

48783
108-PAGE ISSUE

SPECIAL
101 PAGE
BUYERS GUIDE
YOUR OWN COMPUTER

\$1.95 OCT. 1983
U.K. 85p
DGS

Radio- Electronics

COMPUTERS - VIDEO - STEREO - TECHNOLOGY - SERVICE

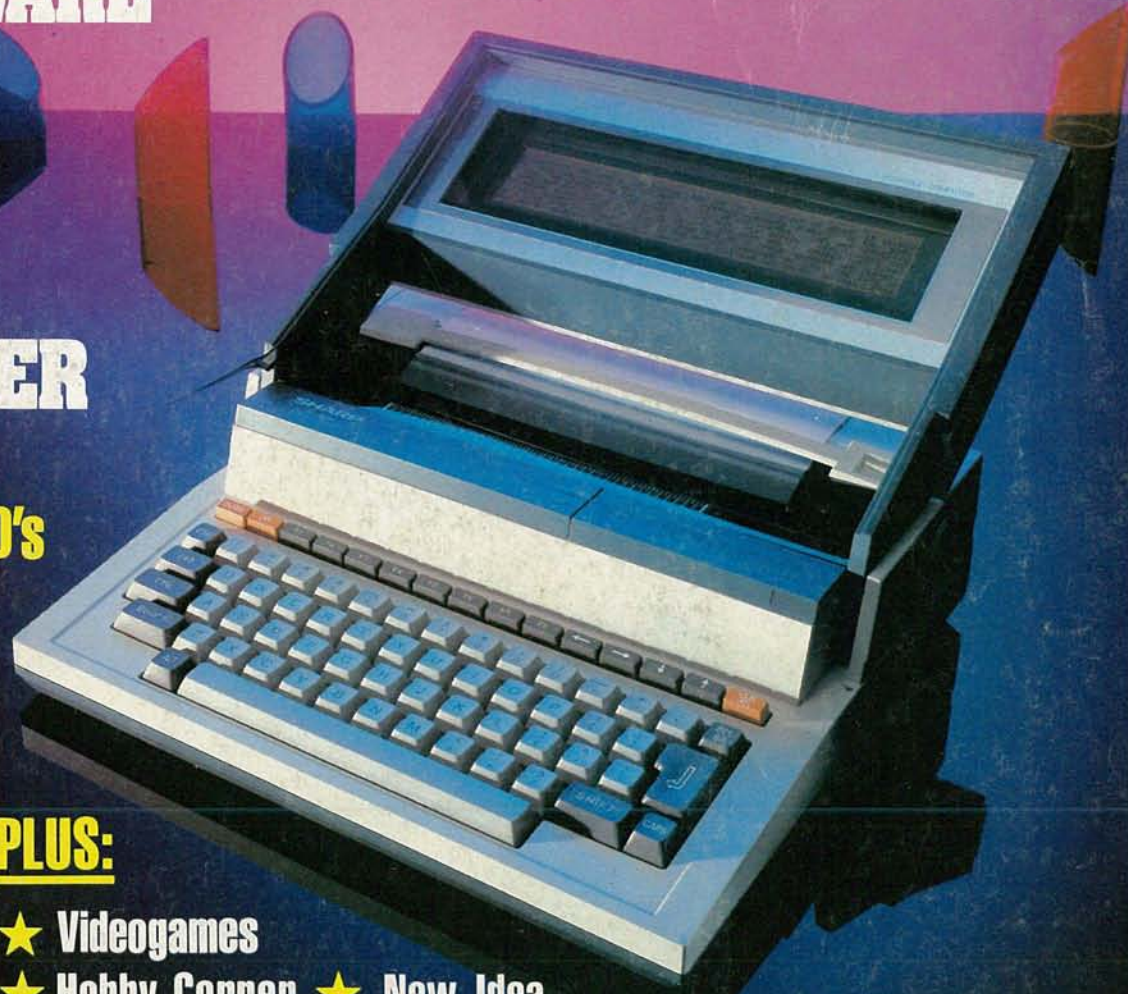
YOUR OWN
Computer

A
GERNSBACK
PUBLICATION

COMPREHENSIVE
BUYERS GUIDE
TO HARDWARE

Under \$500
to over \$4500

Build a
MINI-PLAYER
PIANO
with keyboard, LED's
and memory



PLUS:

- ★ Videogames
- ★ Hobby Corner ★ New Idea
- ★ Equipment Reports





The choice is Weller®



Soldering, desoldering, fixed or portable, look for Weller!

The DS500 power vacuum desoldering station works with external air system. The DS100 provides identical desoldering performance linked with temperature controlled soldering capability.

The new portable DS600 offers you a compact self-contained vacuum/air pump desoldering unit.

Which one is for you?



Use only genuine soldering tips from Weller.

The Cooper Group PO Box 728 Apex NC 27502 USA Tel (919) 362-7510 Telex 579497

BOKER® CRESCENT® LUFKIN® NICHOLSON® PLUMB® WELLER® WISS® XCELITE®

CooperTools

CIRCLE 21 ON FREE INFORMATION CARD

SOLTEC®

DESIGNER'S NOTEBOOK

100 MHz OSCILLOSCOPE MODEL 5100

- 4 Channels / 8 traces
- Fast sweep speeds from 2nS/DIV
- Dual Time Base
- High sensitivity from 2mV/DIV
- Glass epoxy circuit boards
- 15,000 MTBF
- Brilliant intensity, domed-mesh CRT
- Patented AUTO-FIX circuit for easy triggering
- Jitter-free trigger circuit
- Two year parts and labor warranty



SEE IT

\$1995.00

OSCILLOSCOPES

SCOPE CAMERAS & PROBES

DIGITAL WAVEFORM RECORDER

OCTOBER 1983

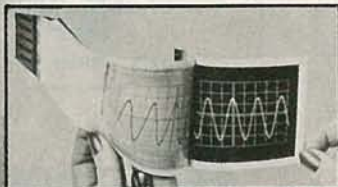
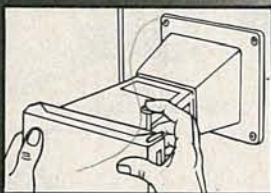
1

SHOOT IT

\$397.00

OSCILLOSCOPE CAMERA MODEL 7000

- Fits all Oscilloscopes and most Logic Analyzers
- Can be hand-held or mounted
- Uses standard Polaroid® film
- Variable aperture control: f3.5 - f32
- Variable shutter speeds: 1 second to 1/125th & B
- Built-in "X" contact for event triggering



Available hand-held or bezel mount

SCOPE MEMORY/WAVEFORM RECORDER MODEL VK12-2

- ... converts any oscilloscope into a storage scope
- ... permits acquisition of analog data with any computer

- Storage adapter for any oscilloscope with external trigger input
- Permits recording of high speed measured values with strip chart recorders.
- Amplitude resolution of 8 bits = 256 steps
- Maximum clock rate 2 MHz, permits storage of analog signals up to 300 kHz
- Parallel operation possible
- Pre-trigger switchable in steps for recording the "history" of a trigger event
- Built-in linear interpolator which can be switched off
- Memory capacity 2000 bytes
- Digital data input and output
- Optional IEEE-488 interface
- Strip chart recorder output.

CAPTURE IT

\$1495.00

ASK FOR IT

SOLTEC® CORPORATION

11684 Pendleton Street • Sun Valley, California 91352
(213) 767-0044 • TELEX: 67-4188
TOLL FREE 800-423-2344 Outside California

CIRCLE 43 ON FREE INFORMATION CARD

Free Timex Computer, Software and Free Timex Watch

Just in time for back to school...

Timex technology and the buying power of Communications Electronics will put you in the challenging, fascinating arena of home electronics for much less than you thought possible. As you grow in your computer expertise and needs, you can be secure knowing your TIMEX SINCLAIR 1000 Computer is expandable with a complete line of accessories. You won't outgrow your T/S 1000 Computer — it grows with you!

In addition to the accessories, Timex offers a full range of software for the T/S 1000 Computer. Cassette programs designed especially for your computer open the magical microprocessor doors to home management, business applications, educational aids and computer games. If your computer is used in business, it may be fully tax deductible.

Of course, as you become more skillful in using the T/S 1000 Computer, you'll find that you can create your own programs — tailored, as you wish, to your own specific requirements. The extensively detailed instruction manual that comes with the T/S 1000 Computer gives complete information on how to do your own programming.

Behind you and your TIMEX SINCLAIR 1000 Computer is proven Timex technology and reliability. It doesn't end with the unique design of this sensational computer. Timex wants you to enjoy and grow with it. When something isn't clear or if you're having trouble operating your computer, just dial **800-24-TIMEX** — you'll be in touch with the Timex Technical Support Group. They're ready to answer all your questions.

Join the home computer technology generation at an amazingly low cost.

Receive your TIMEX T/S 1000 personal home computer and your TIMEX quartz watch absolutely *free* when you purchase the following:

- The Timex T/S 1016 16K Ram Pack
- The Timex T/S 2040 Printer
- And your choice of six of the following software cassettes:

1. College Cost Analyzer	10. Coupon Manager
2. Home Improvement Planner	11. IRA Planner
3. Organizer	12. Stock Option Analyzer
4. Money Analyzer 1	13. Geometry 1
5. Algebra 1	14. Statistics
6. Mixed Game Bag II	15. Power Pack 1
7. Fortress of Zorlac	16. Grimm's Fairy Trails
8. Gambler	17. Presidents
9. Supermaze	18. Cube Game

When you order, you will receive this complete package: T/S 1000 Computer, Ram Pack, Printer, choice of six Timex software cassettes, and as an extra bonus, a coupon for a free Timex quartz watch. But wait, there's more. If you order before October 31, 1983 from CE, Timex will also give you a coupon that's good for an additional six free software cassettes from a choice of over seventy titles (Frogger™ excluded). The additional value of this bonus software is worth up to \$116.70. Therefore, if you act now, you can get this complete package worth up to \$461.20 for only \$199.00 plus \$10.00 for U.P.S. shipping and handling in the continental U.S.A.

Order at no risk.

All Timex products carry CE's 31 day money back guarantee. If for any reason you are not completely satisfied with this special offer, return everything within 31 days and we will give you a full refund (less shipping and handling charges). All Timex computer products come with a **ninety day warranty**. Should anything go wrong with your Timex products, simply mail it to Timex and they will promptly repair or replace it. Dealer and educational inquiries welcome.

Mail orders to: Communications Electronics,™ Box 1002-Dept. CE-10, Ann Arbor, Michigan 48106 U.S.A. If you have a Visa or MasterCard, 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 800-265-4828. Telex anytime 810-223-2422. If you are outside the U.S.A. or in Michigan dial 313-973-8888. Michigan residents add tax. The demand will be great for this fantastic limited time offer, so be sure to order today.

Order Toll-Free 800-521-4414

T/S 1000 is a registered trademark of Timex Corp. Copyright© 1983 Communications Electronics™

TIMEX *sinclair* 1000

Free!

Timex Sinclair 1000 Computer
a \$49.95 value



Free!

6 Timex Software Cassettes
up to a \$116.70 value



Free!

Timex Watch
Choose your watch from 5 styles
up to a \$49.95 value



Timex T/S 1016 16K Ram Pack



Choice of 6 Software Cassettes



Timex T/S 2040 Printer



COMMUNICATIONS ELECTRONICS™

Computer 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



FREE!!

Computer, Watch & Software Cassettes

• **YES, Please send my free Timex computer, software and watch with the purchase of a Ram Pack, Printer and choice of six cassettes for only \$199.00** (plus \$10.00 for shipping/handling in the continental U.S.A. For Canada, Puerto Rico, Hawaii, Alaska, or APO/FPO delivery, shipping is \$25.00).

• **Mail To:** Communications Electronics™
Box 1002-Dept. CE-10
Ann Arbor, Michigan 48106 U.S.A.

• List selection of cassettes by number: 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___

• Credit Card # _____ Exp. _____

• Name _____

• Address _____

• City _____ State _____ Zip _____

• Telephone _____

• Note: For additional product information call **800-24-TIMEX**.

• To order call **800-521-4414** or **313-973-8888** CE-10

SPECIAL FEATURE

- 75 **YOUR OWN COMPUTER**
A round-up of the computer systems currently available, organized in price categories from under \$500 to over \$4500. **Marc Stern**
- 79 **UNDER \$500**
- 95 **\$500 TO \$1000**
- 111 **\$1000 TO \$1500**
- 118 **MANUFACTURER LIST**
- 119 **\$1500 TO \$2000**
- 129 **\$2000 TO \$2500**
- 135 **\$2500 TO \$3000**
- 147 **\$3000 TO \$3500**
- 155 **\$3500 TO \$4000**
- 162 **\$4000 TO \$4500**
- 167 **OVER \$4500**

BUILD THIS

- 63 **MINI PLAYER-PIANO**
Part 2. Winding up the theory and beginning construction.
Robert Grossblatt

TECHNOLOGY

- 4 **VIDEO ELECTRONICS**
Tomorrow's news and technology in this quickly changing industry.
David Lachenbruch
- 10 **SATELLITE/TELETEXT NEWS**
The latest happenings in communications technology.
Gary H. Arlen
- 12 **VIDEOGAMES**
Some different ways of distributing games.
Danny Goodman.

CIRCUITS AND COMPONENTS

- 56 **NEW IDEA**
An award-winning project from one of our readers.
- 58 **HOBBY CORNER**
A new contest. **Earl "Doc" Savage, K4SDS**

EQUIPMENT REPORTS

- 24 **BK Dynascan Model 1653 and 1655 Variable Voltage Supply**
- 30 **Finger Print Control Module For Epson Printers**
- 32 **Global Specialties Model 6000 Frequency Counter**
- 40 **Tektronix Model 213 DMM Oscilloscope**

DEPARTMENTS

- | | |
|---------------------------------|-------------------|
| 8 Advertising and Sales Offices | 20 Letters |
| 208 Advertising Index | 177 Market Center |
| 8 Editorial | 44 New Products |
| 209 Free Information Card | 6 What's News |

ON THE COVER

There's little doubt that personal computers have become the fastest growing segment of the consumer-electronics market. In the past year many new companies have been founded, and scores of new machines have been introduced. In addition, most of the "established" manufacturers (in this industry that's anyone that's been around longer than two years) have either unveiled new systems, or beefed-up their existing ones, to remain competitive. The result has been greatly increased selection, generally lower prices, and just about utter confusion for the consumer. That's where this special section comes in—it's designed to help you make sense out of the jumble of systems by summarizing what's available. To help make comparisons easier, everything is organized by list price. The section begins on page 75.

TO OUR READERS

Due to our large computer-hardware section, several articles that were originally scheduled for this issue could not appear, due to space limitations. Those articles will be published in coming months.

COMING NEXT MONTH

On Sale October 20

- **Test Equipment.** A look at what's new and unusual.
- **Audio Tape.** Audio-cassette tapes and how they differ.
- **How To Design Analog Circuits.** All about filters.
- **And lots more!**

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, N.Y. and additional mailing offices. One-year subscription rate: U.S.A. and U.S. possessions, \$14.97, Canada, \$17.97. Other countries, \$22.47 (cash orders only, payable in U.S.A. currency.) Single copies \$1.50. © 1983 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

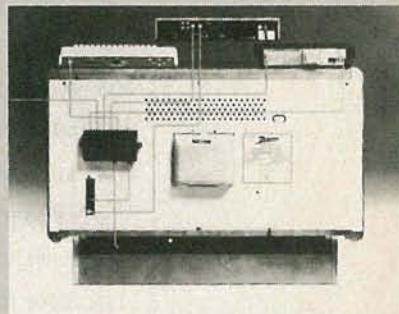
Subscription Service: Mail all subscription orders, changes, correspondence and Postmaster Notices of undelivered copies (Form 3579) to Radio-Electronics Subscription Service, Box 2520, Boulder, CO 80322.

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

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.

VIDEO ELECTRONICS

DAVID LACHENBRUCH
CONTRIBUTING EDITOR



ANTENNA SWITCHING

A noteworthy trend in new sets is the increased use of multiple antenna connections to help solve the problem posed by two or more RF video attachments on a single set. In most cases, the antenna terminals may be switched via remote control. Magnavox, NEC, Panasonic, Quasar, Sanyo, Sony, and Zenith all have sets that permit the viewer to switch from one 75-ohm input to another, eliminating the complicated traffic jam at the antenna terminals.

Sony is fielding a 13-inch model, designed especially for use with videogames or other RF attachments; it has its second antenna terminal at the front. That terminal is controlled by a HIT (*Home Interface Terminal*) Button that switches the set to the game or other device.

Zenith offers a system for switching among four RF inputs by remote control on many of its sets. It requires the addition of a special switching splitter (carrying a suggested list price of \$30) at the back of the set (see photo); the remote-control unit has a sequential four-position antenna control. Zenith also introduced the "Redi-Plug," a video-audio in-out eight-pin DIN connector built into some of its sets and easily installed on most others made since November 1981. It will accommodate a Zenith teletext decoder and (in the future) an adaptor for multichannel (stereo and bilingual) sound. GE and Magnavox sets, as well as most of the other "true components," also are claimed to be easily adaptable to multichannel sound.

HI-FI VHS

With *Beta Hi-Fi* now launched on the market and providing excellent audio, Matsushita Electric (parent of Panasonic and Quasar) has introduced the VHS answer in Japan, and it should arrive on these shores by the end of this year or early next. Like *Beta Hi-Fi*, the Hi-Fi VHS system uses the high head-to-tape speed of the helical track to provide an auxiliary high-quality stereo audio track. *Beta Hi-Fi* superimposes FM audio on the video track, but Hi-Fi VHS uses a somewhat different approach. It adds two audio heads to the video head drum and records the audio with a different geometric head angle (azimuth) to avoid interference with the video information. As in *Beta Hi-Fi*, the standard longitudinal audio track is retained to maintain compatibility of older tapes with Hi-Fi VHS machines. The specs of Hi-Fi VHS are similar to those of *Beta Hi-Fi*—a dynamic range of more than 80 dB, a frequency response of 20-20,000 Hz, distortion 0.3% or less, wow and flutter less than 0.005%.

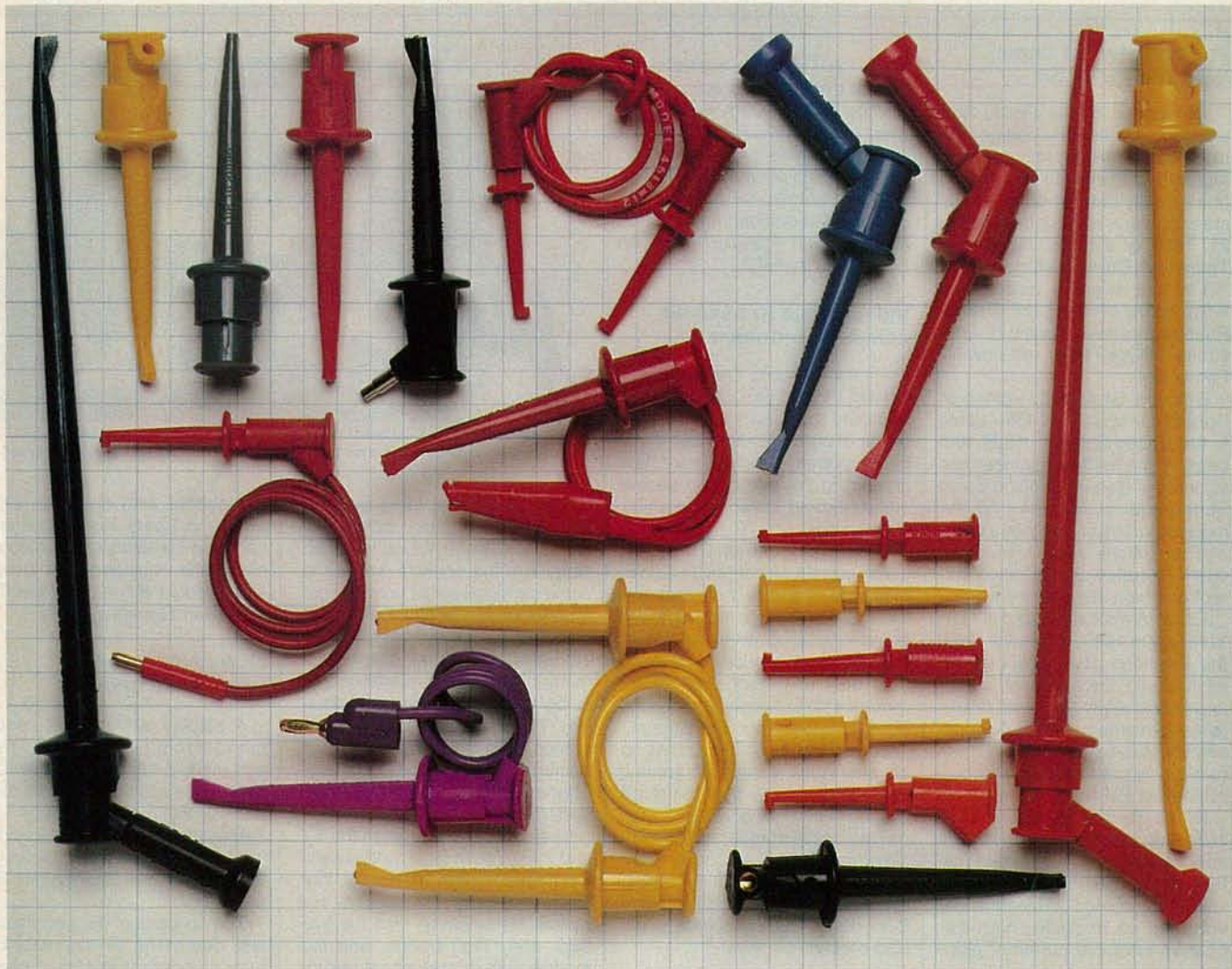
RANDOM-ACCESS CED

They said it couldn't be done—which gives RCA all the more satisfaction with its introduction of a random-access CED videodisc player. The new model, which was still unpriced at presstime, uses a wireless remote control to let the user choose any "page" (single groove) or "band" (selection) of the disc, or the choice may be made by dialing up the minute and second desired. These may be programmed to play in any sequence, repeat, etc. An added feature of the new machine is on-screen prompting: Alphanumerical reminders and queries appear on the screen—such as "please load disc," "audio track A or B?" "Band ___ to Band ___," and so forth. Special discs with individual frames repeated three times (the CED disc has four frames per groove) will be available for programs using stop-motion. The random-access disc player may be programmed with its own remote-control unit or with a *Digital Command Center*, a 51-button remote control that comes with many of RCA's new-model TV sets and monitors and is designed to operate TV set, VCR and videodisc player.

R-E

THE POMONA PROMISE

We provide the design engineer with the best Grabber* made in this country. Or anywhere.



Saying you can perform at that level is one thing. Doing it may be something else.

But doing it is what ITT Pomona Electronics is all about. And has been ever since we opened shop better than thirty years ago.

That's why we promised that no matter what it took, we were going to produce the best line of plunger action test clips going.

It's clearly a promise we made good on.

And every year we add new versions and new applications. Now our Grabber line is one of the

most versatile assortment of testing tools we offer.

At ITT Pomona Electronics, we know there is no such thing as standing pat. We also know that your needs change and your expectations become greater as the demands become more severe. To this end we will continue to create a better way. A better product.

That's a promise.

All of our products are described and illustrated in our General Catalog, and it's free. Just call (714) 623-3463 or 623-6751. TWX 910-581-3822. Write to us at ITT Pomona Electronics, a Divi-

sion of International Telephone and Telegraph Corporation, 1500 E. Ninth St., Pomona, CA 91766.

In Europe: ITT CANNON BELGIUM S.A./N.V. Rue Colonel Bourg Str. 105 Space A (B.3) 1140 Brussels, Belgium. Phone: 02-735-6094.

Our products are available through your favorite electronics parts distributor.

* GRABBER is the trademark for a Pomona Electronics test clip.

ITT Pomona Electronics

CIRCLE 97 ON FREE INFORMATION CARD

WHAT'S NEWS

Postage stamps honor four U.S. inventors

The United States Postal Service has unveiled the design of a block of 20-cent stamps honoring four American inventors in the field of electricity and electronics. The stamps were issued September 21, 1983, at the U.S. Patent and Trademark Office in Arlington, VA.

The four inventors selected as most worthy of honor are Charles Proteus Steinmetz, Edwin H. Armstrong, Nikola Tesla, and Philo T. Farnsworth.

Charles Steinmetz—born in Breslau, Germany, in 1865—came to the United States in 1899, and became the leading engineer and scientist of General Electric Co. in Schenectady, NY. Among the more important of his many studies and inventions were researches on the theories of alternating current and high-voltage power.

Edwin Armstrong—born in New York City in 1890—is credited with the invention of the superheterodyne radio, the type used almost universally today. His most important achievement was the development of wide-band frequency modulation, known to the average listener as FM radio.

Nikola Tesla was born in 1857, in Smiljan Lika, Croatia, in what is now Yugoslavia. The more important of his more than 700 inventions included pioneering developments in radio, high-frequency electrical currents, glow-

lamps, and polyphase alternating current theory and practice.

Philo T. Farnsworth was born in Utah in 1906. His more than 300 inventions were practically all in television and related subjects. He is most famous for his first all-electronic television transmission, made in San Francisco, CA, on September 7, 1927.

Videogames to become computer terminals?

A new service, *Gameline*, by Control Video Corp of Vienna, VA, promises as a start to allow any owner of an Atari 2600 video computer system (and a few other brands) to tap into a vast central computerized library of popular videogames.

Eventually, says CVC, the game-system owner will be able to make use of a variety of other features, such as sports reports, stock quotations, news, electronic banking, and other services now available only to personal-computer owners who subscribe to services like CompuServe or The Source.

In addition to giving access to an enormous variety of games, *Gameline* gives the player a chance to preview new games just coming on the market, and to sample games before purchase. Contests, from regional to worldwide, with prizes ranging from T-shirts to four-year college scholarships, are also offered.



MASTER MODULE PLUGGED INTO AN ATARI VCS 2600 and connected to the telephone brings the avid player a plethora of the latest video games.

The "brain" that turns an Atari 2600 into a computer terminal is the CVC *Master Module*, which plugs into the console where the game cartridge would normally go. It consists of a sophisticated modem, two memory devices, and an automatic telephone dialer. One memory unit stores a videogame or up to six pages of typewritten text. The other stores the players' names, ID's, the module's serial number, contest scores, and telephone numbers to access the system.

The user simply turns on the TV and the game system, and selects the desired game from a list that flashes on the TV screen. He makes his selection with the joystick and "fire" button, and the module dials its memory-stored local number to connect with the central computer. The game's software is then fed into the *Master Module*. The whole telephone call lasts usually less than one minute.

Costs of the service are claimed to be moderate. The *Master Module* is being offered at an introductory rate of \$49.50 (plus \$5 for shipping and handling). Game sessions (multiple plays of a game) cost \$1, or about 10 to 15 cents a play, depending on the player's skill. A \$15 membership fee (waived during the introductory period) is charged each member, and if the player wants to enter contests, a fee of 50 cents for registering a high score in the central computer. Games are charged against credit cards. (Credit limits can be set.)

The *Gameline Master Module* is

compatible with the Atari 2600 VCS and Sears Video Arcade. It can also be used with ColecoVision units equipped with *Expansion Module #1*, or with the ColecoVision *Gemini* system.

New color display uses liquid crystals

A display system that uses a monochrome cathode-ray tube and a liquid crystal "color switch" to produce a high-resolution, field-sequential color display was demonstrated recently by Tektronix at the Philadelphia meeting of the Society for Information Display.

The success of the new system was due to the development of a new, proprietary, fast liquid-crystal optical switch. Combined with the monochrome CRT, it produces a high-resolution field-sequential color display.

Because there are no shadow masks or penetration phosphors, the resolution can be as high as that of any monochrome CRT. Other advantages are inherent convergence (there is only one electron beam) excellent contrast in high ambient light, and ruggedness. (The fragile shadow mask and complex color gun are eliminated.)

The new technology is expected to find applications in instrument displays, where its high resolution will make it useful. It will also be useful in small process-control displays, where the color can be used for warnings or for highlighting special situations.



FOUR AMERICAN INVENTORS ARE HONORED on US postage stamps. Charles Steinmetz, upper left, for pioneering in electrical theories; Edwin Armstrong, upper right, for frequency modulation; Nikola Tesla, lower left, for alternating current theory and practice, and Philo Farnsworth, lower right, for television pioneering and invention.

Now 60 MHz or 100 MHz Tek quality is just a free phone call away!



Tek has expanded its best-selling 2200 scope line up to 100 MHz. And brought it all as close as your phone. Tek's revolutionary, reduced-component architecture brings unprecedented quality, reliability and affordability to the 60 MHz 2213 and 2215, and now, the 100 MHz 2235.

All three of these lightweight (13.5 lb.) scopes feature 2 mV/div vertical sensitivity and 5 ns/div sweep speeds, plus a complete trigger system for stable triggering on digital, analog or video waveforms.

Scopes with a comprehensive 3-year warranty*... probes...and expert advice. One free call gets it all! You can order, or obtain literature, through the Tek National

	2213	2215	2235
Bandwidth	60 MHz	60 MHz	100 MHz
No. of Channels	2	2	2 + Trigger View
Alternate Sweep	—	Yes	Yes
Vert/Trig B/W Limit	—	—	Yes—20 MHz
Single Sweep	—	—	Yes
Accuracy: Vert/Horz	3%	3%	2%
Delay Jitter	1:5,000	1:10,000	1:20,000
Trigger's Sensitivity	0.4 div at 2 MHz	0.4 div at 2 MHz	0.3 div at 10 MHz
Input R-C	1M Ω -30pf	1M Ω -30pf	1M Ω -20pf
Variable Holdoff	4:1	4:1	10:1
Price	\$1200†	\$1450†	\$1950†

Marketing Center. Technical personnel, expert in scope applications, will answer your questions and expedite delivery. Direct orders include operating and service manuals, two 10X probes, 15-day return policy, and worldwide service back-up.

**Call toll-free:
1-800-426-2200,
Extension 76.**

In Oregon, call collect:
(503) 627-9000, Ext. 76.

†Price F.O.B. Beaverton, OR.
*3-year warranty includes CRT and applies to 2000 family oscilloscopes purchased after 1/1/83.
Scopes are UL Listed, CSA and VDE approved.

Tektronix®
COMMITTED TO EXCELLENCE

EDITORIAL

Yes! Another Buyers Guide For Computers

Our research tells us that most of our readers either own a computer or are considering purchasing a computer. Even among those of you who do own a computer, many are considering either upgrading their systems or outrightly purchasing a new system. In today's marketplace, that's not an envious position to be in. It seems as if everyone, and I mean everyone, is jumping into the computer marketplace with a new computer. And to make matters even more confusing, there's a flood of workalikes and lookalikes. These are computers that are designed to look like or be "compatible" with other computers such as the IBM PC, TRS-80, Apple, or others.

With prices, features, and capability varying widely from computer to computer, your decision won't come easy—and it shouldn't. With such a wide array of computers available, you must weigh your decision carefully. Even with the drastic price reductions of late, computers aren't cheap. Even after you've made a decision, reconsider it before you make your final decision. Get your hands on the computer and play with it. Make sure it runs the software that you ultimately intend to use and that it will interface with the peripherals you wish to connect to it. Try your darndest to ensure that the computer won't become obsolete within a few months.

This month's *Your Own Computer* special section is intended to be a guide to help you narrow down your choices. It is not meant to be used to make a final decision. And above all, unless you pay careful attention to compatibility, or buy peripherals from the same manufacturer, don't expect to take your computer home, plug it in and have it work. For example, all RS-232 I/O ports are created equal. Right? Wrong! The RS-232 standard is sometimes adhered to and sometimes it isn't. So, if you buy a printer with an RS-232 port and connect it to a computer with an RS-232 port, it may work. Then again, it may not. Remember—*Caveat Emptor!*



ART KLEIMAN
Editor

Radio- Electronics

Hugo Gernsback (1884-1967) founder
M. Harvey Gernsback, editor-in-chief
Larry Steckler, CET, publisher
Arthur Kleiman, editor
Carl Laron, WB2SLR, associate editor
Brian C. Fenton, assistant editor
Jack Darr, CET, service editor
Robert F. Scott, semiconductor editor
Herb Friedman, communications editor
Gary H. Arlen, contributing editor
David Lachenbruch, contributing editor
Earl "Doc" Savage, K4SDS, hobby editor
Danny Goodman, contributing editor
Dan Rosenbloom, production manager
Robert A. W. Lowndes, production associate
Joan Roman, circulation director
Arline R. Fishman, advertising coordinator

Cover photo by Robert Lewis

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

Gernsback Publications, Inc.
200 Park Ave. South
New York, NY 10003
President: M. Harvey Gernsback
Vice 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
413 So. La Brea Ave.
Los Angeles, Ca 90036
213-938-0166



The 100 MHz scope that won the largest scope contract ever awarded...

Now just \$1,950.

For sales and technical
information: call toll free
800-421-5334 (in Calif., Alaska,
Hawaii 213-515-6432)

Kikusui International Corp.
17819 Figueroa Street, Gardena, Calif. 90248
TWX 910-346-7648
In Canada call: Interfax Systems, Inc. 514-336-0392
Subsidiary of Kikusui Electronics Corp., 3-1175
Shinmaruko-Higashi, Nakaharu-Ku, Kawasaki City,
Japan (044)-411-0111 © Kikusui International 1983

KIKUSUI



Ch1 & Ch2
(1 mV w/5X mag)

Alternate
trigger

Multi-mode.
Any combination
of modes may
be selected.
5 channels

Multi-trace.
500KHz chop
frequency.
20 KV
acceleration
potential

Alternate
time base

Lock (P-P
auto
trigger)

Sweep time:
0.5S to 20nS.
Ch3 external
sweep input

Ch4
input

3rd channel
(0.1 & 1V/div)

20 MHz
bandwidth
limit

Beam
finder

Calibrated
sweep delay

A & B
trace
separation
for alternate
sweep

Ch5
input
10X
sweep mag

CIRCLE 48 ON FREE INFORMATION CARD

SATELLITE/TELETEXT NEWS

GARY ARLEN
CONTRIBUTING EDITOR

THREE-BIRD SYSTEM

Geostar Satellite System has proposed an all-digital nationwide service which would offer paging, emergency monitoring, and other special services via three new satellites. The newly formed company, based in Princeton, NJ, envisions three operational geostationary satellites (at 70°, 100° and 130° west longitude) plus an earth station with massive computer power. The system would operate in the 2.48, 1.6 and 5.1 GHz spectrums and, if Geostar gets FCC approval, the service could be up and running by 1987.

Geostar customers would be equipped with a \$200 transceiver to transmit their coordinates to any other transceiver. The units would have a 36-character message readout (probably liquid crystal) or possibly a hard-copy printer. Geostar will automatically track the location of all transceivers; one of the birds will transmit an interrogation signal 100 times per second to each transceiver; the transceiver automatically will relay a signal with an identifying code through all three satellites. Using eight 32-bit sequences, GSS will be able to address 268 million individual users. The system will include suppression circuits in the transceivers to limit the number of times they would respond to the interrogation if the user does not need instant access.

GSS foresees airplanes and autos equipped with the devices to help signal an emergency call for help. Travelers could also send or receive brief messages or reports via the GSS system.

NBC ESCALATES TRANSMISSION

NBC-TV is now feeding its entire New York-originated schedule via satellite, with most of the programming traveling via Comstar D-3, transponder 1V (at 87° west longitude); some afternoon programming goes out via Satcom IV, transponder 24 (at 83°). Almost all of the network's programs—with the exception of sports broadcasts—are sent to affiliates via satellite, including special closed-circuit news reports transmitted daily at 4:30 p.m. (eastern time).

RCA LAUNCHES ADVANCED SATCOM

RCA Satcom 1R—the replacement satellite for RCA's original communications satellite which has been in service for nearly eight years—is now in place at 139° west longitude. Meanwhile the original Satcom 1 is still in service at 136°. The new bird is the first completely solid-state domestic communications satellite, with 24 transponders of 8.5 watts each. The new antennas provide stronger signal coverage to all 50 states.

AROUND THE SATELLITE CIRCUIT

Oak Industries has dropped its plans to build and operate a direct-broadcasting satellite system. The company had intended to launch its own DBS bird by 1986 for direct-to-home pay-TV programming, but now Oak has retrenched on its plans, although it still intends to make equipment and programming for DBS and other pay TV services.

The FCC is eyeing a plan to restructure spectrum allocations to put DBS service in the 12-GHZ band, shared with other microwave services.

United Satellite Communications, which plans to begin DBS service this fall, is negotiating with local telephone companies to install and service receiver facilities. USC will have five channels of programming, and the company is also talking to existing cable-programming services such as ESPN and Cable News Network about carrying their feeds as part of the DBS service. USC plans to offer its package of programming for about \$17.50 per month in addition to the cost of buying reception facilities, now estimated at about \$500.

VIDEOTEX/ TELETEXT BRIEF BITS

Public Broadcasting Service has launched a demonstration teletext service, using vertical-blanking-interval lines 17 and 18 for business data provided by Merrill Lynch and Co. The service will be tested via public TV stations in New York, Chicago, and Miami.

American Bell Inc. will sell its videotex home terminal in south Florida this year for \$595; for now, the unit is intended to be used by customers of Viewtron, the electronic publication and home banking/shopping service developed by Knight-Ridder Newspapers.

Control Data Corp. is becoming a major partner in Source Telecomputing Corp., raising the possibility that some Control Data subsidiaries (notably Ticketron and various financial service companies) may soon offer online interactive services via The Source. **R-E**



NEW Tech VOM WV-547C

Drop-proof. Fuse protected.
High impact ABS plastic case.

Rugged,
accurate taut-band meter.

Sensitivity
20,000 ohms-per volt DC
9,000 ohms-per volt AC
21 color coded ranges.

Snap action,
dual detent range switch.

Temperature scale
(optional accessory)

User oriented
"right angle" test leads.

For \$35.50 Here's your best VOM value.



It's compact, drop-proof (3 feet) and provides 21 color-coded ranges—volts, milliamps, ohms, temperature scale and decibels. True quality instrument for your portable applications. Tough, accurate, taut-band meter, fuse-protected. Sensitivity 20,000 ohms/volt DC. High-impact case, colored bright orange. Snap action, dual-detent range switch. Range limits: 1000V DC and AC, 250 mA DC, one megohm, +200°C. Battery Test provision. Meter OFF position. Temperature scale (special probe optional).

WV-547D. Same instrument in impact-resistant carrying case. Handle converts to tilt stand.

\$39.95

Want full technical details and a demonstration? Call toll-free, 1-800-523-3696, for the VIZ distributor near you.

VIZ

**Look to VIZ for value, quality, availability.
Over 70 instruments in the line—PLUS full accessories.**

VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144

CIRCLE 91 ON FREE INFORMATION CARD

VIDEOGAMES

Alternate means of distribution

DANNY GOODMAN, CONTRIBUTING EDITOR

THE TIME MAY COME WHEN, HAVING CONQUERED or become bored with a cartridge, we no longer put it on the shelf and go out to buy another. Recently, a couple of ideas have surfaced to offer different ways of providing us with games to play without investing in \$20 to \$40 cartridges or waiting for a cable-TV company to offer a game service.

One system getting underway now is called GameLine by Control Video Corporation (8620 Westwood Center Drive, Vienna, VA 22180). GameLine's idea is to have games downloaded to your 2600 via the telephone. Here's how it works.

First, you need to buy CVC's GameLine *Master Module* for \$50-60 at a local videogame store. That gizmo, shown in Fig. 1, looks like an oversized cartridge and plugs into the cartridge slot of the 2600 (or a 2600-compatible machine). It also comes with a cord that has modular telephone plugs on either end and a "Y" adapter. All you have to do is plug the adapter into the back of your telephone, and the cord from the adapter to the *Master Module*.



FIG. 1

A \$15 registration fee sets up your account with CVC. All charges are billed to a credit card, and parents have the option of limiting the dollar amount playable per week. Each time you download a game, you are charged \$1.00. For that dollar, you get about 10 complete games—then the game disappears from the console's memory.

To download a game, you must first look at the listings of games offered by GameLine in their monthly newsletter (free for the first year). Responding to

prompts on the screen with your joystick, you select the number of the game you want. Then the *Master Module* automatically calls GameLine (either a toll-free or local call), tells the main computer who is calling, and asks for the game you want to play. The entire transfer process takes about a minute.

As of this writing, however, CVC has not lined up too many suppliers of games. Imagic is about the biggest of them all. The balance of the listings are of smaller—and a few defunct—producers, including Telesys, U.S. Games, Data Age, and so on. If CVC can attract the big guns—Atari, Activision, Parker, Coleco—only then will GameLine be something to consider. And even then, only if the companies release titles to GameLine at the same time they're released to the stores. Then it'll really be a great way to try out a potential blockbuster cartridge. Unfortunately, I don't believe CVC will get too big a following of the big-name game producers—they would rather sell cartridges outright.

The system does, however, hold promise as a telecommunications network for the 2600 as people graduate to the computer keyboard. The GameLine *Master Module* (technologically a fine product at an attractive price) and main computer could become a low-cost electronic mail system for the masses.

Another approach

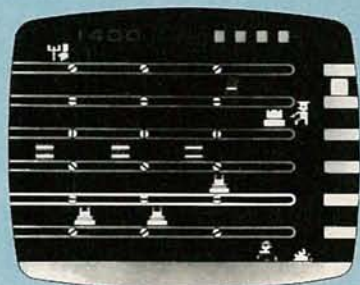
Taking a different approach to game distribution is a company called Romox (501 Vandell Way, Campbell, CA 95008). Although the firm is focusing its attention on computer cartridge-type software now, there is nothing that would prevent its concept from being carried over to videogames.

Romox produces cartridges that can be reprogrammed by a dealer equipped with a special computer-like terminal. The system is based on periodic telephone transfers of software from a central computer to the in-store terminal where it is stored on a hard disk. The first cartridge you buy costs about the same as a regular game cartridge: \$25-35. Later, if you find you don't use that program anymore, you can take it back to the dealer, look at the list of hundreds of programs on hand and have the cartridge reprogrammed with a new game for about \$10. The process takes only a minute or two, and you leave

the store with a new program at one-third the regular cost.

Romox has signed up several major computer-software houses, including Sierra On-Line, to participate in this new distribution method. What I like about this system over GameLine is that you get a cartridge that you can play as many times as you want. With GameLine, the meter is running every time you lose a life. That's too much like the quarter-eating arcades. I thought the home videogame was supposed to let us get away from constantly reaching into our pockets for one more chance.

CommaVid's Cake Walk for Atari 2600



CIRCLE 101 ON FREE INFORMATION CARD

	Comma Vid					Cake Walk				
GRAPHICS										
SOUND										
EASE OF LEARNING										
CHALLENGE										
VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good		Excellent			

THERE IS NO LACK OF "CUTESY" videogame cartridges available for the 2600, yet more keep coming. CommaVid Inc. (1470 N. Farnsworth, Suite 203, Aurora, IL 60505) has published another one of those games that seems aimed at the younger or more sensitive games player. This one is called *Cakewalk*, a simplistic hand-eye coordination activity.

continued on page 14

NEW!

Regency[®] Scanners

Communications Electronics,[™] the world's largest distributor of radio scanners, introduces new models with special savings on all radio scanners. Chances are the police, fire and weather emergencies you'll read about in tomorrow's paper are coming through on a scanner today.

We give you excellent service because CE distributes more scanners worldwide than anyone else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are in stock for quick shipment, so if you're a person who prefers fact to fantasy and who needs to know what's really happening around you, order your radio today from CE.

Regency[®] M100

List price \$319.95/CE price \$199.00
6-Band, 10 Channel • Crystalless • AC/DC Search • Lockout • AC/DC

Bands: 30-50, 144-174, 440-512 MHz. The Regency Touch M100 provides the ease of computer-controlled, touch-entry programming in a compact-sized scanner for use at home or on the road. Enter your favorite public service frequencies by simply touching the numbered pressure pads. You'll even hear a "beep" tone that lets you know you've made contact.

In addition to scanning the programmed channels, the M100 has the ability to search through as much as an entire band for an active frequency. When a call is received, the frequency will appear in the digital display. You can either continue searching or store the new frequency in one of the 10 scan channels.

NEW! Regency[®] HX650

List price \$119.95/CE price \$84.00
5-Band, 6 Channel • Handheld crystal scanner

Bands: 30-50, 146-174, 450-512 MHz. Now you can tune in any emergency around town, from wherever you are, the second it happens. Advanced circuitry gives you the world's smallest scanner. Our low CE price includes battery charger/A.C. adapter.

NEW! Regency[®] MX7000

Allow 120-240 days for delivery after receipt of order due to high demand for this product.

List price \$599.95/CE price \$449.00
10-Band, 20 Channel • Crystalless • AC/DC

Frequency range: 26-27, 30-108, 108-136 AM, 144-174, 440-512, 806-881 MHz., 1.0 GHz., 1.1 GHz. In addition to normal scanner listening, the MX7000 offers CB, VHF, and UHF TV audio, FM Broadcast, all aircraft bands (civil and military), 800 MHz communications, cellular telephone, and when connected to a printer or CRT, satellite weather pictures.

The Regency Touch MX7000 provides the ease of computer controlled, touch-entry programming in a compact-sized scanner for use at home or on the road. Enter your favorite frequencies by simply touching the numbered pressure pads. You'll even hear a "beep" tone that lets you know you've made contact.

In addition to scanning the programmed channels, the MX7000 has the ability to search through as much as an entire band for an active frequency. When a call is received, the frequency will appear on the digital display.

NEW! JIL SX-200

CE price \$279.00/NEW LOW PRICE
8-Band, 16 Channel • No-crystal scanner
Quartz Clock • AM/FM • AC/DC

Bands: 26-88, 108-180, 380-514 MHz. Tune Military, F.B.I., Space Satellites, Police & Fire, D.E.A., Defense Department, Aeronautical AM band, Aero Navigation Band, Fish & Game, Immigration, Paramedics, Amateur Radio, Justice Department, State Department, plus thousands of other restricted radio frequencies not other scanner is programmed to pick up.

The JIL SX-200 features unrestricted federal frequency coverage - all 8 bands, selectable AM/FM receiver circuits - 60db plus selectivity, tri-switch squelch settings - signal, audio and signal & audio, outboard AC power supply - DC at 12 volts built-in, quartz clock - bright vacuum fluorescent blue readouts & dimmer, dual level search speeds - tri-level scan delay switches, 16 memory channels in two channel banks, receive fine tune (RIT) ± 2 KHz, speaker, recorder, and recorder control jacks, dual level RF gain settings - 20 db pad, AGC test points for optional signal strength meters and many more features. Order your JIL SX-200 scanner today.

NEW! JIL SX-100

CE price \$149.00/NEW LOW PRICE
6-Band, 16 Channel • Crystalless • AC/DC
Frequency range: 30-54, 140-174, 410-514 MHz.

The JIL SX-100 scanner is a mobile keyboard programmable scanner that puts you in the seat of the action at home or in your car. Compact and good looking, the SX-100 even gives you the time and date. It's small size will easily fit in most domestic or foreign cars and it's AC/DC adaptable for home use.

Regency[®] R106

List price \$149.95/CE price \$99.00
5-Band, 10 Channel • Crystal scanner • AC/DC
Frequency range: 30-50, 146-174, 450-512 MHz.

A versatile scanner, the Regency R-106 is built to provide maximum reception at home or on the road. Rugged cabinet protects the advanced design circuitry allowing you years of dependable listening.

You'll hear calls on all the public service bands, also extended UHF and amateur. What you will really appreciate, though, is that the R-106 will provide the kind of first rate performance you have come to expect from Regency. Order crystal certificates for each channel.

NEW! Regency[®] D810

List price \$399.95/CE price \$259.00
8-Band, 50 Channel • Crystalless • AC only

Bands: 30-50, 88-108, 118-136, 144-174, 440-512 MHz. This scanner offers Public service bands, plus Aircraft and FM broadcast stations. You can listen to Bach or a Boeing 747, the Rolling Stones or the riot squad, or any of 50 channels. Plus special direct access keys let you listen to police, fire, emergency, or any of your favorite channels just by pushing a button.

Regency[®] R1040

List price \$199.95/CE price \$129.00
6-Band, 10 Channel • Crystalless • AC only
Frequency range: 30-50, 144-174, 440-512 MHz.

Now you can enjoy computerized scanner versatility at a price that's less than some crystal units. The Regency R1040 lets you in on all the action of police, fire, weather, and emergency calls. You'll even hear mobile telephones.

Programming the R1040 is easy. Merely touch the keyboard and enter any of over 15,000 frequencies on your choice of 10 channels.

Fanon Slimline 6-HLU

List price \$169.95/CE price \$99.00
Low cost 6-channel, 4-band scanner!

The Fanon Slimline 6-HLU gives you six channels of crystal controlled excitement. Unique Automatic Peak Tuning Circuit adjusts the receiver front end for maximum sensitivity across the entire UHF band. Individual channel lockout switches. Frequency range 30-50, 146-175 and 450-512 MHz. Size 2 3/4 x 6 1/4 x 1 1/2". Includes rubber ducky antenna. Made in Japan. Order crystal certificates for each channel.

TEST ANY SCANNER

Test any scanner purchased from Communications Electronics[™] for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).

CIRCLE 22 ON FREE INFORMATION CARD

OTHER RADIOS & ACCESSORIES

Regency [®] C403 Scanner	.....	\$59.00
Panasonic RF-9 Shortwave receiver	.....	\$84.00
Panasonic RF-799 Shortwave receiver	.....	\$219.00
Panasonic RF-2600 Shortwave receiver	.....	\$199.00
Panasonic RF-2900 Shortwave receiver	.....	\$249.00
Panasonic RF-3100 Shortwave receiver	.....	\$269.00
Panasonic RF-6300 Shortwave receiver	.....	\$539.00
NEW! Bearcat [®] 151 Scanner	.....	\$169.00
NEW! Bearcat [®] Five-Six Scanner	.....	\$129.00
Bearcat [®] 300 Scanner	.....	\$349.00
Bearcat [®] 250 Scanner	.....	\$279.00
Bearcat [®] 200 Scanner	.....	\$189.00
Bearcat [®] 210XL Scanner	.....	\$229.00
Bearcat [®] 20/20 Scanner	.....	\$289.00
Bearcat [®] 100 Scanner	.....	\$289.00
Bearcat [®] Weather Alert	.....	\$49.00
CHB-6 Fanon AC Adapter/Battery Charger	.....	\$15.00
CAT-6 Fanon carrying case with belt clip	.....	\$15.00
SP55 Carrying case for Bearcat Five-Six	.....	\$15.00
MA-506 Carrying case for Regency HX650	.....	\$15.00
SCMA-6 Fanon Mobile Charger/Audio Amplifier	.....	\$49.00
AUC-3 Fanon auto lighter adapter/Battery Charger	.....	\$15.00
FB-E Frequency Directory for Eastern U.S.A.	.....	\$12.00
FB-W Frequency Directory for Western U.S.A.	.....	\$12.00
TSG "Top Secret" Registry of U.S. Government Freq.	.....	\$15.00
RRF Railroad Frequency Directory	.....	\$10.00
ESD Energy Services Directory	.....	\$10.00
ASD Frequency Directory for Aircraft Band	.....	\$10.00
SRF Survival Radio Frequency Directory	.....	\$10.00
TIC Techniques for Intercepting Comm. Manual	.....	\$12.00
CIE Covert Intelligence, Elect. Eavesdropping Man.	.....	\$12.00
B-4 1.2 V AAA Ni-Cad batteries (set of four)	.....	\$9.00
B-6 1.2 V AA Ni-Cad batteries (set of four)	.....	\$12.00
A-135c Crystal certificate	.....	\$3.00

Add \$3.00 shipping for all accessories ordered at the same time. Add \$12.00 per shortwave receiver for U.P.S. shipping.

INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your scanner, it is essential that you use an external antenna. We have a base and a mobile antenna specifically designed for receiving all bands. Order #A60 is a magnet mount mobile antenna and order #A70 is an all band base station antenna. Price is \$35.00 each plus \$3.00 for UPS shipping in the continental United States.

BUY WITH CONFIDENCE

To get the fastest delivery from CE of any scanner, send or phone your order directly to our Scanner Distribution Center.[™] Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax or supply your tax I.D. number. Written purchase orders are accepted from approved government agencies and most well rated firms at a 30% surcharge for net 30 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 back-order automatically unless CE is instructed differently. Minimum prepaid order \$35.00. Minimum purchase order \$200.00. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

Mail orders to: Communications Electronics[™], Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$7.00 per scanner for U.P.S. ground shipping and handling in the continental U.S.A. 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 800-265-4828. Telex anytime 810-223-2422. 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.[™]

† Bearcat is a federally registered trademark of Electra Company, a Division of Masco Corporation of Indiana.

‡ Regency is a federally registered trademark of Regency Electronics Inc. AD #072583

Copyright ©1983 Communications Electronics[™]



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

OCTOBER 1983

VIDEOGAMES

continued from page 12

An introductory screen depicts a large face of a mustached baker, complete with chef's hat, and pairs of cakes streaking along the bottom of the screen. When you turn on the game, the name of the cartridge and the CommaVid company logo appears at the upper left corner of the screen. That introductory screen comes back at the end of each game, displaying the final score.

The actual game begins with a press of the RESET button. Six rows of conveyor belts dominate the screen action. At the end of each conveyor is a small gap; on the other side of the gap is a shelf. The object of the game is to move the baker up and down the screen to each belt, where he transfers the cake or other pastry coming off the conveyor over to the shelf. If he fails to get to a pastry in time, it falls to the floor, and a cleanup man comes out and sweeps the mess away. To keep things interesting, pastries come at random, either singly or in groups of two and three, and at different speeds on each belt.

In defense of the oncoming cakes, you can stop one conveyor by positioning the baker at the end of that belt and pressing the action button on the controller. The belt turns red and stops for a few seconds, allowing you some time to catch up with the other cakes.

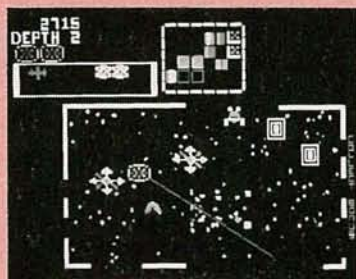
The cartridge contains 16 variations of this one-player game. Differences between versions lie for the most part in the speed of the cakes and the response speed of the baker to your joystick action. A few variations at the top-end feature tricky gingerbread men who move along the belts erratically.

What disappointed me most about this game is what I call the two-dimensionality of the game play. I'm not talking about graphics—which, I'm sorry to say, are nothing special either—but about how the game plays. All the action is on the screen at once, and the action or thought demanded of the player is minimal. In other words, there is essentially no depth to the game.

Perhaps this level of game is what the very young and/or inexperienced go for. But there are so many other similar-playing games in the store racks with much better graphics and sound (sound that does more than chime a dull tone at the acquisition of each point) that you probably already own enough games of

this type to take care of the occasional players in your household. And I am concerned that between each game, when the title screen reappears, the cartridge does not cycle through the colors to avoid burn-in on a color TV. There is also another potential problem: the cartridge may not work on the Colecovision 2600-cartridge adapter—the sample we had did not.

Atari's Space Dungeon for Atari 5200



CIRCLE 102 ON FREE INFORMATION CARD

Atari	Space Dungeon									
GRAPHICS										
SOUND										
EASE OF LEARNING										
CHALLENGE										
VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good					Excellent

FOR THE POOR 5200 OWNERS WHO HAVE had to get by with only a handful of cartridges, let it be known that relief is on the way; the recent crop of Atari (1265 Borregas Ave., Sunnyvale, CA 94086) 5200 cartridges have been outstanding additions to the fledgling library. And I don't think I've come across a more challenging and purely addictive action-videogame cartridge on any system to date than *Space Dungeon*.

One of the most unusual features of this game is that the player must use both joysticks to control the action. The cartridge is packaged with a special plastic

brace that tries to hold both controllers steady while you concentrate your physical action on the joystick. Without going into the somewhat inane instruction manual explanation of what your screen character is doing, suffice it to say that you must move your character into as many of the 36 chambers on each level as possible.

Treasures are picked up by running over them. But you have to avoid or destroy all the enemies who can do you in on a second's notice. There are many kinds to watch out for.

The only time you gain the bonus point for picked-up treasure is when you fight your way into the chamber with the bonus square. Then, not only do you collect bonus, but you proceed to the next, more intensive level of 36 chambers. And so on—for more levels than I could reach. At levels two and up, a Thief is also in the game. The Thief's objective is to try to take away treasures while you try to collect them.

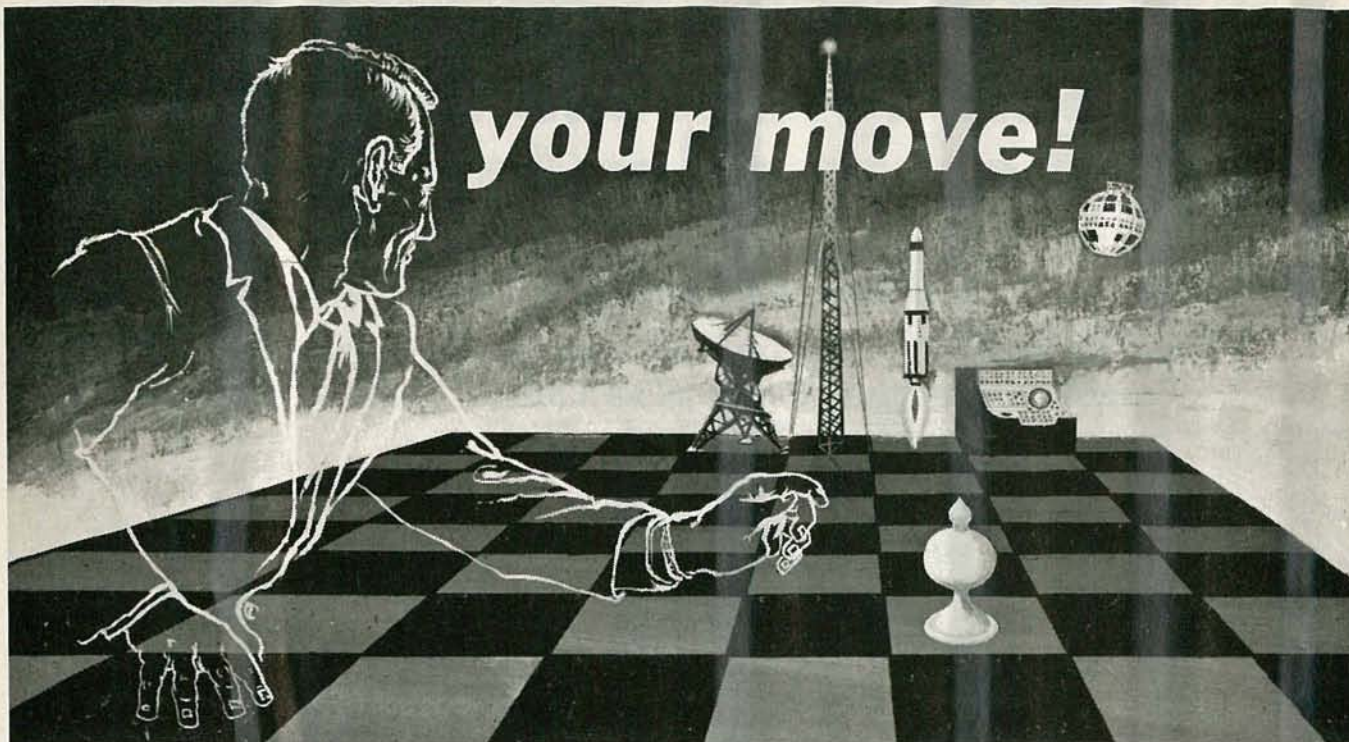
Controller action takes quite a while to get used to. One joystick controls the movement of your character within the chamber and through openings to adjacent chambers. The other joystick controls the firing direction of a powerful laser-type cannon. Unfortunately, you have only eight firing directions, so to aim at a rapidly oncoming enemy, you need to juggle the firing direction and movement of your character. That's not an easy task by any means because each joystick needs to go in opposite directions: moving away from the enemy, while firing toward the enemy.

Your progress through a level is monitored in a map of the level that depicts which chambers you've been in. That map also shows which chambers still have enemies lurking within; which one has the bonus portal to the next level, and where you dropped the treasure the last time an enemy hit you.

The physical challenge of maneuvering two joysticks is trouble enough. When you add the very fast action on screen, you have one harried time keeping on top of the situation. *Space Dungeon* is an excellent example of the computer-quality games that the Atari 5200 is capable of. Let's hope Atari maintains the same level of quality in future 5200 offerings.

R-E

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
2500 South La Cienega Blvd.
P. O. Box 35499
Los Angeles, CA 90035

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.

We are located at 2500 S. LaCienega Blvd., Los Angeles, California, but for faster response please use our mailing address: P. O. Box 35499, Los Angeles, CA 90035.

Grantham College of Engineering 10-83
P. O. Box 35499, Los Angeles, CA 90035

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

Name _____ Age _____

Address _____

City _____ State _____ Zip _____

Everybody's making money selling microcomputers. Somebody's going to make money servicing them.

Now NRI Trains You At Home To Make Money Servicing, Repairing,
and Programming Personal and Small Business Computers



Learn At Home to Service Any Computer

NRI can train you for this exciting, rewarding field. Train you at home to service not only microcomputers, but word processors and data terminals, too. Train you at your convenience, with clearly written "bite-size" lessons that you do evenings or weekends, without going to classes or quitting your present job.

Your training is built around the latest model of the world's most popular computer. It's the amazing TRS-80™ Model 4, now with disk drive and the capabilities and features to perform a host of personal and business functions. No other small computer has so much software available for it, no other is used and relied on by so many people. And it's yours to keep for personal and business use.

You get plenty of practical experience. Under NRI's carefully planned training, you even install a *disk drive*

as an alternative to the Model 4. The same technique for getting inside is enhanced by using the new NRI-developed Computer Access Card. Only NRI offers you a choice to fit your specific training needs.

Become the Complete Computer Person

In addition to training in BASIC and advanced machine language, you gain hands-on experience in the operation and application of the latest computers for both business and personal jobs. You're trained to become the fully rounded, new breed of technician who can interface with the operational, programming, and service facets of all of today's computers. You're ready to take your place in the new electronic age.

Other Opportunities

NRI has been giving ambitious people new electronic skills since 1914. Today's offerings also include TV/Audio/Video Systems servicing with training on our exclusive Heath/Zenith computer-programmable 25" diagonal color TV... Industrial Electronics, Design Technology... and other state-of-the-art courses.

Training now includes either the TRS-80 Model 4 Microcomputer with *Disk Drive* or the TRS-80 Color Computer with Computer Access Card; professional LCD multimeter; the NRI Discovery Lab; and hundreds of demonstrations and experiments.

Seems like every time you turn around, somebody comes along with a new computer for home or business use. And what's made it all possible is the amazing microprocessor, the tiny little chip that's a computer in itself.

Using this new technology, the industry is offering compact, affordable computers that handle things like payrolls, billing, inventory, and other jobs for business of every size...perform household functions including budgeting, environmental systems control, indexing recipes. And thousands of hobbyists are already owners, experimenting and developing their own programs.

Growing Demand for Computer Technicians

This is only one of the growth factors influencing the increasing opportunities for qualified computer technicians. The U.S. Department of Labor projects over a 600% increase in job openings for the decade; most of them *new* jobs created by the expanding world of the computer.

(TRS-80 is a trademark of the Radio Shack division of Tandy Corp.)



verifying its operation at each step. Using the NRI Discovery Lab® that also comes as part of your course, you build and study circuits ranging from the simplest to the most advanced. You analyze and troubleshoot using the professional 4-function LCD digital multimeter you keep to use later in your work. Then you use the lab and meter to actually access the interior of your computer...build special circuits and write programs to control them. You "see" your computer at work and demonstrate its power.

Same Training Available With Color Computer

NRI offers you the opportunity to train with the TRS-80 Color Computer

The Catalog is Free. The Training is Priceless.

Send the postage-paid card for our 104-page catalog showing all courses with equipment and complete lesson plans. There's no obligation other than to yourself. See how NRI can help you take advantage of the exciting job and earnings opportunities in the exploding field of microcomputers. If card has been removed, please write to us.



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

We'll give you tomorrow.

LETTERS

Address your comments to: Letters, **Radio-Electronics**,
200 Park Avenue South, New York, NY 10003

RECEIVE-BOARD PROBLEM

Heathkit has found a problem with HERO's sonar receive board. It acts erratically within a few hours of operation. That is caused by noise-pickup from the logic supply.

Although they will upgrade HERO's under warranty, you can also do it yourself. Just replace the receive transducer wiring with a shielded cable. Be sure, however, to connect the shield to the uninsulated pin on the transducer. Finally, lift the P1101 plug above the circuit board.

MICHAEL A. TYBORSKI
Application Engineer
Greendale, WI

SPEAKER PROBLEMS

Having restored many old radios myself, I thoroughly enjoyed the article "How To Repair Antique Radios" in the March 1983 issue of **Radio-Electronics**.

We are a major reconing center with over 30 years' experience behind us. We would gladly help any of your readers with any speaker problems that they might have.

FRANK PETRONELLA
Phoenix Electronics
1100 FM 1960 W.
Houston, TX 77090

ON CHOOSING A PRINTER

I really must take exception to a number of items in Les Spindle's comments on choosing a printer ("Computer Corner," **Radio-Electronics**, March 1983). First of all, dividing printers into dot-matrix and impact is like dividing IC's into NAND gates and CMOS—not only do the categories overlap, they don't cover the entire topic.

"Impact" refers to the method of producing the image on the paper. In impact printing, an inked surface (normally a ribbon) and the

paper are forced together at high speed, transferring the ink to the paper. All of the printers that Mr. Spindle talks about are impact printers.

There are also a number of non-impact printing technologies, the most common of which are thermal (using a specially treated paper that changes color when heated), Xerographic (the laser printers, which are very popular on large mainframe computers), and electrostatic (similar to Xerographic, but using specially treated paper and much simpler mechanism).

The main advantages of impact technologies are low cost and the ability to produce carbon copies. The disadvantages are lots of noise, lots of moving parts to wear out, and fairly low speed. The main advantages of non-impact technologies are high speed and low noise levels; the disadvantages are high cost and inability to make carbons.

Dot-matrix refers to the method of forming

Krista instruments

1 Year Warranty



31B-430



30B-140



50B-180

6.5 MHz
OSCILLOSCOPE

\$179.00 +\$7.00
Shipping

- Sensitivity 10mV/Div.
- Input imped. 1M Ω , 35pF shunted
- Maximum vertical input voltage 600V p-p or 300V (DC + AC peak)
- Attenuation 1/1, 1/10, 1/100
- CRT 75mm round screen
- 8-1/16" W x 6-7/16" H x 12 1/2" D
- Weight: 8.3 lbs.

3 1/2 Digit LCD
MULTIMETER

\$39.95 +\$4.00
Shipping

- AC DC to 1000V/DC to 10A
- Resistance up to 2M ohms
- DC accuracy $\pm 0.5\%$ typical
- Auto polarity
- Full overload protection
- Low battery indicator
- Full overload protection
- 7" H x 3 1/4" W x 1 1/2" D. Wt. 16 oz.

Temperature Control
Soldering Station

\$54.95 +\$4.00
Shipping

- Continuous temp. adjust. at front
- Temp. range 100°C to 500°C
- Heater power 48W, 24V
- No RF interference
- LED indicators for power & heater
- Direct temp. indicating meter
- 4 1/2" W x 6" D x 3" H. Wt. 4 lbs.

DOUBLE GUARANTEE

* TRY FOR 10 DAYS. If not satisfied, return in original condition. NO QUESTIONS ASKED!

** WE WILL NOT BE UNDERSOLD! Give us the cheapest quotation you have received and WE'LL BEAT IT!

Money Order, Visa, MC, COD Welcome.

EPS

ELECTRONIC PARTS SUPPLY, INC.

1029 Oak Street, Oakland, CA 94607

TOLL FREE 1-800-227-0104

In Calif., Hawaii & Alaska 1-415-839-2267

Calif. Residents add appropriate Sales Tax.

Overseas Orders add 5% for Shipping.

FREE CATALOG
Call 1-415-839-2267

Be an FCC LICENSED ELECTRONIC TECHNICIAN!



Earn up to \$600 a week and more!

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

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 _____

Here's why we're Number One.

When it comes to logic probes, more people purchase Global Specialties! Because you can spend twice as much and not get the speed, precision, flexibility and accuracy offered by our four logically-priced probes—including our remarkable new 150 MHz ECL Probe. Not to mention the versatility, reliability and durability we've become famous for.

But we don't stop there. When it comes to logic testing, Global Specialties does the *complete* job. With our DP-1 auto-sensing digital signal injector—for fast, easy stimulus-response testing at an economical \$83.00*. Plus a line of multi-channel Logic Monitors that provide an inside picture of circuit activity at up to 40 nodes simultaneously. And each product has an idea-filled applications manual—as well as an unmatched line of highly-functional accessories, to extend its versatility still more.

With Global Specialties, there's no need to compromise on performance. Or *value*. Discover for yourself why we're the number-one logical choice!



Easy-to-use Memory and Pulse functions

Full readout indications—HI, LOW PULSE

Overload and AC-line-protected high-impedance input
Linear input impedance eliminates errors due to non-uniform loading

Complete line of interchangeable probe tips and grounding wires, including easy clip, banana plug, alligator clip jumpers and variety of power cords

Compact, high-impact, human-engineered case

True multi-family performance: DTL, TTL, CMOS. Or ECL!

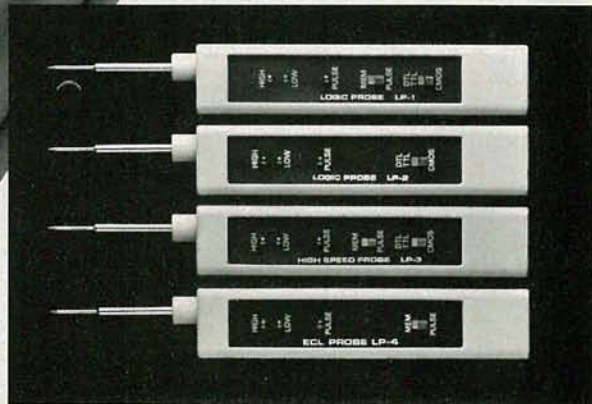
Interchangeable thin-profile power cords (instead of awkward, heavy or coiled cords)

Unsurpassed reliability—performance proven

All specs conservative and *guaranteed*

Half the price for equal (or better) performance

Circuit-powered with reverse-voltage protection



Standard LP-1, only \$50.00*, with latching memory—captures pulses as fast as 50 nsec, to 10MHz, guaranteed

Economy LP-2, \$32.00*, guaranteed to 50 nsec, 1.5 MHz

High-speed LP-3 with memory, only \$77.00*, guaranteed to 10 nsec (6 nsec, typical) and 50 MHz!

New ECL LP-4, \$150.00*; the new industry standard—with memory, guaranteed to 4 nsec (2 nsec, typical) at 150 MHz!
*LP-4 probe exclusively for use with ECL. For DTL, TTL or CMOS, select LP-1, -2 or -3.

70 Fulton Terr., New Haven, CT 06509 (203) 624-3103, TWX 710-465-1227
OTHER OFFICES: San Francisco (415) 648-0611, TWX 910-372-7992
Europe: Phone Saffron-Walden 0799-21682, TLX 817477
Canada: Len Finkler Ltd., Downsview, Ontario

GLOBAL SPECIALTIES CORPORATION

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

*Suggested U.S. resale. Prices, specifications subject to change without notice. © Copyright 1981 Global Specialties Corporation.

CIRCLE 10 ON FREE INFORMATION CARD

OCTOBER 1983

21

Three New Simpson 3½ Digit DMMs!

FOR THE MAN ON THE JOB...

Professional-grade instruments have: continuity beeper, diode test, transient protection and double fusing. UL Recognized test leads and a full line of optional accessories.

The **470™** is our new low-cost, full-function, hand-held DMM with 25 ranges, 0.15% basic accuracy, thumbwheel knobs, and a 2-way fold-out stand. The **467E** hand-portable DMM has 0.1% basic accuracy, peak hold, true RMS and 26 ranges. The **360 Series 3** digital VOM (with world famous 260® styling) has 0.1 basic accuracy, 28 ranges, bright LED display, rechargeable batteries.

These 3 new DMMs will join the family of 29 other UL Listed Simpson Instruments... available at leading electrical/electronics distributors worldwide.



SIMPSON ELECTRIC COMPANY

A Katy Industries, Inc. Subsidiary
853 Dundee Avenue, Elgin, IL 60120
(312) 697-2260
Telex 72-2416
Cable SIMELCO



360 Series 3
\$275

470™
\$139

467E
\$225

characters. Dot-matrix printers form characters from an array of dots (usually 5 dots wide by 7 dots high, or 9 dots wide by 11 dots high). Formed-character printers (what Mr. Spindle calls "impact printers") have the complete set of characters fully formed (as you find on a typewriter). There are a few other methods of forming characters, but they are very rare. The main trade-offs between dot-matrix and formed-character printers are speed, print quality, and functionality. (Contrary to Mr. Spindle's assertion, noise level is a function of image technology, rather than of character technology.)

Dot-matrix printers are generally faster than formed-character printers. The print quality of formed-character printers is usually much higher, but some of the newer dot-matrix printers use overlapping dots, which results in a print quality that is nearly as good as that of formed-character printers.

An area that Mr. Spindle completely ignores is that of functionality. A formed-character printer can produce only characters which are in its formed set; a dot-matrix printer, however, has the capacity to produce any character which *can* be formed from its matrix—including complete pictures. (Those capabilities, programmable character sets and graphics capabilities, are usually offered as options.)

LAWRENCE J. JONES
Cincinnati, OH

RADAR DETECTORS

Richard Kolasinski presented quite a few important pieces of information in his letter on radar detectors in the March 1983 **Radio-Electronics**, but it seems that he forgot to take all of his information to its logical conclusion.

If the "vast majority of drivers" are exceeding the speed limit "when they think they can get away with it," then obviously, the speed limit is too low. What isn't quite so obvious is that police officers, who are required to enforce artificially low speed limits, have their hands full, and end up ignoring the bad drivers — in effect, condoning their bad driving.

Want to put the radar-detector industry out of business, Mr. Kolasinski? Then help us get the speed limits back to reasonable levels. Maybe then we can all stop watching our speedometers and watch the road instead.
DAVID BARNES
Cincinnati, OH

THE PROGRAMMA III

I thought I would let you know how much I enjoyed building the Programma III, and best of all the application and use of it. I was able to build it in 12 hours' time.

When I fired it up, I found one wiring error and one bad IC. The LM380N went up in smoke. The reason for that was that it went into oscillation (448 kHz) out of pin-8 output and couldn't handle the power dissipation. I cured the problem of oscillation by referring to the *National Linear Data Book*, page 10-42, note 4. If oscillation exists under some load conditions, add 2.7 ohm in series with pin 8. Thought I would let you know about that, in case someone else has the same problem.

All in all, it was a fine project and I loved it. I have learned more about IC's these past two weeks, using your Programma III, than in the previous 10 years. I have even fixed a way with the plugs to test op-amps.

GEORGE STEINER
Sacramento, CA

R-E

CIRCLE 54 ON FREE INFORMATION CARD

Now you can choose
from the big, wide
wonderful world of
ZENITH
VIDEO/AUDIO
ACCESSORIES
for the new sounds,
new sights, and fun
you may be missing

Today, with more of us tapping into our TVs for more than the news, sports, and the typical TV "shows" we are so familiar with, Zenith introduces a whole host of video accessories designed to access just about anything in the television spectrum.

First among these super-convenient TV accessories is the push-button Zenith Video Organizer that lets you switch from one program source to another — even lets you record — without the nuisance of changing connections manually.

Individually packaged and clearly labeled for cash-and-carry convenience at your Zenith dealer's are such TV accessories as dust covers, video tape ID kits, cassette storage modules, signal splitters, attenuators, terminators, A-B switches, "F;" mini and other types of plugs and jacks in virtually any combination... plus cables in a variety of lengths, each with gold electroplated connectors.

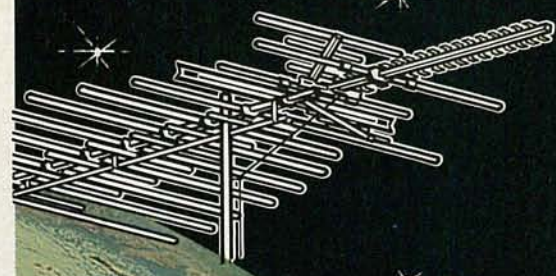
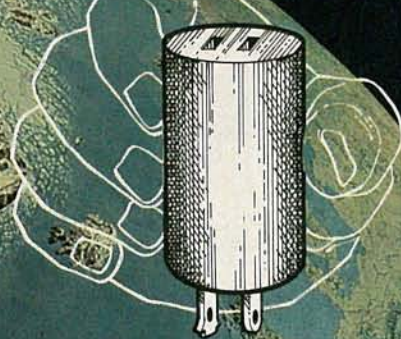
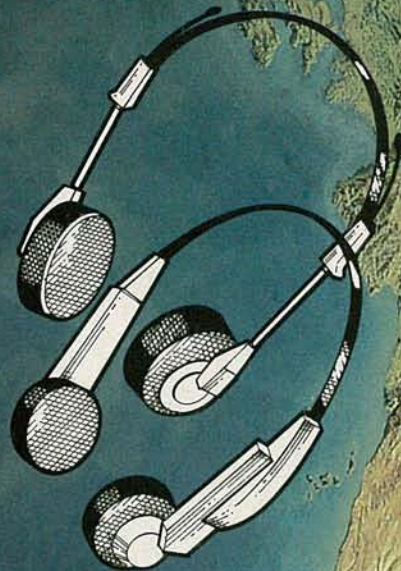
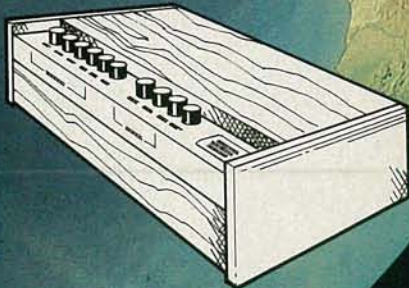
Also included in this, the biggest, broadest-ever Zenith line of video, audio and telephone accessories, are indoor and outdoor antennas... super lightweight stereophones... and 2- and 3-prong Zenith Spike Suppressors to protect the TVs, home appliances, and solid-state electronics in your home from damaging high-voltage surges the year-around.

Make the most of TV's new potential. With video/audio accessories bearing TV's best known name for reliability. They're at your Zenith dealer's now. Go see!

ZENITH

The quality goes in before the name goes on.®

Zenith Radio Corporation
Service, Parts & Accessories Division
11000 Seymour Avenue
Franklin Park, Illinois 60131



EQUIPMENT REPORTS

B&K-Dynascan Models 1653 and 1655 Variable Voltage Supplies



CIRCLE 103 ON FREE INFORMATION CARD

B&K		1653/1655											
OVERALL PRICE													
EASE OF USE													
INSTRUCTION MANUAL													
PRICE/VALUE													
		1	2	3	4	5	6	7	8	9	10		
		Poor			Fair			Good			Excellent		

WE'VE FELT FOR A LONG TIME THAT ONE of the most useful pieces of test equipment for servicing TV sets is the variable-

voltage transformer (Variac). Now, B&K-Dynascan (6460 West Cortland Street, Chicago, IL 60635) has come up

with a couple of units that are even better. Those are their model 1653 and 1655 (shown) isolated variable-voltage supplies. The advantage that those have over a standard Variac is that they also isolate hot-chassis sets. That's essential considering that so many modern TV sets use full-wave bridges right across the AC line. A chassis like that is hot to everything, (including your test instrument!) so an isolation transformer is necessary for safe servicing.

The difference between the two models lies in their current ratings, and the inclusion of some extras on the 1655. The 1653 has a 2-amp current rating, ample for practically all TV sets. The 1655 has a 4-amp rating, and also has a variable voltage soldering-iron outlet on the back. With that, you can keep the iron hot enough to work, yet cool enough to save tips.



One source for thousands of VCR parts.

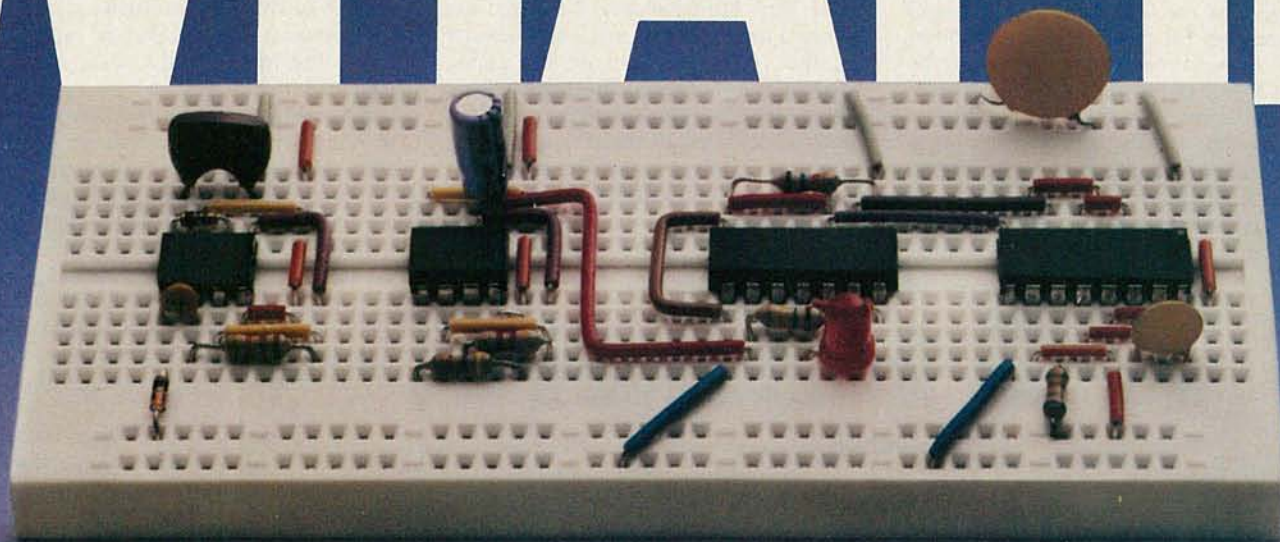
RCA VCR parts are available from more than 600 authorized RCA parts distributors. See your local RCA distributor for RCA's new VCR parts kits — they're easy to use and reuse. Each package has a handy slide top — and features detailed cross-references to other manufacturers' model numbers and stock numbers.

One more thing. Kit prices are lower than the total cost of the individual parts. So see your RCA distributor today. Also ask for a copy of the VCR Parts Cross Reference of more than 8000 VCR parts (Form 1F6627) and VCR Tool Catalog (Form 1F6857). Or write: RCA Distributor and Special Products Division, 2000 Clements Bridge Road, Deptford, NJ 08096.

Service more than 95 RCA and other brand models with these VCR Parts Kits:

199094 and 199095 Belt Kits, 199096 Lamp Kit, 199097 Fuse Kit, 199300 IC Kit

RCA VCR Parts



What if there were a faster way to build and test circuits?

There is. Circuit-Strip from A P PRODUCTS makes circuit building a snap, giving you more time to experiment, to create. With a Circuit-Strip solderless breadboard, all you have to do is plug in components and interconnect them with ordinary #22 AWG solid hook-up wire. If you want to make a circuit change, just unplug the components involved and start over. It's just that easy. Circuit-Strips feature 610 plug-in tie-points and have a capacity of up to 6 14-pin DIPs. Four separate distribution buses of 35 tie-points each give you access for power, ground or signal.

What if it were easier to identify tie-point locations in a circuit?

It is. Circuit-Strip has a molded-in alpha-numeric grid for instant identification of every tie-point. Schematics can be labeled with each tie-point location to make circuit building faster and troubleshooting easier. Circuit-Strip is ideal for electronic training programs as well as laboratory use.

What if Circuit-Strip had a new low price?

It does. Circuit-Strip now carries a suggested resale price of only \$12. That means that the best tool for the job now has the best price ever.

What if you need more information?

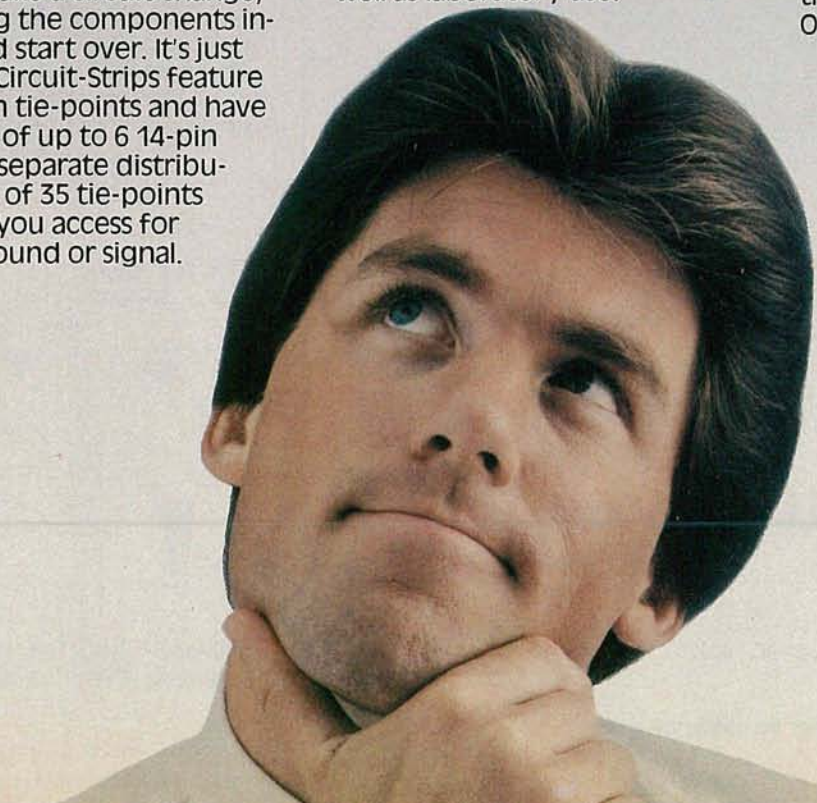
That's easy, too. Just call toll free 800-321-9668 for the name of the distributor near you. (In Ohio, call collect (216) 354-2101.)



A P PRODUCTS INCORPORATED
9450 Pineneedle Dr. • Box 540
Mentor, Ohio 44061-0540
(216) 354-2101
TWX: 810-425-2250

In Europe, contact A P PRODUCTS
GmbH Baumlesweg 21
D-7031 Weil 1 • West Germany
Phone: (07157) 62424
TLX: 841 07 23384

CIRCLE 56 ON FREE INFORMATION CARD



Both units have a front-panel meter that measures voltage and current. The meter's function is selected by pushbutton switches. On the 1653, the meter measures voltages when the button is in, current when it is out. The 1655 has separate pushbuttons for voltage, two current ranges (0-2 and 0-4 amps), and a special leakage test for checking the isolation of any exposed metal parts to either the ground side of the line or to the hot side. The test probe for that last function is permanently connected; all you have to do is pick up the probe, push the button and you're ready. Leakage is read on the meter in microamps. Incidentally, if you read more than 500 microamps, some-

thing is definitely wrong in the set! That is the standard maximum value specified by OSHA, UL and CSA. Some makers specify even a lower limit for greater safety.

As we mentioned earlier, you need an isolation transformer when working with hot-chassis sets. Both of the B&K units have very high isolation (leakage less than 0.1 mA). There is one isolated outlet on the 1653, and two on the 1655. However, the manufacturer warns against plugging two hot-chassis sets into the 1655 at the same time. There is always a chance that the two will be hot to one another, and cause damage to something.

The load current can be accurately read with either unit. That is useful for such

things as checking for nuisance tripping of circuit breakers. To do that, check the rating of the breaker in the service data, then plug it in and bring up the current slowly to see if the breaker is tripping too fast. That isn't at all uncommon, and it can lead you to unnecessary testing to find out if the set has too much leakage, etc. If, for instance, the breaker is rated 1.9 amps, but trips at only 1.5 amps, it's obviously bad.

Sets with problems that show up only with high or low line-voltage can be checked instantly. (Those are the ones that work fine in the shop, but act up as soon as they are taken home.) High line-voltage should be suspected if the set has a history of blowing out output transistors, etc. To assure yourself that the set will work fine at low (105-volts AC) or high (125-volts AC) line-voltages, simply use either device to check operation at the extremes.

The standard use for devices such as those is to raise the line voltage slowly enough to allow you to perform some tests on the set before blowing out the output transistor, etc. Be sure to watch the line current while doing that. The normal load current is provided on the schematic (or should be!)

The units' meter is very accurate; we checked readings against a very accurate DVM and found them to be right on the button. They claim an accuracy of $\pm 5\%$ full scale, but our tests showed it to be even better than that.

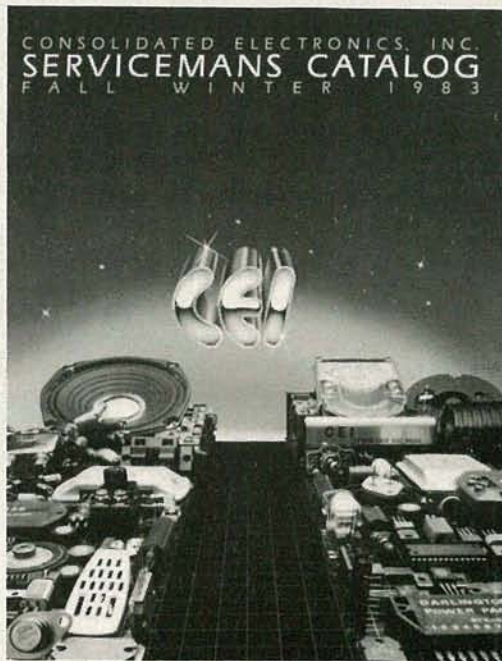
In all, then, those are versatile, useful instruments that make servicing safer for the set and yourself. They are also well made. As evidence of that, one of the ones sent for review had been badly mishandled by the shipping company—the front panel, as well as the shaft of the Variac control, had been bent. For curiosity's sake we tried it out before sending it back for adjustment. It worked perfectly.

The model 1653 carries a suggested list price of \$165; the model 1655 carries a suggested list price of \$350. **R-E**

continued on page 30

IT'S HERE!

IT'S FREE . . .



. . . AND IT'S YOURS!

Consolidated Electronics has a catalog that's sure to please you. We've slashed **80%** of our prices in this catalog. We at CEI are so sure that you'll find our quality parts dependable that we've put a **TWO YEAR WARRANTY** on everything. Not only that, CEI is offering **FREE** shipping and handling. Just call us **TOLL FREE** for details.

CALL TOLL FREE TODAY!

1-800-543-3568

NATIONAL WATS

1-800-762-3412

OHIO WATS

705 WATERVLIET AVE., DAYTON, OHIO . 45420
IN DAYTON • (513) 252-5662

TELEX NO. 288-229

CIRCLE 18 ON FREE INFORMATION CARD



"If you think that's bad, you should try turning it on when it's plugged in!"

RCA's

REPLACEMENT OF THE JEDEC



***The newest book
in the MRO Series!
Over 3000 RCA devices
replace 9500 JEDEC*
and commercial types.***

RCA's galaxy of MRO devices makes your world an easier place to work. Our new Industrial/MRO Guide is your one solid state replacement source for everything you'll need on maintenance and repair jobs. And it's bigger and better than ever.

We've added 32 extra pages, and a combined Index/Cross Reference section with four separate columns: product type, device ID code, device to use, and page number for abbreviated device specs. You need look in only one place in the Guide to

determine which RCA device will best fulfill your MRO requirements. There is even a special section on High Reliability Devices.

The RCA Industrial/MRO Guide, #1K7304. One source for all your JEDEC and commercial replacements. For your copy, see your local RCA Industrial/MRO distributor. Or write: Sales Promotion Services, RCA Distributor and Special Products Division, 2000 Clements Bridge Road, Deptford, NJ 08096. And may the source be with you!

*Joint Electron Device Engineering Council

RCA
**SK Replacement
Solid State**

HITACHI

NLS Non-Linear Systems

HICKOK

WESTON

DATA PRECISION

KEITHLEY

AWS
A. S. SPICER
INSTRUMENTS INC.

FLUKE

PHILIPS

BK PRECISION

VIZ R&A

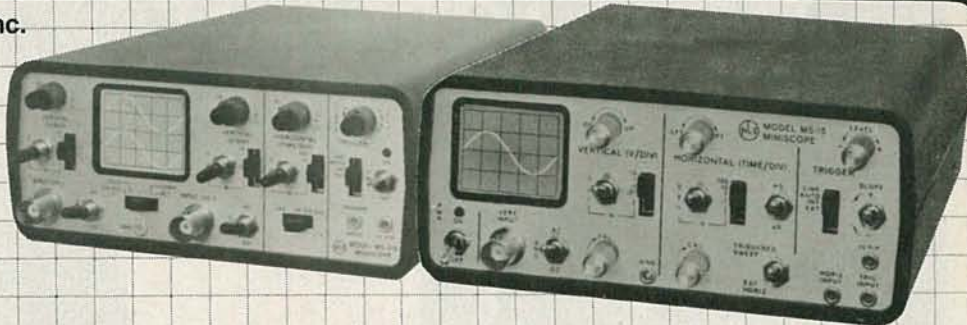
TRIPLETT

Simpson

LEADER

NLS Non-Linear Systems, Inc.
OSCILLOSCOPES

- MS15 15 MHz Single Trace
- MS215 15 MHz Dual Trace
- MS230 30 MHz Dual Trace



Non-Linear Systems' trio of miniscopes are accurate, affordable, portable. And there's one to match nearly every budget and need. Standard features on all models include an input impedance of 1 megohm with 50 pF; maximum input voltage of 350 V; trigger modes in auto, internal, external and line; slope that's + or - selectable; graticule (4 x 5 division of 0.25" each); dual power sources operating either internally from rechargeable lead acid batteries or externally from 115 VAC or 230 VAC (50-60 Hz) via plug-in transformer; handy size (2.9"H x 6.4"W x 8.0"D) and weighs just 3 lbs.*

*(Exception: model MS-230 is slightly deeper, at 8.6", and heavier, at 3.6 lbs.)

BK PRECISION

POWER SUPPLIES



MODEL 1601

\$299.95
WAS \$359.

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



MODEL 1650

\$319.95
WAS \$390.

- 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

**BECKMAN'S
CIRCUITMATE
AVAILABLE NOW UNDER \$100**

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

\$69.95

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

\$89.95



BK PRECISION

FUNCTION GENERATORS



MODEL 3010

- 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 3010 **\$179.95**
WAS \$229.

MODEL 3020 **\$319.95**
WAS \$394.

**SWEEP FUNCTION
MODEL 3020**

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

BK PRECISION

CAPACITANCE METERS



MODEL 830

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

\$189.95
WAS \$238.



\$159.95
WAS \$192.

MODEL 820

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

**BECKMAN
DIGITAL
MULTIMETERS**



300 310 320
330 350 360

ALL IN STOCK
CALL FOR PRICES

**ORDERING
INFORMATION**

We don't just take orders, we ship them
Advance Electronics
endeavors to keep everything we advertise in stock for immediate delivery.



- Mastercharge & Visa shipped within 24 hours.
 - Bank checks or Money Orders shipped within 24 hours.
 - Personal checks — please allow 3 weeks for check to clear.
 - All prices plus shipping charges. Please call for appropriate charges. Use our toll free number.
 - New York State residents add appropriate sales tax.
 - PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
- Quantities are limited

HITACHI

NLS Non-Linear Systems

HICKOK

WESTON

DATA PRECISION

KEITHLEY

AWS
A. W. SPERRY
INSTRUMENTS INC.

