.59
74C14	14	.59	74C157	16	1.75	74C902	14	.79
74C20	14	.35	74C160	16	1.19	74C903	14	.59
74C30	14	.35	74C161	16	1.19	74C906	14	.59
74C32	14	.39	74C162	16	1.19	74C907	14	.89
74C42	16	1.19	74C163	16	1.19	74C911	28	8.95
74C48	16	1.79	74C164	14	1.29	74C912	28	8.95
74C73	14	.69	74C165	16	1.29	74C915	18	1.19
74C74	14	.59	74C173	16	.89	74C917	28	8.95
74C85	16	1.39	74C174	16	1.19	74C922	18	4.49
74C86	14	.29	74C175	16	1.19	74C923	20	4.95
74C89	16	5.95	74C192	16	1.39	74C925	16	5.95
74C90	14	1.09	74C193	16	1.39	74C926	18	5.95
74C93	14	1.09	74C195	16	1.29	80C95	16	.69
74C95	14	1.19	74C221	16	1.75	80C97	16	.69

LINEAR

Part No.	Pins	Price	Part No.	Pins	Price	Part No.	Pins	Price
TL071CP	8	.79				LM747N	14	.69
TL072CP	8	1.09				LM748N	8	.59
TL074CN	14	1.95	LF355N	8	1.09	UA760HC		9.95
TL081CP	8	.59	LF356N	8	1.09	LM1456V	8	1.95
TL082CP	8	1.19	LM358N	8	.59	LM1458CN	8	.59
TL084CN	14	1.95	LM359N	14	1.79	LM1488N	14	.69
LM108K		5.95	LM370N	14	4.95	LM1489N	14	.69
LM301CN	8	.39	LM373N	14	4.95	LM1496N	14	.99
LM302H		2.49	LM377N	14	1.95	LM1605CK		9.95
LM304H		1.95	LM380CN	8	1.09	LM1800N	16	2.49
LM305H		.99	LM380N	14	.89	LM1871N	18	2.95
LM307CN	8	.49	LM381N	14	1.79	LM1872N	18	3.25
LM308CN	8	.69	LM382N	14	1.49	LM1877N-9	14	2.95
LM309K		1.25	LM384N	14	1.95	LM1889N	18	1.95
LM310CN	8	1.95	LM386N-3	8	.89	LM1896N	14	1.59
LM311CN	8	.59	LM387N	8	1.39	LM2002T		1.95
LM312H		2.79	LM389N	18	1.19	ULN2003A	16	1.49
LM317T		1.19	LM391N-80	16	1.19	XR2206	16	3.95
LM317K		3.49	LM392N	8	.59	XR2207	14	2.49
LM318CN	8	1.59	LM393N	8	.45	XR2208	16	1.79
LM319N	14	1.49	LF398N	8	3.95	XR2211	14	2.95
LM320K-5		1.35	LM399H		5.95	LM2877P		1.95
LM320K-12		1.35	LF412CN	8	1.95	LM2878P		2.95
LM320K-15		1.35	TL494CN	16	2.79	LM2901N	14	.79
LM320K-24		1.35	TL496CP	8	1.59	LM2902N	14	.89
LM320T-5		.85	NE531V	8	1.79	LM2907N	14	2.49
LM320T-12		.85	NE544N	14	1.95	LM2917N	8	1.95
LM320T-15		.85	NE550A	14	.95	LM3900N	14	.59
LM320T-24		.85	NE555V	8	.35	LM3905CN	8	1.19
LM322N	14	1.49	XR-L555	8	.69	LM3909N	8	.89
LM323K		4.95	LM556N	14	.79	LM3914N	18	2.39
LM324N	14	.59	NE558N	16	1.59	LM3915N	18	2.39
LM329DZ		.65	NE564N	16	1.95	LM3916N	18	2.39
LM331N	8	3.95	LM565N	14	.99	RC4136N	14	1.25
LM334Z		1.19	LM566CN	8	1.49	RC4151NB	8	1.95
LM335Z		1.29	LM567V	8	.99	RC4195TK		5.95
LM336Z		1.09	NE570N	16	2.95	LM4250CN	8	1.49
LM337MP		1.15	NE571N	16	2.49	LM4500A	16	2.95
LM337T		1.89	NE592N	14	1.19	NE5532	8	1.69
LM338K		6.95	LM703CN	8	1.49	NE5534	8	1.39
LM339N	14	.69	LM710N	14	.69	79M05AH		1.29
LM340K-5		1.35	LM711N	14	.79	ICL8038B	14	3.95
LM340K-12		1.35	LM723N	14	.49	LM13080N	8	1.19
LM340K-15		1.35	LM733N	14	.89	LM13600N	16	1.19
LM340K-24		1.35	LM739N	14	1.95	76477	28	3.95
LM340T-5		.75	LM741CN	8	.39	MORE AVAILABLE		
LM340T-12		.75						
LM340T-15		.75						
LM340T-24		.75						
LF347N	14	1.49						
LM348N	14	.89						
LM350K		4.79						
LF351N	8	.59						
LF353N	8	.89						

30003 1982 Nat. Linear Data Book (1952 pgs.) . $11.95

CIRCLE 44 ON FREE INFORMATION CARD

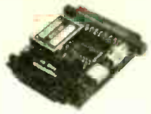
www.americanradiohistory.com

Commodore® Accessories

✻ HAPPY HOLIDAYS! ✻

Apple® Accessories

RS232 ADAPTER FOR VIC-20 AND COMMODORE 64



The JE232CM allows connection of standard serial RS232 printers, modems, etc. to your VIC-20 and C-64. A 4-pole switch allows the inversion of the 4 control lines. Complete installation and operation instructions included.

· Plugs into User Port · Provides Standard RS232 signal levels · Uses 6 signals (Transmit, Receive, Clear to Send, Request to Send, Data Terminal Ready, Data Set Ready)

JE232CM **$39.95**

VOICE SYNTHESIZER FOR APPLE AND COMMODORE

• Over 250 word vocabulary - affixes allow the formation of more than 500 words • Built-in amplifier, speaker, volume control, and audio jack • Recreates a clear, natural male voice • Plug-in user ready with documentation and sample software • Case size: 7¼"L x 3¼"W x 1-3/8"H

APPLICATIONS: • Security Warning • Teaching • Instrumentation • Telecommunication • Handicap Aid • Games

Part No.	Description	Price
JE520CM	For Commodore 64 & VIC-20	$114.95
JE520AP	For Apple II, II+, and IIe	$149.95

Computer Memory Expansion Kits

IBM PC AND PC XT

Most of the popular Memory Boards (e.g. Quadram™ Expansion Boards) allow you to add an add'l 64K, 128K, 192K or 256K. The IBM64K Kit will populate these boards in 64K byte increments. The Kit is simple to install—just insert the 9 - 64K RAM chips in the provided sockets and set the 2 groups of switches. Complete conversion documentation included.

IBM64K (Nine 200ns 64K RAMs) **$43.95**

COMPAQ · COLUMBIA · EAGLE

These PC compatibles and others use the IBM64K for memory expansion.

IBM64K (Nine 200ns 64K RAMs) **$43.95**

APPLE IIe

Extended 80-Column/64K RAM Card. Expands memory by 64K to give 128K when used with programs like VisiCalc™. Fully assembled and tested.

JE864 .... **$99.95**

TRS-80 MODEL I, III

Each Kit comes complete with eight MM5290 (UPD416/4116) 16K Dynamic RAMs and documentation for conversion. Model I: 16K equipped with Expansion Interface can be expanded to 48K with 2 Kits. Model III: Can be expanded from 16K to 48K using 2 Kits. Each Kit will expand computer by 16K increments.

TRS-16K3 200ns (Model III) **$8.95**
TRS-16K4 250ns (Model I) **$6.95**

TRS-80 MODEL IV

Easy to install Kit comes complete with 8 ea. 4164N-20 (200ns) 64K Dynamic RAMs & conversion documentation.

TRS-64K-2 (Converts from 16K to 64K) **$38.95**
TRS-64K-2PAL (8 ea. 4164 w/Special PAL Chip to expand from 64K to 128K) **$59.95**

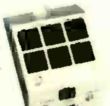
TRS-80 COLOR AND COLOR II

Easy to install Kit comes complete with 8 each 4164N-20 (200ns) 64K Dynamic RAMs and documentation for conversion. Converts TRS-80 Color Computers with D, E, ET, F and NC circuit boards to 32K. Also converts TRS-80 Color Computer II to 64K. Flex DOS or OS-9 required to utilize full 64K RAM on all computers.

TRS-64K-2 .... **$38.95**

INDUSTRIES Protect Yourself...

DATASHIELD® Surge Protector



· Eliminates voltage spikes and EMI-RFI noise before it can damage your equipment or cause data loss · 6 month warranty · Power dissipation (100 microseconds): 1,000,000 watts · 6 sockets · 6 foot power cord · Normal line voltage indicator light · Brown out/black out reset switch

Model 100 .... **$69.95**

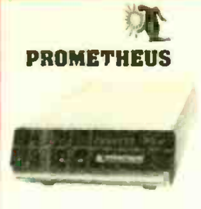
Protect Yourself... DATASHIELD® Back-Up Power Source

Provides up to 30 minutes of continuous 120 VAC 60Hz power to your computer system (load dependent) when you have a black out or voltage sag · Six month warranty · Weight (PC200): 24 lbs. – (XT300): 37.5 lbs.

PC200 (Output rating: 200 watts) **$299.95**
XT300 (Output rating: 300 watts) **$399.95**

PROMETHEUS

Intelligent 300/1200 Baud Telephone Modem with Real Time Clock/Calendar



The ProModem™ is a Bell 212A (300/1200 baud) intelligent stand-alone modem · Full featured expandable modem · Standard features include Auto Answer and Auto Dial, Help Commands, Programmable Intelligent Dialing, Touch Tone™ and Pulse Dialing & More · Hayes command set compatible plus an additional extended command set · Shown w/alphanumeric display option.

Part No.	Description	Price
PM1200	RS-232 Stand Alone Unit	$349.95
PM1200A	Apple II, II+ and IIe Internal Unit	$369.95
PM1200B	IBM PC and Compatible Internal Unit	$269.95
PM1200BS	IBM PC & Comp. Int. Unit w/ProCom Software	$319.95
MAC PAC	Macintosh Package (Includes PM1200, Cable, & ProCom Software)	$399.95

OPTIONS FOR ProModem 1200

PM-COM	(ProCom Communication Software). Please specify Operating System.	$79.95
PM-OP	(Options Processor)	$79.95
PMO-16K	(Options Processor Memory – 16K)	$10.95
PMO-32K	(Options Processor Memory – 32K)	$20.95
PMO-64K	(Options Processor Memory – 64K)	$39.95
PM-ALP	(Alphanumeric Display)	$79.95
PM-CC	(Apple IIc to PM1200 Cable)	$29.95
PM-MC	(Macintosh to PM1200 Cable)	$29.95

KEYBOARDS

13½"L x 4¼"W x ⅜"H

Mitsumi 54-Key Unencoded All-Purpose Keyboard

· SPST keyswitches · 20 pin ribbon cable connection · Low profile keys · Features: cursor controls, control, caps (lock), function, enter and shift keys · Color (keycaps): grey · Wt.: 1 lb. · Pinout included

KB54 .... **$14.95**

16-9/16"L x 6⅞"W x 1⅝"H

76-Key Serial ASCII Keyboard

· Simple serial interface · SPST mechanical switching · Operates in upper and lower case · Five user function keys: F1-F5 · Six finger edge card connection · Color (keys): tan · Weight: 2 lbs. · Data incl.