FLUKE

PHILIPS

BK PRECISION

VIZ R&A

TRIPLETT

Simpson

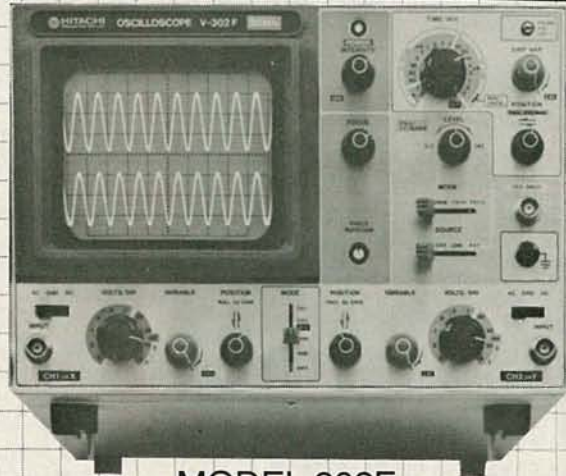
LEADER

HITACHI

A 30 MHz SCOPE AT A 15 MHz PRICE

\$549⁹⁵

Dual Trace
w/Delay



MODEL 302F

Price does not include probes.
Probes \$50. a pair when purchased with scope. \$10. shipping within continental U.S.

All Hitachi Oscilloscopes feature 2 year parts and labor warranty.

**WE CARRY
A FULL LINE
OF HITACHI
OSCILLOSCOPES**

**CALL FOR
OUR PRICES**

FEATURES

- 1 mV/div high sensitivity design. Effective for measurement of weak signals.
- Employs TV sync separator circuitry with one touch synchronization of both TV horizontal and vertical signals.
- Built-in signal delay line enables front observation of fast rising waves.

BK PRECISION

INDUSTRIAL TRANSISTOR TESTER

\$199⁹⁵

WAS \$249.

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

FLUKE

4½ DIGIT MULTIMETERS

MODEL 8060A



\$349⁰⁰

- Frequency measurements to 200KHz
- dB measurements
- Basic dc accuracy 0.04%; 10 μV, 10 nA and 10 mΩ sensitivity.
- Relative measurements
- True RMS
- High-speed Beeper

- Continuity and relative reference functions identical to 8060A.
- True RMS measurements to 30 kHz.
- Basic dc accuracy 0.05%; 10 μV, 10 nA and 10 mΩ sensitivity.
- Beeper

MODEL 8062A



\$279⁰⁰

AVAILABLE FOR IMMEDIATE DELIVERY

Circle Reader Service 7 for more information



TOLL FREE HOT LINE
800-223-0474

THE TEST EQUIPMENT SPECIALISTS

**ADVANCE
ELECTRONICS**

26 WEST 46th STREET, NEW YORK, N.Y. 10036 212-730-7030

TECHNICIANS,

Get serious about your profession;



Now you can order the "Study Guide for the Associate—Level CET Test" from the International Society of Certified Electronics Technicians. It includes material covering the most often missed questions on the Associate CET Exam. 8½" x 11", paperback, 80 pages.

GET CERTIFIED!

Send check to IS CET, 2708 W. Berry St., Ft. Worth, TX 76109.

Name _____
 Address _____
 City _____
 State _____ Zip _____
 _____ copies @ \$5.00 ea.
 _____ Send material about IS CET and becoming certified.

EQUIPMENT REPORTS

continued from page 26

Finger Print Control Module for Epson Printers

SOME OF THE MORE POPULAR PRINTERS, such as the the Epson MX-80/MX-100 printers and their clones—such as the printer for the IBM PC—have extended software-programmable "fonts" (print styles). They include 10 (standard) pitch, 16.5 (compressed) pitch, expanded size, italics, double strike, enhanced printing, or almost any possible combination of type styles. For example, it's possible to have the Epson print enhanced, expanded, italics in either pitch.

Unfortunately, the printers' features are software driven by control codes from within the program or by a direct statement (command) from BASIC, such as "LPRINT CHR\$(27)'P'." While some software, such as word-processing software, makes provision for a few printer codes, other software doesn't. Even the few non word-processors that permit initial printer-setup codes rarely allow the user to change the setup once the printing is under way.

That's where *Finger Print* from Dresselhaus Computer Products (PO Box 929,



CIRCLE 104 ON FREE INFORMATION CARD

Dresselhaus	Finger Print									
OVERALL PRICE										
EASE OF USE										
INSTRUCTION MANUAL										
PRICE/VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair			Good			Excellent	

Azuza, CA 91702) comes in. It is a user-installed retrofit device for the Epson (and similar) printers that allows many of the most commonly used print functions to be pre-programmed by simply touching the printer's control buttons—the three buttons located on the top of the printer which normally place the printer on/off line, formfeed (FF) the paper, and linefeed (LF) the paper.

With *Finger Print*, the user can select the setup function(s) before printing starts, and even change the setup during the run. If the software can't be programmed to stop the printer for a change in setup (type style), the printer can be stopped with its own on/off line switch, the new setup can be programmed in, and the printer restarted.

Finger Print provides either nine or ten functions, depending on whether the Epson printer has *Graftrax* or *Graftrax-Plus*. If the printer has *Graftrax Plus* the functions are: 1: RESET (clears all setup—restores printer to normal power-up state, and flushes the printer's own buffer); 2: COMPRESSED PRINT (16.5 characters-per-inch); 3: DOUBLE WIDE (does not automatically cancel at the end of the print line); 4: EMPHASIZED (creates bold print); 5: DOUBLE STRIKE creates super-bold printing when used with EMPHASIZED command or it can be combined with COMPRESSED PRINT for enhanced "micro type"); 6: PERFORATION SKIPOVER (when printing near the bottom of the page the printing automatically skips over the perforations of tractor-fed paper); 7: INDENT (indents left margin six spaces so print-outs can be punched and put into binders

FREE SOCKETS!

Send **\$1.00** postage and handling for DIP Socket Deal!

8, 14, 16, 24 and 40 pin DIP Sockets **plus** we will send you FREE our 56 page catalog with \$1.00 OFF Coupon on any purchase.

How can you lose?

SINTEC COMPANY When Ordering
 28 8th Avenue Call Toll Free:
 Box 410 1-800-526-5960
 Frenchtown, NJ 08825 In NJ call (201) 996-4093

Fill in below or ask for Socket Deal

I want the Socket Deal Enclosed is my \$1.00 cash.

Name _____
 Address _____
 City _____ State _____ Zip _____

DON'T FORGET



USE
YOUR
READER
SERVICE
CARD

- Quality Components • Over 650 Items Available From Our 700
- Competitive Prices • Authorized JIM-PAK Distributors
- Send Self-Addressed Stamped Envelope for 1983 Catalog and Distributor List

BUG TRAY

New!



BUG TRAY™ — Stores in Bug Cage • Molded plastic • Three styles: Open (1 compartment); Vertical (5 compartments); and Horizontal (8 compartments) • Ideal for tools, hardware, components, etc. • Color: Black • Size: 3.55" x 5.05" x .6".

PART NO.

- Horizontal Bug Tray (2) BTH-002
- Vertical Bug Tray (2) BTV-002
- Open Tray (2) BTO-002

BUG CAGE

New!



BUG CAGETM — 6 locations store Bug Boxes, Big Bug Boxes or Bug Trays • Modular & interlocking • Cage size: 5-1/8" x 5" x 3-7/8" • Color: Blue

PART NO. BGC-001B

LSI BIG BUG BOXTM — Designed to store large IC's, Resistors, Capacitors and Diodes • Three vertical and three horizontal dividers included • Color: Blue • Size: 4.9" x 3.3" x .6".

PART NO. BLX-002B (2 Boxes)

ANTI-STATIC

PART NO. BLX-002BAS (2 Boxes)

BUG BOX

New!



BUG BOXTM — 30 individual compartments • Stores 60 8-pin or 30 14- or 16-pin DIPs • Heavy duty injection molded plastic • Clear plastic cover slides & locks • Cover marked w/numbers 1-30 • Compartment size: 1" x 3.75" x .5" deep • Box size: 4.9" x 3.3" x .6" • Weight: 1.75 oz. • Color: Blue

PART NO. BGX-002B (2 Boxes)

ANTI-STATIC

PART NO. BGX-002BAS (2 Boxes)

DATA BOOKS

Part No.	Description	Pages
30001	National CMOS	(628 pg.)
30003	National Linear	(1952 pg.)
30005	National TTL Logic	(624 pg.)
30008	National Memory	(464 pg.)
30009	Intersil Data	(1356 pg.)
30013	Zilog Micro	(641 pg.)
10400	Intel Data	(1405 pg.)



CONNECTORS



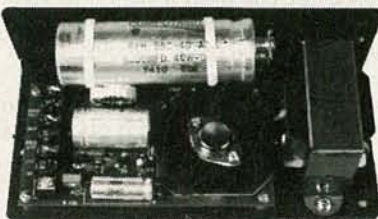
Description	Part No.
9 Pin Plug	DE9P
9 Pin Socket	DE9S
15 Pin Plug	DA15P
15 Pin Socket	DA15S
25 Pin Plug (Meets RS232)	DB25P
25 Pin Socket (Meets RS232)	DB25S
37 Pin Plug	DC37P
37 Pin Socket	DC37S
50 Pin Plug	DD50P
50 Pin Socket	DD50S

Accessories

Hood for DE-9 Series Connectors	DE-9H
Hood for DA-15 Series Connectors	DE-15H
Hood for DB25 Series Connectors	DB25H
Hood for DC37 Series Connectors	DB37H
Hood for DD50 Series Connectors	DD50H

JE224 Adjustable Switching Power Supply Kit

4-24VDC REGULATED, UP TO 5AMP



The JE224 is a high-efficiency power supply utilizing a LH1605 5 amp switching regulator. The LH1605 provides high current output while maintaining a small physical configuration. Open frame type to allow mounting into restricted areas.

FEATURES: Adjustable 4-24VDC: 5VDC @ 5A, 6VDC @ 4.8A, 9VDC @ 4.1A, 12VDC @ 3.3A, 18VDC @ 1.9A, 24VDC @ .5A. Overvoltage protection. Input: 115VAC 50/60Hz. Output variations within 20mV. Size: 8.24" L x 4.25" W x 2.25" H. Weight: 3.25 lbs.

PART NO. JE224 KIT

JOYSTICKS



- JS-5K 5K Linear Taper Pots
- JS-100K 100K Linear Taper Pots
- JS-150K 150K Linear Taper Pots
- JVC-40 40K (2) Video Controller in case

Muffin-Style Fan



- 105cfm free air delivery
- 4.68" sq. x 1.50" depth
- 10 years continuous duty at 20°C
- Impedance protected, ambients to 70°C
- 115V 50/60Hz 14W
- Weight: 17 oz.

PART NO. MU2A1

Sprite-Style Fan



- 36cfm free air delivery
- 3.125" sq. x 1.665" depth
- 10 years continuous duty at 20°C
- 115V 50/60Hz

PART NO. PWS2107

Anti-Theft Auto Alarm System

• Audible horn is activated when door or trunk is opened • Alarm sounds for 3 min. — unless turned off by secret 3-digit code. • Wire cutting will not deactivate alarm. • Code set by owner. • Uses only 0.01mA power. • System complete w/one black-box control unit; one personal coded keyboard; 2 sets of sensors; one audible horn; & wiring (incl. one 10A fuse).

PART NO. CA-06 Auto Alarm



- DIODES
- CRYSTALS
- TRANSISTORS
- SOCKETS
- KITS
- SWITCHES
- RESISTORS
- LEDS
- HEAT SINKS
- KEYBOARDS
- WIRE
- SPEAKERS
- TOOLS
- CORDS
- SOLDER
- IC'S
- BOOKS
- CAPACITORS
- and more...

Door Security System

• Coded door alarm. • Instant or 7-second delay system. • Alarm activated as door is opened. • Can be de-activated by pressing personal code. • Power: One 9V battery (not incl.). • System includes one personal coded keyboard and one magnetic sensor.

PART NO. ES-07 Door Alarm

Home Alarm System

• Self-Installation • Presettable w/individual 3-digit code — no key nec. • Instant or 10-sec. delayed warning system • Alarm system incl. window & door contacts • One 9V battery required (not incl.) Low power consumption (0.01mA) • Loud audible alarm (90db) • Delayed exit feature • System complete w/one control station with built-in siren and test button; 4 magnetic contact sets & connecting wires for entire system

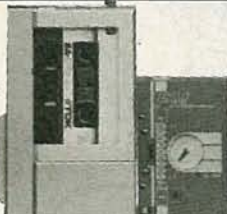
PART NO. ST-05 Home Alarm System

Stereo Cassette Player with FM Stereo Tuner Pack

- Lightweight Headphones
- Cr02/Metal/Normal Tape Selector
- Anti-Rolling Mechanism

FEATURES: • Blue carrying case, shoulder strap, belt strap, lightweight headphones, FM stereo tuner pack & instruction manual • Talkline • Tone selector • Cr02/Metal/Normal tape selector • LED operation indicator • Built-in microphone • Stop/eject, play, rewind/review, fast forward/cue, tape/radio selector functions • Vol. control • Ext. power input jack • Headphone jack • Auto-stop mechanism (shuts off player when tape ends) • Anti-rolling mechanism (prevents sound from quivering when walking, jogging, etc.) • Weight: 13 oz. • Requires 4 AA batteries (not included) • Size: 6"L x 4"W x 1-1/8"H

PART NO. MODEL TWF-802



Mini Stereo AM/FM Receiver

WITH HEADPHONES For Joggers, Cyclists, Skaters & Sports Events



FEATURES: Lightweight headphones. Left/right balance control. Full fidelity stereo sound. Additional black soft carrying case & shoulder strap. Belt-clip (hands-free). Uses 3 AA cell batteries (not included). Compact size: 3-1/8"H x 4-7/8"L x 1"D. Wt. 6 oz.

PART NO. MODEL 2830

without obscuring part of the copy); 8: EIGHT LINES-PER-INCH (normal is 6 lines-per-inch); 9: ITALICS; 10: FINE PRINT (about 5-point size—sets superscript mode and 12 lines-per-inch). Function 10 isn't implemented on *Grafrax* models.

Using the module

The *Finger Print* functions are entered through the three control buttons on the top of the printer, which retain their normal functions of on/off line, formfeed, and linefeed. If the ON LINE button is held down for about a second, the printer's "bell" beeps to tell the user that the printer is now in the "Finger Print" mode. The beep counts as one entry, or RESET, which clears the printer and flushes its buffer. To indent the left margin, which is function 7, the user presses the ONLINE button for six more beeps (for a total of 7). Pressing the printer's FF button programs the command into the printer. Additional functions such as double-wide, enhanced italics, the perforation skipover can be "stacked." When the *Finger Print* functions are programmed, pressing the LF (linefeed) button resets the printer controls back into normal operation.

Any part of the setup can be changed whenever the printer is stopped. A function is eliminated by simply "beeping" the appropriate number of times. For example, if you entered three beeps to turn on the double-wide printing, entering

three more beeps will turn it off. Similarly, if the indent was turned on with 7 beeps, 7 beeps will turn it off.

Finger Print is completely hardware driven. It consists of a small printed-circuit module that is user-installed within the Epson printer as a substitute for the IC normally located in socket 1B. The retrofit requires no soldering or cutting of existing printed-circuit foils. First, the cover is removed, then the IC is removed from the 1B socket and installed in a matching socket on the *Finger Print* module. Next, the module is plugged into the printer's 1B socket. A small clip terminal is slipped on an IC lead that has been bent outward, and a miniclip is slipped over the terminal of another IC within the printer. The whole installation from beginning to end takes about 10 minutes, 15 if you're extra careful.

It's a simple task for someone with just a minimum of electronic assembly experience, but if you're not used to close-quarter assembly have someone else do it. Actually, a **Radio-Electronics** reader should have no problems because the documentation—the assembly and use manual—is outstanding; possibly the best in the entire computer industry. It is typeset, printed on coated stock with photographic reproductions and line artwork exceeding the quality you would expect to find in a professional photographic magazine. And all this is topped off with su-

perbly written installation instructions that leaves nothing to chance or any danger of misinterpretation.

An equally well-prepared self-adhering metallic label that lists the *Finger Print* function "beep" commands is supplied for the front panel of the printer.

As far as gadgets for personal computers are concerned, *Finger Print* is one of the best and most reliable accessory devices we have used, installed, or serviced. The printed-circuit module doesn't look like much, but it does one heck of a job.

Finger Print is available by direct mail from Dresselhaus Computer Products for \$59.95. It is also sold by some local computer dealers. A call to Dresselhaus will get you the name of the nearest store. **R-E**

Global Specialties Model 6000 Frequency Counter

FOR MANY YEARS, A FREQUENCY COUNTER was considered a luxury. However, because counters are so versatile—even for the hobbyist or radio amateur—and because their prices have fallen to reasonable levels, the frequency counter has become more of a necessity than a luxury. One instrument we examined recently was the model 6000 from Global Specialties Corporation (70 Fulton Terrace, New Haven CT 06509). That counter, with a frequency-measurement range

Now 27 choices! Free, free, free...



Hurry, hurry, step right up! It's RCA's Carnival of Awards. And what a lineup of acts. First, the headliners: RCA receiving tubes, very popular with TV technicians for their top performance and dependability.

Plus, a stupendous carnival of valuable awards. Shown here are just a few of the 27 great gifts waiting for you. To earn them, just purchase RCA receiving tubes in required quantities from your participating RCA distributor. Each purchase helps qualify you for the award of your choice. See your participating RCA distributor for details. And come one, come all to RCA's Carnival of Awards!



CIRCLE 105 ON FREE INFORMATION CARD

Global Specialties Model 6000

OVERALL PRICE										
EASE OF USE										
INSTRUCTION MANUAL										
PRICE/VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor			Fair			Good			Excellent

from 5 Hz to 650 MHz, is housed in a neat, compact plastic case. It has a large (0.43 inch) 8-digit LED display across the top of the panel. The display is easy to read, even in high ambient light, due to its contrast-enhancement filter.

While there is no need for a range switch, there are two BNC input jacks on the panel. The A INPUT jack is used for frequency inputs from 5 Hz up to 100 MHz; the B INPUT jack is used for inputs from 40 MHz up to 650 MHz.

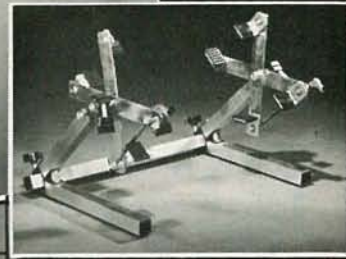
The 8-digit display reads out the frequency in kHz. For example, a frequency
continued on page 38

THE INDUSTRY'S NEWEST CHASSIS MOUNT

Loaded with features and advantages never before available for only \$199.95



Price subject to change without notification.



For complete information contact:



2850 East 29th Street Long Beach, California 90806 (213) 595-7621

CIRCLE 69 ON FREE INFORMATION CARD

with your purchase of RCA Receiving Tubes!



CG7170
RAY-O-VAC "Magnum"
5-Function Light
Value: \$27.45



CG7178
Waring
Ice Cream Parlor
Value: \$44.99



CG7163
Cobra Cordless
Extension Phone
Value: \$189.95

CG7164
Wittnauer "Saturn"
Man's Quartz Watch
Value: \$175.00



CG7169
Skil Cordless
Screwdriver
Value: \$39.99



CG7162
Canon Palm-sized
Printing Calculator
Value: \$64.95



CG7168
Skil Double Insulated
7 1/4" Power Saw
Value: \$65.99



CG7167
American Tourister
5 Inch Attache Case
Value: \$56.00



CG7180
London Fog
Man's Raincoat
Value: \$150.00



RCA Receiving Tubes

RCA Distributor and Special Products Division, Deptford, NJ 08096

NTS Electronics

Learn Robotics, Microcomputers, Microprocessors, Digital Video, Test Equipment and more with NTS INTRONIC™ home training. Courses include state-of-the-art equipment, lessons and texts to make your hands-on programs exciting and down-to-earth practical.

HERO 1 is included in two courses, one basic and one advanced. You'll cover principles of industrial electronics, microprocessor troubleshooting, fundamentals of mechanics, and robotic applications in industry. You'll learn analog and digital skills, radio control, fluidic, pneumatic and servo-mechanisms, as well as computer interfacing and robotic programming. **HERO 1**, complete with arm, gripper and speech synthesis board, is a fully self-contained electro-mechanical robot—the featured unit in the most exciting training programs ever offered in home study.

NTS Intronic Training is a carefully developed and tested learning system providing a thorough intergration of advanced electronic hardware with modern lesson texts. The relationship between theory and practical applications is made clear through the hands-on experience of building and assembling kits of state-of-the-art equipment. Courses include a wide variety of test instruments, both digital and analog, as well as other units not shown here. And, depending on the NTS program you select, you can earn up to 30 CEU credits for successful completion. Our full-color catalog has complete details. NTS has taught industrial skills for over 78 years—a record that has no equal.



Training.....

FIRST WITH TOMORROW'S TECHNOLOGY

1. **Advanced "Z Chassis" NTS/HEATH "Smart Set"** with computer space command remote control and space phone. Originate or receive telephone calls through this set and the number appears on the screen-store your police and other emergency numbers into memory which may be recalled and auto-dialed at any time. Traditional and incomparable picture quality. Unit has Quartz Controlled Tuning, 178 channel capacity, remote antenna switch accessory for reception of VCR, VDR, Broadcast, Cable, Video Games, and Personal Computer Input (no cable change) plus computer-controlled color. Featured in all-new Video Technology Course.

2. **NTS/HEATH HN89A Microcomputer** is included in two programs. This famous and reliable unit features Floppy Disc Drive, 48K Memory on Board, CRT Terminal with its own Z-80 Processor, and standard keyboard as well as Numerical Input Keyboard. The growing importance of computer knowledge and skills have made these programs increasingly significant. The experience gained in assembling these kits is invaluable in the understanding of computer troubleshooting skills.

3. **NTS Microprocessor Trainer** is included in our Industrial and Microprocessor Technology Course. It is a portable unit, contained in a convenient high-impact carrying case. Hardware/Firmware includes Monitor Operating System-Expandable User Memory-User Experimental On-Board Section-Breakpoint Editor-Single Step Trace-Cassette I/O.



NO OBLIGATION

NO SALESMAN WILL CALL

NTS NATIONAL TECHNICAL SCHOOLS

TECHNICAL TRADE TRAINING SINCE 1905
Resident and Home-Study Schools

4000 So. Figueroa St., Los Angeles, CA 90037

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. 206-103
4000 South Figueroa Street, Los Angeles, CA 90037

Please send FREE color catalog on course checked below:

- | | |
|---|---|
| <input type="checkbox"/> Robotics | <input type="checkbox"/> Computer Electronics |
| <input type="checkbox"/> Digital Electronics | <input type="checkbox"/> Video Technology |
| <input type="checkbox"/> Auto Mechanics | <input type="checkbox"/> Home Appliances |
| <input type="checkbox"/> Air Conditioning/Solar Heating | |

Name _____ Age _____

Address _____

Apt. _____ City _____

State _____ Zip _____

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

OCTOBER 1983

TIMEX-SINCLAIR SOFTWARE

Hardware / Books



New from Gladstone Electronics! This exciting new 34 page color catalog lists arcade, fantasy, and family games, business and educational programs; books for beginners as well as experienced users; hardware add-ons and other peripherals for use with your TS1000/TS1500/TS2000/ ZX81 Home Computer!

CALL or WRITE for FREE CATALOG

**ORDER TOLL-FREE
800-833-8400**

In New York 716-874-5510

GLADSTONE Electronics Inc.
1585 Kenmore Ave., Buffalo, New York 14217

In Canada: Gladstone Electronics,
Toronto 800-268-3640.

RE10

CIRCLE 71 ON FREE INFORMATION CARD

EQUIPMENT REPORTS

continued from page 33

of 624 MHz would be shown as 624000.00 kHz. (Decimal point placement is automatic.) Two red LED's at the left of the display indicate GATE OPEN and OVERFLOW.

Controls

There are four "push-push" controls across the bottom of the panel, more or less under the display. First is the power switch, which is marked STANDBY/ON. (No pilot light is necessary because when the 6000 is on, the display is lighted.) The STANDBY position is used in the similar model 6500. That model has a crystal oven that is kept running even when the rest of the circuitry is off. The standard model 6000 has a temperature-compensated crystal oscillator (often called TCXO), with a 3.579545 MHz crystal. The TCXO uses special components to minimize the effect of temperature on the crystal frequency. It has a rating of ± 1 ppm at 40°C ambient, and ages less than 4 ppm/year. The model 6500 has a temperature-controlled crystal oven that keeps the crystal at a constant temperature and gives the oscillator a rating of 0.1 ppm from 10-40°C, and an aging rate of less than 1 ppm/year.

The GATE/SECONDS control will set gate times of 0.1, 1.0, and 10.0 seconds; a red LED lights to show which one is in use. Next to the gate control is the INPUT SELECT button, which chooses between the two inputs. Again, LED's show which is in use.

For low-frequency readings (only on the A input), a lowpass filter can be switched into the input circuit simply by pressing the LOWPASS FILTER button. That filter makes it easier to make low-frequency readings in noisy (high-RF) environments. The filter response is flat up to 30 kHz. Above that, the input sensitivity is reduced by 3-dB-per-octave. That control also has a red LED indicator to show that it is in use.

The A input has a high input impedance (1 megohm) and an input capacitance of 25 pF. The sensitivity of that input is 10 millivolts RMS at the low-frequency end, rising to 40 mV at 50 MHz. The B input has a load impedance of 50 ohms, to match common transmission lines. Its sensitivity is 50 mV RMS at 40 MHz, rising to 150V RMS at 600 MHz. The maximum allowable input voltage is 5.0 V peak.

The instruction book that came with the counter is quite complete. It has full instructions on use, setup tests, plus a good explanation of the counter's circuitry. Calibration procedures are given; the calibration trimmer is accessible from the bottom of the case. A signal generator at least 5 times as accurate and stable as the instrument being calibrated is needed for calibration. (Incidentally, for quick checks, you can read the frequency of the 3.579545 MHz oscillator in any TV Set on a network picture!)

The model 6000 is priced at \$399.95; the Model 6500 with the crystal oven is \$449.95. Those are good prices for such instruments, and well below average. So if you require accurate frequency measurement of anything from the frequency of an ultrasonic remote control unit up to a UHF radio transmitter, keep the 6000/6500 in mind.

R-E

continued on page 40

Radio-Electronics REPRINT BOOKSTORE

- Build Your Own Satellite TV Receiver \$7.00
- 8-Ball Satellite TV Antenna \$5.00
- Build Your Own Robot \$12.00
- TV Descrambler (January, February 1981) \$3.00
- Radio-Electronics back issues (1983) \$3.00
(January, February 1983 not available)
Write in issues desired _____
- Radio-Electronics back issues (1982) \$3.00
(January 1982 not available)
Write in issues desired _____
- Radio-Electronics back issues (1981) \$3.50
(March, December 1981 not available)
Write in issues desired _____
- Etch your own PC Boards \$3.00

- Special Projects (Spring 1981) \$4.00
- Special Projects #4 (Summer 1982) \$4.00
- Special Projects #5 (Winter 1983) \$3.00
- Special Projects #6 (Spring 1983) \$3.00
- Radio-Electronics Annual 1983 \$2.50
- How to Make PC Boards \$2.00
- All About Kits \$2.00
- Modern Electrics (Vol. 1, #1, \$2.25
April 1908)
- Electro Importing Co. Catalog \$4.95
(1918) (176 pp)

To order any of the items indicated above, check off the ones you want. Complete the order form below, include your payment, check or money order (DO NOT SEND CASH), and mail to Radio-Electronics, Reprint Department, 200 Park Ave. South, New York, NY 10003. Please allow 4-6 weeks for delivery.

If you need a copy of an article that is in an issue we indicate is unavailable you can order it directly from us. We charge 50¢ per page. Indicate the issue (month & year), pages and article desired. Include payment in full, plus shipping and handling charge.

ARTICLE _____

MONTH _____ YEAR _____

PAGES _____

TOTAL PAGES _____ @ 50¢ each _____ TOTAL PRICE _____

MAIL TO: **Radio-Electronics** 10-83
Reprint Department, 200 Park Ave. South, New York, NY 10003 **All payments must be in U.S. funds**

Total price of order \$ _____

Sales Tax (New York State Residents only) \$ _____

Shipping & Handling (U.S. & Canada only) (Includes FIRST CLASS POSTAGE) \$1.00 per item \$ _____

All other (\$2.00 per item, sea mail) \$ _____

(\$4.00 per item, air mail) \$ _____

Total Enclosed \$ _____

Name _____

Address _____

City _____ State _____ Zip _____



Our innovation.



Their imitation.



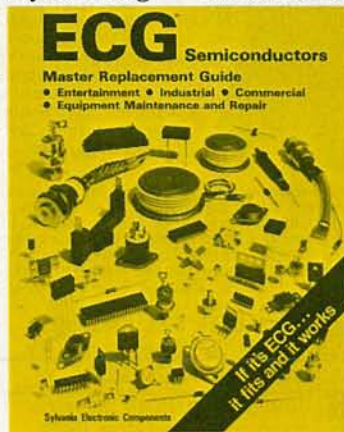
If you need any one of nine microwave oven rectifiers now, only Philips ECG is ready to deliver today.

You can tell where your new markets are by checking out what's new from Philips ECG.

When microwave ovens became popular, Philips ECG was ready first with Sylvania microwave oven components. When the computer boom hit, we were first again. In fact, on average, we introduce roughly 300 new replacement semiconductors every year—far more than anyone else in the business.

Maybe that's why even our competition looks to us first for new ideas. But although they copy us, they never quite equal either our superior performance specs or our cross-reference accuracy. So for the best insurance against premature

failures and call backs, demand parts from Philips ECG. We're the only source you'll ever need for replacement semiconductors that fit and work.



But just because the imitators can't keep up with us doesn't mean it's hard for you to keep up-to-date. To stay posted on all our latest advances in profit-generating replacement parts, stop by your Philips ECG distributor's and pick up your copy of our new, expanded Master Guide (ECG212L) and our *ECG Counterpoints* new product update. For the name and number of your nearest distributor, call 1-800-225-8326 toll free (in MA, dial 1-617-890-6107). Or just send \$3.25 for your Master Guide to Philips ECG, Inc., Dept. RE, 70 Empire Drive, West Seneca, NY 14224.

Philips ECG

A North American Philips Company

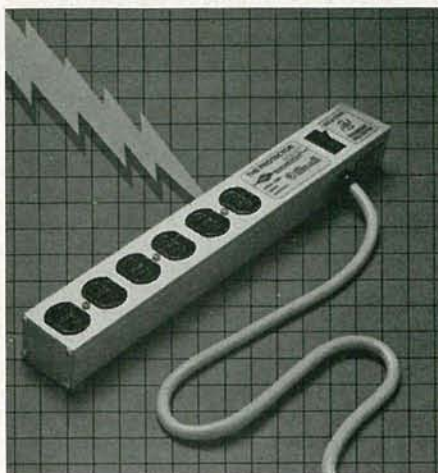
If it's ECG[®], it fits. And it works.

CIRCLE 70 ON FREE INFORMATION CARD

OCTOBER 1983

39

INTRODUCING



THE PROTECTOR 6000™

TOTAL PROTECTION FOR YOUR SENSITIVE ELECTRONIC EQUIPMENT.

Something that you can't even see may be slowly but surely killing your expensive electronic equipment. It's transient voltage, and it can be fatal to computers, medical equipment, electronic games, videotape recorders, electronic test equipment, electronic cash registers — almost any of today's sophisticated solid state equipment.

THE TRANSIENT VOLTAGE PROBLEM.

Most of this modern electronic equipment uses LSI and MOS semiconductor devices which are extremely sensitive to voltage transient surges or "glitches." In fact, a large percentage of equipment failures can be directly linked to the damaging effects of over-voltage line transients to unprotected, highly fragile components.

THE PROTECTOR 6000™ SOLUTION.

Not to be confused with other transient voltage protection units available today, THE PROTECTOR 6000 uses state-of-the-art solid state components and exclusive circuitry to provide you with complete and total protection from transient voltage surges of up to 6,000 volts. THE PROTECTOR 6000 uses silicon PN junction devices — proven to provide the fastest response to surges! They have a statistical life expectancy of over 20 years. THE PROTECTOR 6000 has a maximum clamping voltage of only 335 volts, well below the voltage rating of other transient protection devices which commonly use much less effective MOV's or gas discharge tubes. It also provides full protection from electro-magnetic and radio frequency interference. The unit operates in both common and differential modes, and is outfitted with a circuit breaker to guard against severe current overloads over 15 amps.

Why take chances with your expensive electronic equipment? For full details contact your local NTE distributor or write:



NEW-TONE ELECTRONICS, INC.
44 Farrand St., Bloomfield, NJ 07003
THE PEOPLE WHO BRING YOU THE TCG LINE OF SEMICONDUCTORS.
© 1983 New-Tone Electronics, Inc.

EQUIPMENT REPORTS

continued from page 38

Tektronix Model 213 DMM Oscilloscope



CIRCLE 106 ON FREE INFORMATION CARD

Tektronix	213									
OVERALL PRICE	[Red bar]									
EASE OF USE	[Red bar]									
INSTRUCTION MANUAL	[Red bar]									
PRICE/VALUE	[Red bar]									
	1	2	3	4	5	6	7	8	9	10
	Poor			Fair			Good			Excellent

IF YOU WERE TO ASK A FIELD TECHNICIAN to design a "fantasy" instrument, one

that he would desperately want if it really existed, what you might wind up with is the Tektronix (PO Box 500, Beaverton, OR 97077) model 213 DMM oscilloscope. That's right—a DMM and a single-channel oscilloscope all wrapped up into one package. And to make things even nicer, that package measures just 5.35-inches wide, by 2.95-inches high, by 9.05-inches long—smaller than some portable DMM's alone—and weighs 3.7 pounds. Finally, the whole thing is battery operated, has its own built-in recharger, and comes with the primary test-leads permanently attached. (Some additional test leads are needed for some DMM functions—more on that later.)

Oscilloscope

All of the oscilloscope's functions are selected using a row of pushbuttons on the front of the unit. Also on the front panel are two rotary switches used to select the vertical (volts/mA-per-division) and the horizontal (seconds-per-division) deflection; settings on those switches are laid out in the familiar 1-2-5 sequence.

The rest of the controls are located along the side of the unit. Slide switches are used to select how the signal is coupled to the input amplifier (AC, DC, or ground), to chose the triggering mode (external DC, normal internal AC, and automatic internal AC), and to turn the unit on and off.

Looking a little closer at the triggering modes for just a second, in the normal internal AC mode, no trace appears when the input signal is not sufficient to cause triggering. In the automatic internal AC mode, the sweep runs free to provide a reference trace when the signal is insufficient to cause triggering.

Moving on, six continuously variable controls are used to set the triggering level, the beam intensity, the horizontal and vertical position of the trace, and magnification in the horizontal and vertical directions. The last two controls may vary from what you might be used to. On many scopes, the level of magnification is switch-selected, which limits you to just a few discrete settings (and sometimes just one). Here, the magnification is continuously variable and can be set for between 1 and 2.5 times the calibrated vertical (volts/mA-per-division) setting and 1 and 5 times the calibrated horizontal setting. Note, however, that the magnified displays are not calibrated. Magnification is turned off by turning the vertical control fully clockwise, and the horizontal control fully counter-clockwise.

The remaining controls are only occasionally used and are screwdriver-adjustable. Those are the DC balance, focus, vertical gain, sweep calibrate, and trace rotate.

Turning to the scope's specifications, the bandwidth varies with the selected vertical deflection. For settings of 5- μ A-

For Home or Business
WHAT...WHEN...HOW...

LEARN HOW TO USE A COMPUTER

Train at home in spare time! No previous experience needed! Now you can learn it all! Computer programming...computer applications...computer games...everything you ever wanted to know about computer operations! Write your own computer programs or use hundreds of programs already available...budgeting, real estate, bookkeeping, expenses, investments, interest, taxes, shopping lists, vacation planning, addresses, phone numbers, routing...even foreign languages and graphics.

You'll know what really happens when you have a computer problem with a bank, store, loan company, oil company, utility or anyone else. You'll be able to talk their language...understand why and how things happen...to be able to take the offensive when you're the victim of a computer error. Experts explain everything in easy-to-understand language with step-by-step directions.

- TIMEX COMPUTER INCLUDED WITH YOUR TRAINING • Plugs into any TV
- SEND FOR FREE FACTS!

ICS COMPUTER TRAINING, Dept. DE093
SINCE 1991 Scranton, Pennsylvania 18515

Please rush me free facts and color brochure that tells how I can learn computer applications, programming and operation at home in spare time. No cost. No obligation.

Name _____ Age _____
Address _____
City/State/Zip _____

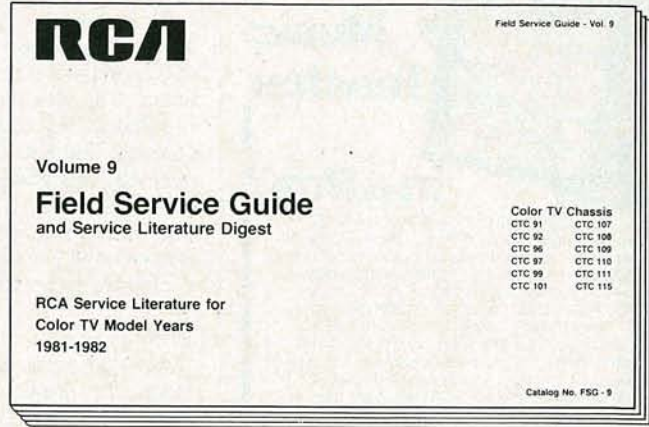
For more proficient color TV servicing,
in-home and on the bench . . .



Field Service Guide and Service Literature Digest

Up-to-date service information compiled from regular RCA color TV service literature . . . in convenient, easy-to-use 17" x 11" volumes that each cover two years of RCA color TV models . . . designed especially for in-home servicing but equally useful as handy bench references . . . featuring:

- Complete chassis and tuning system schematics
- Chassis circuit board illustrations
- Disassembly/reassembly instructions
- Comprehensive parts lists
- Tables of common trouble symptoms and typical causes
- *Quick-Find Indexes* and cross references



VOLUME 9 NOW AVAILABLE!

This latest addition to RCA's popular series of service literature digests covers model years 1981-1982 and RCA color TV chassis CTC91, 92, 96, 97, 99, 101, 107, 108, 109, 110, 111, 115 . . . 520 pages, 17" x 11", saddlestitched . . . **ONLY \$14.95**

VOLUME 8 STILL AVAILABLE

Covers model years 1979-1980 and RCA color TV chassis CTC 85, 86, 87, 88, 89, 90, 91, 92, 93, 96, 97, 99, 101 . . . 424 pages, 17" x 11", saddlestitched . . . **ONLY \$12.95**

SPECIAL LIMITED-TIME TWO-VOLUME OFFER!

Save \$5.40 . . . Volume 8 and 9 together cover four years of RCA color TV models . . . **Order now and receive both volumes for only \$22.50.**

RCA Field Service Guide Order Form

Check appropriate boxes, indicate quantities & prices, enclose check payable to "RCA Consumer Electronics"

MAIL TO: RCA TECHNICAL PUBLICATIONS 1-450
P.O. Box 1976
Indianapolis, IN 46206



FIELD SERVICE GUIDES

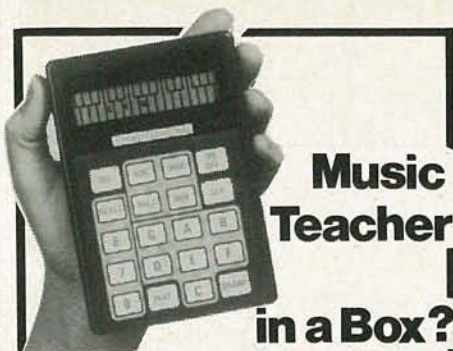
	PRICE	QUANTITY	PRICE TOTAL
<input type="checkbox"/> VOLUME 9	\$14.95 ea.	_____	_____
<input type="checkbox"/> VOLUME 8	\$12.95 ea.	_____	_____
<input type="checkbox"/> TWO-VOLUME SPECIAL OFFER (VOLS. 8 & 9)	\$22.50 ea.	_____	_____

(PLEASE PRINT)

NAME _____ TOTAL (AMOUNT OF YOUR CHECK) _____

STREET ADDRESS _____

CITY _____ STATE _____ ZIP _____



Music Teacher in a Box?

To get ahead in music, you need to know music theory. PAIA's Chord Computer helps you understand both music and keyboards better by cramming the equivalent of pages and pages of music theory into a compact, calculator-style package.

The Chord Computer is easy to use. Simply select a chord letter, and the Chord Computer's LCD 31-key piano keyboard display will show which notes to play for the selected chord. Press another button to choose sharp, flat, major, minor, augmented, diminished, 6th, 7th or 9th chords—including inversions. The Chord Computer can also display complete scales for all keys, or even transpose them at the touch of a button.

Serious about music? The Chord Computer could be the best investment you'll ever make. **only \$59.95** (plus \$2.50 postage/handling) **Order yours today...**

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

Ask for your free PAIA catalog.

Direct mail orders and inquiries to: Dept. 10R

PAIA Electronics, Inc.

1020 W. Wilshire, Oklahoma City, OK 73116 - (405)843-9626

CIRCLE 52 ON FREE INFORMATION CARD

to 10- μ A-per-division, the bandwidth is DC to at least 200 kHz; for settings of 20- μ A- to 200-mA-per division and 5-mV- to 10-mV-per-division, the bandwidth is DC to at least 400 kHz, and for settings of 20-mV- to 100-volts-per-division, the bandwidth is DC to at least 1 MHz. Accuracy is claimed to be 3% or better. The maximum safe input voltage is rated at 500 (DC + AC peak) DC coupled, and 800 (DC + AC peak) AC coupled; the maximum safe current is rated at 2-amps RMS or 3-amps peak. The sweep rate can be varied between 500-ms- and 2- μ s-per-division; accuracy is claimed to be within 5%.

DMM

Now we get to what this reviewer considers the most interesting part of the unit—the built-in 3½-digit DMM. Using that DMM, measurements from 0.1 to 1000 volts, 0.1 to 1000 mA, 1 kilohm to 10 megohms can be made. All AC measurements are made in true RMS. Overrange inputs of up to 200% full scale can be accommodated on all ranges except 1000 volts. Range selection, including resistance, is done using the vertical deflection (volts/mA-per-division) switch. The voltage and current settings are made using the same scale that's used by the oscilloscope; a separate ohms scale, in blue, is used for resistance.

Turning to the test leads, the built-in

ones are used for voltage measurements. For current and resistance, separate leads (not provided) must be connected to the banana jacks on the side of the unit.

Looking at the readout, rather than the small LCD or LED unit you might have expected, the display is generated by the 1.2 x 2-inch CRT itself. Among its features are an automatic polarity indicator and an overrange indicator. The positioning of the decimal point is determined by the range setting.

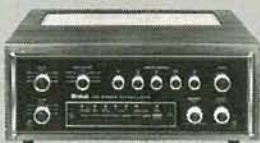
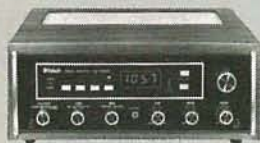
Two manuals were provided with the unit we received for evaluation; both were excellent. The small operators' manual provides all the information one needs to successfully use the instrument. It includes such things as a rundown on the controls and functions, the unit's electrical specifications, and suggested applications for the device. The second one is a very complete service manual. It covers just about anything you might ever need to know about the unit. Included are complete electrical and mechanical diagrams including schematics and parts-placement diagrams, a parts list including both Tektronix' and the manufacturer's part numbers (where applicable), theory of operation, and full maintenance, calibration, and service data.

There is one thing about the instrument that we found a little disturbing. It was designed with the input-common reference floating above ground. Because of that, the probe-common clip, the common input-jack, the mA-ohm input jack, the external-trigger jack, and power-plug prongs may be at a dangerous potential. Specifically, when the unit is battery-operated, a voltage applied to the common inputs could cause some current to flow through the power-line circuitry creating a potential shock hazard on the prongs. The danger of that is clearly spelled out in the manual. To prevent shocks, it is strongly recommended that the power-cord plug be stored in the special compartment in the rear of the instrument.

Despite the above hazard, we feel that this unit has a lot going for it, especially for the field technician. If the thought of replacing your scope and DMM with a unit that's barely larger than your DMM appeals to you, give this unit a look. It's suggested retail price is \$2410. **R-E**

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. **RE**
 East Side Station P.O. Box 96
 Binghamton, N.Y. 13904-0096

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 93 ON FREE INFORMATION CARD



"Now tell me how smart you are!"


THE NEW

performer.

Model 3500 has manual ranging
or easy to use auto ranging . . .

ONLY \$140

A custom CMOS integrated circuit provides additional state-of-the-art features such as:

1. Readings to 2999 in all manual ranges and functions. Flashing "1" in illustration signifies a "2" for a 2234 reading. This provides an additional digit of resolution. Flashing "1" with three zeros indicates an over range.
- 
- (*"1" Flashing*)
2. Relative reference, off set, measurement up to 99 counts on all DMM functions, displays subsequent readings as a \pm deviation from stored input.
 3. Autoranging voltage and resistance ranges with simple switching to manual ranging mode and 12 LCD display annunciators, mV, V, mA, A, Ω , K Ω , LP Ω , AUTO, BATT, ADJ, AC and negative (-).

Note these additional features:

- basic dc accuracy 0.25%,
- selectable audible continuity tone on all ohms ranges.
- 10A range,
- overload protection to 1000 VDC, 750 VAC and 600 V on ohms and current ranges with .3A/250V and 2A/600V fuses arrangement,
- only two jacks make all measurements,
- five Hi Power and four Low Power ohms ranges,
- easy access to 2 AA batteries and fuses,
- temperature probe accessory available.

For a demonstration, contact your Triplet Distributor, Mod Center or Representative.

Triplet Corporation, One Triplet Drive, Bluffton, OH 45817.
(419) 358-5015, TWX (810) 490-2400.



ACTUAL
SIZE



Triplet performance . . . a tough act to follow

TRIPLET

CIRCLE 62 ON FREE INFORMATION CARD

The "OUT FRONT" DMM



HICKOK'S LX-306 PIED PIPER with exclusive Vari-Pitch®

... combines the best of DMM's, analog meters, logic probes, tracers and continuity testers into one compact unit. The LX-306 offers 0.25% accuracy and all functions and ranges featured by other leading DMMs; PLUS, VARI-PITCH, the audible DMM tone system that obsoletes all others.

VARI-PITCH changes tone proportionate to the signal input. Its usage is limited only by your imagination. Imagine:

- Troubleshooting by character or "signature" sound.
- Detecting ripple or noise on the power supply line.
- Quickly locating intermittents.
- Locating and testing capacitors in a circuit.
- Making analog-type peaking and nulling adjustments.
- Reducing troubleshooting time by 25% or more.

The LX-306 is the ideal DMM for tough jobs and busy schedules. Built to fit your hand and your budget!

LIST PRICE ~~\$155.00~~

LIMITED TIME OFFER \$139.00

See your Hickok distributor, or contact:

HICKOK
the value innovator

THE HICKOK ELECTRICAL INSTRUMENT CO.
10514 Dupont Avenue • Cleveland, Ohio 44108
(216) 541-8060 • TWX: 810-421-8286

NEW PRODUCTS

For more details use the free information card inside the back cover

DIGITAL MULTIMETER, model LX-306, features the same *Vari-Pitch* audible tone that was introduced in Hickok's model MX-33. It has 3½-digit capability and is accurate to within 0.25%. It includes full AC/DC voltage ranges up to 1000 volts DC, 750 volts AC (usable to 5 kHz), 10-ampere AC/DC current ranges, resistance ranges from 200 ohms to 20 megohms, diode-test function, and 10-megohm impedance.



CIRCLE 111 ON FREE INFORMATION CARD

The unit's miniaturized hand-held case design allows ease of handling, conveniently fits into a tool kit, and the case is sturdy enough to pass a 4-foot drop test. The *Vari-Pitch* audible tone varies in frequency proportionally to the signal input, and is usable on all ranges and functions. Response is instantaneous. Using *Vari-Pitch*, troubleshooting by characteristic or "signature" sound, saves time and effort in detecting ripple or noise on power-supply lines, locating intermittent problems, locating and testing capacitors. The user can make analog-type peaking and nulling adjustments.

The model LX-306 is priced at \$139.00.—
Hickok Electrical Instrument Company,
10514 Dupont Ave., Cleveland, OH 44108.

FUNCTION GENERATOR, model 528D, has a frequency range of 0.001 Hz to 20 MHz and produces sine, square, triangle, positive square, and negative square waveforms from the main generator. An auxiliary ramp is also available through the main output amplifiers, and is used to sweep the main generator in the SWEEP mode. A built-in frequency/period counter reads out the frequency/period of the main generator, the frequency/period of the ramp (sweep) generator, and also serves as a frequency/period counter for external signals from 1 Hz to 100 MHz and 1 microsecond to 1000 seconds.



CIRCLE 112 ON FREE INFORMATION CARD

In the sweep mode, the ramp generator is used to internally sweep the main generator either up or down linearly (up to 1000:1) or logarithmically (up to 100,000:1). The start and stop frequencies are independently settable and either may be easily set and measured using the RUN/HOLD and TRIGGER/HOLD positions of the RAMP-MODE switch and the built-in frequency counter. The main generator frequency can be manually swept linearly up to 3 decades, or logarithmically up to 5 decades, using the START FREQUENCY dials. A VCF input allows the external control of frequency over a 5-decade range in the log mode and a 3-decade range in the linear mode. The frequency controls are dual (coarse and fine), providing excellent resolution.

As a pulse generator, the model 528D uses the ramp generator to trigger the main generator. Square pulses of either polarity, or single pulses of sinewave, triangle, haversine, or havertriangle waveforms can be selected.

The model 528D is priced at \$1495.—
Exact Electronics, 2000 Arrowhead Dr., PO Box 1925, Carson City, NV 89701.

SATELLITE-TV RECEIVER, model SC-7032, has a wide range of features to cover the requirements of the home satellite-TV reception system. Included are channel scan for convenient and quick review of available channels on each satellite; polarity-reverse



CIRCLE 113 ON FREE INFORMATION CARD

button; signal-strength meter for easy video fine-tuning control; audio tune; channel select, with LED readout; built-in satellite-selector control, with LED readout for optional actuator, and built-in polarizer that automatically changes polarization. In addition, an optional channel-select remote con-

Amazing new solid-state oscilloscope... fits in the palm of your hand

CRT oscilloscopes just became obsolete!

The revolutionary new solid-state digital LED Pocket-O-Scope does it all, in a 4-ounce package you can put in your pocket.

Easy to use. Ideal for the hobbyist or the technician. The Pocket-O-Scope is 100% solid-state, focus and brightness on the 210 point, high-intensity illuminated screen are *electronically* self-controlled. The trace is *always* in sharp focus. Zero and sweep positions are maintained automatically. Zero-reference, or cross-over line is always centered for full trace minimum on the screen. Automatic internal circuitry always assures a properly positioned wave form. **4 solid-state controls do it all.** The only knobs on the Pocket-O-Scope are for positive and negative sensitivity and for coarse and fine synchronization of the frequency of the incoming signal. The easiest to use, full capability scope available!

Years in development. The Pocket-O-Scope is the culmination of years of development in high technology, micro-electronic components and digital design.

Features: All solid-state, digital design • Hand-held or bench operation • High resolution 210 point, 1.5" square display • Battery or A/C operation with adapter • Factory calibrated – *never requires recalibration* • Full function, single trace capability plus 1/2 channel dual trace and signal inverter • Full overload protection to prevent damage to scope



Patent Pending

• Automatic zero voltage centering • Automatic free run or locked image • Automatic full horizontal sweep circuit • External input/output for add-on capability

Specifications:
5 Megahertz bandwidth • Sensitivity – vertical, 10MV • Accuracy ± 3% on wave forms – sweep linearity ± 5% • Time base – .1 microseconds to .5 seconds

Controls: Single or dual trace • On-off, battery-A/C • Sensitivity; separate pos. & neg. controls • Sync C & Sync F controls
Limited, 90-day warranty
No risk introductory offer. The revolutionary Pocket-O-Scope is a development of Calvert Instruments, Inc., for 25 years a manufacturer of electrical equipment. As an introductory offer for a limited time only, you can buy the Pocket-O-Scope including a carrying case, A/C adapter, 3 standard "grabber" probes and 2 high voltage probes for only \$249.95, a \$321 value. If you act now, you will also receive FREE Calvert's 200-page Comprehensive Oscilloscope Training Manual, a \$15.95 value! Put your Pocket-O-Scope to the test for two weeks. And if you decide, for *any* reason, that the Pocket-O-Scope is not for you, return it within the 14-day trial period for a prompt refund. The training manual will still be yours to keep.

• Vertical gain – 0 to 120 volts • Continuous free run to locked image response • Power supply 9VDC – dual polarity

Limited, 90-day warranty

No risk introductory offer. The revolutionary Pocket-O-Scope is a development of Calvert Instruments, Inc., for 25 years a manufacturer of electrical equipment. As an introductory offer for a limited time only, you can buy the Pocket-O-Scope including a carrying case, A/C adapter, 3 standard "grabber" probes and 2 high voltage probes for only \$249.95, a \$321 value. If you act now, you will also receive FREE Calvert's 200-page Comprehensive Oscilloscope Training Manual, a \$15.95 value!

Put your Pocket-O-Scope to the test for two weeks. And if you decide, for *any* reason, that the Pocket-O-Scope is not for you, return it within the 14-day trial period for a prompt refund. The training manual will still be yours to keep.



Mail this coupon today, or call toll-free* while the introductory offer is still in effect.

Calvert Instruments, Inc.

19851 Ingersoll Dr., Cleveland OH 44116 • 216-356-2155

Please send me:

____ Pocket-O-Scope(s), including carrying case, A/C adapter, standard and high voltage probes, and FREE training manual. (Batteries not included) all for \$249.95 plus \$5 for postage and insurance. Ohio residents add 6.5% sales tax.

____ Pocket-O-Scope only with standard probes: \$179.95 plus \$5 postage. Ohio Residents add 6.5% sales tax.

My check is enclosed.

Please charge the credit card account checked below. (Fill in all account number digits of the *one* credit card you wish to use.) RE-1083

MasterCard Visa

Expiration Date _____ Interbank No. _____ (MasterCard only)

Full signature _____

Name _____ (please print)

Address _____ Apt. _____

City _____

State _____ Zip _____

*CALL TOLL-FREE 800-835-2246 EXT. 118 to order by phone, request further information or to inquire about becoming a distributor. In Kansas, call 800-362-2421 Ext. 118. Allow 6-8 weeks for delivery.

CIRCLE 7 ON FREE INFORMATION CARD

Digital Features.



Analog Prices.

Now you can get all the measurement capability you've been looking for in a digital multimeter for the price of an analog.

Priced as low as \$59.95, the Circuitmate™ Series DMMs from Beckman offer a superior combination of standard features including:

- DC + AC Volts
- DC + AC Amps
- Resistance
- Diode Test
- 0.8% or 0.5% DC Accuracy (depending on model)
- Single Rotary Selection Switch

Depending on the model you choose—you can enjoy the added capability and convenience of 10 Amps AC + DC, audible continuity checking, hFE testing, capacitance and conductance capability.

Get your hands on a Circuitmate™ DMM today. For the dealer nearest you, write or call Beckman Instruments, Inc., Instrumentation Products, 2500 Harbor Blvd., Fullerton, CA 92634, (714) 993-8803.

BECKMAN

CIRCLE 41 ON FREE INFORMATION CARD

trol with fine-tune button and up/down transponder switch is available.

Input frequency of the model SC-7082 is 70MHz at 72 ohms impedance. The video output level is 1 volt peak-to-peak nominal at 27MHz with 20Hz to 4.2MHz frequency response. Audio output is variable 5.5 to 8.0 MHz, selectable from the front panel. Frequency response is 50Hz to 15kHz. Harmonic distortion is less than 2% maximum THD. Power is 115 volts AC, 50/60Hz.

A single-conversion downconverter with IF output of 70MHz mounts at the antenna, with 72-ohm output for coaxial cable to the receiver. A channel ¾ crystal-controlled modulator is built into the receiver.

The model SC-7032 is priced at \$965.00—Winegard Company, 3000 Kirkwood Street, Burlington, IO 52601.

STEREO PHASER, model VC-1, easily connects most TV sets, and all video recorders to your stereo unit. It improves ordinary TV sound in three ways.



CIRCLE 114 ON FREE INFORMATION CARD

1: Dynamic range expansion: the model VC-1's dynamic range-expansion process restores and delivers the depth, and clarity of the original production sound.

2: Synthesized stereo sound: The model VC-1 takes the video mono signal, processes it, and creates a stereo effect.

3: Noise/hiss elimination: A simple four-step control dial on the model VC-1 effectively blocks out garbage noise and hiss, and allows you to adjust the noise reduction for any video source: TV program, cable, videotape deck, or videogame.

The model VC-1 is priced at \$199.00.—RG Dynamics, Inc., 6440 North Ridgeway Ave., Lincolnwood, IL 60645.

LOW-DISTORTION OSCILLATOR, model 4500 ranges from 1Hz to 100kHz. It generates a sinewave with less than .001% (-100dB) distortion, and squarewaves with



CIRCLE 115 ON FREE INFORMATION CARD

aberrations of less than 5% peak-to-peak amplitude. Five pushbuttons of decade multiplication with an infinite-resolution, single-turn dial calibrated in Hz from 1 to 10 provides continuous frequency coverage. Also, a vernier dial that covers ±5% of the frequency range is provided for intricate adjustments.

The model 4500 delivers up to 7 volts RMS open circuit to MAIN and INVERTED outputs of

SAVE!

MONEY • TIME • FREIGHT

♪ QUALITY STEREO EQUIPMENT AT LOWEST PRICES.

♪ YOUR REQUEST FOR QUOTATION RETURNED SAME DAY.

♪ FACTORY SEALED CARTONS—GUARANTEED AND INSURED.

♪ SAVE ON NAME BRANDS LIKE:

PIONEER	JVC
KENWOOD	TEAC
MARANTZ	SANSUI
TECHNICS	SONY

AND MORE THAN 50 OTHERS
BUY THE MODERN WAY
BY MAIL—FROM

illinois audio

BANK CARDS ACCEPTED

12 East Delaware

Chicago, Illinois 60611

312-664-0020

800-621-8042

CIRCLE 94 ON FREE INFORMATION CARD

If you need

QUARTZ CRYSTALS

—one or hundreds—

YOU NEED JAN

- high stability
- prompt service
- cost savings

- General Communication
- Industry
- Marine VHF
- Scanners
- Amateur Bands
- CB Standard
- CB Special
- Microprocessor

JAN CRYSTALS

Call or Write

JAN CRYSTALS

P.O. Box 06017
Ft. Myers, FL 33906-6017
All Phones (813) 936-2397

CIRCLE 28 ON FREE INFORMATION CARD

EXTRA EXTRA VALUES

MONEY SAVING SALES SPECIALS



Cobra® TELEPHONES

PORTABLE CORDLESS EXTENSION TELEPHONE

• Exclusive clear call selector allows optimum voice clarity within operation range

89⁹⁵ ea.

MODEL CP2055

• Portable handset allows you to place or answer calls up to 600 feet from base unit... inside or outside.



CORDLESS TELEPHONE- CLOCK RADIO

119⁹⁵ ea. MODEL RP-740S

• For inside or outside your house (up to 100 ft.)
• Automatically redials last telephone number called.
• Mute button for privacy.

AM-FM ELECTRONIC DIGITAL CLOCK RADIO FEATURE: • Large LED time display
• Hi-Lo dimmer switch • Snooze alarm • Walnut styling • Slide rule dial indicator.



CORDLESS TELEPHONE

88⁰⁰ ea.

MODEL CP-110S

• Mute button on handset allows you to talk to someone in room without party on line listening to conversation. Remote Rechargeability • Works up to 600* feet from base unit.

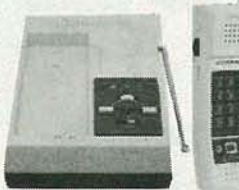


CORDLESS SPEAKERPHONE

149⁹⁵ ea.

MODEL CP-130S

• Speakerphone is built into base unit. Allows entire family to speak and listen without passing around the handset. You get Hands Free Conversation • 9 Number Automatic Dialer • Last number redial • 2-Way intercom with Hold • Works Up to 600* feet
• Exclusive Clear Call Selector



PAIR-O-PHONES: COMPLETE PHONE SYSTEM

165⁰⁰ ea. MODEL CP-140S

• 1 Cordless Telephone with memory that stores and automatically dials up to 9 numbers plus last number redial • 2-Way intercom that allows paging from remote handset and base, plus hold • 1-Standard Telephone with 10 foot cord and RJ-11 modular plug, mute button and last number redial button. • 1-Telephone Wall Holster • 1-Remote Charger.




Cobra® CB RADIOS & ACCESSORIES

AM CB RADIOS

119⁹⁵ ea.

MODEL 29LTD

"The Truckers Choice" with an instant emergency channel 9 switch • Delivers maximum power output, 100 per cent modulation and fine receiver sensitivity. Features: SWR bridge and antenna warning indicator.



SUPER HETERODYNE RADAR DETECTOR

139⁹⁵ ea.

MODEL RD-4000

Dual Band Super Sensitivity/Dual Alarm... Audible and Visual with exclusive SIGNAL

ELIMINATES FALSE ALARMS • Responds to X and K band Speed radar frequencies. The only one approved by the FCC.



SSB MOBILE

179⁹⁵ ea.

MODEL 148GTL

Precision AM/SSB mobile unit for CB. Features: DynaMike, Volume, ON/OFF control, Squelch, RF gain, SWR CAL control, Voice Lock, S/RF/CAL/SWR switch, LSB/AM/USB mode switch, switchable automatic noise limiting and noise blanking, CB/PA switch and much more.



40-CHANNEL CB 2-WAY MINI-MOBILE RADIO

39⁹⁵ ea.

MODEL 19XS

• Combination Squelch/PA/CB Control
• ANL Switch automatically reduces the high-pitched noises • S/RF PWR Meter
• Off/On/Volume • PA



S.O.S. 40 CHANNEL EMERGENCY 2-WAY RADIO

55⁰⁰ ea.

MODEL 39LTD

Needs no installation. Simply plug into cigarette lighter. Features a built-in microphone, LED channel display, emergency channel 9 indicator plug a host of others.



FORDHAM

260 Motor Parkway, Hauppauge, N.Y. 11788

- Master Charge
- VISA
- Money Order
- Check

N.Y. State residents add appropriate sales tax.

COD's extra (required 25% deposit)

ADD FOR SHIPPING AND INSURANCE	
\$250.00.....	\$4.50
\$251.00 to 500.00.....	\$6.50
501.00 to 750.00.....	8.50
751.00 to 1000.00.....	12.50
over 1000.00.....	15.00

TOLL FREE
(800) 645-9518
in N.Y. State call 800-832-1446

SEE YOUR DEALER TODAY



FROM



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 40 ON FREE INFORMATION CARD

600-ohm impedance. A MAIN output of 50-ohm impedance is also provided. Exceptionally flat response. (.05dB) virtually eliminates the need to constantly monitor output voltage levels. A four-position pushbutton attenuator, calibrated in 20-dB steps, together with a 30dB vernier, provides a total dynamic range of 90dB. Amplitude and frequency stability varies less than .001% with a 10% change in line voltage.

A rear-panel switch selects chassis or floating ground. The oscillator uses only 6 watts and operates on switch-selectable line voltages of 90-132 or 180-264 volts, 50-60Hz. An optional 19-inch Rack Mount Kit is available. The model 4500 is priced at \$675.00. — **Krohn-Hite Corporation**, Avon Industrial Park, Avon, MA 02322.

DIGITAL THERMOMETERS, model 865, model 866, model 868 (shown), and model 869 (shown) have thermistor or RTD (Resistance Temperature Detector) sensors and offer increased accuracy over thermocouple



CIRCLE 116 ON FREE INFORMATION CARD

meters; they have 0.1° sensitivity.

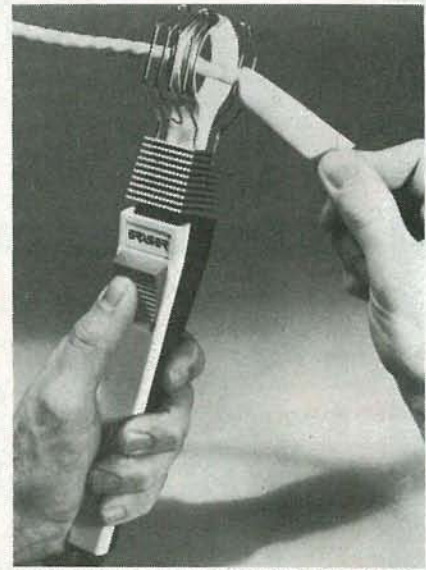
Model 865 (°F) and model 866 (°C) are thermistor thermometers, designed for applications in electronics, life sciences, food processing, and heating and ventilating.

Model 868 (°F) and model 869 (°C), with platinum RTD sensors, offer accuracy equivalent to thermistors over a wide range. The RTD models are designed to meet the accuracy and long-term stability requirements of critical laboratory applications.

The thermometers are priced as follows: Model 865 and model 866 are \$139.00 each; model 868 and model 869 are \$249.00 each. — **Keithley Instruments, Inc.**, 28775 Aurora Road, Cleveland, OH 44139.

HEATING TOOL, the *Glo-Ring Infra-Red Heat Tool*, is a hand model with half-inch-diameter elements designed specifically for shrinking heat-shrinkable tubing on small work pieces in the electrical and electronics industry. It uses quartz-glass heating elements that open and close like a thumb and forefinger to encircle the work piece with instant radiant heat at a temperature of 1000°F.

Glo-Rings provide an alternative to using the traditional heat gun. Cost savings are realized by reducing production time and electrical power consumed. Safety hazards are eliminated because no uncontrollable blowing hot air is generated.



CIRCLE 117 ON FREE INFORMATION CARD



2 NEW OPTO DESIGN KITS!

Now you can have 36 different options for easy LED design right at your finger tips!

Opto Designer I 180 T-1 and T-1 1/4 Red, Green, Yellow, Orange and Red-Orange LED Lamps **\$19.95**

Opto Designer II 180 Round, Square, Triangular, Rectangular and Cylindrical LED Lamps **\$24.95**

Send for **FREE LED BROCHURE:**

- 3 mm (T-1) 5mm (T-1 1/4) • Round • Square
- Cylindrical • Triangular • Rectangular • High Intensity • Custom • Arrays • Two-color Round, Rectangular • Level meter panel displays.



FREE 100 CB-50 T-1 1/4 mounting Clips if you order within 7 days

ETRONIX 14803 NE 40th Street, Dept. RE103 Redmond, WA 98052

YES, I would like to take advantage of your offer.

- Send me — **Opto Designer I** @ \$19.95 plus \$3.00 shipping and handling.
- Send me — **Opto Designer II** @ \$24.95 plus \$3.00 shipping and handling.

Name _____
Address _____
Company _____
City _____ St. _____ Zip _____
Signature _____
Please charge my Mastercard Visa
No. _____ Exp. _____

CALL TOLL FREE 1-800-426-1044

CIRCLE 31 ON FREE INFORMATION CARD

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***



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 & hdg. 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 (213) 90421 Phone 869-8519

CIRCLE 51 ON FREE INFORMATION CARD

State-of-the-Art VIDEO EQUIPMENT

Quality • Low Prices • Immediate Delivery

SPECIAL!



MODEL V-1880

**BP STABILIZER/IMAGE ENHANCER/
RF CONVERTER/VIDEO FADER/2-WAY
DISTRIBUTION AMPLIFIER**

OUR PRICE \$119⁹⁵

Contains five units in one; stabilizer (video guard remover); image enhancer; video to RF converter; video fader; and dual output distribution amplifier.

Stabilizer Will correct entire range of copy guard distortion such as jitter, vertical roll or black bar travelling through picture.

Enhancer Attain best picture for your preference.

RF Converter Allows your TV set to receive video and audio signals from your image enhancer, guard stabilizer, video camera, computer, VCR, etc. The direct video signal from any video component can be fed into the V-1880 and converted to a usable RF signal that can go to your TV antenna terminals.

Video Fader Used to produce fade ins and outs.

NEW!



MODEL V-2250

**BP TV TO STEREO
AUDIO ADAPTOR/
ENHANCER \$17⁹⁵**

OUR PRICE

Easily connects to any TV and Stereo Amplifier or simulated stereo sound. Makes taping TV Audio simple - TV can be located any distance from stereo. Delivers two channels of simulated stereo. With noise eliminator and special output level controls. Frequency response: 50 Hz - 15,000 KHz.

**NEW! BP VIDEO COLOR PROCESSOR/RF CONVERTER/
STABILIZER/3-WAY DISTRIBUTION AMPLIFIER**

OUR PRICE

\$189⁹⁵

Corrects video signal directly into tape not just on playback. Luminance meter monitors brightness levels for quality recordings. Can also be used between video cameras and VCR, VCR and VCR and from VCR to TV during playback mode. Corrects off-color tapes. Center detent, luminance, chroma, phase and audio controls. Stabilizer for removing copyguard.



MODEL V-1890

**BP VIDEO GUARD STABILIZER
MODEL
V-1875**



OUR PRICE \$45⁰⁰

Has self contained A&B and bypass switch. Many movies, concerts and special programs for sale or rental are copy guarded. This removes copy guard and allows you to make copies. Many TV sets will not play prerecorded tapes because copy guard causes picture to roll and jitter, turn to snow or disappear. Video Guard Stabilizer removes copy guard from signal.

**BP RF CONVERTER/MODULATOR
MODEL V-1885**

OUR PRICE \$39⁹⁵

Allows your TV to receive video and audio signals from image enhancer, guard stabilizer, video camera, computer, VCR, etc.

The outputs of many video components cannot be directly hooked up to the VHF antenna terminals on your TV set. This problem is solved by using the Model V-1885 RF Converter. Converts video signal from any video component to adjustable RF signal at antenna terminals. Allows your VCR output to feed two TV sets at the same time, with virtually no signal loss.



**BP VIDEO SELECTOR CENTER
MODEL V-4803**

OUR PRICE \$49⁹⁵

A switcher that can accept 6 inputs and direct them to 3 outputs. Utilizes switch similar to one used on home VCR's. You avoid signal loss incurred by using splitters.



**PHILIPS/MAGNAVOX
REMOTE TV CONVERTER
MODEL CTC9R**

OUR PRICE \$125⁰⁰

60 Channel selection. Infrared transmitter system for impedance free operation. On/Off, change channels, fine tune. Programmable 12 hour clock with Auto and PM indication. Channel memory and recall.



**BP UHF CABLE CONVERTER
WITH FINE TUNING/46 CHANNEL
MODEL V-5746**

OUR PRICE \$24⁹⁵

Fully shielded oscillator eliminates herring bone distortion. For Beta/VHS recording. Record & use TV's remote control. Complete programming of VTR.



**BP VIDEO GUARD STABILIZER/
RF CONVERTER
MODEL
V-1877**



OUR PRICE \$69⁹⁵

Same as V-1875 but with a built-in RF Converter that gives the model V-1877 an RF output which can be fed directly to the antenna terminals of a TV set. This enables you to remove the copy guard from a pre-recorded tape and view it on a TV using only a VCR.

Use as an RF Converter only. Used in conjunction with your TV, you can feed direct audio and video signals from any video device such as video camera, computer, portable VCR, etc.

**BP IMAGE ENHANCER
MODEL V-1860**

Dramatically improves performance of video cameras and VCR's (off-the-air or second generation recordings), by compensating for deterioration of detail and sharpness. Includes video distribution amplifier with two video outputs.



OUR PRICE \$59⁹⁵

FORDHAM

260 Motor Parkway, Hauppauge, N.Y. 11788

Master Charge
VISA
Money Order
Check

N.Y. State residents add appropriate sales tax.

COD's extra (required 25% deposit)

ADD FOR SHIPPING AND INSURANCE

\$250.00	\$4.50
\$251.00 to 500.00	6.50
501.00 to 750.00	8.50
751.00 to 1000.00	12.50
over 1000.00	15.00

TOLL FREE (800) 645-9518
in N.Y. State call 800-832-1446

OCTOBER 1983

Vital protection for PC Boards



Be safe. Desolder PC components with Endeco irons. Get *proper* HEAT TO MELT and *strong* VACUUM ACTION TO LIFT solder and *cool* both PC board and component without damage.

These PC components replaced fast with Endeco desoldering or soldering tools.



Endeco professional features include safety light that denotes *high*, *low* and *off* on switch models, SS construction for long life, light weight and balance for easy use.

Contact your distributor for Endeco desoldering and soldering irons, kits and equipment—or write us today.

Enterprise Development Corp.
5127 East 65th Street
Indianapolis, IN 46220
Phone: (317) 251-1231

CIRCLE 15 ON FREE INFORMATION CARD

The convertible screen directs the brightest optical path to the viewer's eye level, and can be adjusted easily for either seated or standing positions. It is cylindrically curved to reduce room light reflections, and uses a special dye to minimize the effects of ambient light.



CIRCLE 118 ON FREE INFORMATION CARD

The model RVP-460's high-resolution, high-contrast picture makes the set especially useful as a computer data-display unit. That application is further enhanced by an RGB input circuit that provides a display of 80-characters (color) by 25 lines. Use of a comb filter improves picture quality even further. The resolution is more than 500 lines (RGB), 450 lines (video), and 340 lines (RF).

The model RVP-460 is priced at \$4400.00 — Sony Corporation of America, 9 West 57th Street, New York, NY 10019.

PHONE-RINGER KIT, model GT-1218, is designed to replace the sometimes unpleasant ring of a conventional telephone bell; in its place, it will play one of four tunes or tones that the user can select or change at any time.

The pre-programmed integrated circuit in this one-evening kit is a true polyphonic synthesizer and alerts the owner of phone calls in one of four ways: a beeping signal, an upbeat four-note chime, ten seconds of Beethoven's "Für Elise," or 20 seconds of "Romance" by Rubenstein.

A pushbutton switch lets the user choose either the standard telephone bell, or one of the pleasant signals from the Phone Ringer, which are selected by jumping a small wire to separate sockets on the internal circuit board.



CIRCLE 119 ON FREE INFORMATION CARD

Housed in a beige snap-together case (5 7/8 x 4 3/4 x 1 1/4 inches) with an internal speaker, the phone ringer includes two connector leads for remote speakers, a variable volume control, modular phone plug with six feet of cable, and keyhole slots in the caseback to facilitate wall mounting. It installs between any modular telephone unit and a modular telephone set (except wall-mount set). It is powered up to a year by two 'C' cell alkaline batteries, and is approved by the FCC for direct-line connection.

The Pleasant Phone Ringer, model GT-1218, is priced at \$29.95. — Heath Company, Benton Harbor, MI 49022.

MOTION DETECTOR, the *Micro Motion Sensor*, is designed for automotive security applications, and is easy to mount anywhere under the hood or fender. It is made of glass-filled virgin nylon, and is completely sealed to



CIRCLE 120 ON FREE INFORMATION CARD

eliminate the false alarms common to older type motion detectors during damp or rainy weather. The *Micro Motion Sensor* is 3 x 1 1/2 x 1 inches and can be used in any system that employs motion detection. It is priced at \$9.95 — Thug Bug Corporation, 1999 Johns Drive, Glenview, IL 60025. R-E

CABLE TV Buy Direct & Save

SUPER SPECIALS

MasterCard VISA

40 CHANNEL CONVERTER \$29⁹⁵

Advanced Solid State design and circuitry allows you to receive mid & super band channels. Restores programming to Video Recorders.

36 CHANNEL REMOTE CONTROL CABLE CONVERTER \$69⁹⁵

JERROLD 400 THE ULTIMATE CABLE TV CONVERTER

60 CHANNEL INFRARED REMOTE CONTROL \$129⁹⁵

Send \$5 for Complete Catalog

DIRECT VIDEO SALES
P.O. BOX 1329
JEFFERSONVILLE, INDIANA 47130
CALL
1-812-282-4766

CIRCLE 53 ON FREE INFORMATION CARD

Versatile Lab Power Supply



EXCEPTIONAL VALUE! Only \$125⁰⁰

- 0-30 VDC at 0-2A • Excellent Regulation
- Ripple & Noise - 500 uV • 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.

Optional 10-turn voltage & current controls: \$25 each. Add \$3.00 for UPS shipping in Continental U.S. Check, Money Order or C.O.D. accepted. Illinois residents add 6% sales tax.

ELECTRO INDUSTRIES, INC.
4201 W. IRVING PK., CHICAGO, IL 60641
312/736-0999

CIRCLE 26 ON FREE INFORMATION CARD

Two facts you'll find hard to believe . . .

1. **This phone, with engineering for the year 2001, is yours right now.**
2. **Your cost is only \$99.95.**

Some of the brightest electronic engineers in the world decided to build a telephone that makes all others obsolete.

This phone would have a **big** memory to remember (and dial with one or two buttons) a lot of phone numbers.

It would handle one or two lines, with a "hold" button, for big-phone performance and convenience.

It would work with rotary pulse or Touchtone®, so you can use it to talk to a computer or to use MCI, Sprint, or any of the tone-code long distance services.

It would display the number being dialed in LED-illuminated figures, to prevent errors even in the dark.

Most of all —

It would be beautiful, a magnificent sleek instrument to enhance any room.

Ladies and gentlemen, we give you..

The Electronic Secretary-Phone

Every other state-of-the-art phone we've seen handles either just one line or (bulkily) five lines.

The ELECTRONIC SECRETARY-PHONE is about half the size of most phones, but its innards are crammed with advanced electronic technology.

What a timesaver! It "remembers" up to 32 numbers! Enter them just once — then call any of them by pushing one or two buttons.

Two-In-One, with "Hold" Button

You control two separate phone lines, which means you can have a true multi-line conference call without involving the phone company.

Talk on Line 1; or put the call on Line 1 on hold while you talk on Line 2; or tie both lines together by depressing both buttons!

Best of all, you can touch one key and you'll have a hands-free speakerphone whose sound fidelity is surprising. Your phone has a volume control, of course.

Before we tell you how little it costs, here a few more timesavers and conveniences built into your Electronic Secretary-Phone:

Elegant, Expensive-Looking, Easy!

We've seen phones you need an engineer's degree to operate. A child will have no trouble putting this wonder-phone through its paces.

You won't dial a wrong number because an LED display shows you, digitally, the number you're calling.

You can call MCI, Sprint, your computer, or anywhere you need the touchtone signal. A touch of your finger switches back and forth from pulse to touchtone.

Automatic redialling of the last number? Of course. No jangling ringer-bell; the ringer is a pleasant electronic tone.

But we think what you'll like most about the Electronic Secretary-Phone is its beauty. If ever a phone could win an award for design, this is it. You'll be proud to have this phone in your home or office.



LED Display Shows No. Being Dialed.

Get It Far Below Market Place

We originally planned to sell this phone for \$169.95, and it would be a bargain at that price. When we decided to feature it in our catalog, we lowered the price to \$129.95.

Now we've been able to contract for enough of them that you can own an Electronic Secretary-Phone for only \$99.95! At that price, while we have them, you should order two.

Our absolute guarantee means you'll have a month to use this phone and see for yourself that our claims about it are true. Enjoy it!

WE ABSOLUTELY GUARANTEE!

Plug in the ELECTRONIC SECRETARY-PHONE. Use it for up to 30 days. If you decide for any reason you don't want to keep it, return it for a 100% refund.

• Handles TWO Phone Lines

Use the "Hold" button to switch back and forth, Or use them together for conference calls!

• Conference Call Feature

Just push both buttons and both lines are open. They're interactive, so you can tie two calls together!

• Speaker Phone

If you have a roomful of people, or if you just don't want to hold the instrument, your Speakerphone has wonderful sound fidelity plus volume adjustment!

• 32 Memories

Your phone "remembers" up to 32 numbers. Enter them just once, then dial by pushing one or two buttons. Even remembers long strings of numbers like MCI!

\$99.95 complete

SAVE \$20.00! Two for \$179.90
(+ \$2.50 per total order for shipping)

Order TOLL-FREE

For fast delivery on credit card orders
call toll-free 24 hours a day, 7 days a week:

800-443-0100

Ask for Ext. 111

Or send check or money order.
Please add indicated shipping cost.

NEW HORIZONS

Dept. R10 5-31 50th Avenue
Long Island City, N.Y. 11101

At CIE, you get electronics career training from specialists.



If you're interested in learning how to fix air conditioning, service cars or install heating systems— talk to some other school. But if you're serious about electronics... even earning an Associate Degree... come to CIE —The Electronics Specialists.

Why trust your education and career future to anything less than a specialist?

You shouldn't. And you certainly don't have to.

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

Be sure to shop around. Because, frankly, CIE isn't for everyone.

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

What you should look for first.

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

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

How practical is the training?

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

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

With CIE's Personal Training Laboratory...

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

When you get your own 5MHz, solid-state

oscilloscope, you take some real professional steps. You use it as a doctor uses an X-ray machine—to "read" waveform patterns...lock them in...study, understand and interpret them!

When you get your Digital Learning Laboratory, you'll

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

You'll build your Microprocessor Training Laboratory, a working microcomputer—from "scratch." You'll also learn how to program and interface it with displays, memories, switches, and more.

Earn An Associate Degree from CIE.

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

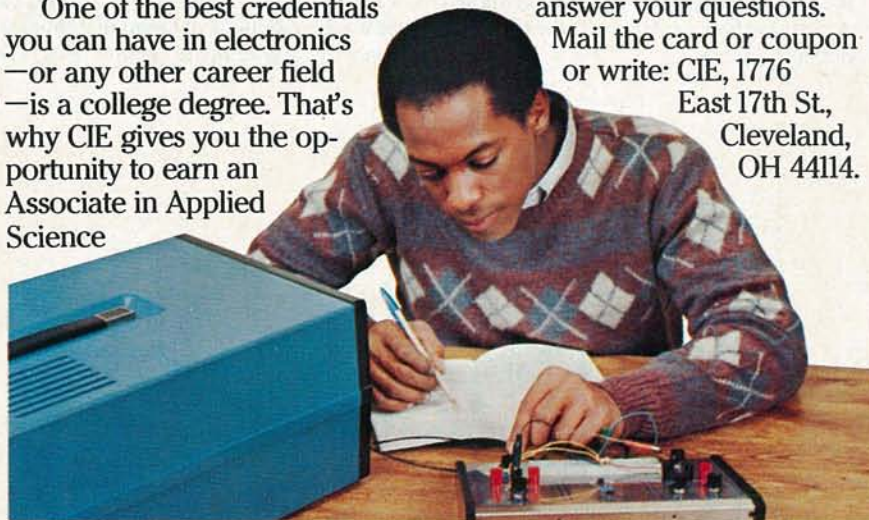
in Electronics Engineering Technology. Any CIE career course can offer you credit toward the degree...more than half of the number needed in some cases.

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.

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

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

Mail the card or coupon or write: CIE, 1776 East 17th St., Cleveland, OH 44114.



CIE Cleveland Institute of Electronics, Inc.

1776 East 17th Street, Cleveland, Ohio 44114

Accredited Member National Home Study Council

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

Print Name _____

Address _____ Apt. _____

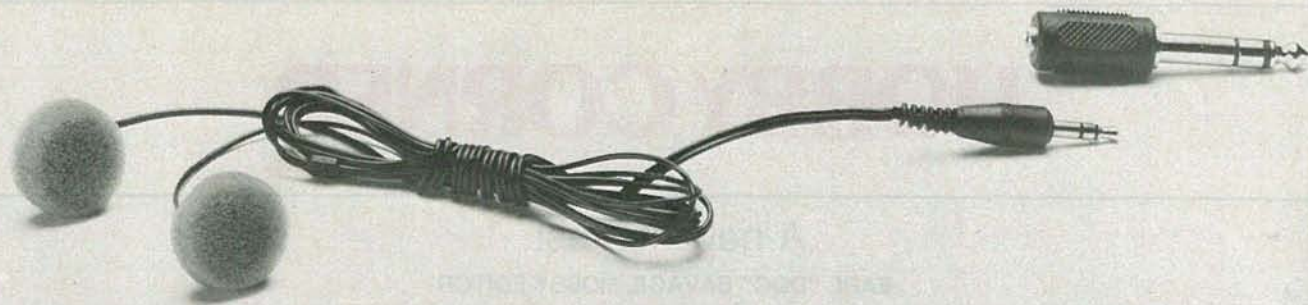
City _____ State _____ Zip _____

Age _____ Area Code/Phone No. _____ / _____

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

MAIL TODAY!

RE-70



MAKE YOUR STEREO SOUND SUPER FOR ONLY \$4.50

THE SOUND RIVALS THE MOST EXPENSIVE SPEAKERS

IT'S A GREAT DEAL BUT THERE'S A CATCH

Only \$4.50? It's true. Sound that rivals the most expensive speakers? That's also true. But there is a catch to this deal. Not number 22. Actually, our first. Read on.

We're a new company. We need customers. So we're offering this special deal, on a very special product. The headphones are very new on the market. You'll see similar models just beginning to appear in hifi stores bearing respected names like Sony and Toshiba.

Actually they're miniature versions of the famous new technology headphones that wrap around your head with a steel band. The mylar diaphragms are exactly the same. So the tight crisp response is unbelievable, over the entire 20-20,000 Hz frequency range. And as you probably know mylar domes simply don't work with normal speaker magnets. So the miniatures have the same powerful rare earth Samarium magnets as the ones you've seen.

But here's where the similarities end. There is no steel band to fit around your head and press against your ears. They simply slip into your ears. That makes them more comfortable, but what's more important something really amazing happens to the sound. You're closer to the music, it almost seems to envelope you. The sound truly is all encompassing. If you ever try the older style headphones again, you'll think you're missing half the sound you've

come to expect. You get these remarkable little speakers with a standard phone plug adaptor plus an extra set of foam covers.

Now you're saying you never bought a Walkman. Glad you thought of that. Because we also have this neat little radio. Take seven normal filter cigarettes. Line 'em up in a row. That's the size of it. Really, it's that small. Plus it comes with its own headphone set, and it's powered for up to 24 hours straight by two normal AAA batteries. Get the FM stereo version for \$22.50 or the slightly larger AM/FM model for \$27.50. Both include headphones exactly like the ones we've described.

Now if you like that idea, you don't mind the catch. Painless and easy, here it is: Try the radio and we'll throw in the extra headphones, adaptor and foam covers for only \$4.50 more.

So why do we do it? We're losing our shirts on the earphone, but we need to build our sales, and find people who like neat deals on neat electronics. We're a brand new division of a very large electronics company. And we want to show those guys at headquarters what we can do. The best way is very special deals like this. So you benefit.

To try this deal with your credit card call the RCD toll free hotline or send your check plus \$2.00 postage and handling. Specify group 1900 on FM or AM/FM on the radio. If you aren't 100% satisfied return it in the original carton within 25 days for a courteous refund. No hassles, no problems.

Be prepared to get an explosion of sound, at home or anywhere you go.



RCD

806 Custer Avenue
P.O. Box 1494
Norfolk, Nebraska 68701

call TOLL FREE 800-228-8108

HOBBY CORNER

A new contest

EARL "DOC" SAVAGE, HOBBY EDITOR

FOR SOME REASON THERE HAS BEEN AN increase in the number of inquiries about an unusual clock readout that was described here several years ago (March, 1980). Since that time, all kinds of new IC's have appeared and there are more modern ways to achieve the same result. Let's see who can come up with the best new circuit. To be fair to those of you who may not have been around back then and/or who do not have ready access to back issues, I'll run through the description.

Bob Hankinson (PA) built a readout that consisted of a single vertical column of LED's. They were turned on and off in such a way that you could read the digits by "sweeping" your eyes across the column. (Think of a "Times Square" billboard—except your eyes, not the numbers, scroll.) If you looked at it straight on, it looked just like a line of LED's. Here are a few hints that should help you to understand the problem better.

Imagine a block as shown in Fig. 1 consisting of just 15 LED's. (The filled-in circles are lighted.) By lighting selected LED's, you can show any digit. (For example, in Fig. 1, the numeral 4 is shown.) With four blocks, you could show the time in hours and minutes. That's how many early digital clocks were made.

For clarity, I'll confine the discussion to one digit/block. Looking again at Fig.

AN INVITATION

To better meet your needs, "Hobby Corner" has undergone a change in direction. It has been changed to a question-and-answer form. You are invited to send us questions about general electronics and its applications. We'll do what we can to come up with an answer or, at least, suggest where you might find one.

If you need a basic circuit for some purpose, or want to know how or why one works, let us know. We'll print those of greatest interest here in "Hobby Corner." Please keep in mind that we cannot become a circuit-design service for esoteric applications; circuits must be as general and as simple as possible. Please address your correspondence to:

Hobby Corner
Radio-Electronics
200 Park Ave. South
New York, NY 10003

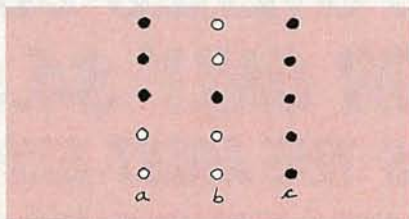


FIG. 1

1, you will see that the "4" (in this case) is made of 3 vertical columns. Of course, in the normal readout all three columns are lighted properly at the same time.

Now take just one column of 5 LED's and light it sequentially according to the pattern of column *a* and then *b* and then *c*. If you get a match between the sequential rate and the speed of your eyes sweeping horizontally across the column, you can actually see the digit 4. It's really quite fascinating.

Of course, once you get it working for one digit, all you have to do is add three more into the pattern and add blank spaces between digits. Then drive the whole thing with a clock IC and your family and guests will go bananas until they get the hang of reading it.

Now for the contest: See what you can build and send me the circuit. (Show the entire clock circuit or at least back to the commonly available signal lines.) Keep it as simple and as inexpensive as possible (and make the diagram legible, of course).

You have until the end of the October. That should give you plenty of time. Meanwhile, I'll see what I can do about finding some kind of prize for the best circuit.

An old puzzle

Some of you missed the point of the 3-house/3-utility problem back in March. Recall that I said I had "whiled away many pleasant hours" on it back in junior high school. That, of course, was before I had learned enough math to prove that the problem has no solution—it just can't be done.

I do hope those who have been working

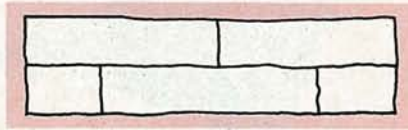


FIG. 2

on it and requesting a solution have had as much fun with it as I once did! If not, perhaps you have learned to read more carefully.

If you would like another, similar puzzle, try this one: Figure 2 shows a design. Place your pencil anywhere inside or outside that design. The idea is to cross every line-segment with your pencil without crossing any segment more than once. (This one brings back memories of junior high, too.) Good Luck!

Homebrew transceiver

Darrell Hohensee (KS) has asked for schematic for a 4-band ham transceiver with internal VFO. Well, the best I can do is to refer you to the publications of an organization of radio amateurs, the ARRL or American Radio Relay League (225 Main Street, Newington, CT 06111). I have built and learned from their *Radio Amateur's Handbook* for many years. That and several of their other publications contain the kind of information you seek.

Darrell, you are right: you can learn a great deal by building (or "homebrewing") your own equipment. From your letter, however, I gather that you have not done much construction. The transceiver you ask about is a big project to undertake, especially on limited experience. There's an old saying about learning to walk before you run that applies equally well to building electronic projects. If you get involved in a big one before you have worked your way up to it with smaller projects, you can easily get jammed up. You can end up with something that is partially built and it's easier for someone else to start from scratch than to correct your mistakes. So start small, Darrell, and work your way up. Those ARRL books have plenty of less-complex ham gear to build, too.

More on the solar collector

Marvin Roesch (AZ) wants that solar follower from the June Hobby Corner to return to the east direction under its own steam. Apparently, he plans to put a collector in a remote location.

The first consideration is a motor to turn the mechanism "backwards." That can be a second motor or a the original motor can be one that will reverse. The easiest way to point the collector east is to

Now electronics technicians can get into VCR Servicing quickly and easily

Learn professional VCR servicing at home or in your shop with exclusive videotaped demonstrations

Today, there are more than 10 million VCRs in use, with people standing in line to have them serviced. You can bring this profitable business into your shop with NRI professional training in VCR servicing. This top-level training supports the industry's claim that the best technicians today are those who service VCRs.

Integrated Three-Way Self-Teaching Program

In one integrated program, NRI gives you a study guide, 9 instructional units, 2 hours of video training tapes accompanied by a 32-page workbook that pulls it all together. At home or in your shop, you'll cover all the basic concepts of video recording, mechanical and electronic systems analyses, and the latest troubleshooting techniques. Your workbook and instructional units also contain an abundance of diagrams, data, and supplementary material that makes them valuable additions to your servicing library.

The "How-To" Videotape

Your NRI Action Videocassette uses every modern communications technique to make learning fast and easy. You'll enjoy expert lectures and see animation and video graphics that make every point crystal-clear. You'll follow the camera eye into the heart of the VCR as step-by-step servicing techniques are shown. Both electronic and mechanical troubleshooting are covered . . . including everything from complete replacement and adjustment of the recording heads to diagnosing micro-processor control faults.

Plus Training On All The New Video Systems

Although your course concentrates on VCRs covering Beta, VHS, and 3/4" U-Matic commercial VCRs, NRI also brings you up to speed in other key areas. You'll get training in capacitance and optical video disc players, projection TV, and video cameras. All are included to make you the complete video technician. There's even an optional final examination for NRI's VCR Professional Certificate.



Covers Beta and VHS systems with actual instruction on videotape.

The Best Professional Training

This exclusive self-study course has been developed by the professionals at NRI. NRI has trained more television technicians than any other electronics school! In fact, NRI has consistently led the way in developing troubleshooting techniques for servicing virtually every piece of home entertainment equipment as it appears in the marketplace.

Satisfaction Guaranteed . . . 15-Day No-Risk Examination

Send today for the new NRI Self-Study Course in VCR Servicing for

Professionals. Examine it for 15 full days, look over the lessons, sample the videotape. If you're not fully satisfied that this is the kind of training you and your people need to get into the profitable VCR servicing business, return it for a prompt and full refund, including postage. Act now, and start adding new business to your business.

Special Introductory Offer

This complete VCR training course with two hour videotape is being offered for a limited time only, on orders received from this ad, at our low introductory price of \$179.95. Save \$20 by acting now!

NRI Training For Professionals
McGraw-Hill Continuing Education Center
3939 Wisconsin Avenue Washington, DC 20016

YES! Get me started in profitable VCR servicing. Rush me my NRI self-study course in VCR Servicing for Professionals. I understand I may return it for a full refund within 15 days if not completely satisfied.

PLEASE SPECIFY TAPE FORMAT DESIRED VHS BETA

Name (please print) _____

Company _____

Street _____

City/State/Zip _____

Enclosed is my check money order for \$179.95 (D.C. residents add 6% tax) Make check payable to NRI

Charge to VISA MasterCard _____

Interbank Number _____

Card Number _____ Expiration Date _____

Signature _____

(required for credit card sales)



NRI Training For Professionals
McGraw-Hill Continuing
Education Center
3939 Wisconsin Avenue
Washington, DC 20016

CABLE TV

CONVERTERS DESCRAMBLERS

Largest Selection
of Equipment Available
\$ Buy Warehouse Direct & Save \$



36 channel
converter
\$45⁹⁵

36 channel
wired remote
converter
only
\$88⁹⁵



Send \$2 for complete catalog
of converters and unscramblers

Quantity Discounts • Visa • Master Charge
Add 5% shipping—Mich. residents add 4% sales tax

C&D Electronics, Inc.
P.O. Box 21, Jenison, MI 49428
(616) 669-2440

MOVING?

Don't miss a
single copy of
**Radio-Elec-
tronics.** Give
us:

Six weeks' no-
tice

Your old ad-
dress and zip
code

Your new ad-
dress and zip
code

ATTACH
LABEL
HERE

name (please print)

address

city state zip code

Mail to: Radio-Electronics
SUBSCRIPTION DEPT., P.O. BOX 2520,
BOULDER, COLO. 80322

control the second motor or reverse switch with a clock/timer. Every night at midnight it can swing the reflector back to be ready for the rising sun. It can also be done in fancier ways, Marvin, but the solution you should always look for is the simplest and most straightforward one—the one that causes the fewest troubles in construction and operation.

Resistance, reactance, impedance

A series of basic questions was sent in by Anwar Khan (NY). Space will not permit giving detailed answers, but perhaps the following will help him and others who may be a bit confused.

From his letter, I deduce that Anwar's fundamental difficulty is in having a clear picture of the difference between resistance, reactance, and impedance. Here are some pointers toward the right direction: Resistance is the opposition to the flow of electrical current that results in heat in the conducting material. Resistance is symbolized in equations by the letter R. It is measured in *ohms*, which are symbolized by the capital Greek letter omega (Ω).

Reactance is the opposition to the flow of AC current. It's symbol is the letter X. Reactance is also measured in ohms.

Impedance is the combination of the opposition to the flow of AC current due to resistance and reactance. It is measured in ohms and is symbolized by the letter Z.

Though the units of measurement for each of them is called the ohm, they are quite obviously different. Thus, you cannot substitute or switch one for the other.

There is no formula that relates the DC resistance of a coil directly to the (AC) impedance or reactance of that coil. That's because the resistance is determined by the type and length of the wire used. The reactance is determined by how the wire is wound and the frequency of the signal that is fed through it.

Consider this example: the resistance of a ten-foot piece of wire is a certain number of ohms. That value remains unchanged regardless of the form into which you put the wire—anything from a straight line to a tightly wound ball. On the other hand, its inductance, and thus its reactance, changes depending on the shape(s) into which the wire is placed. The reactance is also related to the frequency, *f*, of the signal that is fed through it ($X = 2\pi fL$).

So, Anwar, knowing only the DC resistance of a coil will not enable you to determine its reactance or impedance. The other factors must be considered.

Your input

Your input makes a valuable contribution to this column. Your suggestions are encouraged. Don't hesitate to ask a question—there are probably hundreds of other readers who would like to know the same thing. And don't forget—I'll be on the lookout for your contest entries. R-E

COMPUTERS

TELEMARKETING
Works For You

1-800-841-0860

Call For Your
Discount Prices

Write For Free Price List

Commodore • EPSON

IBM SMITH-CORONA

FRANKLIN • OKIDATA

EAGLE • TRS-80

MICRO MANAGEMENT SYSTEMS

TELEMARKET DEPT. 15

2803 Thomasville Rd. E. • Cairo, Ga.

912-377-7120

TIMEX/SINCLAIR COMPUTER USERS

We Have The Books You Need



- ART OF PROGRAMMING THE 1K ZX81.**
How to use the features of the ZX81 in programs that fit into the 1K machine. 96pp. **\$5.75 postpaid.**
- ART OF PROGRAMMING THE 16K ZX81.**
How to use your 16K RAM pack and ZX printer to the full. 144 pp. **\$6.95 postpaid.**
- ART OF PROGRAMMING THE ZX SPECTRUM.**
Everything you need to know to put the ZX Spectrum to work for you. 144 pp. **\$8 postpaid.**

ELECTRONIC TECHNOLOGY TODAY, INC.
P.O. BOX 240
MASSAPEQUA PARK, NY 11762

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Number of books ordered

VIC-20

VIC-20 INTERFACING BLUE BOOK

Did you know that your VIC can be used to control a 99¢ toy motor so effectively that it runs like a precision machine? Or that you can build an accurate digital thermometer using the VIC and four parts costing less than \$5?

These and other 28 interfacing projects selected for usefulness, ease of construction and low cost are detailed in the VIC-20 Interfacing Blue Book, a veritable gold mine of practical information on how to build a variety of interfaces for your computer.

Projects include: Connecting VIC to your stereo; Pickproof digital lock; Capacitance meter; Liquid level sensor; Telephone dialer; Voice output; 8K/16K RAM/ROM expansion; 128K RAM expansion; 8-bit precision D/A; 8-bit A/D converter; MX-80 interface and more.

Written by a college professor in a friendly and informative style, the Blue Book gives you theory of operation, schematics, program listings, parts list, construction hints and sources of materials for each one of the 30 projects.

If you want to get the most out of your VIC this book is a must. Cost is \$14.95 (less than 50¢ per project!). Price includes postage.

microsignal Dept M
P.O. BOX 22
MILLWOOD NY 10546

VIC-20

CIRCLE 46 ON FREE INFORMATION CARD

ANNUAL INVENTORY REDUCTION... TEST INSTRUMENT SALE!

NOT SECONDS, NOT REBUILTS, NOT REJECTS—
ALL ARE BRAND NEW-IN FACTORY CARTONS!
HAVE NOT BEEN USED FOR DEMOS.

	LIST	SALE
HITACHI V-099 WAVE FORM MONITDR	\$1350.	\$1350. SOLD OUT
HITACHI V-089 VECTOR SCOPE	\$1684.	\$1684. SOLD OUT
HITACHI V-152F 15MHZ SCOPE	\$595.	\$468.
HITACHI V-1050F100MHZ SCOPE	\$1980.	\$1589.
HITACHI V-151F 15MHZ SCOPE	\$495.	\$388.
HITACHI V-202F 20MHZ SCOPE	\$695.	\$546.
HITACHI V-650F 60MHZ SCOPE	\$1195.	\$1195. SOLD OUT
HITACHI V-302F 30MHZ SCOPE	\$799.	\$665.
BECKMAN TECH300 DMM	\$120.	\$108.
BECKMAN HD-100 DMM	\$169.	\$152.
BECKMAN TECH 310 DMM	\$145.	\$130.
BECKMAN TECH 330 DMM	\$219.	\$197.
BECKMAN TECH 350 DMM	\$229.	\$206.
BECKMAN TECH 360 DMM	\$289.	\$260.
LEADER LBO-514A SCOPE	\$695.	\$589.
LEADER LFG-1300S, FUNCTION GEN.	\$495.	\$419.
LEADER LSG-17, SIGNAL GEN.	\$190.	\$160.
LEADER LAG-27 SINE/SQ. WAVE GEN.	\$205.	\$184.
LEADER LDC-823S FREQ. COUNTER	\$450.	\$405.
LEADER LDC-822 FREQ. COUNTER	\$320.	\$288.
LEADER LBO-524, 35 MHZ SCOPE	\$995.	\$848.
VIZ WP-704A POWER SUPPLY	\$139.	\$115.
VIZ WP-702A POWER SUPPLY	\$184.	\$165.
VIZ WP-708 POWER SUPPLY	\$499.	\$399.
VIZ WE-130A SOUND LEVEL METER	\$179.	\$133.
VIZ WA-504B/44D AUDIO GENERATOR	\$184.	\$127.
SIMPSON 7016 COUNTER TIMER	\$447.	\$447. SOLD OUT
SIMPSON 7020 SCALER	\$506.	\$506. SOLD OUT
SIMPSON 420A FUNCTION GEN.	\$204.	\$183.

	LIST	SALE
SIMPSON 452 15 MHZ SCOPE	\$919.	\$827.
SIMPSON 454 15MHZ SCOPE	\$730.	\$657.
SIMPSON 260-7 MM	\$119.	\$103.
SIMPSON 260-7M MM	\$127.	\$114.
SIMPSON 269-3 MM	\$218.	\$196.
SIMPSON 360-2 DMM	\$375.	\$337.
SIMPSON 463 DMM	\$210.	\$174.
SIMPSON 461-2 DMM	\$204.	\$174.
SIMPSON 461-2R DMM	\$246.	\$219.
SIMPSON 464A-3 DMM	\$304.	\$273.
SIMPSON 464D-3 DMM	\$355.	\$319.
SIMPSON 460-5 DMM	\$397.	\$357.
SIMPSON 467-E DMM	\$225.	\$202.
BBC MA3E MM	\$179.	\$161.
BBC MA1H MM	\$49.	\$44.
BBC MA2H MM	\$79.	\$71.
BBC M2011 DMM	\$119.	\$107.
BBC M2012 DMM	\$139.	\$125.
BBC MA5D DMM	\$595.	\$535.
BBC M2030 DMM	\$199.	\$179.
BBC M2031 DMM	\$219.	\$197.
BBC M2032 DMM	\$259.	\$233.
A.W. SPERRY 315P, 15MHZ SCOPE	\$800.	\$720.
A.W. SPERRY 620C, 20MHZ SCOPE	\$785.	\$706.
A.W. SPERRY EZ-6110 DMM	\$160.	\$89.88
A.W. SPERRY SP-10 MINI-METER	\$17.75	\$15.88
A.W. SPERRY SP-15 MINI-METER	\$19.95	\$17.88
A.W. SPERRY SJ-25 MINI-PROBER	\$32.95	\$29.88

ALL ITEMS CARRY FULL MANUFACTURERS
WARRANTY PLUS ELECTRONICS WAREHOUSE
FULL 45 DAY MONEY BACK GUARANTEE!

**SALE
EXTENDED
TO SEPT. 30TH
1983!!**

**ELECTRONICSTM
WAREHOUSE**

Halls Rd. - P.O. Box 624 - Old Lyme, CT 06371

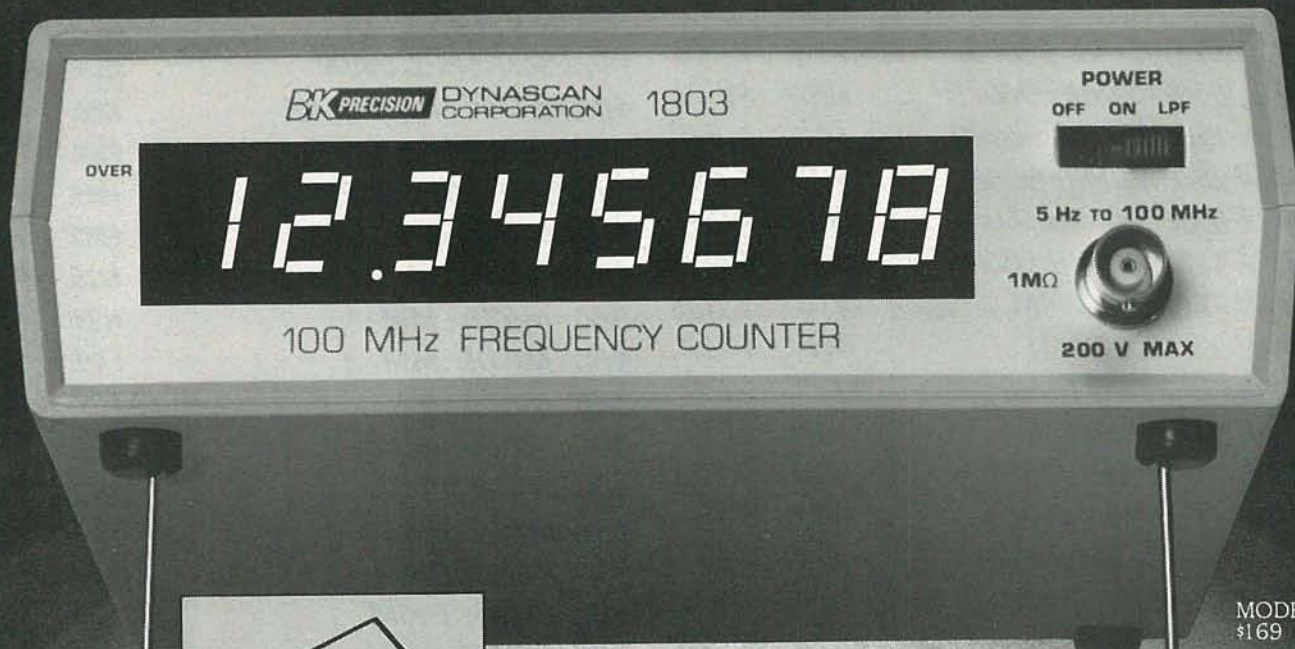
TERMS: U.S. funds, Visa, Amex, MC, Money Order, Check (allow 2 weeks to clear), CT residents add 7½% sales tax. Sale prices for prepaid orders only. Prices and availability of product subject to change without notice. Write for free catalog. C.O.D. orders cash or certified check add \$1.50. Shipping and handling charges add \$3.50 for orders under \$100., add \$7 for orders over \$100. (air freight extra).



TELEPHONE ORDERS FILLED
FAST! ORDER DESK OPEN
FROM 9AM TO 5PM E.S.T.
CALL (203) 434-8308

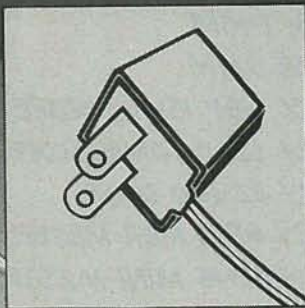
SIMPLY AMAZING.

B&K-PRECISION's under \$170 100 MHz frequency counter.

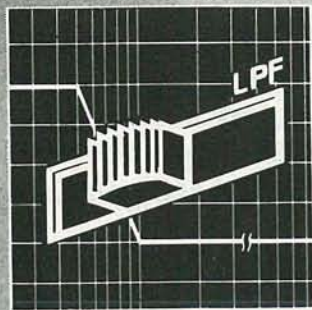


MODEL 1803
\$169

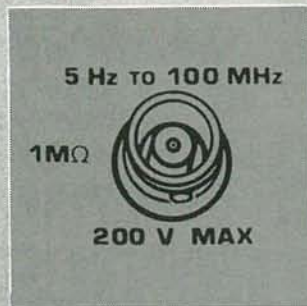
SHOWN ACTUAL SIZE



SIMPLE TO POWER.
BATTERY OR AC LINE
OPERATION
[ADAPTER INCLUDED].



SELECTABLE LOW-PASS
FILTER FOR ACCURATE
LOW-FREQUENCY
MEASUREMENTS.



BNC INPUT CONNECTOR
SIMPLIFIES HOOK-UPS
—ELIMINATES NEED FOR
ADAPTERS.



EASY-TO-READ,
8-DIGIT DISPLAY
PROVIDES 1 Hz RESOLUTION

For more details on the amazing 1803 and the full line of new B&K-PRECISION frequency counters, see your local distributor or call 1-312-889-9087.

BK PRECISION DYNASCAN CORPORATION

6460 W. Cortland Street • Chicago, IL 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

CIRCLE 77 ON FREE INFORMATION CARD

BUILD THIS

Part 2 THIS MONTH, WE'LL SEE HOW TO BUILD THE pianomatic. But before we begin, let's finish up our look at how the circuit operates.

Note generator

The note generator has the job of creating the notes played by the Pianomatic. As we've seen, it consists of two parts—an oscillator and a frequency divider. The frequency of an oscillator formed by IC15-e and IC15-f is determined by the formula: $f = 1/2.2RC$. With the values used for R35 and C22, we get a frequency of about 300 kHz. That is fed to the clock input of IC7, a special IC that does the necessary division to provide thirteen notes of the scale. It's internally designed so that a clock input of about 2 MHz will produce the top octave on the piano. By using a clock input of 300 kHz we bring the notes down to roughly the middle of the piano keyboard.

The outputs of the note generator are connected to the

mini player-piano

Build the Pianomatic and make beautiful music—electronically.

ROBERT GROSSBLATT

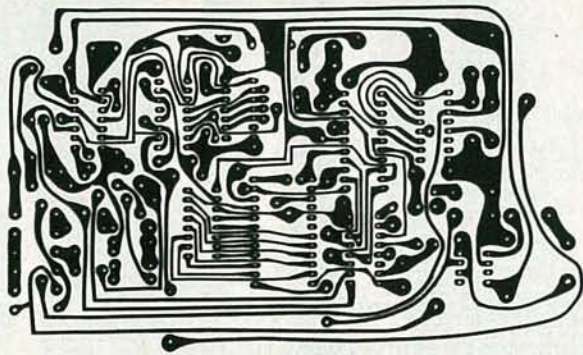


FIG. 5—TWO OF THE FIVE boards used in this project are double-sided. The foil side of one of those boards, Board 1, is shown here half-size.

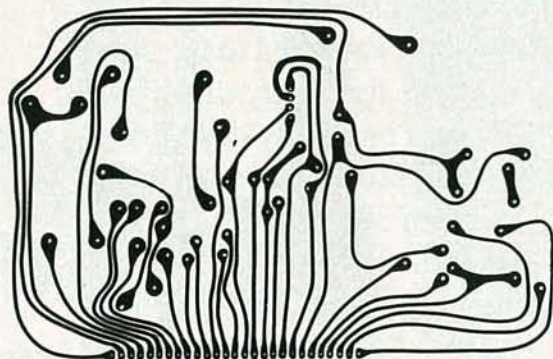


FIG. 6—THE COMPONENT SIDE OF BOARD 1. Note the pads for the male header at the bottom of the pattern. Once again this board is shown half-size.

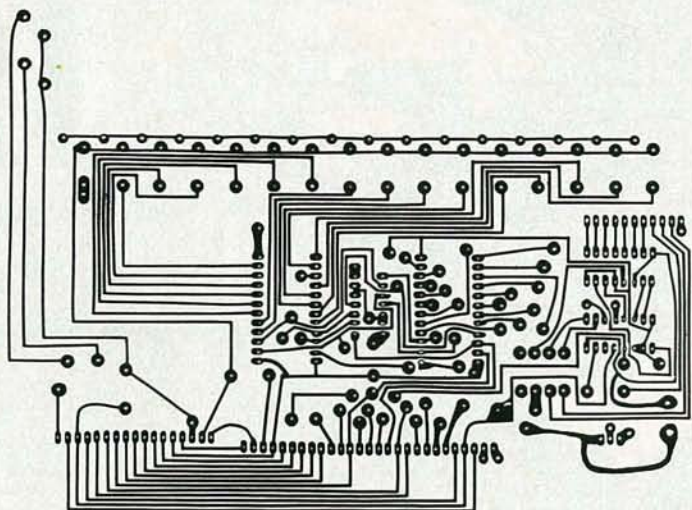


FIG. 7—THE FOIL PATTERN for Board 2. The foil side of that double-sided board is shown here half-size.

inputs of IC8, the note selector. That one-of-sixteen analog switch will output the input chosen by the binary word on the output-data bus. When the inhibit pin of the IC, pin 15, is connected to +V, it will disable the output. If we're reading a tune back from memory, we obviously want the output of IC8 turned on all the time, but if we leave it on when we're writing a tune into memory we'll run into a prob-

lem similar to the one we ran into earlier when we wanted to play the Pianomatic without writing into memory.

The problem before was caused by the fact that there was always data on the input-data bus. The problem this time is similar. There is always some data on the output-data bus, and it's not always the data we want. When we're writing a tune into memory, pressing a key will cause

that note to be written into memory. Remember that before we pressed the key, there was always something stored at that location in the memory. Consequently, until we program the note we want, we'll hear whatever note was already at that memory address. Even when the memory is first put in the circuit, some sort of random data will be stored in it. If we're writing a tune on a page we've previously used, the old tune will be stored there. The way around this problem is to use the inhibit pin (pin 15) of IC8 when we're writing into memory.

Once again we use the "any-key-pressed" signal from the keyboard encoder to enable the note selector. Since we need a high to turn off IC8, we have to use the inverted version of the "any-key-pressed" signal available at the output of IC15-c. Switch S2-b connects the inhibit pin of IC8 to ground when we are reading from memory and to the inverted "any-key-pressed" signal when we are writing into memory. That means that IC8 is always enabled during a READ but, during a WRITE operation, it's only enabled when a key is pressed. Now, it's true that since this same inverted signal is also used to generate a write pulse for the memory, there will be a period of time when IC8 is enabled and the new note hasn't yet been written into memory. But let's be realistic. The write time of the memory is something like 300 nanoseconds so the old data will be present for only—to be generous—a brief period of time.

Amplifier

The output of IC8, available at pin 1, is fed to the input of IC10 through C18. That is a 1/2-watt integrated amplifier that can directly drive an 8-ohm speaker. The noteworthy thing here is that the gain of the amplifier is varied by the output of the tremolo clock, IC14-a. That is a low frequency oscillator running at about 6 Hz or so. The output is integrated by R31 and C21 to produce something vaguely resembling a sinewave. We're not after perfection here, but we do have to smooth it out somewhat. The reason for that is that the Pianomatic uses CMOS logic; one of the characteristics of that logic family is that oscillators using it can swing nearly the full range of the supply voltage. For the output here, the low point is pretty near ground and the high point is within shouting distance of the positive supply rail. If we connected the tremolo clock directly to the gain control pin of the amplifier, pin 8, it would turn the amplifier off every time the oscillator reached the bottom of the curve. It would be like trying to sing while someone was hitting you on the back (although there are certain kinds of music where that would be a definite plus).

Because we're using the gain-control pin of the amplifier to add tremolo, the volume of the Pianomatic is determined by the size of the capacitor, C19, that

connects the output of IC10 to the speaker. The value chosen provides a comfortable level but you can change it. Raising the value will increase the volume and vice versa. Keep in mind though, IC10 is only a 1/2-watt amplifier and the speaker is a miniature one. If you have visions of using the Pianomatic at a rock concert, you're going to have to come up with some other output stage—you might try converting it to run off diesel power.

Memory retention

The Pianomatic will remember programmed tunes even after it's been turned off. That nonvolatility of the memory is a nice feature and understanding how it's done means that you can use the same technique in other designs. Basically we're using a backup battery to retain the memory and although the same method can probably be used with any other memory device, there are several memories that are specifically designed with that feature in mind. Those particular memories are the so-called "low-power" devices. They are generally CMOS and provide guaranteed data retention with as little as two volts applied. The rules for using them are simple since they usually have a control pin to switch the memory over to the LOW POWER mode. The Pianomatic uses three 20-milliamp-hour (mAh) nickel-cadmium button cells to provide a memory-retention voltage of 3.6. The draw is so low that 1-mAh nickel-cadmium cells could have been used if they could have been found.

Diodes D14 and D15 are used to steer the power for the memory. When the Pianomatic is turned on, D15 isolates the +V pin of the memory, D14 protects the batteries, and R16 allows the batteries to trickle charge at a rate we can figure from Ohm's law.

The operating voltage of the Pianomatic is 7.3 volts and, since D15 is a silicon diode, the drop across it will be about .65 volts. That makes the voltage at the batteries, B9-B11, 6.65 volts. Nickel-cadmium button cells should be recharged at no more than 10 percent of their rated capacity—the so-called C10 rate. In the case of our batteries that would be a recommended charging current of 20 mA/10, or 2 mA. The batteries also have a nominal voltage of 3.6 volts (1.2 volts per cell). Now that we've worked all that out, our charging resistor can be figured easily.

$$V = IR$$

$$R = V/I$$

$$V = V_{\text{system}} - V_{\text{batteries}}$$

$$V = 6.65 - 3.6 = 3.05 \text{ volts}$$

$$I = 2\text{mA} = .002 \text{ amps}$$

$$R = 3.05/.002$$

$$R = 1525 \text{ ohms}$$

That's why our charging resistor, R16, is 1.5K ohms. If you use different batteries in your Pianomatic, be sure to recalculate the value of R16. Nickel-cadmium batteries have a nasty habit of blowing up

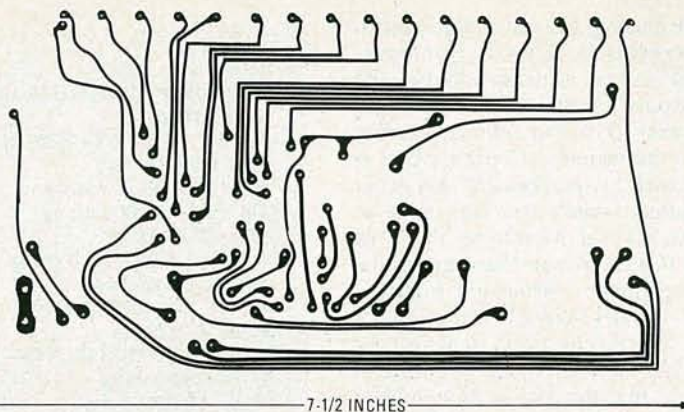


FIG. 8—FOR SIMPLICITY IN MAKING THE BOARDS, neither of the double-sided boards uses plated-through holes. The foil pattern for the component side of the second double-sided board, Board 2, is shown here. Once again, that board is shown here half-size.

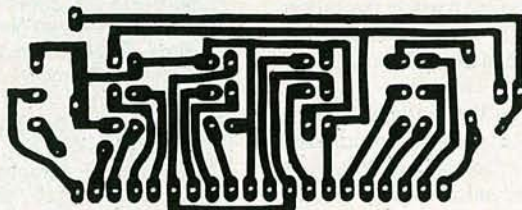


FIG. 9—MOST OF THE control switches are mounted on this small board, Board 3. Note that this foil pattern is shown full-size.

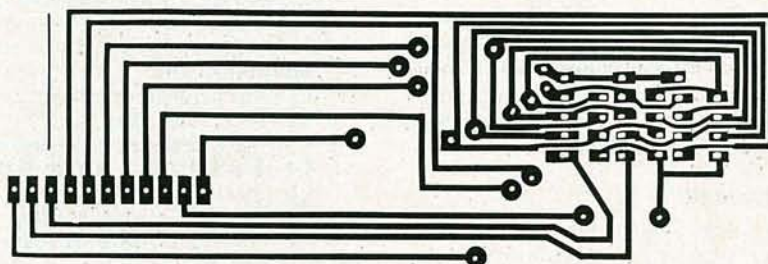


FIG. 10—FOIL PATTERN FOR THE DISPLAY BOARD. Note that there are only nine mounting holes for the LED displays. Pin 1 of each display is not used and therefore has been removed.

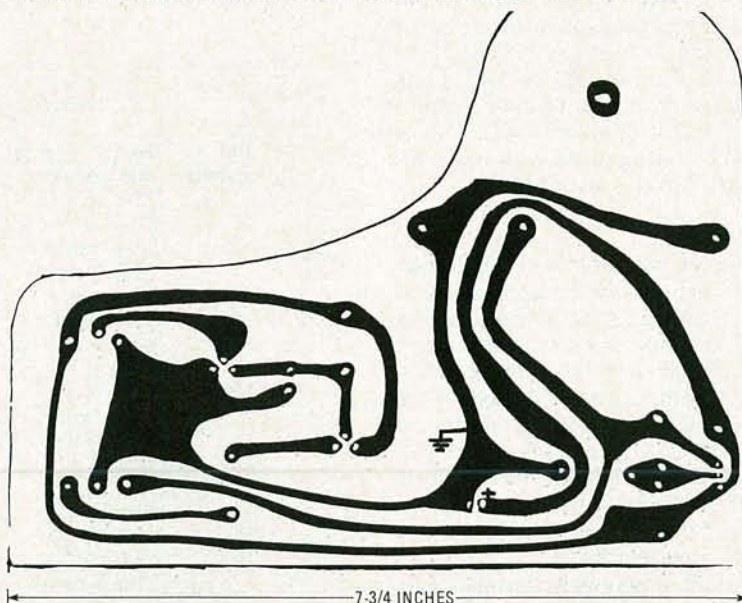


FIG. 11—BOARD FIVE is shaped to fit the rear of a piano-shaped case. If a speaker is mounted on this board, the large hole at the top of the pattern will have to be further enlarged so that the speaker's magnet-housing fits snugly (see text).

if they're charged too fast and/or without the proper controls. When the Pianomatic is turned on, the batteries charge, and when the power is turned off, the batteries forward-bias D14 and provide standby power to the memory. Capacitor C15 is there to catch any glitches that may occur if the battery switch-over isn't quite as noise-free as we'd like it to be. Pin 17 of memory IC4 is the input that controls the low-power mode. When it's high the memory operates normally and when it's brought low the memory is in its low power, data-retention mode. We have to make sure that this pin is brought low before we switch over to the standby battery supply. That is easily done by making sure that our ON/OFF switch, S8, is a SPDT type. When we switch the power off, we connect the +V line to ground. Since pin 17 of the memory is on the +V bus, our problem is solved.

If you monitor the voltage on the batteries you'll make an interesting discovery. Although the nominal voltage is 3.6 volts, the unloaded voltage of the charged cells is a bit higher—about 4.2 volts. When the batteries are put under load, that is, used to power something, you would ordinarily expect to see the voltage drop to the nominal voltage—3.6 volts. When you turn the Pianomatic off, the memory draws whatever power it needs to retain the data, but the battery voltage won't fall below 4 volts. What that is telling you is that the draw from the batteries is really low—on the order of about about 10 microamps!

Note counter

The note counter (IC11, IC12, and DISP1-DISP3) is a standard counter-decoder/driver combination. IC12 is a three-digit counter in one package, is extremely convenient to use, and has an internal multiplexer for a three digit display. The clock, reset, and blanking control lines are handled automatically by the circuitry and switching of the rest of the Pianomatic. Resistors R37 and R38 bring the clock-voltage and rise-time requirements in line with those of IC3. That is necessary since they are both being incremented by the same clock.

Power supply

The power supply is standard. Diode D16 prevents an accidental reversal of polarity from damaging anything and the voltage regulator, IC13, is set to provide the Pianomatic with 7.3 volts. Potentiometer R41 and transistor Q1 monitor the unregulated voltage. When it falls below a preset level, Q1 conducts and causes SCR1 to fire and light the three decimal points in the display. That is a low-battery warning; the trip point of the circuit can be set by adjusting R41.

If you look closely at the schematic and follow the output of SCR1, you'll notice that there are two resistors (R30 and R40) on the line in series. The reason for that is

PARTS LIST

All resistors ¼ watt, 5%, unless otherwise noted

R1, R7, R10, R17—8200 ohms
R2—6800 ohms
R3, R8, R29—1 megohm
R4, R38—10,000 ohms
R5—3000 ohms
R6, R12, R30—1000 ohms
R9—150,000 ohms
R11, R15—100,000 ohms
R13—470 ohms
R14, R19—R28, R36, R40—160 ohms
R16—1500 ohms
R18—82,000 ohms
R31—22,000 ohms
R32, R33—560,000 ohms
R34—390 ohms, ½ watt
R35—15,000 ohms
R37, R39—2200 ohms
R41—500,000 ohms, multi-turn potentiometer, PC mount

Capacitors

C1, C4, C6, C8, C9, C13, C15, C18, C20, C23, C28—0.47 µF, 35 volts, tantalum
C2—0.5 µF, ceramic disc
C3, C22—100 pF, ceramic disc
C5, C16—0.22 µF, 35 volts, tantalum
C7, C19—2.2 µF, 35 volts, tantalum
C10, C11, C14, C25, C26, C29—0.01 µF, ceramic disc
C12—47 pF, ceramic disc
C17—0.01 µF, ceramic disc
C21—10 µF, 16 volts, electrolytic
C24—500 µF, 25 volts, electrolytic
C27—100 µF, 16 volts, electrolytic

Semiconductors

IC1—4514 1-of-16 data selector
IC2—4520 dual binary counter
IC3—4040 12-stage binary ripple counter
IC4—5101L-1 256 × 4 static RAM
IC5—4066 quad analog switch
IC6—4515 1-of-16 data selector
IC7—50240 top-octave generator (AMI, Mostek)
IC8—4067 1-of-16 analog switch
IC9—4082 dual 4-input AND gate
IC10—386 ½-watt audio amplifier
IC11—4511 BCD-to-7-segment-display decoder/driver

IC12—4553 3-digit counter
IC13—7805 five-volt positive regulator
IC14—4093 quad 2-input NAND Schmitt trigger
IC15—4049 hex inverter
SCR1—ECG 5400 or equivalent
Q1—2N2222A or equivalent NPN silicon transistor
D1—D3, D5—D7, D9, D11, D13, D17, D18—1N34A germanium diode
D4, D8, D10, D12—1N914 silicon diode
D14, D15—1N4001 silicon diode
D16—1N4003 silicon diode
DISP1—DISP3—FND 359, common cathode 7-segment displays with decimal point
LED1—LED13—miniature red LED
LED14—LED16—miniature green LED
S1—S3, S7—DPDT miniature switch
S4—S6—SPST normally open momentary switch
S8—SPDT miniature switch
S9—S24—SPDT miniature lever-type switch, Radio Shack 275-016, or equivalent
J1—miniature N.C. chassis-mount phone jack, Radio-Shack 274-253 or equivalent
SO1, SO2—female header strips, AP Products 929974 or equivalent
PL1—PL5—male header strips, right-angle, AP Products 929835 or equivalent
PL6—male header-strip, AP Products 929834 or equivalent
B1—B8—1.5-volt alkaline "AA" cell
B9—B11—nickle-cadmium "button" cell, 20 mAh, or larger
Miscellaneous: PC boards, IC sockets, female header-strips (AP Products 929974 or equivalent) for interconnections (see text), solder, wire, case, etc.
A set of the five PC boards, etched and drilled, but not plated through, is available from Hal-Tronix, PO Box 1101, Southgate, MI 48195. The price is \$39.95. Please add \$2.00 for shipping and handling. MI residents add 4% tax.

TABLE 2—BOARD 2/BOARD 3 CONNECTIONS

Pin number	Switch number and position	Connection
1	S2-b, WRITE	From Board 2, pin 17 (IC15, pin 6)
2	S2-a, center	" " " " 4 (IC3, pin 11)
3	S2-b, center	" " " " 5 (IC8, pin 15)
4	S3-b, MANUAL	" " " " 15 (IC6, pin 1)
5	S3-a, center	" " " " 2 (D3, D6 junction)
6	S3-b, center	" " " " 1 (Blanking)
7	S3-a, AUTOMATIC	" " " " 14 (IC15, pin 3)
8	Various	" " " " 6 (Ground)
9	S7-b, PLAY	" " " " 16 (IC15, pin 7)
10	S7-a, center	" " " " 15 (IC6, pin 1)
11	S7-b, center	" " " " 7 (IC5, pins 5, 6, 12, 13)
12	Various	" " " " 13 (+V)
13	S1-a, center	" " " " 12 (IC3, pin 4)
14	S1-a, 2 TUNES	" " " " 10 (IC4, pin 7)
15	S1-b, 2 TUNES	" " " " 9 (IC2, pin 12)
16	S1-b, center	" " " " 11 (R-12)
17	S1-b, 4 TUNES	" " " " 8 (IC2, pin 13)
18	S1-a, 4 TUNES	" " " " 3 (D18)

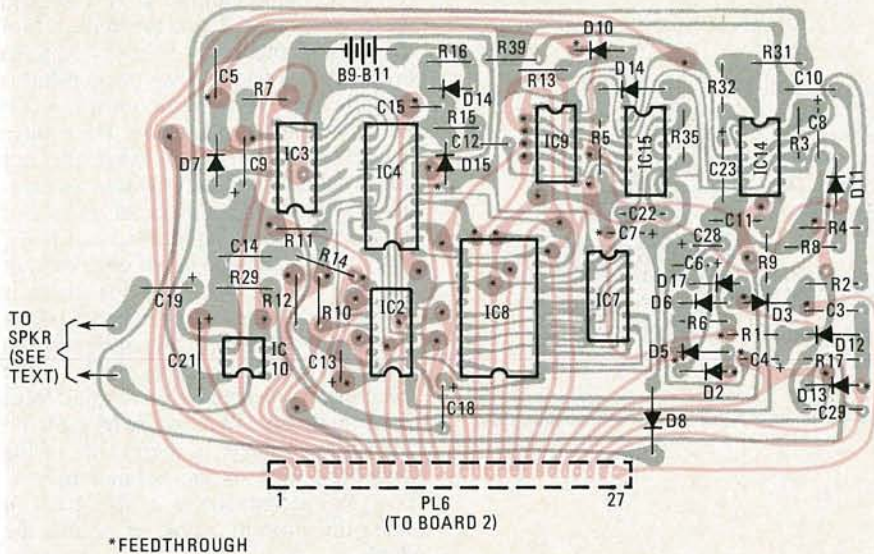


FIG. 12—PARTS-PLACEMENT DIAGRAM for Board 1. Note that female header, PL6, mounts on the foil side of the board.

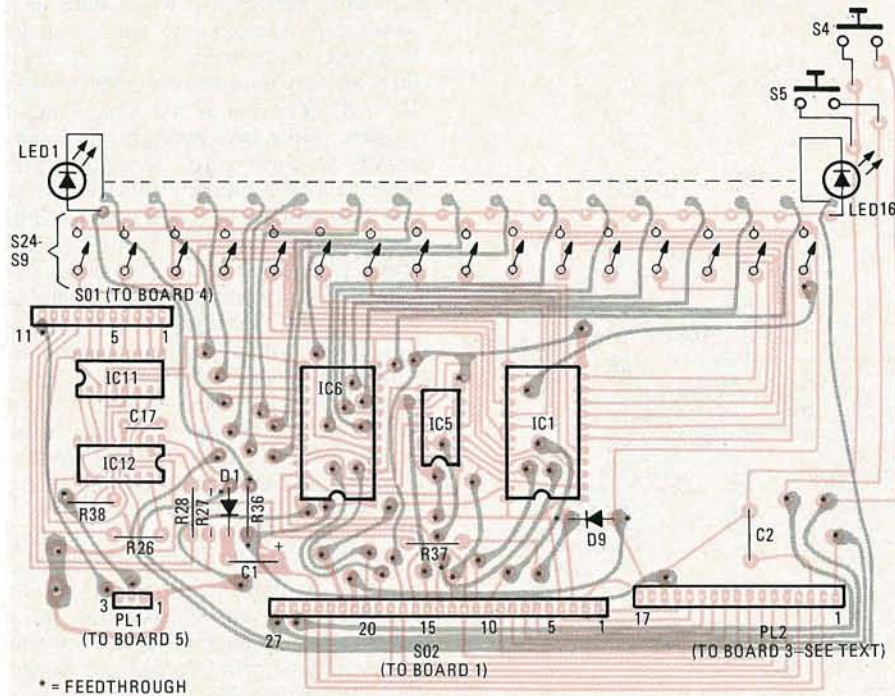


FIG. 13—AS SHOWN HERE, the cathode connections for LED1-LED16 are located on the foil side of Board 2.

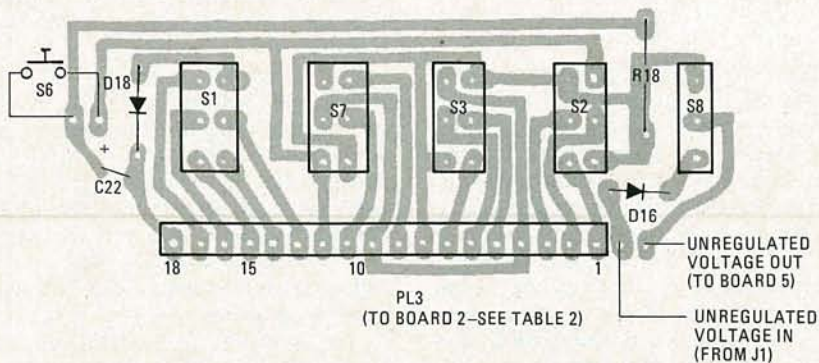


FIG. 14—THIS TINY, single-sided, board can be mounted anywhere that is convenient. In the prototype it was mounted in a "piano bench."

that they are on two separate boards. Resistor R40 is on the display board because locating it there allows us to test the board all by itself.

Keyboard display

The last part of the Pianomatic that we'll look at is the keyboard display, controlled by IC6, a one-of-sixteen data selector similar to the keyboard selector, IC1. The output-data bus is monitored by IC6; that IC puts a low at the pin selected by the word on the bus. Those outputs are used to turn on small LED's buried in the piano keys. The inhibit input is connected to the center pole of switch S7-b, half of the PLAY/MEMORY switch. That means that the LED's will be turned on only when the memory is enabled. Since only one LED will be on at a time, we only need a single current-limiting resistor, R36.

Construction

Now that we understand how the Pianomatic works, we can put it together. You could use perfboard and wire wrap the whole thing—after all, the pyramids were built thousands of years ago with primitive tools and they've lasted—but the use of printed-circuit boards is strongly suggested. The PC-board patterns for the device are shown in Figs. 5-11; the parts-placement diagrams are shown in Figs. 12-16. If those are used, the project becomes neater and cleaner.

There's nothing particularly complicated about the construction of the Pianomatic. The circuit has been designed to fit on five separate boards. The interconnection diagram for the boards is shown in Fig. 17 (which appears next month). The interconnection between boards 2 and 3 is a little complicated, so to simplify things it's been listed in Table 2.

There is one small complication with the boards: two of them—boards 1 and 2—are, unfortunately, double sided. Don't forget to solder small pieces of wire to both sides of the double-sided boards as feedthroughs. All feedthroughs are indicated by asterisks on the appropriate parts-placement diagrams. Where possible, the feedthroughs were done on the legs of the components, but there are some that had to stand by themselves.

A few important points: First, note that the pads for the LED's are on the front of board 2 in between the pads for keyboard switches S9-S24 (see Fig. 13). Notice that the cathode pads are on the component side of the board and the anode pads are on the foil side. Also, the cathode of LED16 is used as a feedthrough between the two sides of the board; be sure to solder it on both sides of the board. Finally, watch the polarity of electrolytics and IC's and above all, use IC sockets.

There are several options available to you in building the Pianomatic and one really tricky thing to watch out for. You can change the speed of the tremolo by

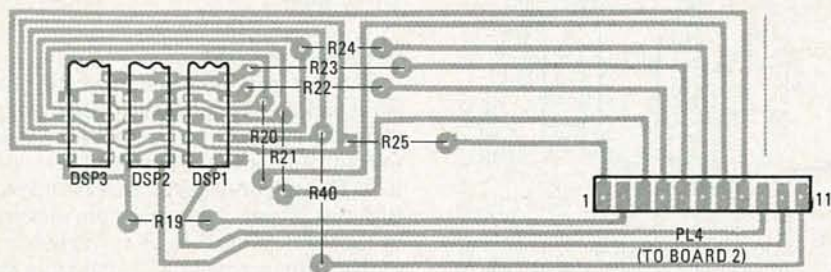


FIG. 15—THE DISPLAY BOARD mounts directly on Board 1 using a right-angled male header, PL4.

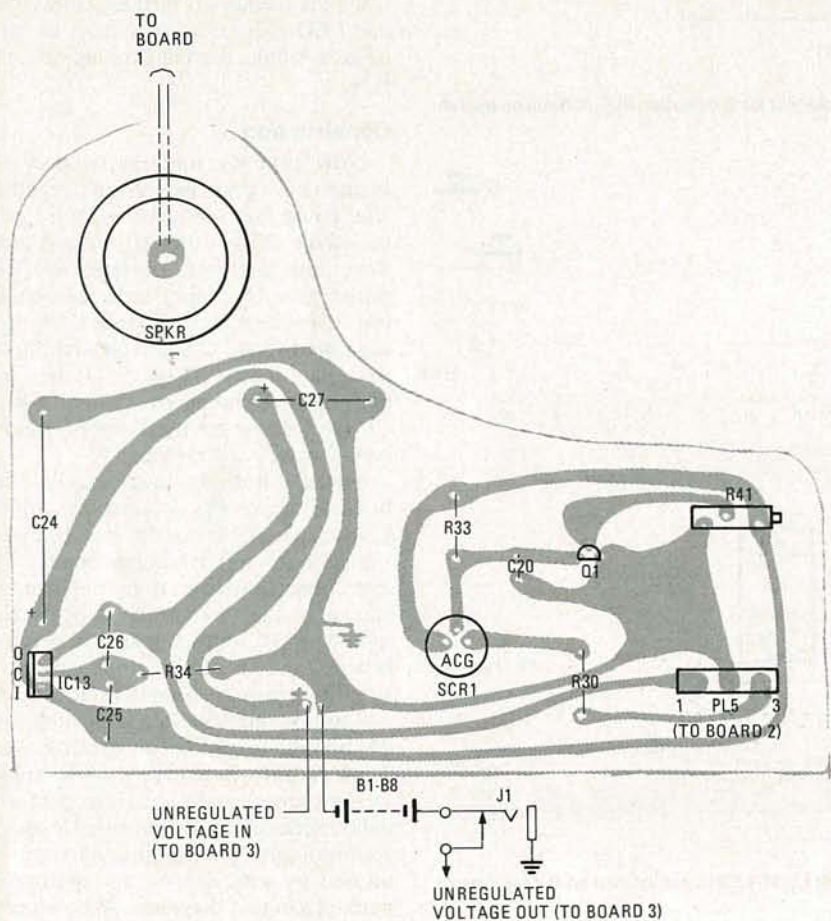


FIG. 16—MOST OF THE POWER-SUPPLY COMPONENTS mount on Board 5. Batteries B1-B8 and jack J1 can be mounted anywhere that is convenient. In the prototype they were mounted in the wood base.

adjusting the value of R32. Raising the value will slow it down and lowering the value will, logically enough, speed it up. The pitch of the Pianomatic can be changed by adjusting the parameters of the oscillator made from IC15-e and IC15-f. Just plug the values of R35 and C22 into the formula $f = 1/2.2RC$ and you'll be OK. Remember, though, IC7 does a good deal of division internally. The lowest note available from IC7 is the input frequency divided by 478, so bear that in mind when you start substituting values.

The tricky part of the Pianomatic is the tempo clock. Getting it to work in the manual mode is straightforward and shouldn't present any problems—getting it to work in automatic is something else. The problem comes about because you're operating at the upper and lower trip points of the Schmitt trigger. Although things seem clear cut when they're on paper, and formulas and graphs indicate all sorts of precision, dealing with the real world is quite another matter.

The important parameters in the tempo clock are R2, R3, and R4. Resistor R3

serves the same purpose as R31 does in the tremolo clock. It sets the frequency of the clock. Either R3 or C8 can be altered to change the tempo. The relationship is complicated but is of the form $f = (1/RC)K$, where K is a constant. The voltage divider made up of R2 and R4 is what sets things up for automatic playback. In manual playback, the voltage at pin 12 of IC14-d should be at ground when the clock is disabled and about one third below the supply rail when the clock is enabled (when the start switch, S4, is kept closed). In automatic, the voltage of pin 12 should be half the supply voltage when the clock is disabled. Now, mind you, that is in theory. What we're trying to do is keep the voltage in the middle of the dead-band area of the Schmitt trigger. That way it only takes a little push in either direction to enable or disable the clock.

When you put your Pianomatic in automatic, one of three things will happen—it will work perfectly, it won't start, or it won't stop. Assuming the pin-12 voltage is correct, the problem facing you is that there are variations in the dead band from IC to IC. You'll find that some Schmitt triggers have a dead-band area that tends to favor the upper end of the supply, while others favor the lower end. That is normal and the solution is to vary R2 and R4 until the circuit works. Now, nothing would make us happier (well, a few things would) than to give you numbers, but that is impossible. We've taken our Pianomatic, which works perfectly, and substituted different 4093's for IC14. Some would work and some wouldn't, even though no other changes were made in the circuit. Even IC's from the same production run will have different trip points. Be comforted by knowing that any of those IC's could be made to work by fooling around with the values of R2 and R4. The best way to find the correct values for your circuit is to realize that varying R2 is going to have a much greater effect than playing around with R4. We've seen that R4 has a function when the Pianomatic is in manual as well as automatic playback—it pulls pin 12 low to stop the clock. On the other hand, R2 has no purpose in life other than keeping pin 12 in the middle of the dead-band area when the Pianomatic is set to automatic playback.

Raising the value of R2 will lower the voltage on pin 12 and lowering the value will raise the voltage. If your Pianomatic won't start playing in automatic, the voltage on pin 12 is too low—if it won't stop playing, the voltage is too high. Don't make heroic changes in the value of R2, however, because, as you'll discover, a handful of ohms will go a long way. In fact, going up or down about 2K should solve the problem.

Next month the final installment on the Pianomatic will discuss the voltage-regulator circuit, operation, troubleshooting, and calibration. **R-E**

TAFT

ELECTRONIC SALES

HAS IT ALL FOR LESS

OVER 10,000 PARTS IN STOCK-CALL FOR LOW PRICES



\$88⁸⁸

“ALL-IN-ONE VIDEO PROCESSING CENTER”

- STABILIZER - Eliminates picture roll/jitter
- IMAGE ENHANCER - Adjusts picture contrast/clarity and detail for improved home viewing and recording or dubbing
- RF CONVERTER - Converts video and audio direct line outputs from any VCR component, TV or video camera to an "RF" signal
- VIDEO FADER - Produces gradual "fade-ins" or "fade-outs" with professional results
- DISTRIBUTION AMPLIFIER - Provides extra signal gain needed for best results (dual output)

COMPUTER POWER SUPPLY



\$69

4 CHANNEL SWITCHING

- +5V@5A, -5V@1A, +12V@1A, -12V@1A
- INPUT 90-130V AC
- REGULATION: LINE ±0.2% LOAD ±1%
- RIPPLE: 30 MV P-P



FLUKE

- 8060A **\$345**
- 8062A **\$267**
- 8022B **\$143**
- 8020B **\$193**
- 8024B **\$247**

BECKMAN

- 300 **\$109**
- 310 **\$129**
- 330 **\$199**

Xcelite®



- TC-100ST XCELITE'S BEST CONTAINS 53 TOOLS **\$329**
- TC-150ST SMALLER VERSION **\$279**



- 99SM ROLL KIT **\$65**

BK PRECISION



- 1476P-10MHZ DUAL TRACE **\$439**
- 1477P-15MHZ DUAL TRACE **\$495**
- 1479BP-30MHZ DUAL TRACE **\$609**
- 1570P-70MHZ QUAD TRACE **\$1049**

PRICES INCLUDE PROBES



3 1/2 DIGIT MULTIMETER



\$79.88

MODEL 8050

- 8 separate functions (30 ranges) including diode and transistor check, 10 AMP range on AC and DC
- Single rotary switch for all functions/ranges
- Accuracy ±0.5% DVC
- 6 1/4" x 3 1/2" x 1" Small enough to fit into shirt pocket
- One year parts and labor warranty

#CC531 Carrying Case — **\$9.90**

VIDEO ACCESSORIES BY ARISTA

MASTER VIDEO SELECTOR



\$16.88

#5000

- Brings all video components under simultaneous control
- Eliminates unnecessary extra wiring
- Low loss bypass routing handles up to 5 inputs including cable converter, disc player, video games, TV antenna or cable, home computer, TV, VCR and auxiliary
- With touch of switch your TV turns into a multi-media event

MAGNETIC BULK ERASER



\$29.88

#5410

- Thoroughly erases video and audio from all video cassettes
- Takes only minutes to remove all information
- On-off switch with LED indicator
- Fuse protected line power/automatic thermal protection
- More efficient erasure than VCR erase heads

DISTRIBUTION AMPLIFIERS



As low as

\$8.88

- #945 — 25DB, FM trap, UHF/VHF/FM-**\$24.88**
- #910 — 10 DB, VHF/FM-**\$8.88**
- #911 — One input, four 3 DB outputs, VHF/FM **\$11.88**

STEREO SIMULATOR

For TV and VCR



\$17.88

#780

- Achieve simulated stereo with simple hook-up
- Enables TV or VCR to play through your stereo system and Hi-Fi speakers
- Eliminates tiny and tinny TV speaker sound

75 OHM INDOOR/OUTDOOR SPLITTERS



#1900 - 2 set - **\$1.88**

#1930 - 3 set - **\$3.88**

#1940 - 4 set - **\$4.88**

COAXIAL SIGNAL SWITCH



\$3.88

#4550

75 OHM INPUT
75 OHM OUTPUT

A/B/C COAXIAL SWITCH



\$6.88

#4540

TRIPLE PLAY! Select choice of signal antenna, cable or video player or decide if video tape or disc will play through one set, two or three. Easy to connect.

Standard "F" Connections

TAFT ELECTRONIC SALES

68 W. 45th Street
N.Y.C., N.Y. 10036

CALL
212-575-
8632

- MASTER CHARGE
- VISA
- MONEY ORDER
- CHECK
- 25% DEPOSIT ON C.O.D.'s

ADD FOR SHIPPING
UP TO \$300.00 - \$5.50
OVER \$300.00 - \$8.00
N.Y.S. ADD SALES TAX

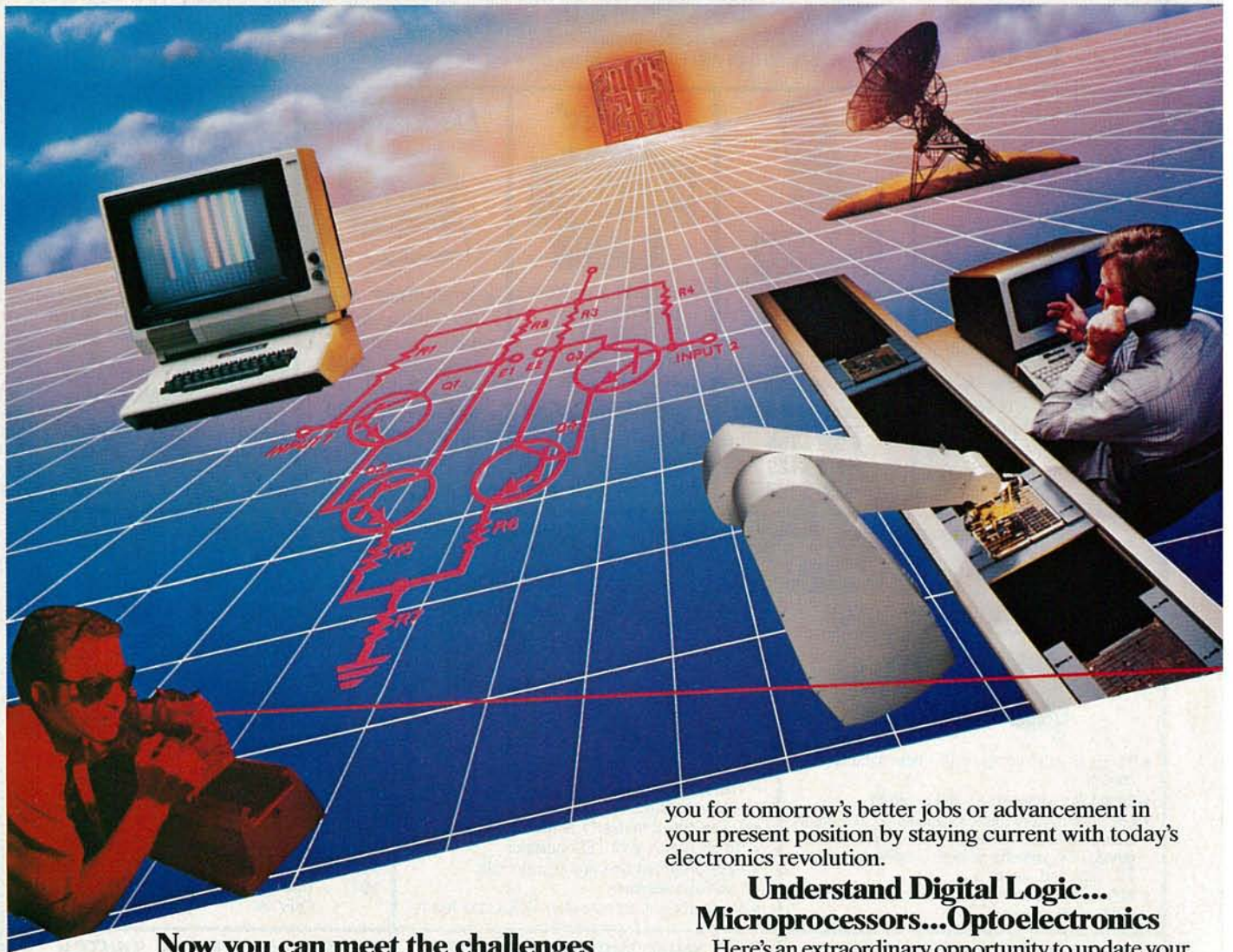
CIRCLE 38 ON FREE INFORMATION CARD

OCTOBER 1983

69

MASTER THE "NEW ELECTRONICS" WITH MCGRAW-HILL'S

Contemporary



Now you can meet the challenges of today's incredibly rapid changes in electronics quickly and easily. This professional level electronics learning series is as innovative as the circuitry it explains and as fascinating as the experiments you build and explore!

From digital logic to the latest 16-bit microprocessor, you master one subject at a time with McGraw-Hill Concept Modules sent to you one at a time, once a month, to make up the complete CONTEMPORARY ELECTRONICS SERIES. Each module of the fifteen in the Series is a unique blend of "hands-on" experience, interactive audio cassettes, and vividly illustrated printed support materials. Together they will prepare

you for tomorrow's better jobs or advancement in your present position by staying current with today's electronics revolution.

Understand Digital Logic... Microprocessors...Optoelectronics

Here's an extraordinary opportunity to update your understanding of today's most important technological changes in electronics. You can start from scratch or use the Series to update yourself. You cover the latest integrated circuits, including TTL, CMOS, and ECL digital circuits; op-amps; phase-locked loops; microprocessors; and opto devices such as LEDs and LCDs.

Perform Electronic Experiments

With your first module you'll use the latest digital integrated circuits to build an oscillator circuit that demonstrates digital signals — verified visually by the flash of light emitting diodes (LEDs) and audibly by tones produced through the mini-speaker that is provided.

You'll learn concepts applicable to all electronic circuits. With the first module, you will be able to identify the major passive components, like resistors, capacitors, inductors, diodes and transformers, and active

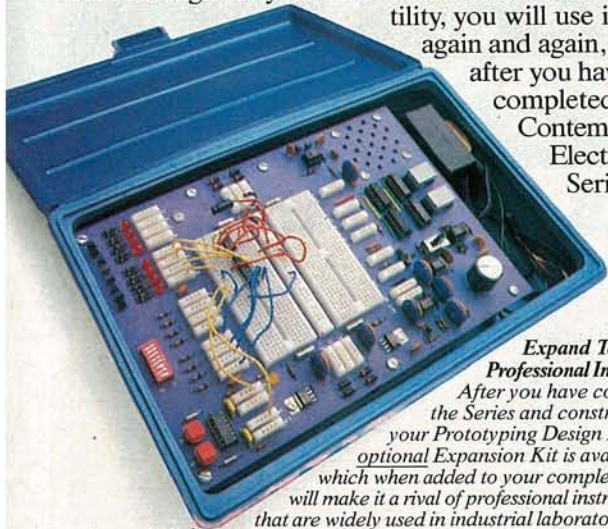
Electronics Series

components such as transistors and integrated circuits.

Each Concept Module goes right to the heart of the matter. You waste no time on extraneous material or outdated history. It's a fast, efficient, and lively learning experience, a nontraditional approach to the most modern of subject matter.

Construct and Use a Prototyping Design Laboratory

You will construct a professional Prototyping Design Laboratory which will be a valuable learning tool throughout your studies. Because of its versatility, you will use it again and again, even after you have completed your Contemporary Electronics Series.



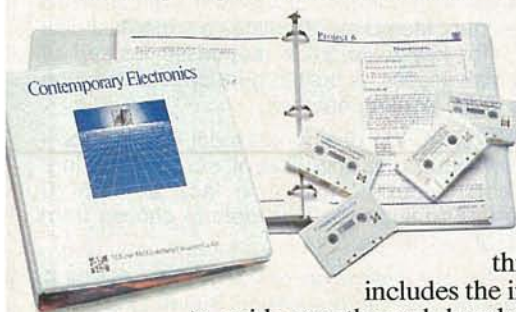
Expand To Rival Professional Instruments
After you have completed the Series and constructed your Prototyping Design Lab, an optional Expansion Kit is available which when added to your completed lab will make it a rival of professional instruments that are widely used in industrial laboratories for electronic design and development as well as testing and measuring.

Unique Interactive Instruction Makes Learning Easy

With each new module you'll receive a McGraw-Hill Action-Audio Cassette, a proven successful method of interactive instruction. Each tape creates a dynamic dialogue that not only quickly communicates the facts, but makes you feel that you're participating, as you respond to questions and listen to problems being solved.

Your ability to rapidly make this knowledge your own is further aided by a strikingly original technique for using diagrams, illustrations and schematics to

drive home points made as you listen to the cassette. Carefully indexed binder that contains this material also



includes the instructions to guide you through hands-on experiments. Finally, having completed the Series, you can

be awarded a Certificate of Achievement from McGraw-Hill upon passing an optional final examination.

YOU COVER EVERY SUBJECT IN CONTEMPORARY ELECTRONICS

- Digital logic
- Digital gates (TTL, CMOS, ECL, NMOS)
- Flip flops
- Counters and Registers
- Op-amps and Applications
- Combinational logic circuits (ROMs, PLAs, decoders, etc.)
- Circuit analysis. LCR networks
- Transistors (bipolar and FETs), diodes and thyristors
- Integrated circuits (linear and digital)
- Oscillators
- Optoelectronics
- Microprocessors
- Voltage Regulation
- Advanced Digital Concepts

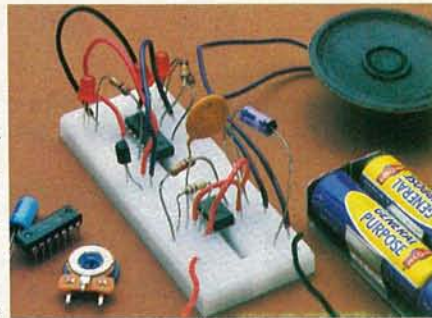
Update Your Knowledge of the New Electronics

This program is for you whether you're a scientist who can use electronics to improve or speed up your investigations...a teacher who'd benefit from a refresher in contemporary components, circuits and applications...a manager or supervisor in an electronics related business or industry...an engineer in another field who finds electronics playing an ever more important role in your work...

someone looking to find new direction in this wide open field...or the kind of person who wants to understand what's going on in the world around you.

McGraw-Hill's Contemporary Electronics Series offers you the quickest and probably least expensive learning method available today, and the only one with "hands-on" experience. The only equipment you will need to complete the experiments in the Series is a multimeter, which is not included.

The First Module Includes a Solderless Breadboarding System
It enables you to connect components and build electronic circuits easily and quickly. You'll use it throughout the Series to build and test your own contemporary circuits. Each module includes an essential hands-on experiment with real electronic components to give you a clear understanding of contemporary electronics.



15-Day Trial

To order your first module under our 15-day trial examination, simply complete the card and send today! If card is missing, write us for ordering information: McGraw-Hill CEC, 3939 Wisconsin Ave., Washington, DC 20016.



Compare Radio Shack's TRS-80® Model 4 With IBM® and Apple®



Model 4 Wins! And You Save Up to \$1014

Description	Radio Shack Model 4	IBM PC	Apple IIe
Two-Drive Unit	\$1999	\$1864	\$1995
Formatted Disk Capacity	174Kb each (TRSDOS)	180Kb (DOS 2.0) 160Kb (DOS 1.0)	124Kb (DOS 3.3)
80-Column	Included	Included	Included
Monitor	Included	\$345	Included
Monitor Adapter	Not Required	\$335	Not Required
First Drive	Included	Included	Included
Second Drive	Included	\$289	\$395
Parallel Printer Interface	Included	Included	\$165
Serial Interface	Included	\$120	\$195
Reference Books	Included	Included	\$50
Numeric Pad	Included	Included	\$159.95
Diskette Operating System	Included	\$60	Included
Total	\$1999*	\$3013	\$2959.95

Radio Shack®
The biggest name in little computers®
A DIVISION OF TANDY CORPORATION

*Price applies at participating Radio Shack stores and dealers. IBM is a registered trademark of International Business Machines Corp. Apple is a registered trademark of Apple Computers. CP/M is a registered trademark of Digital Research, Inc. Prices based on manufacturer's literature.

Send me a free TRS-80 Model 4 brochure today!

Mail To: Radio Shack, Dept. 84-A-836
300 One Tandy Center, Fort Worth, Texas 76102

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

TELEPHONE _____

TRS-80 Model 4 Is the Logical Choice. For performance and price, our Model 4 desktop computer is the professional approach to improving your productivity. It has features built-in that cost extra in other computers—features that will make your job a lot easier.

Designed to Make Hard Work Easy. The easy-to-read 80-character by 24-line display and 64,000-character memory make Model 4 perfect for complex spreadsheet analysis. To speed operations, our "MemDisk" emulates a super-fast disk drive in memory for keystroke-quick responses instead of time-consuming disk access. A built-in print spooler lets you work on one job while printing another.

Versatile and Powerful. We designed Model 4 to be completely compatible with our existing line of word processing, time management, electronic filing—in fact, *all* TRS-80 Model III software. And soon you'll be able to choose from thousands of CP/M®-based programs.

See It Today. Get a demonstration of the TRS-80 Model 4 (Cat. No. 26-1069) at your nearest Radio Shack Computer Center, participating store or dealer. Be sure to ask about our leasing, training and service plans, too.

CIRCLE 61 ON FREE INFORMATION CARD

Computer[®]

©Copyright Gernsback Publications, Inc., 1983

IT HAS BEEN ONLY A YEAR SINCE THE last **Your Own Computer** hardware buying guide was published, but what a year it has been! Almost overnight, the shape of the microcomputer world has been changed. A generation of new microcomputers has appeared, bringing low-cost computing power to price levels unimagined at the time.

The primary change that brought this about has to do with economics more than anything else. As recently as five or six years ago, the small piece of silicon that carries the number-crunching circuitry—the CPU (Central Processor Unit)—cost as much as \$50 or more in small quantities. Yes, they were used in many items and as they became more common their cost began to drop. Soon they were selling for \$20, and shortly thereafter for \$10. The economies resulting from mass production techniques were making themselves felt.

At the same time, the price of mass memory fell dramatically. No longer was the price of this key ingredient in the makeup of a personal computer pro-

COMPREHENSIVE BUYERS GUIDE TO COMPUTER SYSTEMS

MARC STERN

Under \$500

\$500 - \$1000

\$1000 - \$1500

\$1500 - \$2000

\$2000 - \$2500

\$2500 - \$3000

\$3000 - \$3500

\$3500 - \$4000

\$4000 - \$4500

Over \$4500





A NEW GENERATION OF COMPUTERS, the lap computer, makes its appearance this year.

hibitive. Instead, like the price of CPU's, the price of the memory IC's used to store information for use by the microcomputer fell to low levels, with the result that there are now home computers that have as much on-board memory as some of last year's higher-priced models. This development in the home-computer market is perhaps more dramatic than any other that has occurred in the last few years.

8-bit/16-bit CPU's

The face of the microcomputer industry is changing. No longer is the industry standardized around an 8-bit CPU (the length of a digital "word"). Instead, the standard word size found in many of today's moderate and higher-priced home-microcomputer systems is 16-bits. A 16-bit CPU can address more memory space. Where the 8-bit machine is limited in its memory-addressing capability to 64K bytes (actually 65,536 bytes) of memory to perform its tasks, the 16-bit CPU can address more than 1 megabyte. Thus, the 16-bit CPU can handle tasks that are far too complex for the 8-bit machine to handle and it can handle those tasks faster.

It should be noted, though, that 8-bit CPU's are still more than powerful enough for the average, single home user, so it isn't necessary to spend the extra money for a 16-bit system, unless you need its extra computing power.

The inevitable move to 16-bits has been spurred by the entry of IBM into the microcomputer market. Long dominant in the mainframe world, this computer giant jumped into the micro world nearly two years ago and, since that time, it has become a major force. Of course, Apple, Radio Shack, Heath, and Commodore Business Machine microcomputers are still abundant; but it has been estimated that nearly 20 percent of the microcomputer market is held by IBM and, with such representation in the market, it naturally calls the tune.

Thus, more and more microcomputer systems are becoming IBM-workalikes, IBM-lookalikes or IBM-compatibles. They also run similar operating systems to IBM's PC-DOS. In the non-IBM world, this disk operating system is known as MS-DOS and you will see many references to it in the "Operating System" category of the pricing charts included in this buying guide. Such is the success and dominance of this microcomputer system that other computer manufacturers are going out of their way to make their machines compatible.

In a sense, this is a good move because it provides a measure of standardization in an otherwise nonstandard, incompatible market. Just as IBM's 8-inch floppy-disk format became a standard, so to has its operating system become a standard for the micro world. However, it should be realized that though a

machine may be capable of running MS-DOS, it may still be incompatible with others on the market because of incompatible storage formats. That is one facet of the microcomputer market that has yet to be worked out.

This trend has its parallel in the 8-bit world. The CP/M (Control Program/Microcomputers) operating system became the de facto 8-bit standard operating system because of its early headstart and subsequent dominance in this sphere. Yes, there is a 16-bit version of CP/M (CP/M-86), but it hasn't achieved the dominance of MS-DOS.

Portable computers

Another trend over the last year has affected the so-called portable market. Just a year ago, this type of computer was the rage of the microcomputer world. It had the following attributes: a small CRT screen (5 to 9 inches) built-in; two disk drives for storage; or comprehensive software applications packages included, and weighed up to 30 pounds. At this weight, these machines were certainly transportable, but were they portable? Obviously, the microcomputer industry didn't believe they were because it has come out with a new generation of lap computers (also called notebook or briefcase computers) which weigh between 9 and 11 pounds. This new generation has also split the "portable" market into the transportable computer market, as the heavier machines are called, and the lap-machine market, as the new notebook-sized machines are called.

Last year's portables are as different from these machines as day is from night. Where last year's portable had the two power-hungry drives and the CRT, this year's crop of lap computers is capable of running off battery power. And, where last year's group of machines included software packages that were stored on minifloppy diskettes that had to be inserted into the drives before they could be used, this year's breed of lap computers includes software that is part of the machine itself. This software is stored in ROM (Read-Only Memory) and is accessed with the push of a button. Typically, this software includes some variety of text editor, electronic mail system, appointments calendar and more. The lap computer usually includes at least 16K of user memory (RAM) with the upper limit being either 32K or a full 64K.

Like last year's portables, the majority of today's lap machines are driven by 8-bit CPU's, although some contain 16-bit CPU's. These microcomputers, though, aren't power-hungry. Instead, they are CMOS 8- or 16-bit microcomputers, which mean these machines can rely on battery power.

Unlike last year's portables, though, these compacts rely on liquid crystal displays, rather than cathode-ray tubes. Using this remarkable technology, the industry has been able to develop 8-line by 40-character displays for the new generation of lap computers. This means these devices are free of the need for large power-supplies and AC outlets.

Generally, these machines—like last year's models—feature full-travel, typewriter-style keyboards, which is a remarkable feature, when you consider that microcomputers of the same size class last year featured membrane or rubber overlay keyboards.

Like their larger counterparts, though, the new portables also feature some sort of storage medium. Some feature cassette interfaces for mass storage, while others—the Epson QX-10, for instance—have integral minicassette data storage. Still other portables use the more traditional minifloppy disks for storage, although they are capable of storing some information that may have been generated in the field in RAM.

An interesting use of RAM has been made by Athena Computer and Electronic Systems in its *Athena I*. Instead of using two disk-drives for mass storage, it uses RAM configured as a storage device. This allows a user to load applications software and files and use this memory space for work. The key advantage to using RAM in this configuration is a manyfold increase in speed because the necessary program files are available in memory for instant use. There is no need to wait for a disk access that slows program speed.

It must be noted that although RAM drives, as these are termed, are very quick and speed things up greatly, they are also volatile. In other words, the contents of these drives disappear as soon as the power is turned off. So, unless you want to keep the computer on all the time, you must eventually empty the contents of the RAM drive to some sort of storage device, which the *Athena I* does. It provides one standard drive for storage.

About this supplement

In this year's **Your Own Computer** supplement, we will take a look at small computer systems in order of increasing price, from below \$100 to over \$4500. A series of charts will help you understand how small-computer systems become more powerful as their prices increase. They will also show you the trends that we have just mentioned.

In a departure from last year's supplement, we have omitted printers because of the wide variety available for a wide range of prices. This means that instead of having to rely on a manufacturer's suggested printer, the small-computer buyer can find one of his own, within his price range. And, since most printers interface with small computers in only one of two manners, serial or parallel, there should be little trouble interfacing the printer with the computer. Thus, because of the disparity in printer prices and varieties, we leave it up to the individual buyer to make his own choice.

As for the system prices you will find they might differ somewhat from what you may see advertised. The reason is quite simple, we are using the *manufacturer's suggested retail price* as the basis for our pricing considerations. Using this type of guideline provides a more objective standard by which to judge the many systems on the market.

Many, but not all, computers can be purchased ready to plug in and run. They will usually have a minimal amount of standard memory and provisions for a video display. Further, they will also usually have some provision for storing programs and data, either on cassette tape or floppy disks. Most of our systems assume that—after the lowest price level—you will be buying one of the display devices offered by the manufacturer. The prices reflect this, although it should be noted that you can also buy a monitor yourself and save money with it.

Regardless of whether a particular device is included with our listings, the computer can usually be purchased without it and, in many cases, you will want to do that and then add the peripherals that best meet your needs.

For your own shopping, though, one of the items that must be carefully considered is the amount of memory available for a system. Memory is the most vital consideration in any small-computer system. The reason is that without it, the system is little more than an inert box, capable of little or nothing. Memory is vital because it provides an area in which to store and manipulate data.

Most small computers come with a minimal amount of user memory, usually ranging from 4K to 16K. While this level is adequate for game-playing and simple home applications, a computer used for more serious purposes will generally require at least 48K or more memory and most of the systems mentioned in our supplement can be expanded beyond this point. And, with the new generation of memory-intensive 16-bit programs coming onto the market, 48K is not enough, with a minimum of 64K preferred, although 128K is better.

Some of the computers you will find listed here are "micro-mainframes." These systems are little more than boxes housing the CPU, disk drive storage devices and motherboard—the board that carries the bus signals. Usually found on high-end systems, these machines have several input/output ports and you will also find that these systems must have terminals or workstations attached to them before they can become useful. Typically, these systems are usually found in multiuser environments, although a single user can function with one, too.

Every small-computer system comes with some means of mass data storage. The device can be a cassette interface or floppy-disk drives and controller. These devices allow data to be



stored for future use. Our tables show the typical configuration for the price range in question. In nearly every case, there are other alternatives open to the user, but it should be kept in mind that these are more expensive. For instance, the typical dual-drive 5¼-inch configuration may add \$300 to \$500 to the cost of a typical one-drive system, while an 8-inch drive may add \$1500 or more. Also keep in mind, though, that higher-density storage options increase the usefulness of the system, but at a cost. For instance, a double-sided, double-density 8-inch floppy disk storage system is capable of storing 2 megabytes of information or about 16 million bits of information (8 bits to a byte).

Some of our completed systems mention "hard" or Winchester disk storage. These fixed medium storage devices are capable of huge amounts of storage, 5 megabytes and up to 20 for the typical 5¼-inch hard disk system. However, they add considerably to the cost of the unit—from \$1500 to \$3000 on average—and they should only be considered for serious computer work.

For the typical small-system user, we recommend a two-drive floppy-disk system. Not only will this give you greater storage, but you will also find it faster to copy files from one disk to another. More important, if you can afford this type of system, is the fact that if the storage capacity of the disk is small, it may not be possible to hold both the DOS (Disk Operating System) and the data you require. In the two-drive configuration, one drive is used to hold the application program and DOS, while the second drive holds the data.

Most systems require the use of a keyboard for input and some type of video display device for output. The most inexpensive computers usually rely on a home television set and interface with the video unit through an RF modulator. You will find the definition and clarity of this type of display device is poorer than a dedicated monitor. The RF modulator will usually be built into the unit or might be an extra-cost add-on and it pays to check.

Some computers, the Heath *H89* or Radio Shack *TRS-80 Model III*, come with built-in video display devices, while others, primarily the micromainframe category, require auxiliary terminals—a combination keyboard and display unit. If you opt for this type of unit, it should be noted that terminal prices start about \$600.

We have tried to give you as complete an indication as possible as to what the display situation is with a particular system. However, it should be kept in mind there might be several possible choices for any system.

The tables included with each price-category section show which computers, features and accessories you can expect to find in a typical system within that price range. If a system has been upgraded from the previous table, the new information appears in blue print in the comments line to the right of the table. The tables will give you an idea of what you can get for a given price; a local computer store will be able to answer your questions and tailor a system to your specific requirements. **R-E**

COMMODORE 64

(more power than Apple II at half the price)

\$139.00*

- 170K DISK DRIVE \$179.00*
- TRACTION FRICTION PRINTER \$119.00*

(* with software savings applied)

COMMODORE 64 COMPUTER \$139.00

You pay only \$239.00 when you order the powerful 84K COMMODORE 64 COMPUTER! LESS the value of the SPECIAL SOFTWARE COUPON we pack with your computer that allows you to SAVE OVER \$100 off software sale prices!! With only \$100 of savings applied, your net computer cost is \$139.00!! LESS a \$49.50 BONUS PACK of 30 programs on tape or disk we give you absolutely FREE!!!

170K DISK DRIVE \$179.00

You pay only \$279.00 when you order the 170K Disk Drive! LESS the value of the SPECIAL SOFTWARE COUPON we pack with your disk drive that allows you to SAVE OVER \$100 off software sale prices!! With only \$100 of savings applied, your net disk drive cost is \$179.00. LESS a \$49.50 BONUS PACK of 30 disk programs we give you absolutely FREE!!!

TRACTION FRICTION PRINTER \$119.00

You pay only \$219.00 when you order the Comstar T/F deluxe line printer that prints 8 1/2 x 11 full size, single sheet, roll or fan fold paper, labels etc. 40, 66, 80, 132 columns. Impact dot matrix, bi-directional, 80 CPS. LESS the value of the SPECIAL SOFTWARE COUPON we pack with your printer that allows you to SAVE OVER \$100 off software sale prices!! With only \$100 of savings applied your net printer cost is only \$119.00.

80 COLUMN BOARD \$149.00

You pay only \$149.00 for this 80 Column Board when it is purchased with a COMMODORE 64 Computer or a Disk Drive or a Printer or a Monitor. If purchased alone the sale price is \$169.00. Included with this board is word processor pack, electronic spread sheet and mail merge data base on two tapes. List \$249.00. (Disk add \$10.00).

EXECUTIVE WORD PROCESSING PACKAGE

SCRIPT 64 EXECUTIVE WORD PROCESSOR is the finest available for the COMMODORE 64 Computer! THE ULTIMATE for PROFESSIONAL wordprocessing application. Featuring simple operation, powerful text editing with a customized word dictionary, complete cursor and insert/delete key controls, line and paragraph insertion, automatic deletion, centering, margin settings and output to all printers. Included is a powerful MAIL MERGE When used with THE COMPLETE DATA BASE PACKAGE. List \$99.00. Sale \$79.00. Coupon Price \$52.00. (Disk only).

COMPUTER AND SOFTWARE SALE

WE
HAVE
THE
BEST
SERVICE

WE
HAVE
THE
LOWEST
PRICES

SPECIAL SOFTWARE COUPON

We pack a SPECIAL SOFTWARE COUPON with every COMMODORE 64 COMPUTER-DISK DRIVE-PRINTER-MONITOR we sell! This coupon allows you to SAVE OVER \$100 OFF SALE PRICES! \$200-\$300 savings are possible!! (example)

PROFESSIONAL SOFTWARE COMMODORE 64		
Name	List	Coupon
Executive Word Processor	\$99.00	\$52.00
Complete Data Base	\$89.00	\$46.00
Electronic Spreadsheet	\$89.00	\$46.00
Accounting Pack	\$69.00	\$32.00
Total 5.2 Word Processor—Plus		
Tape	\$69.00	\$37.00
Disk	\$79.95	\$42.00
Total Text 2.6 Word Processor—		
Tape	\$44.95	\$26.00
Disk	\$49.95	\$26.00
Total Label 2.6	\$24.95	\$12.00
Disk	\$29.95	\$15.00
Quick Brown Fox Word Processor	\$69.00	\$40.00
Programmers Reference Guide	\$20.05	\$12.50
Programmers Helper	\$69.00	\$40.00
Basic Tutor	\$29.95	\$15.00
Typing Tutor	\$29.95	\$15.00
Sprite Designer	\$16.95	\$10.00
Medicinemen	\$19.95	\$12.00
Weather War II	\$19.95	\$12.00
Music-Maker	\$19.95	\$12.00
EDU-Pack	\$24.95	\$13.00
3D Maze Craze	\$24.95	\$13.00
Professional Joy Stick	\$24.95	\$12.00
Light Pen	\$39.95	\$20.00
Deluxe Dust Cover	\$ 8.95	\$ 4.60

(and many other items)

Write or call for

Sample SPECIAL SOFTWARE COUPON!

PROFESSIONAL BUSINESS SOFTWARE EXECUTIVE QUALITY BY TIME WORKS!

The Cadillac of business programs for Commodore 64 Computers

Item	List	*SALE
Inventory Management	\$89.00	\$69.00
Accounts Receivable	\$89.00	\$69.00
Accounts Payable	\$89.00	\$69.00
Payroll Management	\$89.00	\$69.00
Cash Flow Management	\$89.00	\$69.00
Sales Analysis	\$89.00	\$69.00
General Ledger	\$89.00	\$69.00
(* COUPON PRICE \$59.00)		

VIC-20

(a real computer at the price of a toy)

\$77.00*

- 40-80 COLUMN BOARD \$99.00*
- VOICE SYNTHESIZER \$69.00*

(* with Cassette and Gortek purchase)

VIC-20 COMPUTER \$77.00

You get the Commodore VIC-20 Computer for only \$77.00 when you buy at sale prices: The Commodore Data Cassette for only \$69.00 and the Gortek Introduction to Basic program for only \$19.95. TOTAL LIST PRICE \$302.95. SPECIAL PACKAGE SALE PRICE \$165.25.

40-80 COLUMN BOARD \$89.00

A fantastic price breakthrough for VIC-20 owners on this most wanted accessory!! "Now you can get 40 or 80 Columns on your T.V. or Monitor Screen." Plus we add a word processor with mail merge, electronic spread sheet, time manager and terminal emulator!! These PLUS programs require 8K or 16K RAM memory. (Disk add \$10.00).

VOICE SYNTHESIZER \$59.00

Votrax Based. Make your VIC-20 COMPUTER TALK! Has features equivalent to other models costing over \$370.00. You can program an unlimited number of words and sentences and even adjust volume and pitch. You can make adventure games that talk! A must for enhancing your programming creativity and pleasure.

60K MEMORY EXPANDER \$59.00

Sixslot — Switch selectable — Reset button — Ribbon cable. A must to get the most out of your VIC-20 Computer. Includes FREE \$29.95 adventure game.

8K RAM CARTRIDGE \$39.95

Increases programming power 2 1/2 times. Expands total memory to 33K (33,000 bytes). Memory block switches are on outside of cover! Includes FREE \$16.95 game.

16K RAM CARTRIDGE \$69.00

Increases programming power 4 times. Expands total memory to 41K (41,000 bytes). Memory block switches are an outside cover! Includes FREE \$29.95 adventure game!!

12" GREEN SCREEN MONITOR \$109.00

Excellent quality GREEN PHOSPHOROUS VIDEO MONITOR with antiglare, 1920 characters (80 characters x 24 rows). Save your TV! a must for 80 column word processors. PLUS \$9.95 for VIC 20 or Commodore 64 Cable.

12" AMBER SCREEN MONITOR \$149.00

Premium quality AMBER VIDEO MONITOR With antiglare, (80 characters x 24 rows), exceptionally clear screen, faster scanning, 1000 lines. PLUS \$9.95 for VIC 20 or Commodore 64 Cable.

- LOWEST PRICES • 15 DAY FREE TRIAL • 90 DAY FREE REPLACEMENT WARRANTY
- BEST SERVICE IN U.S.A. • ONE DAY EXPRESS MAIL • OVER 500 PROGRAMS • FREE CATALOGS

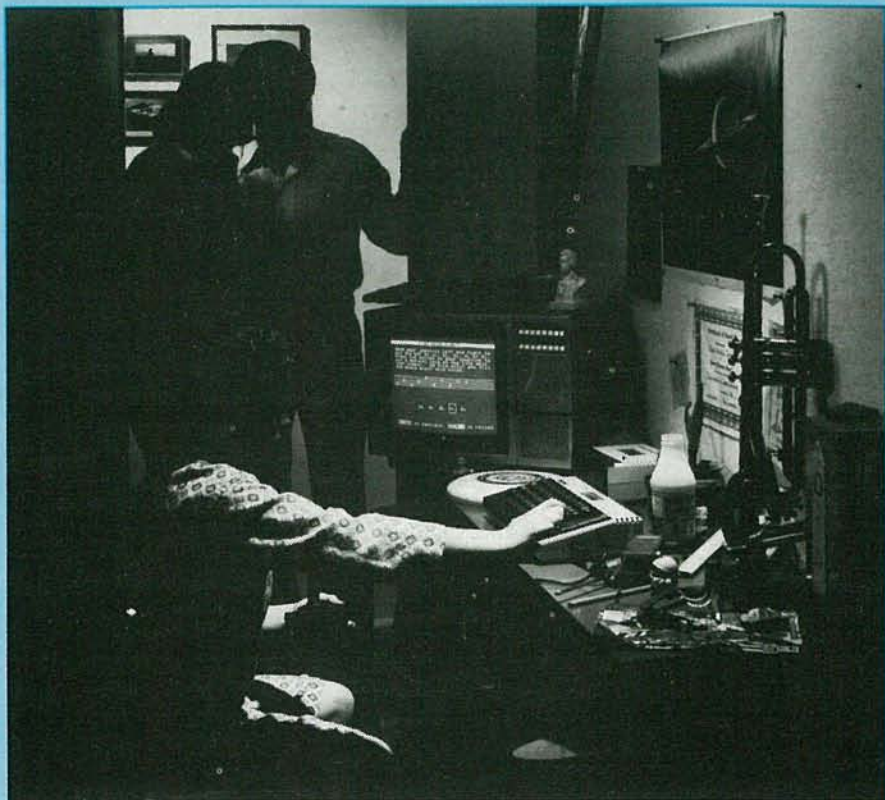
Add \$10.00 for shipping, handling and insurance. Illinois residents please add 6% tax. Add \$20.00 for CANADA, PUERTO RICO, HAWAII orders. WE DO NOT EXPORT TO OTHER COUNTRIES.

Enclose Cashiers Check, Money Order or Personal Check. Allow 14 days for delivery, 2 to 7 days for phone orders, 1 day express mail! Canada orders must be in U.S. dollars. VISA — MASTER CARD ACCEPTED

PROTECTO ENTERPRISES

(WE LOVE OUR CUSTOMERS)

BOX 550, BARRINGTON, ILLINOIS 60010
Phone 312/382-5244 to order



It's amazing how much computer power can be bought for less than \$500. Let's take a look.

Under \$500

MARC STERN

PERHAPS THE MOST VOLATILE SEGMENT OF THE PERSONAL-computer marketplace is the segment under \$500. Since last year's supplement was published, seven new names have joined the ranks of the manufacturers producing machines here. Those manufacturers include some of the leading names in consumer electronics, notably Mattel and Panasonic, while the others include new companies whose products are now just hitting the market.

Timex

Still leading this price segment is the Timex-Sinclair 1000 (formerly the Sinclair ZX81). A tiny machine, about the size of a book, it features 2K of user memory—expandable to 16K—and a cassette interface. Essentially, it is a computer learning machine with which one can begin to understand the basics of microcomputing. Supplied with the 1000 is a BASIC learning guide with which you can learn how to program in this high-level language.

The BASIC programming language is resident in 8K ROM (Read-Only Memory). The 1000's unique multi-function, single-key entry system permits the user to enter BASIC commands and instructions with a single push of the tiny microcomputer's membrane keyboard.

This type of keyboard, which has been used on other machines on the market, is fine for hunt-and-peck typists, but it is lacking for touch typists. In fact, the size of the unit makes speedy text entry nearly impossible.

Capable of interfacing with a home television set as an output device, the 1000 has a limited 32-character by 24-line display. This is less than half the industry-standard 80 by 24 display and this is limiting because the display isn't entirely flicker-free.

Moving up a notch from the 1000, we come to the recently introduced 1500. Driven by a Z80A microprocessor, the same CPU that drives the 1000, the 1500 has an improved keyboard,

with small-sized calculator-type keys, much like those found on pocket calculators. And, while this type of keyboard is better from a tactile standpoint, the experienced typist will be hindered by the non-standard keys.

This mini-microcomputer, which weighs in with a mini-price of \$79.95, has 16K of user memory standard. This feature means it can handle far more complex tasks than the 1000. It also makes the 1500 the first computer in the under-\$100 market that has 16K of resident user memory.

Mass storage for the 1500 is provided with a standard cassette interface. User-generated data can be stored for future use via this interface.

Unlike the more limited 1000, the 1500 can have its memory expanded to 32K, providing more than enough user memory for games and limited home-computing applications.

But like the 1000, video output is handled via a built-in RF modulator that interfaces with a home television set. Both units are also capable of generating black-and-white graphics and include the plot and unplot graphics commands provided in the high-level Extended BASIC language provided in the ROM.

Another computer from Timex is the top-of-the-line 2000 series, that consists of two models, one priced at \$149.95 with 40K of user memory and the other priced at \$199.95 with 72K of user memory. Both provide color graphics and feature sophistication not normally found in low-cost home computers.

Physically much larger than its stablemates, the 2000 features a standard "QWERTY"-type keyboard with large calculator-type keys. The keys appear large enough so that an experienced typist should almost feel comfortable using it.

Actually developed by Sinclair Research Ltd. during Great Britain's Prestel videotext terminal competition, the 2000 is a sophisticated machine with a nearly normal screen display of 64-characters by 24-lines, or twice the capability of its stablemates.