KB76 .... **$29.95**

Apple Keyboard and Case for Apple II and II+

· Keyboard: Direct connection with 16-pin ribbon connector · 26 special functions · Size: 14½"L x 5½"W x 1½"H
· Case: Accommodates KB-A68 · Pop-up lid for easy access · Size: 15½"W x 18"D x 4⅝"H

Part No.	Description	Price
KB-EA1	Keyboard and Case (pictured above)	$134.95
KB-A68	68-Key Apple Keyboard only	$79.95
EAEC-1	Expanded Apple Enclosure Case only	$59.95

POWER SUPPLIES

TRANSACTION TECHNOLOGY, INC. 5VDC @ 1 AMP Regulated Power Supply

· Output: +5VDC @ 1.0 amp (also +30VDC regulated) · Input: 115VAC, 60 Hz · Two-tone (black/beige) self-enclosed case · 6 foot, 3-conductor black power cord · Size: 6½"L x 7"W x 2¼"H · Weight: 3 lbs.

PS51194 .... **$14.95**

Power/Mate Corp. REGULATED POWER SUPPLY

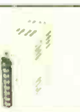
· Input: 105-125/210-250 VAC at 47-63 Hz · Line regulation: ±0.05% · Three mounting surfaces · Overvoltage protection · UL recognized · CSA certified

Part No.	Output	Size	Weight	Price
EMA5/6B	5V@3A/6V@2.5A	4⅞"L x 4"W x 2⅜"H	2 lbs.	$29.95
EMA5/6C	5V@6A/6V@5A	5⅝"L x 4⅞"W x 2⅜"H	4 lbs.	$39.95

POWER PAC INC. REGULATED POWER SUPPLY

· Perfect for computer systems · Output: +5VDC @ 11 Amps, -5VDC @ 1 Amp, +12VDC @ 2 Amps, -12VDC @ 0.5 Amp and +24VDC @ 3 Amps · Overvoltage protection · Size: 12⅝"L x 6⅝"W x 4⅝"H · Weight: 17 lbs. · Spec incl.

PS2922 .... **$69.95**



4-CHANNEL SWITCHING POWER SUPPLY

· Microprocessor, mini-computer, terminal, medical equipment and process control applications · Input: 90-130VAC, 47-440Hz · Output: +5VDC @ 5A, -5VDC @ 1A, +12VDC @ 1A, -12VDC @ 1A · Line regulation: ±0.2% · Ripple: 30mV p-p · Load regulation: ±1% · Overcurrent protection · Adj: 5V main output ±10% · Size: 6⅝"L x 1⅝"W x 4-15/16"H · Weight: 1½ lbs.

FCS-604A **$69.95**

Switching Power Supply for APPLE II, II+ & IIe™

· Can drive four floppy disk drives and up to eight expansion cards
· Short circuit and overload protection · Fits inside Apple computer
· Fully regulated +5V @ 5A, +12V @ 1.5A, -5V @ .5A, -12V @ .5A
· Direct plug-in power cord included · Size: 9⅝"L x 3½"W x 2⅛"H
· Weight: 2 lbs.

KHP4007 (SPS-109) **$59.95**

$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6½% Sales Tax
Shipping — Add 5% plus $1.50 Insurance
Send S.A.S.E. for Monthly Sales Flyer!

Spec Sheets — 30¢ each
Send $1.00 Postage for your
FREE 1985 JAMECO CATALOG
Prices Subject to Change

MasterCard · Mail Order Electronics · Worldwide · **Jameco ELECTRONICS** · VISA

1355 SHOREWAY ROAD, BELMONT, CA 94002

12/84 *PHONE ORDERS WELCOME — (415) 592-8097 Telex: 176043*

5¼" APPLE™ Direct Plug-In Compatible Disk Drive and Controller Card

The ADD-514 Disk Drive uses Shugart SA390 mechanics – 143K formatted storage · 35 tracks · Compatible with Apple Controller & ACC-1 Controller · The drive comes complete with connector and cable — just plug into your disk controller card · Size: 6"L x 3½"W x 8-9/16"D · Weight: 4½ lbs.

ADD-514 (Disk Drive) **$169.95**
ACC-1 (Controller Card) **$49.95**

More Apple Compatible Add-Ons...

APF-1	(Cooling Fan)	$39.95
KHP4007	(Switching Power Supply)	$59.95
JE614	(Numeric/Aux. Keypad for IIe)	$59.95
KB-A68	(Keyboard w/Keypad for II & II+)	$79.95
MON-12G	(12" Green Monitor for II,II+, IIe, IIc)	$99.95
JE864	(80 Col. +64K RAM for IIe)	$99.95
ADD-12	(5¼" Half-Height Disk Drive)	$179.95

DISK DRIVES

RFD480	(Remex 5¼" full-ht.)	$129.95
JA551-2	(Panasonic 5¼" half-ht.)	$139.95
TM100-2	(Tandon 5¼" full-ht.)	$159.95
FD55B	(Teac 5¼" half-ht.)	$149.95
SA455	(Shugart 5¼" half-ht.)	$159.95
FDD100-8	(Siemens 8" full-ht.)	$139.95
PCK-5	(5¼" Power Cable Kit)	$2.95
PCK-8	(8" Power Cable Kit)	$3.95

UV-EPROM Eraser

8 Chips - 21 Minutes

1 Chip - 15 Minutes

Erases all EPROMs. Erases up to 8 chips within 21 minutes (1 chip in 15 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact — only 9.00"L x 3.70"W x 2.60"H. Complete with holding tray for 8 chips.

DE-4 UV-EPROM Eraser **$74.95**
UVS-11EL Replacement Bulb **$16.95**

JE664 EPROM PROGRAMMER

8K to 64K EPROMS — 24 & 28 Pin Packages

Completely Self Contained — Requires No Additional Systems for Operation

· Programs and validates EPROMs · Checks for properly erased EPROMs · Emulates PROMs or EPROMs · RS232C Computer Interface for editing and program loading · Loads data into RAM by keyboard · Changes data in RAM by keyboard · Loads RAM from an EPROM · Compares EPROMs for content differences · Copies EPROMs · Power input: 115VAC, 60Hz, less than 10W power consumption · Enclosure: Color-coordinated, light tan panels with molded end pieces in mocha brown · Size: 15⅝"L x 8⅝"D x 3½"H · Weight: 5⅝ lbs.

The JE664 EPROM Programmer emulates and programs various 8-Bit Word EPROMs from 8K to 64K-Bit memory capacity. Data can be entered into the JE664's internal 8K x 8-Bit RAM in three ways: (1) from a ROM or EPROM, (2) from an external computer via the optional JE665 RS232C BUS, (3) from its panel keyboard. The JE664's RAMs may be accessed for emulation purposes from the panel's test socket to an external microprocessor. In programming and emulation, the JE664 allows for examination, change and validation of program content. The JE664's RAMs can be programmed quickly to all "1"s (or any value), allowing unused addresses in the EPROM to be programmed later without necessity of "UV" erasing. The JE664 displays DATA and ADDRESS in convenient hexadecimal (alphanumeric) format. A "DISPLAY EPROM DATA" button changes the DATA readout from RAM word to EPROM word and is displayed in both hexadecimal and binary code. The front panel features a convenient operating guide. The JE664 Programmer includes one JM16A Jumper Module (as listed below).

JE664-A EPROM Programmer **$995.00**
Assembled & Tested (includes JM16A Module)

JE665 — RS232C INTERFACE OPTION — The RS232C interface Option implements computer access to the JE664's RAM. This allows the computer to manipulate, store and transfer EPROM data to and from the JE664. A sample program listing is supplied in MBASIC for CP/M computers. Documentation is provided to adapt the software to other computers with an RS232 port. 9600 Baud, 8 bit word, odd parity with 2 stop bits.

EPROM Programmer w/JE665 Option

JE664-ARS **$1195.00**
Assembled & Tested (includes JM16A Module)

EPROM JUMPER MODULES — The JE664's JUMPER MODULE (Personality Module) is a plug in Module that pre-sets the JE664 for the proper programming pulses to the EPROM and configures the EPROM socket connections for that particular EPROM.

JE664 EPROM Jumper Mod. No.	EPROM	Programming Voltage	EPROM MANUFACTURER	Price
JM08A	2708	25V	AMD, Motorola, Nat., Intel, TI	$14.95
JM16A	2716, TMS2516 (TI)	25V	Intel, Motorola, Nat., NEC, TI, AMD, Hitachi, Mostek	$14.95
JM16B	TMS2716 (3-V's)	5V, -5V, +12V	Motorola, TI	$14.95
JM32A	TMS2532	25V	Motorola, TI, Hitachi, OKI	$14.95
JM32B	2732	25V	AMD, Fujitsu, NEC, Hitachi, Intel, Mitsubishi, National	$14.95
JM32C	2732A	21V	Fujitsu, Intel	$14.95
JM64A	MCM68764, MCM68L764	21V	Motorola	$14.95
JM64B	2764	21V	Intel, Fairchild, OKI	$14.95
JM64C	TMS2564	25V	TI	$14.95

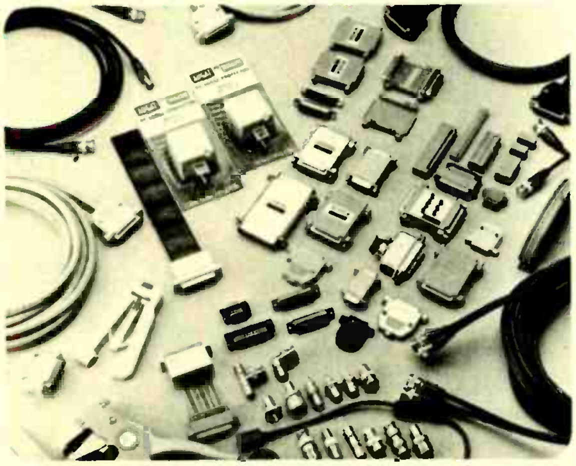
CIRCLE 114 ON FREE INFORMATION CARD

www.americanradiohistory.com

CHOOSE AUGAT® PACKAGED PRODUCTS

Sockets, Switches, Knobs, IDC Products, — and now RDI Terminal Blocks

PLUS *a full line of DATA Cable Products featuring Coaxial and RS-232C Cables, D-Subs, Edge Cards, B & C Connectors and Gender Changers.*



Over 1300 items are now available to you through your local Electronics Store. For the store closest to you, contact our Sales Representatives or call us directly.