TABLE 1—under \$500

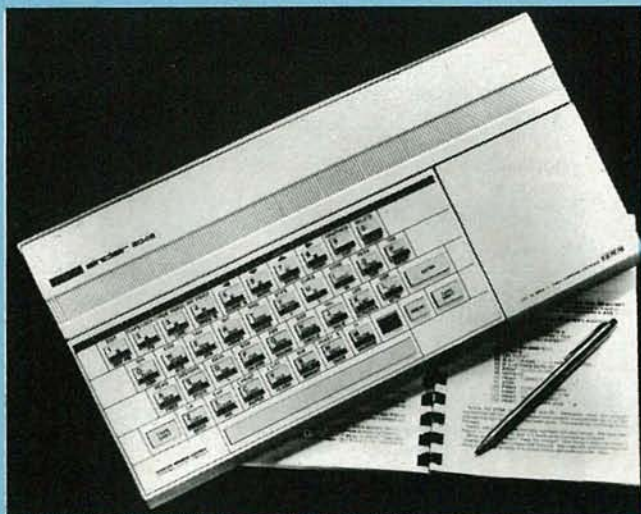
Manufacturer	Model	Price	CPU	Word length	Operating System	Languages
Timex Computer	1000	\$49.95	Z80A	8-bit	N/A	BASIC
Radio Shack	TRS-80 Pocket Computer PC-4	\$69.95	Custom CMOS	Not announced	N/A	BASIC
Timex Computer	1500	\$79.95	Z80A	8-bit	N/A	BASIC
Radio Shack	TRS-80 Pocket Computer PC-4	\$89.95	Custom CMOS	Not announced	N/A	BASIC
Video Technology Inc.	VZ200	\$99.95	Z80A	8-bit	N/A	BASIC
Netronics Research	Elf II	\$99.95	1802	8-bit	N/A	machine
Sharp Electronics	PC-1250	\$110	Custom CMOS	8-bit	N/A	BASIC
Radio Shack	TRS-80 MC-10	\$120	6803	8-bit	N/A	BASIC
Video Technology Inc.	VZ200	\$125	Z80A	8-bit	N/A	BASIC
Netronics Research	Explorer/85	\$130	8085	8-bit	N/A	machine
Radio Shack	TRS-80 Pocket Computer PC-4	\$140	Custom CMOS	Not announced	N/A	BASIC
Timex Computer	2000	\$150	Z80A	8-bit	N/A	BASIC
Netronics Research	Elf II	\$150	1802	8-bit	N/A	machine
Mattel Electronics	Aquarius	\$150	Z80A	8-bit	N/A	BASIC, LOGO
Video Technology Inc.	VZ200	\$174.95	Z80A	8-bit	N/A	BASIC
Sharp Electronics	PC-1250	\$185	Custom CMOS	8-bit	N/A	BASIC
Atari Products	600XL	\$199	6502C	8-bit	N/A	BASIC
Sord Computer	M5	\$199	Z80A	8-bit	N/A	BASIC
Multitech Electronics	MPF-IP	\$199	Z80	8-bit	N/A	BASIC, FORTH
Timex Computer	2000	\$199.95	Z80A	8-bit	N/A	BASIC
Radio Shack	TRS-80 Pocket Computer PC-2	\$199.95	Custom CMOS	8-bit	N/A	BASIC
Commodore Business Machines	VIC-20	\$199.95	6502	8-bit	N/A	BASIC
Mattel Electronics	Aquarius	\$205	Z80A	8-bit	N/A	BASIC, LOGO
Sharp Electronics	PC-1500	\$220	Custom CMOS	8-bit	N/A	BASIC
Netronics Research	Elf II	\$224.45	1802	8-bit	N/A	machine
Video Technology Inc.	VZ200	\$224.45	Z80A	8-bit	N/A	BASIC
Texas Instruments	TI-99/4A	\$225	TMS9900	16-bit	N/A	BASIC
Texas Instruments	CC-40	\$250	7C20	8-bit	N/A	BASIC
Mattel Electronics	Aquarius	\$265	Z80A	8-bit	N/A	BASIC, LOGO
Radio Shack	TRS-80 Pocket Computer PC-2	\$269.90	Custom CMOS	8-bit	N/A	BASIC
Commodore Business Machines	VIC-20	\$274.95	6502	8-bit	N/A	BASIC
Panasonic Co.	JR-200	\$279.95	Not announced	Not announced	Not announced	BASIC
Sharp Electronics	PC-1500	\$295	custom CMOS	8-bit	N/A	BASIC
Radio Shack	TRS-80 Color Computer	\$299	6809E	8-bit	N/A	BASIC

Memory/Storage	Keyboard	I/O	Display	Comments
2K/cassette interface	membrane keyboard/ multifunction keys	peripheral interface	TV output/32 × 24 capability	basic system
544 steps	53 calculator keys, 10-key keypad	12-pin interface connector	1 line 12-character liquid crystal display	handheld computer, basic model
16 K/cassette interface	40 keys/multifunction/ rubber overlay	peripheral interface	TV output/32 × 24 capability	memory expands to 16K
1568 steps	53 calculator keys, 10-key keypad	12-pin interface connector	1 line 12-character liquid crystal display	memory expands
4K/cassette interface/software cartridges	45 keys, 16 predefined function		built-in modulator/32 × 16 text mode/128 × 64 color cap.	basic configuration kit
256 bytes/cassette interface	hex keypad	N/A		
1.7K	54 keys, reservable keys, keypad		24-character × 1 line liquid crystal display	low-cost, handheld micro-computer
4K/cassette interface	48 multifunction keys	1 serial port	eight color output/32 × 16 text mode/RF modulator	entry level color computer
4K/cassette interface/software cartridges	45 keys, 16 predefined function	1 parallel	built-in modulator/32 × 16 text mode/128 × 64 color capability.	parallel printer port
256 bytes/cassette interface	N/A	N/A	N/A	basic Explorer/85 building block system
1568 steps/cassette interface	53 calculator keys, 10-key keypad	12-pin interface connector	1 line 12-character liquid crystal display	cassette interface
40K/cassette interface/software cartridge slot	42 keys/multifunction/rubber overlay keyboard	peripheral interface	color output/256 × 192 capability/64 × 24 text mode	basic system
256 bytes/cassette interface	hex keypad	N/A		assembled
4K/cassette interface	49 keys	1 serial, peripheral interface	320 × 192 graphics/40 × 24 text/user option	basic system
4K/cassette recorder/software cartridges	45 keys, 16 predefined function	1 parallel	built-in modulator/32 × 16 text mode/128 × 64 color capability.	cassette recorder
5.7K	54 keys, reservable keys, keypad		24-character × 1 line liquid crystal display	memory increases 4K
16K/cartridge slot	62 keys, help key, 4 special function	1 serial, 2 controller, expansion connector	built-in video output supports 256 colors, 40 × 24 text	basic system
20K/cassette	54 keys	Not announced	Home television	
4K/cassette interface	49-key	peripheral connector	20-digit, 1-line alphanumeric display	basic system
72K/cassette interface/software cartridges	42 keys/multifunction/ rubber overlay keyboard	peripheral interface	color output/256 × 192 capability/64 × 24 text mode	internal memory expanded to 72K
2640 bytes	65 calculator keys, 19-key pad, 18 definable	60-pin bus connector	1 line 7 × 156 dot matrix liquid crystal display	pocket computer
5K/cassette interface	66 keys, 4 user-programmable		color capability	basic system
4K/cassette recorder	49 keys	1 serial, peripheral interface	320 × 192 graphics/40 × 24 text	cassette recorder
2.6K	65 keys, 10-key keypad, function keys		26-character × 1 line liquid crystal display	basic system
256 bytes/cassette interface	hex key pad	1 serial, 2 parallel	home TV	expansion board with ports, RF modulator
20K/cassette recorder/software cartridges	45 keys, 16 predefined function	1 parallel	built-in modulator/32 × 16 text mode/128 × 64 color capacity	1 memory expansion module brings RAM to 20K
16K/cassette interface	standard		16 colors	basic system
6K/software cartridges	standard layout		31-character × 1 line liquid crystal display	hand-held computer
4K/cassette recorder	49 keys	system expander with cartridge/memory ports/1 serial	320 × 192 graphics/40 × 24 text	system expander, 2K memory added
4K	65 calculator keys, 19-key keypad, 18 definable	60 pin bus connector	1 line 7 × 156 dot matrix liquid crystal display	memory expanded to 4K
5K/cassette recorder	66 keys, 4 user-programmable		color capability	digital cassette recorder
32K/cassette interface	60 keys, multifunction	1 parallel	RGB/composite video output/CRT is user option	basic system
6.6K	65 keys, 10-key keypad, function keys		26-character × 1 line liquid crystal display	user memory expanded 4K
16K/cassette interface	53 keys	1 serial	CRT is user opt/32 × 16 color text mode/256 × 192 graphics capability	basic system

TABLE 1 under \$500 (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Spectravideo	SV-318	\$299	Z80A	8-bit	N/A	BASIC
Atari Products	600XL	\$299	6502C	8-bit	N/A	BASIC
Spectravideo	SV-318	\$299	Z80A	8-bit	N/A	BASIC
Commodore Business Machines	VIC-20	\$324.90	6502	8-bit	N/A	BASIC
Netronics Research	Elf II	\$339.40	1802	8-bit	N/A	machine
Panasonic Co.	JR-200	\$340	Not announced	Not announced	Not announced	BASIC
NEC Home Electronics	PC-6000	\$349.95	Z80A-compatible	8-bit	N/A	BASIC
Sharp Electronics	PC-1500	\$370	Custom CMOS	8-bit	N/A	BASIC
Panasonic Co.	H1400	\$380	6502	8-bit	SNAP (version of FORTH)	BASIC
Radio Shack	TRS-80 Color Computer	\$399	6809E	8-bit	N/A	BASIC
Multitech Electronics	MPF-II	\$399	6502	8-bit	N/A	BASIC
Netronics Research	Explorer/88-PC	\$399.95	8088	16-bit	N/A	machine
Texas Instruments	CC-40	\$400	7C20	8-bit	N/A	BASIC
Unitronics	Sonic	\$400 (est.)	6502	8-bit	N/A	BASIC
Unitronics	Sonic	\$400 (est.)	6502	8-bit	N/A	BASIC
Commodore Business Machines	VIC-20	\$404.85	6502	8-bit	N/A	ASIC
Sord Computer	M5	\$421	Z80A	8-bit	N/A	BASIC
Video Technology Inc.	VZ200	\$424.95	Z80A	8-bit	N/A	BASIC
Texas Instruments	TI-99/4A	\$425	TMS9900	16-bit	N/A	BASIC
Panasonic Co.	JR-200	\$430	Not announced	Not announced	Not announced	BASIC
NEC Home Electronics	PC-6000	\$450	Z80A-compatible	8-bit	N/A	BASIC
Netronics Research	Elf II	\$454.40	1802	8-bit	N/A	machine
Radio Shack	TRS-80 Pocket Computer PC-2	\$480	Custom CMOS	8-bit	N/A	BASIC
Panasonic Co.	H1800	\$480	6502	8-bit	SNAP (version of FORTH)	BASIC
Spectravideo	SV-318	\$490	Z80A	8-bit	N/A	BASIC
Atari Products	1200XL	\$499	6502	8-bit	N/A	BASIC
Netronics Research	Explorer/85	\$499.75	8085	8-bit	N/A	machine
Panasonic Co.	JR-800	\$499.95	Not announced	Not announced	N/A	BASIC

Memory/Storage	Keyboard	I/O	Display	Comments
16K/cassette interface	71 keys, 10 programmable, built-in joystick		256 × 192 resolution, 16 colors, television used as display	basic system
16K/cassette recorder/cartridge slot	62 keys, help key, 4 special function	1 serial, 2 controller, expansion connector	built-in video output supports 256 colors, 40 × 24 text	cassette recorder
16K/cassette recorder/cartridge slot	standard layout, function keys		256 × 192/16 colors	
13K/cassette recorder	66 keys, 4 user-programmable		color capability	user memory expanded 8K
4K/cassette interface	hex keypad	1 serial, 2 parallel	home TV	user memory expanded to 4K
32K/cassette interface	60 keys, multifunction	1 parallel, 1 serial	RGB/composite video output/CRT is user option	serial port
16K/cassette interface	71 keys, 5 multifunction	1 parallel, 2 game controller ports	256 × 192 capability, 32 × 16 text, composite video output avail.	basic system
10.6K	65 keys, 10-key keypad, function keys		26-character × 1 line liquid crystal display	user memory expanded by 8K
4K	65 calculator keys in typewriter arrangement, redefinable		1-line × 26-character liquid crystal display	basic hand-held computer
16K/cassette interface	53 keys	1 serial	CRT is user opt/32 × 16 color text mode/256 × 192 graphics capability	extended BASIC
64K/cassette interface	52 keys	1 parallel, 1 game controller	supports 40 × 24 text/6 colors/180 × 192 res./user option	basic system
64K/cassette interface	N/A	1 serial	N/A	starter kit
22K/software cartridges	standard layout		31-character × 1 line liquid crystal display	user memory upgraded to 22K
80K/148K wafertape	70 keys, 10 function	expansion ports, game controller	16 colors, 40 column capability	basic Sonic home computer system, includes stringy-floppy mass storage
112K/148K wafertape	70 keys, 10 function	expansion ports, game controller	16 colors, 40 column capability	32K memory added
29K/cassette recorder	66 keys, 4 user-programmable		color capability	user memory expanded to 29K
20K/cassette/cartridges	54 keys	Not announced	Home television	BASIC home finance software, joysticks, games added
64K/cassette recorder/software cartridges	45 keys, 16 predefined function	1 parallel	built-in modulator/32 × 16 text mode/128 × 64 color capacity	44K memory added
16K/wafertape	standard	HEX-BUS expansion unit	16 colors	Wafertape drive used in place of cassette
32K/cassette recorder	60 keys, multifunction	1 parallel, 1 serial	RGB/composite video output/CRT is user option	cassette recorder
16K/cassette recorder	71 keys, 5 multifunction	1 parallel, 2 game controller ports	256 × 192 capability, 32 × 16 text, composite video output available	cassette recorder
16K/cassette interface	hex keypad	1 serial, 2 parallel	home TV	user memory expanded to 16K
16K	65 calculator keys, 19-key keypad, 18 definable	60 pin bus connector	1 line 7 × 156 dot matrix liquid crystal display	memory expanded to 16K
8K	65 calculator keys in typewriter arrangement, redefinable		1-line × 26-character liquid crystal display	basic system
4648K/cassette recorder	71 keys, 10 programmable, built-in joystick		256 × 192 resolution, 16 colors, television used as display	cassette recorder added for storage, user memory upgraded to 48K
64K/cassette recorder	standard typewriter/16 special function	1 printer, 2 controller, expansion connector	built-in video output supports 256 colors, 40 × 24 text	basic 1200 system/no std. CRT
256 bytes/cassette interface	56 keys	N/A	12-inch monochrome CRT	expansion board, keyboard, CRT
16K/cassette interface	47 keys, 20-key keypad, 10 programmable	parallel	8-line × 32-character LCD	notebook computer with ROM-based software



THE TIMEX SINCLAIR 2048 provides 8 colors.

Another feature not normally found on home computers in this price category is included: memory bank-switching. Using this technique, the microcomputer is fooled into thinking it can address more memory than it normally can. In reality, the Z80A can still only directly address 64K, but bank-switching allows it to address much more.

The 2000-series can display a range of eight colors and allows separate control of foreground, background, and border areas. Resolution is fairly high with 256- by 192-dots (horizontal by vertical). All pixels (picture elements) are individually addressable by the user, which means the video output is memory mapped, with specific memory addresses provided for each pixel.

Like other members of the Timex Sinclair family, mass storage is via cassette interface to a cassette recorder.

Radio Shack

Competing heavily in the under-\$100 market is Radio Shack with its \$69.95 Pocket Computer *PC-4*, one of this manufacturer's series of handheld pocket computers that is driven by a custom CMOS VLSI microprocessor.

The miniscule *PC-4* reaches its fullest configuration in this pricing category with maximum memory expansion and all peripheral accessories. It features a 544-step user memory that can be expanded to 1568 steps with the plug-in memory expansion module.

Featuring a one-line, 12-character LCD readout, this tiny microcomputer is programmable in BASIC and can handle strings of up to 30 characters in length.

Using a "QWERTY" keyboard layout, you can use the 53 keys for text or program input. In fact, 15 BASIC programming functions can be entered with two keystrokes. While the keyboard does have the traditional layout, it should be noted that the keys are actually calculator-type keys and the close placement really won't allow touch typing. A separate keypad allows numeric entry. Total system expansion is achieved in this price range. This includes the 1K RAM module and cassette-recorder interface and tiny thermal printer with a total price of \$140.

Radio Shack has many other entries in the under-\$500 category. These microcomputers include a variety of handheld and small keyboard-computers.

While Radio Shack's bottom-of-the-line handheld microcomputer is the *PC-4*, its bigger brother is the recently introduced *PC-3* that sports a 1.4K nonexpandable memory. The \$99.95 unit, like its stablemates, features a one-line LCD readout and it features a standard keyboard layout. Like its stablemates, it uses tiny calculator-type keys that aren't suited for speedy text entry.

The *PC-4*, driven by a CMOS 8-bit microprocessor, reaches its full configuration in this price category with the addition of a

printer/cassette interface. This boosts the price to roughly \$220.

While the *PC-1* has been discontinued since last year, the *PC-2*, manufactured for Radio Shack by Sharp, is still available and represents Radio Shacks's top-of-the-line handheld. Offered at a base price of \$199.95, it reaches its fullest configuration in the \$500 to \$1000 price category.

A versatile unit, its basic user memory is 2.6K. This memory, however, is expandable to a maximum of 16K, with the addition of the proper memory modules. It will also accept ROM modules, but the limit is still 16K. This expandability makes this unit a powerful, flexible handheld microcomputer.

Programmable in Extended BASIC, the *PC-2* features 42 statements and 34 built-in functions. It allows a user to have two-dimensional arrays, variable-length character strings with extensive string handling, formatted printing, and other features.

The display is a 26-character by 1-line dot matrix LCD with user-addressable graphics over its complete range. The keyboard is a full "QWERTY" type, with 65 keys and a separate number pad. There are also six user-definable keys.

Like the others in the Radio Shack handheld line, the *PC-2* uses tiny calculator-type keys that are better suited to single-finger use, rather than two-handed touch typing. Another feature that might prove somewhat confusing is the placement of the space bar next to the function entry key. The layout, though, is about as clean as one could hope for in a small unit.

Driven by an 8-bit, low-power CMOS microprocessor, the *PC-2* is powered by 4 "AA" batteries. A 60-pin expansion port allows interfacing with a variety of peripherals, including a color-printer/dual-cassette interface (valuable for speedier program storage and retrieval) and an RS-232C interface for tying into such data networks as The Source or CompuServe via a phone line.

Altogether, the *PC-2* is a powerful handheld unit. However, this isn't the only Radio Shack offering in this pricing category. Radio Shack also offers two Color Computers, the new *MC-10 Micro Color Computer* and the more traditional *TRS-80 Color Computer*.

The *MC-10* is a tiny unit, about the size of the Timex 1000. However, instead of using a membrane keyboard, Radio Shack has opted for a more standard set of small calculator-type keys in a standard keyboard format. The multi-function keys allow quick two-key entry of program commands. A learning machine, the *MC-10* comes with a tutorial manual that describes how to produce 8-color graphics and teaches a user BASIC programming.

The 4K memory of the *MC-10* is expandable to 20K through an expansion connector on the tiny box. Unlike other low-cost microcomputers, the *MC-10* has a built-in serial interface that allows the user to connect either a modem or printer to the unit. With either of these peripherals attached, the user gains flexibility in output format. In fact, with a modem the user will gain access to such services as The Source or CompuServe.

This year, only the 16K-version of the more-powerful \$299.95 *TRS-80 Color Computer* is available rather than the 4K-version that was available last year.

Driven by an 8-bit 6809E microprocessor, the *Color Computer* interfaces directly with a color-television set as a display device through a built-in RF modulator.

An even more powerful version, capable of programming in Extended BASIC, is available for \$399.95. This version of the *Color Computer* allows multi-character variable names and string arrays of up to 255 characters; full-featured editing, floating point 9-digit accuracy, trigonometric functions, user definable keys, specific error messages and PEEK, POKE and USR commands to call machine-language routines.

This machine is a good basic home system, capable of personal computer power or videogame entertainment. It is a flexible unit. There is a wide variety of prepackaged programs available for it on cassette and it includes a standard serial interface port for using a modem to tie into one of the many information services available.

"I built this 16-bit computer and saved money. Learned a lot, too."

Save now by building the Heathkit H-100 yourself. Save later because your computer investment won't become obsolete for many years to come.

Save by building it yourself. You can save hundreds of dollars over assembled prices when you choose the new H-100 16-Bit/8-Bit Computer Kit – money you can use to buy the peripherals and software of your choice.

H-100 SERIES COMPUTER SPECIFICATIONS:

USER MEMORY:
192K-768K bytes*

MICROPROCESSORS:
16-bit: 8088
8-bit: 8085

DISK STORAGE:
5.25" disk drive,
8" disk drive
Winchester drive

KEYBOARD:
Typewriter style, 95 keys,
13 function keys,
18-key numeric pad

GRAPHICS:
Always in graphics mode.
640h/225v resolution; up to
eight colors are available**

COMMUNICATIONS:
Two RS-232C Serial
Interface Ports and
one parallel port

DIAGNOSTICS:
Memory self-test
on power-up

AVAILABLE SOFTWARE:
Z-DOS (MS-DOS)
CP/M®
Z-BASIC Language
Microsoft BASIC
Multiplan
SuperCalc
WordStar

MailMerge
Data Base Manager
File Manager
General Ledger
Accounts Receivable
Accounts Payable
Inventory Control
Sales Invoicing
Lotus 1,2,3
PeachText 5000
Fortran-86
Cobol-86
Pascal
Basic Compiler
Most standard
8-bit CP/M
Software

The H-100 is easy to build – the step-by-step Heathkit manual shows you how. And every step of the way, you have our pledge – "We won't let you fail." Help is as close as your phone, or the nearest Heathkit Electronic Center.†

And what better way to learn state-of-the-art computing techniques than to build the world's only 16-bit/8-bit computer kit? To run today's higher-speed, higher-performance 16-bit software, you need an H-100. It makes a big difference by processing more data faster.

Dual microprocessors for power and compatibility. The H-100 handles both high-performance 16-bit software and most current Heath/Zenith 8-bit software.

Want room to grow? The H-100's standard 192K byte Random Access Memory complement can be expanded to 768K bytes – compared to a 64K standard for many desktop computers.

And the industry-standard S-100 card slots support memory expansion and additional peripheral devices, allowing your investment to grow.

High-capacity disk storage, too. The H-100's 5.25" floppy disk drive can store 320K bytes on a single disk. The computer also supports an optional second 5.25" and external 8" floppy disk drives. For maximum storage, an optional internal Winchester disk drive is also available.

For more information, circle the reader service number below. Better yet, visit your Heathkit Electronic Center for a demonstration!

*The H-100 gives me
the most for my
computer dollar!*

*192K bytes standard.
**Optional.
CP/M is a registered
trademark of Digital
Research.



Heathkit
Heath
Company

A subsidiary of Zenith Radio Corporation

†Heathkit Electronic Centers are units of Veritechnology Electronics Corporation.

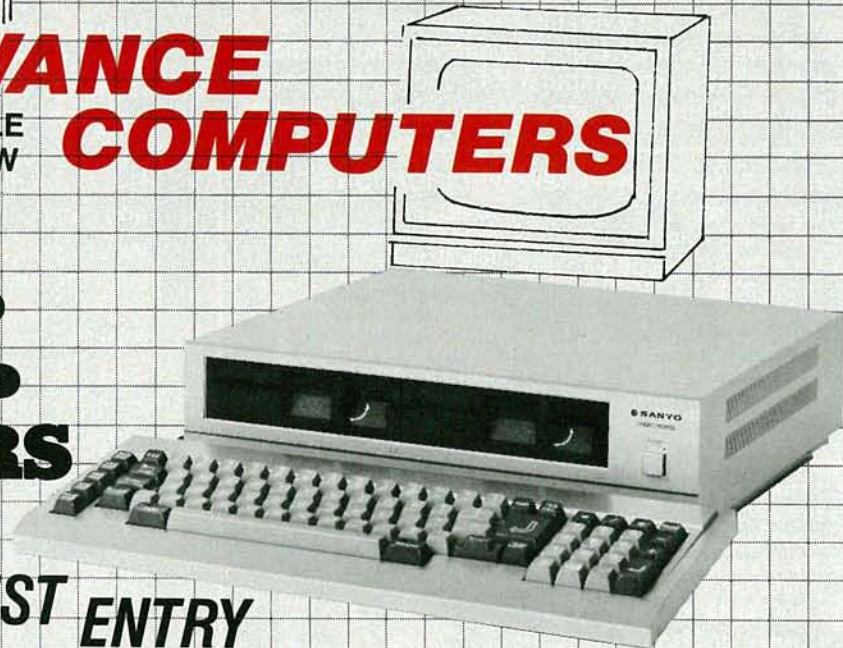
CIRCLE 37 ON FREE INFORMATION CARD

The **SPECIALISTS IN TEST EQUIPMENT**
AND NOW

COMPUTERS

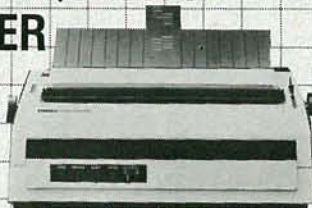
FROM  **ADVANCE**
THE PEOPLE WHO KNOW **COMPUTERS**

 **SANYO**
DESK-TOP
COMPUTERS



LATEST ENTRY

LETTER QUALITY
PRINTER



PR 5500

- 16 characters per second
- Bi-Directional printing
- Quiet operation
- Choice of 10, 12 or 15 characters per inch

\$795⁰⁰

Reg. \$995⁰⁰

***PLUS**

FREE

MICROPRO SOFTWARE (\$2,000.00 Value)

- WORDSTAR • SPELLSTAR • CALCSTAR
- MAILMERGE • INFOSTAR

INTRODUCTORY
PRICE

Reg. \$995⁰⁰

\$895⁰⁰*

PLUS

- IBM PC Compatible
- Disc Drive
- 128K Memory
- Centronics Printer Port Compatible

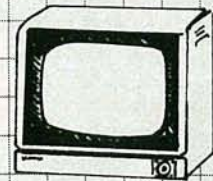
- Color Graphics Capability
- 8088 CPU
- Self-Diagnostics

*IBM PC registered trademark of IBM Corporation

9" MONITOR (Hitachi B/W)

Reg. \$149⁹⁵ **\$99⁹⁵**

WHEN PURCHASED WITH
COMPUTER OR PRINTER



master charge

VISA

ADVANCE

THE PEOPLE
WHO KNOW

COMPUTERS

TOLL FREE HOT LINE
800-223-0474

26 WEST 46th STREET, NEW YORK, N.Y. 10036 212-730-7030

The *Color Computer* can have its user memory expanded to 32K, with the addition of a RAM expansion kit. An already expanded version is available for \$549.95 and it features the same functions already described.

For the user who would like the ultimate in flexibility and speedy mass storage, there is an optional external disk drive available. The *Color Computer* can support up to four of these drives and this gives the user far more flexibility in this system than in other low-end systems. However, the buyer should note that even one drive will significantly raise the cost of the system.

The *Color Computer's* expansion possibilities are outlined in subsequent sections and you will find it becomes a full-blown system in the \$1500 price range.

Handheld microcomputers continue to abound in the low-end price range, with offerings from Sharp, Hewlett-Packard, and Panasonic.

Sharp

For instance, Sharp offers two handhelds, the *PC-1250* and the *PC-1500*. The *PC-1500* is identical to Radio Shack's *PC-2*, so its description will suffice for the *1500*, except to say that it is more expensive than the Radio Shack unit, with a base price of \$220. Both of these handhelds become fully configured in higher price categories.

The basic model, the *PC-1250*, is available for \$185. It is driven by a CMOS 8-bit microprocessor, which means that it can be run by battery power because the current drain is low.

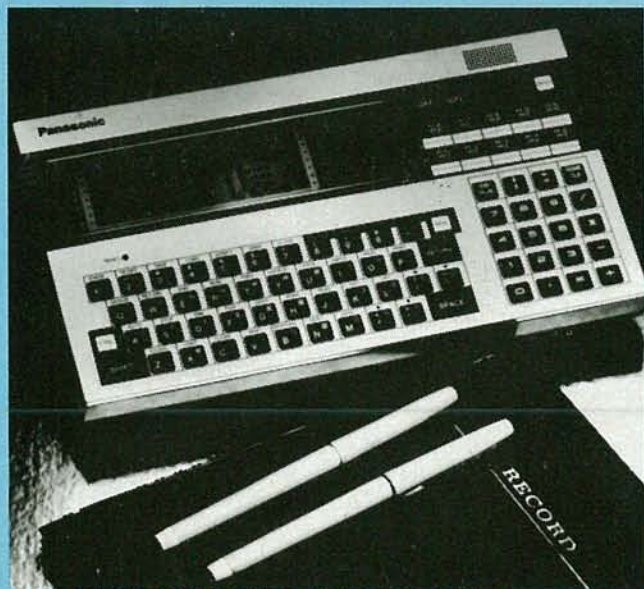
Programmable in BASIC, its 54-key small calculator-type keys are arranged in a "QWERTY" layout. However, since the unit is handheld, it isn't suited to fast touch-typing. The *PC-1250* has a one-line by 24-character LCD readout.

Panasonic

Another of the entrants in the handheld computer field is Panasonic, whose *H1400/H1800-series* builds into a portable briefcase system. In reality, this series uses the same handheld case, but each pricing level reflects more user memory. For instance, the \$380 *H1400* features 4K of user memory, while the \$480 *H1800* features 8K of user memory.

If you look closely at the accompanying table, you will see an operating system is noted. Unlike other handheld computers, which operate with machine language instruction sets, the *H1400/1800 series* uses the SNAP operating system, a derivative of FORTH. Under this operating system, BASIC is the programming language.

Again, like other handheld computers, the keyboard is laid out in a standard "QWERTY" fashion, however, with 65 small calculator-type keys and narrow spacing on the keyboard, it



PANASONIC'S JR-800 displays eight 32-character lines.



would seem that this type of layout wouldn't lend itself to touch-typing. Instead, it seems more oriented toward one-finger entry. To give these units their due, though, they are larger than other handheld units on the market.

Notice that they are on the upper end of the pricing scale. Although they are less expensive than they were last year, all it takes is a bit of added memory—expansion RAM modules are available—to push them into the next price class, where you will again see them mentioned.

These aren't the only Panasonic units available in the under-\$500 category. Another is the recently introduced \$279.95 *JR-200*. It is a complete keyboard-computer and features a built-in AC power supply, a built-in RF modulator, built-in cassette interface port, and game-controller connections. Unlike other low-priced units, this one includes a standard printer interface port. Other systems in this price range usually make additional ports for communications or printers extra-cost additions.

With 32K of RAM, this unit is capable of handling some fairly sophisticated programs. Its programming language is BASIC, whose commands and other textual matter are inserted through the 60 multifunction small calculator-type keys. One of the nicer features of this keyboard is its standard key spacing that should make quick data entry easy.

The *JR-200* is also a color home computer that can interface not only with a home television set, but also with a monitor with either composite video or RGB inputs. It is capable of generating eight colors simultaneously and—for music composition or sound effects—three simultaneous tones in five octaves. Mass storage is through the cassette interface and Panasonic has an interesting option, a 2400-baud data cassette recorder that allows faster data storage and retrieval via cassette.

Rounding out Panasonic's entries in this field is one of the new breed of lap computers now making their way to the market. The *JR-800*, that weighs a mere 1½ pounds and which fits easily into a briefcase, is priced at \$499.95. For that price, the user receives a powerful piece of equipment.

Initially equipped with 16K of user memory, or enough to perform complex tasks and to store a good deal of information, the memory is expandable to 24 or 32K, or as much RAM as some much larger machines had only a few years ago. No pricing was provided on this expandable feature.

Featuring a full travel standard layout typewriter keyboard, the *JR-800* also has 20 programmable function keys and an independent numeric keypad. The programmable keys can be programmed to carry out often-used commands to help simplify and speed up the computing process.

Like other lap computers, the *JR-800* has taken advantage of advances in liquid-crystal-display technology and sports a 32-character by 8-line LCD. The display can be scrolled through 255 columns and contrast control is provided so the display can be adjusted for easy viewing in a variety of lighting conditions.

Memory protection is provided so that any data or programming material that has been stored in RAM will be saved even if the power is turned off.

The BASIC programming language this unit uses is located in ROM for quick loading and 51 BASIC commands are provided on the keyboard, as well as 64 graphic symbols and 32 user-definable keys.

Texas Instruments

Since last year's supplement was published, there has been a tremendous price war going on in the low-cost home-computer field and the semiconductor giant, Texas Instruments, has been among those companies battling it out with its *TI-99/4A*, the only low-cost home computer to use a true 16-bit microprocessor, *TMS-9900*. In fact, TI was the first manufacturer on the market with a 16-bit CPU when the model was introduced three years ago. Although you might find the manufacturer's suggested retail list price somewhat shocking, in view of the heavy price discounting and rebate programs that have gone on, it is \$225.

However, the user gets a machine with a typewriter-style keyboard and immediate availability to TI's wide library of prepackaged software. This software is immediately usable thanks to the *TI-99/4A*'s 16K user memory.

Programmable in BASIC, a user can use a built-in cassette interface for data storage. Disk drives are available, but they push its cost up to other pricing categories.

The *TI-99/4A* is capable of generating up to 16 colors and interfaces with a television set through a built-in RF modulator. It can also use a color monitor, as will be shown in other pricing categories.

This isn't the only TI entrant in this pricing category. The company is also marketing its *Compact Computer 40*, a handheld unit with a base price of \$249.95. It interfaces with a wide variety of peripherals.

Driven by a low-power CMOS 8-bit microprocessor, the *CC-40* comes equipped with 6K of user memory. Its standard keyboard layout allows entry of BASIC commands and text, although its display is only a 1-line by 32-character LCD. Mass storage is via TI's proprietary *Wafertape* drive system. In other circles, this type of tape system might be called a "stringy" floppy drive.

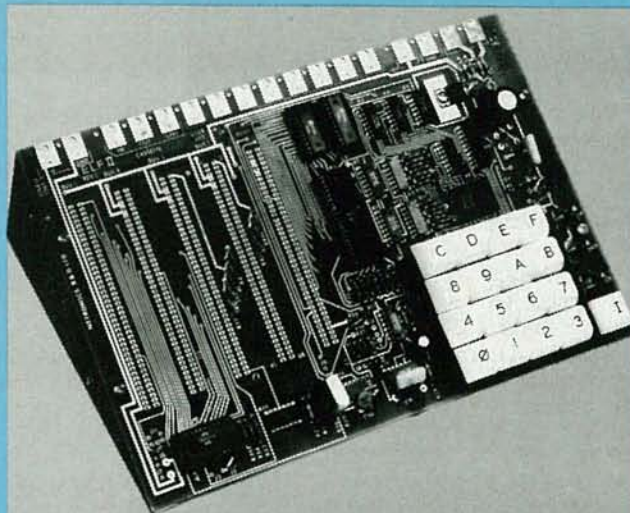
Wafertape is actually a continuous-loop cassette tape system that allows quick data entry and retrieval. This is similar to the endless tape loops used in telephone answering machines.

If you look closely at the accompanying table, you will find this system mentioned twice because it starts its upgrading within this price segment with the addition of a serial input/output port.

The *TI-99/4A* also begins upgrading and its price rises to \$425 with the addition of the *Wafertape* drive, in place of a standard cassette recorder.

Video Technology

A newcomer to the home-computer wars, Video Technology is offering a keyboard-computer, the *VZ200*, whose pricing starts at \$99.95. For this price, a user gets a Z80A 8-bit microprocessor, one of the 8-bit world's standards, but only 4K of user memory, which is enough for simple tasks and home



THE ELF II from Netronics is one of the oldest computer kits available.

games, but isn't really enough for complicated tasks. In fact, if you watch how the system upgrades, you will notice the first expansion is to increase the amount of user memory, which is accomplished before it reaches the \$500 to \$1000 pricing category.

Fully programmable in BASIC, the *VZ200* features a standard keyboard layout with small calculator-type keys. These multi-function keys allow one-key entry of BASIC commands and speed up programming.

The *VZ200* features a built-in cassette interface for data storage. In the next pricing level the manufacturer's proprietary data cassette recorder is added to the system configuration. (You will notice the same thing happening with many of the home-computer systems listed. In a departure from last year, we have included the proprietary cassette recorder in the pricing equation.)

The unit is also capable of a video output of 32-characters by 16-lines in its 9-color text mode. Low-resolution graphics of 64-by 32-dots are available in 9 colors, although a higher resolution of 128-by 64-dots is available in eight colors.

An interesting feature of the *VZ200* is its dedicated video RAM. The manufacturers have set aside 2K of user memory, roughly two pages of text, for video memory. This assures that display input won't be overwritten should the user-memory area become full. The unit is also capable of interfacing with a home television set (through an RF modulator) or a dedicated monitor.

In this pricing category, according to the manufacturer's released prices, the *VZ200* gains a printer port, memory expansion and peripheral expansion bus, and this just about exhausts the list of possibilities because other planned peripheral prices weren't available at press time.

Mattel Electronics

Making its first formal foray into the home-computer field, Mattel Electronics has introduced the \$150 *Aquarius* system. (It has an add-on computer module for its Intellivision game controller, but this is its first formal home computer.)

Driven by an 8-bit Z80A microprocessor, the *Aquarius* comes with only 4K of user memory. Eventually, the company plans total user memory capability of 52K.

Another of the keyboard-computers available, the *Aquarius* has a 49-key small calculator-type of keyboard. Its basic measurements are 13 by 6 inches and it is capable of 256 graphics characters, as well as 16 colors.

Capable of interfacing with a cassette recorder for mass storage, software is available not only on tape, but also in the form of plug-in cartridges. Programming languages include BASIC and the educationally-oriented LOGO.

In its two expansions in this pricing category, one will find the cassette recorder and the expansion bus have been added.



COMMODORE'S VIC-20 is a BASIC-programmable machine.

INTRODUCING the world's first, affordable teaching robot...

HERO¹ the most sophisticated microprocessor-controlled device since the microcomputer.

HERO 1 is a completely self-contained, electro-mechanical robot capable of interacting with its environment. Controlled by an on-board, programmable computer, it has electronic sensors to detect light, sound, motion and obstruction in its path.

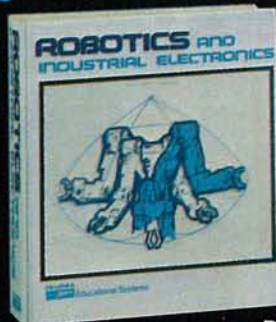
Capable of seven axes of mo-

tion, the robot can be programmed to pick up small objects with its arm. It will also speak in complete sentences, using its voice synthesizer.

Remarkable though the robot is, its companion **Robotics Education Course**

is an even more significant "first." It provides a thorough understanding of robot technologies, including robotics programming. Course features self-test unit reviews, experiments and final exam.

Designed to be used with HERO 1, this 1200 page course is the most complete introduction to robotics available today.



HERO 1 is a computer on wheels. HERO 1 uses a 6808 microprocessor that controls 13 functions and sense boards. Its on-board processor can take it through complex maneuvers. The programming process is straightforward with provision for step-by-step debugging, enhancement and other corrections.

HERO 1 senses include: sound detection (frequency range 200-5000 Hz); light detection; ultrasonic ranging; ultrasonic motion detection; speech synthesis; and real time, four year calendar clock.

A completely mobile platform robot, HERO 1's motion abilities permit head rotation and arm rotation of 350°, shoulder rotation of 150°, arm extension of 5 inches, wrist pivot of 180° and wrist rotation of 350°. Gripper will open to a maximum of 3½ inches and rotate 90° at extreme extension. Payload capacity of arm is 8 oz. at maximum extension and 16 oz. at normal.

The remarkable HERO 1 robot is in production now, ready for you. Buy assembled or build it from a kit. Kit price is \$1500 and the assembled robot is \$2500, FOB Benton Harbor, or through your nearest Heathkit Electronic Center.

For full information on HERO 1 call 800-253-0570 toll-free. (In Alaska, Hawaii and Michigan, call 616-982-3411.) We'll give you the address of the nearest Heathkit Electronic Center and send you a booklet that gives details about the robot, the content of this course, and other information.

Please send details on the HERO 1 robot and robotics course.

Mail to: Heath Company, Dept. 020-108
Benton Harbor, MI 49022

Name _____

Address _____

City _____

State _____ Zip _____

Heathkit/Zenith Educational Systems is a division of Heath Company,
Benton Harbor, Michigan 49022. RO-100AR1

Heathkit[®]
Heathkit/Zenith
Educational Systems

Heathkit Electronic Centers are units of Veritechnology Electronics Corporation.
Heath Company is a subsidiary of Zenith Radio Corporation.

CIRCLE 16 ON FREE INFORMATION CARD

MEMOTECH

The Complete Range

Fifteen months ago Memotech developed the first 64K Memopak, designed to maximise the capabilities of the Sinclair ZX81. Since then, using the ZX81 as a starting point, we've gone on to produce a comprehensive range of Memopaks, adding 16K and 32K memory expansions, utilities packages comprising a Word Processor, Z80 Assembler and Spreadsheet Analysis, plus Communication Interfaces, High Resolution Graphics and a professional quality Keyboard. To complete our range of Timex add-ons, we are now introducing the MEMOPAK RS232 Serial Interface.

RS232 Interface

The RS232 is an all-purpose interface which allows the Timex not only to output to suitable serial printers, but can link up with numerous types of peripheral or even other processors. The Interface has two main modes of operation: BASIC mode allows you to use the range of functions supplied in the RS232 EPROM within an ordinary BASIC program, and TERMINAL mode allows you to use your Timex as a terminal to another processor. The EPROM functions offered permit the user to send, receive and convert bytes between Z80 code and ASCII, as well as check the status of numerous control flags. Received or transmitted data can appear simultaneously on the screen, and received data may be printed simultaneously.

\$99.95 cable \$19.95

Memopak Centronics I/F

The BASIC commands LPRINT, LLIST and COPY are used to print on any CENTRONICS type printer. All ASCII characters are generated and translation takes place automatically within the pack. Reverse capitals give lower case. Additional facilities allow high resolution printing.

\$74.95 cable \$19.95

Memopak HRG

This pack breaks down the constraints imposed by operating at the Z80 character level and allows high definition displays to be generated. All 248 x 192 individual pixels can be controlled using simple commands, and the built in software enables the user to work interactively at the dot, line, character, block and page levels.

\$99.95

Memocalc

The screen display behaves as a 'window' on a large sheet of paper on which a table of numbers is laid out. The maximum size of the table is determined by the memory capacity, and with a Memopak 64K a table of up to 7000 numbers with up to 250 rows or 99 columns can be specified.

\$49.95

Memotext

Text is first arranged in 32 character lines for the screen with comprehensive editing facilities. On output the user simply chooses the line length required for printing and the system does the rest. Used with the Memopak Centronics Interface, the Word Processor makes available printout with 80 character lines, upper and lower case and single and double size characters.

\$49.95

Memopak Memory Extensions

For those just setting out on the road to real computing, these packs transform the Timex from a toy to a powerful computer. Data storage, extended programming and complex displays all become feasible. Further details available on request.

16K Memopak \$49.95
32K Memopak \$99.95
64K Memopak \$149.95

Z80 Assembler

The Assembler allows you first to code and edit a source program in the Z80 language, and then assemble it into machine code. You can now write flexible and economic programs. The Editor mode allows you to code directly in the right format, manipulate individual lines and control the exact placing of source and machine code. Routines may be merged or listed (even to a commercial printer using our Centronics Interface). The assembler mode handles all standard Z80 mnemonics, numbers in hex or decimal, comments and user-selected labels.

\$49.95



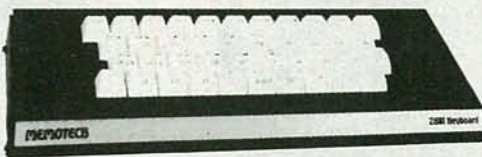
Memotech Keyboard

The Memotech plug-in Keyboard plus buffer pack takes the effort out of data entry for Timex users. The Keyboard has a light professional touch and is housed in an elegant aluminum case. The simple plug-in system means that you are not obliged to open up your Timex, use a soldering iron or invalidate your Timex warranty.

Keyboard Buffer Pak

The Buffer Pak performs a "housekeeping" function for the Keyboard, interfacing directly with the port of your Timex.

\$99.95 - (keyboard & buffer included)



Note! All Memotech products carry a 6 mo. warranty. 80 column dot matrix printer packages available at a substantial savings from Memotech.

Order at no risk (10 day money-back guarantee): Call 1-800-662-0949 (Colorado 1-303-986-1516). Or send your name, address, phone number and a check/money order/Visa or MasterCard number with expiration date to: Memotech Direct Sales Division, 7550 W. Yale Avenue, Denver, Colorado 80227.

Shipping/Handling \$4.95; Colorado Residents add applicable sales tax.



VIDEO TECHNOLOGY'S VZ200 has calculator-type keys.

Commodore Business Machines

Commodore Business Machines, one of the longtime microcomputer manufacturers, also has a keyboard-computer entry in this price category, the VIC-20. CBM, as the manufacturer is also known, has been one of the firms engaged in a hotly contested drive for domination of the under-\$500 marketplace and even though the VIC-20 carries a \$199.95 manufacturer's suggested retail price tag, you should be able to find it for much less.

Driven by a 6502, 8-bit microprocessor, the VIC-20 features a full-travel keyboard. Some of its keys, such as the quotation marks, are in nonstandard locations, so this could slow an accomplished touch typist. However, once the user is familiar with the keyboard, it should be easy to use. Four function keys are provided.

In the accompanying table, you will find the VIC-20 listed three times in this price class. At each level something has increased and if you note, the first addition is the data recorder. At the second level, user memory is expanded. At the third level, memory is expanded farther.

The VIC-20 system is fully programmable in BASIC. It features color-display capability with graphics resolution of 176- by 184-dots and it is capable of generating a 22-character by 23-line display. It is also capable of generating sounds over a five-octave range.

In this portion of the price range, the VIC-20 is limited to either cassette tape or plug-in cartridge software. However, its versatility grows as more system expansion takes place, as you will see later.

Atari

Atari Home Computers has three entries in this price category, the \$199 model 600XL, the \$299 (give or take a few dollars) 800XL and the \$499 model 1200XL. The reason the price of the 800XL isn't detailed is because specific pricing for the new models offered by Atari was not available at press time. Atari has a total of five models in the home-computer market.

The low-cost 600XL is equipped with 16K of user memory that is expandable to 64K. It also features a full-stroke typewri-



ter keyboard and is programmable in BASIC. This low-cost unit expands once with the addition of Atari's data recorder and features five text modes and 11 graphics modes with 256 colors.

The 600XL is capable of a maximum graphic resolution of 320- by 192-dots and a 40-character by 24-line text display. A serial input-output port is standard on this unit as are two game-controller ports. It has a built-in RF modulator for using a home television as the output device.

The 800XL, priced somewhere between the 600XL and the 1200XL, includes all the features of the lower-priced model, plus 64K of user memory. It also has outputs to enable you to connect the computer to either a television set or a monitor.

This new line of computers seems to fix one of the weaknesses of the former price leader, the 400, which has been discontinued. The 400 used a membrane keyboard that has never been popular. Instead, the new machines sport keyboards with typewriter-style keys. They also include slots to accept software cartridges.

The only machine that continues in Atari's lineup is the 1200XL, which is driven by a 6502 8-bit microprocessor. It features a keyboard with typewriter-like keys and is programmable in BASIC.

Also included in the basic outline of this machine is a parallel printer port and two game controllers. Its display capabilities include the generation of up to 256 colors and 40-character by 24-line text generation. It interfaces with a home television set.

Netronics

If you want to "roll your own" microcomputer, then you have three choices from Netronics—the Elf II, Explorer/85 and the Explorer/88-PC.

The Elf II is one of the oldest kit computers on the market and is driven by the venerable 1802 8-bit microcomputer from RCA. It is also one of the last microcomputers on the market to still use Tiny BASIC.

Constructed on a small PC board, the Elf II uses a hex keypad for machine-language programming. It generates a composite video display for interfacing with a monitor or it can interface with a home-television set through an RF modulator. An extremely expandable machine—more than half the motherboard is reserved for that—at its basic level there are only 256 bytes of user memory. However, that can be expanded to 64K. Options include a full keyboard and an A/D converter board. As you can see from the chart below, it upgrades several times in this price category.

Far more complete machines are represented by the Explorer/85 and the Explorer/88-PC.

The Explorer/85 contains an S-100 bus—100 signal-lines on the motherboard that carry data, address, and control information to the various boards plugged into it—and as a result, expansion is nearly unlimited. Various S-100 boards that are available include RAM boards, floppy-disk controllers, serial



SPECTRAVIDEO'S SV-328 uses a Z80A microprocessor.

and parallel I/O boards, and more. The *Explorer/85* is also capable of running the the CP/M operating system.

The *Explorer/88-PC* is a good learning experience for those who would like to see what makes an IBM-compatible machine tick. It not only includes the motherboard and microprocessor, but also the IBM-type expansion bus. With the correct add-on board, cabinet and drives, the user has an IBM-compatible system. In fact, in one of the higher price categories, there is a full-blown kit that will produce such a machine.

NEC

The *NEC PC-6000* is another of the computers found on the market today with an integral keyboard. Priced at \$349.95, it is driven by a Z80A-compatible microprocessor. The *PC-6000* contains 16K of user RAM and is expandable to 32K with an optional cartridge.

Its BASIC programming language is resident in 16K of ROM and features enhanced graphics and sound capabilities. Capable of color graphics with a resolution of up to 256-by 192-dots, the *PC-6000* is useful for color graphics work. In the text mode, resolution is 32-characters by 16-lines. A composite video output is available.

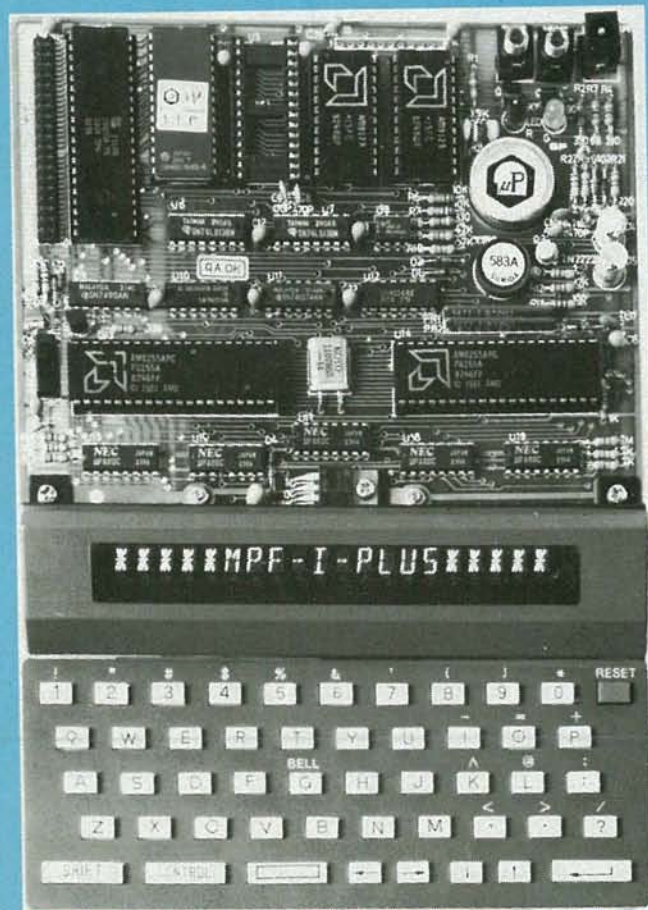
The *PC-6000* upgrades once in this price category with the addition of the NEC-offered cassette recorder for mass storage.

Multitech

Multitech Electronics has two offerings in this pricing category, the *MPF-IP* and the *MPF-II*.

The *MPF-IP* is driven by an 8-bit Z80 microprocessor. It contain 4K of RAM memory that is expandable to 10K via an optional input output and memory board.

Basically a computer literacy machine, the *MPF-IP* has a 49-key keyboard with calculator-type keys. The keyboard will enable a user to enter programs in assembly language, machine code, BASIC, or FORTH.



MULTITECH'S *MPF-IP* is another Z80A machine.

The display of this device is a 20-digit, 14-segment alphanumeric green tube display that scrolls much like a Times Square billboard.

It features a built-in speaker, battery-operated memory back-up circuit and such options as an EPROM (Erasable Programmable Read-Only Memory) board, a speech-synthesizer board, thermal printer, and a combination I/O and memory board and accessory kit for experiments.

The *MPF-II* is an Apple-compatible machine driven by a 6502 8-bit microprocessor. Featuring 64K of user memory, the *MPF-II* is programmable in BASIC via its 53-key standard-layout keyboard with calculator-like keys. A serial port allows interfacing with peripheral devices such as modems or printers.

The *MPF-II* will interface with a user's choice of video-display device. It is capable of displaying 40-characters by 24-lines of text and six colors with a resolution of up to a 180-by 192-dots.

Spectravideo

Spectravideo also has two computer offerings in this price category, the *SV-318* and the *SV-328*.

The *SV-318* is driven by a 3.6 MHz Z80A microprocessor and features 32K of user memory built-in. This means that nearly from the start this unit can handle sophisticated applications programs.

The keyboard, which uses a standard-keyboard layout and calculator-type keys, also features user-programmable function keys.

Programmable in BASIC, as are most of the other low-cost home computers on the market, it is capable of handling high-level color-graphics functions. A user can address 16 colors from the keyboard with a resolution of 256-by 192-dots.

The more expensive *SV-328* is also driven by a Z80A microprocessor. It features 80K of RAM—the top amount found in microcomputers in this price category—and built-in BASIC.

Further, this machine features CP/M compatibility, which increases the flexibility and usefulness of this computer, especially in a small-business setting.

It also features two built-in ROM-resident programs, a word-processing application and a terminal application, which make this a full-featured machine from the start.

An 87-key, full-stroke keyboard offers 10 user-definable functions, three special word-processor keys, 34 keyboard-generated computer-graphic symbols, and a separate numeric keypad.

The screen is somewhat limited for serious business work, offering 32 characters-per-line in the graphics mode and 40 characters-per-line in the text mode, but it should easily serve the average home user.

At this level, data storage is via a built-in cassette interface, while its composite video and audio output are through an RF modulator.

Sord

Another of the low-priced keyboard-computers is the *Sord M5*, which is driven by a Z80. It upgrades once in this price category and features two joysticks and programming for household accounting and bank-loan management. Input/output is handled through a parallel printer port, while data can be saved to cassette. A home-television set is used as a display.

Unitronics

Driven by an 8-bit 6502 microprocessor with a Texas Instruments video-display processor for arcade quality graphics, the *Sonic* uses a Waferdrive (endless-loop tape) that allows full read/write capabilities and mass storage for 128K.

The *Sonic* includes a 16-color display, 40 column display and a 70-key typewriter-style keyboard. The keyboard includes 10 function keys.

An additional 32K of RAM can be added to this system with the addition of a RAM module. It interfaces with the *Sonic's* expansion port.

R-E



Surprising sophistication and low cost are the characteristics of the systems in this category.

\$500 to \$1000

MARC STERN

IT'S AMAZING THE AMOUNT OF SOPHISTICATION BUILT INTO today's crop of low-cost home computers. Just a few years ago, machines in this price category were fairly primitive affairs, with little user memory and few peripherals. In fact, the microcomputer world was dominated by hobbyists, rather than home users. These hobbyists put together their systems with a little bit from this source and a little bit from that source, until they had fairly decent machines.

Contrast this situation with today where anyone can go to a retail outlet or computer store and buy a machine with 64K of user memory, sophisticated peripherals, and graphics capability. Today's microcomputer market has radically changed and the consumer has benefited from that change.

In this price category, some new companies make their first appearance. Some of these companies are more widely known for their consumer-electronics goods than their computer hardware and they include Casio, Sanyo, and Toshiba. Other companies, better known in the computer peripheral business than for their home computers, have also joined and they include Epson America and Formula International. Even a widely known game manufacturer, Coleco, has an entry in this price level.

New machines also make their appearance from Commodore Business Machines and Atari.

At this price level, many of the machines mentioned in the under-\$500 price category start to become more powerful systems. So, without further delay, let's take a look at the new entrants in this market and then wrap up with a look at how some systems have matured.

Coleco

The *Adam* is Coleco's first entry into the computer marketplace, and it is being marketed as a complete system. It includes a standard printer in its initial configuration.

User memory stands at 80K, which is enough for most chores that a home-computer user might have and the system features a standard typewriter-like keyboard with 75 full-travel keys. Built into this system is a word-processing package. The *Adam* is also compatible with CP/M, which makes this system a candidate for small businesses, because of access to the rich variety of CP/M programs.

Unlike other machines in this price category, the *Adam* includes an integral storage device, called a digital data-pack drive, capable of 500K of mass storage. According to industry reports, it is a tape drive, much like others on the market.

This near full configuration makes this machine ideal for the person looking for a fairly complete system under \$1000. It is programmable in BASIC.

Formula International

Long associated with the hobby-electronics world, this company is offering an Apple-compatible kit called the *Pinecom*. It is driven by a 6502 8-bit microprocessor and the kit includes the basic computer with keyboard and little more.

Programmable in BASIC, the *Pinecom* has 64K of user memory. Data input is via a 60-key keyboard and the unit is capable of 40-character by 24-line display for output. It also has color capability. It upgrades once in this price category with the addition of a parallel printer port.

Toshiba

Better known for its semiconductors and consumer-electronics products, Toshiba has introduced its *T100* computer that is driven by a Z80A.

The *T100*, in this price category, is a pretty barebones machine. It includes 64K of user memory but mass storage is limited to cassette tape.

TABLE 1—\$500 to \$1000

Manufacturers	Model	Price	CPU	Word length	Operating System	Languages
NEC Home Electronics	PC-6000	\$500	Z80A-compatible	8-bit	N/A	BASIC
Commodore Business Machines	Pet 64	\$500	6500 series	8-bit	N/A	BASIC
Atari Products	800XL	\$500 (est.)	6502C	8-bit	N/A	BASIC
Sharp Electronics	PC-1250	\$505	Custom CMOS	8-bit	N/A	BASIC
Atari Products	600XL	\$519	6502C	8-bit	N/A	BASIC
Texas Instruments	TI-99/4A	\$525	TMS9900	16-bit	N/A	BASIC
Panasonic Co.	H1400	\$538	6502	8-bit	SNAP	BASIC
Netronics Research	Explorer/85	\$539.70	8085	8-bit	N/A	machine
Radio Shack	TRS-80 Color Computer	\$549	6809E	8-bit	N/A	BASIC
NEC Home Electronics	PC-6000	\$550	Z80A-compatible	8-bit	N/A	BASIC
Texas Instruments	CC-40	\$555	7C20	8-bit	N/A	BASIC
Netronics Research	Elf II	\$559.30	1802	8-bit	N/A	machine/BASIC
Texas Instruments	TI-99/4A	\$585	TMS9900	16-bit	N/A	BASIC
Netronics Research	Explorer/85	\$589.65	8085	8-bit	N/A	machine
Commodore Business Machines	Commodore 64	\$595	6510	8-bit	N/A	BASIC
Atari Products	1200XL	\$598	6502	8-bit	N/A	BASIC
Spectravideo	SV-328	\$600	Z80A	8-bit	N/A	BASIC
Sharp Electronics	PC-1500	\$600	Custom CMOS	8-bit	N/A	BASIC
Spectravideo	SV-328	\$600 (est.)	Z80A	8-bit	N/A	BASIC
Coleco Industries	Adam	\$600 (est.)	Not announced	Not announced	N/A	BASIC, LOGO
Panasonic Co.	H1800	\$638	6502	8-bit	SNAP	BASIC
Formula International	Pinecom (kit)	\$645	6502	8-bit	N/A	Not announced
Commodore Business Machines	Commodore 64	\$670	6510	8-bit	N/A	BASIC
Netronics Research	Explorer/85	\$689.60	8085	8-bits	N/A	machine/BASIC
Texas Instruments	CC-40	\$695	7C20	8-bit	N/A	BASIC
Spectravideo	SV-328	\$700	Z80A	8-bit	N/A	BASIC
Formula International	Pinecom (kit)	\$730	6502	8-bit	N/A	Not announced
Radio Shack	TRS-80 Pocket Computer PC-2	\$759.75	Custom CMOS	8-bit	N/A	BASIC
Netronics Research	Explorer/85	\$789.80	8085	8-bit	N/A	machine/BASIC
Toshiba America	T100	\$795	Z80A	8-bit	N/A	BASIC
Epson America	HX-20	\$795	6301	8-bit	N/A	N/A
Multitech Electronics	MPF-II	\$797	6502	8-bit	Proprietary	BASIC
Radio Shack	TRS-80 Model 100	\$799	80C85	8-bit	N/A	BASIC

Memory/Storage	Keyboard	I/O	Display	Comments
32K/cassette recorder	71 keys, 5 multifunction keys	1 parallel, 2 game controller ports	256 × 192 capability, 32 × 16 text, composite video output avail.	memory expanded to 32K RAM
64K/cassette interface	standard, numeric keypad	1 serial	integral display	basic system
64K/cartridge slot	54 keys, help key, 4 special function keys	1 serial, 2 controller, expansion connector	built-in video output supports 256 colors, 40x24 text	basic system
9.7K/cassette recorder	54 keys, reservable keys, keypad		24-character × 1 line liquid crystal display	interface/printer/cassette unit added, user memory expanded 8K
16K/cassette recorder/cartridge slot	62 keys, help key, 4 special function keys	1 serial, 2 controller, expansion connector/ interface module	built-in video output supports 256 colors, 40x24 text	interface module added for future expansion
48K/cassette interface	standard		16 colors	user memory upgraded by 32K
4K	65 calculator keys in typewriter arrangement, redefinable keys	input/output adapter/expansion bus	1-line × 26-character liquid crystal display	I/O adapter
256 bytes/cassette interface	56 keys	N/A	12-inch monochrome CRT	S-100 card cage added for expansion boards
32K/cassette interface	53 keys	1 serial	32 × 16 color text mode/256 × 192 graphics capability	user memory expanded to 32K
32K/cassette recorder	71 keys, 5 multifunction keys	1 parallel, 1 serial, 2 game controller ports	256 × 192 capability, 32 × 16 text, composite video output avail.	serial port added
22K/software cartridges	standard layout	1 serial, 1 parallel	31-character × 1 line liquid crystal display	serial and parallel ports
16K/cassette interface	56 keys	1 serial, 2 parallel	home TV	keyboard, BASIC added
48K/cassette interface	standard	HEX-BUS expansion unit	16 colors	HEX-BUS expansion unit
4K/cassette interface	56 keys	N/A	12-inch monochrome CRT	user memory increases to 4K
64K/cassette interface	60 keys, 4 programmable keys		16 color graphics capability/text	basic system
64K/cassette recorder/cartridge slot	standard typewriter/16 special function keys	1 printer, 2 controller, expansion connector	built-in video output supports 256 colors, 40x24 text	cassette recorder
80K/cassette interface	87 keys, keypad, 10 definable keys			basic system
10.6K/cassette interface	65 keys, 10-key keypad, function keys		26-character × 1 line liquid crystal display	cassette interface, printer/plotter added
80K/cassette interface	87 keys, 10 programmable, numeric keypad		40 × 24 text mode capability/16 colors	basic system
80K/500K memory storage drive (see text)/software cartridges	75-keys, 6 "smart" keys, detachable 12-key keypad	Not announced	color graphics capability/36 column	basic system
8K	65 calculator keys in typewriter arrangement, redefinable keys	input/output adapter/expansion bus	1-line × 26-character liquid crystal display	I/O adapter added
48K	66 keys, 14-key keypad		40 × 24 text mode/280 × 192 graphics capability	Apple-compatible kit
64K/cassette recorder	60 keys, 4 programmable keys		16 color graphics capability/text	cassette recorder
4K/cassette interface	56 keys	N/A	12-inch monochrome CRT	ROM-based BASIC added
22K/stringy floppy/software cartridges	standard layout	1 serial, 1 parallel	31-character × 1 line liquid crystal display	walrtape drive added
80K/cassette recorder	87 keys, 10 programmable, numeric keypad		40 × 24 text mode capability/16 colors	cassette recorder
48K	66 keys, 14-key keypad	1 parallel	40 × 24 text mode/280 × 192 graphics capability	parallel port
32K	65 calculator keys, 19-key keypad, 18 definable keys	60 pin bus connector	1 line 7 × 156 dot matrix liquid crystal display	memory expanded to 32K, 4 memory modules added
16K/cassette interface	56 keys	N/A	12-inch monochrome CRT	user memory expands to 16K
64K/cassette interface	89 keys, 8 special function keys	1 parallel, 1 serial		basic system
16K/microcassette storage (built-in)	standard, 5 function keys, 10-key keypad	1 serial	4-line liquid crystal display	lap computer
64K/1 190K SS/DD 5 1/4" drive	52 keys	1 parallel, 1 game controller	supports 40 × 24 text/6 colors/ 180 × 192 resolution/ display is user option	disk drive added
8K/cassette interface	56 keys, embedded 10-key keypad, 8 programmable	1 parallel, 1 serial, built-in modem	40 × 8 liquid crystal display	lap computer

TABLE 1—\$500 to \$1000 (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
NEC Home Electronics	PC-6000	\$800	Z80A-compatible	8-bit	N/A	BASIC
Atari Products	1200XL	\$818	6502	8-bit	N/A	BASIC
Sharp Electronics	PC-1500	\$825	Custom CMOS	8-bit	N/A	BASIC
Texas Instruments	TI-99/4A	\$835	TMS9900	16-bit	N/A	BASIC
Panasonic Co.	JR-200	\$880	Not announced	Not announced	Not announced	BASIC
Panasonic Co.	H1400	\$938	6502	8-bit	SNAP	BASIC
Netronics Research	Explorer/85	\$939.80	8085	8-bit	N/A	machine/BASIC
Atari Products	600XL	\$969	6502C	8-bit	Atari DOS II/III	BASIC
Radio Shack	TRS-80 Pocket Computer PC-2	\$979.70	Custom CMOS	8-bit	N/A	BASIC
Sanyo	MBC 550	\$995	8088	16-bit	MS-DOS	BASIC
Commodore Business Machines	Executive 64	\$995	6500 series	8-bit	Proprietary	BASIC
Hewlett-Packard	HP75C	\$995	Not announced		N/A	BASIC
Radio Shack	TRS-80 Model 100	\$999	80C85	8-bit	N/A	BASIC
Radio Shack	TRS-80 Model 4	\$999	Z80A	8-bit	N/A	BASIC
Radio Shack	TRS-80 Model III	\$999	Z80	8-bit	N/A	BASIC
Casio, Inc.	FX-9000P	\$999	Z80A-compatible	8-bit	Not announced	BASIC

Programmable in machine language and BASIC, data entry is via the 89-key typewriter-style keyboard. This keyboard also has 8 special-function keys that are user programmable. This unit includes standard serial and parallel ports for input/output.

Epson

Another of the entrants on the market with lap computers, Epson America is probably better known for its microcomputer printers than it is for its small systems. However, in the last year it has come out with two, the *HX-20* lap computer and its user-friendly *QX-10*.

In this price category, the *HX-20* lap computer makes its debut. Like other lap models, this one is capable of independent operation with batteries. Its 6301 8-bit microprocessor is capable of handling sophisticated number-crunching or just about any other task it will be called on to handle.

The beauty of this type of machine is its ability to go anywhere. With 16K of user memory, it can store about 16 typewritten pages in memory, or about as much daily production as anyone in the field might generate. The machine also features a built-in microcassette storage system.

Its full-travel, keyboard has five multifunction keys. A serial port allows the *HX-20* to be used with a modem so that the person in the field can upload or download files to/from a mainframe or office minicomputer system. Further, this port will allow the user to tie into any of the many information networks available today.

The *HX-20's* display is more limited than the competition in the lap market. Unlike other machines with 8-line liquid-crystal displays, the *HX-20* has a four-line display, although this should be enough for many users.

Sanyo

Another of the firms that is better known for its consumer electronics products, Sanyo, also has a microcomputer, the

MBC 550. Unlike other small-computer systems in this price category, the *MBC 550* is driven by a 8088 microprocessor. This feature alone will give the user access to the rapidly growing world of MS-DOS applications software that runs on this microprocessor. (A version of this disk operating system—PC-DOS—is what is primarily used in the IBM Personal Computer world and this is what has contributed to its lead in the 16-bit single-user system world.)

Unlike other systems in this price category, this one comes with 128K of user memory. It is one of the only microcomputers in this area to provide so much standard start-off RAM. (Sixteen bit computers can address up to 1.2 megabytes of RAM.) And, unlike other systems in this category, the *MBC 550* comes with one single-sided, double-density 160K floppy disk drive for storage. When you add in other peripherals, as we have done in other price categories, you will find this is a powerful home system.

Radio Shack

Not only does this major consumer-electronics firm have small-computer-system entries in the \$100-to-\$500 field—primarily handheld and small color systems; they also have entries in this category that begin their climbs toward computing power.

The first new Radio Shack system is the *Model 100* lap computer. Another of the many lap computers that are appearing on the market, the *model 100* uses a CMOS 80C85 8-bit microprocessor. It is a low-power version of the standard 8085.

This system comes with 8K of user memory, but, while that figure may seem small, it must be noted it has several powerful programs built into ROM that are accessed at the touch of a button. This means that the user memory can be used for user input without worrying about loading an applications program into memory.

Programmable in BASIC, the *Model 100* sports a full-travel,

Memory/Storage	Keyboard	I/O	Display	Comments
32K/cassette recorder	71 keys, 5 multifunction keys	1 parallel, 1 serial, 2 game controller, digitized touch panel	256 × 192 capability, 32 × 16 text, composite video output avail.	expansion module, digitized touch tablet added
64K/cassette recorder/cartridge slot	standard typewriter/16 special function keys	1 printer, 2 controller, expansion connector/interface module	built-in video output supports 256 colors, 40 × 24 text	interface module added
10.6K/cassette interface	65 keys, 10-key keypad, function keys	1 serial	26-character × 1 line liquid crystal display	serial port added
48K/cassette interface	standard	HEX-BUS expansion unit, peripheral interface	16 colors	expansion interface
32K/cassette interface	60 keys, multifunction keys	1 parallel, 1 serial	RGB CRT/RGB and composite video output	color CRT
14K	65 calculator keys in typewriter arrangement, redefinable keys	input/output adapter/expansion bus	1-line × 26-character liquid crystal display	memory expanded to 14K
64K/cassette interface	56 keys	N/A	12-inch monochrome CRT	user memory expands to 64K
16K/floppy disk drive	62 keys, help key, 4 special function keys	1 serial, 2 controller, expansion connector/interface module	no std. CRT/built-in video output supports 256 colors, 40x24 text	floppy disk drive added
32K/cassette interface	65 calculator keys, 19-key keypad, 18 definable keys	60 pin bus connector	1 line 7 × 156 dot matrix liquid crystal display	cassette interface/printer added
128K/1 160K floppy disk drive	Not announced	1 parallel, joystick port	color graphics capability (no further details)	basic system
64K/1 170K 5 1/4" floppy disk drive	standard	1 IEEE-488 serial	6-inch high-res. color display	transportable business computer
16K/built-in card reader (see text)	61 keys, multifunctional keys	interface port for add-on options	32 character one-line LCD	basic system, includes card reader
24K/cassette interface	56 keys, embedded 10-key keypad, 8 programmable keys	1 parallel, 1 serial, built-in modem	40 × 8 liquid crystal display	memory increased to 24K
16K/cassette interface	70 keys, 3 programmable keys, 12-key keypad	1 parallel	12-inch monochrome/80 × 24 text (64 × 16 double-sized)	basic system
16K/cassette interface	64 keys, 12-key keypad	1 parallel	12-inch monochrome	basic system
4K/cassette interface	67 keys, 16-key keypad		5.5-inch monochrome	basic system

typewriter-like keyboard. It also features a cassette-tape interface for data storage.

An interesting feature of this system is the built-in direct-connect modem and software to drive it. This makes the *Model 100* a very versatile machine for use in the field because it can act as a portable terminal from just about anywhere there is a phone. Its 40-character by 8-line display is more than adequate for most field situations. This unit upgrades once in this category with the addition of 16K of RAM.

Another offering from Radio Shack is the new *Model 4*, an all-in-one, terminal-type computer system.

At this point in its pricing, the *Model 4*, driven by an 8-bit Z80A microprocessor, relies on a cassette recorder for mass storage, has 16K of RAM (that is more than enough for average home usages), and it includes a 70-key standard typewriter-type keyboard. This keyboard contains three programmable keys and a separate 12-key pad.

The beauty of an all-in-one system versus others on the market is that the buyer doesn't have to worry about which display unit to buy, because the system includes one. The display on the *Model 4* is a full 80 characters by 24 lines.

Similarly, the *TRS-80 Model III* desktop, which uses a Z80 microprocessor instead of the Z80A, is another all-in-one system. It also differs from the *Model 4* in its display, which is 64-characters by 16-lines. It is an older unit and offers the same amount of basic user memory, although its keyboard is more limited.

Both systems can be expanded into fairly powerful units, as will be seen later.

Two other Radio Shack computers that were introduced in the \$100 to \$500 price category, upgrade in this price category. The *Color Computer* has its memory increased to 32K, while the *PC-2 Pocket Computer* reaches 32K of RAM and its flexibility is increased with the addition of the printer/cassette interface expansion unit.

Commodore

Commodore is another computer manufacturer with a wide range of products. In this price category, alone, three new systems debut including the *Pet 64*, aimed at business, the *Commodore 64*, and the *Executive 64*, a tote-along system.

The *Pet 64* continues Commodore's policy of making a display screen available with its microcomputer systems. Driven by a 6500-series—Commodore actually came up with this series and uses it in all its products—8-bit microprocessor, the *Pet 64* has 64K of user memory standard.

With its standard typewriter-like keyboard, a user can program in BASIC and then save the results to a cassette recorder. Actually the basis of a very powerful system, the *Pet 64* comes with a standard 12-inch monochrome monitor and a serial port so the unit can interface with a printer or modem for output.

The *Commodore 64*, of which the *Pet 64* is a variant, is another unit driven by a 6500-series microprocessor. Very expandable, it will interface with all the peripherals offered for the *VIC-20*. Like the *VIC*, the *Commodore 64* has been part of the ongoing battle for dominance in the low-cost personal computer market and Commodore has cut its price. Although the price in our listing looks high, you should be able to find it substantially discounted.

Programmable in BASIC, the *Commodore 64* has a standard 64-key typewriter-like keyboard and it features 64K of RAM that makes it a highly versatile unit for many tasks. It will interface with a home television set through a built-in RF modulator and is capable of 16-color graphics and text. The system upgrades once in this price category with the addition of the digital tape recorder offered by Commodore.

Also based on the *Commodore 64* is the *Executive 64*, another entry in the transportable market. Again driven by a 6500-series 8-bit microprocessor, the *Executive 64* has one built-in 170K single-sided, double-density disk drive for mass storage. This

increases the capability of the unit from the start because it is able to access and store large amounts of data very quickly.

The built-in 6-inch display is capable of high-resolution color, a departure from the usual monochrome display found on other transportable computer systems.

The *Executive* is capable of interfacing with a printer through a parallel port for hard-copy output. It is the basis of an expandable transportable system and, as we shall see, it continues to expand in other price categories.

Atari

Best known for its home games, Atari's line expands in this price category with the addition of the *800XL*. Driven by a more advanced 6502C 8-bit microprocessor, the *800XL* features 64K of RAM. Not only is it capable of high-level tasks because of its level of RAM; it is also capable of using Atari's programming cartridges through a standard cartridge port.

Programmable in BASIC, the *800XL* has a standard typewriter-like keyboard for data entry. This is aided by four special-function keys and a HELP key. Its built-in video output supports 256 colors in the graphics mode or 40-characters by 24-lines in text mode. The display of 40 characters-per-line would seem to limit this unit's usefulness to casual word-processing or note writing.

In this price category the *600XL* upgrades with the addition of an expansion module that permits further system expansion. A second expansion adds a disk drive.

The *1200XL* upgrades twice. With the first upgrade, the Atari-offered data cassette recorder has been added to the picture for mass storage, while, with the second, the expansion interface module has been added to permit system growth.

Hewlett-Packard

Hewlett-Packard has a new entry in this price category, the *HP75C*. Actually a handheld, the *HP75C* features a "QWERTY" type of keyboard layout. In reality, though, the small calculator keys and the rather narrow placement of the keys make this keyboard suited only to one-finger entry than touch typing. Its display is a one-line by 32 character liquid-crystal display that is limited to casual or field use.

The *HP75C*'s forte is its portability. With 16K of built-in user memory, it is capable of most tasks one would expect it to perform in the field. However, this memory limits the sophistication of those tasks because it cannot perform functions requiring more memory. Perhaps its key feature is its built-in card reader. This allows the user to store data on magnetic cards.

Like other small-computer systems, this one is programmable in BASIC. This and other data entry is performed through the unit's 61-key keyboard. The *HP75C* also features an interface port for add-on peripheral options.

NEC

The *PC-6000* begins to expand to a much more powerful system in this price category. Its first expansion brings the user memory to 32K, while its second, the addition of a serial port, gives it the ability to communicate with the outside world via either a printer or modem.

The addition of the expansion module and a digitized touch-tablet for graphic input gives this system more flexibility and sophistication.

Texas Instruments

The *TI-99/4A* expands three times in this segment. Its first expansion increases its user memory by 32K, while the second adds to its flexibility with the addition of the *Hex-Bus* option. The *Hex-Bus* allows external peripherals to be added to this unit to give it, for example, additional input/output capability through serial and parallel ports that can be added.

In its next upgrade, the expansion interface is added to increase the versatility of this system. The expansion interface is used to accommodate such items as disk drives.

TI's *CC-40* also becomes more fully configured in this price

category. In its first expansion, it gains I/O capability with the addition of parallel and serial ports. With these ports, the computer can interface with either a printer or a modem for output or input. In its second expansion, the *CC-40* gains greater—and faster—mass storage with the addition of the *Wafertape* continuous tape-loop data drive.

Panasonic

The Panasonic *H1400* and *H1800* begin to become more fully configured also. In the first expansion, the input/output adapter is added to each unit. This enables each unit to interface with other peripherals, as will be shown in other price categories.

In its second expansion, the *H1400* becomes more useful as its user memory is increased to 14K.

The *JR-200* computer also becomes a little more powerful in this price category as a color monitor is added.

Netronics

The *Explorer/85* kit expands five times. In the first expansion, the S-100 card cage is added. When this is done, the user has the ability to choose from the many S-100 add-in cards available to configure his system as he wants. For instance, there are cards adding serial or parallel ports, disk controllers, analog-to-digital and digital-to-analog conversion, etc.

However, the memory capacity is still lacking in this unit and the second expansion brings it up to 4K. At this level, though, it is still only capable of performing very basic functions because of the limited memory.

The third expansion adds BASIC, with the addition of the correct ROM. This simplifies the use of the *Explorer/85* because BASIC no longer has to be loaded from tape.

Expansion number 4 increases the RAM to a much more reasonable 16K. At this level, the machine is capable of performing more serious tasks. The final expansion brings memory up to 64K.

The *Elf II* expands here with the addition of a full-blown keyboard (replacing the hex pad of the earlier price level.) At the same time, the unit becomes more flexible in its programming capabilities with the addition of BASIC. Now, a user has a choice of machine-level or BASIC programming.

Spectravideo

The Spectravideo *SV-328*, described in an earlier section of this supplement, expands once in this price category with the addition of the company-offered tape recorder. Although it was described earlier, as you will note from the chart, its basic price puts it in this category, as does its first expansion.

Sharp

The Sharp *PC-1250* becomes a more versatile unit with the addition of a cassette interface and printer. This gives the user the opportunity of storing his work on magnetic tape or outputting it to the thermal printer built into the unit. Additionally, the unit becomes more versatile with the expansion of user memory to 8K.

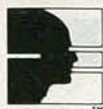
The *PC-1500* expands twice here. The first expansion adds the color printer, the plotter, and the cassette interface, which gives the user the option of outputting either hard text or saving the work to a cassette recorder.

In its next expansion, the *PC-1500* gains the possibility of accessing a data network or mainframe computer through the addition of a serial port. To use this capability, of course, you must add a modem to pass data through the phone lines. Still, it shows this system can become a powerful workstation for someone in the field.

Multitech

The *MPF-II* becomes a more powerful unit with the addition of a minifloppy disk drive for data storage. A disk drive helps increase the flexibility of any system because it gives the user a method for quick data storage and retrieval. It is a quantum leap over the use of a cassette recorder.

R-E



HOWARD W. SAMS & CO., INC.
4300 West 62nd Street P.O. Box 7092
Indianapolis, Indiana 46206

Repeated By Popular Demand!

SAMS 20% DISCOUNT SALE

Once again, Sams helps you invest in your future with a flat 20% discount on genuine Sams Computer Books, the same ones you'll find in our latest regular catalog!

The sale includes our brand-new 1983 titles as well as our best-sellers—books about the Apple II®, IBM® PC, Timex Sinclair 1000®, VIC-20, Commodore 64, TRS-80®, and more!

If you're into computing, you need to be into a Sams Book now!

ELEMENTARY COMPUTING Sams/Waite Primers



UNIX™ PRIMER PLUS

Presents the elements of UNIX clearly, simply, and accurately, for ready understanding by anyone in any field who needs to learn, use, or work with this remarkable operating system. Fully illustrated. By Mitchell Waite, Donald Martin, and Stephen Prata.

Ask for No. 22028 . . . \$19.95
Now Only \$15.96

CP/M® PRIMER (2nd Edition)

Completely updated to give you the know-how you need to understand and work with new or old CP/M versions immediately, in any application. Includes CP/M terminology, operation, capabilities, internal structure, and more. By Mitchell Waite and Stephen Murtha.

Ask for No. 22170 . . . \$16.95
Now Only \$13.56



BASIC PROGRAMMING PRIMER

(2nd Edition)
Improved and expanded edition gives you fundamental keywords, statements, and functions usable with the IBM® PC, Apple® II, or any other computer running a variation of Microsoft BASIC. Also contains new, advanced BASIC coverage, new game-program listings, and more. By Mitchell Waite and Michael Pardee.

Ask for No. 22014 . . . \$17.95
Now Only \$14.36



COMPUTER GRAPHICS PRIMER

Amaze yourself! Create computer animation and other graphics routines and techniques with this colorful Sams best-seller. Many examples, all in BASIC. By Mitchell Waite.

Ask for No. 21650 . . . \$15.95
Now Only \$12.76



PASCAL PRIMER

You'll learn to generate powerful programs in UCSD™ Pascal as this Sams powerhouse guides you through Pascal program structure, procedures, variables, decision-making statements,

and numeric functions. Remarkably user-friendly, with many examples and 8 appendixes. By Mitchell Waite and David Fox.

Ask for No. 21793 . . . \$17.95
Now Only \$14.36

MICROCOMPUTER PRIMER (2nd Edition)

Covers basic computer concepts, the electronics behind the logic, what happens inside the computer as a program runs, and a little about languages and operating systems. Excellent introductory material. By Mitchell Waite and Michael Pardee.

Ask for No. 21653 . . . \$14.50
Now Only \$11.60

COMPUTER FUNDAMENTALS



HOWARD W. SAMS CRASH COURSE IN MICROCOMPUTERS

(2nd Edition)
An actual self-study course in one lay-flat volume, completely updated with new chapters on 16-bit micros and BASIC programming, expanded coverage of applications software, new photos, and more. Lets you learn about microcomputers and programming fast! No previous computer knowledge necessary. By Louis E. Frenzel.

Ask for No. 21985 . . . \$21.95
Now Only \$17.56

HOW TO MAINTAIN AND SERVICE YOUR SMALL COMPUTER

Shows you simple procedures you can use to sharply reduce problems and down-time with your Apple® II, TRS-80®, or other small computer. Also shows you how to diagnose what's wrong, find the faulty part, make simple repairs yourself, and deal with the repair shop when professional servicing is necessary. By John G. Stephenson.

Ask for No. 22016 . . . \$17.95
Now Only \$14.36



MICROCOMPUTERS ON THE FARM

Gives farm-management and agribusiness professionals the information needed to make intelligent decisions about using microcomputers in farming operations. Discusses programs, applications, examples, and more. By Jack O. Beasley.

Ask for No. 22011 . . . \$14.95
Now Only \$11.96

MEGABUCKS FROM YOUR MICROCOMPUTER

Shows you how to make money using your creative talents through your microcomputer, and includes details for doing your own writing, reviewing, and programming. By Tim Knight.

Ask for No. 22083 . . . \$3.95
Now Only \$3.16



YOUR OWN COMPUTER (2nd Edition)

Explains and explores computer applications, buzzwords, programs, hardware, and peripherals. Compares 30 different models of personal and small-business computers. Easy to read, informative, and ideal for newcomers to computing. By Mitchell Waite and Michael Pardee.

Ask for No. 21860 . . . \$8.95
Now Only \$7.16



PERSONAL COMPUTERS HANDBOOK

You'll need this practical guide to explain the hows and whys of your micro's microprocessor, memory, peripherals, programming, and hardware/software troubleshooting. By Walter H. Buchsbaum.

Ask for No. 21724 \$12.95
Now Only \$10.36

GUIDEBOOK TO SMALL COMPUTERS

Presents an unbiased review of the capabilities of 21 popular microcomputer systems from 14 different manufacturers. Helps you make an informed choice. By William Barden, Jr.

Ask for No. 21698 \$6.95
Now Only \$5.56



UNDERSTANDING AND BUYING A SMALL BUSINESS COMPUTER

A lively, practical guide for anyone considering a micro- or minicomputer for business use. Filled with useful examples, diagrams, and case studies. Non-technical, and not a shopping guide. By Susan Blumenthal.

Ask for No. 21890 \$9.95
Now Only \$7.96

DICTIONARIES



USER'S GUIDE TO MICROCOMPUTER BUZZWORDS

Handy quick-reference that provides an understanding of the basic terminology you need to become "computer literate." Contains many illustrations. By David H. Dasenbrock.

Ask for No. 22049 \$9.95
Now Only \$7.96



COMPUTER DICTIONARY

(3rd Edition)

More than 12,000 definitions in this paperback reference translate computing terminology into language you can easily understand. By Charles J. Sippl.

Ask for No. 21652 \$16.95
Now Only \$13.56

MICROCOMPUTER DICTIONARY

(2nd Edition)

Most current, down-to-earth, and complete explanation of 5000+ microcomputer products, procedures, systems, techniques, and components available. By Charles J. Sippl.

Ask for No. 21696 \$16.95
Now Only \$13.56

COMPUTER DICTIONARY & HANDBOOK

(3rd Edition)

Largest, most complete reference book available on all phases of computers and their applications. More than 22,000 definitions, plus 14 appendixes. By Charles J. Sippl and Roger J. Sippl.

Ask for No. 21632 \$34.95
Now Only \$27.96

COMPUTER MATH



MICROCOMPUTER MATH

Excellent introduction to binary, octal, and hexadecimal number systems plus arithmetic operations on all microcomputers. Many practical examples. By William Barden, Jr.

Ask for No. 21927 \$11.95
Now Only \$9.56



BOOLEAN ALGEBRA FOR COMPUTER LOGIC

Basic introduction that covers everything from binary numbers to Karnaugh maps. No knowledge of higher math needed. By Harold E. Ennes.

Ask for No. 21554 \$7.95
Now Only \$6.36

PRACTICE PROBLEMS IN NUMBER SYSTEMS, LOGIC, AND BOOLEAN ALGEBRA

(2nd Edition)

Sixty-four lessons covering number systems, conversions, binary and octal arithmetics, Boolean algebra, and implementation of Boolean relationships. By Edward Bukstein.

Ask for No. 21451 \$10.95
Now Only \$8.76

GENERAL PROGRAMMING

DON LANCASTER'S MICRO COOKBOOK, Volume 2: MACHINE LANGUAGE PROGRAMMING

Covers address space and addressing, system architecture, programming using the "those \$!&#%\$! codes" technique, details of input/output, and more. By Don Lancaster.

Ask for No. 21829 \$17.95
Now Only \$14.36

NUMERICAL BASIC

Thoroughly explains techniques for using trigonometry, vector algebra, and matrix manipulations under ordinary BASIC on a microcomputer. By Bruce Powell Douglass.

Ask for No. 22048 \$15.95
Now Only \$12.76

CP/M® BIBLE: THE AUTHORITATIVE REFERENCE GUIDE TO CP/M

Gives you instant, one-stop access to all CP/M keywords, commands, utilities, and conventions. Covers CP/M-86, MP/M-80 and 86, CP/Net, and more. By Mitchell Waite and John Angermeyer.

Ask for No. 22015 \$19.95
Now Only \$15.96



SOUL OF CP/M®: HOW TO USE THE HIDDEN POWER OF YOUR CP/M SYSTEM

Teaches you how to use and modify CP/M's internal features, including how to modify BIOS, use CP/M® system calls in your own programs, and more! By Mitchell Waite and Robert Lafore.

Ask for No. 22030 \$18.95
Now Only \$15.16

ELECTRONICALLY SPEAKING: COMPUTER SPEECH GENERATION

Learn to generate synthetic speech with a microcomputer. Includes techniques, a synthesizer overview, and advice on problems. By John P. Cater.

Ask for No. 21947 \$14.95
Now Only \$11.96



INTRODUCTION TO ELECTRONIC SPEECH SYNTHESIS

Explains creation of an electronic "voice", three current speech-synthesis technologies, and speech quality vs. data rate and hardware costs. By Neil Sclater.

Ask for No. 21896 \$8.95
Now Only \$7.16

COMPUTER LANGUAGE REFERENCE GUIDE

If you know one language, this small book can help you understand six more! Seven chapters cover seven languages, and an eighth presents a keyword dictionary. By Harry L. Helms, Jr.

Ask for No. 21786 \$9.95
Now Only \$7.96

FORTH PROGRAMMING

Shows you the differences between FORTH-79 and fig-FORTH, and how to write or modify software using either dialect. Includes more than 50 useful programs. By Leo J. Scanlon.

Ask for No. 22007 \$16.95
Now Only \$13.56



INTRODUCTION TO FORTH

A fundamental approach to FORTH programming, using MMS FORTH in particular. Program examples are directly compared to the same program in Level II BASIC for clarity. By Ken Knecht.

Ask for No. 21842 \$10.95
Now Only \$8.76



26 BASIC PROGRAMS FOR YOUR MICRO

A series of 26 simple-to-complex games, most of which need 500 to 5000 bytes of RAM (13K is the highest). Conversion charts included. By Derrick Daines.

Ask for No. 22047 \$8.95
Now Only \$7.16



WHAT DO YOU DO AFTER YOU PLUG IT IN?

Complete tutorial covers hardware, software, languages, operating systems, data communications, and more, followed by solutions to the practical problems you'll meet while using them. By William Barden, Jr.

Ask for No. 22008 \$10.95
Now Only \$8.76

EXPERIMENTS IN ARTIFICIAL INTELLIGENCE FOR SMALL COMPUTERS

Takes you into the fascinating world of artificial intelligence, where you and your computer directly participate in sessions involving reasoning, problem-solving, creativity, and verbal

communication. By John Krutch.
Ask for No. 21785 \$9.95
Now Only \$7.96



DON LANCASTER'S MICRO COOKBOOK, Volume 1

Includes ground-zero basics, a real-world set of rules for the novice, pragmatic number systems and logic, usable codes, memory, and memory devices, all dedicated to helping you profit from and enjoy computing. By Don Lancaster.

Ask for No. 21828 \$17.95
Now Only \$14.36



CHEAP VIDEO COOKBOOK

Shows you how to build and use a \$20, seven-IC circuit that lets your computer provide any alpha or graphics format, including hi-res and a four-color mode, via software control. There's more, too. By Don Lancaster.

Ask for No. 21524 \$7.95
Now Only \$6.36

SON OF CHEAP VIDEO

Gives you do-it-yourself specs for a low-cost, custom EPROM character generator, plus lowercase for an Apple II, cheap video for 8080/Z-80, complete video display for \$7, and more. By Don Lancaster.

Ask for No. 21723 \$10.95
Now Only \$8.76

BUSINESS PROGRAMMING



BASIC BUSINESS SOFTWARE
Explains the fundamentals of application software for busi-

ness, how to evaluate it, and how to write it. Covers information storage and retrieval, inventory control, payroll, and general ledger programming. By E. G. Brooner.

Ask for No. 21751 \$11.95
Now Only \$9.56



WORD PROCESSING FOR SMALL BUSINESSES

Tells you about doing practical word processing on a personal computer, and presents details for more than 50 word-processing systems, including hardware, software, and more. By Steven F. Jong.

Ask for No. 21929 \$11.95
Now Only \$9.56



MICROCOMPUTER DATABASE MANAGEMENT

Create your own database program! Complete tutorial shows routines you can use to control and access large amounts of data with a microcomputer. Also explains operation of 3 commercial D/B programs. By E. G. Brooner.

Ask for No. 21875 \$12.95
Now Only \$10.36



USING COBOL IN AN MP/M® SYSTEM

Shows you how to use COBOL with a multiple-terminal CP/M system so that more than one user can access the same file at the same time without interference. Describes system design and more. By Neil G. Gelb.

Ask for No. 21936 \$12.95
Now Only \$10.36



COMPUTER PROGRAMS FOR MACHINE DESIGN

Ready-to-use BASIC programs to help mechanical and material engineers, machinists, technicians, and students solve the everyday problems they meet in machine technology. By Robert J. Wenzel.

Ask for No. 21960 \$21.95
Now Only \$17.56

GENERAL INTERFACING

ANALOG ELECTRONICS FOR MICROCOMPUTER SYSTEMS

Useful desktop reference covering power supply design, analog signal conditioning, data acquisition principles, data communication links, PID control, and other material necessary to microcomputer interfacing. By Paul Goldsbrough, Trevor Lund, and John Rayner.

Ask for No. 21821 \$19.95
Now Only \$15.96



COMPUTER COMMUNICATION TECHNIQUES

Covers data transfer techniques, hardware matching, standards and protocols, networking, videotex, teletext, software, and what's necessary to use them. By E. G. Brooner and Phil Wells.

Ask for No. 21998 \$15.95
Now Only \$12.76



THE WORLD CONNECTION
Powerful information that shows you how to select and use a



modem for sending and receiving electronic mail, making use of *CompuServe* and *The Source*, using electronic bulletin boards, and more. By Timothy Orr Knight.

Ask for No. 22042 \$9.95
Now Only \$7.96



THE S-100 AND OTHER MICROBUSES

Discusses microcomputer bus systems in general, examines 21 of the most popular ones, and explores ways to interface any two of them. By Elmer C. Poe and James C. Goodwin II.

Ask for No. 21810 \$9.95
Now Only \$7.96



STD BUS INTERFACING

Gives you all information and circuitry needed to interface your STD bus system easily. Much assembly language software included for Z-80, 8080/8085, 6502, and 6800-based boxes. By Christopher A. Titus, Jonathan A. Titus, and David G. Larsen.

Ask for No. 21888 \$13.95
Now Only \$11.16

APPLE® PROGRAMMING & INTERFACING



POLISHING YOUR APPLE Volume 2

Guides intermediate-level programmers in making finished, commercially salable products. Demonstrates menu techniques, error-trapping, making your programs run smoothly, and more. By Herbert M. Honig.

Ask for No. 22160 \$4.95
Now Only \$3.96

DISKS, FILES, AND PRINTERS FOR THE APPLE II

Provides you with outstanding explanations for Apple programming with sequential-access, random-access, and executive files, plus basic-to-advanced details for using disks and printers. By Brian D. Blackwood and George H. Blackwood.

Ask for No. 22163 \$15.95
Now Only \$12.76

APPLE II APPLICATIONS

Real-world interfacing applications that can be modified to fit your needs. Includes serial and parallel I/O boards, EPROM or E²PROM boards, remote data acquisition system, and more. By Marvin L. De Jong.

Ask for No. 22035 \$15.95
Now Only \$12.76



APPLESOFT™ LANGUAGE (2nd Edition)

The only complete Applesoft manual on the market, now with new material covering disk operations plus additional detail on numbers and number programming. Many usable routines and programs, too. By Brian D. Blackwood and George H. Blackwood.

Ask for No. 22073 \$13.95
Now Only \$11.16

POLISHING YOUR APPLE Volume 1

Clearly written, highly practical, concise assembly of all procedures needed for writing, disk-filing, and printing programs with an Apple II. Positively ends your searches through endless manuals to find the routine you need! By Herbert M. Honig.

Ask for No. 22026 \$4.95
Now Only \$3.96



ENHANCING YOUR APPLE II, Volume 1

Shows you how to mix text, LORES, and HIRES anywhere on the screen, how to open up whole new worlds of 3-D graphics and special effects with a one-wire modification, and more. Tested goodies from a trusted Sams Author! By Don Lancaster.

Ask for No. 21846 \$17.95
Now Only \$14.36



APPLE II ASSEMBLY LANGUAGE

Shows you how to use the 3-character, 56-word vocabulary of Apple's 6502 to create powerful, fast-acting programs! For beginners or those with little or no assembly language programming experience. By Marvin L. DeJong.

Ask for No. 21894 \$15.95
Now Only \$12.76

MOSTLY BASIC: APPLICATIONS FOR YOUR APPLE II, Book 2

Now, a second goldmine of fascinating BASIC programs for your Apple II, featuring 3 dungeons, 11 household programs, 6 on money or investment, 2 to test your ESP level, and more—32 in all! By Howard Berenbon.

Ask for No. 21864 \$12.95
Now Only \$10.36

MOSTLY BASIC: APPLICATIONS FOR YOUR APPLE II, Book 1

An assortment of 28 useful and ready-to-use Applesoft programs including a telephone dialer, a spelling test, house-buying guide, gas mileage calculator, and many more. By Howard Berenbon.

Ask for No. 21789 \$13.95
Now Only \$11.16



THE APPLE II CIRCUIT DESCRIPTION

Provides you with a detailed circuit description of all Apple II motherboards, including the keyboard and power supply. Comes complete with timing diagrams for major signals and a discussion of differences between the various revisions. By Winston D. Gayler.

Ask for No. 21959 \$22.95
Now Only \$18.36

ATARI® PROGRAMMING & INTERFACING



MOSTLY BASIC: APPLICATIONS FOR YOUR ATARI, Book 1

Thirty-eight fascinating and useful Atari BASIC programs you can run on any Atari 400, 800, or 1200XL computer! Includes a bar-chart generator, IRA planner, message taker, medical expense recorder, and many more. By Howard Berenbon.

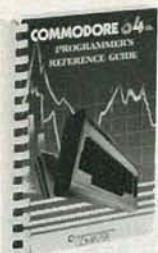
Ask for No. 22075 \$12.95
Now Only \$10.36

COMMODORE PROGRAMMING & INTERFACING

COMMODORE SOFTWARE ENCYCLOPEDIA (3rd Edition)

Giant, comprehensive Third Edition directory of software for the entire line of Commodore microcomputers, including the VIC 20 and Commodore 64. Covers games, business, education, and much more. By Commodore Computer.

Ask for No. 22091 \$19.95
Now Only \$15.96



COMMODORE 64 PROGRAMMER'S REFERENCE GUIDE

This creative programmer's working tool for the Commodore 64 includes a complete, detailed dictionary of all Commodore BASIC commands, statements, and functions, followed by BASIC program samples showing how each item works, and much, much more! By Commodore Computer.

Ask for No. 22056 \$19.95
Now Only \$15.96

COMMODORE 64 USER'S GUIDE

Shows you how to set up, program, and operate your Commodore 64, including how to do arcade-type color animation, music, and sound effects. Same book that comes packed with every Commodore 64 computer! By Commodore Computer.

Ask for No. 22010 \$12.95
Now Only \$10.36



VIC 20 PROGRAMMERS REFERENCE GUIDE

An easy-to-use, detailed manual that helps you program your VIC 20 like a pro in either BASIC or machine language! Includes a special section on VIC 20 I/O operations, too. By Commodore Computer.

Ask for No. 21948 \$16.95
Now Only \$13.56

MOSTLY BASIC: APPLICATIONS FOR YOUR PET®, Book 2

A second collection of ready-to-run BASIC programs that includes three dungeons, eleven household programs, seven on money and investment (three of which are on the stock market), two that test your ESP level, and more! Thirty-seven in all. By Howard Berenbon.

Ask for No. 22001 \$13.95
Now Only \$11.16

MOSTLY BASIC: APPLICATIONS FOR YOUR PET®, Book 1

Contains 28 useful BASIC programs for home, business, and entertainment. Includes a telephone dialer, spelling test, house buying guide, gas mileage calculator, and more. By Howard Berenbon.

Ask for No. 21790 \$13.95
Now Only \$11.16

IBM® PROGRAMMING & INTERFACING

INTERFACING TO THE IBM PERSONAL COMPUTER

Written by the lead designer and architect of the IBM PC itself, this authoritative, single-volume presentation gives you detailed technical data and operational theory for interfacing the IBM PC with a variety of hardware and software. By Lewis C. Eggebrecht.

Ask for No. 22027 \$17.95
Now Only \$14.36



MOSTLY BASIC: APPLICATIONS FOR YOUR IBM PC, Book 1

Brings you 38 chapters filled with useful and entertaining BASIC programs for your home and office. Helps you save money on energy usage, bar-chart your business sales, dial the telephone, learn a foreign language, and more. By Howard Berenbon.

Ask for No. 22076 \$12.95
Now Only \$10.36

MOSTLY BASIC: APPLICATIONS FOR YOUR IBM PC, Book 2

A second collection of 32 assorted programs in IBM BASIC you can use wherever you use your IBM PC. Includes a math dungeon, two memory challenges, a student grader, a phone directory, monthly budget, and much more. By Howard Berenbon.