Guaranteed Source of Supply

for Sockets, Interconnection Products, IDC Products, AlcoSwitches, Lamps, Knobs, RDI Terminal Blocks . . . and much more!

AUGAT® PACKAGED PRODUCTS

300 Pine St., Canton, MA 02021
(617) 828-7220
Outside 617 Area Call Toll Free 1-800-336-3613

REPRESENTATIVES

New England
KEENE SALES CO., INC.
*Lynn, MA 01901
(617) 595-2300
East Longmeadow, MA 01028
(413) 525-1049

Upstate NY
LEONARD D. ALLEN, INC.
Syracuse, NY 13211
(315) 437-8387

Metropolitan New York, Long Island, No. NJ
STEVE FISHER SALES CORP.
Teaneck NJ 07666
(201) 837-1200

S. NJ, East PA, DE, MD, DC, VA
AUSTIN ASSOCIATES
*Willingboro, NJ 08046
(609) 871-9290
Middletown, MD 21769
(301) 371-9390

GA, SC, NC, TN, AL, MS
WALLACE ELECTRONIC SALES
*Kernersville, NC 27284
(800) 672-4290
Jonesboro, GA 30236
(800) 334-3518
Norcross, GA 30093
(800) 334-3518

FL, Puerto Rico
SEACOM SALES CO.
*Lauderdale Lakes, FL 33319
(305) 486-0260
Tampa, FL 33629
(813) 831-6083

AR, LA, OK, TX
BOB GUNN & ASSOCIATES
*Carrolton, TX 75006
(214) 733-1222
Oklahoma City, OK 73132
(405) 721-9400
Folsam, LA 70437
(504) 796-9825
San Antonio, TX 78247
(512) 655-1041
Houston, TX 77065
(713) 469-7041

IL, East WI, Clinton Cty, IA, Lake & Porter Counties, IN
ELECTRONIC SPECIALISTS, INC.
Elmhurst, IL 60126
(312) 941-0710
Hales Corners, WI 53130
(414) 529-2653

OH, WV, West PA
MANDABACH-LEHNER CO.
*Columbus, OH 43213
(614) 235-0265
Stow, OH 44224
(216) 686-1965

No. CA, NV
FEATHERSTONE SALES CO.
Hayward, CA 94544
(415) 785-1926

So. CA, Clark Cty, NV
LESSING ASSOCIATES
*Newhall, CA 91321
(805) 254-0274
Carlsbad, CA 92008
(619) 434-6913

AZ, NM, El Past Cty, TX
MORE SALES COMPANY
Phoenix, AZ 85016
(602) 265-9201

OR, WA, West ID, West MT, AK
ROGER M. MINTHORNE CO.
*Portland, OR 97219
(503) 246-4556

CO, UT, WY, S.E. ID, East MT, West NE
MKP MARKETING INC.
*Denver, CO 80222
(303) 759-5661

IN (excluding Lake & Porter Ctys.), KY
STB & ASSOCIATES INC.
*Carmel, IN 46032
(317) 844-9227

MO, KS, IA (excluding Clinton Cty.), NB, So. IL
KATHRINUS KELLY BAUMHAUER & CO.
*St. Louis, MO 63117
(314) 647-2400
Blue Springs, MO 64015
(816) 229-0001

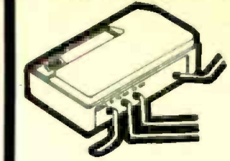
MI & MN: contact
AUGAT PACKAGED PRODUCTS

*Main Office

CIRCLE 52 ON FREE INFORMATION CARD

QUALITY SPECIALS

DELUXE 46 CHANNEL CABLE TV CONVERTER

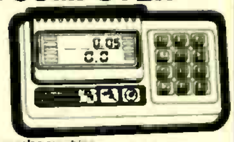


With Fine Tuning Dial
- Shifts all cable channels to UHF
- Extend pay TV to all your TV sets without extra monthly fee
- Allows taping pay TV (decoder required) while viewing another channel
- Restores TV remote control and VCR programming ability

$24.95

BICYCLE COMPUTER

A Dashboard for your Bike



Handsome matte black console with keyboard input. Displays your speed, distance & calories burned on 2 sq. in. LCD screen. Quartz clock/stopwatch built in. Complete with MAG pickup & all mounts.

$49.95

Upgrade any bike to a deluxe exercise machine

NEW DIGITAL SCALE

Lab accuracy at an everyday price ...reads 1 gram or .1 oz.

Gives fast, exact weight in ounces or grams for the lab, dieting, postage, photography. Capacity: 1999 grams/70 ozs. with automatic tare. Free postage & diet chart.

Best Value $74.95

POCKET MICROSCOPE

USA Made precision 4 lens optics gives sharp undistorted image. Easily detects hairline faults. Internal scale accurate to 1%. Rugged metal case, only 5 inches long.

10X has .265 in. field, .005 in. scale divisions
20X has .190 in. field, .002 in. scale divisions

4 x 40 Screw Tap Specify 10X or 20X **$14.95**

GOLDSMITH SCIENTIFIC CORPORATION

VISA

720 E. Industrial Park Dr., Manchester, NH 03103

PHONE ORDERS WELCOME (603) 624-8030

FREE CATALOG OF NEW DEVICES

POSTAGE—ADD 5% PLUS $1.50 INSURANCE, C.O.D. $2.00 EXTRA
SATISFACTION FULLY GUARANTEED

CIRCLE 256 ON FREE INFORMATION CARD

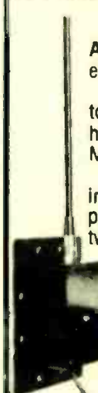
ACTIVE RECEIVING ANTENNA

Gives excellent reception, 50 KHz to 30 MHz.

New MFJ-1024 Active Receiving Antenna mounts outdoors away from electrical noise for maximum signal.

Gives excellent reception of 50 KHz to 30 MHz signals. Equivalent to wire hundreds of feet long. Use any SWL, MW, BCB, VLF or Ham receiver.

High dynamic range RF amplifier. 54 in. whip. 50 foot coax. 20 dB attenuator prevents receiver overload. Switch between two receivers. Select auxiliary or active antenna. Gain control. "ON" LED. Remote unit, 3x2x4 in. Control, 6x2x5 in. 12 VDC or 110 VAC with optional adapter, MFJ-1312, $9.95.



$129.95 (+$4.00 shipping)

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping).

One year unconditional guarantee.

Order today. Call **TOLL FREE 800-647-1800.** Charge VISA, MC. Or mail check, money order.

Write for free catalog. Over 100 products.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 in Miss., outside continental USA, tech/order/repair info. TELEX 53-4590.

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

CIRCLE 105 ON FREE INFORMATION CARD

www.americanradiohistory.com

STOP DREAMING START BUILDING

HANDY MAKES IT EASY!
Build anything from computers to LED flashers ... any project you want the fast, easy, fun way. Use HANDY solderless breadboards to build, test, modify and expand your ideas.

SATISFACTION GUARANTEED OR YOUR MONEY BACK!

JUST LOOK AT THESE SOCKET FEATURES...
- Full contact labeling — simplifies component layouts
- New durable clip design assures reliable, low resistance, corrosion-free interconnections
- High temp plastic — no warping or melting...ever!
- Self-adhesive backing — mounts anywhere
- Big 9 14-pin IC capacity per socket
- Expands horizontally and vertically

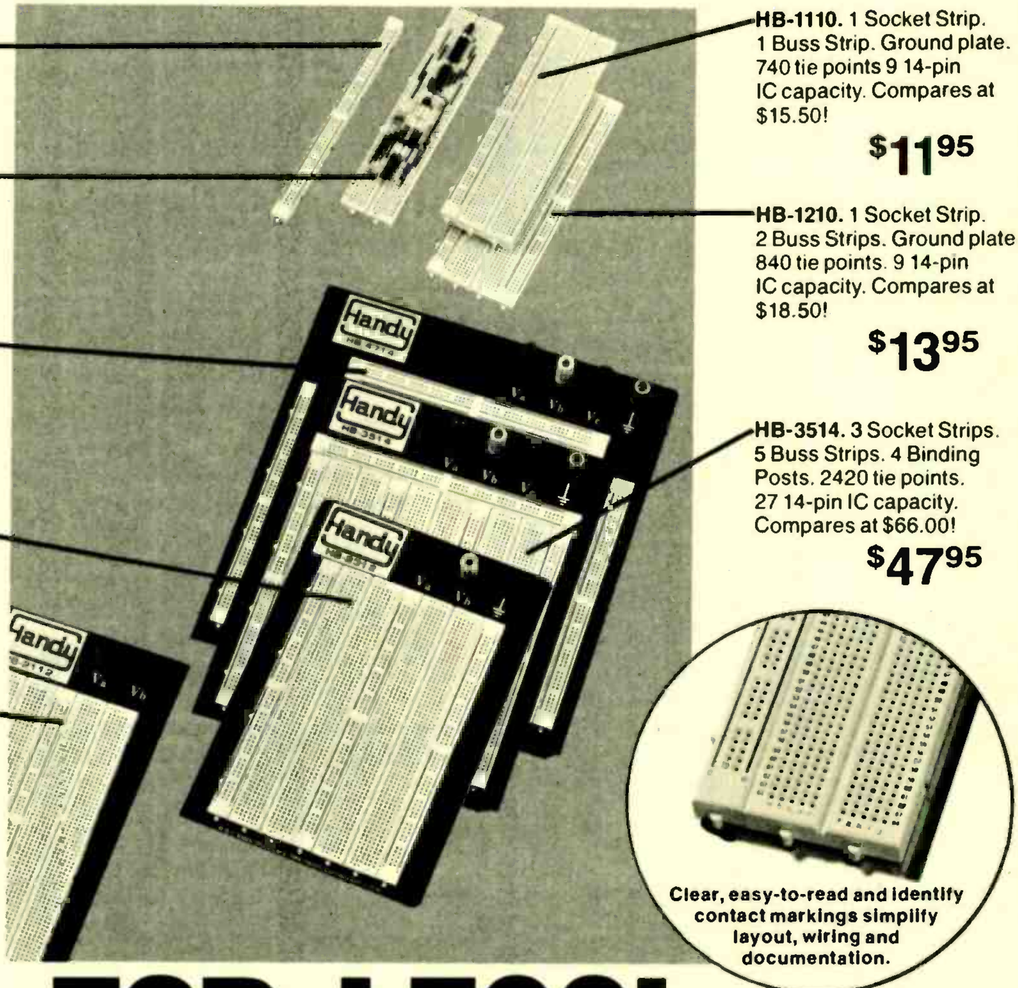
HB-0100. 1 Buss Strip. 100 tie points. Compares at $3.00!
$2.25

HB-1000. 1 Socket Strip. 640 tie points. 9 14-pin IC capacity. Compares at $12.50!
$9.95

HB-4714. 4 Socket Strips. 7 Buss Strips. 4 Binding Posts. 3260 tie points. 36 14-pin IC capacity. Compares at $89.00!
$63.95

HB-2312. 2 Socket Strips. 3 Buss Strips. 3 Binding Posts. 1580 tie points. 18 14-pin IC capacity. Compares at $51.50!
$31.00

HB-2112. 2 Socket Strips. 1 Buss Strip. 2 Binding Posts. 1380 tie points 18 14-pin IC capacity.
$24.95



Clear, easy-to-read and identify contact markings simplify layout, wiring and documentation.

HB-1110. 1 Socket Strip. 1 Buss Strip. Ground plate. 740 tie points 9 14-pin IC capacity. Compares at $15.50!
$11.95

HB-1210. 1 Socket Strip. 2 Buss Strips. Ground plate. 840 tie points. 9 14-pin IC capacity. Compares at $18.50!
$13.95

HB-3514. 3 Socket Strips. 5 Buss Strips. 4 Binding Posts. 2420 tie points. 27 14-pin IC capacity. Compares at $66.00!
$47.95

FOR LESS!

SEND FOR FREE Colorful Brochure!

Available at Selected Distributors throughout the USA and Canada
HANDY PRICES ARE UP TO 25% LESS THAN COMPETITORS!

ORDER TOLL FREE
1-800-34-HANDY
charge with VISA or MasterCard. All items off-the-shelf for immediate Shipment!

VISA MasterCard

Handy
a division of RSP Electronics Corp.
7 Business Park Drive • P.O. Box 699 • Branford, CT 06405
Telephone: (203) 488-6603 CompuServe: 71346, 1070
TWX: (910) 997-0648 Easy Link Mail Box: 62537580

Mail Orders: Please add $3 (Canada & Int'l add $5) for shipping/handling. **Charge Cards:** (Min. $15). Please include Acct. No., Exp. Date and your signature. **Checks:** drawn in U.S. Dollars on U.S. banks only. **C.O.D.'s** accepted. **Connecticut Residents:** Add 7.5% Sales Tax.

CIRCLE 71 ON FREE INFORMATION CARD

www.americanradiohistory.com

PARTIAL LISTING ONLY- PLEASE CALL OR WRITE FOR FREE CATALOG.

STATIC RAMS

2112	256x4	(450ns)	2.99
2114	1024x4	(450ns)	8/9.95
2114-25	1024x4	(250ns)	8/10.95
2114L-4	1024x4	(450ns)(LP)	8/12.95
2114L-3	1024x4	(300ns)(LP)	8/13.45
2114L-2	1024x4	(200ns)(LP)	8/13.95
TMM2016-200	2048x8	(200ns)	4.15
TMM2016-150	2048x8	(150ns)	4.95
TMM2016-100	2048x8	(100ns)	6.15
HM6116-4	2048x8	(200ns)(cmos)	4.75
HM6116-3	2048x8	(150ns)(cmos)	4.95
HM6116LP-4	2048x8	(200ns)(cmos)(LP)	5.95
HM6116LP-3	2048x8	(150ns)(cmos)(LP)	6.95
HM6264P-15	8192x8	(150ns)(cmos)(LP)	34.95

LP = Low Power

DYNAMIC RAMS

4116-250	16384x1	(250ns)	8/7.95
4116-200	16384x1	(200ns)	8/12.95
4116-150	16384x1	(150ns)	8/14.95
4164-200	65536x1	(200ns)(5v)	9/44.95
4164-150	65536x1	(150ns)(5v)	9/49.00
TMS4164	65536x1	(150ns)(5v)	8.95

5v = Single 5 Volt Supply

EPROMS

2708	1024x8	(450ns)	3.95
2716	2048x8	(450ns)(5v)	3.95
2716-1	2048x8	(350ns)(5v)	5.95
TMS2532	4096x8	(450ns)(5v)	5.95
2732	4096x8	(450ns)(5v)	4.95
2732-250	4096x8	(250ns)(5v)	8.95
2732-200	4096x8	(200ns)(5v)	11.95
2732A	4096x8	(250ns)(5v)(21vPGM)	9.95
2732A-2	4096x8	(200ns)(5v)(21vPGM)	13.95
2764	8192x8	(450ns)(5v)	6.95
2764-250	8192x8	(250ns)(5v)	7.95
2764-200	8192x8	(200ns)(5v)	19.95
27128-30	16384x8	(300ns)(5v)	22.95

5v = Single 5 Volt Supply
21vPGM = Program at 21 Volts

SPECTRONICS CORPORATION EPROM ERASERS

	Timer	Chip Capacity	Intensity (uW/Cm²)	
PE-14		9	8,000	83.00
PE-14T	X	9	8,000	119.00
PE-24T	X	9	9,600	175.00

8000

8035	5.95
8039	5.95
8080	3.95
8085	4.95
8085A-2	11.95
8087	175.00
8088	29.95
8155	6.95
8155-2	7.95
8156	6.95
8748	24.95
8755	24.95

8200

8203	39.95
8205	3.50
8212	1.80
8216	1.75
8228	3.49
8237-5	21.95
8243	4.45
8250	10.95
8251	4.49
8253	6.95
8253-5	7.95
8255	4.49
8255-5	5.25
8259	6.90
8259-5	7.50
8272	39.95
8275	29.95
8279	8.95
8282	6.50
8284	5.50
8286	6.50
8288	25.00

Z80

2.5 Mhz

Z80-CPU	3.95
Z80-CTC	3.95
Z80-PIO	3.95
Z80-SIO/0	11.95

4.0 Mhz

Z80A-CPU	4.49
Z80A-CTC	4.95
Z80A-DART	9.95
Z80A-PIO	4.49
Z80A-SIO/0	12.95

6.0 Mhz

Z80B-CPU	9.95

6500

6502	4.95
6520	4.35
6522	6.95
6532	9.95
6551	11.85
6502A	6.95
6522A	9.95
6551A	11.95

6800

68000-8	49.95
6800	2.95
6802	7.95
6809E	14.95
6809	11.95
6821	2.95
6845	12.95
6850	3.25
6883	22.95

DISK CONTR

1771	15.95
1791	23.95
1793	23.95
UPD765	19.95

INTERFACE

8T26	1.59
8T28	1.98
DM8131	2.95
DP8304	2.29

CLOCK CHIPS

MM5314	4.95
MM5369	3.95
MM58167	12.95
MSM5832	3.95

DATA ACQ

ADC0804	3.49
ADC0809	4.49
ADC0817	9.95
DAC0808	2.95
MC1408L8	2.95

SOUND CHIPS

76477	3.95
76488	5.95
AY3-8910	12.95
SSI263	39.95

74LS00

74LS00	.24	74LS157	.65
74LS01	.25	74LS158	.59
74LS02	.25	74LS160	.69
74LS03	.25	74LS161	.65
74LS04	.24	74LS163	.65
74LS05	.25	74LS164	.69
74LS08	.28	74LS165	.95
74LS09	.29	74LS166	1.95
74LS10	.25	74LS169	1.75
74LS11	.35	74LS173	.69
74LS12	.35	74LS174	.55
74LS13	.45	74LS191	.89
74LS14	.59	74LS192	.79
74LS20	.25	74LS193	.79
74LS21	.29	74LS194	.69
74LS26	.29	74LS195	.69
74LS27	.29	74LS197	.79
74LS32	.29	74LS221	.89
74LS33	.55	74LS240	.95
74LS37	.35	74LS241	.99
74LS38	.35	74LS242	.99
74LS40	.25	74LS243	.99
74LS42	.49	74LS244	1.29
74LS47	.75	74LS245	1.49
74LS51	.25	74LS251	.59
74LS73	.39	74LS253	.59
74LS74	.35	74LS257	.59
74LS75	.39	74LS258	.59
74LS76	.39	74LS259	2.75
74LS85	.69	74LS260	.59
74LS86	.39	74LS266	.55
74LS90	.55	74LS279	.49
74LS92	.55	74LS280	1.98
74LS93	.55	74LS283	.69
74LS107	.39	74LS290	.89
74LS109	.39	74LS293	.89
74LS112	.39	74LS299	1.75
74LS122	.45	74LS323	3.50
74LS123	.79	74LS365	.49
74LS124	2.90	74LS367	.45
74LS125	.49	74LS368	.45
74LS126	.49	74LS373	1.39
74LS132	.59	74LS374	1.39
74LS136	.39	74LS377	1.39
74LS138	.55	74LS390	1.19
74LS139	.55	74LS393	1.19
74LS145	1.20	74LS640	2.20
74LS148	1.35	74LS645	2.20
74LS151	.55	74LS670	1.49
74LS153	.55	74LS682	3.20
74LS154	1.90	74LS688	2.40
74LS155	.69	81LS95	1.49
74LS156	.69	25LS2521	2.80

7400

7400	.19	7492	.50
7401	.19	7493	.35
7402	.19	74100	1.75
7403	.19	74107	.30
7404	.19	74116	1.55
7405	.25	74121	.29
7406	.29	74122	.45
7407	.29	74123	.49
7408	.24	74125	.45
7409	.19	74126	.45
7410	.19	74132	.45
7411	.25	74145	.60
7413	.35	74148	1.20
7414	.49	74150	1.35
7416	.25	74151	.55
7417	.25	74153	.55
7420	.19	74154	1.25
7421	.35	74155	.75
7425	.29	74157	.65
7427	.29	74159	1.65
7430	.19	74161	.69
7432	.29	74163	.69
7437	.29	74164	.85
7438	.29	74165	.85
7442	.49	74166	1.00
7445	.69	74173	.75
7447	.96	74174	.89
7448	.69	74175	.89
7473	.34	74185	2.00
7474	.33	74192	.79
7475	.45	74193	.79
7476	.35	74194	.85
7483	.50	74259	2.25
7485	.59	74367	.65
7489	2.15	74368	.65
7490	.35	74393	1.35

74S00

74S00	.32
74S02	.35
74S04	.35
74S05	.35
74S08	.35
74S10	.35
74S11	.35
74S20	.35
74S32	.40
74S37	.88
74S74	.50
74S86	.50
74S112	.50
74S124	2.75
74S132	1.24
74S133	.45
74S138	.85
74S139	.85
74S140	.55
74S151	.95
74S153	.95
74S157	.95
74S158	.95
74S161	1.95
74S163	1.95
74S174	.95
74S175	.95
74S240	2.20
74S241	2.20
74S244	2.20
74S280	1.95
74S287	1.90
74S288	1.90
74S373	2.45
74S374	2.45
74S471	4.95

★★★★HIGH TECH★★★★

65C02 $12.95
CMOS VERSION OF THE 1 MHz 6502 MICROPROCESSOR

- LOW POWER-8ma OPERATION, 10 MICROAMP STANDBY
- SINGLE POWER SUPPLY: 3-6 VOLTS
- 27 NEW INSTUCTIONS AND ADDRESS MODES
- PIN FOR PIN COMPATIBILITY WITH 6502
- BUS ENABLE AND MEMORY LOCK FEATURES
- USED IN APPLE IIc COMPUTERS

★★★★SPOTLIGHT★★★★

CRYSTALS

32.768Khz	1.95
1.0Mhz	3.95
1.8432	3.95
2.0	2.95
2.4576	2.95
3.579545	2.95
4.0	2.95
5.0	2.95
5.0688	2.95
6.0	2.95
6.144	2.95
8.0	2.95
10.0	2.95
10.738635	2.95
14.31818	2.95
15.0	2.95
16.0	2.95
17.430	2.95
18.432	2.95
20.0	2.95

UARTS

AY5-1013	3.95
AY3-1015	6.95
TR1602	3.95
2651	8.95
IM6402	7.95

BIT-RATE GENERATORS

BR1941	11.95
4702	12.95
COM8116	10.95
14411	11.94

MISC.