Ask for No. 22093 \$14.95
Now Only \$11.96



USING YOUR IBM PERSONAL COMPUTER

Part One gets you started with off-the-shelf programs, and shows you how to use the PC's system hardware. Part Two teaches you to program in PC BASIC, and includes graphics, music, sound effects, and more. Fully indexed and illustrated. By Lon Poole.

Ask for No. 22000 \$16.95
Now Only \$13.56



8088 ASSEMBLER LANGUAGE PROGRAMMING: THE IBM PC

Shows you how to program the PC with 8088 assembler language. Includes a complete functional description of the 8088 microprocessor, plus a detailed analysis of the IBM PC architecture and how to make full use of it. By David C. Willen.

Ask for No. 22024 \$15.95
Now Only \$12.76

TEXAS INSTRUMENTS PROGRAMMING & INTERFACING

THE TI 99/4A® USER'S GUIDE

You'll like this badly needed guide to all aspects of the TI 99/4A! Covers everything from system setup to expansion options, including languages, software, and peripherals. By Carol Ann Casciato and Donald J. Horsfall.

Ask for No. 22071 \$10.95
Now Only \$8.76

TIMEX SINCLAIR PROGRAMMING & INTERFACING

TIMEX SINCLAIR 1000™/ZX81 USER'S HANDBOOK

Keep this handy as a useful reference source and you'll have most of the answers you'll ever

need on hardware and peripheral details, interfacing, machine-code programming, and possibly troublesome areas of BASIC. By Trevor J. Terrell and Robert J. Simpson.

Ask for No. 22012 \$13.95
Now Only \$11.16



TIMEX SINCLAIR 1000™/ZX81 BASIC BOOK

Neatly and effectively teaches ZX81 BASIC language, instructions, and programming techniques to owners of the ZX81 personal computer. Includes many examples and exercises. By Robin Norman.

Ask for No. 21957 \$12.95
Now Only \$10.36

TRS-80® PROGRAMMING & INTERFACING

TRS-80 FOR KIDS FROM 8 TO 80, Volume 2

Assumes you've either read Volume 1 or are familiar with its concepts. Covers new topics but also gives new detail on material from Volume 1, and includes many helpful programs, hints, and techniques. By Michael P. Zabinski.

Ask for No. 22070 \$9.95
Now Only \$7.96



LEARNING AND TEACHING PROGRAMMING USING THE TRS-80 MODEL III

Makes it possible for parents and teachers of elementary-aged children to become computer literate enough to teach gradeschoolers the subject using Computer Aided Instruction. By Nancy Lee Olsen.

Ask for No. 22072 \$10.95
Now Only \$8.76



BATTLESTAR BASIC FOR THE TRS-80

You construct an arcade-type video game program from scratch, using (and learning) new BASIC statements and commands as they become necessary to make the game gradually more complex and sophisticated. By David H. Dasenbrock.

Ask for No. 22006 \$14.95
Now Only \$11.96



TRS-80 FOR KIDS FROM 8 TO 80, Volume 1

Amazingly effective information suitable for beginning TRS-80 programmers of any age, especially youngsters. No special background is needed. Same principles used at National Computer Camp help you learn quickly and easily. By Michael P. Zabinski.

Ask for No. 22046 \$9.95
Now Only \$7.96



TRS-80 COLOR COMPUTER INTERFACING, WITH EXPERIMENTS

Teaches you the interfacing techniques, inner workings, and operation of the TRS-80 Color Computer and its high-performance 6809 microprocessor. Shows how you can control and monitor various equipment and events. By Andrew C. Staugard, Jr.

Ask for No. 21893 \$14.95
Now Only \$11.96



TRS-80 MODEL I, III, AND COLOR COMPUTER INTERFACING PROJECTS

A unique book for beginning interfacers which includes 14 simple, useful, and easy-to-build construction projects to help you make use of your TRS-80 model 1, 3, or Color Computer in the real world. By William Barden, Jr.

Ask for No. 22009 \$14.95
Now Only \$11.96

MOSTLY BASIC: APPLICATIONS FOR YOUR TRS-80, Book 2

Now, a second goldmine of fascinating BASIC programs for your TRS-80, featuring 3 dungeons, 11 household programs, 6 on money or investment, 2 to test your ESP level, and more—32 in all! By Howard Berenbon.

Ask for No. 21865 \$12.95
Now Only \$10.36

MOSTLY BASIC: APPLICATIONS FOR YOUR TRS-80, Book 1

Brings you 28 ready-to-use BASIC programs for your TRS-80, including a telephone dialer, spelling test, house buying guide, gas mileage calculator, and more. By Howard Berenbon.

Ask for No. 21788 \$12.95
Now Only \$10.36

TRS-80 ASSEMBLY LANGUAGE MADE SIMPLE

Learn how to plan, write, and hand-assemble your own assembly language programs in memory, using the T-BUG and Level II BASIC ROM subroutines. Provides immediate, short-cut results for the user who can simply use existing routines. By Earles McCaul.

Ask for No. 21851 \$12.95
Now Only \$10.36

16-BIT MICROPROCESSOR PROGRAMMING & INTERFACING



16-BIT MICROPROCESSORS

Carefully steps you through the complexities of programming and designing with powerful 16-bit microprocessors. Covers the 68000, 8086, Z8001/2, 9900, and NS16000. By Christopher A. Titus, Jonathan A. Titus, Alan Baldwin, W. N. Hubin, and Leo Scanlon.

Ask for No. 21805 \$15.95
Now Only \$12.76



THE 68000: PRINCIPLES AND PROGRAMMING

Systematically guides you through the 68000's complex architecture, instruction set, pinouts, and interfacing techniques. Excellent for design engineers, programmers, and students. By Leo J. Scanlon.

Ask for No. 21853 \$15.95
Now Only \$12.76

6502 MICROPROCESSOR PROGRAMMING & INTERFACING



6502 SOFTWARE DESIGN

Shows you how to place the powerful 6502 under assembly language program control. Contains 88 debugged and usable sample programs, and a wealth of additional material. By Leo J. Scanlon.

Ask for No. 21656 \$13.95
Now Only \$11.16



PROGRAMMING AND INTERFACING THE 6502, WITH EXPERIMENTS

Good any time, but excellent if you don't have much 6502 assembly language programming or chip-level interfacing experience. Simple I/O techniques, instructions, and interfacing that can be reinforced by a KIM, SYM, or AIM system. By Marvin L. DeJong.

Ask for No. 21651 \$17.95
Now Only \$14.36

6809 MICROPROCESSOR PROGRAMMING & INTERFACING



6809 MICROCOMPUTER PROGRAMMING AND INTERFACING, WITH EXPERIMENTS

Instructional text and applications handbook giving you a solid understanding of the 6809 high-performance chip. Covers all aspects and includes much software. By Andrew C. Staugard, Jr.

Ask for No. 21798 \$14.95
Now Only \$11.96



HOW TO PROGRAM AND INTERFACE THE 6800

Introductory tutorial to Motorola's popular 6800, emphasizing real-world applications. Covers internal structure, instruction set, programming, hardware, and interfacing techniques. Many experiments! By Andrew C. Staugaard, Jr.

Ask for No. 21684 . . . \$15.95
Now Only \$12.76

8080/8085 MICRO-PROCESSOR PROGRAMMING & INTERFACING

8085A COOKBOOK

A design-it-yourself guide to basic microcomputing concepts for the 8085A microprocessor and its family-compatible chips. Helps you design a number of completely operational, 8085A-based microcomputers. By Jonathan A. Titus, David G. Larsen, and Christopher A. Titus.

Ask for No. 21697 . . . \$15.95
Now Only \$12.76

8080/8085 MICROPROCESSOR PROGRAMMING & INTERFACING



8080/8085 SOFTWARE DESIGN, Book 1

Gives you a thorough and detailed look at programming in assembly language for the 8080 or 8085 microprocessor. Includes a complete discussion of the 8080/8085 instruction sets and interfacing techniques. By David G. Larsen, Jonathan A. Titus, and Christopher A. Titus.

Ask for No. 21541 . . . \$13.95
Now Only \$11.16

Z-80 MICROPROCESSOR PROGRAMMING & INTERFACING

Z-80 MICROPROCESSOR ADVANCED INTERFACING WITH APPLICATIONS IN DATA COMMUNICATIONS

Helps you learn to exchange information and access data bases all over the world, using a system based on the Z-80 or almost any other 8- or 16-bit microprocessor. Includes much portable software. By Joseph C. Nichols, Elizabeth A. Nichols, and Keith A. Musson.

Ask for No. 22003 . . . \$19.95
Now Only \$15.96



Z-80 MICROCOMPUTER HANDBOOK

Acquaints you with the hardware of the Z-80 and discusses its software aspects, including use of machine and assembly language. Also looks at the microcomputers using that chip. By William Barden, Jr.

Ask for No. 21500 . . . \$13.95
Now Only \$11.16

Bug symbol is a registered trademark of The Blacksburg Group, Inc., and denotes those books in the Blacksburg Continuing Education Series.

Apple II and Apple II Plus are registered trademarks of Apple Computer, Inc. IBM is a registered trademark of International Business Machines, Inc.

TRS-80 is a registered trademark of Radio Shack, a Tandy Corporation. PET is a registered trademark of Commodore Business Machines. CP/M and MP/M are registered trademarks of Digital Research, Inc. UCSD is a trademark of UC Regents, San Diego campus. Timex/Sinclair 1000 is a registered trademark of Timex Computer Corporation.

IMPORTANT— HERE'S HOW TO ORDER

1. Look through the Sams Book listings in this ad and find the books that fit your interests or the interests of someone you know.
2. To get your books at this special discount, and in the shortest possible time, complete and mail the handy order card attached. If the order card is missing, send us the order form on this page or staple it to your purchase order.
3. Charge your books to your MasterCard or VISA account, or include your check or money order for the full amount due. Be sure to add \$2 for handling.
4. If you'd rather order by phone, call the Sams Order Desk at 800-428-3696 toll-free or 317-298-5566 and charge it to MasterCard or VISA. Give the Order Desk operator the code number in the box at the bottom of the order form when she asks for it. Order Desk hours are 8:00 AM to 4:30 PM Monday thru Friday, EST the year 'round.
5. Mail your order to:

SAMS 20% DISCOUNT SALE ORDER FORM

Catalog No.	Qty.	Special Price	Total	Catalog No.	Qty.	Special Price	Total

Check
 Money Order
 MasterCard
 VISA

Account Number _____ Expires _____
Name (print) _____
Signature _____
Address _____
City _____ State _____ Zip _____

Subtotal _____
Add Local Sales Tax Where Applicable _____
Add Handling Charge 2.00
Total Amount Enclosed _____

Offer good in USA only and expires 1/31/84. Prices subject to change without notice. All books available from Sams distributors, bookstores, and computer stores nationwide. In Canada, contact Lenbrook Electronics, Markham, Ontario L3R 1H2.

AD453

Howard W. Sams & Co., Inc., 4300 W. 62nd St., P.O. Box 7092, Indianapolis, Indiana 46206

CIRCLE 32 ON FREE INFORMATION CARD

OCTOBER 1983

IT'S HERE AT LAST!

THE FIRST LOW COST 6502 COMPUTER WITH 48K RAM THAT'S COMPLETELY COMPATIBLE WITH APPLE II®

Introducing the RAM-TECH* RT 2 computer which offers you greater flexibility than the Apple II+® at a price that's easier on your finances. The RT 2 will run all software and use all peripheral hardware designed for the Apple II+®. It's 100% Apple® compatible yet it offers you features not available on the Apple II+®.

COMPARE THESE FEATURES:

- supports upper & lower case characters from the keyboard
- high quality ABS case will not crack and is light weight
- RF modulator included in addition to composite video output
- high quality light-touch keyboard with upper/lower case key
- 15 key numeric key pad for fast data entry (optional)
- high power switching power supply (8.5 amps total) will power two disk drives and several peripherals easily, has internal circuit breaker
- eight expansion slots to increase flexibility with peripheral cards
- 48K RAM expandable to 64K (192K RAM upgrade card available soon)
- socketed IC's for quick and easy service
- thousands of programs (business & home) available
- operates identically to the Apple II+® with exception of extra features on RT 2
- full 90 days parts and labor warranty with fast service turn-around



THE RAM-TECH* RT 2 IS EVERYTHING YOU ALWAYS WANTED FROM AN APPLE® (AND MORE), BUT THOUGHT YOU COULDN'T AFFORD. AND THAT'S GOOD NEWS!

BUT THE BEST NEWS IS THE PRICE:

\$525.00 + \$18.00 shipping & handling

WITH OPTIONAL NUMERIC KEYPAD:

\$575.00 + \$18.00 shipping & handling

COMPARED TO APPLE II® WHICH RETAILS AT MORE THAN DOUBLE THIS PRICE AND OFFERS YOU LESS, YOU CAN SEE WHY THE RAM-TECH* RT 2 SHOULD BE YOUR CHOICE. MAKE NO SYNTAX ABOUT IT, THE RT 2 IS FOR YOU!

PERSONAL I.D. OPTION — We will burn your name into ROM. When you power up your Ram-Tech your name will be displayed on the screen. **AN EXTRA MEASURE OF SECURITY AGAINST THEFT.**

Indicate on your order what name you wish to use (maximum 8 letters including spaces) — ADD: \$25.00 for I.D. option.

ALSO AVAILABLE: (sub-assemblies for do-it yourselfers) — 90 days warranty

- | | |
|---|----------|
| 1 - ABS case, high quality, Apple® look-a-like and color matched, will replace Apple® case | \$ 68.50 |
| 2 - same as #1 above but with numeric keypad cutout | \$ 84.00 |
| 3 - keyboard with upper/lower case key, direct replacement for Apple® or Ram-Tech* | \$110.00 |
| 4 - same as #3 above but with numeric keypad, use in combination with #2, also fits Apple® | \$139.50 |
| 5 - RF modulator with TV switch and cable, also fits Apple® | \$ 19.50 |
| 6 - switching power supply, 8.5 amps, internal circuit breaker, high power, also fits Apple® | \$112.00 |
| 7 - motherboard, completely assembled & tested, fully operational with burned ROMS | \$295.00 |
| 8 - bare motherboard w/ parts discription screened on board and instructions, highest quality G10 epoxy | \$ 48.00 |

SHIPPING & HANDLING FOR ABOVE: cases #1 & 2 add 10%; all others add 5%

PERIPHERALS, CARDS & ACCESSORIES FOR YOUR RAM-TECH* OR APPLE®

all items #1 to 19 guaranteed for one year (disk drives for six months)

- | | | | |
|---|----------|--------------------------|----------|
| 1 - 16K RAM card | \$ 58.00 | 11 - interger card | \$ 97.50 |
| 2 - 80 column card | \$ 94.50 | 12 - PAL card | \$114.00 |
| 3 - clock card | \$135.00 | 13 - language card | \$ 72.50 |
| 4 - communications card | \$ 89.00 | 14 - RS-232 serial card | \$ 84.00 |
| 5 - disk controller card | \$ 58.00 | 15 - Z-80 CP/M card | \$ 92.00 |
| 6 - EPROM writer card | \$124.50 | 16 - VERSA card | \$345.00 |
| 7 - FORTH card | \$ 98.50 | 17 - analog/digital card | \$116.50 |
| 8 - IEEE-488 card w/cable | \$186.00 | 18 - system cooling fan | \$ 63.00 |
| 9 - parallel printer card w/cable | \$112.00 | 19 - joy stick w/button | \$ 24.50 |
| 10 - parallel printer buffer and grappler card with cable | \$245.00 | | |

DISK DRIVES: Guaranteed high quality for use with all Apple® compatible (or Ram-Tech*) controllers - DOS 3.3 & 3.2

USES SPECIAL LOW POWER CONSUMPTION CIRCUITRY

- | | | |
|----------|----------|--------------------------|
| TEAC 55A | \$325.00 | \$370.00 with controller |
| SHUGART | \$285.00 | \$330.00 with controller |

SHIPPING & HANDLING: add \$3.50 per item #1 - 19 . . . disk drives add \$10.00

TO ORDER

- ALL PRICES IN U.S. CURRENCY
- VISA OR MASTER CARD: SEND NUMBER, EXPIRY DATE, BANK NAME & CARD HOLDER'S NAME, INCLUDE PHONE NUMBER.
- CHECKS & MONEY ORDERS O.K. - CHECKS NEED THREE WEEKS TO CLEAR. (NO C.O.D.'S TO U.S. DUE TO POSTAL REGULATIONS)
- CANADIAN ORDERS ADD 25% FOR CDN FUNDS EXCHANGE.
- U.S. CUSTOMERS WILL HAVE TO PAY U.S. CUSTOMS 4.7% DUTY. DUTIES COLLECTED BY POST OFFICE. WE ASSUME NO LIABILITY FOR CUSTOMS CLEARANCE.

DEALER INQUIRIES REQUESTED

BYTE-RYTE

DEPT. RE

P.O. BOX 205, STATION CART.
MONTREAL, QUEBEC, CANADA H4K 2J5

(514) 335-1717

*Apple is a trademark of Apple Computer Inc.

*Ram-Tech is a trademark of 99506 CANADA INC.



Some big-name and some new-name manufacturers join the list of companies we have already mentioned.

\$1000 to \$1500

MARC STERN

BY NOW YOU ARE PROBABLY WONDERING WHERE ALL THE "BIG names" in the microcomputer industry are hiding. Well, this price category answers that question as such giants as IBM, Apple, and Heath join the parade of small-computer manufacturers.

At the same time, another Apple-compatible computer makes its debut, the *Ace*-series from Franklin Computer Corp., which has been the subject of controversy, but whose way seemingly has been cleared thanks to recent court actions. And, another system debuts from a manufacturer whose name has long been associated with consumer electronics: Sony.

New systems debut from manufacturers whose names we are familiar with. Atari has a new system as does NEC Home Electronics and Commodore Business Machines.

Meanwhile, systems launched in the lower-price categories begin to either become fully configured or take on new power and become much more versatile.

Let's start our exploration of this price category with the new entries on the block, moving on to the new entries from those manufacturers we have already met, and wrap it up with looks at how already-described systems take on new configurations.

IBM

Two key changes have occurred during the last 12 months. First, IBM increased the amount of user memory from 16K to 64K in the basic unit and second, the computer giant has dropped a standard cassette interface.

At this point in its life, the IBM *Personal Computer* is little more than the system box, motherboard, 64K of user memory, and the 83-key keyboard that boasts 10 function keys. However, this is the beginning of a truly powerful system.

Capable of interfacing with a home television set—providing the user opts for the correct monitor-interface board—the IBM *PC* is driven by a 16-bit 8088 microprocessor. This gives it the

ability to handle up to 1.2 megabytes of RAM and, further, it also has the ability to handle complex applications programming.

In reality, these capabilities are reserved for higher price classes.

Franklin

Franklin was the perhaps the first domestic computer manufacturer to enter the highly lucrative Apple-compatible market last year with its *Ace*. It continues to market the *Ace 1000* this year and has expanded its offerings, as you will see in other price categories.*

The *Ace 1000* is driven by an 8-bit 6502 microprocessor, the same micro that drives the venerable *Apple II* series. This small computer comes with 64K of user memory that makes it capable of highly complex applications. It also features a cassette interface for mass storage and is programmable in BASIC.

The *Ace 1000* features a full, typewriter-style keyboard with 72 keys and a 12-key numeric keypad. This feature, alone, makes this machine very usable and should enable quick data or program entry by a skilled typist.

The *Ace 1000* is capable of 40-character by 24-line text display and 280- by 192-dot graphics resolution.

Although it is the basic *Ace 1000* system, it is still a capable unit, whose functionality grows as we add more peripherals to it. For instance, the *Ace 1000* becomes more versatile in this price category with the addition of a floppy-disk drive that uses an Apple-compatible disk operating system.

Apple

Apple Computer, one of the long-time leaders in the microcomputer market, apparently knew it had a good thing on its hands with the *Apple II* and *Apple II-Plus* and so rather than phasing out this long-lived series, the company upgraded it to

TABLE 1—\$1000-\$1500

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Atari Products	1400XL	\$1000 (est.)	6502C	8-bit	N/A	BASIC
Atari Products	1450XLD	\$1000 (est.)	6502C	8-bit	Atari DOS III	BASIC
Texas Instruments	TI-99/4A	\$1009	TMS9900	16-bit	N/A	BASIC
Commodore Business Machines	Commodore 64	\$1018.95	6510	8-bit	N/A	BASIC
Formula International	Pinecom (kit)	\$1029	6502	8-bit	N/A	Not announced
Panasonic Co.	H1800	\$1038	6502	8-bit	SNAP	BASIC
Toshiba America	T100	\$1050	Z80A	8-bit	N/A	BASIC
Radio Shack	TRS-80 Model III	\$1059	Z80	8-bit	N/A	BASIC
Spectravideo	SV-318	\$1079	Z80A	8-bit	N/A	BASIC
Commodore Business Machines	BX256-80	\$1095	6509/8088	8/16-bit		BASIC
Franklin Computer Corp.	Ace 1000	\$1095	6502	8-bit	N/A	BASIC
Radio Shack	TRS-80 Model 100	\$1118	80C85	8-bit	N/A	BASIC
Sord Computer c/o Mitsui	M23	\$1120	Z80A	8-bit	Proprietary, CP/M- compatible	BASIC, Pascal, FORTRAN
Texas Instruments	TI-99/4A	\$1135	TMS9900	16-bit	N/A	BASIC
Casio, Inc.	FX-9000P	\$1144	Z80A-compatible	8-bit	Not announced	BASIC
Radio Shack	TRS-80 Color Computer	\$1148	6809E	8-bit	Proprietary	BSIC
Commodore Business Machines	VIC-20	\$1152.80	6502	8-bit	Proprietary	BASIC
Formula International	Pinecom (kit)	\$1154	6502	8-bit	N/A	No announced
Radio Shack	TRS-80 Pocket Computer PC-2	\$1179.20	Custom CMOS	8-bit	N/A	BASIC
Panasonic Co.	H1400	\$1188	6502	8-bit	SNAP	BASIC
NEC Home Electronics	PC-8800	\$1199	Z80A-compatible	8-bit	N/A	BASIC
Spectravideo	SV-328	\$1200	Z80A	8-bit	N/A	BASIC
Radio Shack	TRS-80 Model III	\$1207	Z80	8-bit	N/A	BASIC
Radio Shack	TRS-80 Model III	\$1255	Z80	8-bit	N/A	BASIC
Atari Products	1200XL	\$1268	6502	8-bit	Atari DOS III	BASIC
Netronics Research	Explorer/88-PC	\$1284.48	8088	16-bit	N/A	machine/BASIC
Panasonic Co.	H1800	\$1288	6502	8-bit	SNAP	BASIC

Memory/Storage	Keyboard	I/O	Display	Comments
64K/cartridge slot	66 keys, 4 special function, 4 programmable, 12 preprogrammed	1 serial, 2 controller, expansion connector, modem, speech synthesizer	256 colors, 40 × 24 text	basic system
64K/1 slim line 254K DS/DD drive	66 keys, 4 special function, 4 programmable, 12 preprogrammed	1 serial, 2 controller, expansion connector, modem, speech synthesizer	256 colors, 40 × 24 text	basic system
48K/cassette interface	standard	1 serial, HEX-BUS expansion unit, peripheral interface	16 colors	serial port
64K/cassette recorder	60 keys, 4 programmable	1 serial	14-inch high-res. dedicated color monitor	color monitor, serial port
48K	66 keys, 14-key keypad	1 parallel	80-column text capability/280 × 192 graphics	80-column video card
16K	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus	1-line × 26-character liquid crystal display	memory expanded to 16K
64K/cassette interface	89 keys, 8 special function	1 parallel, 1 serial	80 × 25 monochrome	monitor
16K/cassette recorder	64 keys, 12-key keypad	1 parallel	12-inch monochrome/64 (32) × 16 text mode	cassette recorder
64K/cassette recorder	71 keys, 10 programmable, built-in joystick	1 serial, 1 parallel	256 × 192 resolution, 16 colors, television used as display	serial, parallel ports added, memory upgraded, expansion interface
256K	standard, numeric keypad	1 serial	12-inch monochrome CRT/80 × 25 text mode	basic system, dual processors
64K/cassette interface	72 keys, 12-key keypad	game controller	40 × 24/280 × 192 graphic capability	basic system
32K/cassette interface	56 keys, embedded 10-key keypad, 8 programmable	1 parallel, 1 serial, built-in modem	40 × 8 liquid crystal display	memory expanded to 32K
128K	59 keys, 20-key keypad, 9 special function	Not announced		basic system
48K/cassette interface	standard	1 serial, 1 parallel HEX-BUS expansion unit, peripheral interface	16 colors	parallel port
8k cassette interface	67 keys, 16-key keypad		5.5-inch, 32 × 16 monochrome, 256 × 128 graphics	4K RAM
32K/1 156K 5 1/4" floppy disk drive	53 keys	1 serial	32 × 16 color text mode/256 × 192 graphics capability	156K drive
29K/1 170K 5 1/4" floppy disk drive	66 keys, 4 user-programmable	1 serial	14-inch high-res. dedicated color monitor	color monitor, 170K floppy disk drive and serial port
48K	66 keys, 14-key keypad	1 parallel	9-inch monochrome CRT/280 × 192 graphics/80 column capability	monochrome monitor
32K/cassette interface	65 calculator keys, 19-key keypad, 18 definable	60 pin bus connector/RS-232C interface	1 line 7 × 156 dot matrix liquid crystal display	communications interface
22K	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus	1-line × 26-character liquid crystal display	memory expanded to 22K
64K/cassette interface/disk interface	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	RGB/composite video outputs 640 × 400 res./80 × 25 text	basic system
80K/cassette recorder	87 keys, 10 programmable, numeric keypad	1 serial, 1 parallel	80 × 24 text mode capability/16 colors	serial and parallel ports, 80-column display card, expansion interface
32K/cassette recorder	64 keys, 12-key keypad	1 parallel, 1 serial	12-inch monochrome/64 (32) × 16 text mode	memory expands by 16K, serial port added
48K/cassette recorder	64 keys, 12-key keypad	1 parallel, 1 serial	12-inch monochrome/64 (32) × 16 text mode	memory expanded to 48K
64K/floppy disk drive	standard typewriter/16 special function	1 printer, 2 controller, expansion connector	built-in video output supports 256 colors, 40 × 24 text	floppy disk drive
64K/cassette interface	83 keys, 10 function, numeric keypad	1 serial	12-inch monochrome CRT	assembled Explorer/88-PC with keyboard, color board, ROM and monitor
24K	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus	1-line × 26-character liquid crystal display	memory expanded to 24K

TABLE 1—\$1000-\$1500 (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
NEC Home Electronics	PC-6000	\$1350	Z80A-compatible	8-bit	Proprietary	BASIC
Formula International	Pinecom (kit)	\$1354	6502	8-bit	N/A	Not announced
IBM	IBM-PC	\$1355	8088	16-bit	N/A	COBOL, FORTRAN, BASIC, Macro Assembler, Pascal
Multitech Electronics	MIC-500	\$1395	Z80A	8-bit	CP/M	BASIC, COBOL, Pascal
Apple Computer	Apple IIe	\$1395	6502A	8-bit	N/A	BASIC
Heath Company	HS-89-3 (kit)	\$1399	Z80	8-bit	HDOS/CP/M optional	BASIC
Commodore Business Machines	Commodore 64	\$1417.95	6510	8-bit	Proprietary	BASIC
Heath Company	HS-89-2 (kit)	\$1429	Z80	8-bit	HDOS/CP/M optional	BASIC
Commodore Business Machines	Commodore 64 Executive	\$1443.95	6500 series	8-bit	Proprietary	BASIC
Hewlett-Packard	HP75C	\$1445	Not announced		N/A	BASIC
NEC Home Electronics	PC-8800	\$1448	Z80A-compatible	8-bit	N/A	BASIC
Sony	SMC-70	\$1475	Z80A	8-bit	N/A	BASIC, CB-80, Pilot Plus
Franklin Computer Corp.	Ace 1000	\$1494	6502	8-bit	Apple DOS 3.3 compatible	BASIC
Commodore Business Machines	CBM 8032	\$1495	6502	8-bit	N/A	BASIC
TeleVideo Systems	Teletote	\$1499	Z80A	8-bit	CP/M	Not announced

the *Apple IIe* that made its appearance earlier this year. Still using a 6502 microprocessor, the 8-bit *Apple IIe* has had its user memory upgraded to 64K. Further, it has also changed its keyboard slightly, providing 63 keys and two programmable keys.

As with other small-computer systems, this one uses BASIC as its primary user programming language and it features either low- or high-resolution graphics capability, along with a standard 40-character by 24-line text mode. The 40-character lines are fine for standard home applications, but it is limited for some applications such as word processing. If one wants to have word-processing capability, then the Apple-offered 80-column display card must be used. For output, a user can interface with a standard monitor or with a home television if he buys an RF modulator. (But not for 80 columns.)

Heath

For those would-be computer users who would like more than just an outside look at a microcomputer, there's the Heath line of computer kits, the *H89-series*. These computers give you an inside-out look at what makes a microcomputer tick as you put them together piece-by-piece.

Since this series, the *H89-2*, *H89-3*, comes with a single, built-in 5¼-inch minifloppy double-sided, double-density disk, the user has fast mass storage and retrieval capabilities right from the start.

Programmable in BASIC and Z80 based, this series features an 84-key keyboard and a separate 12-key keypad. The sloped keyboard allows for quick data entry. Input/output is provided by three serial ports. These allow the *H-89-series* to interface with a variety of printers or modems.

It should be noted that this CP/M-compatible system is all-in-one. It combines the CRT, system board, and keyboard into one box and looks much like the traditional type of computer workstation with which many of us are familiar.

TeleVideo

TeleVideo is another of the long-established firms in the computer industry and it has an entry in the transportable computer market, the *Teletote*. (Remember, the transportable market was last year's portable market, but the new generation of lap computers has changed this designation.)

The *Teletote* breaks no new ground in the computer industry, having been based around proven technology. It is driven by an 8-bit Z80A microprocessor and uses the industry-standard CP/M operating system.

It features 64K of RAM and one 368K double-sided, double-density 5¼-inch minifloppy disk drive for storage. This combination gives the user a great deal of flexibility and increases the system's capabilities. Its prime drawback is that the user must use the same drive for both the application program disk and a data disk, which can make it somewhat cumbersome, especially if a file has to be copied. In this situation, the user must keep switching disks, so it's a good idea to consider investing in a second disk.

Data entry is facilitated with the 75-key typewriter-type keyboard and output is aided by 2 standard serial-ports. It is also equipped with what seems to be becoming the standard-sized monitor in the transportable field, a 9-inch monochrome unit, capable of 80-characters by 24-lines in text mode and high-resolution graphics of 640- by 240-dots.

Sony

Sony, long a leader in consumer electronics, also has a small-computer offering in this price segment, the modular *SMC-70*. This computer contains a keyboard and easily upgrades into a powerful system. However, at this price level it is very much a basic unit.

Driven by an 8-bit Z80A microprocessor, the *SMC-70* consists of a system box and keyboard. The keyboard includes 71 keys, a keypad, and nine special-function keys. It is a standard

Memory/Storage	Keyboard	I/O	Display	Comments
32K/1 floppy disk drive unit	71 keys, 5 multifunction	1 parallel, 1 serial, 2 game controller, digitized touch panel	256 × 192 capability, 32 × 16 text, composite video output avail.	floppy disk drive
48K	66 keys, 14-key keypad	1 parallel	9-inch monochrome CRT/280 × 192 graphics/80 column capability	color monitor
64K	59 keys, 10 special function, 20-key keypad	N/A	N/A	basic system, includes mother board, cpu, 64K memory, system housing and keyboard only
64K/2 5 1/4" floppy disk drives	N/A	2 serial, 1 parallel	N/A	basic system, terminal required
64K/cassette interface	63-key typewriter, 2 programmable	game controller	low/high-res. color, 40 × 24 test mode, video output	basic system
48K/1 5 1/4" floppy disk drive	84 keys, 12-key keypad	3 serial, 1 parallel	white monochrome display/80 × 25 text mode	kit
64K/1 170K 5 1/4" floppy disk drive	60 keys, 4 programmable	1 serial	14-inch high-res. dedicated color monitor	floppy disk drive
48K/1 5 1/4" floppy disk drive	84 keys, 12-key keypad	3 serial, 1 parallel	green monochrome display/80 × 25 text mode	kit
64K/2 170K 5 1/4" floppy disk drives	standard	1 IEEE-488 serial, 1 standard serial	6-inch high-res. color display	2nd drive, standard serial port
24K/cassette recorder	61 keys, multifunctional	interface port for add-on options	32 character one-line LCD	cassette recorder
64K/cassette interface/disk interface	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch monochrome CRT/80 × 25 text	monochrome display
64K/cassette interface	72 keys, keypad, 9 special function	1 parallel		basic system
64K/1 5 1/4" floppy disk drive	71 keys, 12-key keypad	game controller	40 × 24/280 × 192 graphic capability	floppy disk drive
32K/cassette interface	standard, numeric keypad	1 serial	integral display	basic system
64K/1 368K DS/DD 5 1/4" floppy drive	75 keys, 16 special function, 17-key keypad	2 serial	9-inch CRT/640 × 240 graphics/80 × 24 text	basic system, transportable

typewriter-style unit that should facilitate keyboarding data or BASIC programming, the language that comes with the system.

At this stage, the *SMC-70* relies on a cassette interface and cassette recorder for data storage.

Commodore

A multi-line computer manufacturer, Commodore Business Machines has entries in many price classes and this price category is no exception. It is here that the *BX256-80* makes its appearance, as does the *8032*.

The *BX256-80* is a dual-processor machine, capable of handling both 8-bit and 16-bit programming. It was unveiled about a year ago.

Driven by dual 6509 and 8088 processors, the *BX256-80* is capable of sophisticated tasks. Its 256K of standard user memory assures that more than enough memory is available for almost anything a user may want to do. In fact, with some of the new generation of memory-hungry programs, 256K is needed.

It features a standard keyboard and is programmable in BASIC. It has a 12-inch monochrome CRT to display the machine's 80-characters by 25-lines.

The second system to debut in this category is the *8032*. This long-time veteran of the computer wars is driven by an 8-bit 6502 microprocessor and it comes with 32K of RAM as standard. Mass storage at this price level is handled via cassette recorder.

Data entry is facilitated by a standard keyboard and separate numeric keypad. It is programmable in BASIC. With a standard monochrome display, this basic system should easily meet most beginning home needs for most users. The user should also be able to access any information network by attaching a modem to the standard serial port.

While these are the new systems in this price category, there are also two other systems that have been upgraded, the *VIC-20* and the *Commodore 64*. The *VIC-20* upgrades and becomes a

fairly sophisticated system. With 29K of RAM, the system is becoming fairly flexible. However, it becomes even more flexible with the addition of a 170K 5 1/4-inch minifloppy disk for storage. This provides the user with a large increase in speed for both data access and retrieval. A color CRT is also added and a serial port gives this unit communications ability.

The *Commodore 64* upgrades twice. First, a color CRT and serial port are added. These two additions give the user the potential for color-graphics work and communications. Of course, if a user wants to take advantage of the communications potential he must add a modem.

The second expansion gives the user access to a 170K floppy disk, with its speed and storage flexibility advantages. With this system limited to one disk, though, it is a bit cumbersome. However, help is on the way when this system gains its second disk in another price category.

The *Executive 64*, on the other hand, becomes powerful with the addition of a second drive.

Atari

The new Atari systems appearing in this price category are the *1400XL* and *1450XLD*. Although exact prices hadn't been established at press time, they are likely to be in the \$1000 range.

The *1400XL* is driven by an 8-bit 6502C microprocessor and it comes with 64K of RAM. It has an integral software cartridge slot which allows it to use Atari's proprietary packaged software.

Programmable in BASIC, it features a standard typewriter keyboard that has four special-function keys, four programmable keys and 12 preprogrammed function keys.

Input/output is provided by standard serial port. However, a user doesn't have to tie up this port by connecting it to a modem because it includes a built-in modem, which is a plus.

Capable of supporting up to 256 colors, the display is limited to 40-characters by 24-lines of text, which is somewhat limiting

for serious word-processing work.

The *1450XLD* is nearly identical to the *1400XL* with one major exception, it includes disk storage. The *-XLD* includes a slim line 5¼-inch minifloppy disk as standard and this gives the user access to 254K of mass storage.

Another Atari system, the *1200XL*, has its capabilities upgraded in this segment with the addition of a disk drive.

NEC

Not only does the NEC *PC-6000* upgrade in this price category, but the manufacturer also has another model that makes its debut here, the *PC-8800*, a more powerful version of last year's *PC-8001*-series.

What makes the new system different? At one point in this expansion, the *PC-8800* gains an 8086 co-processor, giving this unit 8-bit and 16-bit capability.

But, we're getting ahead of ourselves because at this level, the *PC-8800* is roughly equivalent to last year's *PC-8001*. It is driven by a Z80A-compatible 8-bit microprocessor and it includes 64K of user memory. However, at this level the user is limited to cassette storage that is far slower than disk storage and far less versatile. In its favor, though, is the fact that this model includes a disk interface, which gives the user the option of equipping this system with a disk drive, if he so desires.

The 81-key typewriter-like keyboard has five multifunction keys and a separate 10-key keypad. Input/output is aided by standard serial and parallel ports that enable you to tie a printer or modem to the unit, further increasing the unit's versatility.

This computer features RGB color or composite-video output. It is capable of 640- by 400-dot resolution in the graphics mode or 80 characters by 25 lines in the text mode.

The *PC-8800* also upgrades once in this price category with the addition of a monochrome display that provides far better resolution than using a home television set.

The *PC-6000* gains a minifloppy drive in this price range.

Sord

Sord, one of the newer names in the microcomputer business, has a new offering in this price category, the *M23*. Driven by a Z80A 8-bit microprocessor, the *M23* comes with 128K of RAM, which is about twice the user memory offered on other systems in this price category.

Programmable in BASIC, Pascal, or Fortran, this unit has a 59-key typewriter-like keyboard with a 20-key numeric keypad and nine special-function keys.

Multitech

Although a relative newcomer to the microcomputer marketplace, Multitech not only has lower-priced offerings, but is also offering a full-blown small-computer system, the *MIC-500*.

Driven by a Z80A 8-bit microprocessor, the *MIC-500* is a full-featured system. It includes not only dual serial ports, but also a parallel printer port.

Its standard 64K RAM will perform many tasks the system is called upon to perform, including sophisticated applications routines. It is equipped with two disk drives and runs under the industry-standard CP/M operating system.

It must be noted, should the user opt for the *MIC-500* system, that it is a micromainframe and a terminal will have to be added to handle input and output.

Radio Shack

Radio Shack has four systems that become more fully configured in this price category. For instance, the full complement of memory is added to the lap *Model 100* to bring the total memory to 32K.

The *Model III* is upgraded three times in this price category. The second and third expansions of the *Model III* make it a far more powerful system. In the first expansion, a cassette recorder is added. In the second, the memory is increased to 32K, which means the system can perform far more serious microcomputing tasks. A serial port is also added that gives this small-computer

system the potential of tying into a modem and linking to other systems via the phone line. The third expansion brings this system up to its full memory complement of 48K.

The *Color Computer* becomes a more sophisticated system here with the addition of one 156K 5¼-inch drive.

The *PC-2* can now act as a terminal in the field with the addition of a communications interface.

Hewlett-Packard

Hewlett-Packard's handheld computer also becomes more powerful in this price segment. The lone upgrade to the *H75C* is the inclusion of a cassette recorder for data storage and retrieval.

Panasonic

The HHC series also upgrades in this pricing segment. For instance, the *H1400* has its memory expanded to 22K. This means that you can enter longer documents or handle more complex tasks with this handheld. At the same time, the *H1800* undergoes two memory upgrades.

Texas Instruments

Contrary to what one might have thought about the capabilities of the *TI-99/4A* system, it is much more than a simple, low-cost home computer.

In the first expansion, a serial port is added to this home computer. The second expansion adds a parallel port.

Formula International

The *Pinecom* kit becomes even more versatile in this price category with the addition of an 80-column card and two types of monitors. The 80-column card gives the user the ability to handle serious word-processing chores because the machine now has the ability of displaying a full page's worth of text.

The user is also given the option of choosing the type of monitor which best suits his needs. If he is interested in data and word-processing then a monochrome display is the best choice. However, if he is interested in graphics and color game-playing capability, then he should opt for the color CRT.

Netronics

The *Explorer/88-PC* from Netronics becomes nearly a full-blown system with the addition of a keyboard, color monitor board, ROM-based BASIC and system-monitor program, and a color CRT.

Although this system is still limited to cassette storage, a user can take advantage of cassette-based programs for applications. It should be kept in mind, though, that a cassette system is nowhere near as fast as a floppy-disk drive system for storage.

Spectravideo

Both the *SV-318* and *SV-328* upgrade in this category, too. The *SV-318* becomes a far more powerful system with the addition of parallel and serial ports for input/output and with the addition of more user memory for handling programs with greater sophistication. An expansion interface is also added for future system upgrading.

The *SV-328* also becomes more powerful as it gains parallel and serial interface ports. An 80-column card has also been added so that this system can handle either word-processing or sophisticated data processing chores. An expansion interface has also been added to facilitate system upgrading.

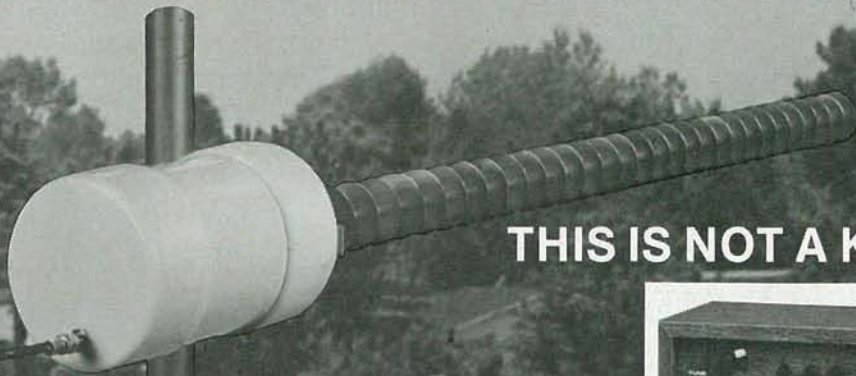
Toshiba

The *T100* upgrades with the addition of a monochrome display, giving the user the chance to handle sophisticated word-processing or data-processing applications.

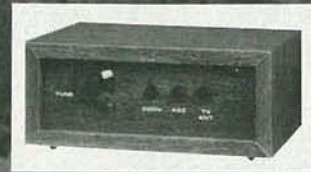
Casio

The Casio *FX-9000P* becomes more versatile with the addition of 4K of RAM. This means it can now handle more sophisticated routines, although this amount of memory is somewhat limited for high-level tasks. **R-E**

VARIABLE MICROWAVE DOWN CONVERTER



THIS IS NOT A KIT!!



QUANTITY DISCOUNT	
1.....	79.95
10.....	74.95
25.....	69.95
50.....	64.95
100.....	59.95

All down converters built with New **HOT** Transistor for more amplifier gain. **GREATER DISTANCE**

NEW—Power supply built with push button simplicity **ABC** Switch built in

★ Coax cable not included

PLEASE ADD SUFFICIENT POSTAGE

1 Unit weighs 5 lbs.

To order by Visa or Master Charge
No C.O.D. orders

Call 800-428-3500
Information 317-291-7262
6254 La Pas Trail
Indianapolis, Indiana 46268

ELECTRONIC RAINBOW INC

SATELLITE TELEVISION RECEIVER

KITS



Rainbow makes a top-of-the-line Receiver affordable

The Electronic Rainbow Receiver consists of a receiver with an external down-converter that mounts at the antenna, feeds the voltage to the LNA through the coax cable. The 4GHz signal is down converted to 70 MHz and is fed through the RG59/U coax to the receiver.

Rainbow Kits are supplied with simple step by step instructions. All the circuits that you need expensive test equipment to do are pre wired and tested. All printed circuit boards have the outline of each part printed on them.

RECEIVER FEATURES

Built in RF modulator • Detent Tuning-3.7 to 4.2 GHz • Variable Audio-5.5 to 7.5 MHz • Invert Video • Channel Scan • Voltage monitoring • Meter output • Remote Tuning

SPECIFICATIONS:

Single Conversion Image Rejection Downconverter • Threshold 8 db CNR • IF Bandwidth 24MHz • Output IV Audio and Video • IF Frequency 70MHz • Video Bandwidth 4.5MHz • Size 3½"Hx8½"Dx11¼"W

Complete Satellite TV Receiver

KIT #1 — Contains:

- Mainboard • Tuning Board • Down-converter Board • Modulator Board
- All parts needed to complete receiver
- Down Converter built in case.
- Cabinet, attractive black brushed anodized metal with silk screened front and back for a professional look
- 70 MHZ Filter is pre-wired and tested.
- Complete instruction Manual. **\$395.00**

KIT #2 — Board Kit Contains:

- Main Board • Tuning Board • Down-converter board • Modulator Board
- Parts List, assembly and alignment manual
- 4GHz local oscillator and 70MHz filter is pre-wired and tested. **\$129.00**

Instruction manual. Contains printed circuit board layouts, parts placement, and alignment instructions. **\$25.00**

Ask about guaranteed to play

We will accept telephone orders for Visa & Mastercard
No C.O.D. Orders

To Order Call 800-428-3500 317-291-7262
Complete Kit Weighs 10 pounds. Please add Sufficient Postage
6254 La Pas Trail
Indianapolis, Indiana 46268

ELECTRONIC RAINBOW INC 146

COMPUTER MANUFACTURERS

The following is a list of the manufacturers whose systems were covered in this special section. Those readers who wish to get more information about a system should contact the manufacturer directly.

Access Matrix Corp.
2159 Bering Drive
San Jose, CA 95131

Albert Computers
3170 Los Feliz Drive
Unit C
Thousand Oaks, CA 91362

Alspa Computer
300 Harvey West Blvd.
Santa Cruz, CA 95060

Altos Computer Systems,
2641 Orchard Park Way
San Jose, CA 95134

Apple Computer
20525 Mariani Drive
Cupertino, CA 95014

Atari Products
Box 50047
San Jose, CA 95150

Athena Computer
31952 Camino Capistrano
San Juan Capistrano, CA
92675

Basis, Inc.
5435 Scotts Valley Drive
Scotts Valley, CA 95066

Canon USA
One Canon Plaza
Lake Success, NY 11042

Casio, Inc.
15 Gardner Rd.
Fairfield, NJ 07006

Coleco Industries
945 Asylum Ave.
Hartford, CT 06105

Columbia Data Products
8990 Route 108
Columbia, MD 21045

Commodore Business Mach.
1200 Wilson Drive
West Chester, PA 19380

Compaq Computer Corp.
20333 FM 149
Houston, TX 77070

CompuPro
Box 2355
Oakland Airport, CA 94614

Computer Devices, Inc.
25 North Ave.
Burlington, MA 01803

Cromemco, Inc.
280 Bernado Ave.
Box 7400
Mountain View, CA 94039

Digital Equipment Corp.
2 Mount Royal Ave.
Box 1008
Maynard, MA 01752

Docutel/Olivetti Corp.
155 White Plains Rd.
Tarrytown, NY 10591

Durango Systems
3003 North First St.
San Jose, CA 95134

Dynalogic Info-Tech Corp.
8 Colonnade Road
Ottawa, CANADA, K2E 7M6

Eagle Computer, Inc.
983 University Ave.
Los Gatos, CA 95030

Epson America
3415 Kashiwa St.
Torrance, CA 90505

Formula International
12603 Crenshaw Blvd.
Hawthorne, CA 90250

Franklin Computer Corp.
2138 Route 38
Cherry Hill, NJ 08002

Fujitsu Microelectronics
3320 Scott Blvd.
Santa Clara, CA 95051

Gavilan Computer Corp.
240 Hacienda Ave.
Campbell, CA 95008

Gifford Systems
1922 Republic Ave.
San Leandro, CA 94577

Heath Company
Benton Harbor, MI 49022

Hewlett-Packard
1000 NE Circle Blvd.
Corvallis, OR 97330

Hitachi Sales Corp.
West Artesia
Compton, CA 90220

Honeywell, Inc.
200 Smith St.
Waltham, MA 02154

IBC
21592 Marilla St.
Chatsworth, CA 91311

IBM
Box 1328
Boca Raton, FL 33432

IMS International
2800 Lockheed Way
Carson City, NV 89701

Intertec Data Systems
2300 Broad River Rd.
Columbia, SC 29210

Ithaca Intersystems
200 E. Buffalo, Box 91
Ithaca, NY 14851

Kaypro Division
PO Box N
Del Mar, CA 92014

LNW Research Corp.
2620 Walnut
Tustin, CA 92680

Mattel Electronics
5150 Rosecrans Ave
Hawthorne, CA 90250

Morrow Designs
600 McCormick St.
San Leandro, CA 94577

Multitech Electronics
195 West El Camino Real
Sunnyvale, CA 94086

NEC Home Electronics
1401 Estes Ave.
Elk Grove Village, IL 60007

NEC Information Syst.
5 Militia Drive
Lexington, MA 02173

Netronics Research
333 Litchfield Rd.
New Milford, CT 06776

North Star Computers
14440 Catalina St.
San Leandro, CA 94577

Osborne Computer Corp.
26538 Danti Court
Hayward, CA 94545

Panasonic Co.
One Panasonic Way
Secaucus, NJ 07094

Radio Shack
One Tandy Center
Fort Worth, TX 76102

Sage Computer Tech.
35 North Edison Way, Suite 4
Reno, NV 89502

Sanyo
51 Joseph St.
Moonachie, NJ 07074

Seequa Computer Corp.
209 West St.
Annapolis, MD 21401

Sharp Electronics
10 Sharp Plaza
Paramus, NJ 07652

Sony
Sony Drive
Park Ridge, NJ 07656

Sord Computer
200 Park Ave
New York, NY 10166

Spectravideo
39 W. 37th St.
New York, NY 10018

Sumicom Inc.
17862 East 17 St.
Tustin, CA 92680

TeleVideo Systems
1170 Morse Ave
Sunnyvale, CA 94086

Texas Instruments
Box 53
Lubbock, TX 79408

Timex Computer
Box 1700
Waterbury, CT 06721

Toshiba America
2441 Michelle Dr.
Tustin, CA 92680

Unitronics
401 Grand Ave.
Suite 350
Oakland, CA 94610

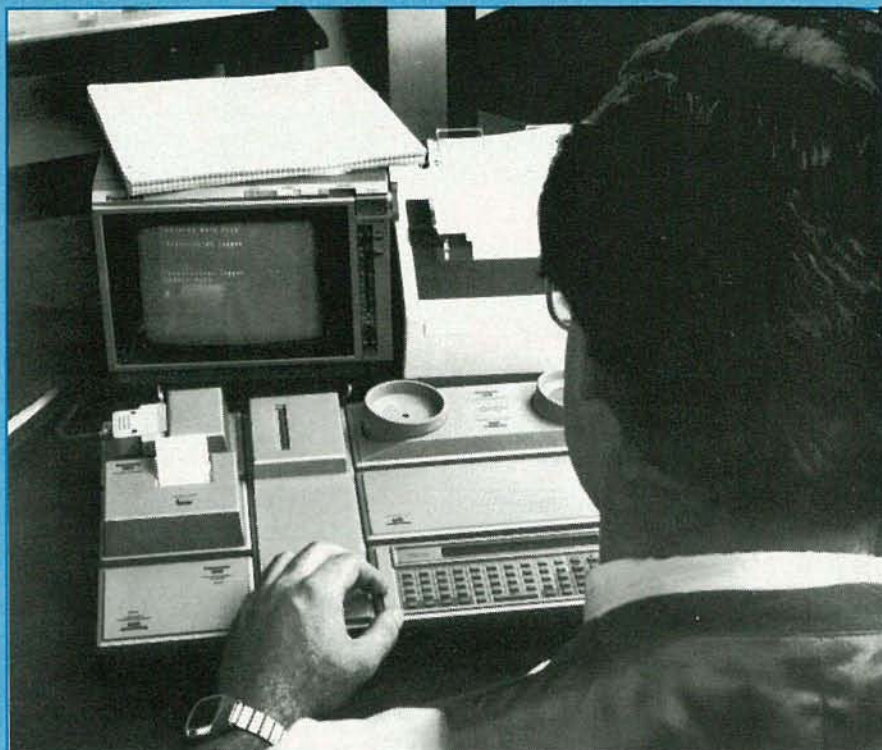
Vector Graphic, Inc.
500 North Ventu Park Rd.
Thousand Oaks, CA 91320-
2798

Video Technology
2633 Greenleaf Ave.
Elk Grove, IL 60007

Wang Laboratories
One Industrial Ave.
Lowell, MA 01851

Xerox Corp.
1341 West Mockingbird Lane
Dallas, TX 75247

Zenith Data Systems
1000 North Milwaukee Ave
Glenview, IL 60025



Disk drives are almost standard equipment as we move into this range. And most machines here have at least 64K RAM.

\$1500 to \$2000

MARC STERN

IF THERE HAS BEEN ONE TRUTH ABOUT THE MICROCOMPUTER industry during the last couple of years, it is this: every day it gets more crowded. In this year's hardware guide alone, there are more than 500 entries as various machines go through their paces and upgrade.

Some estimates have put the number of small-computer systems available at more than 250, while others have put the number at more than 400. But, whatever the number, there's little doubt that it's confusing to the average buyer and our supplement is an attempt to ease that confusion.

As you look over the charts we offer, note how each system upgrades as the price climbs. And, if you pay careful attention, you should have a good idea of how much computing power you can buy and still be within your budget.

Don't let the absolute numbers confuse you because, in the final analysis, only you can judge which computer system is right for you. If we have helped you in that search, then we have succeeded in the purpose of this section.

In this price category nine new names join the list of manufacturers offering systems. But, these aren't all the new entries you will find. Other manufacturers that have already been mentioned also have new offerings to look at. Finally, existing systems continue to grow more and more powerful.

One of the more interesting things to note, as you examine the charts, is that in this category more and more systems are starting to come through with either one or two minifloppy disk drives for storage. Of course, including a drive does raise the system's price, but it also makes it much more flexible and provides speedier data retrieval and storage.

So, without further ado, let's look at the new additions to the price parade and see what each system has to offer.

Morrow Design

George Morrow is a longtime veteran of the microcomputer industry and you would expect his company to have an entry in the microcomputer field. Indeed he does. In fact, he has two—

the *Micro Decision MD1* and *MD2*. Both have their starting prices in this category.

The *Micro Decision* is a Z80-based, 8-bit system that runs under the CP/M operating system. Its 64K of user memory provides more than enough memory space for many sophisticated routines. This operating system is a natural for the average user because it allows access to a wide variety of already-packaged, proven programs.

Programmable in BASIC, the *MD1* includes one 200K single-sided, double-density disk drive as standard. The typewriter-like keyboard allows quick data or word-processing entry and enhances this machine.

Input/output is provided through two serial ports that Morrow includes with this system. This gives the user the option of attaching both a dedicated printer and a modem. The modem, incidentally, gives the user access to the world of database networks, bulletin boards, or other computer systems and gives him the ability to upload or download files.

The *MD1* includes basic applications software in its base price and gives the user a monochrome display for output.

The *MD2* is an upgraded *MD1*. It adds a second single-sided, double-density disk drive. This is perhaps the most important improvement that can be made to any system, because adding a second drive so greatly improves the flexibility and productivity of any system. Using one disk limits the user to loading not only the program disk in the single drive, but also removing the program disk and loading the data. It involves an incredible amount of disk-swapping that having a second drive eliminates. Further, only having only one disk drive makes copying a program or data file cumbersome.

Kaypro

Although Kaypro (Non-Linear Systems) has been in the transportable computer business only a little more than a year, it has already made quite a market for itself. This firm has a long history of producing fine electronics test equipment and so its

TABLE 1—\$2000-\$2500

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
NEC Home Electronics	PC-6000	\$1500	Z80A-compatible	8-bit	Proprietary	BASIC
Panasonic Co.	H1400	\$1537	6502	8-bit	SNAP	BASIC
Radio Shack	TRS-80 Color Computer	\$1547	6809E	8-bit	Proprietary	BASIC
Commodore Business Machines	VIC-20	\$1551.80	6502	8-bit	Proprietary	BASIC
Spectravideo	SV-318	\$1554	Z80A	8-bit	CP/M	BASIC
Toshiba America	T100	\$1590	Z80A	8-bit	N/A	BASIC
Morrow Design	Micro Decision (MD1)	\$1590	Z80A	8-bit	CP/M	BASIC
Kaypro Corporation	Kaypro II	\$1595	Z80	8-bit	CP/M	BASIC, Pascal, Fortran, Assembly, COBOL
Franklin Computer Corp.	Ace Professional	\$1595	6502	8-bit	Apple DOS 3.3 compatible	BASIC
Albert Computers	Albert	\$1595	Not announced	Not announced	Apple DOS 3.3 compatible	Not announced
Eagle Computer Inc.	Eagle IIE-1	\$1595	Z80A	8-bit	CP/M	BASIC
Panasonic Co.	H1800	\$1637	6502	8-bit	SNAP	BASIC
Casio, Inc.	FX-9000P	\$1637	Z80A-compatible	8-bit	Not announced	BASIC
Hewlett-Packard	HP75C	\$1640	Not announced		N/A	BASIC
Radio Shack	TRS-80 Model 4	\$1699	Z80A	8-bit	TRSDOS, LDOS, CP/M	BASIC
Atari Products	1200XL	\$1718	6502	8-bit	Atari DOS III	BASIC
NEC Home Electronics	PC-6000	\$1749	Z80A-compatible	8-bit	Proprietary	BASIC
Apple Computer	Apple IIe	\$1769	6502A	8-bit	N/A	BASIC
Netronics Research	Explorer/85	\$1784.75	8085	8-bit	CP/M	machine/BASIC
Texas Instruments	TI-99/4A	\$1785	TMS9900	16-bit	Proprietary	BASIC
Cromemco Inc.	C-10	\$1785	Z80A	8-bit	CP/M	BASIC, RATFOR, COBOL, Fortran, LISP, assembler
Panasonic Co.	H1400	\$1791	6502	8-bit	SNAP	BASIC
Franklin Computer Corp.	Ace 1000	\$1794	6502	8-bit	Apple DOS 3.3 compatible	BASIC
Sumicom Inc.	System 330	\$1795	8088	16-bit	N/A	Fortran, COBOL, Pascal, BASIC
Hewlett-Packard	HP86A	\$1795	Not announced		N/A	BASIC, Pascal, Fortran
Osborne Computer Corp.	Osborne I	\$1795	Z80A	8-bit	CP/M	BASIC
Commodore Business Machines	Commodore 64	\$1816.95	6510	8-bit	Proprietary	BASIC
Radio Shack	TRS-80 Model III	\$1849	Z80A	8-bit	TRSDOS	BASIC, COBOL, Fortran, Assembler
Sony	SMC-70	\$1850	Z80A	8-bit	N/A	BASIC, CB-80, Pilot Plus

Memory/Storage	Keyboard	I/O	Display	Comments
32K/1 floppy disk drive unit	71 keys, 5 multifunction	1 parallel, 1 serial, 2 game controller, digitized touch panel	monochrome CRT added, 32 × 16	monochrome (green) CRT
22K	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus	1-line × 26-character liquid crystal display/color TV adapter	color television adapter
32K/2 156K 5 1/4" floppy drives	53 keys	1 serial	32 × 16 color text mode/256 × 192 graphics capability	second drive added
29K/2 170K 5 1/4" floppy disk drives	66 keys, 4 user-programmable	1 serial	14-inch high-res. dedicated color monitor	2nd drive added
64K/1 256K 5 1/4" floppy disk drive	71 keys, 10 programmable, built-in joystick	1 serial, 1 parallel	256 × 192 resolution, 16 colors, television used as display	1 256K drive
64K/cassette, 16K RAM pack	89 keys, 8 special function	1 serial, 1 parallel	8-line by 40-char. liquid crystal display	liquid crystal display, 16K RAM cartridge
64K/1 160K 5 1/4" floppy drive	standard	1 serial, 1 parallel	monochrome CRT	basic system
64K/2 190K SS/DD 5 1/4" drives	72 keys, 14-key keypad, 20 programmable	1 serial, 1 parallel	9-inch monochrome monitor/80 × 25 text	portable system
64K/1 5 1/4" floppy disk drive	72 keys, 12-key keypad	game controller	80 × 24/280 × 192 graphic capability	system includes one drive monochrome monitor, 80-column card, and bundled software
64K/2 5 1/4" floppy drives	59 keys, 5 special function	1 serial, 1 parallel, RS-422/423 capability	RGB outputs, 256 colors, 40 or 80-column text mode	basic system
64K/1 390K 5 1/4" floppy drive	75 keys	2 serial, 2 parallel	optional	basic system
24K	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus	1-line × 26-character liquid crystal display/color TV adapter	color television adapter
24K/cassette interface	67 keys, 16-key keypad		5.5-inch monochrome, 32 × 16 text, 256 × 128 graphics	16K RAM added
24K/cassette recorder	61 keys, multifunction	interface port for add-on options		memory increased to 24K
64K/1 184K 5 1/4" floppy drive	70 keys, 3 programmable keys, 12-key keypad	1 parallel	12-inch monochrome/80 × 24 text (64 × 16 double-sized)	disk drive added
64K	standard typewriter/16 special function	1 printer, 2 controller, expansion connector	built-in video output supports 256 colors, 40 × 24 text	2nd floppy disk drive added
32K/1 floppy disk drive unit	71 keys, 5 multifunction	1 parallel, 1 serial, 2 game controller, digitized touch panel	composite color CRT added, 32 × 16, up to 256 × 192 graphics	color CRT
64K/cassette interface	63-key typewriter, 2 programmable	game controller	12-inch monochrome CRT/80-column card/80 × 24 text mode	CRT and 80-column card
64K/1 8" floppy disk drive	56 keys	N/A	12-inch monochrome CRT	disk drive, controller, operating system
48K/1 floppy disk drive	standard	1 serial, 1 parallel HEX-BUS expansion unit, peripheral interface	16 colors	disk drive, plus controller
64K/1 390K 5 1/4" floppy disk drive	57 keys	1 serial, 1 parallel	12-inch monochrome/80 × 25 text/high-resolution graphics	modular system with one drive
22K	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus/1 serial	1-line × 26-character liquid crystal display/color TV adapter	serial port
64K/1 5 1/4" floppy disk	72 keys, 12-key keypad	game controller	40 × 24/280 × 192 graphic capability	integral disk housing and disk
128K	95 keys, 8 special function, 10-key keypad	1 parallel		basic system
64K	59 keys, 20-key keypad, 14 special function	1 parallel		basic system
64K/2 102K 5 1/4" floppy drives	57 keys, 12-key keypad	1 serial, 1 IEEE-488, modem, external video connector	5 1/2" monochrome CRT/52 × 24 text mode	transportable
64K/2 170K 5 1/4" floppy disk drives	60 keys, 4 programmable	1 serial	14-inch high-res. dedicated color monitor	2nd drive added
48K/1 184K 5 1/4" floppy drive	64 keys, 12-key keypad	1 parallel	12-inch monochrome/64 (32) × 16 text mode	184K drive added
64K/cassette	72 keys, keypad, 9 special function	1 parallel, 1 serial	home television	basic system

TABLE 1—\$2000-\$2500 (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Atari Products	600XL	\$1869	6502C	8-bit	Atari DOS III	BASIC
Spectravideo	SV-328	\$1874	Z80A	8-bit	CP/M	BASIC
Panasonic Co.	H1800	\$1891	6502	8-bit	SNAP	BASIC
Toshiba America	T100	\$1895	Z80A	8-bit	N/A	BASIC
TeleVideo Systems	Teletote	\$1899	Z80A	8-bit	CP/M	Not announced
Netronics Research	Explorer/88-PC	\$1899.95	8088	16-bit	MS-DOS	machine/BASIC
Heath Company	HS-89-3 (kit)	\$1924	Z80	8-bit	HDOS/CP/M optional	BASIC
Apple Computer	Apple IIe	\$1934	6502A	8-bit	N/A	BASIC
Hewlett-Packard	HP75C	\$1935	Not announced		N/A	BASIC
Radio Shack	TRS-80 Model III	\$1948	Z80A	8-bit	TRSDOS	BASIC, COBOL, Fortran,
Spectravideo	SV-318	\$1953	Z80A	8-bit	CP/M	BASIC
Heath Company	HS-89-2 (kit)	\$1954	Z80	8-bit	HDOS/CP/M optional	BASIC
Docutel/Olivetti Corp.	M20	\$1988	Z8001	16-bit	N/A	BASIC
Morrow Design	Micro Decision (MD2)	\$1990	Z80A	8-bit	CP/M	BASIC
Commodore Business Machines	SuperPET	\$1995	6502/6809	8-bit	N/A	BASIC, APL, COBOL, Fortran, Pascal
Osborne Computer Corp.	Osborne I	\$1995	Z80A	8-bit	CP/M	BASIC
Seequa Computer Corp.	Chameleon	\$1995	Z80A/8088	8/16-bit	MS-DOS, CP/M, CP/M-86	BASIC, Fortran, Pascal, COBOL, FORTH, LISP, assembly, C, PL/1
Franklin Computer Corp.	Ace 1200	\$1995	6502/Z80	8-bit	Apple-compatible/CP/M	BASIC
Toshiba America	T100	\$1995	Z80A	8-bit	CP/M	BASIC
LNW Research Corp.	LNW80 Model 2	\$1995	Z80A	8-bit	N/A	BASIC
Kaypro Division	Kaypro IV	\$1995	Z80	8-bit	CP/M	BASIC, Pascal, Fortran, Assembly, COBOL
Eagle Computer Inc.	Eagle IIE-2	\$1995	Z80A	8-bit	CP/M	BASIC
Sanyo	MBC 1000	\$1995	Z80A	8-bit	CP/M	BASIC
Eagle Computer Inc.	Eagle PC-E	\$1995	8088	16-bit	CP/M-86	
NEC Home Electronics	PC-8800	\$1998	Z80A-compatible/8086	8/16-bit	N/A	BASIC
Radio Shack	TRS-80 Model 4	\$1999	Z80A	8-bit	TRSDOS, LDOS, CP/M	BASIC

move into the microcomputer field is somewhat logical.

Its offering in this field, the *Kaypro II*, easily shows its heritage. Packaged in a sturdy, all-metal box, the *Kaypro II* looks as if it would be more at home on a test bench than in a computer showroom. The box is heavy-gauge metal and the components look like they mean business.

Like the all-in-one transportable *Osborne I*, the *Kaypro II* is a fully configured system. It includes a Z80 8-bit microprocessor and a series of applications programs to complete this system. These applications include a spreadsheet, word-processing, and business BASIC programming language, plus the CP/M operating system. Its 64K of user memory lets the user take advantage of those sophisticated packages.

This system takes advantage of a disk operating system from the start as it includes two single-sided, double-density 190K 5¼-inch minifloppy disk drives.

The *Kaypro II* features a standard, sloped typewriter-like keyboard with 72 keys, and a 14-key numeric pad plus programmable keys. The keys make a telltale beeping sound as you input data.

Input/output is handled by a standard serial and a standard parallel port. Display output is handled by a 9-inch monochrome CRT. This is rapidly becoming the standard size in the transportable field.

There's also another Kaypro model in this field, the *Kaypro IV*, whose price puts it just at the top limit of this category. The

Memory/Storage	Keyboard	I/O	Display	Comments
16K/2 floppy disk drives	62 keys, help key, 4 special function	1 serial, 2 controller, expansion connector/interface module	built-in video output supports 256 colors, 40 × 24 text	2nd floppy disk drive
144K/1 256K 5 1/4" floppy drive	87 keys, 10 programmable, numeric keypad	1 serial, 1 parallel	80 × 24 text mode capability/16 colors	64K, disk drive
24K	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus/1 serial	1-line × 26-character liquid crystal display/color TV adapter	serial port
64K/cassette, 32K RAM cartridges	89 keys, 8 special funct.	1 serial, 1 parallel	8-line by 40-char. liquid crystal display	liquid crystal display, 32K RAM cartridge
64K/2 368K DS/DD 5 1/4" floppy drives	75 keys, 16 special function, 17-key keypad	2 serial	9-inch CRT/640 × 240 graphics/80 × 24 text	2nd drive
64K/1 5 1/4" floppy disk drive	83 keys, 10 function, numeric keypad	1 serial	12-inch monochrome CRT	kit form of Explorer/88-PC with drive and boards
48K/2 5 1/4" floppy disk drives	84 keys, 12-key keypad	3 serial, 1 parallel	white monochrome display/80 × 25 text mode	2nd drive
64K/cassette interface	63-key typewriter, 2 programmable	1 parallel, game controller	12-inch monochrome CRT/80-column card/80 × 24 text mode	parallel port added
24K/cassette recorder	61 keys, multifunction	general purpose I/O port	32 character one-line LCD	general purpose I/O port added
48K/1 184K 5 1/4" floppy drive	64 keys, 12-key keypad	1 parallel, 1 serial	12-inch monochrome/64 (32) × 16 text mode	serial port
64K/2 256K 5 1/4" floppy disk drives	71 keys, 10 programmable, built-in joystick	1 serial, 1 parallel	256 × 192 resolution, 16 colors, television used as display	2nd drive
48K/2 5 1/4" floppy disk drives	84 keys, 12-key keypad	3 serial, 1 parallel	green monochrome display/80 × 25 text mode	2nd drive
128K/cassette interface	72 keys, 16-key keypad	1 serial, 1 parallel	12-inch high-res. monochrome/80 × 25 text mode	basic system
64K/2 200K 5 1/4" floppy drives	standard	1 serial	monochrome CRT	second SS/DD drive added
96K/cassette interface	standard, numeric keypad	1 serial	12-inch monochrome CRT/80 × 25 text mode	basic system
64K/2 204K 5 1/4" floppy drives	57 keys, 12-key keypad	1 serial, 1 IEEE-488, modem, external video connector	5 1/2" monochrome CRT/52 × 24 text mode	disks now DS/DD
128K/2 160K SS/DD 5 1/4" floppy drives	83 keys, 10 function, 17-key keypad	1 serial, 1 parallel	9-inch monochrome/80 × 24 text/640 × 200 graphics	basic system
128K/1 5 1/4" floppy disk drive	72 keys, 12-key keypad	1 serial, 1 parallel, game controller	80 (40) × 24/280 × 192 graphic capability	basic system
64K/2 280K DS/DD 5 1/4" drives	89 keys, 8 special function	1 parallel, 1 serial	8 lines × 40 characters, LCD	2 drives added
96K/cassette interface	73 keys, 11-key keypad	1 parallel, 1 serial	480 × 192 color capability/62 × 16 text mode	basic system
64K/2 5 1/4" DS/DD drives	72 keys, 14-key keypad, 20 programmable	1 serial, 1 parallel	9-inch monochrome monitor, 80 × 25 character	DS/DD drives
64K/2 390K 5 1/4" floppy drives	75 keys	2 serial, 2 parallel	12-inch monochrome/80 × 25 text mode	2nd drive added
64K/1 328K DS/DD 5 1/4" floppy drive	55 keys, 5 programmable, 10-key keypad	1 parallel, 1 serial	12-inch monochrome/80 × 25 text mode	basic system
64K/1 320K 5 1/4" drive	105 keys	2 serial, 1 parallel	optional	basic system
128K/cassette interface/disk interface	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch monochrome CRT/80 × 25 text	8086 co-processor, 64K, high-res CRT
64K/2 184K 5 1/4" floppy disk drives	70 keys, 3 programmable, keypad	1 parallel	12-inch monochrome	2nd drive added

Kaypro IV is essentially the same machine as the *II*, but with much greater memory. The amount of storage on the *IV* is upgraded to 800K by changing to two double-sided, double-density 5 1/4-inch minifloppy drives. It, too, comes with all the basic software one could need for serious computing as soon as the box is opened.

Osborne

The *Osborne I* is the machine that launched the transportable/portable computer market. When it was introduced in 1981, it was a daring gamble. How, people asked, could the company include software, dual disk drives, and a monitor in a portable package and still remain in business? After all, it was reasoned at

the time, the software cost as much as the system itself. But, Osborne did it and established a new segment of the microcomputer market.

What does this package include? For starters, there's 64K of user memory, enough to use the sophisticated software packages included with this system efficiently. Further, the system includes two 102K single-sided 5 1/4-inch floppy disk drives and a full keyboard with 57 keys and a separate numeric keypad.

Perhaps its prime drawback is the size of its screen. At 5.5 inches, it is one of the smallest video displays on the market. Although it is a high-resolution affair, the display is limited to 52 characters by 24 lines; and, the size of the display makes the letters somewhat hard to see at times. However, a user should

soon become acclimated to this display and it should be easy to use.

It runs under the industry-standard CP/M operating system, so a user can have access to the wide range of packaged software available. Interestingly, this unit includes one serial port, that can be used with either a printer or modem, and an IEEE-488 port. This port, serial in nature, is extensively used in the scientific computing environment and allows the Osborne to interface with a wide variety of peripherals.

You don't have to tie up the serial port with a modem, though, because a modem is included with the *Osborne I*, so the serial port can be used with a printer. The Osborne system upgrades once in this category as the disks are upgraded so they can accommodate a total of 400K of storage.

Eagle

A newcomer to the microcomputer field, Eagle Computers has three entries in this price category, the *Eagle IIE-1*, *Eagle IIE-2* and the *Eagle PC-E*.

The *Eagle IIE-1* is another of the many Z80A-based systems on the microcomputer market. This is important to the user looking for a wide base of existing applications software because the 8-bit Z80A, and the CP/M operating system that works with it, have a wide variety of software available. This software will fill just about any need a user might have.

This system can take advantage of CP/M from the start because it includes one 390K double-sided, double-density disk as standard. And, any time a system includes a disk, it needs a disk operating system to work correctly. The system also has more than enough user memory—64K—to take advantage of the sophisticated programs available on the market.

Input/output is aided by including two standard serial ports and two standard parallel ports. This means this machine can interface with a wide variety of peripherals.

The standard 12-inch monochrome display handles the industry-standard 80-by 25-line display, thus fulfilling the needs of users who have a great deal of serious data or word-processing work to attend to.

The *Eagle IIE-2* is essentially an upgraded *IIE-1* system. In this version, a second drive is added.

The *Eagle PC-E* represents another trend in the microcomputer field, the trend toward IBM *Personal Computer* workalikes and lookalikes. Under this trend, competing computer manufacturers are trying to build systems that operate as closely to the IBM as possible. The reason the manufacturers are taking this tack is because of the popularity of the IBM system and because of the wide software base that is rapidly building for that system.

Like the IBM, the *Eagle PC-E* is driven by a 16-bit 8088 microprocessor. It features 64K of user memory, about the minimum needed in this type of system for efficient perfor-

mance. (Where 8-bit systems get along with 64K easily, 16-bit systems like a minimum of 64K, with 128K preferred, to promote efficient operation. This is because the programming is more complex.)

Running under CP/M-86 (the 16-bit version of CP/M), MS-DOS—the system used by the IBM-PC—is available as an option. The Eagle system is able to use a disk operating system because it comes with one 390K double-sided, double-density 5¼-inch minifloppy disk drive for storage. Output is provided by two standard serial ports and one parallel port. The user has the option of choosing a video-display device.

Docutel/Olivetti

Long a name in the office-equipment field, Olivetti introduced its *M207* microcomputer system more than a year ago. It is one of the few systems marketed that uses the 16-bit Z8001 microprocessor, something the potential buyer of this system should recognize.

Currently there is little likelihood a wide software base will develop rapidly, unless other manufacturers take advantage of this microprocessor. This means the user will be limited to those packages offered by the manufacturer and to the support the manufacturer offers.

The buyer who opts for this system will find that it offers plenty of potential power. Standard user memory is 128K, or about twice the amount offered by most small computer systems, and this means the system can handle sophisticated tasks.

What limits this system in this price category is the fact that storage is via cassette. Cassettes, while they can offer nearly 500K of storage, are much slower than disk-based storage systems and, unless the system can act randomly by reading the tape back and forth, it is limited to slower serial—one file after another—operation.

The typewriter-style 72-key keyboard and 16-key pad allow quick data or numeric entry and input/output is aided with standard serial and parallel ports. The 12-inch monochrome display is a high-resolution unit, with an 80-character by 25-line text display and respectable graphics.

Seequa

A newcomer to the transportable microcomputer market, Seequa's *Chameleon* is an IBM *PC*-compatible unit, with a difference; it uses two CPU's, an 8-bit Z80A and a 16-bit 8088. This feature alone offers the user the best of two worlds, CP/M and MS-DOS. CP/M is the standard operating system of the 8-bit microcomputer world, while MS-DOS is rapidly becoming the standard operating system of the 16-bit world. This system can also run the alternative 16-bit system, CP/M-86.

Because the *Chameleon* gives the user access to either processor, he has the option of running any of the many programs that exist in both microcomputer segments. Its 128K of user memory also gives the user enough memory space to take advantage of those programs. With its 9-inch monochrome display, 80-character by 24-line text mode or a 640- by 200-dot graphics mode, the *Chameleon* delivers a high-resolution video output.

Input is aided by an 83-key keyboard and a 17-key keypad. Like the IBM *PC*, the microcomputer has 10 function keys. Unlike the *PC*, the *Chameleon* has standard serial and parallel input and output ports. The IBM-*PC*'s are extra-cost add-ons. Programmable in a variety of high-level languages, this microcomputer, including two 160K single-sided, double-density drives as standard equipment, is a unit that can be used in a home or business environment.

Albert

Another newcomer to the microcomputer market is the *Albert*. An *Apple IIe*-compatible system, the *Albert* includes 64K of RAM and two 5¼-inch minifloppy disk drives. Because it has disk drives, it needs an operating system and it uses Apple's.

Its 59 typewriter-style keys and five special-function keys



MORROW DESIGNS MICRO DECISION MD1 is a CP/M machine that includes bundled software.

make short work of data input, while output is handled by standard serial and parallel ports. It has RGB output and it can display up to 256 colors, and its text-display capability includes either 40 or 80 characters-per-line.

Sumicom

Sumicom, another newcomer to the small-computer system world, is another manufacturer that has chosen to take the IBM-workalike route with its *System 330*. Driven by a 16-bit 8088 CPU, this system has 128K of user memory.

With a 95-key keyboard that includes 8 special-function keys, data or word-processing input should be easy. A parallel interface is included in the basic configuration.

LNW

LNW Research is offering another of the many Z80A-based systems on the market. As with other 8-bit Z80A systems, the user has access to a wide variety of programming when disk drives are added to the configuration. However, in this price category, the user will have to content himself with a cassette recorder for data storage. The *LNW80 Model 2* comes with 96K of RAM standard.

Keyboard input is via a keyboard having 73 keys and an 11-key numeric keypad, while output is handled by standard serial or parallel ports. The monochrome display provides 80-characters by 25-lines of text.

Cromemco

Long associated with the microcomputer industry, Cromemco has an offering in this price category, the single-user *C-10* system. This is an 8-bit Z80A microprocessor-based system. It is programmable in several high-level languages.

Its 64K of standard memory and its standard 390K 5¼-inch minifloppy disk drive provide the basics for a very powerful system. This means he can take advantage of the CP/M operating system and the wide variety of programs available that run under it. Input is handled via a 57-key keyboard while output is handled either via a standard parallel or serial port. Its 12-inch monochrome monitor displays a standard 80-character by 25-line text or high-resolution graphics.

Franklin

Although this Apple-compatible computer manufacturer has only been in the microcomputer field for less than two years, it has already gathered a fine reputation and has built a rather wide product line. Two of those products make their debut in this price category.

The first is the *Ace Professional*, a business-oriented system, based on the Apple-compatible *Ace 1000*. It is driven by the same 8-bit 6502 microprocessor, and is programmable in BAS-



THE KAYPRO II from Non-Linear Systems is one of the most popular transportable computers.



IC, and shares many of the same attributes of the *Ace 1000*. However, this model differs in that it includes a standard 5¼-inch minifloppy disk drive for mass storage, an 80-column card, as well as some standard applications software. Since this system runs under an Apple-compatible operating system, it is able to take advantage of the many programs available. The keyboard is a typewriter-style affair with 72 keys and a 12-key numeric keypad.

Also in this price category, the basic *Ace 1000* system can be upgraded with the *Ace 1100* integral disk drive and housing. Of course, that raises the price of the system.

The other new system here is the top-of-the-line *Ace 1200* which offers the user a way to enjoy the best of two worlds: Apple and CP/M. Unlike other dual-processor machines on the market, that combine either two Z80's for speed or a Z80 and an 8086/88 microprocessor for access to both the 8 and 16-bit worlds of software, the *Ace 1200* combines a 6502 and a Z80. This gives the user the option of running either Apple-compatible software or CP/M-compatible software.

Since it is the top-of-the-line, you would expect it to have other features that the other models don't offer and it does. The *Ace 1200* comes with a standard 128K of user memory and a built-in 5¼-inch minifloppy disk drive for storage. It also features the same keyboard as the other machines in the *Ace* line, but adds standard serial and parallel ports to its configuration and its display output capability is 80 columns for CP/M; forty columns for Apple programs.

Hewlett-Packard

A new Hewlett-Packard system makes its appearance in this category, the first of this manufacturer's full-blown *HP86A*. In this price level, the system is just the basic unit and includes one parallel port. It has a 59-key keyboard, 20-key keypad and special-function keys and is programmable in several high-level languages, including BASIC.

Another of H-P's handheld systems, the *HP75C*, continues to become much more powerful in this price category. In its first upgrade, the user memory increases to 24K, enough to handle sophisticated routines in the field. In its second upgrade, a general-purpose I/O port is added. Don't underestimate the importance of this second upgrade. With this port, the *HP75C* can now interface with a variety of peripherals and can become the heart of a very powerful portable system.

Commodore

As we have seen in the other price categories, Commodore Business Machines is a microcomputer manufacturer with a broad line, and its machines make their debuts in several price categories. This classification is no exception as CBM introduces the *SuperPET*, a dual-processor model driven by 8-bit 6502 and 6809 microprocessors.

The *SuperPET* is the basis of a powerful dual-processor development system and comes with 96K of memory as stan-

dard. Also standard, is the 12-inch monochrome display, that delivers an 80-characters by 25-lines text display. At this level, the speed of this system is somewhat limited by the need for cassette storage. But, this changes in other price categories as disk drives are added.

Its keyboard is a standard typewriter-type unit and it has a separate numeric keypad. This keyboard lets the user write programs in the high-level languages available for this machine. Those languages include: BASIC, COBOL, APL, Fortran, and Pascal.

Input/output is provided by a standard serial port a user can use to attach either a printer or a communications modem, should he have need of hard copy or communications ability.

The *VIC-20* and *64* are still being manufactured in quantity. Versions are now available with two 5¼-inch disc drives. This increases the effectiveness and flexibility of these units. When the *VIC-20* is equipped with two drives it can handle both data and program disks simultaneously, and no longer is the user limited to using one disk to copy files. Instead, he can use two disks, and gain a manyfold increase in system speed and capability.

In the same way, a second disk drive is added to the *Commodore 64*.

Sanyo

The *MBC 1000* is another of the many Z80A, 8-bit systems in the small-computer market and because it is, the system can take advantage of the CP/M operating system and the many programs available under it. The system comes with one standard 328K double-sided, double-density 5¼-inch minifloppy disk.

With 64K of standard user memory, this system can perform highly sophisticated tasks. Data input is facilitated by the 55-key keyboard, that includes five multifunction keys and a 10-key numeric pad. Input/output is aided by a standard serial port and a standard parallel port. The 12-inch monochrome display handles 80-characters by 25-lines of text.

Radio Shack

Radio Shack has three systems that upgrade in this price category—the *Color Computer, Model III*, and *Model 4*. The *Color Computer* becomes fully configured by adding a second disk drive.

The *Model III* upgrades twice. The first step is to add a 184K 5¼-inch minifloppy drive. The second upgrade gives this system a serial port.

The *Model 4*, a newly introduced unit, becomes even more powerful when a 184K minifloppy-disk drive is added. The second upgrade adds a second drive to this system.

Toshiba

The Toshiba *T100* lap computer upgrades in this price category. In the first upgrade, the *T100* goes portable and its user-memory area is expanded by adding nonvolatile RAM cartridges that hold their contents even when unplugged from the system.

Also, the *T100* becomes configured with two 280K double-sided, double-density disk drives. This upgrade gives the user access to the CP/M operating system and the many programs that work under it. For the user who may not want to be limited to the liquid-crystal display, video monitors are available.

NEC

Both NEC systems, the *PC-6000* and *PC-8800*, include two upgrades. The first adds a green monochrome video display to the unit. This type of dedicated, high-resolution monitor lets the user take full advantage of the graphics capability of this or any other system, something a home television set can't match. The second upgrade shows you what happens to the price when the color monitor is added to the configuration.

The *PC-8800* becomes a more powerful unit when we add the 8086 16-bit card. This gives the user the option of taking advantage of the rapidly growing variety of 16-bit programs. In later stages, as disks are added, the user can take advantage of

either the world of CP/M or MS-DOS and the many programs available that run under those systems.

Apple

In its first upgrade, the *Apple IIe* becomes more versatile when the screen enhancement card (80-column) and a video monitor are added. These changes, alone, give the user the advantage of the graphics capability of this system, plus letting the system handle serious word-processing or data processing chores.

The second upgrade gives this system output capabilities by adding a parallel printer port. Now the user can have hard copy backups of the material he is working on.

Atari

Two Atari systems upgrade in this price category, the *1200XL* and the *600XL*. The *1200XL*'s upgrade adds a second disk drive. The *600XL* also receives a second floppy disk drive.

Panasonic

The *HHC* series, (*H1400* and *H1800*), of handheld minicomputers become true systems in this price category with the added color display adapter. It can be used to interface with a color television, and a serial port.

Heath

The Heath *HS-89-2(3)* system reaches its full configuration in this price category by adding a second drive.

Since it is a kit, the *HC-89-2(3)* system is a good learning experience for the potential computer user who wants to know his system inside and out.

Spectravideo

The *SV-318* system becomes fully configured in this price category and its first upgrade adds a 256K 5¼-inch minifloppy disk drive. This gives the user a manyfold increase in data access and retrieval time. Adding a second drive, also in this price category, makes this system even more versatile.

For the *SV-328*, the user gains more memory area and a disk drive for storage, thus increasing this system's versatility.

Netronics

By adding a disk drive, disk-drive controller and operating system, the *Explorer/85*, an 8085-based small-computer becomes much more powerful. It now has disk storage and speed, and it can access and use the many programs that run under its operating system.

The new Netronics system, the *Explorer/88-PC*, (also a kit) is a fully configured system at this point. The user who does take the time to put the kit together will be rewarded with an intimate understanding of an IBM-compatible microcomputer system.

Texas Instruments

By this time in the price categories, the Texas Instruments *T1-99/4A* is becoming a very powerful system. Not only is it driven by a 16-bit microprocessor, but it now has a disk drive for mass storage; it is now a far cry from the low-cost unit that was introduced in our first price category.

Sony

At this point in the *SMC-70*'s price path, it gains a serial interface for output. The RGB/composite video/RF-modulator gives the user several choices for video output.

TeleVideo

The transportable *Teletote* gains even more versatility when a second disk drive is added. This frees the user from the restriction of being tied to using only one drive.

Casio

The *X-9000P* becomes more versatile and able to perform more sophisticated tasks by adding 16K of RAM. **R-E**



The computer becomes more business-like than personal as we cross the \$2000 mark.

\$2000 to \$2500

MARC STERN

IF THERE IS ANY LINE OF DEMARCATION IN THE SMALL-computer world, we have reached it, the \$2000 barrier. Many of the systems that had their origins in the low-cost regions of the microcomputer marketplace, have, by now, reached their full configurations and those that continue in our charts become more and more oriented toward business, rather than home use, because of the powerful levels they attain.

Because of this you will find the systems that join our listings now are much more fully configured right out of the box. It's the usual practice in the industry to include at least one disk drive as standard equipment in this pricing level and to include at least 64K or more of user memory. And on those systems where disks are included as standard, the disk-operating system is also a standard or reasonable-cost option.

It's also an important line of demarcation in the type of microprocessor unit driving the system we will be discussing. In the \$2000 region, it seems that more and more of the systems are using standard 16-bit microprocessors, as opposed to 8-bit CPU's. This stands in marked contrast to a year ago when the majority of systems on the market were 8-bit systems.

Why is the industry moving toward the 16-bit CPU? The most obvious reason is because IBM has chosen to market a 16-bit microcomputer and the rest of the industry is moving to cash in on the market created by that move. But another, not so obvious reason, is because the 16-bit CPU allows small-computer systems to achieve true power. They can handle applications that, a few years ago, were limited only to mainframe and powerful minicomputers. In fact, the 16-bit microprocessors now on the market and those planned for the near future blur the distinction

between the minicomputer—a more powerful, business-oriented system—and the microcomputer.

So, as we cross the line of demarcation, we find 12 new systems joining the microcomputer field. Some of them are from companies whose names are already mentioned in earlier price categories, while others are new to the field.

Let's begin our look at this price category with those systems from the new manufacturers, moving on to those from established firms, and wrap it up with a look at some of the systems that have upgraded.

Access Matrix

Access Matrix Corp. is a new entrant to the microcomputer market and its product, the *Access*, is a full-featured transportable computer, based on the near-standard 8-bit Z80A CPU. With this CPU and the features this small-computer packs, a user needs little more to fulfill his computing needs.

For starters, the *Access* includes two standard 184K single-sided, double-density minifloppy disk drives for storage and 64K of RAM. With this combination, the user has access to the wide variety of ready-to-run programs available under the CP/M operating system, which is another 8-bit industry standard.

Programmable in BASIC, this unit features a typewriter-style keyboard, that has 62 keys, 15 special-function keys and a 15-key numeric keypad. Input/output is provided by standard serial and parallel ports.

The 7-inch built-in amber CRT display is capable of an 80-character by 24-line text mode, which is important for serious word-processing or data entry.

TABLE 1—\$2000-\$2500

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Casio, Inc.	FX-9000P	\$2015	Z80A-compatible	8-bit	N/A	BASIC
Franklin Computer Corp.	Ace 1000	\$2044	6502	8-bit	Apple DOS 3.3 compatible	BASIC
Hewlett-Packard	HP86A	\$2090	Not announced		N/A	BASIC, Pascal, FORTRAN
Panasonic Co.	H1400	\$2091	6502	8-bit	SNAP	BASIC
Apple Computer	Apple IIe	\$2129	6502A	8-bit	N/A	BASIC
Franklin Computer Corp.	Ace Professional	\$2144	6502	8-bit	Apple DOS 3.3	BASIC
Hewlett-Packard	HP75C	\$2160	Not announced		N/A	BASIC
Sord Computer	M23P	\$2185	Z80A	8-bit	Proprietary, CP/M-compatible	BASIC, Pascal, FORTRAN
Panasonic Co.	H1800	\$2191	6502	8-bit	SNAP	BASIC
NEC Home Electronics	PC-8800	\$2197	Z80A-compatible	8-bit	N/A	BASIC
Heath Company	HS-100-31	\$2199	8085/8088	8/16-bit	Proprietary ZDOS	BASIC
Toshiba America	T300	\$2200	8088	16-bit	MS-DOS, CP/M-86	BASIC
Seequa Computer Corp.	Chameleon	\$2219	Z80A/8088	8/16-bit	MS-DOS, CP/M, CP/M-86	BASIC, FORTRAN, Pascal, COBOL, FORTH, LISP, assembly, C, PL/1
Spectravideo	SV-328	\$2273	Z80A	8-bit	CP/M	BASIC
Netronics Research	Explorer/85	\$2284.70	8085	8-bit	CP/M	machine, BASIC
Texas Instruments	TI-99/4A	\$2285	TMS9900	16-bit	Proprietary	BASIC
Radio Shack	TRS-80 Model III	\$2295	Z80A	8-bit	TRSDOS	BASIC, COBOL, FORTRAN, Assembler
Commodore Business Mach.	Pet 64	\$2295	6500 series	8-bit	Proprietary	BASIC
Franklin Computer Corp.	Ace 1000	\$2343	6502	8-bit	Apple DOS 3.3 compatible	BASIC
Heath Company	HSA-120-31	\$2349	8085/8088	8/16-bit	Proprietary ZDOS	BASIC
Sord Computer	M23P	\$2380	Z80A	8-bit	Proprietary, CP/M-compatible	BASIC, Pascal, FORTRAN
Seequa Computer Corp.	Chameleon	\$2394	Z80A/8088	8/16-bit	MS-DOS, CP/M, CP/M-86	BASIC, FORTRAN, Pascal, COBOL, FORTH, LISP, Assembler, C, PL/1
Morrow Design	MD3	\$2395	Z80A	8-bit	CP/M	BASIC
Hewlett-Packard	HP75C	\$2455	Not announced		N/A	BASIC
Sanyo	MBC 1200	\$2495	Z80As	8-bit	CP/M	BASIC, Pascal, FORTRAN, Macro-80
Osborne Computer Corp.	Executive	\$2495	Z80A	8-bit	CP/M	BASIC
Access Matrix Corp.	Access	\$2495	Z80A	8-bit	CP/M	BASIC
Intertec Data Systems	Superbrain II - Jr.	\$2495	Z80As	8-bit	CP/M	BASIC, FORTRAN
Canon USA	AS100	\$2495	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
Apple Computer	Apple III	\$2495	6502B	8-bit	Apple SOS	BASIC, Pascal
TeleVideo Systems Inc.	TS 803	\$2495	Z80A	8-bit	CP/M	COBOL
Toshiba America	T300	\$2495	8088	16-bit	MS-DOS, CP/M-86	BASIC

Memory/Storage	Keyboard	I/O	Display	Comments
32K/cassette interface	67 keys, 16-key keypad		5.5-inch, 32 × 16 monochrome, 256 × 128 graphics	28K RAM
64K/2 5 1/4" floppy disk drives	72 keys, 12-key keypad	game controller	40 × 24/280 × 192 graphic capability	2nd floppy disk drive
64K	59 keys, 20-key keypad, 14 special function	1 parallel	9" monochrome CRT, 80 × 25 text	monochrome CRT
22K/cassette interface	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus/1 serial/modem	1-line × 26-character liquid crystal display/color TV adapter	modem/cassette interface
64K/cassette interface	63-key typewriter, 2 programmable	1 parallel, 1 serial, game controller	12-inch monochrome CRT/80-column card/80 × 24 text mode	serial port
64K/2 5 1/4" floppy disk drives	72 keys, 12-key keypad	game controller	40 × 24/280 × 192 graphic capability	2nd drive
24K/cassette recorder	61 keys, multifunction	general purpose I/O port	32 character one-line LCD/video interface	video interface
128K/290K microfloppy drives	60 keys, 20-key keypad, 9 special function	2 serial, 1 parallel		basic system
24K/cassette interface	65 calculator keys in typewriter arrangement, redefinable	input/output adapter/expansion bus/1 serial	1-line × 26-character liquid crystal display/color TV adapter	modem/cassette interface
64K/cassette interface/disk interface	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch color CRT/640 × 400 res./80 × 25 text	color display
192K/1 320K DS/DD 5 1/4" floppy disk drive	60 keys, 14 function keys, 18-key keypad	2 serial, 1 parallel	monochrome	basic version, includes 1 drive
192K/1 640K DS/DD 5 1/4" drive	67 keys, 18 special function, 10 edit, 18-key keypad	1 parallel, 1 serial		basic system
192K/2 160K SS/DD 5 1/4" floppy disk drives	83 keys, 10 function, 17-key keypad	1 serial, 1 parallel	9-inch monochrome/80 × 24 text/640 × 200 graphics/RGB output	user memory expands to 192K, RGB output card added
144K/2 256K 5 1/4" floppy drives	87 keys, 10 programmable, numeric keypad	1 serial, 1 parallel	80 × 24 text mode capability/16 colors	2nd drive
64K/2 8" floppy disk drives	56 keys	N/A	12-inch monochrome CRT	second disk drive
48K/2 floppy disk drives	standard	1 serial, 1 parallel HEX-BUS expansion unit, peripheral interface	16 colors	2nd disk drive
48K/2 184K 5 1/4" floppy disk drives	64 keys, 12-key keypad	1 parallel, 1 serial	12-inch monochrome/64 (32) × 16 text mode	serial port, second drive
64K/dual 5 1/4" floppy disk drives	standard, numeric keypad	1 serial	integral display	standard 12-inch monochrome display; dual drives added
64K/2 5 1/4" floppy disk drives	72 keys, 12-key keypad	game controller	40 × 24/280 × 192 graphic capability	2nd drive added to Ace 1000 unit
192K/1 320K DS/DD 5 1/4" floppy disk drive	60 keys, 14 function keys, 18-key keypad	2 serial, 1 parallel	monochrome version	basic system
128K/2 290K microfloppy disk drives	60 keys, 20-key keypad, 9 special function	2 serial, 1 parallel	12-inch green CRT	CRT added
256K/2 160K SS/DD 5 1/4" floppy disk drives	83 keys, 10 function, 17-key keypad	1 serial	9-inch monochrome/80 × 24 text/640 × 200 graphics/RGB output	user memory expands to 256K
64K/2 320K 5 1/4" floppy disk drives	standard	1 serial, 1 parallel	monochrome CRT	drive capacity increases with DS/DD drives
24K/cassette recorder	61 keys, multifunction	general purpose I/O port	32 character one-line LCD/9" 80 × 25 CRT	CRT added
64K/1 640K slim line DS/DD floppy disk drive	50 keys, 15 programmable, 18-key keypad	1 parallel, 1 serial	12-inch monochrome/80 × 25 text/640 × 400 graphics	higher-density disk drives
64K/2 102K 5 1/4" floppy disk drives	57 keys, 12-key keypad	1 serial, 1 parallel	7-inch monochrome (amber)/80 × 24 text mode	basic system
64K/2 184K SS/DD floppy disk drives	62 keys, 15 special function, 15-key keypad	2 serial, 1 parallel, 1 IEEE-488	7-inch monochrome (amber)/80 × 25 text mode	full-featured transportable computer
64K/2 350K DS/DD 5 1/4" floppy disk drives	62 keys, 18-key keypad	2 serial	12-inch monochrome/80 × 24 text mode	basic system
Not announced/2 640K DS/DD 5 1/4" floppy disk drives	standard		monochrome display/80 × 25 text mode	basic system
128K/1 140K SS/DD 5 1/4" floppy disk drive	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller	280 × 192/560 × 192 graphics capability/80 × 24 text	basic system
64K/2 368K 5 1/4" DS/DD floppy disk drives	72 keys, 16 programmable, 17-key keypad	2 serial	14-inch monochrome/80 × 25 text	basic system
192K/1 640K DS/DD 5 1/4" drive	67 keys, 18 special funct., 10 edit, 18-key keypad	1 parallel, 1 serial	80 × 25 monochrome	display added

Intertec Data Systems

Although Intertec is a long-time veteran of the microcomputer wars, few consumers have probably heard of its products. The prime reason for this is that it has addressed the business market.