3242	7.95
MC3470	4.95
AY5-3600 PRO	11.95
HD46505SP	15.95
CRT5027	19.95

LINEAR

TL084	2.19	NE564	2.95
LM301	.34	LM565	.99
LM307	.45	LM566	1.49
LM308	.69	NE592	2.75
LM309K	1.25	LM733	.98
LM310	1.75	LM741	.35
LM311	.64	LM747	.69
LM317T	1.19	LM1310	1.49
LM317K	3.95	MC1330	1.69
LM318	1.49	MC1372	6.95
LM323K	4.95	LM1458	.59
LM324	.59	LM1488	.69
LM331	3.95	LM1489	.69
LM334	1.19	LM1496	.85
LM335	1.40	LM1800	2.37
LM336	1.75	LM1812	8.25
LM337T	1.95	LM1889	1.95
LM338K	3.95	ULN2003	2.49
LM339	.99	XR2006	3.75
LM348	.99	XR2211	5.25
LM350K	4.95	CA3146	1.85
LF351	.60	LM3900	.59
LF353	1.00	LM3911	2.25
LF356	1.10	LM3914	3.95
LF357	1.40	MC4024	3.95
LM358	.69	MC4044	4.50
LM359	1.79	RC4136	1.25
LM377	1.95	75150	1.95
LM383	1.95	75154	1.95
LM386	.89	75188	1.25
LM393	1.29	75189	1.95
LM393	1.29	75451	.39
TL497	3.25	75453	.39
NE555	.34	75492	.79
NE556	.65		

T = TO-220 K = TO-3

VISIT OUR NEW, EXPANDED RETAIL STORE AT 1256 SOUTH BASCOM IN SAN JOSE

HOURS: M-W-F, 9-5 T-TH., 9-9 SAT., 10-3

JDR Microdevices

1224 S. Bascom Avenue, San Jose, CA 95128
800-538-5000 • 800-662-6279 (CA)
(408) 995-5430 • Telex 171-110
FAX (408) 275-8415

PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: Minimum order $10. For shipping and handling include $2.50 for UPS Ground and $3.50 for UPS Air. Orders over 1 lb. and foreign orders may require additional shipping charges — please contact our sales department for the amount. CA residents must include 6% sales tax. Bay Area and LA residents include 6½%. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sale.

© Copyright 1984 JDR Microdevices

CIRCLE 113 ON FREE INFORMATION CARD

www.americanradiohistory.com

PARTIAL LISTING ONLY- PLEASE CALL OR WRITE FOR FREE CATALOG.

CAPACITORS

ELECTROLYTIC

RADIAL			AXIAL		
.47uf	50v	.14	10	50v	.16
10	50v	.15	22	16v	.14
47	35v	.18	47	50v	.20
100	16v	.18	100	15v	.20
220	35v	.20	150	25v	.25

50v MONOLITHIC

.01uf	.14	.1	.05
.047	.15	.47	.25

50v DISC

10pf	.05	470	.05
22	.05	560	.05
25	.05	680	.05
27	.05	820	.05
33	.05	.001uf	.05
47	.05	.0015	.05
56	.05	.0022	.05
68	.05	.005	.05
82	.05	.01	.07
100	.05	.02	.07
220	.05	.05	.07
330	.05	.1	.12

SPECIALS ON BYPASS CAPS

.01uf disc	50v	100/6.00
.1uf disc	12v	100/8.00
.01uf mono	50v	100/12.00
.1uf mono	50v	100/15.00

ACCESORIES & PERIPHERALS

FOR IBM

MAXIMIZER Memory Multifunction	259.95
HAYES SMARTMODEM 1200B	419.95
PC PEACOCK Color Display Adaptor	239.95
130W POWER SUPPLY	175.00
PROTOTYPE CARD	27.95
PROTOTYPE CARD With Decoding	29.95

FOR APPLE

JDR 16K RAM CARD	39.95
BAL-500 ½ Ht. Disk Drive, Teac Mechanism	169.95
MITAC AD-1 Full Height, Shugart Mechanism	179.95
DISK CONTROLLER CARD	49.95
OMNIGRAPH Parallel Graphics Card	79.95
VIEWMAX-80 80 Column For Apple II+	159.95
VIEWMAX-80e 80 Column For Apple IIe	129.95
THUNDERCLOCK Official PRODOS Clock	129.95
KRAFT JOYSTICK	39.95
60W POWER SUPPLY	49.95

MISCELLANEOUS

ZENITH ZVM-123 15 MHz Green Monitor	105.00
NEC JB1201M 20 MHz Green Monitor	169.00
BMC BM-AU9191U Comp. 13" Color Monitor	279.00
BMC BX-80 PRINTER	249.00
NASHUA DISKETTES SS/SD Box of 10	19.95
VERBATIM DATALIFE DISKETTES DS/DD	34.95
DISKETTE FILE Holds 70 Diskettes	16.99

BARGAIN HUNTERS CORNER

***NASHUA DISKETTES**

5¼" SOFT SECTOR

DOUBLE SIDED, DOUBLE DENSITY

WITH HUB RINGS

BULKED PACKED IN FACTORY SEALED BAGS OF 50. INCLUDES DISKETTE SLEEVES AND WRITE PROTECT TABS. IDEAL FOR SCHOOLS, CLUBS, AND USERS GROUPS. THIS IS A SPECIAL PURCHASE, SO QUANTITIES ARE LIMITED.

5 YEAR WARRANTY.

$1.39 ea. QTY 250 **$1.49 ea.** QTY 100 **$1.59 ea.** QTY 50

*NASHUA DISKETTES WERE JUDGED TO HAVE THE HIGHEST POLISH AND RECORDED AMPLIYUDE OF ANY DISKETTES TESTED. (SEE "COMPARING FLOPPY DISKS", BYTE 9/84)

DISKETTE FILE $9.95

BY DEALING DIRECT WITH THE FACTORY WE CAN MAKE THIS UNBEATABLE OFFER!

- ATTRACTIVE SMOKED ACRYLIC CASE WITH 6 INDEXED DIVIDERS
- RUGGED, HIGH QUALITY CONSTRUCTION
- HOLDS 70 5¼" DISKETTES WITH ROOM TO SPARE

ORDER 50 NASHUA DISKETTES, AND GET THIS DISKETTE FILE FOR ONLY $6.95

SPECIALS END 11/30/84

5¼" DISK DRIVES

TANDON TM100-2	DS/DD	199.00
SHUGART SA400L	SS/DD	199.95
MPI B52	DS/DD	139.95
TEAC FD55B ½ Ht.	DS/DD	159.00
TEAC FD55F ½ Ht.	DS/Quad	200.00

8" DISK DRIVES

SIEMENS FD200-8	DS/DD	195.00
SIEMENS FD100-8	SS/DD	149.95

IC SOCKETS/DIP CONNECTORS

LEADS	LOW PROFILE SOLDERTAIL		3 LEVEL WIREWRAP		TEXTOOL ZERO INSERTION ZIFxx	CDMPONENT CARRIES ICCxx	IDC PLUG RIBBON CABLE IDPxx
	1-99pcs.	100&up	1-99pcs.	100&up			
8	.13	.11	.59	.49	---	.65	---
14	.15	.12	.69	.52	5.95	.75	1.45
16	.17	.13	.69	.58	5.95	.85	1.65
18	.20	.18	.99	.90	---	1.00	---
20	.29	.27	1.09	.98	---	1.25	---
22	.30	.27	1.39	1.28	---	1.25	---
24	.30	.27	1.49	1.35	7.95	1.35	2.50
28	.40	.32	1.69	1.49	8.95	1.50	---
40	.49	.39	1.99	1.80	10.95	2.10	4.15
64	4.25	---	---	---	---	---	---

IDC CONNECTORS

DESCRIPTION	ORDER BY	CONTACTS 20	26	34	40	50
RIBBON HEADER SOCKET	IDSxx	1.86	2.43	3.15	3.73	4.65
RIBBON EDGE CARD	IDExx	2.36	2.65	3.25	3.80	4.74

ORDERING INSTRUCTIONS: Insert the number of contacts in the position marked "xx" of the "order by" part number listed. EXMAMPLE: A 20 pin ribbon edge card would be IDE 20.

SWITCHING POWER SUPPLIES

KEPCO/TDK	ASTEC
MODEL MRM174KF	MODEL AA11190
+5V @ 5A	+5V @ 4A
+12V @ 2A	+12V @ 2.5A
+12V @ 2.8A	-5V @ .25A
-12V @ .5A	-12V @ .30A
49.95	39.95

LIGHT EMITTING DIODES

JUMBO	1-99	100-up	DISPLAYS			
RED	.10	.09	MAN-72	CA	.3"	.99
GREEN	.18	.15	MAN-74	CC	.3"	.99
YELLOW	.18	.15	FND-500	CC	.5"	1.49
			FND-507	CA	.5"	1.49

D-SUBMINIATURE

DESCRIPTION		ORDER BY	CONTACTS 9	15	25	37
SOLDER CUPS	MALE	DBxxP	2.08	2.69	2.50	4.80
	FEMALE	DBxxS	2.66	3.63	3.25	7.11
RT. ANGLE PC SOLDER	MALE	DBxxPR	1.65	2.20	3.00	4.83
	FEMALE	DBxxSR	2.18	3.03	4.42	6.19
IDC RIBBON CABLE	MALE	IDBxxP	3.37	4.70	6.23	9.22
	FEMALE	IDBxxS	3.69	5.13	6.84	10.08
HOODS	BLACK	HOOD-B	---	---	1.25	---
	GREY	HOOD	1.60	1.60	1.25	2.95

MOUNTING HARDWARE-$1.00

FOR ORDERING INSTRUCTIONS, SEE IDC CONN. ABOVE.