In this price category, we find one of its several products, the *Superbrain II Jr.*, another of the 8-bit systems on the market using the Z80A as the CPU.

However, the *Superbrain II Jr.* departs from standard philosophy in its use of dual processors. Although there are several systems on the market today with two microprocessors, the chances are very good that one will be an 8-bit device, while the other is a 16-bit device. This gives the user access to the established base of 8-bit software and the rapidly growing base of 16-bit software. The *Superbrain II Jr.*, on the other hand, uses dual 8-bit processors for speed. While one is busy handling the processing (computing) chores, the other is handling house-keeping functions, such as keyboard input and screen output. That is a way to achieve faster throughput.

The *Superbrain II Jr.*, is an all-in-one unit, with dual 350K double-sided, double-density minifloppy-disk drives, 64K RAM, and runs CP/M.

Programmable in high-level Fortran or BASIC, this unit features a 62-key typewriter-style keyboard with an 18-key numeric keypad. Two serial ports are also included.

Video output is via a built-in 12-inch monochrome display unit, capable of 80-characters by 24-lines in the text mode.

Canon

If the inclusion of the name Canon in a computer hardware supplement startles you, it shouldn't. The reason is Canon is not only big in the camera field, but also in the office-equipment field. And because it is, its development of a microcomputer system isn't really any surprise. The *AS100* is a new system and like many other machines on the market, it is an IBM-workalike. It runs under MS-DOS, although Canon is also hedging its bet by providing access to CP/M-86, the 16-bit version of the CP/M operating system. This second option gives the user access to many programs that run under this operating system and, if the market swings in its direction, then the user also has this advantage, too.

That it can use an operating system indicates that this system has floppy disk drives, and it does. Canon provides the user with two 640K minifloppy disk drives for mass storage and retrieval.

Programmable in BASIC and COBOL, the *AS100* has a typewriter-style keyboard for data input. Data is output to an 80-character by 25-line monochrome display, which is the standard for serious data or word-processing work.

Apple

Although Apple's name has appeared before, it has a new system appearing in this category, the *Apple III*, a more powerful, business-oriented system than other Apple offerings.

The *Apple III* system has twice the RAM of the *Apple IIe* with 128K and it features a standard 140K single-sided, double-density minifloppy disk drive for storage.

A sophisticated system, the *Apple III's* operating system is also more sophisticated. Called Apple SOS, it allows the user access to not only the software written to operate under it, but the existing base of software written for other Apple computers.

Yet, despite its sophistication, the *Apple III* is driven by the same 6502 8-bit microprocessor that drives the other members of the Apple family. Its keyboard is a standard typewriter-like affair with 61 keys, two programmable keys and a 17-key keypad. (It was quite an improvement over the old *Apple II* and *Apple II-Plus* keyboard.)

This system also differs from the rest of the Apple lineup in two other key areas. It is provided with a standard serial port and it has a standard 80-column display capability. (Other members of the family require add-on video cards to provide this function.) This display capability also can be used to generate up to 560- by 192-dot graphics. The actual display device is a user

option.

The *Apple IIe* becomes more flexible in its input/output capabilities here with the addition of a serial port.

Heath

Heath Co. has two kits that debut in this price spectrum, both of which give the user an inside-out knowledge of his microcomputer system, the *HS-100-31* and the *HSA-120-31*. Both microcomputers are kit versions of the Zenith Z-100 series of 8/16-bit computer systems. About the only real difference between the two systems is that the *HS-100-31* is the low-profile version—no monitor included—and the *HSA-120-31* is the all-in-one unit—monitor, keyboard, and system unit in one box. With this in mind, what follows will apply to both.

Driven by a dual 8085/8088 processor set, this series has access to the world of 8- and 16-bit programs and, although it seems like an IBM-workalike, it doesn't run under MS-DOS. Instead, it runs under the proprietary Zenith Disk Operating System—ZDOS.

A 320K double-sided, double-density floppy is built into its standard configuration that includes 192K RAM.

Programmable in BASIC, that unit features a 60-key keyboard that includes 14 function keys and an 18-key keypad.

About the only remaining differences between the two systems is that the all-in-one *HSA-120* has two serial ports and one parallel port, while the *HS-100* has one serial and one parallel; and, the *HSA-120* has a standard monochrome video display, while the *HS-100* leaves it to the user's option.

Toshiba

Toshiba has another system which debuts in this price category, the *T300*, another IBM-workalike.

Driven by a 16-bit 8088 CPU, the *T300* provides the user with 192K of standard memory. A standard 640K 5¼-inch minifloppy disk drive is provided for data storage and retrieval.

Programmable in several high-level languages, data is entered via a typewriter-style keyboard with 67 keys. The keyboard also includes 18 special-function keys, 10 editing keys, and an 18-key numeric keypad.

Equipped with standard serial and parallel ports—extra-cost options on the IBM *PC*—the *T300* is a flexible unit. It upgrades once in this category. That upgrade provides the user with an 80-character by 25-line video display monitor. In its first configuration, that device is left to the user's option.

Sord

Another Z80A-based system debuts in this manufacturer's lineup, the *M23P* with 128K of RAM as standard. The Z80 CPU gives you access to the world of CP/M.

In a departure from usual practice, the *M23P* is equipped with a microfloppy-disk drive capable of holding 290K of data. Very few manufacturers now offer this type of drive and there is an ongoing controversy about standardization.

Sporting a typewriter-style keyboard with a 20-key pad, 60 keys and 9 special-function keys, the *M23P* relies on this device for input, either in the high-level programming languages this system recognizes or word-processing applications.

An almost fully configured system, it includes an input/output adapter, expansion bus, and a serial port. This system also upgrades once in this category with the addition of a 12-inch green monochrome video display device.

TeleVideo

Another single-user system from TeleVideo makes its appearance in this price category, the *TS 803*.

Driven by an 8-bit Z80A microprocessor unit, the modular *TS 803* runs the industry-standard CP/M operating system. The computer includes dual 368K double-sided, double-density minifloppy disk drives for storage.

Programmable in the high-level COBOL language, the *TS 803* is aimed primarily at the business community and its level of

standard features, such as 64K of user memory and two standard serial communications ports, indicates this.

Equipped with a typewriter-style keyboard containing 72 keys, 16 programmable keys and a 17-key numeric keypad, the *TS 803* also features a standard 14-inch monochrome CRT that is capable of 80-characters by 25-lines of display.

Osborne

Osborne Computer Corp. is the firm that kicked off the portable-computer revolution and it has a new offering that debuts in this price spectrum, the *Executive*.

Although based on its *Osborne I*—described elsewhere in this supplement—the *Executive* is substantially upgraded.

Still driven by the same 8-bit Z80A CPU, the *Executive* has dual single-sided, double-density disk drives, rather than the single-density drives of the *Osborne I*.

It also sports the same 62-key detachable keyboard, but its input/output capabilities have been upgraded with the addition of a second serial port and a parallel port for a printer.

Further, the video display has been upgraded to a 7-inch amber monochrome unit, capable of an 80-character by 24-line text display.

The most important improvement in this system is the ability of it to recognize a variety of disk formats and its capability of reading files generated on those systems. This means it can be used with a variety of desktop office-based systems and files can be transported.

Sanyo

Sanyo's *MBC 1200* upgrades in this price segment. Driven by dual Z80A 8-bit CPU's, the *MBC 1200* relies on one of those devices for information processing, while the other handles the housekeeping chores. In this version, the *MBC 1200* has more storage capacity with the addition of a higher-density half-height 640K minifloppy disk drive.

Morrow

The last new system that debuts in this category is the *Morrow MD3 Business Computer*, a full-featured small-business computer. Like the others in the *MD*-series, this micro is driven by an 8-bit Z80A CPU. It comes equipped with 64K of user memory as standard.

Using the industry-standard CP/M operating system, the *MD3* is sold with a powerful set of programs included in the price. These programs include the basic applications needed by a small business or serious home user and, in fact, may be all the user needs.

The *MD3* has two 320K 5¼-inch minifloppy-disk drives for storage. It also has a standard typewriter-style detachable keyboard for user input. Input/output is further provided by two serial ports. This system features a monochrome monitor.

Franklin

Two Franklin systems upgrade in this price category, the *Ace 1000* and the *Ace Professional*. These systems gain a second disk drive for greater storage and this, of course, raises the price of these devices.

Why is a second drive so important? It provides a manifold increase in the flexibility of the system because the user is no longer limited to using just one disk for program and data loading. Instead, the program can be loaded and kept in one disk drive, while the other is used to house the data disk.

Panasonic

The *HHC*-series of handheld computers becomes even more fully configured with the addition of a modem/cassette interface. Now this system has become a true portable, capable of acting as a workstation in the field.

Hewlett-Packard

Another handheld system, the *HP75C* becomes fully configured with the addition of a monochrome video-display de-

vice. The importance of this upgrade to a handheld system can't be overestimated. The reason is the user is freed from the necessity of using a one-line liquid crystal display. Now he can see his input and the system's output in a more convenient manner.

This upgrade wouldn't have been possible without the other upgrade that occurs in this segment, the addition of the video interface.

The same type of upgrade occurs to the *HP86A* microcomputer system. It has also received a monochrome display. The reason this is important is the user now gains far higher resolution by using a dedicated video device, rather than trying to use a home television with its resolution limitations.

Seequa

The dual-processor (Z80A, 8088) *Chameleon* upgrades twice in this price category. In its first upgrade, the buyer receives an increase in user memory to 192K. This gives it enough memory to handle most 8- or 16-bit program on the market. This expansion also gives it color graphics capability.

The second expansion brings user memory to 256K, which is becoming one of the standards of the IBM-workalike world. Yes, many of the IBM-workalikes do have less memory, but it seems that most of them are urging their buyers to upgrade memory to at least 256K.

Radio Shack

In this price category, the *TRS-80 Model III* reaches its full configuration with two drives and a serial port. This all-in-one system is a powerful unit in this configuration.

Commodore

The *Pet 64*, based on the *Commodore 64* system, also becomes fully configured in this price category.

The addition of dual floppy drives for data storage and access makes this a powerful system for either the business or home user.

Texas Instruments

Believe it or not, the low-cost *TI-99/4A* can become a high-powered home system and it does, indeed, have a version that appears in this price category.

The addition of a second drive makes the *TI-99/4A* a system that can be used by either the serious home user or the small businessman who needs a small computer system. The second drive adds flexibility to the system.

Panasonic

Panasonic's *PC-8800* series is still an 8-bit microcomputer at this point. Another upgrade or two will be needed to make it a dual-processor 8/16-bit machine. However, in this configuration a user should find it very powerful.

At this point, color graphics output capability is added to the *PC-8800* system with the addition of a high-resolution, RGB video display device.

Spectravideo

At this point in the price categories, the *SV-328* becomes fully configured. A second drive is added at this point, which provides the user added flexibility and makes this system a full-featured choice for the small business or home user.

Netronics

Another system that reaches its full configuration is the *Explorer/85* from Netronics. This upgrade adds a second disk drive to its configuration that brings with it greater storage capability and far better system flexibility.

Casio

Still a very basic system, the *Casio FX-9000P* has its memory increased to 32K at this point. It still relies on a cassette recorder for storage.



A PRACTICAL DIGITAL ELECTRONICS KIT FOR LESS THAN \$40 ! Suitable for Beginners

Meet the challenges of today's incredibly rapid changes in electronics quickly and easily. This innovative kit is as exciting as the circuits you build and explore.

Learn the wonders of digital electronics and see how quickly you are designing your own circuits with the SUPERKIT which contains:

Seven TTL integrated circuits, breadboard, LED's, and all the DIL switches, resistors, capacitors and other components to build interesting digital circuits; plus a very clear and thoroughly tested instruction manual. This course teaches Boolean logic, gating, R-S and J-K flipflops, shift registers ripple counters and half adders. You will learn about fault finding, improvisation and sub-system checking and the manual asks plenty of questions, but never leaves you stuck for an answer. You don't even need a soldering iron! Using the same breadboard you may construct literally millions of different circuits **\$39.95**
Order one of our written Courses to complement your SUPERKIT.

Digital Computer Logic & Electronics - An introduction to digital electronics designed specifically for the raw beginner. If you're just starting with Digital Electronics this is the Course for you **\$13.95**

DIGITAL COMPUTER DESIGN - A totally revised and updated Course using the programmed learning system. This book is not intended for beginners but is ideally suited to engineers, technicians and hobbyists who want to know more about digital electronics..... **\$17.95**

TO ORDER BY MAIL

Just send your check or money order to the address below. Make sure you enclose your address and specify which Courses you are ordering. Payment must be in US Dollars drawn on major US Bank Mass. Residents add 5% sales tax. Company Purchase Orders also accepted.

PHONE ORDERS - FREE

To order by phone call (617) 664-3657 with your credit card information. It won't cost you a dime, because we'll deduct the cost of the call from the cost of the Courses you order.

NO RISK GUARANTEE

There's absolutely no risk to you. If you're not completely satisfied, simply return your order within 30 days. We'll send you a full refund.

AIR MAIL

The prices shown include surface mail postage. For Airmail shipment please write for additional cost, specifying Courses to be ordered.

CAMBRIDGE LEARNING Inc.

P.O. BOX 307, North Reading, MA 01864



CIRCLE 35 ON FREE INFORMATION CARD

Experience The Future With ROBOTICS AGE

Your Monthly Guide to Intelligent Machines

Intelligent machines have already become a part of our world, touching our lives daily in many ways. The future is unfolding with a wealth of ideas and information. Developments in robotics and intelligent machines are happening at an incredible pace. ROBOTICS AGE is your monthly source of tutorial and practical information about experimental robotics.

ROBOTICS AGE looks to this future with articles on walking machines, pneumatic systems design, low-cost vision systems for microcomputers and domestic robots. You'll find articles on the realities of industrial automation as well as the prospect of personal robotics in the home and office environments. Explore with us the intimate relationship between hardware and software engineering. A subscription to ROBOTICS AGE is your key to the fast-paced technology of robotics.

Don't miss out on a single issue. Subscribe today and have the next issue delivered to you. You can save by subscribing now at our subscription price of \$24 for the next twelve issues. That's a full one-third off the newsstand price for the same issues. And, if you include payment, you'll receive free a reprint of the article "ODEX I: The First Functionoid."

Send in your order to:

ROBOTICS AGE
174 Concord St.
Peterborough, NH 03458
Or give us a call at
(603) 924-7136



Sign me up for a 12-issue trial subscription...

- Send an issue and bill me \$24.00 for 12 in all.
- Enclosed is \$24.00 for 12 issues plus the ODEX I reprint. **RE**

Name _____
Address _____
Town/City _____

State _____ Zip _____
Charge my Master Card Visa MASTERCARD

Charge Card Number _____ Exp. Date _____
Foreign orders should be paid in U.S. funds drawn on U.S. bank, at the following rates: Canada & Mexico—\$28.00; all other Foreign—\$32.00.

CIRCLE 87 ON FREE INFORMATION CARD

NOW!

GET IBM-PC Capacity at a Fraction of IBM's Price!

New NETRONICS 16 Bit EXPLORER 88-PC Kit Starts at Just **\$399.95** -Accepts All IBM Peripherals.

It's true! Now you can enjoy the power of the Intel 8088—the same microprocessor which powers the IBM-PC—and run any program compiled for the IBM-PC...starting at only \$399.95!

Take this easy, low cost way to learn 16-bit technology! Two-board system features:

1. 8088 mother board with 5-slot expansion bus; accepts any hardware designed for IBM-PC; and
2. 64K memory board, expandable to 256K; with IBM compatible RS232 communications port.

Any disk-operating system which works on the IBM will work directly on the EXPLORER 88-PC, and all programs compiled for the IBM will run on it.

The system monitor ROM included in the Starter system features a user-friendly operating system that allows easy program generation and debugging. The commands include display/modify memory...display/modify registers...input/output data to I/O ports...block moves...single-step trace mode...go/run with optional breakpoint and register reports...cassette load/save with file labels...plus a complete system test program that tests and reports condition of ROM, RAM, cassette interface, timer, DMA controller, interrupt controller, and the communications port. These test programs not only allow easy debugging of software but they serve as hardware and software learning tools.

The EXPLORER 88-PC STARTER KIT includes a mother board, memory/I/O board, all components needed, sockets for IC's used, one 62-pin bus connector and complete assembly/test instructions. All you need is a soldering iron, solder, a power supply, and a standard RS232 terminal (Netronics has 2 low-cost ones to choose from).

- Explorer 88-PC Starter Kit...\$399.95
+ 10.00 p&i
 (wired & tested, add \$100.00)
 Extra 62-pin connectors at \$4.25 ea.
+ 1.00 p&i.

Use your own terminal with the EXPLORER 88-PC or, if you plan to expand it to be fully IBM compatible, we offer our IBM compatible keyboard and an IBM compatible color graphics board (only available wired and tested).

- IBM compatible keyboard...\$299.95 + 10.00 p&i.
- IBM compatible color board...\$299.95 + 10.00 p&i.
- Additional ROM required...\$35.00.

Set your own pace! Invest and learn, at the rate YOU want! Add to your EXPLORER 88-PC:

Deluxe heavy-duty steel cabinet that houses either two 5 1/4" floppies or a 5 1/4" hard disk with one floppy. This cabinet features a brush-finish front panel and a wood-grained sleeve.

- EXPLORER 88-PC Cabinet...\$199.95 + 18.00 p&i.

A heavy-duty open frame power supply with fan that can be used in your own cabinet or installed into the Netronics cabinet is available as follows:

- 10 amp power supply for system + 2 floppies...\$149.95 + 8.00 p&i.
- As above + extra power for 1 hard disk...\$169.95 + 8.00 p&i.

IBM compatible disk controller board. Controls four 5 1/4" floppy drives (w/2 drive cable). Available wired and tested only...\$250.00 + 8.00 p&i.

- Monitors and BIOS source listings: available on either disk or hard copy at \$35.00. Please specify format and system required.
- INTEL 8086/8088 user manual...\$15.00 + 1.50 p&i.
- THE 8086 BOOK by RECTOR & ALEX...\$16.00 + 1.50 p&i.



Special IBM compatible system: with keyboard, color graphics board, floppy disk controller, 64K RAM, cabinet, standard power supply and a single 5 1/4" floppy drive... \$1899.95 + 25.00 p&i.

IBM compatible hard disks, built-in modern board, erom burner, print buffer system plus more will be available shortly.

Over 100 EXCLUSIVE Products and Kits—including the "Speak Easy" universal voice synthesizer, a Diagnostic card with built-in logic probe for the IBM-PC, terminals, monitors, the ELF and EXPLORER 85 computers, and much more, are described in our upcoming catalog. It's yours FREE if you check here

For Canadian orders please double the amount of p&i shown. IBM-PC is a registered trademark of IBM Corporation.



"p&i" stands for "postage and insurance".

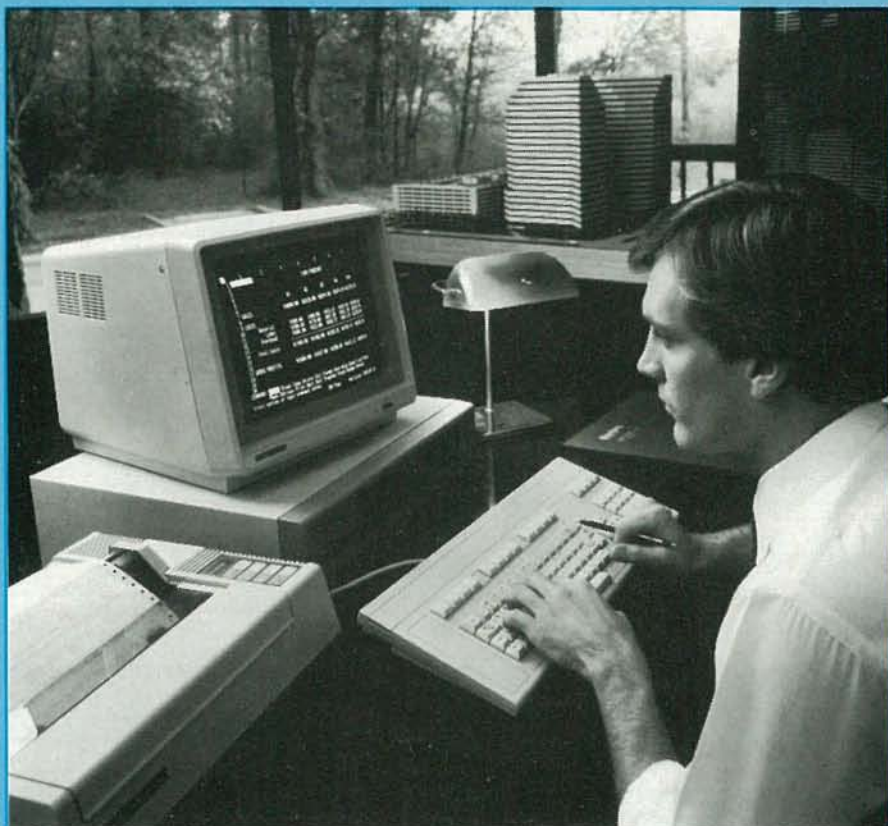
CALL TOLL FREE 1-800-243-7428 for Charge Card Orders.
In Conn., call 203-354-9375. Conn. res. add sales tax.

TO ORDER BY MAIL, CHECK BOXES FOR PRODUCTS DESIRED AND MAIL ENTIRE AD TO:

NETRONICS R & D LTD.

333 Litchfield Rd., New Milford, CT 06776

Amount enclosed OR Charge my VISA MASTERCARD
Acct. No. _____ Exp. Date _____
Signature _____
PRINT NAME _____
Address _____ City _____ State _____ Zip _____



Seven new manufacturers
join our expanding list.

\$2500 to \$3000 MARC STERN

IF YOU THOUGHT THE MICROCOMPUTER FIELD BELOW THE \$2000 level was crowded, then take a look at the chart accompanying this article; this price area is even more crowded. Almost every week there seems to be a new microcomputer entry in this or the higher-priced categories. And, as noted in the previous story, there are more and more 16-bit machines coming out.

With this in mind, a closer look shows that 18 new machines join the market fray. Some of them are from companies whose names are already familiar, while others are from firms whose names appear here for the first time.

Seven manufacturers join the list here, all featuring fairly well configured, powerful systems. Among them there is a fairly even split between 8- and 16-bit microprocessor units.

The other 12 new machines come from already-mentioned manufacturers, while the rest of the listing presents upgrades of systems that were introduced in lower-priced levels.

Without further ado, let's begin our look at the new offerings from the new manufacturers. From there we'll look at what the familiar firms have to offer and we'll tie up this piece with a peek at how various systems upgrade.

Wang

Perhaps best known in the business field, Wang has long held a dominant position in the word-processing/minicomputer market. Its *Wangwriter* has set the standard in this field for years. Now it has an offering in the microcomputer field, its *Professional Computer*.

An IBM-workalike, it differs from the *Personal Computer* because it uses a 16-bit 8086 CPU. However, the 8086 recognizes the 8088's instruction set and will work with any software written for the 8088. With the 128K standard user memory, the buyer has a powerful system from the start.

Equipped with a standard 128K single-sided, double-density

floppy disk drive, the *Professional* runs under MS-DOS. CP/M-86 is also available.

Programmable in several high-level languages, this data can be input via a 101-key typewriter-style keyboard, that features 16 programmable keys, as well as an 18-key numeric pad. Input/output is handled via standard parallel and serial ports.

Compaq

One of the major newcomers in the IBM-compatible field, Compaq Computer's *Compaq* is nearly totally compatible with the IBM offering.

A transportable, the *Compaq* is driven by a 16-bit 8088 CPU, the same one used by the *PC*. It features more standard user memory: 128K.

Operating under Compaq DOS, an IBM workalike disk-operating system, the *Compaq* can use many of the programs written for the IBM-*PC*. Further, it comes with one double-sided, double-density 320K minifloppy disk drive as standard equipment.

Like other small-computer systems, the *Compaq* is programmable in BASIC and data are entered via an 83-key IBM-*PC*-like keyboard. Unlike the *PC*, the *Compaq* comes with a standard parallel printer port. Its built-in 9-inch monochrome display handles both an 80-character by 25-line text mode and graphics.

Altos

The user looking for a more business-oriented system, should check out the Altos *5-15D*. A micromainframe—the system box and drives, the terminal is a user option—the *5-15D* is driven by an 8-bit Z80A CPU and comes with 192K of memory.

Running under the industry-standard CP/M operating system, the *5-15D* comes with two standard 1-megabyte 5¼-inch floppy

TABLE 1—\$2500-\$3000

Manufacturers	Model	Price	CPU	Word Length	Operating System	Languages
Sord Computer	M23 Mark III G	\$2530	Z80A	8-bit	Proprietary, CP/M-compatible	BASIC, Pascal, FORTRAN
Franklin Computer Corp.	Ace 1200	\$2544	6502/Z80	8-bit	Apple DOS 3.3 compatible, CP/M	BASIC
NEC Home Electronics	PC-8800	\$2547	Z80A-compatible	8-bit	CP/M	BASIC
IBM	IBM-PC	\$2564	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FRTRN, BASIC, MACRO assembler, Pascal
Heath Company	HS-100-31	\$2594	8085/8088	8/16-bit	Proprietary ZDOS	BASIC
Texas Instruments	Professional Computer	\$2595	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Sharp Electronics	PC-5000	\$2599 (est.)	8088	16-bit	N/A	
Canon USA	AS100	\$2620	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
Toshiba America	T100	\$2635	Z80A	8-bit	CP/M	BASIC
LNW Research Corp.	LNW80 Model 2	\$2645	Z80A	8-bit	CP/M, Proprietary	BASIC
Apple Computer	Apple IIe	\$2674	6502A	8-bit	Apple DOS 3.3	BASIC, PILOT, Logo, Pascal, FORTRAN, COBOL
Sony	SMC-70	\$2675	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Apple Computer	Apple III	\$2695	6502B	8-bit	Apple SOS	BASIC, Pascal
Access Matrix Corp.	Access	\$2695	Z80A	8-bit	CP/M	BASIC
Apple Computer	Apple III	\$2720	6502B	8-bit	Apple SOS	BASIC, Pascal
Heath Company	HSA-120-31	\$2744	8085/8088	8/16-bit	Proprietary ZDOS	BASIC
Canon USA	AS100	\$2745	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
NEC Home Electronics	PC-8800	\$2747	Z80A-compatible/8086	8/16-bit	N/A	BASIC
NEC Information Syst.	APC	\$2748	8086	16-bit	CP/M-86, MS-DOS	BASIC, COBOL, FORTRAN, PASCAL, Assem.
Hewlett-Packard	HP85A	\$2750	Not announced		N/A	BASIC, assembler
Hewlett-Packard	HP120/125	\$2775	Z80A	8-bit	N/A	BASIC, assembler
IBM	IBM-PC	\$2788	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, MACRO assembler, Pascal
Kaypro Division	Kaypro 10	\$2795	Z80	8-bit	CP/M	BASIC, Pascal, FORTRAN, Assembler, COBOL
Texas Instruments	Professional Computer	\$2820	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Commodore Business Machines	BX256-80	\$2890	6509/8088	8/16-bit	Proprietary	BASIC
Zenith Data Systems	ZF-100	\$2899	8085/8088	8/16-bit	CP/M, ZDOS (proprietary)	BASIC, COBOL, FORTRAN
IBM	IBM-PC	\$2904	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, MACRO assembler, Pascal
Apple Computer	Apple III	\$2920	6502B	8-bit	Apple SOS	BASIC, Pascal
Sord Computer	M23P	\$2930	Z80A	8-bit	Proprietary, CP/M-compatible	BASIC, Pascal, FORTRAN
Hewlett-Packard	HP-85A	\$2945	Not announced		Proprietary	BASIC, assembler

Memory/Storage	Keyboard	I/O	Display	Comments
128K/2 330K 5 1/4" DS/DD drives	59 keys, 20-key keypad, 9 special function	2 serial, 1 parallel	12-inch green CRT	2 DS/DD drives, CRT
128K/2 5 1/4" floppy disk drives	72 keys, 12-key keypad	1 serial, 1 parallel, game controller	80 (40) × 24/280 × 192 graphic capability	Ace 1200 gains further storage with second floppy disk drive
64K/2 320K DS/DD 5 1/4" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch monochrome CRT/80 × 25 text	dual 320K DS/DD drives
64K/1 SS/DD 180K 5 1/4" floppy drive	59 keys, 10 special function, 20-key keypad	1 parallel	12-inch monochrome CRT/80 × 25 text	1 drive added, display device added
192K/2 320K DS/DD 5 1/4" floppy drives	60 keys, 14 function keys, 18-key keypad	2 serial, 1 parallel	monochrome capability	2nd drive
64K/1 320K DS/DD 5 1/4" floppy drive	97 keys, 17-key keypad, 12 special function	1 parallel	12-inch monochrome CRT, 720 × 300 res., 80 × 25 display	base system
128K/128K bubble memory storage/cassette interface	standard typewriter		80-character × 8-line liquid crystal display	base system
Not announced/2 640K DS/DD 5 1/4" floppy drives	standard	1 serial	monochrome display/80 × 25 text mode	serial port
64K/2 280K DS/DD 5 1/4" drives	89 keys, 8 special function	1 parallel, 1 serial	640 × 200 color display, 80 × 25 in text mode	color display
96K/1 5 1/4" floppy disk drive	73 keys, 11-key keypad	1 parallel, 1 serial	480 × 192 color capability/62 × 16 text mode/monochrome CRT	first drive and monochrome
64K/1 5 1/4" floppy drive	63-key typewriter, 2 programmable	1 parallel, 1 serial, game controller	12-inch monochrome CRT/80-column card/80 × 24 text mode	1 disk drive and controller added
64K/1 280K microfloppy drive	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch green 80 × 25 text	disk drive and CRT added, video converter deleted
128K/1 140K SS/DD 5 1/4" floppy drive	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller	280 × 192 and 560 × 192 graphics capability/80 × 24 text	128K memory
64K/2 DS/DD floppy disk drives	62 keys, 15 special function, 15-key keypad	2 serial, 1 parallel, 1 IEEE-488	7-inch monochrome (amber)/80 × 25 text mode	drives upgraded to DS/DD
128K/1 140K SS/DD 5 1/4" floppy drive	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller, 1 parallel	280 × 192 and 560 × 192 graphics capability/80 × 24 text	parallel port
192K/2 320K DS/DD 5 1/4" floppy drives	60 keys, 14 function keys, 18-key keypad	2 serial, 1 parallel	monochrome version	2nd drive
Not announced/2 640K DS/DD 5 1/4" floppy drives	standard	1 serial, 1 parallel	monochrome display/80 × 25 text mode	parallel port
128K/cassette interface/disk interface	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch color CRT/640 × 400 res./80 × 25 text	optional 8086 card/memory upgraded to 128K color CRT for display
128K/1MB 8-inch half-height DS/DD drive	66 keys, 25-key keypad, 23 function	1 parallel, 1 serial	80 × 25 monochrome	basic system
16K/tape cartridge	58 keys, 20-key keypad, 8 special function		built-in 5" CRT, 256 × 192 graphics, 32 × 16 text	portable system
64K	58 keys, 8 special function	2 serial, 1 IEEE-488	9" or 12"-monochrome CRT/80 × 25 text	basic system, HP120 has 9" display, 125 has 12"
64K/1 SS/DD 180K 5 1/4" floppy drive	59 keys, 10 special function, 20-key keypad	1 parallel	12-inch high-res. color display/80 × 25 text	color display adapter
64K/1 5 1/4" DS/DD drive, 10MB hard disk	72 keys, 14-key keypad, 20 programmable	1 serial, 1 parallel	9-inch, monochrome CRT/80 × 25 text	basic system
64K/1 320K DS/DD 5 1/4" floppy drive	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	12-inch monochrome CRT, 720 × 300 res., 80 × 25 display	serial port
256K/dual 5 1/4" floppy disk drives	standard, numeric keypad	1 serial	12-inch monochrome CRT/80 × 25 text mode	dual drives
128K/1 320K DS/DD 5 1/4" drive	77 keys, 18-key keypad, 13 special function	2 serial, 1 parallel	composite video output	basic system
64K/1 320K DS/DD 5 1/4" floppy drive	59 keys, 10 special function, 20-key keypad	1 parallel, 1 serial	12-inch monochrome CRT/80 × 25 text	drive becomes DS/DD, serial port added
256K/1 140K SS/DD 5 1/4" floppy drive	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller, 1 parallel	280 × 192 and 560 × 192 graphics capability/80 × 24 text	parallel port added, memory upgrades to 256K
128K/2 290K microfloppy drives	60 keys, 20-key keypad, 9 special function	2 serial, 1 parallel	14-inch color monitor	color monitor
32K/tape cartridge	58 keys, 20-key keypad, 8 special function		built-in 5" CRT, 256 × 192 graphics, 32 × 16 text	16K RAM added

TABLE 1—\$2500-\$3000 (continued)

Manufacturers	Model	Price	CPU	Word Length	Operating System	Languages
Hewlett-Packard	HP86A	\$2950	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN,
Docutel/Olivetti Corp.	M20	\$2965	Z8001	16-bit	PCOS (Prof. Computer Operating Sys.)	BASIC
Apple Computer	Apple III	\$2969	6502B	8-bit	Apple SOS	BASIC, Pascal
Toshiba America	T300	\$2975	8088	16-bit	MS-DOS, CP/M-86	BASIC
Basis Inc.	Basis 108	\$2985	Z80A/6502	8-bit	CP/M, Apple DOS 3.3	BASIC, Pascal, LOGO
Altos Computer Systems	5-15D	\$2990	Z80A	8-bit	CP/M	BASIC, COBOL, Pascal, FORTRAN, SOFTBOL
Eagle Computer Inc.	Eagle PC-1	\$2995	8088	16-bit	CP/M-86, MS-DOS	
Eagle Computer Inc.	Eagle IIE-3	\$2995	Z80A	8-bit	CP/M	BASIC
Vector Graphic Inc.	Vector 4	\$2995	Z80B, 8088	8/16-bit	N/A	Not announced
Computer Devices Inc.	DOT-3000A	\$2995	8088	16-bit	MS-DOS	BASIC, FORTRAN, COBOL, Pascal, assembler
Hewlett-Packard	H85B	\$2995	Not announced		Proprietary	BASIC, assembler
Sanyo	MBC 1250	\$2995	Z80A	8-bit	CP/M	BASIC, Pascal, Fortran, Macro-80
Sumicom Inc.	System 330B	\$2995	8088	16-bit	MS-DOS/CP/M-86	FORTTRAN, COBOL, Pascal, BASIC
Wang Laboratories	Professional Computer	\$2995	8086	16-bit	MS-DOS, CP/M emulation	BASIC, COBOL, FORTRAN, Pascal
Hewlett-Packard	HP87XM	\$2995	Not announced		N/A	BASIC, Pascal, FORTRAN
Intertec Data Systems	Superbrain II - QD	\$2995	Z80A	8-bit	CP/M	BASIC, FORTRAN
Compaq Computer Corp.	Compaq	\$2995	8088	16-bit	Compaq DOS (Similar to IBM PC-DOS)	BASIC
Columbia Data Products	1600-VP	\$2995	8088	16-bit	MS-DOS	Not announced
Basis Inc.	Basis 108	\$2995	Z80A/6502	8-bit	CP/M 3.0, Apple DOS 3.3	BASIC, Pascal, LOGO
TeleVideo Systems Inc.	TS 1603	\$2995	8088	16-bit	CP/M-86, MS-DOS	COBOL
North Star Computers	Horizon	\$2999	Z80A	8-bit	TSS/C (Proprietary CP/M-like)	Not announced
North Star Computers	Advantage	\$2999	Z80A	8-bit	CP/M, GDOS	BASIC, FORTRAN, COBOL, Pascal

disk drives.

The 5-15D has two serial ports and one parallel port as standard.

Vector Graphic

Vector Graphic is a long-time veteran of the microcomputer marketplace. It was one of the first microcomputer manufacturers and remains in the thick of the fray with its *Vector 4* system. It has 128K of user memory and, with the addition of a couple of drives, can become a powerful system.

Driven by dual Z80B and 8088 CPU's, the system has a typewriter-style keyboard with 91 keys, 15 special-function keys and an 18-key numeric pad. Its 12-inch monochrome display delivers an 80-column by 24-line display or 640- by 312-dot graphics.

Basis

A newcomer to the microcomputer market, Basis Inc. sells the *Basis 108* system, that takes a different tack. A dual-

processor small-computer system, it does not use Z80A's or a Z80/8086(8) combination. Instead the company has opted to make this single-user system compatible with CP/M and its many programs and Apple's disk-operating system and the many programs that run under it. Driven by a Z80A 8-bit microprocessor and a 6502, another 8-bit CPU, the *Basis 108* has 128K of user memory.

The 108 comes with two 5¼-inch minifloppy disk drives. Input/output is provided by serial and parallel ports.

With RGB color outputs available, the *Basis 108* can generate up to 280- by 192-dot video resolution or an 80-character by 25-line text display. This system upgrades once in this price category by adding CP/M 3.0.

Zenith

The parent of the Heath Co., who offers kit versions of the *Z-100* series, Zenith has a ready-to-go version of the same system. The *ZF-100* outlined here is the low-profile version of this system.

Memory/Storage	Keyboard	I/O	Display	Comments
64K/1 270K 5 1/4" drive	59 keys, 20-key keypad, 14 special function	1 parallel	9" monochrome CRT/80 × 25 text	5 1/4" drive added
128K/1 360K 5 1/4" floppy drive	72 keys, 16-key keypad	1 serial, 1 parallel	12-inch high-res. monochrome/80 × 25 text mode	one-drive added
128K/1 140K 5 1/4" floppy drive	61-key typewriter, 13-key keypad, 2 program-mable	1 serial, 2 game controller, 1 parallel	12-inch CRT/280 × 192 and 560 × 192 graphics cap./80 × 24 text	CRT added to 128K Apple III
192K/2 640K DS/DD 5 1/4" drives	67 keys, 18 special funct., 10 edit, 18-key keypad	1 parallel, 1 serial		2nd drive added
128K/2 5 1/4" floppy drives	58 keys, 15 program-mable, numeric keypad	1 parallel, 1 serial	RGB and composite/280 × 192 res./80 × 25 text	basic system
192K/2 1MB DS/DD 5 1/4" floppy drives	N/A	4 serial, 1 parallel	N/A	micro-mainframe, can drive 1 to 3 terminals
128K/1 320K DS/DD 5 1/4" floppy drive	105 keys	2 serial, 1 parallel	12-inch high-res. monochrome/720 × 352 capability/80 × 25 text mode	memory increases to 16K, monitor added
64K/2 780K DS/DD 5 1/4" floppy drives	75 keys	2 serial, 2 parallel	12-inch monochrome/80 × 25 text mode	DS/DD 96-track disk drives
128K	91 keys, 15 special function, 18-key keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 × 24 text/640 × 312 graphics	basic system
64K/1 3 1/8" 280K micro floppy drive	59 keys, 10 function keys, 18-key keypad		80 × 24 text	basic system
32K/tape drive/electronic (RAM) disk	58 keys, 20-key keypad, 8 special function		built-in 5" CRT, 256 × 192 graphics, 32 × 16 text	electronic RAM disk, 32K memory
64K/2 640K slim line DS/DD floppy drives	50 keys, 15 program-mable, 18-key keypad	1 parallel, 1 serial	12-inch monochrome/80 × 25 text/640 × 400 graphics	2nd high-density slim line disk
128K/2 SS/DD 160K 5 1/4" floppy drives	95 keys, 8 special function, 10-key keypad	1 serial, 1 parallel	monochrome CRT	2 SS/DD disks, CRT
128K/1 360K DS/DD 5 1/4" floppy drive	101 keys, 16 program-mable, 18-key keypad	1 parallel, 1 serial		basic system
128K	59 keys, 20-key keypad, 14 special function	multipurpose port	8" monochrome CRT/80 × 25 text	basic system
64K/2 750K 5 1/4" floppy drives	62 keys, 18-key keypad	2 serial	12-inch monochrome/80 × 24 text mode	drives upgraded to 750K
128K/1 320K 5 1/4" DS/DD drive	83 keys, 10-key keypad, 10 special function	1 parallel, opt. serial	9-inch monochrome, 80 × 25 text	basic system
128K/2 320K 5 1/4" floppy disk drives	83 keys, 10 special function, keypad	1 serial, 1 parallel	9-inch monochrome CRT/80 × 25 text	basic system
128K/2 5 1/4" floppy drives	58 keys, 15 program-mable, numeric keypad	1 parallel, 1 serial	RGB and composite/280 × 192 res./80 × 25 text	CP/M 3.0
128K/2 half-height 1MB floppy drives	72 keys, 16 program-mable, 16-key keypad	2 serial, 1 serial RS-422 port	14-inch monochrome/80 × 25 text	16-bit system
64K/2 360K DS/DD 5 1/4" floppy drives	N/A	2 serial, 1 parallel	N/A	micromainframe system
64K/2 360K DS/DD 5 1/4" floppy drives	49 keys, 14-key keypad, 15 function keys	1 parallel, 1 serial	12-inch monochrome CRT/640 × 240 graphics res./80 × 24 text mode	all-in-one microcomputer with dual floppy disks

Driven by an 8085 8-bit processor and an 8088 16-bit processor, this system has 128K of standard user memory.

Another of the IBM-workalikes on the market, the *ZF-100* operates under its own proprietary operating system and CP/M.

With one standard double-sided, double-density 320K minifloppy-disk drive available for storage, the system is almost fully configured right from the box.

Programmable in BASIC, COBOL and Fortran, this and other data are entered via a typewriter-style keyboard with 77 keys. It also features an 18-key numeric keypad and 13 special-function keys. Input/output is through two serial ports and one parallel port.

Computer Devices

Another of the many IBM-compatible systems now on the market, the Computer Devices *DOT-3000A*, is a transportable system. This new manufacturer is using the same CPU found in the IBM, the 16-bit 8088 to drive the *DOT*. Its 64K of user memory is the minimum needed for efficient operation of the

many programs available for MS-DOS, the *DOT's* operating system.

The *DOT* can use several high-level programming languages and this data are input through a 59-key keyboard. Since it is a transportable, the *DOT* has a built-in display, with an 80-character by 24-line text mode.

Columbia Data Products

Although this manufacturer is not widely known outside the computer industry, it also has a microcomputer offering, the *1600-VP*, another IBM-compatible transportable system.

Driven by the 16-bit 8088 CPU, the *1600-VP* has 128K of standard user memory. It is compatible with MS-DOS and runs under it.

The *1600-VP* comes with two 320K double-sided, double-density minifloppy disk drives for storage. The keyboard is patterned after the IBM's 83-key unit. However, unlike the IBM, the *1600-VP* includes standard serial and parallel ports for interfacing with a variety of peripherals. The 9-inch

monochrome screen unit has an 80-character by 25-line text display.

Sord

From Sord/Mitsui comes the *M23 Mark III G*, another of the many Z80A-based systems. A fully configured system right out of the box, it comes with 128K of user memory and a basic set of applications software, something a growing number of systems are doing.

With two standard double-sided, double-density 330K mini-floppy disk drives, this system is flexible. Not only does it run under its own proprietary operating system, it is also CP/M compatible and is programmable in BASIC, Pascal, and Fortran.

Basically the *M23* system, it is actually an upgraded version with the drives and 12-inch green monochrome display device included. User input is via a keyboard containing 59 keys, a 20-key numeric pad and nine special-function keys. Input/output is handled through two serial ports and a parallel port.

The basic *M23* upgrades in this price category by adding a high-resolution color video monitor.

Texas Instruments

A new personal computer joins the array from this semiconductor giant. Its the *Professional Computer*, another of the many IBM-workalikes. Driven by a 16-bit 8088 microprocessor, the same one used by IBM, this system has 64K of RAM.

Its standard 320K double-sided, double-density disk provides basic storage capability, although the addition of a second disk drive increases system flexibility. It runs under MS-DOS, but CP/M-86 and the UCSD p-System are also available.

Output is through a standard parallel port for a printer. The standard display is a 12-inch monochrome screen, with 720- by 300-dot resolution and an 80-character by 25-line text display. It upgrades once in this price category by adding a serial port.

Sharp

A new model joins the Sharp lineup in this price category, the lap computer *PC-5000*. Driven by a 16-bit 8088 microprocessor, the *PC-5000* has a rather unusual feature; it relies on magnetic bubble-memory storage in place of a disk drive. Magnetic bubble memory is nonvolatile user memory that retains its contents even when the power is shut down. This type of memory can effectively eliminate the need for disks for mass storage. The unit comes with 128K of RAM. With a standard keyboard, the *PC-5000* can be programmed in BASIC. Its screen is an 80-character by 8-line liquid-crystal display.

NEC

A new small-computer joins the NEC lineup here, the *APC*, another IBM workalike. Instead of using an 8088, 16-bit CPU, the *APC* takes advantage of its brother the 8086, that recognizes the same instruction set. It is equipped with 128K user memory and a 1-MB 8-inch half-height double-sided, double-density disk drive. It runs under MS-DOS or CP/M-86.

It is programmable in several high-level languages input via a typewriter-style keyboard with 66 keys. Twenty-three function keys and a 25-key numeric pad aid functionality. Input/output is through standard parallel and serial ports. Video output is 80-characters by 25-lines text on a monochrome display.

The *PC-8800*—still only a CP/M-compatible machine at this point—upgrades by adding dual 320K double-sided, double-density minifloppy disk drives. Its second upgrade makes it a true 16-bit machine with the addition of the optional 16-bit card. This gives the user the advantage of MS-DOS capability.

Hewlett-Packard

Two new systems join the Hewlett-Packard lineup in this price category, the *120/125* and the *HP87XM*. In this price category, the new *HP120/125* system is in its most basic configuration. Driven by dual Z80A CPU's, the system has 64K of user memory. But no disk storage is available at this price.

Programmable in BASIC and assembler, this and other data are input via a typewriter-style keyboard with 58 keys. The keyboard includes 8 special-function keys and other soft or programmable keys. Input/output is aided by two standard serial ports as well as an IEEE-488 port, for a variety of test and measurement, and other devices. The standard display on the *HP120* is a 9-inch monochrome display, while the *HP125* has a 12-inch monochrome display.

The *HP87XM* is a very basic machine at this point. Although it has 128K of user memory and is programmable in BASIC, Fortran, Pascal, and COBOL, you will need disk drives to take full advantage of them.

The basic configuration of this system includes a typewriter-style keyboard with 58 keys, a 20-key numeric keypad and eight special-function keys. A multipurpose port facilitates input/output. A built-in 8-inch monochrome display rounds out the basic unit.

Other H-P small-computer systems also upgrade or are introduced in this price segment. There's the portable *HP85A*. It is not only introduced, but also has its RAM expanded to 32K. This system includes 195K of built-in tape storage and a built-in thermal printer and a built-in 5-inch monochrome CRT. It also includes 2 serial ports and an IEEE-488 port.

The *HP85B* enhances the *HP85A* system by including an electronic (RAM) disk for speed and storage and greater user memory. Meanwhile, the *HP86A* system debuts in this category and, while it has many of the attributes of the *HP85* system, it also includes a standard minifloppy disk drive for storage.

North Star

North Star Computers has two systems that debut in this price category, the *Horizon* and the *Advantage*. A micromainframe, the *Horizon* is driven by an 8-bit Z80A CPU. The basis of a multi-user system, it includes 64K of user memory and two standard double-sided, double-density 360K minifloppy disk drives for storage. With access to a proprietary operating system, there are many applications for this computer system, which includes two serial ports and one parallel for input/output. The terminal is a user option.

The *Advantage* is an all-in-one microcomputer system that includes dual floppy-disk storage. Also driven by a Z80A, it has 64K of user memory and runs CP/M. Programmable in BASIC, Fortran, COBOL, and Pascal, this and other data are entered via a typewriter-style keyboard with 49 keys. It also includes a 14-key numeric pad and 15 function keys. Input/output is aided with standard serial and parallel ports. The built-in 12-inch monochrome screen displays 640 by 240 graphics or an 80-character by 24-line text mode.



THE APC from NEC is an IBM workalike.

TeleVideo

Many IBM workalikes have appeared on the market in the recent past from many manufacturers.

TeleVideo is no exception with its 8088-driven *TS 1603* that runs CP/M or MS-DOS. It offers 128K RAM and two half-height one-megabyte double-sided, double-density floppy-disk drives.

With two standard serial ports and an RS-422 serial port, a user has several peripheral interface options for input/output. The *TS 1603* is programmable in COBOL, so it's readily apparent this small-computer is aimed at the business market.

Sanyo

The *MBC 1250* expands in this category with the addition of a second high-density slim-line floppy-disk drive. This type of drive shows an important trend in the small-computer industry, miniaturization.

Unfortunately it also shows another important trend: computer manufacturers often find it hard to agree on standards. There are several computers from different companies who offer microfloppy-disk drives—each with its own "standard".

Kaypro

Kaypro adds to its line of Z80-based, 8-bit transportable microcomputer systems with the *Kaypro 10*. Like the other members of this manufacturer's line, the *Kaypro 10* comes as a full-featured unit right out of the box. However, it features not only a double-sided, double-density 5¼" floppy-disk drive, but also a ten-megabyte hard-disk drive.

Intertec

Intertec's new offering in this price category is the *Superbrain II—QD*. Like the *Superbrain II—Jr.*, this small-computer system is driven by dual Z80A microprocessors; one handles the actual data processing, while the other microprocessor handles the housekeeping.

The key change in this system, and the one that raises it above the *Superbrain II—Jr.* is the use of dual 750K 5¼-inch minifloppy disk drives for storage. It has the same specifications as the Junior and is an all-in-one unit.

Sumicom

The *System 330B* expands in this price category with the addition of two 160K single-sided, double-density minifloppy-disk drives. This turns it into a fully configured microcomputer system.

Apple

Two systems upgrade in this price category, the *Apple IIe* and the *Apple III*. The *Apple IIe* upgrades once with the addition of a minifloppy disk drive and disk-drive controller circuitry.

The business-oriented *Apple III* upgrades four times. Its first upgrade is its increase in user memory to 128K as standard, while its second upgrade gives it output capability by adding a parallel port for a printer. The third upgrade brings the user memory to 256K, and also adds a parallel port for increased output capability, while the fourth upgrade to the 128K version adds a standard video-display device.

IBM

The IBM *Personal Computer* becomes a far more powerful tool with its first upgrade, the addition of a minifloppy disk drive for storage. This upgrade also adds the high-resolution display that enhances serious computing. Its second upgrade adds the color display device to the one-disk drive version of the IBM-PC. In its third upgrade, the PC gains further input/output capabilities with the addition of a serial port and the disk drive becomes even more versatile as its mass-storage capabilities increase to 320K.

Eagle Computer

Both Eagle models, the *PC-1* and *IIE-3*, upgrade here. The



THE *BASIS 108* from Basis, Inc. is a dual microprocessor (Z80A/6502) system that runs CP/M and an Apple-compatible DOS.

PC gains more user memory and a standard video-display device, in addition to its complete complement of bundled (included) software. The storage capacity of the *Eagle IIE-3* increases with the addition of 96-track double-sided, double-density minifloppy disks.

Toshiba

The *T100* system can handle high-resolution color graphics in this price spectrum by adding a 640- by 200-dot resolution color video display device.

The *T300* system gains greater mass-storage capability in this price category with the addition of a second minifloppy-disk drive to its configuration.

Canon

This manufacturer's offering, the *AS100*, has two upgrades. The first adds a serial port for greater input/output capability. The second upgrade adds a parallel port.

Heath

At this time, second disk drives for greater mass-storage capabilities are added to the low-profile Heath *HS-100-31* kit and the *HS-120-31* kit.

Franklin

A second disk drive is added to the Franklin *Ace 1200*. As you might expect, that increases the mass-storage capabilities of this unit.

Sony

The *SMC-70* becomes even more fully configured as a disk drive is added for mass storage and a standard video-display device is also added.

Commodore

The *CBX256-80* becomes fully configured with the addition of two disk drives.

Access Matrix

With the addition of higher-density disks, the mass-storage capabilities of the *Access* transportable increase dramatically.

LNW

In this price category's configuration, the *LNW80 Model 2* gains its first disk drive for storage. Further, the user gains a standard video-display device.

R-E

Professional Books That Help You Get Ahead . . . And Stay Ahead!

Join the **ELECTRONICS AND CONTROL ENGINEERS' BOOK CLUB** and

- Keep up with current technology
- Sharpen your professional skills
- Be ready for new career opportunities
- Boost your earning power

TAKE ANY 3 BOOKS FOR ONLY \$1⁰⁰ EACH

Values up to \$89.50 . . .

If you join now for a trial period and agree to purchase three more books—at handsome discounts—over the next year. (Publishers' prices shown)



INTUITIVE IC ELECTRONICS: A Sophisticated Primer for Engineers and Technicians. By T. M. Frederiksen. 208 pp., illus. Covering both the simplest and the most complicated IC designs, this lively, easy-to-read volume provides a sophisticated, nonmathematical explanation of the basic internal mechanisms common to all semiconductor devices. 219/230 \$19.95

RADIO HANDBOOK, 22/e. By W. Orr. 1,136 pp., more than 1,300 illus. Here's the latest edition of what is universally regarded as the most useful reference in the industry. It's a "course" in communications, a fact-packed reference, and a how-to guide—all in a single book! 582442-6B \$39.95 (Counts as 2 of your 3 books)

VLSI TECHNOLOGY By S. M. Sze. 672 pp., 400 illus., 50 tables. An anthology from more than 3,000 technical papers, by 14 leading experts, covering everything from crystal growth to special packaging considerations. 626/863B \$32.50 (Counts as 2 of your 3 books)

ANTENNA THEORY: Analysis and Design. By C. A. Balanis. 816 pp., illus. Packed with equations, design procedures, and plenty of nuts-and-bolts know-how, this is the first place to turn for answers to all your antenna design questions. 582493-0B \$39.50 (Counts as 2 of your 3 books)

ELECTRONIC COMMUNICATIONS SYSTEMS. By W. D. Stanley. 566 pp., illus. The ideal working tool for practicing engineers who deal with a combination of system-level consideration and actual hardware implementation and operation. 582834-0 \$19.95

DIGITAL COMMUNICATIONS. By J. G. Proakis. 624 pp., illus. A wealth of new material, information about spread spectrum signals, requiring a minimum of math to get through it. 509/271B \$37.50 (Counts as 2 of your 3 books)

MICROPROCESSOR APPLICATIONS HANDBOOK. Editor-in-Chief, D. F. Stout. 472 pp., 284 illus. At last—a reference guide to microprocessor applications to help you make your systems timely, versatile, and cost-effective. 617/988B \$39.95 (Counts as 2 of your 3 books)

OPTICAL FIBER COMMUNICATIONS. By G. Keiser. 416 pp., illus. For those with little or no prior experience with optical fibers, the perfect book to walk you through a typical system. 334/676B \$35.95 (Counts as 2 of your 3 books)

ELECTRONICS ENGINEERS' HANDBOOK, 2/e. Edited by D. G. Fink & D. Christiansen. 2,272 pp., 2,189 illus. This updated and enlarged edition covers the latest knowledge in the field, including new advances in integrated circuits, pulsed and logic circuits, laser technology, telecommunications, and much more. 209/812A \$79.90 (Counts as 3 of your 3 books)

PCM AND DIGITAL TRANSMISSION SYSTEMS. By R. Owen. 320 pp., 186 illus. This useful volume allows newcomers to the field to familiarize themselves with its problems and equipment in two weeks, instead of the three months it would ordinarily take. 479/542B \$34.95 (Counts as 2 of your 3 books)

MODERN ELECTRONIC CIRCUITS REFERENCE MANUAL. By J. Markus. 1,264 pp., 3,666 circuit diagrams. Complete with values of components and suggestions for revisions, plus the original source of each circuit in case you want additional performance or construction details. 404/461A \$74.95 (Counts as 3 of your 3 books)

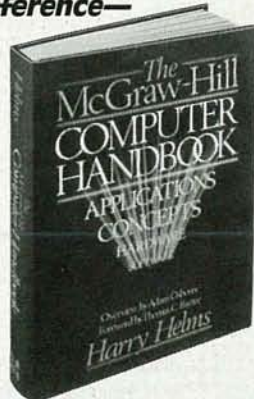
MANUAL OF ACTIVE FILTER DESIGN, 2/e. By J. L. Hilburn and D. E. Johnson. 225 pp., 157 easy-to-use design graphs. This ingenious manual enables you to design filter circuits for virtually any application in minutes—without making a single computation! Covers all the latest designs. 287/694B \$39.95 (Counts as 2 of your 3 books)

This Remarkable New Reference—a \$79.50 value—is yours for only \$3

THE MCGRAW-HILL COMPUTER HANDBOOK.

Edited by H. L. Helms. 992 pp., 475 illus. In one volume, crammed with easy to get at information, ranging from design concepts to programming techniques from data bases to interfacing, networking, speech synthesis and recognition.

279/721A \$79.50 (Counts as 3 of your 3 books)



ELECTRONIC COMMUNICATION, 4/e. By R. L. Shrader. 801 pp., 870 illus. This thoroughly updated edition offers all the theory and fundamentals you need to prepare yourself for the FCC commercial and amateur grade license examinations—and pass them the first time!
571/503 \$26.95

DIGITAL HARDWARE DESIGN. By J. B. Peatman. 428 pp., over 400 illus. Taking you beyond the microcomputer, this guide reexamines traditional techniques and focuses on the design of circuitry too fast for the microcomputer alone.
491/321B \$35.50
(Counts as 2 of your 3 books)

ELECTRONICS ENGINEERING FOR PROFESSIONAL ENGINEERS' EXAMINATIONS. By C. R. Hafer. 336 pp., more than 200 illus. Actually two books in one—a quick preparation manual to help you pass your P.E. exams on the first try and a rich source of practical electronics engineering information and know-how.
254/303 \$29.95

MICROPROCESSOR SUPPORT CHIPS Theory, Design and Application. By J. J. Byers. 228 pp., 170 illus. Everything from pinouts to operating characteristics is spelled out for telecommunications, power supplies, interfaces, control, video and A/D and D/A converters.
095/183B \$38.00
(Counts as 2 of your 3 books)

INTRODUCTION TO RADAR SYSTEMS, 2/e. By M. I. Skolnik. 698 pp., 244 illus. This new edition of a widely used text on radar from the systems engineer's point of view brings you full discussions of the many major changes that have occurred in the field recently.
579/091B \$40.95
(Counts as 2 of your 3 books)

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS, 11/e. By D. G. Fink and H. Beaty. 2,448 pp., 1,414 illus. Today's most widely used source of electrical engineering information and data serves you as no other single work when you need detailed, timely, and reliable facts.
209/74XA \$74.95
(Counts as 3 of your 3 books)

McGraw-Hill's NATIONAL ELECTRICAL CODE® HANDBOOK, 17/e. By J. F. McPartland. 1,162 pp., 1,096 illus. Bigger and better than ever! This mammoth reference explains and clarifies the many complex provisions of the current (1981) Code® to help you meet rules exactly and pass inspections the very first time.
456/933 \$29.95

HANDBOOK OF SEMICONDUCTOR AND BUBBLE MEMORIES. By W. A. Triebel and A. D. Chu. 416 pp., illus., over 50 worked-out problems. This detailed, comprehensive guide brings you right up to the minute on such newly developed devices as the PLA, FIFO, CAM, CCD, and magnetic bubble memory—as well as all the standard storage devices from ROMs and RAMs to shift registers.
582376-4 \$24.95

ANALYSIS AND DESIGN OF DIGITAL INTEGRATED CIRCUITS. By D. A. Hodges & H. G. Jackson. 448 pp., illus. The only book available written from a quantitative point of view for those who design as well as use ICs.
291/535 \$29.50

Be sure to consider these important titles as well!

RADAR TRANSMITTERS. By G. W. Ewell. 198/438 \$29.50

16-BIT MICROPROCESSOR SYSTEMS. By Texas Instruments, Inc. 637/601B \$49.50
(Counts as 2 of your 3 books)

ELECTRONIC CIRCUITS NOTEBOOK: Proven Designs for Systems Applications. Edited by S. Weber. 192/448B \$35.50
(Counts as 2 of your 3 books)

OPTICAL FIBER SYSTEMS: Technology, Design, and Applications. By C. K. Kao. 332/770 \$29.50

INTRODUCTION TO THE THEORY AND DESIGN OF ACTIVE FILTERS. By L. P. Huelsman & P. E. Allen. 308/543B \$34.50
(Counts as 2 of your 3 books)

MICROELECTRONICS. By J. Millman. 423/27XB \$35.95
(Counts as 2 of your 3 books)

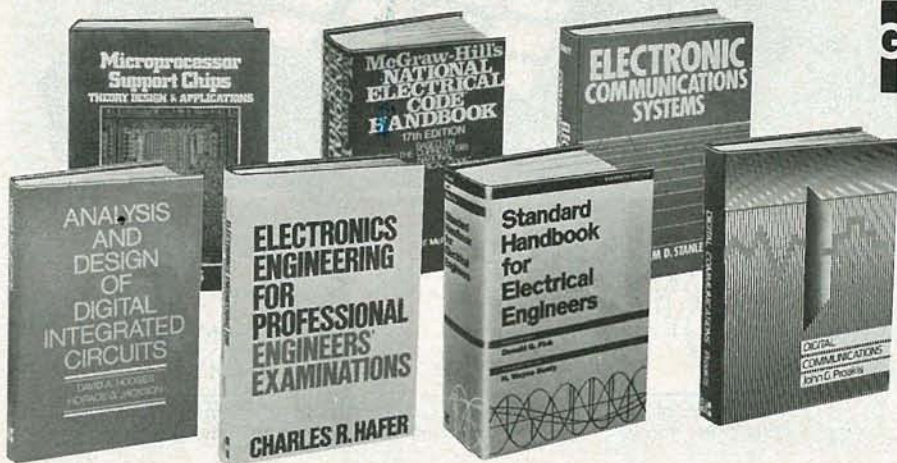
HANDBOOK OF OPERATIONAL AMPLIFIER CIRCUIT DESIGN. By D. E. Stout & M. Kaufman. 617/97XB \$39.50
(Counts as 2 of your 3 books)

MICROCOMPUTER-BASED DESIGN. By J. Peatman. 491/380B \$35.95
(Counts as 2 of your 3 books)

BIT-SLICE MICROPROCESSOR DESIGN. By J. Mick & J. Brick. 417/814B \$31.50
(Counts as 2 of your 3 books)

NETWORK SYSTEMS. By R. Sharma & P. DeSousa. 582557-0 \$29.95

ENGINEERING MATHEMATICS HANDBOOK, 2/e. By J. J. Tuma. 654/298B \$34.50
(Counts as 2 of your 3 books)



Why YOU should join now!

■ **BEST AND NEWEST BOOKS IN YOUR FIELD!** Books are selected from a wide range of publishers by expert editors and consultants to give you continuing access to the best and latest books in your field.

■ **BIG SAVINGS!** Build your library and save money too! Savings ranging up to 30% or more off publishers' list prices—usually 20% to 25%.

BONUS BOOKS! You will immediately begin to participate in our Bonus Book Plan that allows you savings up to 80% off the publisher's prices of many professional and general interest books!

■ **CONVENIENCE!** 12-14 times a year [about once every 3-4 weeks] you receive the Club Bulletin FREE. It fully describes the Main Selection and alternate selections. A dated Reply Card is included. If you want the Main Selection, you simply do nothing—it will be shipped automatically. If you want an alternate selection—or no book at all—you simply indicate it on the Reply Card and return it by the date specified. You will have at least 10 days to decide. If, because of late delivery of the Bulletin you receive a Main Selection you do not want, you may return it for credit at the Club's expense.

As a Club Member you agree only to the purchase of three additional books during your first year of membership. Membership may be discontinued by either you or the Club at any time after you have purchased the three additional books.

Other McGraw-Hill Book Clubs: Accountants' and Controllers' Book Club • Architects' Book Club • Byte Book Club • Chemical Engineers' Book Club • Civil Engineers' Book Club • Mechanical Engineers' Book Club

For more information, write to:

McGraw-Hill Book Clubs • P.O. Box 582, Hightstown, NJ 08520

MAIL THIS COUPON TODAY

McGraw-Hill Book Clubs
Electronics and Control Engineers' Book Club
P.O. Box 582, Hightstown, New Jersey 08520

Please enroll me as a member and send me the three choices I have listed below. Bill me only \$3.00 plus local tax, postage, and handling. If not satisfied, I may return the books within 10 days and my membership will be canceled. I agree to purchase a minimum of three additional books during my first year of membership as outlined under the Club plan described in this ad. A shipping and handling charge is added to all shipments. Indicate below by number the books you want. A few expensive books (noted in the descriptions) count as more than one choice.

Name _____

Address/Apt. _____

City/State/Zip _____

This order subject to acceptance by McGraw-Hill. All prices subject to change without notice. Offer good only to new members. Orders from outside the U.S. cannot be accepted.

E33628

Your own telephone can become a 24-hour-a-day lifeguard!

The SENSAPHONE Transforms Your Telephone Into a Full-Time Monitor, Whether You're Home Or Not.

TALKS TO YOU — IN CLEAR ENGLISH

Your Sensaphone uses a standard built-in modular telephone connector. Instead of plugging your phone into the wall, plug it into the Sensaphone, then in turn plug the Sensaphone into the wall. Total time: 10 seconds.

Once installed, the Sensaphone does its job and reports its findings in clear English. For example —

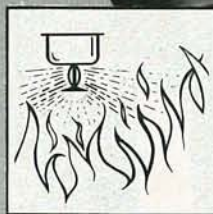
- If you aren't home and a problem occurs, it calls anyone you've designated and reports that problem, **in English**, then arranges to quit calling once the message is acknowledged.
- If you want to know what time it is, your Sensaphone tells you — **in English**.
- If you want to know the current temperature in the room, your Sensaphone tells you — **in English**.
- If the backup batteries (which hold the "memory" if you have a power failure) are low, your Sensaphone tells you so — **in English**.
- If you call in from the outside to learn how things are, your Sensaphone reports on all conditions — **in English**.

YOU MAY NOT BELIEVE IT AS YOU READ THIS, BUT YOU'LL BELIEVE WHEN YOU PLUG IT IN. YOUR MONEY BACK IF WE'RE EXAGGERATING.

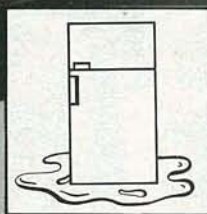
Read This Section Carefully: Your SENSAPHONE Will Do All This —

1. You can call in from any phone in the world. SENSAPHONE will report every monitored condition to you.
2. You can listen to room sounds in your home or office through the powerful built-in microphone, from any phone in the world.
3. It reports **specific** unusual sounds, such as a smoke alarm's ringing or buzzing, or a burglar alarm.
4. It monitors and reports on any three other conditions of your choice (basement water level; door or window opening; water heater; appliance on).

MADE IN U.S.A. by Gulf & Western



Senses and reports problems in the home.



Calls for help so food won't spoil.



Monitor your home from any phone in the world.

5. (Get this!) If one of the pre-programmed problems occurs, it automatically calls you or anyone you designate, then states in English what the problem is. If the first person called doesn't answer, SENSAPHONE calls up to four numbers in rotation until someone answers and acknowledges receiving the call.
6. It monitors your household or office electricity, so if your refrigerator or lights go out, it reports the problem.
7. If room temperature rises above the number you preset, or falls below it, Sensaphone tells you so.
8. An automatic dialer calls any of eight numbers with one-button dialing.
9. It tells you the correct time, in English, including whether the time is a.m. or p.m.
10. It tells you the exact room temperature, on request.

The Sensaphone **\$249.95**
two for \$229.95 each
A FANTASTIC GIFT IDEA!
add \$3.50 per total order for shipping

WE ABSOLUTELY GUARANTEE!

Plug your home or office phone (or both) into the Sensaphone. Use it for up to 30 days. If for any reason you decide you don't want to keep it, return it for a 100% refund.

For fast delivery on credit card orders,
call toll-free 24 hours a day,
7 days a week:

1-800-443-0100

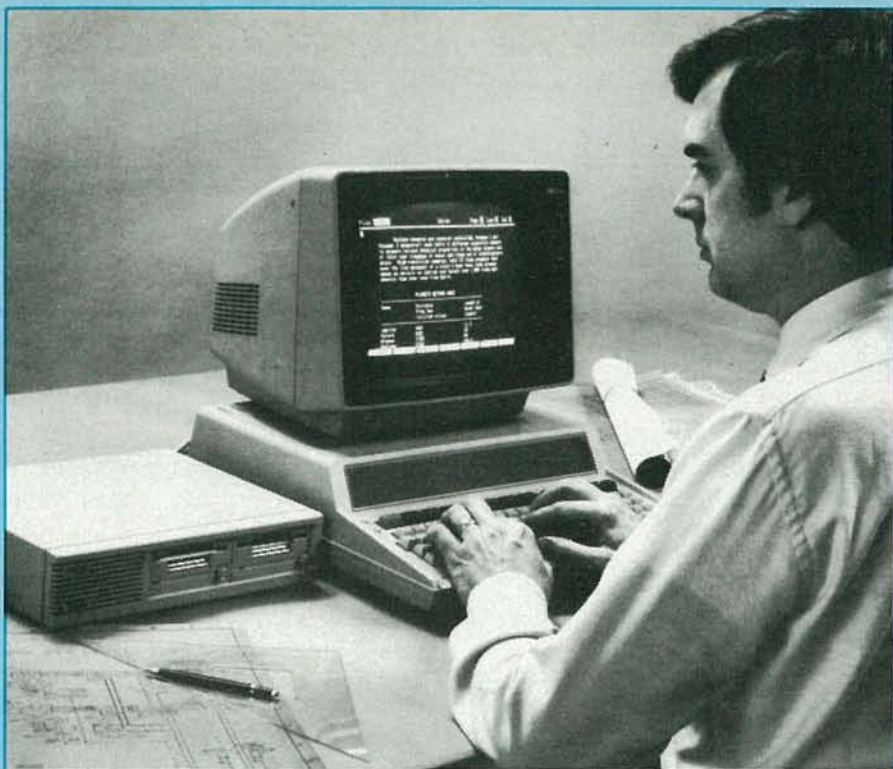
Ask for Extension 111

Or send check or money order.
Please add \$3.50 per total order
for shipping.

The **Sensaphone** is another electronic
marvel from

NEW HORIZONS

Dept. R10, 5-31 Fiftieth Avenue
Long Island City, NY 11101



Sixteen-bit machines begin to take a greater share of the market.

\$3000 to \$3500

MARC STERN

DURING THE LAST YEAR, THE BIGGEST TREND IN THE microcomputer industry has been the swing to the 16-bit machine. And, it's no mystery why it has happened. With the arrival of IBM in the small-computer market, more and more of the computer industry has jumped aboard the bandwagon, hoping to carve out its niche.

For the person thinking of buying such a system there are a couple of benefits. The first is the ability of the 16-bit microcomputer to handle much larger amounts of memory. This means that applications programs can become more comprehensive and more powerful.

The second reason is that IBM is bringing some stability and order to this market. Just as CP/M caught on in the 8-bit market and assured some stability and rationalization and a degree of standardization, so has IBM and the operating system it has chosen—MS-DOS—brought some order to the market.

This means that the buyer will have an easier time deciding which type of machine is the best to buy, since the base of MS-DOS-compatible software is rapidly growing.

Yes, there are a great many machines that are IBM-workalikes and the search for the right one can be confusing. However, if the buyer opts for one using an 8086(88) CPU, there is a measure of order.

Don't think, though, the 8-bit CPU is dead. There are still many fine machines on the market using this type of CPU. In fact, this type of CPU is likely to be around for several years to come in single-user machines and you'll still find a wide variety of those machines available in our listings.

So let's begin our look at the new machines making their debuts here and move on to seeing how other offerings have upgraded.

Epson

Although Epson has long been known for its small-computer

peripheral equipment, it has also entered the microcomputer market with two offerings of its own, the *HX-20* and the easy-to-use *QX-10*. The *HX-20* is a low-cost lap computer, while the *QX-10* is a full-featured small system.

Right from the box, the user has access to the power of an 8-bit Z80A microprocessor and 64K of RAM. This amount of memory is more than enough to handle all the user-oriented software available for this system. This system features a plain language user-interface and a one-key function access.

Fully configured, this system features the CP/M operating system and two double-sided, double-density 5¼-inch mini-floppy-disk drives.

Data are entered via a typewriter-style keyboard with 63 keys. This keyboard includes 21 special-function keys. With the push of one of these buttons, a user is able to access functions without the necessity of entering a series of "computer-like" commands.

Output is via a standard 12-inch monochrome display, capable of 640-by-400-dot graphics resolution or an 80-character by 25-line text display. Input/output is provided by standard serial and parallel ports.

Hitachi

Better known for its consumer electronics products, Hitachi also has an offering that makes its debut in this price range, the 16-bit *MBE 16000* system. Another of the IBM-workalikes, it is driven by an 8088 microprocessor, the same one used by IBM in its *Personal Computer*.

With 128K of user memory, this system is easily able to handle many functions a user may care to undertake. It uses MS-DOS and comes with two 5¼-inch minifloppy-disk drives for storage.

Although a firm price for this system hadn't been established at press time, it's likely to be about \$3000 and for this amount

TABLE 1—\$3000-\$3500

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Epson America	QX-10	\$3000 (est.)	Z80A	8-bit	CP/M	Not announced
Hewlett-Packard	HP86B	\$3000 (est.)	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN
Hitachi Sales Corp.	MBE 16000	\$3000 (est.)	8088	16-bit	MS-DOS	BASIC, FORTRAN, COBOL, Pascal, assemb.
Zenith Data Systems	Z-120	\$3038	8085/8088	8/16-bit	CP/M, ZDOS (proprietary)	BASIC, COBOL, FORTRAN
LNW Research Corp.	LNW80 Model 2	\$3045	Z80A	8-bit	CP/M, Proprietary	BASIC
Apple Computer	Apple IIe	\$3069	6502A	8-bit	Apple DOS 3.3	BASIC, PILOT, Logo, Pascal, FORTRAN, COBOL
Sord Computer	M23 Mark III C	\$3075	Z80A	8-bit	Proprietary, CP/M-compatible	BASIC, Pascal, FORTRAN
Toshiba America	T300	\$3090	8088	16-bit	MS-DOS, CP/M-86	BASIC
NEC Home Electronics	PC-8800	\$3097	Z80A-compatible/8086	8/16-bit	CP/M, CP/M-86, MS-DOS	BASIC
Sony	SMC-70	\$3125	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
IBM	IBM-PC	\$3148	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, MACRO assembler, Pascal
Apple Computer	Apple III	\$3169	6502B	8-bit	Apple SOS	BASIC, Pascal
Dynalogic Info-Tech Corp.	Hyperion	\$3195	8088	16-bit	MS-DOS	BASIC, COBOL, FORTRAN, Pascal
Sony	SMC-70	\$3195	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Toshiba America	T300	\$3195	8088	16-bit	MS-DOS, CP/M-86	BASIC
Canon USA	AS100	\$3195	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
Radio Shack	TRS-80 Model 12	\$3199	Z80A	8-bit	TRSDOS	BASIC
Casio, Inc.	FX-9000P	\$3214	Z80A-compatible	8-bit	Not announced	BASIC
Athena Computer	Athena I	\$3250	NSC-800 (low-power Z80)	8-bit	CP/M	Pascal
Commodore Business Mach.	CBM 8032	\$3290	6502	8-bit	Proprietary	BASIC
Hewlett-Packard	HP86A	\$3290	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN
Computer Devices Inc.	DOT-3000X	\$3295	8088	16-bit	MS-DOS	BASIC, FORTRAN, COBOL, Pascal, assembler
Sanyo	MBC 4000	\$3295	8086	16-bit	CP/M-86	BASIC, assembler
Xerox Corp.	820-II	\$3295	Z80A	8-bit	CP/M	Not announced
NEC Home Electronics	PC-8800	\$3296	Z80A-compatible	8-bit	CP/M	BASIC
IMS International	5000SX	\$3300	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
Canon USA	AS100	\$3320	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
Hewlett-Packard	HP-85A	\$3340	Not announced		N/A	BASIC, assembler
NEC Information Syst.	APC	\$3346	8086	16-bit	CP/M-86, MS-DOS	BASIC, COBOL, FORTRAN, PASCAL, Assem.
Texas Instruments	Professional Computer	\$3370	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Columbia Data Products	1600-1	\$3395	8088	16-bit	MS-DOS	BASIC, assembler

Memory/Storage	Keyboard	I/O	Display	Comments
64K/2 340K DS/DD 5 1/4" floppy drives	63 keys, 21 special function, 18-key keypad	1 serial, 1 parallel	12-inch monochrome CRT/80 × 25 text mode/640 × 400 graphics res.	basic system
128K/1 3.5-inch 270K drive	59 keys, 20-key keypad, 14 special function	1 parallel	12" monochrome CRT/80 × 20 text	memory expands to 128K and microdrive added
128K/2 5 1/4-inch floppy drives	61 keys, 8 special function, 18-key keypad	1 serial, 1 parallel	80 × 25 text/640 × 400 graphics capability	IBM-workalike
128K/1 320K DS/DD 5 1/4" drive	77 keys, 18-key keypad, 13 special function	2 serial, 1 parallel	80 × 25 text/green monochrome CRT	green monochrome display added
96K/2 5 1/4" SS floppy disk drives	73 keys, 11-key keypad	1 parallel, 1 serial	480 × 192 color capability/62 × 16 text mode/monochrome CRT	2nd drive
64K/2 5 1/4" minifloppy disk-drives	63-key typewriter, 2 programmable	1 parallel, 1 serial, game controller	12-inch monochrome CRT/80-column card/80 × 24 text mode	2nd drive
128K/2 330K 5 1/4" DS/DD drives	59 keys, 20-key keypad, 9 special function	2 serial, 1 parallel	14-inch color CRT	color display
192K/2 640K DS/DD 5 1/4" drives	67 keys, 18 special funct., 10 edit, 18-key keypad	1 parallel, 1 serial	80 × 25 monochrome	2nd drive
128K/2 320K DS/DD 5 1/4" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch monochrome CRT/80 × 25 text	dual 320K DS/DD drives added
64K/2 280K 3.5" microfloppy drives	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch green CRT/80 × 25	2nd drive
64K/1 320K DS/DD 5 1/4" floppy drive	59 keys, 10 special function, 20-key keypad	1 parallel, 1 serial	12-inch high-res. color display/80 × 25 text	color, serial port added
256K/1 140K SS/DD 5 1/4" floppy drive	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller, 1 parallel	12-inch CRT/280 × 192/560 × 192 graphics cap./80 × 24 text	CRT added to 256K Apple III
256K/1 320K DS/DD 5 1/4" floppy drive	84 keys, 10 function keys, 10-key keypad	1 serial, 1 parallel	7-inch amber monochrome CRT/80 × 25 text mode/640 × 250 graphics	transportable IBM-compatible
64K/1 280K 3.5" microfloppy drive	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch RGB high-res. color CRT	color CRT substituted
192K/2 640K DS/DD 5 1/4" drive	67 keys, 18 special funct., 10 edit, 18-key keypad	1 parallel, 1 serial	640 × 200 color display, 80 × 25 in text mode	color display
Not announced/2 640K DS/DD 5 1/4" floppy drives	standard		640 × 400 color graphics capability	color version with high-res. graphics capability
80K/1 1.25MB 8" DS/DD floppy drive	82 keys, 8 programmable keys, 19-key keypad	2 serial, 1 parallel	12-inch monochrome/80 (40) × 24 text mode	basic system
32K/dual floppy disk drive	67 keys, 16-key keypad		5.5-inch monochrome CRT, 32 × 16, 256 × 128 graphics	28K RAM, plus disk storage added
68K/128K of RAM-disk storage/1 DD 5 1/4" floppy included	standard	2 serial, 1 parallel	80-character × 4-line liquid crystal display/external CRT connector	lap computer
32K/dual 5 1/4" floppy disk drivers	standard, numeric keypad	1 serial	integral display	dual drives added
64K/1 3.5-inch micro 270K drive	59 keys, 20-key keypad, 14 special function	1 parallel	9" monochrome CRT, 80 × 25 text	3 1/2-inch drive added
128K/1 3.5" 280K micro floppy drive	59 keys, 10 function keys, 18-key keypad		monochrome monitor (built-in)/80 × 24 text	64K RAM added
128K/1 640K slim line 5 1/4" DS/DD floppy drive	60 keys, 15 programmable, 18-key keypad	1 parallel, 1 serial	12-inch monochrome/80 × 25 text mode	basic system
64K/2 SS/DD 5 1/4" floppy drives	standard, 10-key keypad	2 serial, 2 parallel	monochrome CRT/80 × 24 text mode	business-oriented system
64K/2 320K DS/DD 5 1/4" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch color CRT/640 × 400 res./80 × 25 text	color display added
64K/2 409K DS/DD half-height 5 1/4" floppy drives	N/A	2 serial, 3 parallel	N/A	micromainframe system
Not announced/2 640K DS/DD 5 1/4" floppy drives	standard	1 serial	640 × 400 color graphics capability	serial port added
32K/built-in tape storage, 195K	58 keys, 20-key keypad, 8 special function	1 serial	built-in 5" CRT/256 × 192 graphics/32 × 16 text	serial port added
256K/1 1MB 8-inch half-height DS/DD drive	66 keys, 25-key keypad, 23 function	1 parallel, 1 serial	80 × 25 monochrome	128K memory added
64K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	12-inch monochrome CRT, 720 × 300 res., 80 × 25 text	
128K/2 320K 5 1/4" floppy disk drives	83 keys, 10 special function, keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 × 25 text	basic system

TABLE 1—\$3000-\$3500 (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
North Star Computers	Advantage 8/16	\$3399	Z80A/8088	8/16-bit	MS-DOS, GDOS	BASIC, FORTRAN, COBOL, Pascal
Apple Computer	Apple III	\$3404	6502B	8-bit	Apple SOS	BASIC, Pascal
IBM	IBM-PC	\$3433	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, MACRO assembler, Pascal
Canon USA	AS100	\$3445	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
NEC Home Electronics	PC-8800	\$3447	Z80A-compatible	8-bit	CP/M	BASIC
NEC Information Syst.	APC	\$3448	8086	16-bit	CP/M-86, MS-DOS	BASIC, COBOL, FORTRAN, PASCAL, Assem.
TeleVideo Systems Inc.	TS 802	\$3495	Z80A	8-bit	CP/M	COBOL
Alspa Computer	BC-800	\$3495	Z80A	8-bit	CP/M	
Sumicom Inc.	System 330E	\$3495	8088	16-bit	MS-DOS/CP/M-86	FORTTRAN, COBOL, Pascal, BASIC
Computer Devices Inc.	DOT-3000Y	\$3495	8088	16-bit	MS-DOS	BASIC, FORTRAN, COBOL, Pascal, Assembler
Eagle Computer Inc.	Eagle PC-2	\$3495	8088	16-bit	CP/M-86, MS-DOS	
Digital Equipment Corp.	Rainbow 100	\$3495	Z80/8088	8/16-bit	proprietary	Not announced
Intertec Data Systems	Superbrain II - SD	\$3495	Z80A	8-bit	CP/M	BASIC, FORTRAN
NEC Information Syst.	APC	\$3498	8086	16-bit	CP/M-86, MS-DOS	BASIC, COBOL, FORTRAN, PASCAL, Assem.
Zenith Data Systems	ZF-110	\$3499	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN

the user gains access to such high-level languages as BASIC, Fortran, COBOL, Pascal, and assembler.

The graphics resolution of this computer is 640- by 400-dots and the text display is 80-characters by 25-lines. Input/output is provided by standard parallel and serial ports to which a user can add a variety of peripherals including printers and modems.

The *MBE 16000* is fully configured right out of the carton.

Hyperion

One of the remarkable events of the last year has been the appearance of a number of IBM-workalike transportable computers and the *Hyperion* is one of them.

Driven by a 16-bit 8088 CPU, this micro system comes with 256K of user memory as standard.

Capable of running under the near-standard MS-DOS, the *Hyperion* comes equipped with one double-sided, double-density 320K minifloppy-disk drive.

Programmable in BASIC, COBOL, Fortran and Pascal, this and other data are entered via an IBM-like 84-key low-profile keyboard. It features 10 special-function keys and a 10-key numeric keypad. Input/output is aided by standard parallel and serial ports (extra-cost options on the IBM PC).

Since it is a transportable, it has a built-in display. This video display is a 7-inch 80-character by 25-line amber unit. It is also capable of 640- by 250-dot graphics.

Radio Shack

The *Model 12* debuts in this price category. A business-oriented system, the *Model 12* is driven by an 8-bit Z80A microprocessor and is equipped with 80K of user memory. There is a powerful base of proprietary and second-source software available for it which gives the user access to many applications.

This system uses the proprietary TRSDOS system and because it does, one can easily assume that it comes with a standard disk drive, which it does. The standard drive is a double-sided, double-density 8-inch slim-line floppy capable of 1.25MB of mass storage. This amount of storage is enough to satisfy anyone's needs at first.

Programmable in BASIC, this and other data are entered through a keyboard with 82 typewriter-style keys. This unit also features eight programmable keys and 14 special-function keys.

An all-in-one unit, the 12-inch green monochrome monitor, keyboard and system box are housed in the same cabinet. The display is 80 characters by 24-lines in the text mode. Input/output is aided with two standard serial ports and one standard parallel port.

Athena

This is one of the more unusual transportables on the market because it relies on using user memory configured as a disk for high-speed storage and data access. Using memory configured as a pseudo-disk or virtual memory disk isn't a new idea in the microcomputer market, but it is usually an add-on feature, rather than a standard one. The key advantage to a *memory disk* is a manifold increase in program execution speed. Further, the *Athena I* relies on low-power CPU's and circuitry to have effective battery operation.

The *Athena I* is driven by dual NSC-800's, low-power versions of the popular Z80 8-bit microprocessor. It comes equipped with 68K of RAM and 128K of memory dedicated to the virtual memory disk.

The user doesn't have to keep this machine powered up indefinitely to retain this storage because *Athena* makes a double-density 5¼-inch floppy disk available for permanent backup. The system runs under the CP/M operating system and so the user has a wide range of already-produced programs available.

Memory/Storage	Keyboard	I/O	Display	Comments
128K/2 360K DS/DD 5 1/4" floppy drives	49 keys, 14-key keypad, 15 function keys	1 parallel, 1 serial	12-inch monochrome CRT/640 × 240 graphics res./80 × 24 text mode	basic system
128K/2 140K SS/DD 5 1/4" floppy drives	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller, 1 parallel	12-inch CRT/280 × 192/560 × 192 graphics cap./80 × 24 text	2nd drive added to 128K Apple III
64K/2 320K DS/DD 5 1/4" drives	59 keys, 10 special function, 20-key keypad	1 parallel, 1 serial	12-inch monochrome/80 × 25 text	2nd drive
Not announced/2 640K DS/DD 5 1/4" floppy drives	standard	1 serial, 1 parallel	640 × 400 color graphics capability	parallel port
64K/2 1 MB DS/DD 8" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch monochrome CRT/80 × 25 text	dual 8" DS/DD drives added
128K/2 1MB 8-inch half-height DS/DD drives	66 keys, 25-key keypad, 23 function	1 parallel, 1 serial	80 × 25 monochrome	1 disk drive added
64K/2 368K DS/DD 5 1/4" drives	72 keys, 16 programmable, 17-key keypad	2 serial, 1 serial RS-422 port	14-inch monochrome/80 × 25 text	third serial port
64K/2 1.2MB floppy drives	95 keys	2 serial, 2 parallel, 1 RS-422 network port	12-inch monochrome/80 × 25 text	basic system
128K/2 720K 5 1/4" floppy drives	95 keys, 8 special function, 10-key keypad	1 serial, 1 parallel	monochrome CRT	2 720K 5 1/4" drives
128K/1 3 1/8" 280K micro floppy drive	59 keys, 10 function keys, 18-key keypad		monochrome (built-in)/80 × 24 text	64K RAM added
128K/2 320K DS/DD 5 1/4" floppy drives	105 keys	2 serial, 1 parallel	12-inch high-res. monochrome/720 × 352 capability/80 × 25 text mode	2nd drive added
64K/2 400K 5 1/4" floppy drives	58 keys, special function, 14-key keypad	1 serial, 1 RS-423 synchronous	monochrome CRT/80 × 25 text	basic system
64K/2 1.5MB 5 1/4" floppy drives	62 keys, 18-key keypad	2 serial	12-inch monochrome/80 × 24 text mode	disk capacity increases by 750K
128K/1MB 8-inch half-height DS/DD drive	66 keys, 25-key keypad, 23 function	1 parallel, 1 serial	80 × 24 color, 640 × 200 mono res., 160 × 100 16-color, 320 × 200 4-color user option	color CRT added to 1 drive model
128K/2 320K DS/DD 5 1/4" drives	77 keys, 18-key keypad, 13 special function	2 serial, 1 parallel		basic system

Programmable in high-level Pascal, this and other data are input via a standard typewriter-style keyboard. Input/output is provided by two standard serial ports and one parallel port. These can be used to interface with a wide variety of peripherals.

The *Athena I* makes one other departure from standard transportable configuration with its display. Unlike other transportables that use power-hungry CRT's, this small system uses a four-line, 80-character liquid crystal display. It seems this unit is a cross between the lap and the transportable computer. An external video output is available for a standard video display.

Computer Devices

The *DOT-3000X* is another of the many IBM-workalike transportables on the market.

Driven by a 16-bit 8088 microprocessor, the *DOT-3000X* comes with 128K of RAM. This amount of memory should enable the user to take advantage of the new generation of powerful 16-bit software coming to the market.

Capable of operating under MS-DOS (Microsoft Disk Operating System), the *DOT-3000X* comes with a 3.5-inch 280K microfloppy disk drive. It is programmable in BASIC, Fortran, COBOL, Pascal, and assembler.

User input is via a typewriter-style keyboard with 59 keys. There are also 10 special-function keys and an 18-key numeric keypad. Output is via a built-in 5 1/2 by 9-inch display that is capable of an 80-character by 24-line text mode.

Sanyo

Another of the many 16-bit machines on the market is another offering from Sanyo, the *MBC 4000*. Driven by a 16-bit 8086 CPU, the *MBC 4000* comes equipped with 128K of RAM.

Departing from what seems like the norm today, this system runs under the 16-bit version of CP/M, CP/M-86, which, at the moment, limits the user in the amount of software that has been

written for this system. However, Digital Research, the producers of CP/M-86, indicates that this will soon change and more companies will write software for this operating system.

Since it has an operating system, one can assume it also has a disk and it does. It comes equipped with a 640K slim-line double-sided, double-density minifloppy disk drive that saves a great deal of space.

Programmable in BASIC and assembler, this and other data are input via a keyboard containing 60 keys, 15 programmable keys and an 18-key numeric keypad. Input/output is provided by standard serial and parallel ports.

The standard display device for the 80-character by 25-line text display of the *MBC 4000* is a 12-inch monochrome unit.

An upgraded system, the *3000Y*, is also included in this price category. In this higher-cost version, the amount of user memory doubles.

Xerox

Long active in the office-product market, Xerox has an entry in the small-computer sphere, the *820-II*. First released as the *820*, this system was upgraded last year.

Driven by an 8-bit Z80A CPU, the *820-II* comes equipped with 64K of RAM. It features two standard single-sided, double-density minifloppy-disk drives for storage. It operates under CP/M and gives the user access to the wide variety of programs available under that operating system.

Input/output is handled by a standard serial port to which a variety of peripheral equipment can be interfaced, while video output (80 characters by 24 lines of text) is handled by a standard monochrome display.

IMS International

An S-100 micromainframe system is available from IMS International, the *5000SX*.



THE *HYPERION* is a transportable IBM workalike.

The *5000SX* is a Z80-based, 8-bit system that includes two 409K double-sided, double-density minifloppy-disk drives for mass storage. It is capable of operating under CP/M and this gives the user a wide choice of application programs.

When this disk storage is combined with the 64K of RAM, the system's power is quite evident. It will easily handle many routines a user may choose to run.

With two standard serial ports and three standard parallel ports, one can see the *5000SX* is the basis of a multiuser system. With this number of input/output ports, a user can interface two terminals and three printers or a terminal, modem, and several other peripherals. Thus, more than one person can use this system, if it has more than one terminal installed. With the number of parallel ports, it can act as the mainframe driving several peripherals in an office or manufacturing setting.