9000

9334	2.50
9368	3.95
9602	1.50

INTERSIL

ICL7107	12.95
ICL7660	2.95
ICL8038	3.95

DIP SWITCHES

4 position	.85
6 position	.90
7 position	.95
8 position	.95

TRANSISTORS

2N2222	.25	PN2907	.25
PN2222	.10	2N3055	.79
2N2905	.50	2N3904	.10
2N2907	.25	2N3906	.10

DISCRETE

1N751	5.1v zener	.25
1N759	12.0v zener	.25
1N4148	(1N914) switching	25/1.00
1N4004	400PIV rectifier	10/1.00
KBP02	200PIV 1.5a bridge	.45
4N33	OPTO-ISOLATOR	1.75

RIBBON CABLE

CONTACTS	SINGLE COLOR 1'	10'	COLOR CODED 1'	10'
25	.75	6.60	1.32	11.80
34	.98	8.80	1.65	14.50
50	1.38	12.10	2.50	22.00

36 PIN CENTRONICS

CEN36 MALE SOLDER CUP	7.95
IDCEN36 MALE RIBBON CABLE	8.95
IDCEN36F FEMALE RIBBON CABLE	8.95

VOLTAGE REGULATORS

7805T	.75	7915T	.85
78M05C	.35	7805K	1.39
7808T	.75	78H05K	9.95
7812T	.75	7812K	1.39
7815T	.75	7912K	1.49
7824T	.85	78L05	.69
7905T	.85	79L05	.79
7912T	.85	79L12	.79

C, T=TO-220, K=TO-3, L=TO-92

CMOS

4001	.25	4027	.45	4066	.39	4538	1.95
4002	.25	4028	.69	4069	.29	4543	1.19
4011	.25	4029	.79	4070	.35	4553	5.79
4012	.25	4040	.75	4071	.29	4584	.75
4013	.38	4042	.69	4081	.29	74C00	.35
4015	.39	4046	.85	4082	.29	74C04	.35
4016	.39	4047	.95	4093	.49	74C14	.59
4017	.69	4049	.35	4503	.65	74C74	.65
4018	.79	4050	.35	4511	.85	74C906	.95
4020	.75	4051	.79	4518	.89	74C922	4.49
4023	.29	4053	.79	4520	.79	74C923	4.95
4024	.65	4060	.89	4528	1.19	74C926	7.95

. . . I would like to take this opportunity to say I think JDR is super. I have ordered from other companies and had to wait 3-4 weeks while my check cleared and then they were slow in filling the order. I shall continue to buy from JDR as much as possible. Also, you have good merchandise and nice people.

Robert L. Singleton

MasterCard

VISA

ORDER TOLL FREE

800-538-5000

800-662-6279

(CALIFORNIA RESIDENTS)

© Copyright 1984 JDR Microdevices

CIRCLE 113 ON FREE INFORMATION CARD

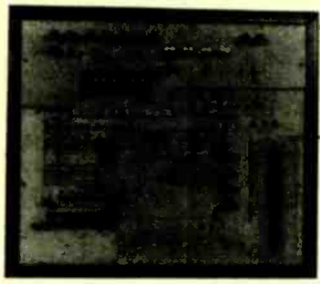
www.americanradiohistory.com

hobbyist dream come true
Perfect training tool
low cost lab equipment

SAVE MONEY TIME

Use ProtoMate ($369.00)

AN UNIQUE design aid
combining multiple equipments



Proto strips optional

Size 13¼ in. X 15¼ in. X 3 in.

FEATURES ARE:

- 2 FUNCTION GENERATORS AM, FM
- VOLTAGE TO FREQUENCY CONVERTER
- DC VOLTMETER
- ±12V, +5V POWER SUPPLIES
- FREQUENCY COUNTER
- PERIOD COUNTER
- PRESETTABLE DECIMAL COUNTER
- CRYSTAL OSCILLATOR
- INTERFACE DRIVERS
- LOGIC PROBE
- 5 WAY GENERAL PURPOSE TERMINALS (OPT)
- 10 OP AMPS
- CONSTANT CURRENT SOURCE

DEALERS INQUIRIES WELCOME
CA resident add 6½% sale tax
add shipping charge $8 ups / $8 ups blue

ELECTRON RESEARCH
P.O. BOX 23698 SANJOSE CA 95123
TEL: 408-224-8206
428 CONESTOGA WAY, SAN JOSE, CA 95123

CIRCLE 269 ON FREE INFORMATION CARD

CABLE TV

CONVERTERS AND DESCRAMBLERS

- * JERROLD
- * OAK
- * ZENITH
- * HAMLIN
- * SCIENTIFIC ATLANTA
- * SATELLITE DESCRAMBLERS
- * CABLE KIT

LOW PRICES
QUANTITY DISCOUNTS
SEND $5.00 FOR CATALOG

R & M DISTRIBUTORS
PO BOX 266-R
BOSTON, MA 02190
(617) 871-5838

VISA · MasterCard

CIRCLE 258 ON FREE INFORMATION CARD

NEW!! 46 CHANNEL VHF TO UHF CATV/VCR CHANNEL CONVERTER With Built In Amplifier and Fine Tuning

- Converts cable TV Mid and Superband Channels to be received on your TV/VCR's Standard UHF channels
- Designed to enhance VCR units and cable add ons
- Convenient fine tuning control permits adjustment without special tools or screwdrivers
- Built in Amplifier for UHF gain of +5 to 8 db
- Channel conversion chart on top of unit
- Easy hookup and excellent performance

This unit contains no decoder and is subject to rules of your local Cable Co.

GMI Model 3640 Our Price $32.95 ea.

CLOSEOUT While They Last — TUSA CATV BLOCK CONVERTERS
CVU-1000 Deluxe Model Reg. $29.95 ea. $24.95 Closeout

B&K PRECISION — TELEPHONE LINE ANALYZER Model 1042
Fast and easy-to-use for quick line checks. No external power required. Isolates problem to telephone line or telephone. Tests wiring for do-it-yourself installation and line functions that affect telephone operation. Complete Instructions incl.
$16.95 ea.

Model 1045 TELEPHONE PRODUCT TESTER
Tests corded/cordless phone operation and automatic phone dialers for all basic functions, defects in line & hand set cords, tone or pulse dial operation, ringing circuit operation, sound volume and voice quality.
$329.95 ea.

POPULAR IC CHIPS

TYPE	DESCRIPTION	1-9	10-up
LM-380N	2 watt Audio Power Amp	$1.49	$1.49
LM-386N-3	Low Voltage Audio Amp	1.59	1.19
NE-564N	Digital Phase Locked Loop	3.50	2.95
LM-565N	Phase Locked Loop	1.49	.99
LM-733N	Video Amp	1.69	.98
MC-1330	Video Detector	2.29	1.69
MC-1349	Video IF Amp	2.08	1.88
MC-1350	Video IF Amp	1.75	1.19
MC-1352	Video IF Amp AGC	2.69	2.09
MC-1358	Audio IF Amp	1.75	1.64
MC-1374P	R.F. Modulator	3.19	2.39
MC-1458	Dual Comp. Op Amp	.88	.59
MC-1496N	Balanced Mod/Demodulator	1.79	1.34
LM-1889	Video Modulator	2.79	1.95

WINEGARD 7-ELEMENT 75 OHM UHF YAGI ANTENNAS
12 db GAIN — Specify Channel — $8.95 EA — 6 OR MORE $7.95 EA.
OPTIONAL Winegard UHF Antenna Preamp 18db Gain NF - 1.8db $39.95 ea.

SANYO UHF VARACTOR TUNERS
75 Ohm Input - 45 MHz Output
For Channels 14 - 83
MODEL 115-B-403A — Now! $16.95 EACH
All units are brand new from Sanyo
Call for Quantity Price

Brand New Hitachi NICAD BATTERIES
Stop wasting money on one-life batteries. These Hitachi batteries can be recharged over and over again. All units are brand new - *not surplus.*
AA....2 for $3.69
C....2 for $5.69
D....2 for $5.69

75 OHM CABLE CONNECTORS
F-59 Male connector for RG-59/U cable. Comes complete with your choice (specify) of ⅜" or ½" crimp-type ferrule.
100 for $10.50 — 20¢ ea.

NEW!! Model SC-34
AB SWITCH ELIMINATOR SIGNAL COMBINER with Switchable Chan. 3 or 4 insertion
• Permits STV, MDS, Satellite or VCR signal insertion into existing MATV/CATV head ends • Permits remote control TVs to switch between off-air and premium recording/viewing • Multi TV set operation without the use of elaborate switchers • High quality six stage bandpass/bandstop filter with adjustable balancing attenuators • Inserts program materials to channel 3 or 4 where adjacent channels 2/4 and 3/5 exist.
Our Price $14.95 ea.

New Version of the Jerrold 400
GEN. INSTRUMENT LCC58 58 CHAN. CATV CONVERTER
Receive all the standard VHF, Mid and Superband cable TV channels. Provides excellent reception on any channels that are not being scrambled by your local cable company. Converts all cable channels to channel 3 for viewing on your regular TV set. Hand held wireless remote control allows remote channel change and TV on/off control, installs in minutes on any set. Note: To receive the cable frequencies you must subscribe to your local cable company.
$99.95 EACH — $94.00 10 OR MORE

1N4001 DIODES
15 for $1.00....100 for $5.00

ISO-TIP — WAHL SOLDERING IRONS
MODEL 7470 Temperature-Adjustable Micro Soldering Station
Compact. 500° to 700°F. Perfect for micro circuits and fine mfg. Grounded tip. Comes with 3/32" B type tip, tip wiping sponge & stand. 3-wire grounded power supply cord.
$39.95 ea.
MODEL 7700 "Quick Charge" Iso-Tip Cordless Soldering Iron
Recharges completely in 3-4½ hours or in 1-2 hours for partially discharged battery. Cannot overcharge. Up to 125 electronic joints per charge. Kit contains cordless soldering iron, stand, 7545 tip, 7546 tip & instructions.
$29.95 ea.
MODEL 7800 Iso-Tip "60" Cordless Soldering Iron
Fastest recharging cordless soldering iron on the market. Same as above but recharges in ONE HOUR.
$39.95 ea.

Car Stereo SIGNAL BOOSTER
Model BF-8000 Amplifies FM radio signals an average of 18db (8 times). Improves reception and extends range to allow a greater selection of stations and reduces fading. Install in minutes under dash on radio antenna cable. Separate switch and indicator light. 12 VDC.
REG. $38.25 — OUR PRICE ON SALE $24.95

THE BRAND NEW WINEGARD Phöne-A-Tennä
EXTENDS CORDLESS TELEPHONE RANGE UP TO 3 TIMES!
Here's the best quality, best working phone antenna on the market. Simple installation. Mounts outdoors. Does not void telephone warranty.
COMPLETE KIT includes antenna, 40' coaxial cable, adaptor and easy instructions.
Introductory Special $37.95 — List Reg. $62.25

QUALITY POWER TRANSFORMERS
24V CT, 500 mA.
$3.19 ea. 10-49 $2.75 ea. 50 or more $2.25 ea.
For Larger Quantities Call

COLORMAX 36 CHANNEL REMOTE CATV CONVERTER
Now you can change channels or fine-tune your TV set by remote control up to 20 ft. away. This unit receives channels 2-13 plus mid & superband cable channels then outputs them on Channel 3.
MODEL CM35-2P — 2 pc. REMOTE CONTROL
Use of this unit may be subject to rules by your local cable TV Co.
$69.95 ea. — 3 or more $64.95 ea.

SURPLUS SYLVANIA VHF VARACTOR TUNERS
45 MHz output. Channels 2 through 13 as well as the mid-band channels. Hookup data included.
WHILE THEY LAST! $13.95 ea.