Columbia Data Products

Every day it seems that one manufacturer or another is introducing an IBM-workalike small-computer system and Columbia is no exception. Its *1600-1* is driven by the same 16-bit CPU, an 8088, used by IBM and it runs under the same operating systems, MS-DOS, CP/M-86 (available for the IBM PC) and UCSD p-System (also available for the PC).

With 128K of RAM, the basic version of the *1600-1* has twice the memory of the basic PC. It also includes two 320K double-sided, double-density 5¼-inch minifloppy disks as standard for mass storage. This system is programmable in BASIC and assembler.

Equipped with an 83-key typewriter-style keyboard, this unit includes 10 special-function keys—as does the IBM—and a numeric keypad. (The importance of a numeric keypad can't be underestimated. It speeds numeric data entry and makes the system far more flexible to use.)

With two standard serial ports and one standard parallel port, the user has a number of interfacing options. He can use the serial ports to support printers, plotters, or modems and he can use the parallel port to support a printer. IBM makes these user options.

An 80-character by 25-line text display is read on a standard 12-inch monochrome video display.

North Star

North Star's all-in-one *Advantage 8/16* combines all the features of an 8-bit small computer with those of a 16-bit machine by using dual Z80A and 8088 CPU's. This gives the user access to the wide variety of programs available for each type of system.

With 128K of RAM, the *Advantage 8/16* is a versatile machine that is programmable in BASIC, Fortran, COBOL, and Pascal. It provides two standard 360K double-sided, double-density minifloppy disk drives for storage.

Equipped with a typewriter-style keyboard, having 49 keys, it also includes a 14-key numeric keypad and 15 special-function keys. User input is handled by this device. However, input can also come via the standard serial port.

Output, on the other hand, is displayed on a standard 12-inch monochrome video screen, either as 640-by 240-dot graphics or 80-character by 25-line text. Output can also be routed through the standard parallel port to a printer.

TeleVideo

The TeleVideo *TS 802* is another of this computer manufacturer's Z80A-based, single-user systems. Fully configured right from the box, it includes two standard 368K double-sided, double-density minifloppy-disk drives.

With 64K of RAM, the *TS 802* is easily able to handle many tasks. When this amount of user memory is combined with the standard disk drives, one can easily see it is a powerful system, capable of running under the industry-standard CP/M operating system.

Programmable in COBOL, this and other data are entered via a typewriter-style keyboard with 72 keys. The keyboard also features 16 programmable keys and a 17-key numeric keypad. Input/output is provided by two standard serial ports and an RS-422 serial port.

Since this is a fully configured system, the video-display device is standard. It uses a 14-inch monochrome screen to display 80 characters by 24 lines of text.

Alspa

A newcomer to the small-computer arena, the Alspa *BC-800* includes a great deal of bundled (included) software. Relying on proven 8-bit Z80A technology, this system comes with 64K of RAM.

A fully configured system, it comes with two 1.2MB floppy-disk drives for storage—a valuable asset. It operates under CP/M, which provides the user with access to a wide variety of proven application programs.

Data is input via a 95-key keyboard and it is output to a standard 12-inch monochrome display. Input/output is provided by two standard serial, two standard parallel and one serial RS-422 port.

Sumicom

Sumicom's *System 330E* is another of the IBM workalikes on the market and it uses the same CPU, the 16-bit 8088, that IBM chose for its *Personal Computer*.

Equipped with 128K of user memory—enough to handle the biggest of spreadsheet programs—the *System 330E* comes with two 720K 5¼-inch minifloppy disks for mass storage. This feature makes this system far more flexible than relying on one disk. Adding to its capabilities are the operating systems available, MS-DOS and CP/M-86.

This typewriter-style keyboard with 95 keys also includes eight special-function keys and a 14-key numeric keypad.



ZENITH'S LOW PROFILE *ZF-100* is a powerful machine.

Actually a system upgrade over lower-priced versions, the *System 330E* is capable of input and output through standard serial and parallel ports. Video output via a monochrome video display device.

Eagle

The Eagle *PC-2* is another of the IBM-workalikes on the market and uses the same CPU that is used in the IBM *PC*, a 16-bit 8088.

The computer comes with 128K of RAM, or twice that of the IBM. This is enough to handle any of the 16-bit applications programs on the market.

That it can run programs written under either MS-DOS or CP/M-86 indicates it has standard disk drives, and it does. The Eagle *PC-2* comes equipped with dual 320K 5¼-inch minifloppy disk drives. This feature makes it a highly versatile system.

User input is via a 105-key keyboard and input/output is handled via two standard serial ports and one standard parallel port.

A fully configured system, video output is to a standard 12-inch high-resolution monochrome display that's capable of an 80-character by 25-line text display.

DEC

Long the leader of the minicomputer world, Digital Equipment Corp. joined the microcomputer world a year and a half ago with its release of several small-computer systems. These systems included the *Rainbow 100*.

Equipped with Z80 and 8088 CPU's, this system uses a proprietary operating system that allows the user access to the world of CP/M and MS-DOS.

The computer comes with 64K of RAM, or enough to handle fairly complex tasks. The dual-standard minifloppy-disk drives are capable of 400K of storage apiece and add to the versatility of this system.

The main slim-line, typewriter-like keyboard has 58 keys including special-function keys and a 14-key numeric keypad. Output to the user is handled via a high-resolution monochrome video display.

Fully configured, this system includes one standard serial port and one serial RS-423 synchronous port.

Intertec

The Intertec *Superbrain II—SD* is the third upgrade of this manufacturer's all-in-one series of microcomputers. Using dual Z80A 8-bit CPU's, this system has 64K of RAM, and uses the CP/M operating system.

It upgrades in its disk storage capability. This system now has two 1.5MB super-density 5¼-inch minifloppy-disk drives. An all-in-one unit, it includes a 12-inch monochrome display in the same cabinet with the system box and the keyboard that contains 62 typewriter-like keys, a 25-key numeric keypad and 23



COMPUTER DEVICES' *DOT-3000X* is another transportable IBM work-alike.



special-function keys. This box also houses the two standard serial ports.

Zenith

The second member of the Zenith *Z-100* family appears in this price category, the all-in-one version, called the *Z-120*. This unit combines the keyboard, system box, and video-display tube into one cabinet, much like the computer workstations with which many people are familiar. Unlike those terminals, which are usually linked to a mainframe and lack any real power of their own, the *Z-100* is a full-blown small-computer system.

Driven by an 8-bit 8085 and a 16-bit 8088, this 8/16-bit system comes with 128K of RAM. An IBM-workalike, it has twice the memory of the IBM *PC*.

Because it uses the proprietary Zenith Disk Operating System (ZDOS) and CP/M, one can assume it has a disk drive included as standard for storage, and it does. The disk drive is a 5¼-inch minifloppy 320K double-sided, double-density unit. This combination is powerful enough to give a user a good start in microcomputing.

Programmable in BASIC, COBOL, and Fortran, this and other data are entered via a typewriter-style keyboard with 77 keys. This keyboard includes an 18-key numeric keypad and nine special-function keys. Input/output is provided by two standard serial ports and a parallel port.

Since it's an all-in-one unit, the video-display tube is included in its basic configuration. It's a 12-inch monochrome display, capable of displaying 80-characters by 24-lines.

The low-profile system, the *ZF-100*, upgrades in this price category to become a full-featured system, with the exception of a standard display. This upgrade adds a second disk drive to the low-profile *ZF-100* system. The video display is still a user option.

Hewlett-Packard

The *HP86B* system upgrades with the addition of more user memory—128K now—and a 3.5-inch 270K microfloppy drive. More and more manufacturers are turning to this type of drive because of the space savings. Like a minifloppy, it makes a system more versatile.

At the same time, the *HP86A* is also upgraded with the addition of the same type of 3.5-inch drive, while the *HP85A* upgrades with the addition of a serial port. This gives the *HP85A* telecommunications capability if you add a modem or the capability to interface with a serial printer, rather than relying on the built-in thermal printer.

IBM

The IBM *Personal Computer* becomes more powerful and capable of high-resolution color output with the addition of a color video-display tube to the double-sided, double-density drive model. In this configuration, a serial port is also added for

communications capability, if you choose, or to interface with a serial printer.

The second upgrade—a second disk drive for storage—brings the IBM *Personal Computer* to its full configuration. Now it has two disk drives for added flexibility in mass storage and data access.

Apple

The *Apple IIe* is just about fully configured in this price category. In the latest upgrade, a second minifloppy-disk drive is added for greater mass storage.

At the same time, the *Apple III* upgrades twice. In the first upgrade, a standard high-resolution video display device is added to the 256K version of this small-computer system.

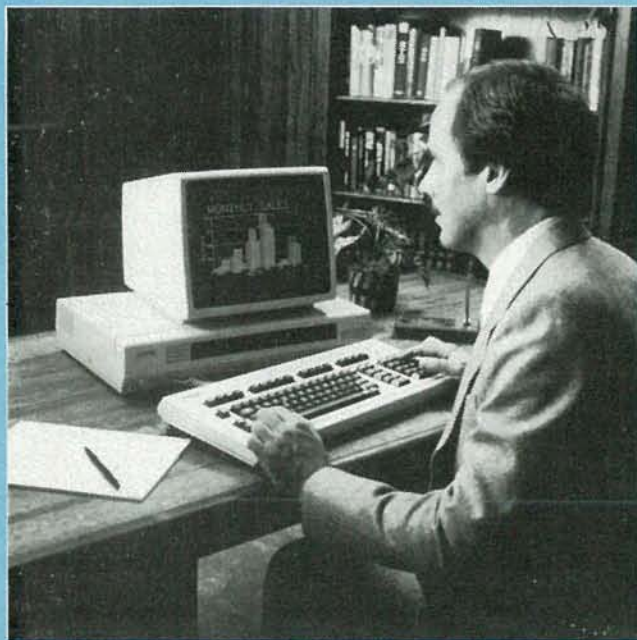
The 128K version of the same system becomes fully configured with the addition of a second minifloppy disk drive for mass storage.

NEC

The NEC *APC* becomes a far more powerful system with its three upgrades. The first adds 128K to the amount of RAM, while the second adds a disk drive. At once, this upgrade makes



THE ALL-IN-ONE version of Zenith's 8/16-bit computer system, the Z-100 has a non-glare green CRT and two 320K 5¼-inch drives.



EPSON's QX-10 desktop computer features two double-sided, double-density disk drives and runs the CP/M operating system.

the system far more flexible. The third upgrade adds a color video-display device to the one-drive needed and gives you color-graphics capability.

The *PC-8800*, now an 8/16-bit system with access to both CP/M and MS-DOS, the leading operating systems of the 8-bit and 16-bit worlds, now becomes fully configured as dual 320K double-sided, double-density disk drives are added. It gains even more capability as the disk-drive capacity is increased even further with dual eight-inch floppy-disk drives.

Toshiba

With the two upgrades to the *T300* small-computer system, it makes the transition from a monochrome microcomputer with two drives to a color computer with two drives.

The first upgrade brings the monochrome system to full configuration with the addition of a second disk drive. This increases the flexibility of this system.

Under the second upgrade, the monochrome display is changed to a high-resolution color display and this system gains color-graphics capability, if the user chooses to use it.

Sony

The *SMC-70* system becomes quite full-featured here. With its first upgrade, a second disk drive increases this system's storage flexibility and capability. This system was the first to make use of 3.5-inch microfloppy-disk drives, which a number of other microcomputer companies are also making use of. However, this isn't yet the standard size because there are also varieties available in the 3 to 3.25-inch range.

The second upgrade substitutes a high resolution RGB color video-display device for the monochrome display and gives this system its full configuration.

Canon

In this price category, the Canon *AS100* system upgrades three times. The first upgrade gives this system color-graphics capability with a color video-display tube capable of a 640- by 400-dot resolution.

In the second upgrade, a serial port is added to the *AS100*'s configuration. The third upgrade, adding a parallel interface, frees the serial port for communications use solely. (The parallel port can be dedicated to a printer.)

Texas Instruments

The *Professional Computer* becomes nearly fully configured in this price category with the addition of a second double-sided, double-density 320K minifloppy-disk drive. This addition gives the user access to a second disk which speeds system operation.

Casio

The Casio *FX-9000P* has its memory increased to 32K with the addition of 28K of memory. Further, the versatility of this small system is increased with the addition of a minifloppy-disk drive.

LNW Research

The *LNW80 Model II* becomes a fully configured system with the addition of a second minifloppy-disk drive.

Sord

Although the name *M23 Mark III C* looks as if it might be a new system, it is, in reality, an upgraded Sord *M23* system. In this configuration, the system upgrades and gains color capability with, as you might expect, the addition of a color video-display device.

Commodore

The *8032* system, which was introduced several price categories ago, makes its appearance again, now in its fully configured state. This system, which includes a standard CRT, now also has dual 5¼-inch minifloppy-disk drives included for storage.

R-E



An innovative lap computer is among the new machines we see here.

\$3500 to \$4000 MARC STERN

AS WE MOVE INTO THE HIGHER PRICE CATEGORIES, PERHAPS you've noticed how more and more central processing units have become 16-bit devices. This contrasts quite markedly with the situation a year ago, when the majority of higher-priced, small-computer systems on the market were still 8-bit machines.

Why has this happened? The key reason is IBM's move into the microcomputer market. It has legitimized the microcomputer in the eyes of many and it has created a vast market of new users. Seeing this, the rest of the microcomputer industry has jumped aboard the bandwagon with new IBM-workalike or compatible systems. A second reason, that is just as important, is that the microcomputer industry has seen the power available in the 16-bit CPU and it wants to make use of that power.

In this price category, 11 new systems make their debuts. Most are from manufacturers that have already been introduced in other price categories. However, there are four new companies that make their appearances here. Let's begin our look at this market with those four new companies. Then we will explore the rest of the category and see how various systems upgrade.

Gavilan

The *Gavilan* is one of the most innovative of the new generation of lap computers, now making their debuts. It is very frankly aimed at the business market and makes no bones about saying so. Because it is, this system includes a variety of bundled (included) software for word-processing, appointments and other business-oriented tasks. They are contained in plug-in capsules, as the company terms them.

Perhaps the most innovative fact about the *Gavilan* is its size. Even though it includes a microdisk drive for storage as part of its basic configuration, it easily folds up and fits into the average briefcase. If you've looked closely at the chart you've probably noticed that it only comes with 32K of RAM. Other ROM-based functions reside in another 32K of built-in memory and this

leaves a full 32K available for the user. This ROM handles much of the work that RAM is required to do in other systems. This system is driven by a 16-bit 8088 microprocessor, that makes it another of the many IBM-workalikes that are now on the market.

Because it does have a standard disk drive it needs an operating system and the one *Gavilan* has chosen is the near-standard 16-bit operating system, MS-DOS. Due to the extensive package of software included with this system, a user really won't have need of much more software than that included.

The *Gavilan's* other unique feature is its "mouse." A relatively new feature in the small-computer world, a mouse is a small device that rolls around a desk top. It interfaces with the system's memory and lets the user move the cursor all over the screen. This eliminates the need for keyboard use and lets the user pick a function from several on the screen, provided a program has this type of feature, by just moving the mouse around. But rather than relying on a true "mouse," *Gavilan* uses a touch-sensitive plate under the 8 line by 66-character liquid-crystal display so a user can access a particular function.

Fujitsu

A leading Japanese computer manufacturer, Fujitsu has an entry in the microcomputer field, the *Micro 16*, a unit with 8- and 16-bit co-processors.

Driven by either a proven 8-bit Z80A CPU or a reliable 16-bit 8086—the bigger brother of the 8088—the *Micro 16* has access to the world of CP/M and its many programs, Concurrent CP/M and its multitasking capabilities, or optional MS-DOS. This gives the user access to a versatile software base.

Equipped with 128K of user memory, this system will easily handle any of the many sophisticated programs available on the market today. Its mass-storage capabilities—two standard 320K double-sided, double-density minifloppy-disk drives—is also easily up to any task given the system.

The keyboard has a total of 98 keys and a separate numeric

TABLE 1—\$3500-\$4000

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Athena Computer	Athena I	\$3500	NSC-800 (low-power Z80)	8-bit	CP/M	Pascal
Texas Instruments	Professional Computer	\$3515	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Basis Inc.	Basis 108	\$3590	Z80A/6502	8-bit	CP/M, Apple	BASIC, Pascal, LOGO
TeleVideo Systems Inc.	TS 1603	\$3590	8088	16-bit	CP/M-86, MS-DOS	COBOL
Compaq Computer Corp.	Compaq	\$3590	8088	16-bit	Compaq DOS (Similar to IBM PC-DOS)	BASIC
Zenith Data Systems	ZF-100	\$3598	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN
IBM	IBM-PC	\$3598	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, Macro Assembler, Pascal
Zenith Data Systems	Z-120	\$3599	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN
Sage Computer Tech.	Sage II	\$3600	MC68000	16/32-bit	UCSD p-System, CP/M-86K, Modula 2, Hyper-FORTH	BASIC, FORTRAN, Pascal, Assembler
Apple Computer	Apple III	\$3604	6502B	8-bit	Apple SOS	BASIC, Pascal
Zenith Data Systems	ZF-100	\$3638	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN
Sony	SMC-70	\$3645	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Texas Instruments	Professional Computer	\$3670	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
IBM	IBM-PC	\$3677	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, Macro Assembler, Pascal
Dynalogic Info-Tech Corp.	Hyperion	\$3690	8088	16-bit	MS-DOS	BASIC, COBOL, FORTRAN, Pascal
Basis Inc.	Basis 108	\$3690	Z80A/6502	8-bit	CP/M, Apple	BASIC, Pascal, LOGO
IMS International	5000IS	\$3700	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
Sony	SMC-70	\$3700	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Compaq Computer Corp.	Compaq	\$3705	8088	16-bit	Compaq DOS (Similar to IBM PC-DOS)	BASIC
Hewlett-Packard	HP-85A	\$3735	Not announced		Proprietary	BASIC, Assembler
Sord Computer	M23 Mark V G	\$3785	Z80A	8-bit	Proprietary, CP/M-compatible	BASIC, Pascal, FORTRAN
Wang Laboratories	Professional Computer	\$3790	8086	16-bit	MS-DOS, CP/M emulation	BASIC, COBOL, FORTRAN, Pascal
Hewlett-Packard	H85B	\$3790	Not announced		Proprietary	BASIC, Assembler
Commodore Business Mach.	SuperPET	\$3790	6502/6809	8-bit	Proprietary	BASIC, APL, COBOL, FORTRAN, Pascal
Toshiba America	T300	\$3795	8088	16-bit	MS-DOS, CP/M-86	BASIC
Columbia Data Products	1600-1	\$3840	8088	16-bit	MS-DOS	BASIC, Assembler
IBM	IBM-PC	\$3842	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, Macro Assembler, Pascal
NEC Home Electronics	PC-8800	\$3846	Z80A-compatible/8086	8/16-bit	CP/M, CP/M-86, MS-DOS	BASIC
Hewlett-Packard	HP86A	\$3865	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN

Memory/Storage	Keyboard	I/O	Display	Comments
68K/256K of RAM-disk storage/1 DD 5 1/4" floppy included	standard	2 serial, 1 parallel	80-character x 4-line liquid crystal display/external CRT connector	256K RAM-disk
64K/1 320K DS/DD 5 1/4" floppy drive	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	13-inch color CRT, 720 x 300 res., 80 x 25 text	color CRT added to 1-disk version
128K/2 5 1/4" floppy drives/256K memory (RAM) disk added	58 keys, 15 programmable, number keypad	1 parallel, 1 serial	RGB and composite/280 x 192 res./80 x 25 text	256K memory RAM-disk
256K/2 half-height 368K DS/DD floppy drives	72 keys, 16 programmable, 16-key keypad	2 serial, 1 serial RS-422 port	14-inch monochrome/80 x 25 text	memory expanded to 256K
128K/2 5 1/4" DS/DD drives, 640K	83 keys, 10-key keypad, 10 special funct.	1 parallel, opt. serial	9-inch monochrome (built-in)/80 x 25 text	second drive added
128K/1 320K DS/DD 5 1/4" drive	77 keys, 18-key keypad, 13 special funct.	2 serial, 1 parallel	color CRT/640 x 225 high-res., 80 x 25 lines	high-res. color CRT added
128K/2 320K DS/DD 5 1/4" drives	59 keys, 10 special function, 20-key keypad	1 parallel, 1 serial	12-inch monochrome/80 x 25 text	memory expanded to 128K
128K/2 320K DS/DD 5 1/4" drives	77 keys, 18-key keypad, 13 special funct.	2 serial, 1 parallel	built-in 80 x 25 monochrome CRT	2nd drive added
128K/1 640K 5 1/4" floppy drive	N/A	2 serial, 1 RS-488, 1 parallel	N/A	powerful MC68000-based micromainframe
256K/2 140K SS/DD 5 1/4" floppy drives	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller, 1 parallel	12-inch CRT/280 x 192/560 x 192 graphics cap./80 x 24 text	2nd drive added to 256K Apple III
128K/2 320K DS/DD 5 1/4" drives	77 keys, 18-key keypad, 13 special funct.	2 serial, 1 parallel	green monochrome CRT/80 x 25 text	green monochrome display added
64K/2 280K 3.5" microfloppy drives	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch RGB high-res. color CRT	color CRT substituted for display
128K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	12-inch monochrome CRT, 720 x 300 res., 80 x 25 display	64K memory added to 2-drive monochrome unit
64K/2 320K DS/DD 5 1/4" drives	59 keys, 10 special function, 20-key keypad	1 parallel, 1 serial	12-inch high-res. color display/80 x 25 text	color display added to 2-drive DS/DD system
256K/2 320K DS/DD 5 1/4" floppy drives	84 keys, 10 function keys, 10-key keypad	1 serial, 1 parallel	7-inch amber monochrome CRT/80 x 25 text mode/640 x 250 graphics	second drive added
128K/2 5 1/4" floppy drives/256K memory (RAM) disk	58 keys, 15 programmable, keypad	1 parallel, 1 serial	RGB and composite/280 x 192 res./80 x 25 text	256K memory RAM disk for greater speed added
64K/2 409K DS/DD half-height 5 1/4" floppy drives	64 keys, 14 special function, 19-key keypad	1 serial	monochrome CRT/80 x 24 text mode	basic system
64K/2 280K 3.5" microfloppy drives	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch green CRT/80 x 25 text	expansion unit
128K/2 5 1/4" DS/DD drives, 640K	83 keys, 10-key keypad, 10 special funct.	1 parallel, 1 serial	9-inch monochrome (built-in)/80 x 25 text	serial port
32K/built-in tape storage, 195K	58 keys, 20-key keypad, 8 special function	1 serial, 1 general purpose interface	built-in 5" CRT/256 x 192 graphics, 32 x 16 text	2nd port serial added
128K/2 1MB 8" drives	59 keys, 20-key keypad, 9 special function	2 serial, 1 parallel	12-inch green CRT	system upgraded to 8-inch drives with 1MB storage
128K/2 360K DS/DD 5 1/4" floppy drives	101 keys, 16 programmable, 18-key keypad	1 parallel, 1 serial	monochrome CRT 800 x 300	second drive, display, and adapter added to Wang PC
160K/tape drive/RAM disk	58 keys, 20-key keypad, 8 special function		built-in 5" CRT/256 x 192 graphics, 32 x 16 text	RAM expanded to 160K
96K/dual 5 1/4" floppy disk drives	standard, numeric keypad	1 serial	12-inch monochrome CRT/80 x 25 text mode	dual floppy disk drives added
192K/2 640K 5 1/4" drives	67 keys, 18 special funct., 10 edit, 18-key keypad	1 parallel, 1 serial	640 x 200, 80 x 25 in text mode	2nd drive added to color model
256K/2 320K 5 1/4" floppy disk drives	83 keys, 10 special function, keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 x 25 text	user memory increased to 256K
128K/2 320K DS/DD 5 1/4" drives	59 keys, 10 special function, 20-key keypad	1 parallel, 1 serial	12-inch high-res. color display/80 x 25 text	memory expanded to 128K in color IBM-PC
128K/2 320K DS/DD 5 1/4" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch color CRT/640 x 400 res./80 x 25 text	color display added to 5 1/4-inch system
64K/2 270K 3.5-inch microdrives for storage	59 keys, 20-key keypad, 14 special function	1 parallel	9" monochrome CRT/80 x 25 text	2nd drive added

TABLE 1—\$3500-\$4000 (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Texas Instruments	Professional Computer	\$3870	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Vector Graphic Inc.	Vector 4/10	\$3895	Z80B, 8088	8/16-bit	CP/M-86, MS-DOS (optional), CP/M	Not announced
Micro Source	M6000P	\$3900	Z80A	8-bit	CP/M	Not announced
Compaq Computer Corp.	Compaq	\$3910	8088	16-bit	Compaq DOS (Similar to IBM PC-DOS)	BASIC
IBM	IBM-PC	\$3928	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, MACRO Assembler, Pascal
Digital Equipment Corp.	Professional 325	\$3945	PDP-11/238	16-bit	Proprietary, CP/M optional	Not announced
Athena Computer	Athena I	\$3950	NSC-800 (low-power Z80)	8-bit	CP/M	Pascal
Hewlett-Packard	HP120/125	\$3975	Z80A	8-bit	CP/M	BASIC, Assembler
Hewlett-Packard	HP200	\$3985	MC68000	16/32-bit	N/A	BASIC, Pascal, HPL
Computer Devices Inc.	DOT-3000Z	\$3995	8088	16-bit	MS-DOS	BASIC, FORTRAN, COBOL, Pascal, Assembler
Gavilan Computer Corp.	Gavilan	\$3995	8088	16-bit	MS-DOS	BASIC, Pascal
Sanyo	MBC 4050	\$3995	8086	16-bit	CP/M-86	BASIC, Assembler
Toshiba America	T250-4	\$3995	Z80	8-bit	CP/M	BASIC
Eagle Computer Inc.	Eagle IIE-4	\$3995	Z80A	8-bit	CP/M	BASIC
Fujitsu Microelectronics	Micro 16	\$3995	Z80A, 8086	8/16-bit	CP/M-86, Concurrent CP/M/MS-DOS optional	Not announced
NEC Home Electronics	PC-8800	\$3997	Z80A-compatible/8086	8/16-bit	CP/M, CP/M-86, MS-DOS	BASIC
Radio Shack	TRS-80 Model 12	\$3999	Z80A	8-bit	TRSDOS	BASIC

keypad, plus 10 programmable keys. This device handles user input, while input/output is handled by standard serial and parallel ports. The video display delivers 640 by 200-line high-resolution graphics or an 80-character by 25-line text mode.

Micro Source

The Micro Source *M6000P* is an industry-oriented S-100 compatible transportable microcomputer system. (The industry-standard S-100 bus features a 100-line bus that accessory cards are plugged into. The microprocessor's motherboard is also tied into this bus.) The *M6000P* has 64K of RAM and operates under CP/M. Because it operates under CP/M, the operator has many programs to use with the standard 376K double-sided, double-density 5¼-inch minifloppy disk drives.

User input is via the keyboard that has a total of 83 keys, including four function keys and a separate 14-key numeric pad. Standard serial and parallel ports handle input/output. The built-in monochrome display is a 9-inch screen that displays 80 characters by 24 lines. RGB outputs are also available for color graphics.

Sage

The Sage *II* is a powerful, multiuser MC68000-based small-computer system. Its 16-, 32-bit MC68000 CPU makes it special, because few other systems use this powerful microprocessor chip (a situation that's likely to change in the relatively

near future). Actually a micromainframe, the Sage *II* has 128K of standard user memory available, enough for a single-user system, but really not enough for an extended multiuser system.

The single 640K 5¼-inch minifloppy disk drive gives the user of this system a great deal of initial mass storage. It can run under several high-level operating systems and the system is programmable in BASIC, Fortran, Pascal, and assembler.

Since this is the basis of a multiuser system, it includes several standard input/output ports. These include two standard serial, an RS-488 general purpose serial port, and a parallel port. The user has his choice of a terminal.

IMS International

The IMS *5000IS* is, at this stage, a fully configured system. Driven by a Z80 microprocessor, it runs under CP/M, MP/M (the multiuser version of CP/M) and TurboDOS, another high-level operating system. Standard user memory is 64K and disk storage is handled by two 409K double-sided, double-density 5¼-inch minifloppy disks.

Programmable in BASIC, COBOL, Fortran, and Pascal, this and other data are input via a typewriter-style keyboard with 64 typewriter-style keys. There are also 14 special-function keys, as well as a separate 19-key numeric pad. Input/output is handled with a standard serial port so that a user can interface a printer or modem for telecommunications. The standard monochrome monitor displays 80 characters by 25 lines.

Memory/Storage	Keyboard	I/O	Display	Comments
192K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	12-inch monochrome CRT/720 x 300 res., 80 x 25 display	2-drive monochrome version, memory expanded to 192K
128K/1 630K 5 1/4" floppy drive	91 keys, 15 special function, 18-key keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 x 24 text/640 x 312 graphics	1 630K 5 1/4" drive added
64K/2 376K DS/DD 5 1/4" floppy drives	83 keys, 4 function, 14-key keypad	1 serial, 1 parallel	9-inch CRT, RGB color avail./80 x 24 text	basic system
256K/2 5 1/4" DS/DD drives, 640K	83 keys, 10-key keypad, 10 special funct.	1 parallel, 1 serial	9-inch monochrome (built-in)/80 x 25 text	128K memory expansion
256K/2 320K DS/DD 5 1/4" drives	59 keys, 10 special function, 20-key keypad	1 parallel, 1 serial	12-inch monochrome/80 x 25 text	memory expanded to 256K
256K/2 400K 5 1/4" floppy drives	58 keys, special function, 14-key keypad	1 serial, 1 RS-423 synchronous	monochrome CRT/80 x 25 text	professional system with powerful CPU and operating system
68K/512K of RAM-disk storage/1 DD 5 1/4" floppy included	standard	2 serial, 1 parallel	80-character x 4-line liquid crystal display/external CRT connector	512K RAM-disk
64K/1 3.5-inch 248K micro-drive	58 keys, 8 special functions, programmable keys	2 serial, 1 IEEE-488	9" or 12"-monochrome CRT/80 x 25 text	3.5-inch drive added
128K	57 keys, 10 definable functions on 5 keys	1 serial, 1 multipurpose IEEE-488 port	9" monochrome CRT/80 x 25 text	base configuration
128K/1 3.5" 280K micro floppy drive	59 keys, 10 function keys, 18-key keypad		monochrome (built-in)/80 x 24 text	software package enhanced
32K/1 320K 3" microfloppy disk drive	61 key board, embedded 10-key keypad	1 serial	66-character x 8-line liquid crystal display/touch panel	full-featured lap computer
128K/2 640K slim line 5 1/4" DS/DD floppy drives	60 keys, 15 programmable, 18-key keypad	1 parallel, 1 serial	12-inch monochrome/80 x 25 text mode	2nd drive added to MBC 4000
64K/2 8-inch DS/DD drives	not announced	not announced	not announced	
64K/1 780K DS/DD 5 1/4" floppy drive/1 10MB hard disk	75 keys	2 serial, 2 parallel	12-inch monochrome/80 x 25 text mode	10MB hard (Winchester) disk drive
128K/2 320K DS/DD 5 1/4" floppy drives	98 keys, separate numeric keypad, 10 programmable keys	1 serial, 1 parallel	80 x 25 text mode/640 x 200 graphics	basic system
128K/2 1MB DS/DD 8" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch monochrome CRT/80 x 25 text	storage grows to 2MB with 8" DS/DD drives
80K/2 1.2MB 8" DS/DD floppy drives	82 keys, 8 programmable keys, 19-key keypad	2 serial, 1 parallel	12-inch monochrome/80 (40) x 24 text mode	2nd drive

Toshiba

With entries in several other pricing categories, Toshiba has a new entry in this one, the *T250-4*. Another of the many Z80 8-bit systems on the market, it features 64K of user memory. Operating under the CP/M operating system, the *T250-4* comes with two standard 8-inch double-sided, double-density floppy-disk drives for storage. Information on the display was unavailable at press time.

DEC

Another of the Digital Equipment small-computer offerings is the *Professional 325*, that uses a proprietary 16-bit microprocessor based on the architecture of the DEC *PDP-11/238*. Equipped with 256K of user memory, this system has two standard 400K 5 1/4-inch minifloppy disks for storage. It operates under a proprietary operating system, but CP/M is also available as an option.

Fully configured at this point, the *Professional* uses a slim-line typewriter-style keyboard with a total of 58 typewriter keys. This keyboard also features special function keys and a separate 14-key numeric pad. While the keyboard handles user input, output is sent to a high-resolution monochrome display that has an 80-character by 25-line display. Input/output is handled by a standard serial port as well as by an RS-423 synchronous port. That port can be used for communications or can interface with a larger network.

Eagle

The Eagle *IIE-4* is another small-computer system that makes its appearance here. Actually an upgrade of an already existing system, the Eagle *IIE* series, that was introduced in another pricing category, the Eagle *IIE-4* is driven by the same type of 8-bit Z80A CPU. Operating under CP/M, it has one 780K double-sided, double-density minifloppy disk available for storage. Its other storage medium, also part of the system upgrade, is a 10-MB hard disk.

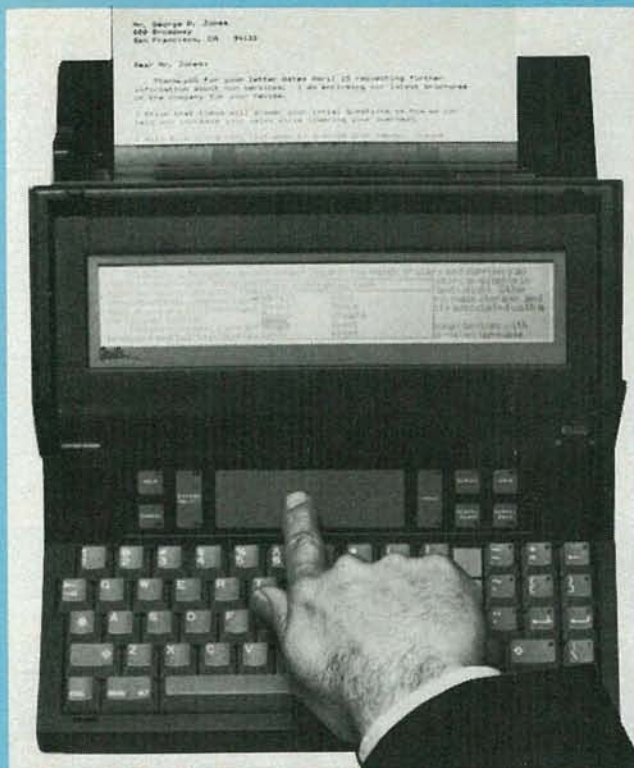
Programmable in BASIC, this and other data are input via the 75-key typewriter-style keyboard. Output is to a 12-inch 80-character by 25-line monochrome display screen. Input/output is handled by two standard serial and two standard parallel ports, so a variety of peripherals can be attached.

Vector Graphic

The Vector *4/10* is an 8/16-bit small-computer that makes use of co-processors, a Z80B (8-bit) and an 8088 (16-bit). The Vector *4/10* runs CP/M-86—the 16-bit version of CP/M—CP/M, with MS-DOS available as an option.

The standard disk drive is a 630K 5 1/4-inch minifloppy unit. When this is combined with the standard 128K RAM, it becomes a flexible unit.

Having a total of 91 typewriter-style keys, the Vector *4/10*'s keyboard also has 15 special-function keys and an 18-key numeric pad. User input is via this device and output is to a



THE GAVILAN is an IBM workalike lap computer.

12-inch monochrome video tube that delivers 640 by 312 graphics or an 80-character by 24-line text display. There are two standard serial ports and one standard parallel port.

Sanyo

A new Sanyo offering is the *MBC 4050* 16-bit small-computer system. Driven by an 8086, 16-bit microprocessor, it has 128K of user memory. This amount of memory is enough to handle any of the complex 16-bit programs available on the market today. Unlike other 16-bit systems today, the *MBC 4050* relies on the CP/M-86 operating system. It could be somewhat limiting to a computer user because most 16-bit programs are being written for MS-DOS. The *MBC 4050* is equipped with two 640K slim-line minifloppy-disk drives for mass storage.

Programmable in BASIC and assembler, this and other data are input via a standard typewriter-style keyboard with 60 typewriter keys. There are also 15 separate programmable keys and a separate 18-key numeric pad. Video output (80 characters by 25 lines text) is to a standard 12-inch monochrome display. Input/output is handled via standard serial and parallel ports. The *MBC 4050* system is actually an upgrade to the *MBC 4000* small-computer system. It adds a second drive for greater storage.



THE SAGE II is shown here with some of its "big brothers."

Computer Devices

The *DOT-3000Z* is basically an upgraded system at this point. The key change to this 8088, 16-bit CPU-based *3000Z* is an enhanced software package. It still has only one 3.5-inch microfloppy drive for storage, but it does offer 128K of user memory. A transportable, it has 59 typewriter-style keys on the main keyboard and eight special-function keys, plus programmable softkeys. Its monochrome display is still a built-in 5½ by 9-inch screen.

Hewlett-Packard

A new system joins the wide-ranging Hewlett-Packard lineup in this price category, the *HP200*, one of the first small-computers in the reasonable-cost market to make use of the powerful MC68000 16-bit microprocessor. That CPU offers seventeen 32-bit registers and can directly address 16 megabytes.

This microcomputer uses the powerful multiuser UNIX operating system, but there is no disk storage indicated at this price level.

Programmable in BASIC, Pascal, and HPL, the system has 128K of standard user memory. The typewriter-style keyboard has 57 keys and 10 definable functions included on five multi-function keys.

In this base configuration, input/output is handled via a standard serial port or a multipurpose IEEE-488 general input/output port. Both of these ports can be interfaced with a variety of peripherals, including printers, plotters, modems, and scientific or manufacturing instruments. The standard screen is a 9-inch monochrome display that shows 80-characters by 25-lines.

For the portable *HP85A*, this upgrade adds a second serial port—a general-purpose input/output port—that lets this small-computer system be linked to a wide variety of peripheral equipment. Meanwhile, the *HP85B* has its user memory increased to 160K. That means it can handle more user input and far more complex routines and tasks.

The *HP86A*, meantime, becomes fully configured with an added second 270K 3.5-inch microfloppy-disk drive for mass storage. This frees the user from the limitations imposed by only having one disk drive. The *HP120/125* becomes much more versatile with one 248K 3.5-inch microfloppy-disk drive.

Compaq

This IBM-compatible transportable small-computer system becomes fully configured in this pricing category. With the addition of a second 320K double-sided, double-density minifloppy-disk drive, the *Compaq* gains much more power and flexibility. Its second upgrade gives it even further capability by allowing serial communications ability. The optional serial interface port is now standard and a user can tie in a variety of peripherals, including printers, plotters, and modems.

Its next upgrade adds to its full configuration by adding a full



DIGITAL EQUIPMENT CORP.'s computers—the *Professional* is in center.

128K of user memory, thus bringing its standard memory to a full 256K. With this much memory, this system can easily handle the memory-hungry 16-bit programs available.

Sony

The full-featured *SMC-70* system becomes even more versatile with the addition of a 12-inch RGB high-resolution color monitor. This system now has color-graphics capability. It becomes even more flexible in its second expansion with the addition of an expansion unit that broadens the range of peripherals to which it can be interfaced.

IBM

The IBM *Personal Computer* begins to become rather powerful as it approaches its fullest configuration. In its first change, the user memory capacity is increased to 128K on the monochrome version. That makes it able to handle just about any program on the market. In its second upgrade, the high-resolution monochrome display is changed to a high-resolution color display.

With this second upgrade completed, the next upgrade increases the memory of the color display version of the IBM-PC to 128K. The final upgrade brings the amount of user memory up to 256K.

Texas Instruments

The one-disk version of the TI *Professional Computer* gains color-graphics capability with the addition of a 13-inch color monitor. It delivers 720 by 300 resolution. Another version, the two-drive monochrome version, has its user memory increased to 128K for more capability.

The last upgrade to the two-drive monochrome TI *PC* brings the amount of user memory up to 192K. Although you may think this is far too much memory, remember that the new generation of memory-hungry 16-bit programs requires great amounts of memory to function correctly.

Zenith

The *Z-100* line becomes more powerful in this region, too. In the first expansion to the low-profile unit, a high-resolution color monitor is added to enhance the unit's graphics capability. Although this seems unlikely, adding the high-resolution green monochrome display increases the cost of the low-profile *Z-100* beyond that of the color version. The prices, though, were obtained from two different Heath/Zenith sources.

The last upgrade to this line makes the all-in-one *Z-100* a fully configured unit. It adds a second 320K double-sided, double-density disk drive to the all-in-one.

NEC

The now-dual processor *PC-8800* series receives the addition of a 14-inch, high-resolution color monitor.



NEC's POWERFUL PC-8800 is shown here.



Basis

The Apple/CP/M-compatible *Basis 108* system becomes a speedier unit with the addition of a 256K virtual-memory disk.

Athena

The transportable *Athena I*, has its standard virtual-memory disk expanded to 256K for greater storage potential. It means a user can now load and use larger programs in this type of pseudo-disk system. The second expansion makes this system even more powerful as this memory disk is expanded to 512K.

TeleVideo

The memory capacity of the *TS 1603* 16-bit system is expanded to 256K, the fully configured number for this supplement. It means this system can use any of the memory-hungry 16-bit programs now coming to the market very efficiently.

Apple

At this stage, the *Apple III* becomes fully configured. Not only does it have a standard display and 256K of memory, but it also has a second drive for more flexible system operation.

Hyperion

This transportable small-computer system finds its flexibility increase in this pricing category with the addition of a second 320K double-sided, double-density minifloppy-disk drive.

Sord

The *M23* system becomes even more powerful as it upgrades to the *Mark V G* model. In this configuration, the drives are upgraded to 8-inch units with 1-megabyte of storage potential per drive.

Wang

The *Professional Computer*—this company also makes one—gains more power and flexibility with the addition of a second 360K double-sided, double-density drive. At the same time, a high-resolution—800 by 300—monochrome display and its adapter become standard equipment.

Commodore

With the addition of dual 5¼-inch disk drives, the 96K *SuperPET* system becomes fully configured.

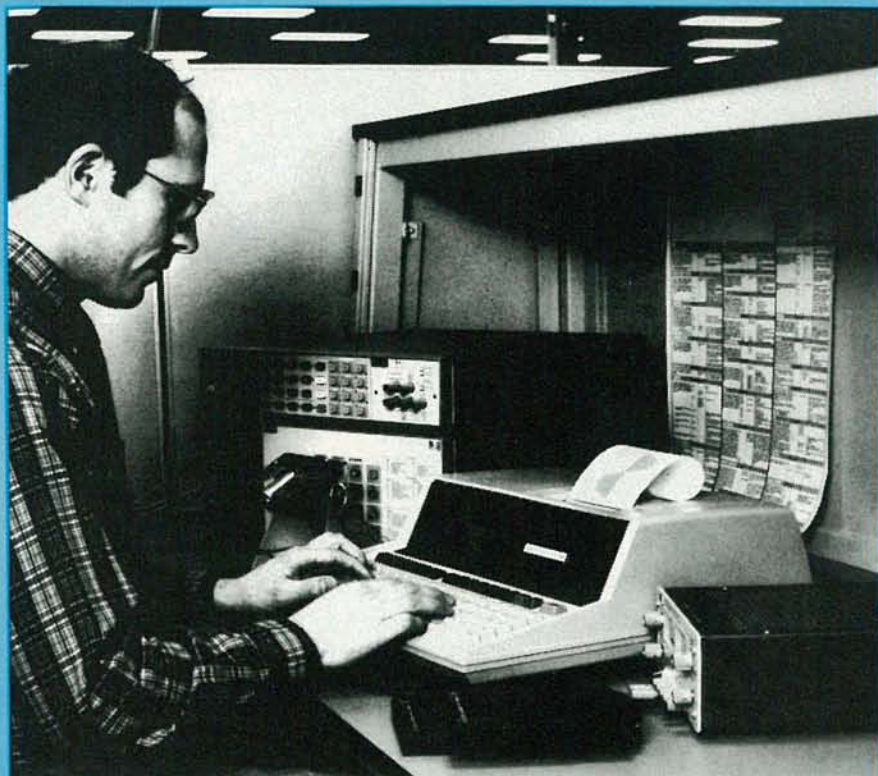
Toshiba

The *T300*, now a color-capable computer, becomes even more capable with the addition of a second 640K 5¼-inch minifloppy-disk drive.

Radio Shack

The *TRS-80 Model 12* business computer becomes even more powerful and flexible with the addition of a second 1.2-MB 8-inch floppy-disk drive.

R-E



The major change in this price range, when compared to last year, is the inclusion of a hard-disk drive in many systems.

\$4000 to \$4500 MARC STERN

SOMETHING INTERESTING IS BEGINNING TO OCCUR AT THIS POINT in our buyer's guide; the Winchester drive is beginning to appear more frequently. Also known as the hard disk, this storage option was, until a couple of years ago, associated only with full-sized mainframe computers or minicomputers. If any were available for the small-computer world, they were only available on high-end systems costing nearly \$10000.

Now, hard disks are available near the top-end of any affordable computer line. Their cost isn't much greater than the cost of a pair of high-density 8-inch floppy-disk drives, but their advantages are greater.

These disks are capable of much greater storage potential. Where a high-density minifloppy may store up to 700 kilobytes of data and an 8-inch floppy may now store over 1 megabyte, the smallest hard disk stores 5 megabytes or more of information.

Perhaps their greatest drawback is backup because it takes a great many floppy or minifloppy disks to back up the information on a hard disk.

In this price category, nine new machines debut and without further ado, we'll begin our look at those machines.

DEC

The *DECmate II* is another of the Digital Equipment Small Computer offerings that were first unveiled about a year and a half ago.

Driven by a proprietary PDP-8 16-bit microprocessor and a Z80 co-processor, the *DECmate II* features 64K of RAM in this configuration.

Capable of using CP/M-86, MS-DOS or its own proprietary operating system, this microcomputer is equipped with two standard 400K 5¼-inch minifloppy-disk drives.

The slim-line typewriter-like keyboard of the *DECmate II* has 58 keys. It also features separate special-function keys and a 14-key numeric keypad.

Equipped with a standard serial port, which can be interfaced with a wide variety of peripherals, including printers, plotters, and modems, the *DECmate II* also features an RS-423 synchronous port. This type of port allows this machine to be tied into a larger office network and provides high-speed data communication in this setting.

User output is via a black-and-white CRT that provides an 80-character by 25-line text display.

IMS

The *5000X16* system is another of the micromainframe systems offered by IMS International. A micromainframe is a small-computer system that features a system box, two drives, and a number of input/output ports. A user has the option of interfacing his own terminal, a device that includes a keyboard and a display screen.

Driven by a 16-bit 8088 CPU—the same one used by the IBM *Personal Computer*, this system runs under either MS-DOS or CP/M-86.

This last feature is also one worth noting. Since the 16-bit microcomputer world seems to be standardizing around MS-DOS as the operating system, it makes sense for a microcomputer manufacturer to offer it. There is a wealth of new, powerful software being written for this operating system. At the same time, though, Digital Research, which offers CP/M-86, is becoming more aggressive in this field and it is possible another body of software will grow under this system. It just gives the user another "in case" option.

With 256K of user memory, this system can handle any of the new 16-bit programs which might be thrown at it. It can also become a multiuser machine with the addition of a hard disk.

The standard disk drives for the *5000X16* are dual 409K double-sided, double-density 5¼-inch minifloppies.

With two standard serial and three parallel ports, there are

enough input/output options for a user to interface a number of peripherals. Those will likely include, in this case, terminals, printers or plotters, and, possibly, a modem. This computer is programmable in BASIC, COBOL, Fortran, and Pascal.

Another IMS offering, the *5000IS16* is also driven by a 16-bit 8088 CPU. An IBM-workalike small computer, this system also has 256K of RAM. This allows the *5000IS16* to easily handle any of the sophisticated 16-bit programs now coming to the market. In fact, most of those programs require a minimum of 90 to 128K of memory for efficient operation.

Running under either MS-DOS or CP/M-86, a user has access to a wide variety of programs. The disk drives are double-sided, double-density 409K 5/4-inch minifloppies.

Programmable in BASIC, COBOL, Fortran, and Pascal, this and other data are input via a keyboard containing 64 separate typewriter-style keys. The keyboard also contains 14 special-function keys and a 19-key numeric keypad.

User output is to a monochrome monitor with an 80-character by 24-line text mode display.

Input/output is handled via a standard serial port to which a variety of peripherals can be attached.

Vector Graphic

The *Vector 4/20* is a new offering from this long-established microcomputer manufacturer.

A co-processor machine, it is driven by an 8-bit Z80B CPU or an 8088 16-bit CPU. This gives the user access to the worlds of CP/M, CP/M-86 or, optionally, MS-DOS. Standard user memory is 128K.

The *Vector 4/20* comes equipped with two standard 630K 5/4-inch minifloppy-disk drives.

User input is handled via a typewriter-style keyboard featuring a total of 91 keys. Included are 15 special-function keys and an 18-key numeric keypad.

Output is a 12-inch monochrome display that is capable of 640- by 312-dot graphics or an 80-character by 24-line text display. Other input/output is provided via two standard serial ports and a parallel port.

Durango Systems

The Durango *Poppy* computer takes advantage of the powerful 80186 16-bit advanced CPU.

This advanced CPU, when combined with the 128K of user memory, allows use to take advantage of the many sophisticated 16-bit programs on the market. Since it has a more powerful architecture it allows the user to have access to MS-DOS, CP/M-86, MP/M-86 and the multiuser, multitasking operating system, Xenix.

Equipped with dual 800K 5/4-inch minifloppy disks, the *Poppy* has more than enough mass storage for most needs.

User input is via a keyboard with 64 typewriter-style keys, eight special-function keys, and a 14-key keypad. Output is to a monochrome CRT with an 80-character by 25-line text display.

Input/output is handled via standard serial and parallel ports that allow the user the ability to interface such peripherals as printers, plotters, and modems.

Eagle

Two new models debut in this pricing category, the *Eagle 1620* and the *Eagle PC-XL*.

The *Eagle 1620* is driven by a 16-bit 8086 CPU, the big brother to the 8088 used by the IBM *Personal Computer*. It comes with 128K of RAM.

Operating under MS-DOS or CP/M-86, the *Eagle 1620* has two 780K double-sided, double-density 5/4-inch minifloppy disks as standard equipment.

User input is via a 105-key keyboard and output is to a 12-inch, high-resolution monochrome display. The display is capable of 720- by 352-dot graphics resolution and an 80-character by 25-line text mode.

Input/output is handled via two standard parallel ports and two standard serial ports.

The *Eagle PC-XL* uses essentially the same mechanical components, but differs in three key areas: CPU, storage, and input/output.

This computer also uses a 16-bit CPU, but it is an 8088, rather than the slightly faster 8086.

Further, rather than having two parallel ports and two serial ports, it only has one parallel port and two serial ports.

Finally, this system includes a standard 10 megabyte Winchester hard disk. This means this system has much greater storage capability and faster data access and retrieval.

Software is also bundled (included) in this configuration.

TeleVideo

A new model appears in this pricing category, the *TS-1602G*, driven by an 8088, 16-bit CPU. This allows the user access to the many programs now appearing for this type of device.

With 128K of RAM memory, the *TS-1602G* is capable of handling any of those new programs. It runs under either CP/M-86 or MS-DOS. The standard disk drives are 2 1-megabyte double-sided, double-density 5/4-inch minifloppies.

Programmable in COBOL, this system accepts this and other data input from its 72 typewriter-style keys, 16 programmable keys, and a 16-key numeric keypad. Output is to a 14-inch monochrome display tube that is capable of an 80-character by 25-line text display. Additional I/O is via two standard serial ports and one parallel port.

The *1603H*, which uses the same components, is an upgraded version of the *TS-1603*. In this version, a 10-megabyte hard disk is added to its configuration for greater storage density.

Hewlett-Packard

The *HP85B* becomes a more completely configured system in this price range with the addition of a serial port. This gives the user the option of interfacing this small-computer system with a printer or a modem.

Meanwhile, the *HP86A* reaches its full configuration with the addition of a second disk drive.

The *HP87XM* becomes more versatile with the addition of a 270K 3.5-inch microfloppy disk for storage.

The change made to the *HP120/125* system finds this small-computer system's drives changed to 5/4-inches.

NEC

The *PC-8800* is becoming fully configured at this point. In this version, the *PC-8800* is still only a CP/M-compatible machine and uses dual 8-inch floppy disk drives for storage. The upgrade to this version adds a high-resolution color monitor. The 14-inch color display is capable of 640- by 400-dot color resolution or an 80-character by 25-line text mode.

Texas Instruments

Both the color version of the TI *Professional Computer* and the monochrome version are upgraded.

The first upgrade to the color version is the addition of a second 320K minifloppy-disk drive.

The second upgrade to that system brings the amount of user memory up to 128K.

The monochrome version reaches its fullest memory configuration—for our supplement—with its upgrade to 256K of RAM.

North Star

The *Horizon* micromainframe system becomes much more powerful with the addition of a 5-megabyte hard disk. The advantage of a Winchester disk is its rapid data-retrieval capability and its voluminous storage.

The *Advantage* also gains much more storage capability with the addition of a hard-disk system.

IBM

The IBM *Personal Computer* reaches its full configuration in this price category by having its on-board RAM memory in-

TABLE 1—\$4000-\$4500

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Wang Laboratories	Professional Computer	\$4030	8086	16-bit	MS-DOS, CP/M emulation	BASIC, COBOL, Fortran, Pascal
Texas Instruments	Professional Computer	\$4065	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Texas Instruments	Professional Computer	\$4070	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
IMS International	5000X16	\$4100	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL, Fortran, Pascal
IBM	IBM-PC	\$4172	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, MACRO assembler, Pascal
Hewlett-Packard	HP85B	\$4185	Not announced		Proprietary	BASIC, assembler
Hewlett-Packard	HP87XM	\$4195	Not announced		UCSD p-System, CP/M	BASIC, Pascal, Fortran
NEC Home Electronics	PC-8800	\$4196	Z80A-compatible	8-bit	CP/M	BASIC
NEC Information Syst.	APC	\$4198	8086	16-bit	CP/M-86, MS-DOS	BASIC, COBOL, FORTRAN, PASCAL, Assem.
Zenith Data Systems	ZF-100	\$4198	8085/8088	8/16-bit	CP/M, ZDOS (proprietary)	BASIC, COBOL, FORTRAN
Digital Equipment Corp.	DECmate II	\$4240	PDP-8 micro-processor, Z80	8/16-bit	CP/M-86, MS-DOS, Proprietary	Not announced
IMS International	5000IS16	\$4250	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL, Fortran, Pascal
Hewlett-Packard	HP120/125	\$4275	Z80A	8-bit	CP/M	BASIC, assembler
Hewlett-Packard	HP86A	\$4320	Not announced	8-bit	UCSD p-System, CP/M	BASIC, Pascal, Fortran
Sord Computer	M23 Mark V C	\$4330	Z80A		Proprietary, CP/M-compatible	BASIC, Pascal, Fortran
Computer Devices Inc.	DOT-3000B	\$4344	8088	16-bit	MS-DOS	BASIC, Fortran, COBOL, Pascal, assembler
Texas Instruments	Professional Computer	\$4365	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Vector Graphic Inc.	Vector 4/20	\$4395	Z80B, 8088	8/16-bit	CP/M-86, MS-DOS (optional), CP/M	Not announced
Durango Systems	Poppy	\$4395	80186	16-bit	MS-DOS, CP/M-86, MP/M-86, Xenix	Not announced
Sage Computer Tech.	Sage II	\$4400	MC68000	16/32-bit	UCSD p-System, CP/M-86K, Modula 2, Hyper-FORTH	BASIC, Fortran, Pascal, assembler
Radio Shack	TRS-80 Model III Desktop	\$4443	Z80A	8-bit	TRSDOS	BASIC, COBOL, Fortran, Assembler
TeleVideo Systems	TS 1603H	\$4495	8088	16-bit	MS-DOS, CP/M-86	COBOL
Eagle Computer Inc.	Eagle 1620	\$4495	8086	16-bit	MS-DOS, CP/M-86	optional
Eagle Computer Inc.	Eagle PC-XL	\$4495	8088	16-bit	CP/M-86, MS-DOS	optional
TeleVideo Systems Inc.	TS 1602G	\$4495	8088	16-bit	CP/M-86, MS-DOS	COBOL
North Star Computers	Horizon	\$4499	Z80A	8-bit	TSS/C (Proprietary CP/M-like)	Not announced
North Star Computers	Advantage	\$4499	Z80A	8-bit	CP/M, GDOS	BASIC, Fortran, COBOL, Pascal

Memory/Storage	Keyboard	I/O	Display	Comments
128K/2 360K DS/DD 5 1/4" floppy drives	101 keys, 16 programmable, 18-key keypad	1 parallel, 1 serial	monochrome CRT/800 x 300 graphics capability	second drive, display and adapter, graphics adapter
64K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	13-inch color CRT/720 x 300 res., 80 x 25 display	2nd drive drive added to color version
256K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	12-inch monochrome CRT/720 x 300 res., 80 x 25 display	64K added to 2 drive monochrome system
256K/2 409K DS/DD half-height 5 1/4" floppy drives	N/A	2 serial, 3 parallel	N/A	basic micromainframe system with dual disk drives
256K/2 320K DS/DD 5 1/4" drives	59 keys, 10 special function, 20-key keypad	1 serial, 1 parallel	12-inch high-res. color display/80 x 25 text	memory expanded to 256K in color version
160K/tape drive/electronic (RAM) disk	58 keys, 20-key keypad, 8 special function	1 serial	built-in 5" CRT/256 x 192 graphics, text	serial port added
128K/1 270K 3.5-inch micro drive	59 keys, 20-key keypad, 14 special function	multipurpose port	monochrome CRT, 80 x 24 text	3 1/2-inch drive added
64K/2 1 MB DS/DD 8" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch color CRT/640 x 400 res./80 x 25 text	color display added
128K/2 1MB 8-inch half-height DS/DD drives	66 keys, 25-key keypad, 23 function	1 parallel, 1 serial	color/640 x 200 mono res., 160 x 100 16-color, 320 x 200 4-color 80 x 25 text	color CRT added
128K/2 320K DS/DD 5 1/4" drives	77 keys, 18-key keypad, 13 special function	2 serial, 1 parallel	color CRT 640 x 225 high-res., 80 x 25 lines	high-res. color CRT added
64K/2 400K 5 1/4" floppy drives	58 keys, special function, 14-key keypad	1 serial, 1 RS-423 synchronous	monochrome CRT/80 x 25 text	basic system
256K/2 409K DS/DD half-height 5 1/4" floppy drives	64 keys, 14 special function, 19-key keypad	1 serial	monochrome CRT/80 x 24 text mode	basic system
64K/1 248K 5 1/4" floppy drive	58 keys, 8 special functions, programmable keys	2 serial, 1 IEEE-488	9- or 12- monochrome CRT/80 x 25 text	drive changed to 5 1/4 inches
64K/2 270K 5 1/4" drives	59 keys, 20-key keypad, 14 special function	1 parallel	9" monochrome CRT/80 x 25 text	2nd 5 1/4" drive added
128K/2 1MB 8" drives	59 keys, 20-key keypad, 9 special function	2 serial, 1 parallel	14-inch color CRT	dual 8-inch drives
128K/2 3.5" 280K micro floppy drives	59 keys, 10 function keys, 18-key keypad	2 serial	monochrome (built-in)/80 x 24 text	2 serial ports, 2nd drive added
128K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	13-inch color CRT/720 x 300 res., 80 x 25 display	64K memory added to 2-drive color version
128K/ 2 630K 5 1/4" floppy drives	91 keys, 15 special function, 18-key keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 x 24 text/640 x 312 graphics	2nd 630K drive
128K/2 800K 5 1/4" floppy disk drives	64 keys, 8 special function, 14-key keypad	1 serial, 1 parallel	monochrome CRT/80 x 25 text	16-bit system
128K/2 640K 5 1/4" floppy drives	N/A	2 serial, 1 RS-488, 1 parallel	N/A	storage expands to 1.28MB with second drive
48K/1 184K 5 1/4" floppy drive/5MB hard disk	64 keys, 12-key keypad	1 parallel, 1 serial	12-inch monochrome/64 (32) x 16 text mode	hard disk drive (5MB) added
128K/1 1MB DS/DD 5 1/4" floppy drive/1 5 1/4" 10MB hard disk	72 keys, 16 programmable, 16-key keypad	2 serial, 1 serial RS-422 port	14-inch monochrome/80 x 25 text	hard disk system added to TS 1603
128K/2 DS/DD 780K (96 tpi) 5 1/4" floppy drives	105 keys	2 serial, 2 parallel	12-inch high-res. monochrome/720 x 352 capability/80 x 25 text mode	base system
128K/1 320K DS/DD 5 1/4" floppy drive/1 10MB hard disk	105 keys	2 serial, 1 parallel	12-inch high-res. monochrome/720 x 352 capability/80 x 25 text mode	fully configured base system
128K/2 1MB DS/DD 5 1/4" floppy drives	72 keys, 16 programmable, 16-key keypad	2 serial, 1 serial RS-422 port	14-inch monochrome/80 x 25 text	base system
64K/1 360K 5 1/4" DS/DD floppy/5MB hard disk	N/A	2 serial, 1 parallel	N/A	micromainframe storage grows with addition of 5 MB hard disk
64K/1 360K DS/DD 5 1/4" floppy drive/5MB hard disk	49 keys, 14-key keypad, 15 function keys	1 parallel, 1 serial	12-inch monochrome CRT/640 x 240 graphics res./80 x 24 text mode	hard disk added

creased to 256K. This upgrade allows the PC to take efficient advantage of the many powerful 16-bit programs now on the market. By this point in this system's expansion we have already added a color display, I/O ports, disk drives, and all the other features necessary to make it a full-featured system.

Zenith

The low-profile Zenith Z-100 becomes a color graphics-capable system with the addition of a high-resolution color-video display. Capable of a 640- by 225-dot resolution, this display is also capable of an 80-character by 25-line text mode.

Sord

Although the M23 Mark V C small-computer system bears another name at this point, it is actually an upgrade to the overall M23 system. At this point, the system has gained dual 1-megabyte 8-inch floppy-disk drives for storage. This fully configured system is now aimed more at the business user than the home computer hobbyist and the potential 2 megabytes of storage provide more than enough to meet the needs of most small businessmen.

Radio Shack

At this point, the Model III system reaches its fullest configuration with the addition of a 5-megabyte hard disk. This same disk can also be added to the Model 4, whose price is just about the same as the Model III. The key advantage to a hard-disk system is the increase in data access and storage speed and a secondary advantage is the massive storage capabilities of such a system.

Sage

The micromainframe Sage II has its potential storage capacity increased to 1.28 megabytes with the addition of a second 640K minifloppy disk.



Computer Devices

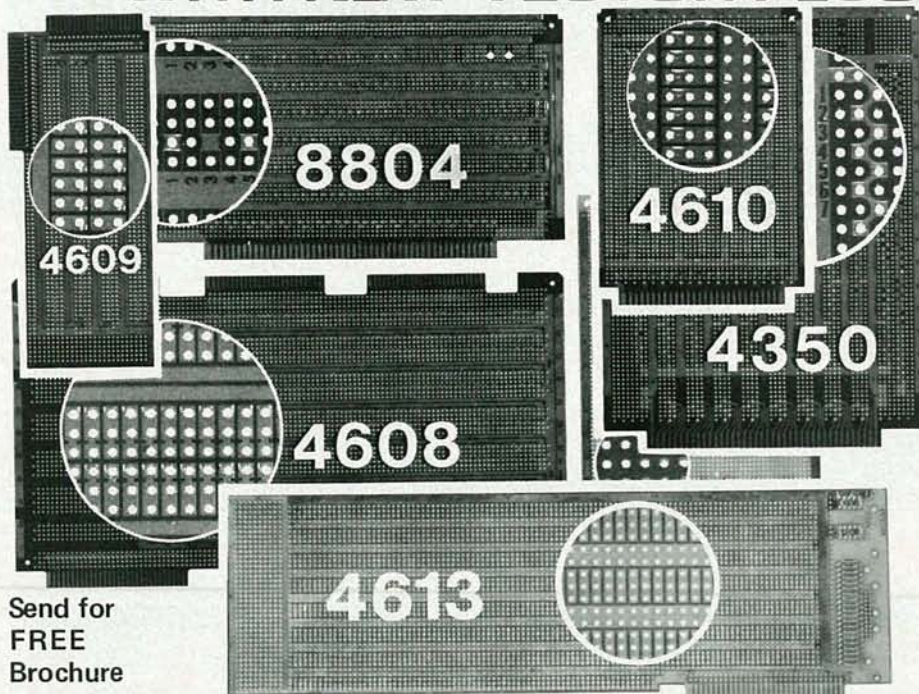
The DOT-3000B, another variation of the DOT series of transportable microcomputers, becomes fully configured at this point with the addition of two serial ports and a second disk drive.

The serial ports give this small-computer system input/output capability and allow it to be connected to a variety of peripheral devices, including printers, plotters, and modems.

Wang

In this configuration, the Wang Professional Computer reaches its full capability as a color-graphics machine. This upgrade involves more than one item and includes the addition of a second 360K double-sided, double-density minifloppy-disk drive for mass storage; an 800- by 300-dot color-graphics monitor and the adapter needed to support this monitor. R-E

BUILD YOUR COMPUTER BREADBOARDS & INTERFACES FASTER AND EASIER WITH NEW VECTOR PLUGBOARDS



New 4613 series — for IBM Personal Computer. Three models available.

New 4614, 4615 series — for VME Bus. Six models available.

4610 series — for STD-Bus. Three models available.

4608 series — for Multibus solderable, or unpatterned.

8804 series — for S-100. Seven models available.

4607 — for DEC LSI-11/PDP-11, Heath-11.

4609 — for Apple II, Super-Kim, Pet Commodore with Expandamem.

4350 — for TI 980

4611 series — for Motorola Exorciser

Send for
FREE
Brochure



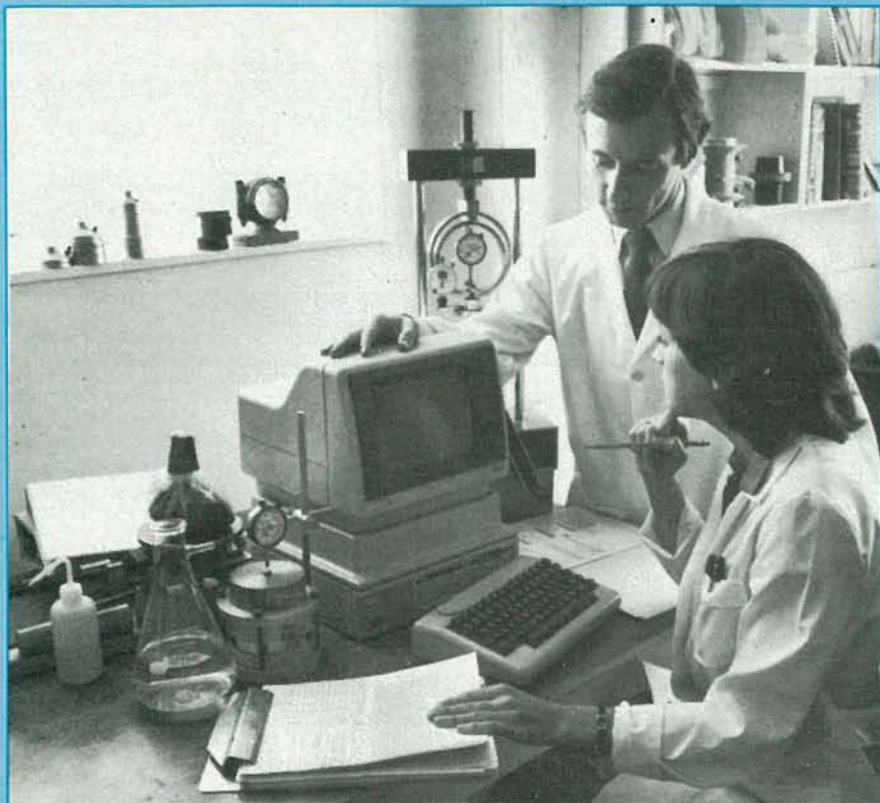
ALSO: Connectors • Enclosures • Mother Boards • Extenders

748209

VECTOR ELECTRONIC COMPANY, Inc., 12460 Gladstone Ave., P.O. Box 4336, Sylmar, CA 91342-0336; (213) 365-9661

See us at Wescon Booths 1717 & 1719

CIRCLE 19 ON FREE INFORMATION CARD



The machines we'll discuss here are the most powerful—and the most expensive.

Over \$4500

MARC STERN

AT THIS POINT IN OUR BUYER'S GUIDE, YOU WILL NOTICE MORE and more systems with hard—Winchester—disks for storage. These devices offer a manyfold increase in data access and storage speed. Usually, storage densities begin at a minimum of 5-megabytes and increase rapidly from there. This is a minimum of a fifteenfold increase in data density over a 300K double-sided, double-density minifloppy disk. Since hard disks rotate much faster than the average minifloppy or even an 8-inch floppy, data access time is quicker. This means that you can load a program from a hard-disk system much quicker than you can load the same program from a floppy-disk system.

One of the most attractive features of the hard disk—besides its data-storage capability—is that a few of these devices have been trimmed down to 5¼ inches, and are no larger than the minifloppy drives they replace.

Many new machines make their debut in this category, and there are upgrades of existing systems. Most of the new machines are from manufacturers we have already discussed in earlier sections of this report. So rather than first looking at the new machines, we'll look at all the offerings from each manufacturer, and put the new ones at the opening of each set.

Hewlett-Packard

A new machine makes its appearance in this price category, the *HP200*, the top-of-the-line HP small-computer system, for our supplement's purposes. This system is not only introduced here, but also upgrades several times in this category.

Based on the Motorola MC68000 CPU, this powerful machine has 128K of standard user memory. Operating under the powerful *UNIX* multiuser operating system, this system includes one 3.5-inch 270K microfloppy-disk drive as standard.

Programmable in BASIC, Pascal, and HPL, this and other data are entered via a keyboard featuring 57 typewriter keys and five keys offering a total of 10 definable functions. User output

is displayed on a standard 9-inch 80-character by 25-line monochrome display. Other input and output functions are handled via a standard serial port or an IEEE-488 general-purpose interface port. This second port allows the *HP200* to be interfaced with a wide variety of test, measurement, scientific, and other peripherals.

This system also upgrades three times in this price realm. In its first significant change, the size of the drive increases from 3.5 inches to the more standard 5¼-inch drive. The second upgrade adds a second 3.5-inch microfloppy-disk drive for storage. The third reconfiguration merely changes the size of the disk drive from a microdrive to a more standard 5¼-inch unit.

The *HP120/125* upgrades twice in this category. In the first upgrade, a second 248K 3.5-inch microfloppy drive is added to this system's configuration. The second reconfiguration increases the size of the disk to a more standard 5¼-inch drive. But there's no increase in storage.

The *HP87XM* has three changes in its configuration, two of which deal with 5¼-inch drives, and a third that deals with a microfloppy drive. Looking at the most important change first, the *HP87XM* gains a second 270K microfloppy-disk drive.

The two changes involving 5¼-inch drives merely involve an increasing drive size to a more standard size configuration. The *HP85B* becomes even more versatile when an IEEE-488 port is added. It allows the user to interface this small-computer system with a number of test, measurement, and manufacturing instruments, as well as other peripherals.

For the *HP86A*, the upgrade increases user memory to 128K.

Texas Instruments

The *TI Professional Computer* undergoes four upgrades in this price category. In the first upgrade, the color *PC* has its user memory expanded to 192K by adding 64K of RAM. At this level a user can configure a portion of that RAM into a pseudo-disk or

TABLE 1—\$4500 AND UP

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Hewlett-Packard	HP87XM	\$4515	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN
Hewlett-Packard	HP120/125	\$4550	Z80A	8-bit	CP/M	BASIC, Assembler
Texas Instruments	Professional Computer	\$4565	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Hewlett-Packard	H85B	\$4580	Not announced		Proprietary	BASIC, Assembler
Docutel/Olivetti Corp.	M20	\$4610	Z8001	16-bit	PCOS (Prof. Computer Operating Sys.)	BASIC
Gavilan Computer Corp.	Gavilan	\$4690	8088	16-bit	MS-DOS	BASIC, Pascal
IMS International	5000SX	\$4700	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
NEC Home Electronics	PC-8800	\$4746	Z80A-compatible/8086	8/16-bit	CP/M, CP/M-86, MS-DOS	BASIC
Texas Instruments	Professional Computer	\$4765	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Hewlett-Packard	HP86A	\$4770	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN
Hewlett-Packard	HP87XM	\$4770	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN
IMS International	8000SX	\$4780	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
Radio Shack	TRS-80 Model III	\$4790	Z80A	8-bit	TRSDOS	BASIC, COBOL, FORTRAN, Assembler
Sony	SMC-70	\$4820	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Honeywell, Inc.	microSystem 6/10	\$4870	Proprietary (Micro 6)/8086	16-bit	Proprietary, MS-DOS, CP/M-86	BASIC
North Star Computers	Advantage 8/16	\$4899	Z80A/8088	8/16-bit	MS-DOS, GDOS	BASIC, FORTRAN, COBOL, Pascal
Sord Computer	M68	\$4899	M68000/ Z80A	8/16/32-bit	Proprietary, CP/M-compatible	BASIC, Pascal, FORTRAN
IBC/Integrated Bus. Comp.	Cadet	\$4925	Z80	8-bit	OASIS, CP/M, MP/M, MVT-FAMOS	Not announced
Computer Devices Inc.	DOT-3000D	\$4943	8088	16-bit	MS-DOS	BASIC, FORTRAN, COBOL, Pascal, Assemble
Computer Devices Inc.	DOT-3000C	\$4943	8088	16-bit	MS-DOS	BASIC, FORTRAN, COBOL, Pascal, Assembler
Athena Computer	Athena I	\$4950	NSC-800 (low-power Z80)	8-bit	CP/M	Pascal
Gavilan Computer Corp.	Gavilan	\$4970	8088	16-bit	MS-DOS	BASIC, Pascal
Hewlett-Packard	HP120/125	\$4975	Z80A	8-bit	CP/M	BASIC, Assembler
Altos Computer Systems	ACS8000-15	\$4990	Z80A	8-bit	CP/M	BASIC, COBOL, Fortran, SOFTBOL, Pascal,
IBM	IBM-PC XT	\$4995	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, Macro Assembler, Pascal
Durango Systems	Poppy	\$4995	80186	16-bit	MS-DOS, CP/M-86, MP/M-86, Xenix	Not announced
Toshiba America	T250-5	\$4995	Z80	8-bit	CP/M	BASIC
Columbia Data Products	1600-4	\$4995	8088	16-bit	MS-DOS	BASIC, Assembler
Ithaca Intersystems	Encore	\$4995	Z80B	8-bit	CP/M	Not announced
Digital Equipment Corp.	Professional 350	\$4995	PDP-11/238 microprocessor	16-bit	Proprietary, CP/M optional	Not announced

Memory/Storage	Keyboard	I/O	Display	Comments
128K/1 270K 5 1/4" drive	59 keys, 20-key keypad, 14 special function	multipurpose port	8" monochrome CRT/80 × 25 text	drive changed to 5 1/4 inches
64K/2 3.5-inch 248 microdrives	58 keys, 8 special functions, programmable keys	2 serial, 1 IEEE-488	9" or 12" monochrome CRT/80 × 25 text	2nd microdrive added
192K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	13-inch color CRT/720 × 300 res., 80 × 25 display	memory expanded to 192K
160K/tape drive/electronic disk	58 keys, 20-key keypad, 8 special function	1 serial, 1 general purpose port	built-in 5" CRT/256 × 192 graphics, 32 × 16 text	general purpose port
160K/2 360K 5 1/4" floppy drives	72 keys, 16-key keypad	1 serial, 1 parallel	12-inch high-res. monochrome/80 × 25 text mode	2nd drive added, memory upgrade to 160K
32K/2 320K 3" microfloppy disk drives	61 key board, 10-key keypad	1 serial	66-character × 8-line liquid crystal display/touch panel	second drive
64K/1 409K DS/DD half-height 5 1/4" drive/6MB hard disk	N/A	2 serial, 3 parallel	N/A	micromainframe system
128K/2 1MB DS/DD 8" floppy drives	81 keys, 5 multifunction, 10-key keypad	1 parallel, 1 serial	14-inch color CRT/640 × 400 res./80 × 25 text	color display added
256K/2 320K DS/DD 5 1/4" floppy drives	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	13-inch color CRT/720 × 300 res., 80 × 25 display	memory expanded to 256K
128K/2 270K 5 1/4" drives for storage	59 keys, 20-key keypad, 14 special function	1 parallel	9" monochrome CRT/80 × 25 text	memory expanded to 128K
128K/2 270K 3.5-inch microdrives for storage	59 keys, 20-key keypad, 14 special function	multipurpose port	8" monochrome CRT/80 × 25 text	2nd drive added
64K/2 1.2MB 8" DS/DD half-height floppy drives/6MB hard disk	N/A	2 serial, 3 parallel	N/A	micromainframe system
48K/2 184K 5 1/4" floppy drives/5MB hard disk	64 keys, 12-key keypad	1 parallel, 1 serial	12-inch monochrome/64 (32) × 16 text mode	hard disk drive (5MB) added
64K/2 280K 3.5" microfloppy/5.7MB hard disk	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch green CRT/80 × 25 text	hard disk and interface unit added, 1 microdrive deleted
128K/1 5 1/4" floppy disk drive	standard, keypad, function keys	2 serial, 1 parallel	12-inch monochrome CRT	basic system
128K/1 360K DS/DD 5 1/4" floppy drive/5MB hard disk	49 keys, 14-key keypad, 15 function keys	1 parallel, 1 serial	12-inch monochrome CRT/640 × 240 graphics res./80 × 24 text mode	5MB hard disk
256K/2 1.2M 5 1/4" drives	Typewriter style, keypad, function keys	2 serial, 1 parallel, 1 IEEE-488	12-inch green CRT/80 × 25	base configuration
64K/1 1MB floppy disk drive	N/A	Not announced	N/A	micromainframe system
256K/2 3.5" 280K micro floppy drives	59 keys, 10 function keys, 18-key keypad	2 serial	monochrome (built-in)/80 × 24 text	user memory expanded to 256K
128K/2 3.5" 280K micro floppy drives	59 keys, 10 function keys, 18-key keypad	2 serial	monochrome (built-in)/80 × 24 text	integral printer, 128K memory
68K/1MB of RAMdisk storage/1 DD 5 1/4" floppy included	standard	2 serial, 1 parallel	80-character × 4-line liquid crystal display/external CRT connector	1MB RAM-disk
96K/2 320K 3" microfloppy disk drives	61 key board, embedded 10-key keypad	1 serial	66-character × 8-line liquid crystal display/touch panel	64K memory added
64K/2 248K 5 1/4" drives	58 keys, 8 special functions, programmable keys	2 serial, 1 IEEE-488	9" or 12" monochrome CRT/80 × 25 text	2nd drive added
208K/2 500K SS/DD floppy drives	N/A	6 serial, 1 parallel	N/A	micromainframe
128K/1 DS/DD 5 1/4" floppy drive/10MB hard disk	59 keys, 10 special function, 20-key keypad	1 parallel		basic system
256K/2 800K 5 1/4" floppy disk drives	64 keys, 8 special function, 14-key keypad	1 serial, 1 parallel	monochrome CRT/80 × 25 text	user memory increased to 256K
64K/1 8-inch DS/DD drive, 1 5MB hard disk	not announced	not announced	not announced	hard disk added
128K/1 320K 5 1/4" floppy disk drive/12MB hard disk	83 keys, 10 special function, keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 × 25 text	hard disk added for greater storage
128K/2 SS/DD 5 1/4" floppy disk drives	N/A	Not announced	N/A	micromainframe system
256K/1 400K 5 1/4" floppy drive	58 keys, special function, 14-key keypad	1 serial, 1 RS-423 synchronous	monochrome CRT/80 × 25 text	system box enlarged for hard disk

TABLE 1—\$4500 AND UP (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
Sanyo	MBC 3000	\$4995	Z80A	8-bit	CP/M, TS-DOS	BASIC, Pascal, FORTRAN, Macro-80
Gifford Systems	100	\$4995	8085/8088	8/16-bit	CP/M, CP/M-86	Not announced
Radio Shack	Model 16	\$4999	MC68000/Z80A	8/16/32-bit	Proprietary	Assembly
TeleVideo Systems Inc.	TS 1602G	\$5090	8088	16-bit	CP/M-86, MS-DOS	COBOL
IMS International	5000SX	\$5090	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
IMS International	5000IS	\$5100	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
Apple Computer	Apple III	\$5164	6502B	8-bit	Apple SOS	BASIC, Pascal
Hewlett-Packard	HP200	\$5185	MC68000	16/32-bit	UNIX	BASIC, Pascal, HPL
Hewlett-Packard	HP87XM	\$5225	Not announced		UCSD p-System, CP/M	BASIC, Pascal, FORTRAN
Gavilan Computer Corp.	Gavilan	\$5240	8088	16-bit	MS-DOS	BASIC, Pascal
Canon USA	AS100	\$5245	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
Sony	SMC-70	\$5340	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Apple Computer	Apple III	\$5364	6502B	8-bit	Apple SOS	BASIC, Pascal
Columbia Data Products	1600-4	\$5440	8088	16-bit	MS-DOS	BASIC, assembler
NEC Information Syst.	APC	\$5446	8086	16-bit	CP/M-86, MS-DOS	BASIC, COBOL, FORTRAN, PASCAL, Assem.
IMS International	5000IS	\$5490	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
Texas Instruments	Professional Computer	\$5490	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Altos Computer Systems	5-5D	\$5490	Z80A	8-bit	CP/M	BASIC, COBOL, Pascal, FORTRAN, SOFTBOL
CompuPro Division	System 816/A	\$5495	8085/8088	8/16-bit	CP/M, CP/M-86	Not announced
Vector Graphic Inc.	Vector 4/30	\$5495	Z80B/8088	8/16-bit	CP/M-86, MS-DOS (optional), CP/M	Not announced
Zenith Data Systems	ZF-100	\$5499	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN
IMS International	5000X16	\$5500	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL, FORTRAN, Pascal
Hewlett-Packard	HP200	\$5505	MC68000	16/32-bit	UNIX	BASIC, Pascal, HPL
Computer Devices Inc.	DOT-3000E	\$5542	8088	16-bit	MS-DOS	BASIC, Fortran, COBOL, Pascal, assembler
IMS International	8000X16	\$5580	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL, FORTRAN, Pascal
Gifford Systems	100+	\$5595	8085/8088	8/16-bit	CP/M, CP/M-86	Not announced
Zenith Data Systems	Z-120	\$5599	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN
Zenith Data Systems	ZF-100	\$5638	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN
IMS International	5000IS16	\$5650	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL, FORTRAN, Pascal
IBM	IBM-PC XT	\$5675	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, Macro Assembler, Pascal
Hewlett-Packard	HP200	\$5760	MC68000	16/32-bit	UNIX	BASIC, Pascal, HPL

Memory/Storage	Keyboard	I/O	Display	Comments
64K/2 8" DS/DD drives, 1MB per drive	59 keys, 22 programmable, 18-key keypad	2 serial, 1 parallel	12-inch monochrome/80 × 25 text mode	basic system
64K/2 1.2MB 8" DS/DD 8" floppy drives	N/A	1 serial	user option	micromainframe
128K/1.25MB 8" floppy disk	76 keys, numeric keypad	2 serial, 1 parallel	12" green monochrome, 80 × 24 text	basic system
256K/2 1MB DS/DD 5 1/4" floppy drives	72 keys, 16 programmable, 16-key keypad	2 serial, 1 serial RS-422 port	14-inch monochrome/80 × 25 text	256K memory added
64K/2 409K DS/DD half-height 5 1/4" floppy drives/6MB hard disk	N/A	2 serial, 3 parallel	N/A	second floppy drive added
64K/1 409K DS/DD floppy drive/6MB hard disk	64 keys, 14 special function, 19-key keypad	1 serial	monochrome CRT/80 × 24 text mode	storage increased with addition of 6MB hard disk
128K/1 140K SS/DD 5 1/4" floppy drive/hard disk drive	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller, 1 parallel	12-inch CRT/280 × 192/560 × 192 graphics cap./80 × 24 text	hard disk (Winchester drive) added to 128K Apple III
128K/1 3.5-inch 270K microfloppy drive	57 keys, 10 definable functions on 5 keys	1 serial, 1 multipurpose IEEE-488 port	9" monochrome CRT/80 × 25 text	3.5-inch microfloppy added
128K/2 270K 5 1/4" drives	59 keys, 20-key keypad, 14 special function	multipurpose port	8" monochrome CRT/80 × 25 text	2nd 5 1/4-inch drive added
160K/2 320K 3" microfloppy disk drives	61 key board, embedded 10-key keypad	1 serial	66-character × 8-line liquid crystal display/touch panel	128K of user memory added
Not announced/2 640K DS/DD 5 1/4" floppy drives/2 8" floppies	standard	1 serial, 1 parallel	monochrome display/80 × 25 text mode	2 eight-inch floppy drives
64K/1 280K 3.5" microfloppy/5.7MB hard disk	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch RGB high-res. color CRT	color CRT substituted for display
256K/1 140K SS/DD 5 1/4" floppy drive/hard disk drive	61-key typewriter, 13-key keypad, 2 programmable	1 serial, 2 game controller, 1 parallel	12-inch CRT/280 × 192/560 × 192 graphics cap./80 × 24 text	hard disk (Winchester drive) added to 256K Apple III
256K/1 320K 5 1/4" floppy disk drive/12MB hard disk	83 keys, 10 special function, keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 × 25 text	user memory increase to 256K
128K/1MB, half-height DS/DD drive, 10MB hard disk	66 keys, 25-key keypad, 23 function	1 parallel, 1 serial	monochrome/80 × 25 text	hard disk added to 1 drive monochrome model
64K/2 409K DS/DD half-height 5 1/4" floppy drives/6MB hard disk	64 keys, 14 special function, 19-key keypad	1 serial	monochrome CRT/80 × 24 text mode	2nd DS/DD floppy drive added
256K/1 320K 5 1/4" DS/DD drive/5MB hard disk	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	12-inch monochrome CRT/720 × 300 res., 80 × 25 display	hard disk added to monochrome unit
192K/1 1MB DS/DD 5 1/4" floppy	N/A	4 serial, 1 parallel	N/A	micromainframe
128K/2 8-inch floppy drives, 2.4MB storage	N/A	4 serial, 1 parallel	user option	micromainframe
128K/1 630K 5 1/4" floppy drive/5 MB hard disk drive	91 keys, 15 special function, 18-key keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 × 24 text/640 × 312 graphics	hard (Winchester) disk
192K/1 320K DS/DD 5 1/4" drive/11.3 MB hard disk	77 keys, 18-key keypad, 13 special funct.	2 serial, 1 parallel	user option	memory increased to 192K and hard disk added, one floppy deleted
256K/1 409K DS/DD half-height floppy drive/6MB hard disk	N/A	2 serial, 3 parallel	N/A	micromainframe
128K/1 270K 5 1/4" drive	57 keys, 10 definable functions on 5 keys	1 serial, 1 multipurpose IEEE-488 port	9" monochrome CRT/80 × 25 text	drive changed to 5 1/4"
256K/2 3.5" 280K micro floppy drives	59 keys, 10 function keys, 18-key keypad	2 serial	monochrome (built-in)/80 × 24 text	256K memory, printer included
256K/2 1.2MB 8" DS/DD half-height drives	N/A	2 serial, 3 parallel	N/A	micromainframe
128K/2 1.2MB 8" DS/DD 8" floppy drives	N/A	1 serial	user option	memory capacity increased to 128K
192K/1 320K DS/DD 5 1/4" drive/11.3 MB hard disk	77 keys, 18-key keypad, 13 special funct.	2 serial, 1 parallel	built-in monochrome CRT/80 × 25 text	hard disk, 92K of memory added, 1 floppy deleted
192K/1 320K DS/DD 5 1/4" drive/11.3 MB hard disk	77 keys, 18-key keypad, 13 special funct.	2 serial, 1 parallel	green monochrome CRT/80 × 25 text	monochrome CRT added
256K/1 409K DS/DD half-height 5 1/4" floppy drive/6 MB hard disk	64 keys, 14 special function, 19-key keypad	1 serial	monochrome CRT/80 × 24 text mode	hard disk added
128K/1 DS/DD 5 1/4" floppy drive/10MB hard disk	59 keys, 10 special function, 20-key keypad	1 serial, 1 parallel	12-inch monochrome/80 × 25 text	monochrome CRT
128K/2 3.5-inch 270K microfloppy drives	57 keys, 10 definable functions on 5 keys	1 serial, 1 multipurpose IEEE-488 port	9" CRT/80 × 25 text	2nd 3.5-inch microfloppy added

TABLE 1—\$4500 AND UP (continued)

Manufacturer	Model	Price	CPU	Word Length	Operating System	Languages
IMS International	8000SX	\$5780	Z80	8-bit	CP/M, MP/M TurboDOS	BASIC, COBOL, FORTRAN, Pascal
Radio Shack	Model 16	\$5798	MC68000/Z80A	8/16/32-bit	Proprietary	assembly
Sony	SMC-70	\$5820	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Gifford Systems	100	\$5870	8085/8088	8/16-bit	CP/M, CP/M-86	Not announced
IMS International	5000X16	\$5890	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL, FORTRAN, Pascal
IBM	IBM-PC XT	\$5919	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, Macro Assembler, Pascal
Canon USA	AS100	\$5945	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL
Fujitsu Microelectronics	Micro 16	\$5990	Z80A/8086	8/16-bit	CP/M-86, Concurrent CP/M/MS-DOS optional	Not announced
Vector Graphic Inc.	Vector 4/40	\$5995	Z80B/8088	8/16-bit	CP/M-86, MS-DOS (optional), CP/M	Not announced
Durango Systems	Poppy	\$5995	80186	16-bit	MS-DOS, CP/M-86, MP/M-86, Xenix	Not announced
TeleVideo Systems Inc.	TS 802H	\$5995	Z80A	8-bit	CP/M	COBOL
North Star Computers	Horizon	\$5999	Z80A	8-bit	TSS/C (Proprietary CP/M-like)	Not announced
North Star Computers	Advantage	\$5999	Z80A	8-bit	CP/M, GDOS	BASIC, FORTRAN, COBOL, Pascal
IBM	IBM-PC XT	\$6005	8088	16-bit	PC-DOS (MS-DOS), CP/M-86, UCSD p-System	COBOL, FORTRAN, BASIC, MACRO assembler, Pascal
IMS International	5000IS16	\$6040	8088	16-bit	MS-DOS, CP/M-86	BASIC, COBOL, FORTRAN, Pascal
Texas Instruments	Professional Computer	\$6185	8088	16-bit	MS-DOS, CP/M-86, UCSD p-System	Macro Assembler, BASIC, COBOL, FORTRAN, Pascal
Zenith Data Systems	Z-100	\$6198	8085/8088	8/16-bit	CP/M/ZDOS (proprietary)	BASIC, COBOL, FORTRAN
Hewlett-Packard	HP200	\$6215	MC68000	16/32-bit	UNIX	BASIC, Pascal, HPL
Sony	SMC-70	\$6340	Z80A	8-bit	CP/M	BASIC, CB-80, Pilot Plus
Honeywell, Inc.	microSystem 6/10	\$6370	Proprietary (Micro 6)/8086	16-bit	Proprietary, MS-DOS, CP/M-86	BASIC
Wang Laboratories	Professional Computer	\$6400	8086	16-bit	MS-DOS, CP/M emulation	BASIC, COBOL, FORTRAN Pascal
Gifford Systems	100 +	\$6470	8085/8088	8/16-bit	CP/M, CP/M-86	Not announced
Fujitsu Microelectronics	Micro 16	\$6490	Z80A/8086	8/16-bit	CP/M-86, Concurrent CP/M, MS-DOS optional	Not announced

virtual-memory disk, provided the system has the proper software. A greater part of this report was written with the assist of such a "disk."

The second upgrade brings the PC's user memory to 256K. The third upgrade to this system involves the monochrome PC. At this stage it reaches its maximum configuration, for our purposes, with the addition of a 5-megabyte hard-disk drive. This provides the user with denser storage and truly high-speed

data access, storage and retrieval. The final change brings the color PC up to its fullest configuration with the addition of the 5-megabyte 5¼-inch hard-disk drive.

Zenith

Zenith has four system configuration changes here. With the first, the user memory of the ZF-100 low-profile small-computer system increases to 192K and, at the same time, the

Memory/Storage	Keyboard	I/O	Display	Comments
64K/1 1.2MB 8" DS/DD half-height floppy drive/6MB hard disk	N/A	2 serial, 3 parallel	N/A	6MB hard disk
128K/slim-line 1.25MB 8-inch floppy disks	76 keys, numeric keypad	2 serial, 1 parallel	12-inch green monochrome/80 × 24 text	2nd drive
64K/1 280K 3.5" microfloppy/12.1 MB hard disk	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch green CRT/80 × 25 text	12.1MB hard disk
64K/2 1.2MB 8" DS/DD 8" floppy drives	N/A	1 serial	standard terminal	micromainframe with user terminal attached
256K/2 409K DS/DD half-height floppy drives/6MB hard disk	N/A	2 serial, 3 parallel	N/A	2nd floppy disk drive
128K/1 DS/DD 5 1/4" floppy drive/10MB hard disk	59 keys, 10 special function, 20-key keypad	1 serial, 1 parallel	12-inch high-res. color display/80 × 25 text	color display and adapter
Not announced/2 640K DS/DD 5 1/4" floppy drives/2 8" floppies	standard	1 serial, 1 parallel	640 × 400 color graphics capability	2 eight-inch floppy drives added
128K/2 320K DS/DD 5 1/4" floppy drives/20MB 5 1/4" hard disk	98 keys, separate numeric keypad, 10 programmable keys	1 serial, 1 parallel	80 × 25 text mode/640 × 200 graphics	hard disk added
128K/1 630K 5 1/4" floppy drive/10MB hard disk drive	91 keys, 15 special function, 18-key keypad	2 serial, 1 parallel	12-inch monochrome CRT/80 × 24 text/640 × 312 graphics	hard disk capacity increased to 10 MB
128K/1 800K 5 1/4" floppy disk drive/10MB hard disk	64 keys, 8 special function, 14-key keypad	1 serial, 1 parallel	monochrome CRT/80 × 25 text	hard disk added
64K/1 368K 5 1/4" DS/DD floppy drive/9.6MB hard disk	72 keys, 16 programmable, 17-key keypad	2 serial, 1 serial RS-422 port	14-inch monochrome/80 × 25 text	hard disk
64K/1 360K 5 1/4" DS/DD floppy/15MB hard disk	N/A	2 serial, 1 parallel	N/A	15MB hard disk
64K/1 360K DS/DD 5 1/4" floppy drive/15MB hard disk	49 keys, 14-key keypad, 15 function keys	1 parallel, 1 serial	12-inch monochrome CRT/640 × 240 graphics res./80 × 24 text mode	15 MB hard disk
256K/1 DS/DD 5 1/4" floppy drive/10MB hard disk	59 keys, 10 special function, 20-key keypad	1 serial, 1 parallel	12-inch monochrome/80 × 25 text	memory expanded to 256K
256K/2 409K DS/DD half-height floppy drives/6MB hard disk	64 keys, 14 special function, 19-key keypad	1 serial	monochrome CRT/80 × 24 text mode	2nd disk added
256K/1 320K 5 1/4" DS/DD drive/5MB hard disk	97 keys, 17-key keypad, 12 special function	1 parallel, 1 serial	13-inch color CRT/720 × 300 res., 80 × 25 display	hard disk added to color unit
192K/1 320K DS/DD 5 1/4" drive/11.3 MB hard disk	77 keys, 18-key keypad, 13 special funct.	2 serial, 1 parallel	high-res. color CRT/80 × 25 text mode	color CRT added
128K/3 270K 5 1/4" drives	59 keys, 20-key keypad, 14 special function	1 serial, 1 multipurpose IEEE-488 port	9" monochrome CRT/80 × 25 text	2nd 5 1/4" drive added
64K/1 280K 3.5" microfloppy/12.1 MB hard disk	72 keys, keypad, 9 special function	1 parallel, 1 serial	12-inch RGB high-res. color CRT	color CRT substituted for display
128K/2 5 1/4" floppy disk drives	standard, keypad, function keys	2 serial, 1 parallel	12-inch monochrome CRT	second high-density disk added
128K/1 360K DS/DD 5 1/4" floppy drive/1 10MB hard disk	101 keys, 16 programmable, 18-key keypad	1 parallel, 1 serial	monochrome CRT/graphics capability	hard disk
128K/2 1.2MB 8" DS/DD 8" floppy drives	N/A	1 serial	standard terminal	terminal added
1MB/2 320K DS/DD 5 1/4" floppy drives	98 keys, separate numeric keypad, 10 programmable keys	1 serial, 1 parallel	80 × 25 text mode/640 × 200 graphics	user memory expanded to 1MB

second minifloppy drive is swapped for an 11.3-megabyte hard-disk drive, with all its advantages. The all-in-one Z-120 system also has the same changes in the second reconfiguration, while the low-profile system gains a high-resolution monochrome display in the third change to the models of this system.