ORDER NOW TOLL FREE
800-854-4655 OUTSIDE CALIFORNIA
714-635-5090 INSIDE CALIFORNIA

R.F. ELECTRONICS
1086-C N. STATE COLLEGE BLVD., DEPT. R
ANAHEIM, CALIFORNIA 92806

OPEN TUES - FRI 10 - 6, SAT 10 - 5, CLOSED SUN & MON
SEND for FREE Mail Order Catalog

MOST ORDERS SHIPPED WITHIN 24 HOURS — NO MINIMUM ORDER
ALL PREPAID ORDERS 2 LBS OR LESS MUST INCLUDE $2.50 SHIPPING & HANDLING — SHIPPED SAME DAY RECEIVED

CIRCLE 121 ON FREE INFORMATION CARD

HIGH QUALITY UP TO 75dB GAIN

MICROWAVE TV SYSTEM

Varible from 1.9 to 2.5 GHz

The latest advance in microwave technology with a SNOW-FREE PICTURE.

Two Models to choose from.
Both Models Include:
- 20" Parabolic Dish
- Pre-assembled Probe with Down Converter
- Power Supply and Coax Switch
- 60' of RG-59/U Coax with Connector
- Transformer for 75 to 300 Ohms
- All Mounting Hardware for Fast and Easy Installation

20" Fiberglass Dish — Up to 55dB Gain — Special $98.95
20" Aluminum Dish — Up to 55dB Gain — Low Priced $98.95

Add 10% for Foreign orders or U.S. Parcel Post

High Gain Yagi Antenna with Down Converter and Power Supply. Complete System. Ready to Use. $89.95

Send $2.00 for Catalog. Refundable with first purchase.
Available thru Mail and Phone Orders Only
20% deposit for COD. CA Res add 6½% Tax.
Send Cashiers Check or Money Order to:
(Personal Checks, allow 2-5 weeks to clear)

PROFESSIONAL VIDEO, Inc.
4670 Hollywood Blvd., Hollywood, Calif. 90027
For C.O.D. Orders Call (213) 219-0227

CIRCLE 119 ON FREE INFORMATION CARD

www.americanradiohistory.com

Radio Shack Parts Place

Quantity Discounts! **No Minimum Order!** **First Quality!**

Ceramic Disc Capacitors

- Hi-Q Design
- Moistureproof
- 50 WVDC Minimum

pF	Cat. No.	Pkg. of 2
4.7	272-120	.39
47	272-121	.39
100	272-123	.39
220	272-124	.39
470	272-125	.39

µF	Cat. No.	Pkg. of 2
.001	272-126	.39
.005	272-130	.39
.01	272-131	.39
.05	272-134	.49
.1	272-135	.49

Tantalum Capacitors

- 20% Tolerance
- IC PCB Spacing

µF	WVDC	Cat. No.	Each
0.1	35	272-1432	.49
0.47	35	272-1433	.49
1.0	35	272-1434	.49
2.2	35	272-1435	.59
10	16	272-1436	.69
22	16	272-1437	.79

Monolithic Ceramic Caps

Epoxy Dipped ■ 50 WVDC

Value	Temperature Coefficient	Cat. No.	Each
10 pF	NPO	272-151	.69
100 pF	NPO	272-152	.69
470 pF	NPO	272-153	.69
1000 pF	Z5U	272-154	.69
4700 pF	Z5U	272-155	.69
.01 µF	Z5U	272-156	.69
.047 µF	Z5U	272-157	.69
.1 µF	Z5U	272-158	.79

¼-Watt, 5% Resistors

Pkg. of 5 **39¢**

Ohms	Cat. No.
10	271-1301
100	271-1311
150	271-1312
220	271-1313
270	271-1314
330	271-1315
470	271-1317
1k	271-1321
1.8k	271-1324
2.2k	271-1325
3.3k	271-1328
4.7k	271-1330
6.8k	271-1333

Ohms	Cat. No.
10k	271-1335
15k	271-1337
22k	271-1339
27k	271-1340
33k	271-1341
47k	271-1342
68k	271-1345
100k	271-1347
220k	271-1350
470k	271-1354
1 meg	271-1356
10 meg	271-1365

Power Transformers

120 VAC Primaries

Type	Volts	Current	Cat. No.	Each
PC Mini	12.0 CT	120 mA	273-1360	2.49
Miniature	6.3	300 mA	273-1384	2.59
Miniature	12.6	300 mA	273-1385	2.79
Miniature	25.2	300 mA	273-1386	3.49
Miniature	12.6 CT	450 mA	273-1365	3.59
Miniature	25.2 CT	450 mA	273-1366	3.99
Standard	6.3	1.2 A	273-1351	3.99
Standard	12.6 CT	1.2 A	273-1352	4.99
Standard	25.2	1.2 A	273-1353	5.99
Heavy-Duty	12.6 CT	3.0 A	273-1511	5.99
Heavy-Duty	25.2 CT	2.0 A	273-1512	6.29
Heavy-Duty	18.0 CT	2.0 A	273-1515	6.99

CT = Center Tap

Computer/Game Connectors

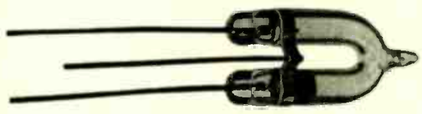
Type	Positions	Cat. No.	Each
Solder Sub-D Male	9	276-1537	1.99
Solder Sub-D Female	9	276-1538	2.49
Hood for Above	9	276-1539	1.99
Solder Sub-D Male	15	276-1527	2.49
Solder Sub-D Female	15	276-1528	3.49
Hood for Above	15	276-1529	1.99
Solder Sub-D Male	25	276-1547	2.99
Solder Sub-D Female	25	276-1548	3.99
Hood for Above	25	276-1549	1.99
Solderless Sub-D Male	25	276-1559	4.99
Solderless Sub-D Fem.	25	276-1565	4.99
Printer Connector	36	276-1534	6.99
Cable Socket	34	276-1525	3.19
Disk Drive Connector	34	276-1564	4.95
Card Edge Socket	44	276-1551	2.99
D-Sub Dustcap (Set)	25	276-1546	2/39¢
5-Ft. Ribbon Cable	25	278-772	3.59
25-Ft. Ribbon Cable	25	278-773	16.95

Hi-Fi Electret Mike Elements

PC Board-Mount. Omnidirectional. 2-10 VDC with very low current drain, 1 milliamp max. 20 to 15 kHz ±4 dB. 6.6 mm high. 270-090 .... 99¢

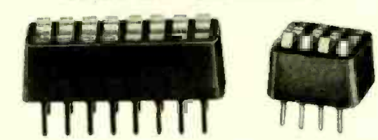
Omnidirectional. Great for projects, upgrading old mikes. Clean 30 to 15,000 Hz response. 4-10 VDC. 7/16 x 3/8" dia. With leads. 270-092 .. 2.69

Xenon Strobe Tube



For replacement or photo and "light-show" projects. Trigger: 4 kV. Anode: 200 V min. 100,000-flash life. 272-1145 .... 2.99

SPST DIP Switches



For digital or low-current applications. Mount in DIP sockets or on PC boards.

8-Position. Fits 16-pin DIP socket. 275-1301 ...... 1.99

4-Position. Fits 8-pin DIP socket. 275-1304 ...... 1.49

Dictionary of Electronic Terms

NEW!

Defines over 1200 modern day electronic terms with concise, understandable descriptions. Large, easy-to-read typeface. Over 100 illustrations. Special up-front section contains over 200 common abbreviations, acronyms and electronic symbols. 96 pages. 62-1391 .... 2.79

Timer IC Mini Notebook

By Forrest Mims III

An excellent reference and hobby book covering the versatile 555 and 556 ICs. By one of America's most popular technical authors. Large schematic diagrams. 32 pages. 276-5010 .... 99¢

Communications ICs

Type	Cat. No.	Each
XR 2206 AFSK Generator	276-2336	5.95
XR 2211 AFSK Decoder	276-2337	5.95
MC1330 Video Detector	276-1757	1.99
MC1350 IF Amplifier	276-1758	1.99
MC1358/CA3065 FM Detector	276-1759	1.79

Voice Synthesizer IC

SPO256-AL2. MOS LSI. Uses a program stored in its built-in ROM to synthesize any English word. Requires low-cost support components and host computer. Easy to interface. Requires 3.12 MHz clock crystal (available through Radio Shack). 5 VDC, single supply. 28-pin DIP with detailed data. 276-1784 .... 12.95

Melody Synthesizer IC

AY-3-1350. NMOS. Ideal for door bells and musical funboxes. Programmed with Yankee Doodle, Brahms' Lullaby, Blue Danube, Star Wars—28 favorites in all. Requires extra parts. 28-pin DIP with data. 276-1782 .... 5.99

Dynamic Transistor Checker

Cut 20%

Reg. 14.95 **11.95**

Tests In or Out Of Circuit

Indicates relative current gain, "opens" and "shorts". Makes it easy to match transistors. Features a front panel socket plus hook-clip leads for in-circuit tests. Output jack for external meter or scope. 2¾ x 4⅜ x 1³⁄₁₆". With instructions. Requires "AA" battery. 22-025 .... Sale 11.95

27-Range, 30,000 Ohms Per Volt Multitester

$10 Off!

Reg. 34.95 **24.95**

Features single-knob function switch, color-coded 4" mirrored scale, polarity-reverse switch. DC Volts: 0 to 1000, 8 ranges. AC Volts: 0 to 1000, 5 ranges. DC Current: 0 to 10 amps, 5 ranges. Resistance: 0 to 10 megohms, 4 ranges, (10 ohms center scale). dB: −10 to +62, 5 ranges. Accuracy: ±4% AC, ±3% DC. 6¼ x 4½ x 1¾". Fused and overload protected. Requires one "AA" and one 9V battery. 22-203 .... Sale 24.95

A DIVISION OF TANDY CORPORATION **Radio Shack®** OVER 8800 LOCATIONS WORLDWIDE

Prices apply at participating Radio Shack stores and dealers

CIRCLE 78 ON FREE INFORMATION CARD

www.americanradiohistory.com

SPARTAN Electronics Inc

CALL MAIL (516) 499-9500

6094 Jericho Tpke.
Commack, N.Y. 11725

CTC9R **Philips Remote Cable Converter**

• Micro computer technology • Quartz controlled IC's lock in picture & prevent drift • 60 channel selections • Programmable time on & off • 24 hour LED digital clock • Favorite channel memory & recall plus scan • Wireless hand held "infra-red" transmitter system • Automatic fine tune • Adaptable to any brand television • One year warranty service

$139.95

SPEAKER PHONE

Model #30-9558
Hands Free Conversation
Modular Connectors
Push Button Dial
Volume Control
Mute/Hold Button
Pulse/Tone Switchable
Last Number Redial
$44.95

SOUND ACTIVATED SWITCH MODEL R-1 $29.95
For Home Security.
Hears a Noise. Turns On Lights!

When lights turn on, intruders are frightened away...ask any policeman. The new SOUND activated SWITCH automatically turns on lights at any sound, so it looks like you're home even when you're not. SOUND activated SWITCH protects your home better than timers. It turns on lights at the sound of an attempted break-in, and automatically turns them off when it's safe.
SOUND activated SWITCH.
It's the **lightwatchman** you can't afford to be without.

• Entry Hall • Nursery • Sick Room • Family Room • Stairways and Halls • Children's Rooms • Attics • Basements • Garage • Closets

REFURBISHED MONITORS
9" and 12" Bell & Howells or GBC Commercial Grade as low as **$39.95**
$10.00 off with a purchase of 2 refurbished monitors

BECKMAN CIRCUITMATE DM73 **$61.95**
• .5% basic Vdc Accuracy probe-sized dmm
• 4 ac/dc voltage ranges (autoranging)
• 4 resistance ranges (autoranging)
• continuity beeper
• "touch hold" button
Other Curcuitmate Meters Available.

Jerrold 58 Channel Wireless Remote Converter $109.95
Jerrold 36 Channel Remote CATV Converter w/on/off Fine Tuning $94.95

40 Channel VHF to UHF Block Converter
28.95 Ea.
24.95 4 & up
Deluxe Version - Features fine tuning knob, matching X former & 2 cables $38.95

BEFORE YOU PAY $$ FOR A TELEPHONE SERVICE CALL, TEST IT YOURSELF
Telephone Line Analyze Model #1042 B&K PRECISION
— Tests telephone line functions that affect telephone operation
— Verifies line and ring voltage levels
— Checks condition of telephone line from central office to user's telephone jack
— Verifies telephone line polarity that can affect polarity sensitive telephones
$19.95

B&K PRECISION **PROFESSIONAL TELEPHONE PRODUCT TESTER**
Features: **MODEL 1045**
• Provides basic operation tests for corded and cordless telephones, answering machines, and automatic dialers
• Checks telephone line cords and handsets cords for continuity, shorts and intermittents
• Verifies number dialed and redialed for pulse or touch-tone telephones
• Provides low and normal level ring test sequence
• Verifies that voice and DTMF (Dual Tone Multiple Frequency) levels are above minimum required level
• Can be used by the consumer without the aid of a salesperson—an easy to follow instruction card is provided with the tester
• Can be used by the salesperson to demonstrate operation and features of telephone products and to screen returns before making an exchange
$335.95

Dealers Welcome
Visa MC BAC Amex All above prices include 4% cash discount COD money order check Add for Shipping

Volume Discounts
Min. Order $25.00
International shipping Add'l
Prices subject to change without notice
COD 2.00 Extra
Add'l shipping for monitors

to	75.00	$2.50
76.00 to	250.00	$4.50
251.00 to	500.00	$6.00
501.00 to	750.00	$8.50
751.00 to	1000.00	$12.00
Over	1000.00	$12.50

(516) 499-9500 Mon Th 9-8 Tu W F 9-6 Sa 9:30-5

CIRCLE 75 ON FREE INFORMATION CARD

ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

WERSI electronics
ORGAN & PIANO KITS
ALPHA DX 300

fully DIGITAL RS232 Interface

THE WORLD LEADER

For Free Sound Info
Call 1-800-233-3865
or write WERSI USA
Dept. M 8 P.O. Box 5318
Lancaster, PA 17601

P.C. BOARDS AND ART SERVICES
• FACE PLATES
• ENCLOSURES
WRITE OR CALL
For Literature or Quotes

Let us quote you on any stage of your product from proto types to production.
FABTRON DIV.
P.O. Box 925
Columbia, TN 38401
(615) 381-1143

CB MODIFICATIONS
Increase channels, range, privacy! We specialize in frequency expanders, speech processors, FM converters, PLL & slider tricks, how-to books, plans, kits. Expert mail-in repairs & conversions. 16-page catalog $2.
CBC INTERNATIONAL, P.O. BOX 31500RE, PHOENIX, AZ 85046 (602) 996-8700

AMAZING DEVICES

PHASORS
PERSONAL DEFENSE AND PROPERTY PROTECTION UTILIZE SPACE AGE TECHNOLOGY.
CAUTION THESE DEVICES CAN BE HAZARDOUS AND MAY SOON BE ILLEGAL.
POCKET PAIN FIELD GENERATOR — IPG50
Assembled $64.50
IPG5 ....Plans.... $8.00 IPG5K ....Kit/Plans.... $44.50
PHASOR PAIN FIELD CROWD CONTROLLER — PPF10
Assembled $250.00
PPF1 ....Plans.... $15.00 PPF1K ....Kit/Plans.... $175.00
BLASTER — Provides a plasma discharge capable of puncturing a can.
BLS10 ....Assembled.... $89.50
BLS1 ....Plans.... $10.00 BLS1K ....Kit/Plans.... $69.50
SHOCKER/PARALYZING DEVICE — Very intimidating and effective. 5 to 10 feet
SHG60 ....Assembled.... $99.50
SHG6 ....Plans.... $10.00 SHG6K ....Kit/Plans.... $69.50

LASERS
RUBY LASER RAY GUN — Intense visible red beam burns and welds hardest of metals. **MAY BE HAZARDOUS.**
RUB3 *All Parts Available for Completing Device* $15.00
CARBON DIOXIDE BURNING, CUTTING LASER — Produces a continuous beam of high energy. **MAY BE HAZARDOUS.**
LC5 *All Parts Available for Completing Device.* $15.00
VISIBLE LASER LIGHT GUN — produces intense red beam for sighting, spotting, etc. Hand held complete.
LGU3 Plans. $10.00 *(Kit & Assembled Units Available)*
IR PULSED LASER RIFLE — Produces 15-30 watt infra-red pulses at 200-2000 per sec.
LRG3 ....*All Parts & Diodes Available*.... $10.00
BEGINNERS LOW POWER VISIBLE LASER — Choice of red, yellow, green — provides an excellent source of monochromatic light.
LHC2 ....Plans.... $5.00 LHC2K ....Kit.... $34.50

SECURITY
SNOOPER PHONE — Allows user to call his premises and listen in without phone ever ringing.
SNP20 ....Assembled.... $89.50
SNP2 ....Plans.... $9.00 SNP2K ....Plans/Kit.... $59.50
LONG RANGE WIRELESS MIKE — Miniature device clearly transmits well over one mile. Super sensitive, powerful.
MFT1 ....Plans.... $7.00 MFT1K ....Plans/Kit.... $49.50
WIRELESS TELEPHONE TRANSMITTER — Transmits both sides of phone conversation over one mile, shuts off automatically.
VWPM5 ....Plans.... $8.00 VWPM5K ....Plans/Kit.... $39.50
TALK & TELL AUTOMATIC TELEPHONE RECORDING DEVICE — Great for monitoring telephone use.
TAT20 ....Assembled.... $24.50
TAT2 ....Plans.... $5.00 TAT2K ....Plans/Kit.... $14.50

Our phone is open for orders anytime. Technicians are available 9-11 a.m., Mon-Thurs for those needing assistance or information. Send for free catalog of hundreds more similar devices. Send check, cash, MO, Visa, MC, COD to: **INFORMATION UNLIMITED**
DEPT R8, P.O. Box 716, Amherst, N.H. 03031 Tel. 603-673-4730

CIRCLE 72 ON FREE INFORMATION CARD

www.americanradiohistory.com

MEET THE MICROPROFESSOR

A portable learning center.
Learning shouldn't be limited to the classroom. That's why we made the MicroProfessor lighter and less bulky than the average textbook. Supported by easy-to-understand documentation, the MicroProfessor leads you through dozens of experiments. And with a wealth of accessories to choose from, including a printer, EPROM programming board and sound and speech synthesis, there's virtually no limit to the kinds of applications you can try your hand at.

Custom tailored to a variety of educational needs.
Whether you're a computer novice or prodigy, interested in guided instruction or independent learning, the MicroProfessor will meet your educational objectives. A teaching tool without peer, the MicroProfessor puts hundreds of hands on lessons in programming, system architecture and circuit design right at your fingertips. Your computer skills will increase dramatically as the MicroProfessor translates important concepts into practical experience.

Multitech ELECTRONICS INC

Unique Microcomputer Products for Education.

The most cost-effective instructional microcomputer on the market.
Today, tight budgets are a fact of life and doubly so for educators and students. At under $200.00 including Instruction Manual and AC Power Supply—less than half the price of any competitive product—the MicroProfessor is a very attractive educational resource.

For more information about putting the MicroProfessor advantage to work in your computer education, please write or call:

DISTRIBUTORS:

IN USA
Learning Labs, Inc.
P.O. Box 122
Calhoun, GA 30701
Outside GA call 1-800-334-4943
In GA call collect 404-629-4624 or 404-659-8176

Etronix
14803 N.E. Fortieth
Redmond, WA 98052
Outside WA call 1-800-426-1044
In WA call collect 206-881-0857

IN CANADA
Cyber Videocom Inc.
971-973 W. Broadway
Vancouver, BC V5Z1K3
Call 604-733-5725

www.americanradiohistory.com

The DX1000 makes tuning in London as easy as dialing a phone.

Direct access keyboard tuning brings a new level of simplicity to shortwave radio. With the Uniden® Bearcat® DX 1000, dialing in the BBC in London is as easy as dialing a telephone. And you can switch from the BBC to Peruvian Huayno music from Radio Andina instantly. Without bandswitching.

Featuring the innovative microprocessor digital technology made famous by Uniden® Bearcat® scanner radios, the DX 1000 covers 10 kHz to 30 MHz continuously, with PLL synthesized accuracy. But as easy as it is to tune, it has all the features even the most sophisticated "DXer" could want. 10 memory channels let you store favorite stations for instant recall —or for faster "band-scanning" during key openings. The digital display measures frequencies to 1 kHz, or at the touch of a button, doubles as a two time zone, 24-hour digital quartz clock. A built-in timer wakes you to your favorite shortwave station. Or, it can be programmed to activate peripheral equipment like a tape recorder to record up to five different broadcasts—any frequency, any mode—while you are asleep or at work.

The DX 1000 also includes independent selectivity selection to help you separate high-powered stations on adjacent frequencies. Plus a noise blanking system that stops Russian pulse radar interference.

There's never been an easier way to hear what the world has to say. With the Uniden® Bearcat® DX 1000 shortwave radio, you have direct access to the world.

For the name of your nearest retailer dial toll-free ...1-800-SCANNER.

Frequency Range: 10 kHz to 30 MHz continuously. **Tuning:** Direct keyboard entry, selectable 3 or 24 kHz per revolution knob tuning, or manual step tuning in selectable 1-99 kHz steps. **Sensitivity:** 1.0 μV AM, 0.5 μV CW/SSB/FM, 1.6-30 MHz. **Image and IF Rejection:** 70 dB or more. **Memory:** 10 frequency capacity. **Frequency Stability:** Better than 100 Hz after warm-up. **Modes:** AM/LSB/USB/CW/FM. **AGC:** Selectable Fast/Slow release times. **Filter Bandwidths:** 2.7 kHz, 6 kHz and 12 kHz. **Filter Selection Independent of Mode.**

uniden®

Bearcat®

CIRCLE 255 ON FREE INFORMATION CARD

Uniden® Corporation of America,
Personal Communications Division
6345 Castleway Court,
Indianapolis, IN 46250

© 1984 Uniden Corporation of America.

www.americanradiohistory.com