The low-profile, monochrome hard-disk ZF-100 reaches its fullest configuration and capability as a color graphics-capable system by adding a 640- by 225-dot high-resolution color moni-

tor. This display handles an 80-character by 25-line text mode.

IBM

A new version of the IBM *Personal Computer* debuts in this price category, the *PC-XT (Extended)*. Having the same essential specifications as the standard IBM *PC*—8088 CPU, PC-DOS, double-sided, double-density minifloppy-disk drive, 59 typewriter-style keys, 10 special-function keys and numeric

keypad—the new system differs in two key areas. First is that the amount of user memory is doubled from 64K to a standard 128K. The second change is an added standard 10-megabyte 5¼-inch hard-disk drive.

This system also has three configuration changes in this price range. The first one involves adding a high-resolution monochrome green display to the *PC-XT*. This monitor delivers a flicker-free detailed text display and is ideal for serious word-processing. In its next change, the *XT* becomes a color-graphics machine with the addition of a color adapter card and a high-resolution 12-inch color monitor. The final expansion of this system brings the user memory up to 256K.

Apple

The 128K version of the *Apple III* becomes a far more versatile system with an added hard-disk drive. This gives the user higher-density, high-speed data storage and access. The last change to this system brings it to its full configuration. The 256K version of the *Apple III* includes a hard disk.

Computer Devices

The *DOT-3000* series has several changes in this price category. The IBM-compatible transportable *DOT-3000D* adds RAM for a total of 256K.

The transportable *DOT-3000C*, retains the standard 128K user memory configuration, and becomes more versatile as the optional built-in printer capability is used and a printer is added. At once, a user has a complete system at his fingertips that can close up and travel with him.

The final version of this system, the *DOT-3000E*, brings both features together. The user memory is expanded to 256K, and the printer is also included.

Gavilan

The innovative, IBM-compatible, 8088-driven *Gavilan* lap-computer system upgrades three times in this price range. In its first upgrade, this system becomes more versatile and flexible by adding a second 320K 3-inch microfloppy-disk drive. The second upgrade gives the user 96K of RAM by adding a 64K RAM memory add-on cartridge. When this is combined with the dual disk drives now included, this system becomes a truly versatile lap machine. In its final upgrade, memory capacity is increased to 160K.

IMS International

This microcomputer manufacturer has a variety of new machines debuting, as well as others that upgrade, in this price category. The micromainframe *5000SX* system, driven by an

8-bit Z80 microprocessor, debuts with a 6-megabyte hard-disk system. Immediately, this increases the versatility of the system, which also has 64K of RAM. The standard minifloppy-disk drive for this system is a 409K, half-height double-sided, double-density unit.

Capable of operating under CP/M, MP/M (the multiuser version) or TurboDOS, this system is programmable in BASIC, COBOL, Fortran, or Pascal. Since it is a micromainframe system, terminal choice is up to the user. However, this system can also support a variety of input/output devices through two standard serial ports and three standard parallel ports. The system upgrades once in this category with an added second 409K half-height minifloppy drive. This makes backing up the contents of the hard disk far easier.

The *8000SX* is another version of this micromainframe system and shares many of the same features with the *5000SX*. The key difference is in the amount of floppy-disk storage. Instead of relying on minifloppy-disks, this system uses half-height, 8-inch floppy-disk drives for storage. Their capacity is 1.2-megabytes per drive and offer the user up to 2.4-megabytes of potential storage.

In this system's upgrade, the second floppy disk is replaced by a 6-megabyte hard-disk drive. This gives the user access to high-density, high-speed data access and retrieval. The Z80-based *5000IS* system upgrades in this price realm, too. This system, which operates under CP/M, MP/M, and TurboDOS and is programmable in BASIC, COBOL, Fortran, and Pascal, gains a 6-megabyte hard disk.

Also added to the configuration of the *5000IS*—which has a keyboard containing 64 keys, 14 special-function keys, and a 19-key numeric keypad and a serial port, plus 64K of RAM, and a monochrome CRT—is a second 409K double-sided, double-density, half-height minifloppy, disk drive. It is in addition to the already-existing minifloppy and hard-disk drives.

The 16-bit 8088-based version of the *5000* system, the *5000X16*, also has a 6-megabyte hard-disk drive added to its configuration. In this configuration, it has a single 409K double-sided, double-density minifloppy-disk drive, as well as the hard disk and 256K of user memory. This system operates under MS-DOS and CP/M-86 and, since it is a micromainframe, the terminal is a user option. It is programmable in BASIC, COBOL, Fortran, and Pascal. The second upgrade to this system adds a second minifloppy to speed hard-disk backup.

The *8000X16*, which shares the same basic attributes as the *5000X16*, differs in that it has a pair of half-height, 1.2-megabyte 8-inch floppy-disk drives, rather than the 5¼-inch units. The *5000IS16*, which has the same basic mechanical attributes as the *5000IS* system, differs in that it has a 16-bit 8088 CPU and operates under MS-DOS and CP/M-86.

In its first upgrade in this price realm, this machine, with its 256K of user memory, gains a 6-megabyte hard disk for storage. This is in addition to the standard 409K, half-height, double-sided, double-density disk drive. The second upgrade adds a second half-height minifloppy drive.

Sony

The *SMC-70* small-computer system upgrades four times in this price category. In the first upgrade, the *SMC-70* gains a 5.7-megabyte hard-disk drive for data storage, while in the second, the system becomes a color computer, with an added 12-inch RGB high-resolution color monitor. The third upgrade to this system brings the capacity of the hard-disk drive to 12.1-megabytes, allowing much greater storage capability on the monochrome version of this system, while the fourth upgrade brings much greater hard-disk storage capability with the addition of the 12.1-megabyte unit to the color *SMC-70*.

Canon

The *AS100* upgrades twice in this price range. The first upgrade adds two 8-inch floppy-disk drives to the system configuration, giving the user access to four disk drives for storage and increasing system capability. The second upgrade adds two



TI's *PROFESSIONAL COMPUTER* gains a RAM disk in this price range.

8-inch floppy disk drives to the configuration of the color *AS100*.

NEC

The *PC-8800C* small-computer system upgrades in this category. The 8-inch drive version of the *PC-8800* becomes a color graphics-capable machine when a 14-inch color monitor is added that can handle 640- by 400-dot resolution and an 80-character by 25-line text display.

Fujitsu

The *Micro 16* upgrades twice in this price category. The first step adds a 20-megabyte 5¼-inch hard disk for dense, high-speed data storage and retrieval, while the second upgrade expands the user memory to a phenomenal 1 megabyte.

North Star

There are three systems that upgrade in this price category, the *Advantage 8/16*, the *Horizon* and the *Advantage*. The *Advantage 8/16*, driven by an 8-bit Z80A and a 16-bit 8088, has its mass-storage capabilities increase with an added 5-megabyte hard disk. This change gives the user access to dense high-speed data storage and retrieval capabilities. The micromainframe *Horizon* becomes a truly powerful system with an added 15-megabyte hard disk. In fact, this change gives this system potential multiuser capability. A 15-megabyte hard disk gives the *Advantage* high-density data-storage capability and brings added versatility to this system.

Durango

The powerful Durango *Poppy* upgrades twice in this price category. With the first upgrade, the small-computer system has its user memory increased to 256K. This lets the system take fuller advantage of the advanced capabilities of its powerful CPU, the 80186. With the second upgrade, the *Poppy* becomes much more fully configured. This is the addition of a 10-megabyte hard disk. When the memory size and hard disk are taken into account, this system becomes a candidate for multi-user status.

Vector Graphic

The co-processor *Vector 4/20* system upgrades as its name changes in this price category. With the addition of a 5-megabyte hard disk for increased storage capability, this system becomes the *Vector 4/30*. This change provides the user with a powerful, high-speed data storage option and increases the versatility of this system by several orders of magnitude. As the hard-disk capacity increases to 10 megabytes, the system's name becomes the *Vector 4/40*.

TeleVideo

The 16-bit *TS1602G* becomes a much more potent machine with the addition of user memory. At this point, this small-



HEWLETT-PACKARD's *HP200* features Motorola's MC68000 microprocessor.



computer system can use any of the advanced programs on the market. With an added 9.6-megabyte hard disk, the *TS802H*, a Z80A, 64K system, becomes much more potent. It now gives the user the option of truly high-density, high-speed data storage and retrieval.

Gifford Systems

A newcomer to our buyer's guide is Gifford Systems' *100/100+* series of co-processor micromainframes. Since these are micromainframes, it's up to the user to supply the terminal—although two of our listings indicate terminals and show how these change the cost parameters for these systems.

Driven by 8-bit 8085 and 16-bit 8088 CPUs, these systems are offered only with the CP/M operating system or CP/M-86, as opposed to MS-DOS. (This could prove a drawback in the 16-bit realm because the emerging standard operating system, and the one that most software is being written for, is MS-DOS.) Equipped with 64K of user memory—somewhat limited for some 16-bit applications—this system has two standard 8-inch double-sided, double-density 1.2-megabyte floppy-disk drives for storage. This makes this system very versatile. Input/output is handled via standard serial ports, to which a variety of peripherals can be interfaced.

These systems upgrade twice. The first upgrade adds 64K to the user memory, bringing it up to 128K. This makes this system more versatile and able to handle 16-bit programs more efficiently, while the second upgrade adds a terminal offered by the manufacturer.

Docutel/Olivetti

At this point, the Olivetti *M20* becomes fully configured. Actually two upgrades are included at once. With the first change, user memory is increased to 160K, making this system more versatile. The second change here adds a second 360K 5¼-inch minifloppy-disk drive.

Honeywell

This is Honeywell's first appearance in this buyer's guide with its *microSystem 6/10*. Driven by a proprietary 8-bit microprocessor—Honeywell Micro 6—teamed with an 8086, 16-bit CPU, the 6/10 has 128K of standard user memory. It works under three operating systems: MS-DOS, CP/M-86, and a proprietary system. The standard disk drive is a 5¼-inch minifloppy-disk drive for storage.

Programmable in BASIC, the 6/10 accepts this and other data input through a standard typewriter-style keyboard. The keyboard also includes a separate numeric keypad and special-function keys. User output is to a standard 12-inch monochrome CRT. Input/output chores are handled through two serial ports or one parallel port. To these ports a user can interface a variety of peripherals.

The system has a key upgrade in the upper end of this price guide with the addition of a second 5¼-inch drive.

Wang

The Wang *Professional Computer* reaches its fullest configuration with the addition of a 10-megabyte hard-disk drive. It gives the user much higher-speed data access, storage, and retrieval capabilities and increases the flexibility of this system.

Athena

This transportable microcomputer system reaches its fullest configuration in this price category. At this point, the memory capacity is increased to a full megabyte. However, much of this memory is used as a virtual or pseudo-disk for high-speed program execution.

Sanyo

A new system debuts in this price range, the *MBC 3000*, driven by dual Z80A CPU's. With two operating systems available, CP/M and the proprietary TS-DOS, this system has more than enough to handle most average applications. The disk drives available are two 8-inch double-sided, double-density floppies. Each of those drives is capable of up to 1 megabyte of storage.

Programmable in BASIC, Pascal, Fortran, and Macro-80, this system accepts this and other data input through 59 typewriter-style keys. The keyboard also features 22 programmable keys and a 18-key numeric keypad. User output is to a 12-inch monochrome display that can deliver an 80-character by 25-line text mode. Input/output is handled by two standard serial ports or an RS-423 synchronous serial port.

Toshiba

The *T250-5* system is an upgrade of the *T250* system already described. It upgrades here and becomes more versatile with an added 5-megabyte hard disk. The addition of that drive gives the user the ability to have truly high-speed, high-density data access and retrieval.

Columbia Data Products

The 16-bit *1600-4*, based on the 8088 CPU, upgrades twice. The first upgrade brings a 12-megabyte hard disk to this 128K system. Backup disk storage is provided by a 320K 5¼-inch floppy disk.

This system, which runs under MS-DOS and is programmable in BASIC and assembler, upgrades again here to 256K of user memory in the second reconfiguration.

Sord

The *M68* is this small-computer firm's top-of-the-line system. A versatile system, it is driven by a powerful MC68000 CPU, with a Z80A acting as co-processor. Running under an operating system that is CP/M-compatible, this system has 256K of user memory and two 1.2-megabyte 5¼-inch minifloppy drives for storage. This configuration is powerful enough to take advantage of the potential of this system. User input is via a typewriter-style keyboard and output is to a 12-inch monochrome CRT. Input/output is handled by two serial ports plus one parallel, and one IEEE-4888 general-purpose interface port.

IBC

The *Cadet* micromainframe uses proven 8-bit technology with a Z80 CPU. It has 64K of standard user memory and runs CP/M, MP/M and two other operating systems, MVT-FAMOS and OASIS. It is programmable in BASIC, COBOL, Fortran, and assembler. Standard disk storage is one 8-inch 1-megabyte floppy-disk drive. The terminal is a user option.

Altos

Another micromainframe that debuts here is the *ACS8000-15*. Driven by an 8-bit Z80A, it has 208K of user memory. It runs under the industry-standard CP/M operating system and has two 500K single-sided, double-density disks for storage. It is programmable in BASIC, Fortran, COBOL, and SOFTBOL and is

meant to be the basis of a multi-user system. It has six standard serial ports and one parallel port as standard. Terminal choice is up to the user.

This company's *5-15D* is another micromainframe system, that debuts here. Driven by a Z80B, this 8-bit system operates under the CP/M operating system. It has 192K of user memory and includes a 1-megabyte double-sided, double-density 5¼-inch minifloppy-disk drive for storage. Programmable in BASIC, COBOL, Pascal, Fortran, and SOFTBOL, the system uses four serial ports and one parallel port for input/output. Since it is a micromainframe—a system box with a disk drive and interface ports—the terminal choice is up to the user.

Ithaca Intersystems

Another 8-bit micromainframe—driven by a Z80B microprocessor—is the *Encore* from Ithaca Intersystems. It operates under CP/M. Standard user memory is 128K, and storage is on two 5¼-inch single-sided, double-density disk drives. Since it is a micromainframe, the choice of terminal devices is up to the user.

CompuPro

Long a leader in S-100 bus products, CompuPro's *System 816/A* also debuts here. A micromainframe small-computer system, it is driven by co-processors, an 8-bit 8085 and a 16-bit 8088 and runs under CP/M and CP/M-86. User memory is 128K and storage is handled by two 1.2-megabyte 8-inch floppy-disk drives. Since it is a micromainframe, terminal choice is up to the user, but input/output functions are handled through four serial ports and one parallel port included as standard.

DEC

The last of the four single-user microcomputer systems introduced a year and a half ago makes its debut here, the *Professional 350*. Actually an upgrade of the *Professional 325*, this system includes a larger system-unit box, that is made to accept a 5¼-inch hard-disk drive. In this version, storage is provided by a single 400K 5¼-inch minifloppy-disk drive. User memory stands at 256K, or more than enough to handle any advanced application program.

The system is driven by a proprietary 16-bit CPU, the PDP-11/238 and operates under a proprietary operating system. CP/M is available as an option. User input is via a slim-line keyboard which contains 58 typing keys. There are special-function keys and a separate 14-key numeric pad. User output is handled by an 80-character by 25-line black-and-white monochrome display, while input/output chores are handled by a serial port or an RS-423 synchronous port.

Radio Shack

The *Model III Desktop* reaches its top configuration in this price category. It becomes a full-blown business small-computer system with the addition of a 5-megabyte hard-disk drive. This allows the user high-speed, high-density data access and storage. A similarly equipped Model 4 would top out about the same price in this range, too.

A new model makes its appearance and becomes fully configured in this price category, the *Model 16*. Driven by the advanced MC68000, the *Model 16* also uses a Z80A to handle the housekeeping chores. This frees the main CPU to handle information-processing functions. Equipped with 128K of user memory, that is expandable, this system operates under a proprietary operating system. In its base configuration, it includes one double-sided, double-density 1.2-megabyte slim-line 8-inch floppy-disk drive for mass storage.

The 76-key keyboard includes a numeric keypad. Output is to a 12-inch green monochrome video-display screen that delivers an 80-character by 24-line display. Input/output is handled via two serial ports and one parallel port, included as standard. It upgrades and becomes fully configured at the upper end of this price category with the addition of a second drive 1.25-megabyte slim-line 8-inch floppy-disk drive.

R-E



The ELECTRONICS BOOK CLUB

18 years experience

Hundreds of time- and money-saving ideas for hobbyists, experimenters and technicians!



Select 6 fact-filled volumes for only \$2.95 (total value up to \$115.70)



1536
List \$13.95



1406
List \$17.95



1467
List \$16.95



1000
List \$13.95



1211
List \$14.95



1468
List \$18.95



1277
List \$19.95



1497
List \$15.95



1451
List \$18.95



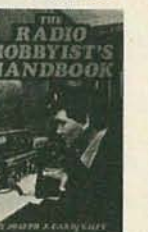
1199
List \$18.95



1062
List \$14.95



1474
List \$15.95



1346
List \$19.95



1465
List \$15.95



1332
List \$16.95



1436
List \$16.95



1473
List \$18.95



1505
List \$18.95



1296
List \$18.95



1113
List \$11.95



1276
List \$15.95



1486
List \$17.95



1160
List \$13.95



1435
List \$15.95

7 very good reasons to try Electronics Book Club

Blue Ridge Summit, PA 17214

- **Reduced Member Prices.** Save 20% to 75% on books sure to increase your know-how
- **Satisfaction Guaranteed.** All books returnable within 10 days without obligation
- **Club News Bulletins.** All about current selections—mains, alternates, extras—plus bonus offers. Comes 13 times a year with dozens of up-to-the-minute titles you can pick from
- **"Automatic Order."** Do nothing, and the Main selection will be shipped automatically! But... if you want an Alternate Selection—or no books at all—we'll follow the instructions you give on the reply form provided with every News Bulletin
- **Continuing Benefits.** Get a Dividend Certificate with every book purchased after fulfilling membership obligation, and qualify for discounts on many other volumes
- **Bonus Specials.** Take advantage of sales, events, and added-value promotions
- **Exceptional Quality.** All books are first-rate publisher's editions, filled with useful, up-to-the-minute information



ELECTRONICS BOOK CLUB

Blue Ridge Summit, PA 17214

Please accept my membership in Electronics Book Club and send the 6 volumes circled below, billing me \$2.95 plus shipping and handling charges. If not satisfied, I may return the books within ten days without obligation and have my membership cancelled. I agree to purchase 4 or more books at reduced Club prices (plus shipping/handling) during the next 12 months, and may resign any time thereafter.

1000 1062 1113 1160 1199 1211
1276 1277 1296 1332 1346 1406
1435 1436 1451 1465 1467 1468
1473 1474 1486 1497 1505 1536

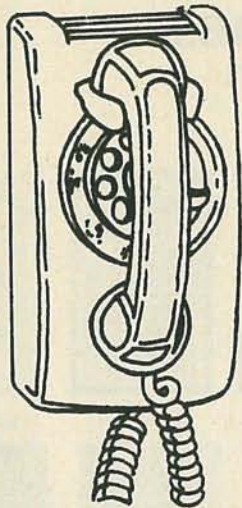
Name _____ Phone _____

Address _____

City _____

State _____ Zip _____

Valid for new members only. (Orders outside U.S. or Canada must be prepaid in International Money Orders in U.S. dollars. Canada must remit in U.S. dollars.) This order subject to acceptance by Electronics Book Club. RE-1083



**CALL NOW
AND
RESERVE
YOUR SPACE**

- 6 x rate \$550 per each insertion.
- Reaches 220,500 readers.
- Fast reader service cycle.
- Short lead time for the placement of ads.
- We typeset and layout the ad at no additional charge.

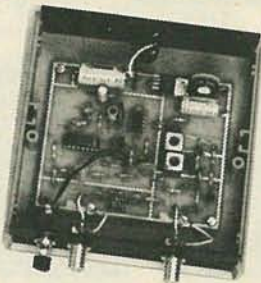
Call **212-777-6400** to reserve space. Ask for Arline Fishman. Limited number of pages available. Mail materials to: mini-ADS, RADIO-ELECTRONICS, 200 Park Ave. South, New York, NY 10003.



COVER STORY AUDIO KITS from *Radio Electronics* 5-6/78, 2/80 and 3-4/81. Our **\$89** Graphic Equalizer (.02% THD, 12 bands, 92dB S/N), **\$40** PLM-1, and **\$120** ASRU (Noise Filter/Expander increases dynamic range by 18dB) are attractive, excellent performers. Free shipping with prepaid orders. **Free catalog with lots more. SYMMETRIC SOUND SYSTEMS, 856J Lynn Rose Ct., Santa Rosa, CA 95404. (707) 546-3895.**



CONVERTERS-DESCRAMBLERS-MICROWAVES-New genuine Oak, Jerrold, Zenith, Hamlin, Sylvania, Test, Pioneer! Name it! Sine-wave, gated-sync, vari-sync, in-band, out-band. We sell 'em all! No order too big or small. Compare our prices. Send \$5.00 for new expanded catalog-now includes schematics. **TV PRODUCTS CO., 635 Park Ave. Suite 222, Idaho Falls, ID 83402.**



CABLE TV DESCRAMBLER KIT \$39.95 Computerized addressable gated sync type. We also have complete line of Jerrold and Oak cable TV converters and descramblers. Such as, Jerrold gated sync (SB-3), Oak sinewave (N12), and Jerrold 61 channel remote control converter descrambler (DRX-DIC-105). 90 day warranty. **SEND \$2.00** for "INFORMATIVE CATALOG" for prices and availability to: **J & W ELECTRONICS, INC., P.O. Box 61-X, Cumberland, RI 02864. CIRCLE 63 ON FREE INFORMATION CARD**



DESCRAMBLERS Completely assembled and tested. Compatible with ZENITH Z-TAC and SSAVI systems. No internal T.V. connections. Built in VARACTOR TUNER. **\$129.00** VISA, M/C, and C.O.D. orders accepted. **DE-CODER DISTRIBUTORS CO., 23400 Michigan Avenue, Suite 502, Dearborn Michigan, MI 48124 (313) 562-9661.** Other models available, we also ship to Canada. **CIRCLE 92 ON FREE INFORMATION CARD**

HEAR THE POWER...



SPEECH SYNTHESIZER SALE!!!—Complete plug-in module interfaces to the Apple II, II+ TRS 80 Models I, III—Commodore 64, Vic 20. Regularly **\$89.95** NOW ONLY **\$59.95** + **\$4.00** Sh/Hd. Complete and Starter Kits Available. All synthesizers include: Phrase Finder program on cassette tape and a Speech Synthesis Instruction Manual—A **\$15.00** VALUE FREE. Send check or M.O., C.O.D. Add **\$2.00**. 10 Day Money-Back Guarantee. **R.I.S.T. INC., P.O. Box 499 Dept. RE1083, Ft. Hamilton Station, Brooklyn NY 11209, (212) 259-4934. CIRCLE 96 ON FREE INFORMATION CARD**



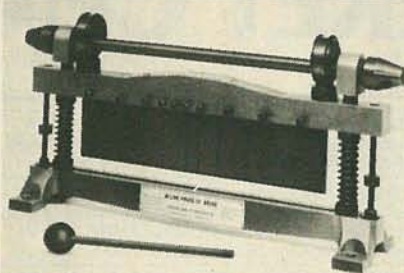
MODERN ELECTRICS. Miniature souvenir of the first publication ever produced by Gernsback Publications. This issue appeared in April 1908—just 75 years ago. You can own your own reprint of this unique first edition for just **\$2.50** plus 75¢ P&H. It's available from **R-E BOOKSTORE, Radio-Electronics, 200 Park Avenue South, New York, NY 10003**

Radio-Electronics mini-ADS



ELECTRO IMPORTING CO. CATALOG.

This reprint of the historic 176-page catalog No. 20 gives you an accurate look at the state of electronics in 1918. Contains everything from a Zinc Spark Gap to a 1000-Mile Receiving Outfit. You can get your own copy of this modern antique, profusely illustrated, for only \$4.95 plus \$1.00 P&H. Order yours from R-E BOOKSTORE, Radio-Electronics, 200 Park Avenue South, New York, NY 10003.



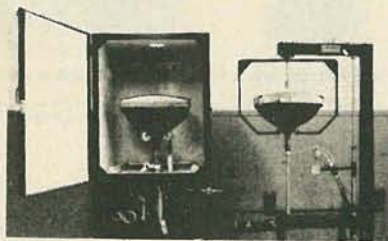
Make your own prototypes! This 14" IN-Line Press Brake is constructed of high-grade ductile iron castings and steel parts. Standard equipment includes male dies for straight or box bends from 1/2" to 14" plus a FREE urethane forming pad. Write or call for literature and prices on our SPECIAL Shear-Notcher-Brake package. **PACIFIC ONE CORP., Suite K302, 513 Superior Ave., Newport Beach, CA. 92663; (714) 645-5962.**

CIRCLE 100 ON FREE INFORMATION CARD



Introducing an **ULTRASONIC ECHO RANGING KIT** with up to 20 feet and greater ranging capabilities. May be interfaced to your microcomputer or used alone with analog output and 4 digit LCD display. Applications in Robotics, Alarms, Positioning, Level control and more. Complete kit #ERS400KD @ \$139.50. Less enclosure and LCD display #ERS400 @ \$89.50. Money orders, checks accepted. COD add 10%. **TRABAND ELECTRONICS, INC., P.O. Box 166, Clifton Heights, PA 19018 (215) 623-2700.**

CIRCLE 64 ON FREE INFORMATION CARD



ONE MAN CRT FACTORY, easy operation.

Process new or rebuild old CRT's for tv's, bus. machines, monitors, scopes, etc. Color, b&w, 20mm, foreign or domestic. 3x6 ft. space required. Profits??? Average CRT rebuilding cost — \$5. Sell for \$100 = \$95 profit; x 5 CRT's = \$475 daily; x 5 days = \$2375 weekly profit. Higher profits outside U.S.A. Investigate this opportunity today. We service the entire world. Write or call: **CRT Factory, 1909 Louise St., Crystal Lake, IL. 60014, (815) 459-0666.**

CIRCLE 84 ON FREE INFORMATION CARD



High precision **NTSC I and Q** color bar generator board. It is the main board from the Multi-dyne TS-1, a broadcast standard portable signal generator. Vectors are accurate to 1 degree and amplitudes to 1%. All pulses are derived from a 14.318180 temperature compensated crystal oscillator. The board is guaranteed for 1 year. It measures 7 3/4 x 3 3/4 and requires + and - 12 volts to produce 1 volt of video n 75 Ohms. It costs **\$198.50**. A standard 14 x 17 EIA Cross-Hatch and Dots generator board matches the RETMA linearity chart and costs \$125. Add \$4.50 for insured shipping. Checks, money orders and C.O.D. only. Other NTSC boards available. Satisfaction is guaranteed. **MULTIDYNE ELECTRONICS, P.O. Box 528, Locust Valley, N.Y. 11560, (516) 671-7278.**

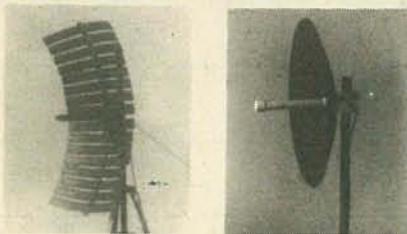
CIRCLE 17 ON FREE INFORMATION CARD.



COMPUTER/PRINTER DESK/STAND.

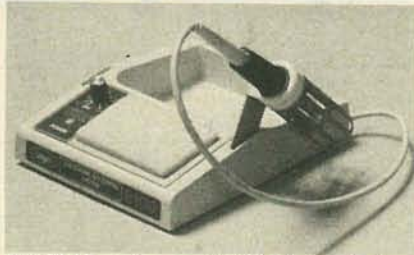
New, Surplus stand was part of a KSR Printer. Mfg. cost over \$100.00. Size; 27h x 24d x 27" w. Space for electronics. Very Rugged. Add top of your choice. Use Order No. R2A70585. Only **\$39.99, \$150.00/4!** Shipped via Truck Freight Collect. 40 pg. pictured catalog of surplus computer equipment available. **BNF Enterprises, 119 Foster Street, Peabody, MA 01960, (617) 531-5774.**

CIRCLE 98 ON FREE INFORMATION CARD



SATELLITE TV SYSTEMS FROM \$1,495.00 **AMATEUR MICROWAVE SYSTEMS FROM \$60.00** T-3 Amateur Antenna-FULL PARABOLIC DISH very high gain **\$60.00** 4 lot, **\$70.00** each. **IMPROVED M-21** Antenna, features grid style antenna and extra high gain-low noise front end. **\$115.00** 5 lot, **\$135.00** each. Amateur Systems not available to Michigan residents. **SATELLITE TV INSTALLATION MANUAL & CATALOG ONLY \$2.50.** **SATELLITE RECEIVER SYSTEMS, 33117 Gratiot Ave., Mt. Clemens, MI 48043, (313) 791-5551.**

CIRCLE 95 ON FREE INFORMATION CARD

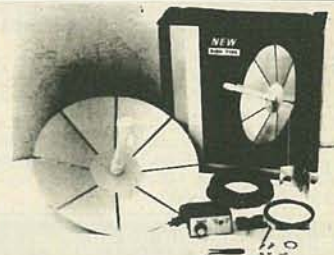


FREE! Ungar's new #9100 Electronic Temperature Controlled Soldering System with each #2000A or #4000 Desoldering System purchased Sept. 15 through Dec. 15, 1982.

For Model 2000A (for use with shop air) and a free \$91.00 system #9100, order #2091 at \$365.00 sugg.

For portable Model 4000 and a free \$91.00 System #9100, order #4091 at \$399.00 sugg. See your Ungar distributor or contact Ungar Division of Eldon Industries, Inc., P.O. Box 6005, Compton, CA 90220, (213) 774-5950, (800) 421-1538.

CIRCLE 65 ON FREE INFORMATION CARD



AMATEUR MICROWAVE RECEIVER -

Regularly **\$99.50**. Now liquidating at only **\$59.95 + \$5.00 S & H.** (Dealer ten pack just **\$499.00 F.O.B.**) Complete system includes dish, probe/downconverter, coax cables, power supply, and instructions. Top quality units. Supply limited. Money order, VISA or Mastercard ONLY. (No checks or C.O.D.) **T.V. PRODUCTS CO., 635 Park Ave., Dept. 222, Idaho Falls, Idaho 83402.** **DE-SCRAMBLERS??** We stock all types. Send \$5.00 (REFUNDABLE WITH ORDER) for new expanded catalog now including schematics.

MARKET CENTER

FOR SALE

CABLE TV products: Wireless, corded & settop converters. Send \$3.00 for catalog **ADDITIONAL OUTLET CORP.**, 231 E. Commercial Blvd., Ft. Lauderdale, FL 33334.

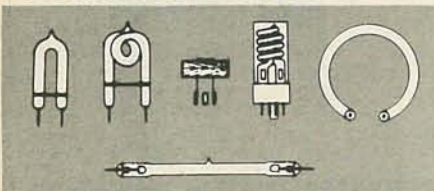
RESISTORS 1/4 & 1/2 W 5% C.F. 3 cents. 1% M.F. All values. **No minimums.** Volume discounts. Write **JR INDUSTRIES**, 5834-B Swancreek, Toledo, OH 43614.

COLOR computer VIC-20 programs hardware Rty code EPROM Programmer RS-232 **FRANK LYMAN**, Box 3091, Nashua, NH 03061.

RECORDS— tapes! Discounts to 73%; all labels; no purchase obligations; newsletter; discount dividend certificates; 100% guarantees. Free details. **DISCOUNT MUSIC CLUB**, 650 Main Street, PO Box 2000, Dept. 3-1083, New Rochelle, NY 10801.

WRITE FOR
McGEE'S
SPEAKER & ELECTRONICS CATALOG
1001 BARGAINS IN SPEAKERS
Tel.: 1 (816) 842 5092
1901 MCGEE STREET KANSAS CITY, MO. 64108

XENON FLASH LAMPS



ASK FOR OUR NEW CATALOG.
CALL OR WRITE FOR INFORMATION.

TEC/WEST (USA) INC.
10889 WILSHIRE BLVD., SUITE 740
LOS ANGELES, CA 90024-4299
CA: 213/208-5529 • OUTSIDE CA: 1-800-421-7215

PRINTED-circuit boards: single side, prototype, and quantity, quick delivery. Send positive, free quotes. **FABTRON**, Box 925, Dept. C, Columbia, TN 38401 (615) 381-1143.

RADIO West— still the best for SW/MW DX receivers and receiver modifications! Catalog 50 cents. **RADIO WEST**, 3417 Purer Road, Dept RE, Escondido, CA 92025 (619) 741-2891.

SCANNER/monitor accessories—kits and factory assembled. Free catalog. **CAPRI ELECTRONICS**, Route 1R, Canon, GA 30520.

FAST, dependable mail-order! Prime semiconductors, parts, supplies. **Free 55 page catalog.** **THE PARTSTORE**, Dept. 165, 999 44th St., Marion, IA 52302 (319) 373-1803.

RELIABLE MICROWAVE TV ANTENNAS
2.1 to 2.6 GHz
Frequency Range
34db System Gain (or Greater)

Complete System (pictured) \$119.95
Down Converter Probe Style
(Assembled & Tested) \$ 49.95
Power Supply (12V to 16V DC*)
(Assembled & Tested) \$ 39.95

PETERSON ELECTRONICS
4558 Auburn Blvd.
Sacramento, CA 95841
(916) 486-9071
SPECIAL QUANTITY PRICING
Dealers Wanted - COD'S

1 YEAR WARRANTY PARTS & LABOR

DESCRAMBLERS! Largest supply U.S.A.—Catalog \$3.00. **TV PRODUCTS CO.**, 635 Park Ave., Idaho Falls, ID 83402.

COMPUTER cables, RS232, VIC 20 and C64 cables, breakout boxes, and switch boxes. **More!** For free catalog, write **COMPUCOMM**, Box 211, South Sioux City, NE 68776.

EPROM programmer programs 2716, 2732, 2764, and 27128. For IBM PC \$225.00 each. For Apple II, ROM version \$195.00 each, diskette version \$225.00 each. Also 64K add-on RAM card for IBM PC \$140.00 each. \$3.00 ship/hndlg. Check, money order, no COD please. Quantity discount. Dealer inquiries invited. **LSG ELECTRONICS, INC.**, 3122 Hollowcreek Dr., Houston, TX 77082 (713) 558-3613.

SATELLITE, microwave, video, audio components and equipment. Send \$1.00 for 1983 catalog. **DSCo**, Department F, 3110 Evelyn Street, Roseville, MN 55113.

ELECTRONIC surveillance! Incredible manual, "Homebrew Bugging" outlines wiretapping, bugging, and other techniques used by professional operatives (schematics included)—\$15.00. We also have manuals on remote control, covert communications, survival, weaponry, exotic alarm systems, countermeasures, and an inventory of amazing electronic devices. Send \$3.00 for catalog. **A.T.I.S.**, Dept. R, 61 Gatchell St., Buffalo, NY 14212.

★ **QUALITY MICROWAVE TV SYSTEMS** ★

★ **Complete Systems From \$69⁹⁵** ★
★ **1.9 to 2.5 GHz Antennas** ★

Galaxy Electronics
6007 N. 61st Ave.
Glendale, Az. 85301
1-602-247-1151
1-800-247-1151

COD's / Dealers Wanted

To run your own classified ad, put one word on each of the lines below and send this form along with your check for \$1.90 per word (minimum 15 words) to:
Radio-Electronics, 200 Park Avenue South, N.Y., N.Y. 10003

ORDER FORM

PLEASE INDICATE in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of \$15.00.

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

Special Category: \$15.00

PLEASE PRINT EACH WORD SEPARATELY, IN BLOCK LETTERS.)

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

PLEASE INCLUDE FOR OUR FILES YOUR PERMANENT ADDRESS AND PHONE NUMBER.

CLASSIFIED COMMERCIAL RATE for firms or individuals offering commercial products or services). \$1.90 per word prepaid (no charge for zip code)...**MINIMUM 15 WORDS.** 5% discount for 6 issues, 10% for 12 issues within one year, if prepaid.

NON-COMMERCIAL RATE (for individuals who want to buy or sell a personal item) \$1.25 per word prepaid...no minimum.

ONLY FIRST WORD AND NAME set in bold caps. Additional bold face (not available as all caps) at 15¢ per word. All copy subject to publisher's approval. **ADVERTISEMENTS USING P.O. BOX ADDRESS WILL NOT BE ACCEPTED UNTIL ADVERTISER SUPPLIES PUBLISHER WITH PERMANENT ADDRESS AND PHONE NUMBER.** Copy to be in our hands on the 20th of the third month preceding the date of the issue (i.e., August issue closes May 20th). When normal closing date falls on Saturday, Sunday, or a holiday, issue closes on preceding working day.

FOR SALE

TI-99/4A software. Free price list plus newsletter. **GLEN DOBBS**, Box 801 RE, Santa Maria, CA 93456.

TROUBLESHOOT design UHF converters video accessories latest system info \$2.00. New manual \$12.95. **A&R ELECTRONICS**, PO Box 381, Dedham, MA 02026.

ALARM! Vic 20/64 CoCo Sinclair become \$1000 burglar fire system. Cassette, documentation (specify microprocessor) \$29.00. Retailers inquire. Catalog. **SKIDMORE'S H'N'S**, 716 Walker, Greensboro, NC 27403. Sinclair piano, music program cassette all hardware \$9.00.



A SINGER'S DREAM!

REMOVES VOCALS FROM RECORDS!

Our **VOCAL ELIMINATOR** can remove most or virtually all of a lead vocal from a standard stereo record and leave most of the background untouched! Record with your voice or perform live with the backgrounds. Used in Professional Performance yet connects easily to a home component stereo system. Not an equalizer! We can prove it works over the phone. Write or call for a free brochure and demo record.

Write to: **LT Sound**, Dept. R-1, PO Box 338 Stone Mountain, GA 30086
In Georgia Call (404)493-1258

TOLL FREE: 1-800-241-3005 - Ext. 72

ANTIQUE radio catalog: 16 pages of tubes, parts, and literature. Send \$1.00 to **ANTIQUE ELECTRONIC SUPPLY**, 1725 W. University, Suite No. 2, Tempe, AZ 85281.

UNUSUAL UHF subscription TV kits and other units. Catalog 50 cents. **TROJAN**, 2920 Shelby, Indianapolis, IN 46203.

VIC-20 TV-test generator cassette. Crosshatch, colorbars, dots, H&V-lines, window, 5 colored testers, 3 tones. \$9.95. **JERRY HILLIARD**, 3223 Ellis Way, Louisville, KY 40220.

ADVENT and Kloss video parts and service available from **PROFESSIONAL ELECTRONICS**. Call 504-467-1717 for further information.

COLOR computer owners—free hardware and software catalog. **SPECTRUM PROJECTS**, 93-15 86 Drive, Woodhaven, NY 11421 (212) 441-2807.

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
\$7.00 - 3rd Class • \$12.50 - 1st Class
\$25.00 - Lifetime - 3rd Class

NUTS & VOLTS
HAM GEAR
COMPUTER SOFTWARE
SCANNERS • OPTICS
TEST EQUIPMENT
MICROWAVE
SATELLITE
AUDIO VISUAL
NEW PRODUCTS
COMPONENTS • KITS
ANTIQUE ELECT.
PUBLICATIONS
PLANS • SERVICES

RELIABLE MICROWAVE TV ANTENNAS
2.1 to 2.6 GHz
Frequency Range
34db System Gain (or Greater)

COMPLETE SYSTEM
Dish Style \$ 99.95

S&W ELECTRONICS
145 North Main
Bountiful, UT 84010
(801) 295-1166

SPECIAL QUANTITY PRICING
Dealers Wanted - COD'S

2 Year Warranty
Parts & Labor

DESCRAMBLERS for downconverters, high gain. Free information. **RB ELECTRONICS**, PO Box 643, Kalamazoo, MI 49005.

PRINTED-circuit boards: Your artwork, quick delivery, reasonable. Quantity discounts. **ATLAS CIRCUITS**, Dept. A, Box 892, Lincolnton, NC 28092 (704) 753-3943.

HIGHLY PROFITABLE ONE-MAN ELECTRONIC FACTORY

Investment unnecessary, knowledge not required, sales handled by professionals. Ideal home business. Write today for facts! **Postcard will do, Barta-RE-X, Box 248, Walnut Creek, CA 94597.**

BUSINESS OPPORTUNITIES

PROJECTION TV... Make \$\$\$ assembling projectors... Easy... Results comparable to \$2500.00 projectors... Your total cost less than \$200.00. ... **Plans, lens & dealers information \$17.50.** ... Illustrated information free ... **MACROCOM-GBX**, Washington Crossing, PA 18977. Credit card orders 24 hours. (215) 736-2880.

DESCRAMBLERS! Largest supply U.S.A.—catalog \$3.00. **TV PRODUCTS CO.**, 635 Park Ave., Idaho Falls, ID 83402.

WHOLESALE MATV/CATV/VCR equipment, antennas, audio cables, adaptors, original/replacement cartridges & styli, telephone accessories, radios, cassette recorders, speakers, etc., send letterhead for free catalog (212) 897-0509 **D&WR**, 66-19 Booth, Flushing, NY 11374.

MONEY broker, commercial business loans to start, expand, etc. \$50,000 to millions. Send \$2.00 **LOREDO ENTERPRISES**, Box 2243 APO NY 09009.

MECHANICALLY inclined individuals desiring ownership of small electronics manufacturing business—without investment. Write: **BUSINESSES**, 92-R, Brighton 11th, Brooklyn, NY 11235.

LCD watches \$2.50, penwatch \$3.60, catalog \$1.00. **RELIANT ENGINEERING COMPANY**, PO Box 33610, Sheungwan, Hongkong.

MAKE additional income and have tax write-offs. Free info. Contact **DEPT. A**, PO Box 222, Harbor City, CA 90710.

SECURITY alarm industry booming. Tremendous demand. Employment—business terrific. E-Z learn. Information package \$2.00. SECURITY ELECTRONICS INTERNATIONAL, PO Box 1456-NE, Grand Rapids, MI 49501.

CB EQUIPMENT

CB radio books, kits, modifications, catalog \$1.00 refundable. **APS**, PO 263RE, Newport, RI 02840.

EPROM PROGRAMMER

FOOLPROOF. Programs 2716 through 27128; 2508 through 2564; 2815/16 eeproms! Others too! Features: Stand alone single board design. Zif eeprom sockets. Automatic duplication. Program verify. Regulated power supply—requires only power transformer. Complete documentation. A/T \$149.00 Compare! Why pay more? Manual \$2.00, refundable first order. **LUBOMIR CORPORATION**, PO Box 511, Rensselaer, NY 12144.

ROBOTIC BOOKS

ROBOTICS books—build your own robot. Write now for free catalog. **H. D. KOHN CO.**, RE2, Box 16265, Alexandria, VA 22302.

DESCRAMBLER TROUBLES

SINE wave descrambler problems? Manual includes trouble shooting, alignment, antenna hookup, improvements, theory. \$15.00. **SIGNAL**, Box 2512-R, Culver City, CA 90230.

CONVERT S/W KIT TO CABLE

CABLE sinewave descrambler from over-air. Instructions including deluxe, scrambled microwave, optional over-air, \$8.00. Manual in descrambler troubles classification, instructions, \$20.00. **SIGNAL**, Box 2512-R, Culver City, CA 90230.

SATELLITE TELEVISION

SATELLITE antennas; build or buy 8-10-12 foot wood or metal from \$43.00 send \$2.00 **PROTOTYPE ENGINEERS**, Box 1812 Deming, NM 88030.

SATELLITE TV receiver breakthrough! Build your own commercial quality receiver now! Complete instruction manual \$8.00! **XANDI**, Box 25647, Dept. 21P, Tempe, AZ 85282.

DESCRAMBLERS! Largest supply U.S.A.—catalog \$3.00. **TV PRODUCTS CO.**, 635 Park Ave., Idaho Falls, ID 83402.

SATELLITE TV system \$1295 complete! 8' antenna, polar mount, 120 LNA, receiver. Handbook and buyer's guide, \$10.00. Dealers wanted. **MICROWAVE SYSTEMS**, 1101 E. Chestnut, Santa Ana, CA 92701.

FREE! Information on 100 satellite television channels plus free catalog of proven do-it-yourself plans/kits for easy, low-cost, attractive satellite antennas. Wholesale electronics components. **GFI-5**, Box 9108, Missoula, MT 59807.

THE original Howard/Coleman TVRO receiver! Instructions, schematics, layouts, printed-circuit boards: **ROBERT COLEMAN**, Rt. 3, Box 58-ARE, Travelers Rest, SC 29690.

RECEIVE 80 channels satellite system only \$1299.00. Complete information and order forms send \$3.00 to **REMINGTON'S SATELLITE SALES**, RR2, Box 124, Noblesville, IN 46060.

SURPRISING news about satellite television: time to know the facts! Send \$1.50 **SASE** to **INFINITY ELECTRONICS**, 1378 Norvella, San Jose, CA 95122.

SEIKO TV watch—Watch TV or listen to FM stereo. Imported direct from Japan—limited supply. \$498.00 for standard model. Money back guarantee. Send check or money order or use Visa, MasterCard. Allow 4 to 6 weeks. **THE MEUNIER COMPANY**, Dept. R, PO Box 4235, Federal Way, WA 98003.

MOST comprehensive video book and manual on the market. 150 pages. All types, UHF, cable, satellite. Complete troubleshooting for Zenith systems. 24-hour COD hotline for orders. 301-668-7099 or send \$21.95 plus \$1.50 shipping to **TELE-PUBLICATIONS**, Dept. RE-10, PO Box 16693, Baltimore, MD 21206.

UHF types, all deluxe, cable units, dealers (Zenith units) excellent quantity pricing. Call (301) 882-9362. Send \$2.00 for catalog. **SATELLITE ELECTRONICS**, Dept. R-10, PO Box 9534, Baltimore, MD 21237.

INTERESTED in home satellite television—don't buy anything until you've read **Homesat Handbook & Buyer's Guide**. Our book tells everything about home satellite TV and may save you hundreds, even thousands of dollars in your selection and installation of a system. \$10.00: **H & G HOMESAT SERVICES**, Box 422, Seaford, NY 11783.

SATELLITE TV VIEWERS

Get the most complete weekly listings. Send \$1 for sample copy.

Satellite TV Week

P.O. Box 308, Fortuna, California 95540
800-358-9997 (U.S.) • 800-556-8787 (Calif.)
707-725-2476 (all others)

HOME ROBOTS

WORLD'S largest supplier of Home Robot kits/parts. Motors, seeing/hearing sensors, batteries, robot mounted computer for programming controls and playing video games. Inexpensive, easy construction. Complete kits \$99.95. Send \$3.00 (refundable with order) for information package, photos, catalog, club membership to: **ROBOT SHACK**, Department 10, PO Box 583, El Toro, CA 92630.

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

COMPUTERS

MAX* Z* tech Timex hi-tech lo-price educational programs. Dataaquis. Hardware upcoming. For samples mail \$2.00 to: **CASH PROG.**, PO Box 318R, Nfld., NJ 07435.

TI-99/4A owners. Send for free list of new and exciting, low cost software. **DYNA**, Box 124, Hicksville, NY 11801.

EDUCATION & INSTRUCTION

EARN your university degree through evaluation assessment, of existing education, experience, achievements. Call, (614) 863-1791, or write, **ASSESSMENT**, Box 13130 R, Columbus, OH 43213.

UNIVERSITY degrees by mail! Bachelors, Masters, Ph.D's... Free revealing details. **COUNSELING**, Box 317-RE10, Tustin, CA 92680.

YOUR own radio station! AM, FM, cable, licensed, unlicensed. Low cost transmitter kits. Free info. **BROADCASTING**, Box 130-F10, Paradise, CA 95969.

F.C.C. commercial radiotelephone license. Home study. Fast, inexpensive! Free details. **COMMAND**, D-91, Box 2223, San Francisco, CA 94126.

REEL TO REEL TAPES

TRUCKLOAD sale Ampex high quality open reel tape, 1800' or 2400' on 7" reels, used once. Case of 40, \$45.00. Cassettes available. **VALTECH ELECTRONICS**, Box 6-RE, Richboro, PA 18954.

CABLE TV

CHANNEL 3- 65dB super notch filter. 63.5 MHz. \$29.00 postpaid. **TV PRODUCTS**, 635 Park Ave., Idaho Falls, ID 83402.

DEALERS wanted: Channel 3 notch filters, send \$15 for sample and quantity price list. **Moneyback guarantee.** **LEE KURTZ**, 235 SW 87th Ter., Plantation, FL 33324.

LSR UHF CONVERTERS WITH AGC

GATED pulse wave (speaker box type), parts \$125.00. Sound out of the TV type: Deluxe IIB sine-wave, parts \$125.00. Digital Z-type FV-4, parts \$225.00. Quantity discounts. Plans: large SASE (54 cents postage). Free shipping/handling. I-312/267-3455. **LSR ENGINEERING**, Dept. RE, Box 6075, Chicago, IL 60680-6075.

DESCRAMBLERS — CABLE — UHF — TVRO

DESCRAMBLERS! Largest supply U.S.A.—catalog \$3.00 **TV PRODUCTS CO.**, 635 Park Ave., Idaho Falls, ID 83402.

WANTED

WANTED: old Western Electric, RCA, tubes, speakers, amplifiers. 713 7284343. **MAURY CORB**, 11122 Atwell, Houston, TX 77096.

TRANSFORMERS rewind specialist will rewind your hard to replace radio transformers, choke coils, series coils, etc. Any type. Send name and phone number to: **A.T.S.**, PO Box 13773, Orlando, FL 32859.

RADAR equipment any type, any condition needed for experimental use. Contact **A. WEINER**, 207-764-6022.

TECHNI-TOOL inc.
TOOLS—TOOL KITS
FREE CATALOG
CALL (215) 825-4990
EXPERIENCE • QUALITY • VARIETY



PLANS & KITS

CATALOG! 40 pages of neat electronics parts and kits. Send 50 cents refundable first order. **BEC ELECTRONICS**, Box 401244R, Garland, TX 75046.

FUN kits—low cost. Easy to build educational electronics projects. Handbook/catalog \$1.00. **TRIANGLE ELECTRONICS**, 89 Arkay Drive, Hauppauge, NY 11788.

PRINTED-circuit boards. Quick prototypes, production, design, reflow solder send print or description for quote to **KIT CIRCUITS**, Box 235 Clawson, MI 48017.

PROJECTION TV... Convert your TV to project 7 foot picture. Results comparable to \$2,500 projector... total cost less than \$30.00. Plans & lens \$19.95... Illustrated information free... Credit card orders 24 hours. (215) 736-3979. **MACROMA-GB**, Washington Crossing, PA 18977.

ELECTRONIC touch light control pad and other products free brochure **EXOTIC ELECTRONIC IDEAS**, PO Box 446, Lake Bluff, IL 60044.

NEW!... Repair any TV... Easy. Anyone can do it. Write: **RESEARCH**, Box 517E Brea, CA 92621.

MOST advanced sine converter descrambler available. PCB and plans \$15. **JIM RHODES**, 1025 Ransome Ln., Kingsport, TN 37660.

Mixers, Equalizers, Limiters, Pre-Amps, VCA's, Power supplies, parts, and more CATALOG

NEW AUDIO KITS

Modular design featuring plug-in construction. Design your own combination of functions. Write: **RODCAR ELECTRONIC SALES** 214-351-9895 9983 Monroe Drive Dallas, Texas 75220

CABLE TV converters and equipment. Plans and parts. Build or buy. For information send \$2.00. **C & D ELECTRONICS**, PO Box 21, Jenison, MI 49428.

SUBSCRIPTION TV out of set UHF sine wave type, PCB and plans \$16.50. In set UHF/VHF type, PCB and plans \$12.50. **RVB INDUSTRIES**, Box 663, Skokie, IL 60076.

DESCRAMBLERS! Largest supply U.S.A.—catalog \$3.00. **TV PRODUCTS CO.**, 635 Park Ave., Idaho Falls, ID 83402.

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

CABLE TV descrambler kits plans \$4.00. For information send \$2.00. **DOMCAN ELECTRONICS**, PO Box 605, Downsview A Downsview, Ontario, Canada M3M3A9.

UP-TO-DATE design electronics kits. High quality. Unbelievable low price. Absolutely free catalog. **INTERNATIONAL POLYTECHNIQUES**, PO Box 862R, New York, NY 10002.

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

DAGE SCIENTIFIC INSTRUMENTS
BOX 144 VALLEY SPRINGS CA 95252

SPIRIT life energy detector and separator complete plans \$4.00. **PO 893**, Torrance, Ca 90508.

SAVE! Build your own cable TV converter. Complete manual \$3.00. **JKA ENTERPRISES**, Box 234, Lyman, SC 29365.

MICROWAVE television "downconverters". Exclusive new five stage design. Easily assembled. Catalog: \$2.00 (refundable). **NDS**, Box 12652-R, Dallas, TX 75225.

PROGRAM your own EPROMS. Build a computerized thermostat. Send SASE for free details. **GLOVATRON**, PO Box 559, East Detroit, MI 48021.

DESCRAMBLERS

AMERICAN—CANADIAN

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 **74.95**

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.

FALL SPECIAL
Buy 1 kit
Get 2nd kit
at 1/2 price
Offer ends 10/1/83

J & D ENGINEERING
P.O. Box 6099
Falmouth, Maine 04105

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

TOP-quality imported, domestic kits, surplus electronics, IC's, free catalog. **TEKTRONIX**, 175 Fifth Ave., Suite 3194, NY, NY 10010.

200 electronics kits, projects, plans. Send stamp for list. **MATCO ELECTRONICS**, Box 316R, Cadillac, MI 49601.

"IN band" descrambler for cable ready television sets (except Zenith) \$139.95. Kits \$99.95. Info? **SASE. ALLSEN ELECTRONICS**, Box 2125, Vero Beach, FL 32960.

RF MODULATORS for the video industry

Satellite modulators from channel 2 thru UHF! Kits & assembled models for all Microcomputers...including our new Apple-verter designed to mount inside computer. Also an extensive line of monitors, cameras and kits. **FREE CATALOG**

PHONE (402) 967-3771
ATV Research
13-RE BROADWAY
DAKOTA CITY, NE 68731

CABLE TV descramblers. For plans send \$3.00 + SASE. **ELECTRA**, 610 Brasted Pl., Waukesha, WI 53186.

TELEPHONE recording control kit. Records incoming/outgoing calls automatically. Connect to your telephone and tape recorder. Easy assembly with case. \$16.95 kit. \$20.50 assembled. Includes shipping. Guaranteed. **CREATIVE ELECTRONICS**, PO Box 4253, Thousand Oaks, CA 91360.

BUILD this electronic-tone circuit to replace that harsh telephone ringer. Gives soft tones, chirps, beeps, and buzzes with simple dipswitch settings. Fully explained schematic and creative suggestions included. Questions answered same day. **PROFESSIONAL CIRCUITS UNLIMITED**, 3509 Park Lane, Suite 1032, Midland, TX 79703. \$5.30.

LEARN copying secrets Atari Vectrex game cartridges includes schematics \$19.95. **ATOMIC COMPUTERS**, PO Box 177, Dyer, IN 46311.

HI-FI speaker kits, auto speaker systems and raw drivers from the world's finest manufacturers. For beginners or experts. Free literature. **A&S SPEAKERS**, Box 7462R, Denver, CO 80207 (303) 399-8609.

LIGHT chaser/color organ kits, rack mount units. 20% off sale. **DESIGN SPECIALTY**, PO Box 1995, Huntington Beach, CA 92647.

CATALOG: Hobby, CB, Broadcasting. Linear, transmitters, bugging devices, scramblers, downconverters, much more. \$1.00 (refundable). **PANAXIS**, Box 130-F10, Paradise, CA 95969.

STOP

LOOKING FOR RESISTORS, CAPACITORS, DIODES, METERS HARDWARE, CONTROLS, POWER RESISTORS, TRANSISTORS, IC'S, TRANSFORMERS, FUSES, KITS, LED'S, CABINETS. SEND \$1.00 (REFUNDABLE) FOR OUR CATALOG OF OVER 1200 ITEMS OR SEND A STAMP FOR OUR FLYER. 24 HOUR TURN AROUND TIME - LOW PRICES - 100% GUARANTEE

Dayapro Electronics, Inc.

3029 N. WILSHIRE LN., ARLINGTON HTS., ILL. 60004
312-870-0555

MAKE RADIO SHACK YOUR PARTS PLACE™

Wide Selection! Low Prices! "Hometown" Shopping!

Versatile New ICs

Low As **159**

TCM5089 Telephone Tone-Dialing Generator. Accurate dual-tone output with low THD. Micro-processor addressable—ideal for use in an auto-dial modem. Line or 9 VDC. 16-pin DIP with data. 276-1301 3.99

ICL7660 Voltage Converter IC. Input: +5 VDC. Output: -5 VDC, up to 10 mA. Ideal for memory circuits. 8-pin DIP with data. 276-2335 3.79

MC3423 Overvoltage Sensor IC. Protects sensitive electronic circuitry by triggering an external LED or crowbar SCR in the event of line transients or loss of regulation. Usable from 4.5 to 40 VDC. 8-pin DIP with data. 276-1717 5.99

10 x 10cm Solar Cell



Harness "Free" Power That's Available Every Sunny Day

Save **\$807**

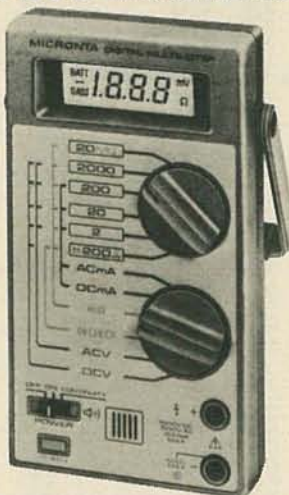
Reg. 17.95 **988**

Cut 45%. Build a panel for charging batteries or powering projects. This quality cell, approximately 4" square, produces 0.42 VDC at 2 amps in full sun. Wire several in series for more voltage. 276-128 Sale 9.88

21-Range LCD Multimeter

\$20 Off!

Reg. 59.95 **3995**

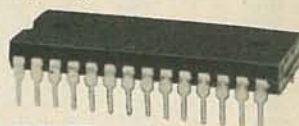


Audible Continuity & Range-Change Indicator

Reduced 33%! Time-saving continuity function "beeps" at less than 300 ohms circuit resistance. "Diode check" allows testing of diodes and transistors. Measures AC and DC voltage, AC and DC current, and resistance up to 20 megohms. Overload protected. 6³/₈ x 3¹/₂ x 1³/₈". With manual, spare fuse, test leads. Requires two "AA" batteries. 22-191 Sale 39.95

Melody Synthesizer

NEW!
599



28-Pin DIP

AY-3-1350 Melody Synthesizer. 28 built-in tunes! NMOS device is ideal for doorbells and musical funboxes. Pre-programmed with Toccata, William Tell, Yankee Doodle, Blue Danube, Star Wars, America, Beethoven's 5th, other pop and classical favorites. Or add a PROM and create your own. Auto switch-off at end of tune. With data. 276-1782 5.99

Universal Breadboard

NEW!
1995



This 2¹/₄ x 6¹/₂" builder's board is mounted on a 7 x 4" "stay-put" steel base with rubber feet. Accepts DIPs, discrete components and up to 22-gauge wire. Total of 640 plug-in tie points. 3 binding posts for power hookup, etc. 276-169 19.95



Universal PC Board
NEW! 195

Accepts ICs up to 40 pins. Total of 750 indexed holes with solder rings, two busses, one grounding strip. Mounting holes at corners. 3³/₈ x 2⁷/₈". 276-168 1.95

Sealant Tape



NEW!
249

Waterproof, non-corrosive, stays flexible. Ideal for outdoor antenna connections. 5 ft. x 1/2". 278-1645 2.49

Coax Stripper

NEW!
995



Adjustable blades for perfect stripping of RG-6, RG58, RG8M, RG62 and other cables from 3/16 to 9/16" dia. 278-240 9.95

PC Board Spacers

NEW!
69¢ Pkg. of 8



Nylon type, mount PC boards 9/8" from chassis or enclosure. Snap into place. 270-1391 Set, 69¢



Lighted Switch
NEW! 495

120VAC SPDT Push-On/ Push-Off. Contacts: 3A at 120 VAC. Lamp requires 12 volts, AC or DC. Mounts in 1/2" diameter hole. 275-676 4.95

Power Cable



18-Gauge **329**

Two-conductor, color-coded cable is ideal for many uses. 25 feet. 278-1250 3.29

Cable Clips

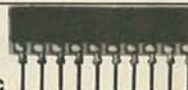
NEW!
199



Keeps cables up to 3/8" dia. in place. Adhere to smooth, non-porous surfaces, indoors or out. 278-1640 Pkg. of 10/1.99

Resistor Networks

NEW! 89¢



Five separate 1/4-watt resistors in one package. Ideal for LED current limiting and digital circuits.

Ohms	Cat. No.	Each
470	271-095	.89
1000	271-096	.89
10k	271-097	.89

Transient Protector



149

V8ZA1. This MOV (metal oxide varistor) protects circuits operating at 5 VDC and below. Absorbs potentially damaging voltage transients. 276-569 1.49

Keep Up With New Developments



349

From Texas Instruments Learning Center

295



Understanding Telephone Electronics. Learn how your phone works and read about the impact electronics is making on telephone systems. Illustrated. 256 pages. 62-1388 3.49

Understanding Communications Systems. Covers the basics of electronic communications—telephone, television, facsimile, data links and more. Illustrated. 256 pages. 62-2018 2.95

"Jumbo" Neon Lamp

NEW! 199



Each Pilot lights that can't be overlooked! Require 9/8" diameter mounting hole.

Color	Cat. No.	Each
Red	272-710	1.99
Green	272-711	1.99

Miniature 4PDT Relay



Cut 26%
Reg. 4.69 **349**

Switches up to four circuits! Contacts: 3A at 125 VAC. 120VAC coil. PC or socket mounting. 1³/₈ x 1¹/₈ x 1³/₈". 275-212 Sale 3.49

Ferrite Beads

NEW!
89¢ Pkg. of 10



For EMI/RFI Reduction Install over insulated wires or component leads to reduce RFI and stabilize circuits. Diameter of hole: 0.7mm. BF40 material. 273-098 Pkg. of 10/89¢

Radio Shack®

A DIVISION OF TANDY CORPORATION • OVER 8600 LOCATIONS WORLDWIDE

Prices apply at participating Radio Shack stores and dealers

CIRCLE 86 ON FREE INFORMATION CARD

7400

*Number of Pins at each I.C. for easy Socket purchase

Part No.	**Pins	Part No.	**Pins	Part No.	**Pins
SN7400N	14	SN7472N	14	SN74156N	16
SN7401N	14	SN7473N	14	SN74157N	16
SN7402N	14	SN7474N	14	SN74158N	16
SN7403N	14	SN7475N	14	SN74159N	16
SN7404N	14	SN7476N	14	SN74160N	16
SN7405N	14	SN7477N	14	SN74161N	16
SN7406N	14	SN7478N	14	SN74162N	16
SN7407N	14	SN7479N	14	SN74163N	16
SN7408N	14	SN7480N	14	SN74164N	16
SN7409N	14	SN7481N	14	SN74165N	16
SN7410N	14	SN7482N	14	SN74166N	16
SN7411N	14	SN7483N	14	SN74167N	16
SN7412N	14	SN7484N	14	SN74168N	16
SN7413N	14	SN7485N	14	SN74169N	16
SN7414N	14	SN7486N	14	SN74170N	16
SN7415N	14	SN7487N	14	SN74171N	16
SN7416N	14	SN7488N	14	SN74172N	16
SN7417N	14	SN7489N	14	SN74173N	16
SN7418N	14	SN7490N	14	SN74174N	16
SN7419N	14	SN7491N	14	SN74175N	16
SN7420N	14	SN7492N	14	SN74176N	16
SN7421N	14	SN7493N	14	SN74177N	16
SN7422N	14	SN7494N	14	SN74178N	16
SN7423N	14	SN7495N	14	SN74179N	16
SN7424N	14	SN7496N	14	SN74180N	16
SN7425N	14	SN7497N	14	SN74181N	16
SN7426N	14	SN7498N	14	SN74182N	16
SN7427N	14	SN7499N	14	SN74183N	16
SN7428N	14	SN7500N	14	SN74184N	16
SN7429N	14	SN7501N	14	SN74185N	16
SN7430N	14	SN7502N	14	SN74186N	16
SN7431N	14	SN7503N	14	SN74187N	16
SN7432N	14	SN7504N	14	SN74188N	16
SN7433N	14	SN7505N	14	SN74189N	16
SN7434N	14	SN7506N	14	SN74190N	16
SN7435N	14	SN7507N	14	SN74191N	16
SN7436N	14	SN7508N	14	SN74192N	16
SN7437N	14	SN7509N	14	SN74193N	16
SN7438N	14	SN7510N	14	SN74194N	16
SN7439N	14	SN7511N	14	SN74195N	16
SN7440N	14	SN7512N	14	SN74196N	16
SN7441N	14	SN7513N	14	SN74197N	16
SN7442N	14	SN7514N	14	SN74198N	16
SN7443N	14	SN7515N	14	SN74199N	16
SN7444N	14	SN7516N	14	SN74200N	16
SN7445N	14	SN7517N	14	SN74201N	16
SN7446N	14	SN7518N	14	SN74202N	16
SN7447N	14	SN7519N	14	SN74203N	16
SN7448N	14	SN7520N	14	SN74204N	16
SN7449N	14	SN7521N	14	SN74205N	16
SN7450N	14	SN7522N	14	SN74206N	16
SN7451N	14	SN7523N	14	SN74207N	16
SN7452N	14	SN7524N	14	SN74208N	16
SN7453N	14	SN7525N	14	SN74209N	16
SN7454N	14	SN7526N	14	SN74210N	16
SN7455N	14	SN7527N	14	SN74211N	16
SN7456N	14	SN7528N	14	SN74212N	16
SN7457N	14	SN7529N	14	SN74213N	16
SN7458N	14	SN7530N	14	SN74214N	16
SN7459N	14	SN7531N	14	SN74215N	16
SN7460N	14	SN7532N	14	SN74216N	16
SN7470N	14	SN7533N	14	SN74217N	16

74LS

Part No.	**Pins	Part No.	**Pins	Part No.	**Pins
74LS00	14	74LS192	14	74LS193	16
74LS01	14	74LS193	16	74LS194	16
74LS02	14	74LS194	16	74LS195	16
74LS03	14	74LS195	16	74LS196	16
74LS04	14	74LS196	16	74LS197	16
74LS05	14	74LS197	16	74LS198	16
74LS06	14	74LS198	16	74LS199	16
74LS07	14	74LS199	16	74LS200	16
74LS08	14	74LS200	16	74LS201	16
74LS09	14	74LS201	16	74LS202	16
74LS10	14	74LS202	16	74LS203	16
74LS11	14	74LS203	16	74LS204	16
74LS12	14	74LS204	16	74LS205	16
74LS13	14	74LS205	16	74LS206	16
74LS14	14	74LS206	16	74LS207	16
74LS15	14	74LS207	16	74LS208	16
74LS16	14	74LS208	16	74LS209	16
74LS17	14	74LS209	16	74LS210	16
74LS18	14	74LS210	16	74LS211	16
74LS19	14	74LS211	16	74LS212	16
74LS20	14	74LS212	16	74LS213	16
74LS21	14	74LS213	16	74LS214	16
74LS22	14	74LS214	16	74LS215	16
74LS23	14	74LS215	16	74LS216	16
74LS24	14	74LS216	16	74LS217	16
74LS25	14	74LS217	16	74LS218	16
74LS26	14	74LS218	16	74LS219	16
74LS27	14	74LS219	16	74LS220	16
74LS28	14	74LS220	16	74LS221	16
74LS29	14	74LS221	16	74LS222	16
74LS30	14	74LS222	16	74LS223	16
74LS31	14	74LS223	16	74LS224	16
74LS32	14	74LS224	16	74LS225	16
74LS33	14	74LS225	16	74LS226	16
74LS34	14	74LS226	16	74LS227	16
74LS35	14	74LS227	16	74LS228	16
74LS36	14	74LS228	16	74LS229	16
74LS37	14	74LS229	16	74LS230	16
74LS38	14	74LS230	16	74LS231	16
74LS39	14	74LS231	16	74LS232	16
74LS40	14	74LS232	16	74LS233	16
74LS41	14	74LS233	16	74LS234	16
74LS42	14	74LS234	16	74LS235	16
74LS43	14	74LS235	16	74LS236	16
74LS44	14	74LS236	16	74LS237	16
74LS45	14	74LS237	16	74LS238	16
74LS46	14	74LS238	16	74LS239	16
74LS47	14	74LS239	16	74LS240	16
74LS48	14	74LS240	16	74LS241	16
74LS49	14	74LS241	16	74LS242	16
74LS50	14	74LS242	16	74LS243	16
74LS51	14	74LS243	16	74LS244	16
74LS52	14	74LS244	16	74LS245	16
74LS53	14	74LS245	16	74LS246	16
74LS54	14	74LS246	16	74LS247	16
74LS55	14	74LS247	16	74LS248	16
74LS56	14	74LS248	16	74LS249	16
74LS57	14	74LS249	16	74LS250	16
74LS58	14	74LS250	16	74LS251	16
74LS59	14	74LS251	16	74LS252	16
74LS60	14	74LS252	16	74LS253	16
74LS61	14	74LS253	16	74LS254	16
74LS62	14	74LS254	16	74LS255	16
74LS63	14	74LS255	16	74LS256	16
74LS64	14	74LS256	16	74LS257	16
74LS65	14	74LS257	16	74LS258	16
74LS66	14	74LS258	16	74LS259	16
74LS67	14	74LS259	16	74LS260	16
74LS68	14	74LS260	16	74LS261	16
74LS69	14	74LS261	16	74LS262	16
74LS70	14	74LS262	16	74LS263	16
74LS71	14	74LS263	16	74LS264	16
74LS72	14	74LS264	16	74LS265	16
74LS73	14	74LS265	16	74LS266	16
74LS74	14	74LS266	16	74LS267	16
74LS75	14	74LS267	16	74LS268	16
74LS76	14	74LS268	16	74LS269	16
74LS77	14	74LS269	16	74LS270	16
74LS78	14	74LS270	16	74LS271	16
74LS79	14	74LS271	16	74LS272	16
74LS80	14	74LS272	16	74LS273	16
74LS81	14	74LS273	16	74LS274	16
74LS82	14	74LS274	16	74LS275	16
74LS83	14	74LS275	16	74LS276	16
74LS84	14	74LS276	16	74LS277	16
74LS85	14	74LS277	16	74LS278	16
74LS86	14	74LS278	16	74LS279	16
74LS87	14	74LS279	16	74LS280	16
74LS88	14	74LS280	16	74LS281	16
74LS89	14	74LS281	16	74LS282	16
74LS90	14	74LS282	16	74LS283	16
74LS91	14	74LS283	16	74LS284	16
74LS92	14	74LS284	16	74LS285	16
74LS93	14	74LS285	16	74LS286	16
74LS94	14	74LS286	16	74LS287	16
74LS95	14	74LS287	16	74LS288	16
74LS96	14	74LS288	16	74LS289	16
74LS97	14	74LS289	16	74LS290	16
74LS98	14	74LS290	16	74LS291	16
74LS99	14	74LS291	16	74LS292	16
74LS100	14	74LS292	16	74LS293	16

74S/PROMS*

Part No.	**Pins	Part No.	**Pins	Part No.	**Pins
74S00	14	74S24	14	74S25	14
74S01	14	74S25	14	74S26	14
74S02	14	74S26	14	74S27	14
74S03	14	74S27	14	74S28	14
74S04	14	74S28	14	74S29	14
74S05	14	74S29	14	74S30	14
74S06	14	74S30	14	74S31	14
74S07	14	74S31	14	74S32	14
74S08	14	74S32	14	74S33	14
74S09	14	74S33	14	74S34	14
74S10	14	74S34	14	74S35	14
74S11	14	74S35	14	74S36	14
74S12	14	74S36	14	74S37	14
74S13	14	74S37	14	74S38	14
74S14	14	74S38	14	74S39	14
74S15	14	74S39	14	74S40	14
74S16	14	74S40	14	74S41	14
74S17	14	74S41	14	74S42	14
74S18	14	74S42	14	74S43	14
74S19	14	74S43	14	74S44	14
74S20	14	74S44	14	74S45	14
74S21	14	74S45	14	74S46	14
74S22	14	74S46	14	74S47	14
74S23	14	74S47	14	74S48	14
74S24	14	74S48	14	74S49	14
74S25	14	74S49	14	74S50	14
74S26	14	74S50	14	74S51	14
74S27	14	74S51	14	74S52	14
74S28	14	74S52	14	74S53	14
74S29	14	74S53	14	74S54	14
74S30	14	74S54	14	74S55	14
74S31	14	74S55	14	74S56	14
74S32	14	74S56	14	74S57	14
74S33	14	74S57	14	74S58	14
74S34	14	74S58	14	74S59	14
74S35	14	74S59	14	74S60	14
74S36	14	74S60	14	74S61	14
74S37	14	74S61	14	74S62	14
74S38	14	74S62	14	74S63	14
74S39	14	74S63	14	74S64	14



COMPUTER-PERIPHERAL SWITCHERS

Connect any number of peripherals to a single I/O port — use a single printer to support several microcomputers — use two or more printers to support a single microcomputer — access a modem from any of several microcomputers — ideal for demonstrating or comparing equipment. The Selecto-Switchers are designed to eliminate the unnecessary plugging & unplugging of cables which connect printers, terminals, or modems to various computers. By using a Selecto-Switch, you achieve more efficient system operation, better utilization of peripherals & computer ports, eliminate redundant hardware & reduce service calls. 5 yr. limited warranty on all Selecto-Switchers. No power required. Size (inches): 5.75" W x 3.125" H.

RS232 SERIAL SELECTO-SWITCH

Switches all lines of asynchronous data • Easy expansion of serial ports • Connectors are female DB25 type

PART NO.	DESCRIPTION	PRICE
GRS232-AB	2-Way Switch	\$139.95
GRS232-ABC	3-Way Switch	\$179.95

DB25 PARALLEL SELECTO-SWITCH

TRS-80, Apple, and IBM compatible • Switches 24 lines (line 1 is ground) • Connectors are female DB25 type

PART NO.	DESCRIPTION	PRICE
GP24-AB	2-Way Switch	\$139.95
GP24-ABC	3-Way Switch	\$179.95

CENTRONICS-STYLE SELECTO-SWITCH

Switches all 36 lines • Connectors are female Centronics

PART NO.	DESCRIPTION	PRICE
GCENT-AB	2-Way Switch	\$199.95
GCENT-ABC	3-Way Switch	\$229.95

Micro-Logic Corp. MICRO-CHARTS

Fully decoded data • Instant access • 2-sided, totally comprehensive • Compact 8 1/2" x 11" in. durable credit card plastic • Perfect for programmers & engineers • Clear & concise tables for full instruction set, disassembly, ASCII, base conversion, effect of flags, compare vs. jump, interrupt structure, pinout, cycle times, diagrams, bug notes, & much more.

PART NO.	REFERENCE	PRICE
ML-Z80	Z80 CPU	\$5.95
ML-8080A	8080A/8085A	\$5.95
ML-6502	6502 (65XX)	\$5.95
ML-8048	8048, Relatives	\$5.95
ML-7400	5400/7400 TTL Pin-Outs	\$5.95

BOOKS

30001	National CMOS Data Book (1981) (640 pages) 74C, CD4000, and A/D Converters	\$6.95
30003	National Linear Data Book (1982) (1376 pages) LM, LF, ADC, DAC, LH Series	\$11.95
30008	National Memory Data Book (1980) (464 pages) RAMs, ROMs, PROMs, EPROMs Series	\$6.95
30009	Intell Data Book (1983) (1356 pages) Complete line.	\$9.95
30010	National Audio/Radio Handbook (1980) (240 pages) Pre-Amps, AM, FM & FM Stereo, Power Amps	\$5.95
30011	National Linear Application Handbook (1980) (736 pages) Application Notes, Linear Briefs, etc.	\$15.95
30012	National PAL Data Book (1982) (176 pages) Application Notes, Linear Briefs, etc.	\$5.95
30013	Zilog Data Book (1983) (641 pages) Microprocessors and Support Chips	\$7.95
210830	Intel Memory Components Handbook (1983) (798 pages) Contains all Application Notes, Article Reprints, Data Sheets, and other design information on Intel's RAMs, EPROMs, & Bubble Memories.	\$14.95
210844	Intel Microprocessor & Peripheral Handbook (1983) (1027 pages) Contains Data Sheets on all of Intel's Microprocessors and Peripherals.	\$14.95

ATARI

ATARI PADDLES
JSP (2) \$2.95 pair

ATARI DRIVER
JSD (1) \$2.95 ea.

TV GAME SWITCH
Used on Atari. Cosmetically blemished. 100% functional.
TGS-1 \$1.95 ea.

Jameco Digital Thermometer Kit

Dual sensors — switch controls for indoor/outdoor or dual monitoring — can be extended to 500 feet. Continuous LED 8" h. display. Range: -40°F to 199°F, -40°C to 100°C. Accuracy: ±1 Fahrenheit. Calibrates for Fahrenheit/Celsius. Simulated walnut case. AC wall adapter included. Size: 6 1/2" L x 3 1/4" W x 1 1/2" H.

JE300 \$39.95

Universal Computer Keyboard Enclosures

DTE-8 Panel Width 7.5" \$24.95
 DTE-11 Panel Width 10.13" \$27.95
 DTE-14 Panel Width 13.5" \$29.95
 DTE-20 Panel Width 19.25" \$34.95

ACCESSORIES FOR APPLE* COMPUTERS

Numeric/Auxiliary Keypad for APPLE IIe*

Computer Ready

The JE614 is a newly introduced numeric/auxiliary keypad for the APPLE IIe. It offers the flexibility of a 24-key pad and the convenience of 23 directly accessible functions. Streamlined functions make menu editing a snap and screen scrolling makes the keypad ideal for "VisiCalc" users. The JE614 keypad is housed in a durable metal enclosure and is color-coordinated with your APPLE IIe computer. Operation of the keypad will begin within minutes from unboxing. General functions include Home, Clear, Clear to End of Screen, Scroll-Up, Scroll-Down, Tab, Delete, Left, Right, Up, and Down. Each key has a sub-function.

JE614 Assembled and Tested \$89.95

Extended 80 Column/64K RAM Card for APPLE IIe*

JE664

Now you can double the memory capacity and get an 80 column display format for your APPLE IIe computer at an attractive price. Just plug the JE664 card into your APPLE IIe and expand your display to 80 characters per line. Perfect for word processing. The JE664 also features 64K bytes of additional memory to allow programming not possible with standard APPLE IIe computers.

JE664 Assembled and Tested \$169.95

Switching Power Supply for APPLE II, II+ and IIe*

Can drive four floppy disk drives and up to eight expansion cards • Overload and overheat protection • Full range digital controller • Fully regulated: 5V @ 5A, 12V @ 3A, 30V @ 1A, 120V @ 5A • Fully regulated power and regulated (line 91.1, 100, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190, 195, 200, 205, 210, 215, 220, 225, 230, 235, 240, 245, 250, 255, 260, 265, 270, 275, 280, 285, 290, 295, 300, 305, 310, 315, 320, 325, 330, 335, 340, 345, 350, 355, 360, 365, 370, 375, 380, 385, 390, 395, 400, 405, 410, 415, 420, 425, 430, 435, 440, 445, 450, 455, 460, 465, 470, 475, 480, 485, 490, 495, 500, 505, 510, 515, 520, 525, 530, 535, 540, 545, 550, 555, 560, 565, 570, 575, 580, 585, 590, 595, 600, 605, 610, 615, 620, 625, 630, 635, 640, 645, 650, 655, 660, 665, 670, 675, 680, 685, 690, 695, 700, 705, 710, 715, 720, 725, 730, 735, 740, 745, 750, 755, 760, 765, 770, 775, 780, 785, 790, 795, 800, 805, 810, 815, 820, 825, 830, 835, 840, 845, 850, 855, 860, 865, 870, 875, 880, 885, 890, 895, 900, 905, 910, 915, 920, 925, 930, 935, 940, 945, 950, 955, 960, 965, 970, 975, 980, 985, 990, 995, 1000, 1005, 1010, 1015, 1020, 1025, 1030, 1035, 1040, 1045, 1050, 1055, 1060, 1065, 1070, 1075, 1080, 1085, 1090, 1095, 1100, 1105, 1110, 1115, 1120, 1125, 1130, 1135, 1140, 1145, 1150, 1155, 1160, 1165, 1170, 1175, 1180, 1185, 1190, 1195, 1200, 1205, 1210, 1215, 1220, 1225, 1230, 1235, 1240, 1245, 1250, 1255, 1260, 1265, 1270, 1275, 1280, 1285, 1290, 1295, 1300, 1305, 1310, 1315, 1320, 1325, 1330, 1335, 1340, 1345, 1350, 1355, 1360, 1365, 1370, 1375, 1380, 1385, 1390, 1395, 1400, 1405, 1410, 1415, 1420, 1425, 1430, 1435, 1440, 1445, 1450, 1455, 1460, 1465, 1470, 1475, 1480, 1485, 1490, 1495, 1500, 1505, 1510, 1515, 1520, 1525, 1530, 1535, 1540, 1545, 1550, 1555, 1560, 1565, 1570, 1575, 1580, 1585, 1590, 1595, 1600, 1605, 1610, 1615, 1620, 1625, 1630, 1635, 1640, 1645, 1650, 1655, 1660, 1665, 1670, 1675, 1680, 1685, 1690, 1695, 1700, 1705, 1710, 1715, 1720, 1725, 1730, 1735, 1740, 1745, 1750, 1755, 1760, 1765, 1770, 1775, 1780, 1785, 1790, 1795, 1800, 1805, 1810, 1815, 1820, 1825, 1830, 1835, 1840, 1845, 1850, 1855, 1860, 1865, 1870, 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910, 1915, 1920, 1925, 1930, 1935, 1940, 1945, 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015, 2020, 2025, 2030, 2035, 2040, 2045, 2050, 2055, 2060, 2065, 2070, 2075, 2080, 2085, 2090, 2095, 2100, 2105, 2110, 2115, 2120, 2125, 2130, 2135, 2140, 2145, 2150, 2155, 2160, 2165, 2170, 2175, 2180, 2185, 2190, 2195, 2200, 2205, 2210, 2215, 2220, 2225, 2230, 2235, 2240, 2245, 2250, 2255, 2260, 2265, 2270, 2275, 2280, 2285, 2290, 2295, 2300, 2305, 2310, 2315, 2320, 2325, 2330, 2335, 2340, 2345, 2350, 2355, 2360, 2365, 2370, 2375, 2380, 2385, 2390, 2395, 2400, 2405, 2410, 2415, 2420, 2425, 2430, 2435, 2440, 2445, 2450, 2455, 2460, 2465, 2470, 2475, 2480, 2485, 2490, 2495, 2500, 2505, 2510, 2515, 2520, 2525, 2530, 2535, 2540, 2545, 2550, 2555, 2560, 2565, 2570, 2575, 2580, 2585, 2590, 2595, 2600, 2605, 2610, 2615, 2620, 2625, 2630, 2635, 2640, 2645, 2650, 2655, 2660, 2665, 2670, 2675, 2680, 2685, 2690, 2695, 2700, 2705, 2710, 2715, 2720, 2725, 2730, 2735, 2740, 2745, 2750, 2755, 2760, 2765, 2770, 2775, 2780, 2785, 2790, 2795, 2800, 2805, 2810, 2815, 2820, 2825, 2830, 2835, 2840, 2845, 2850, 2855, 2860, 2865, 2870, 2875, 2880, 2885, 2890, 2895, 2900, 2905, 2910, 2915, 2920, 2925, 2930, 2935, 2940, 2945, 2950, 2955, 2960, 2965, 2970, 2975, 2980, 2985, 2990, 2995, 3000, 3005, 3010, 3015, 3020, 3025, 3030, 3035, 3040, 3045, 3050, 3055, 3060, 3065, 3070, 3075, 3080, 3085, 3090, 3095, 3100, 3105, 3110, 3115, 3120, 3125, 3130, 3135, 3140, 3145, 3150, 3155, 3160, 3165, 3170, 3175, 3180, 3185, 3190, 3195, 3200, 3205, 3210, 3215, 3220, 3225, 3230, 3235, 3240, 3245, 3250, 3255, 3260, 3265, 3270, 3275, 3280, 3285, 3290, 3295, 3300, 3305, 3310, 3315, 3320, 3325, 3330, 3335, 3340, 3345, 3350, 3355, 3360, 3365, 3370, 3375, 3380, 3385, 3390, 3395, 3400, 3405, 3410, 3415, 3420, 3425, 3430, 3435, 3440, 3445, 3450, 3455, 3460, 3465, 3470, 3475, 3480, 3485, 3490, 3495, 3500, 3505, 3510, 3515, 3520, 3525, 3530, 3535, 3540, 3545, 3550, 3555, 3560, 3565, 3570, 3575, 3580, 3585, 3590, 3595, 3600, 3605, 3610, 3615, 3620, 3625, 3630, 3635, 3640, 3645, 3650, 3655, 3660, 3665, 3670, 3675, 3680, 3685, 3690, 3695, 3700, 3705, 3710, 3715, 3720, 3725, 3730, 3735, 3740, 3745, 3750, 3755, 3760, 3765, 3770, 3775, 3780, 3785, 3790, 3795, 3800, 3805, 3810, 3815, 3820, 3825, 3830, 3835, 3840, 3845, 3850, 3855, 3860, 3865, 3870, 3875, 3880, 3885, 3890, 3895, 3900, 3905, 3910, 3915, 3920, 3925, 3930, 3935, 3940, 3945, 3950, 3955, 3960, 3965, 3970, 3975, 3980, 3985, 3990, 3995, 4000, 4005, 4010, 4015, 4020, 4025, 4030, 4035, 4040, 4045, 4050, 4055, 4060, 4065, 4070, 4075, 4080, 4085, 4090, 4095, 4100, 4105, 4110, 4115, 4120, 4125, 4130, 4135, 4140, 4145, 4150, 4155, 4160, 4165, 4170, 4175, 4180, 4185, 4190, 4195, 4200, 4205, 4210, 4215, 4220, 4225, 4230, 4235, 4240, 4245, 4250, 4255, 4260, 4265, 4270, 4275, 4280, 4285, 4290, 4295, 4300, 4305, 4310, 4315, 4320, 4325, 4330, 4335, 4340, 4345, 4350, 4355, 4360, 4365, 4370, 4375, 4380, 4385, 4390, 4395, 4400, 4405, 4410, 4415, 4420, 4425, 4430, 4435, 4440, 4445, 4450, 4455, 4460, 4465, 4470, 4475, 4480, 4485, 4490, 4495, 4500, 4505, 4510, 4515, 4520, 4525, 4530, 4535, 4540, 4545, 4550, 4555, 4560, 4565, 4570, 4575, 4580, 4585, 4590, 4595, 4600, 4605, 4610, 4615, 4620, 4625, 4630, 4635, 4640, 4645, 4650, 4655, 4660, 4665, 4670, 4675, 4680, 4685, 4690, 4695, 4700, 4705, 4710, 4715, 4720, 4725, 4730, 4735, 4740, 4745, 4750, 4755, 4760, 4765, 4770, 4775, 4780, 4785, 4790, 4795, 4800, 4805, 4810, 4815, 4820, 4825, 4830, 4835, 4840, 4845, 4850, 4855, 4860, 4865, 4870, 4875, 4880, 4885, 4890, 4895, 4900, 4905, 4910, 4915, 4920, 4925, 4930, 4935, 4940, 4945, 4950, 4955, 4960, 4965, 4970, 4975, 4980, 4985, 4990, 4995, 5000, 5005, 5010, 5015, 5020, 5025, 5030, 5035, 5040, 5045, 5050, 5055, 5060, 5065, 5070, 5075, 5080, 5085, 5090, 5095, 5100, 5105, 5110, 5115, 5120, 5125, 5130, 5135, 5140, 5145, 5150, 5155, 5160, 5165, 5170, 5175, 5180, 5185, 5190, 5195, 5200, 5205, 5210, 5215, 5220, 5225, 5230, 5235, 5240, 5245, 5250, 5255, 5260, 5265, 5270, 5275, 5280, 5285, 5290, 5295, 5300, 5305, 5310, 5315, 5320, 5325, 5330, 5335, 5340, 5345, 5350, 5355, 5360, 5365, 5370, 5375, 5380, 5385, 5390, 5395, 5400, 5405, 5410, 5415, 5420, 5425, 5430, 5435, 5440, 5445, 5450, 5455, 5460, 5465, 5470, 5475, 5480, 5485, 5490, 5495, 5500, 5505, 5510, 5515, 5520, 5525, 5530, 5535, 5540, 5545, 5550, 5555, 5560, 5565, 5570, 5575, 5580, 5585, 5590, 5595, 5600, 5605, 5610, 5615, 5620, 5625, 5630, 5635, 5640, 5645, 5650, 5655, 5660, 5665, 5670, 5675, 5680, 5685, 5690, 5695, 5700, 5705, 5710, 5715, 5720, 5725, 5730, 5735, 5740, 5745, 5750, 5755, 5760, 5765, 5770, 5775, 5780, 5785, 5790, 5795, 5800, 5805, 5810, 5815, 5820, 5825, 5830, 5835, 5840, 5845, 5850, 5855, 5860, 5865, 5870, 5875, 5880, 5885, 5890, 5895, 5900, 5905, 5910, 5915, 5920, 5925, 5930, 5935, 5940, 5945, 5950, 5955, 5960, 5965, 5970, 5975, 5980, 5985, 5990, 5995, 6000, 6005, 6010, 6015, 6020, 6025, 6030, 6035, 6040, 6045, 6050, 6055, 6060, 6065, 6070, 6075, 6080, 6085, 6090, 6095, 6100, 6105, 6110, 6115, 6120, 6125, 6130, 6135, 6140, 6145, 6150, 6155, 6160, 6165, 6170, 6175, 6180, 6185, 6190, 6195, 6200, 6205, 6210, 6215, 6220, 6225, 6230, 6235, 6240, 6245, 6250, 6255, 6260, 6265, 6270, 6275, 6280, 6285, 6290, 6295, 6300, 6305, 6310, 6315, 6320, 6325, 6330, 6335, 6340, 6345, 6350, 6355, 6360, 6365, 6370, 6375, 6380, 6385, 6390, 6395, 6400, 6405, 6410, 6415, 6420, 6425, 6430, 6435, 6440, 6445, 6450, 6455, 6460, 6465, 6470, 6475, 6480, 6485, 6490, 6495, 6500, 6505, 6510, 6515, 6520, 6525, 6530, 6535, 6540, 6545, 6550, 6555, 6560, 6565, 6570, 6575, 6580, 6585, 6590, 6595, 6600, 6605, 6610, 6615, 6620, 6625, 6630, 6635, 6640, 6645, 6650, 6655, 6660, 6665, 6670, 6675, 6680, 6685, 6690, 6695, 6700, 6705, 6710, 6715, 6720, 6725, 6730, 6735, 6740, 6745, 6750, 6755, 6760, 6765, 6770, 6775, 6780, 6785, 6790, 6795, 6800, 6805, 6810, 6815, 6820, 6825, 6830, 6835, 6840, 6845, 6850, 6855, 6860, 6865, 6870, 6875, 6880, 6885, 6890, 6895, 6900, 6905, 6910, 6915, 6920, 6925, 6930, 6935, 6940, 6945, 6950, 6955, 6960, 6965, 6970, 6975, 6980, 6985, 6990, 6995, 7000, 7005, 7010, 7015, 7020, 7025, 7030, 7035, 7040, 7045, 7050, 7055, 7060, 7065, 7070, 7075, 7080, 7085, 7090, 7095, 7100, 7105, 7110, 7115, 7120, 7125, 7130, 7135, 7140, 7145, 7150, 7155, 7160, 7165, 7170, 7175, 7180, 7185, 7190, 7195, 7200, 7205, 7210, 7215, 7220, 7225, 7230, 7235, 7240, 7245, 7250, 7255, 7260, 7265, 7270, 7275, 7280, 7285, 7290, 7295, 7300, 7305, 7310, 7315, 7320, 7325, 7330, 7335, 7340, 7345, 7350, 7355, 7360, 7365, 7370, 7375, 7380, 7385, 7390, 7395, 7400, 7405, 7410, 7415, 7420, 7425, 7430, 7435, 7440, 7445, 7450, 7455, 7460, 7465, 7470, 7475, 7480, 7485, 7490, 7495, 7500, 7505, 7510, 7515, 7520, 7525, 7530, 7535, 7540, 7545, 7550, 7555, 7560, 7565, 7570, 7575, 7580, 7585, 7590, 7595, 7600, 7605, 7610, 7615, 7620, 7625, 7630, 7635, 7640, 7645, 7650, 7655, 7660, 7665, 7670, 7675, 7680, 7685, 7690, 7695, 7700, 7705, 7710, 7715, 7720, 7725, 7730, 7735, 7740, 7745, 7750, 7755, 7760, 7765, 7770, 7775, 7780, 7785, 7790, 7795, 7800, 7805, 7810, 7815, 7820, 7825, 7830, 7835,



FORMULA INTERNATIONAL INC.

12603 Crenshaw Blvd., Dept. B, Hawthorne, CA 90250

For information (213) 973-1921 • Orders Only (outside Calif.) (800) 672-8758



POCKET LIGHT

Complete with 5" fluorescent tube, powerful bulb and handy strap. Runs on 3 pcs 1.5V "C" size batteries (not included). It's a practical, convenient, powerful spotlight and fluorescent light. Its superior quality is ideal for indoor or outdoor use.

LOW PRICE \$6.50

SANYO UHF VARACTOR TUNER

FOR UHF CHANNELS 14-83

Tuning voltage +1 to +28VDC. Input impedance 75Ω. IF band width 7-16MHz. Size 2 1/4" x 1 1/4" x 3/4". Supply voltage 15VDC.

Model 115-B-403A, Video IF 45.0MHz

Model 115-B-405A, Video IF 62.5MHz

\$19.95

Tuner is the most important part of the circuit. Don't let those \$19.00 tuners fool you. All units are brand new from Sanyo. When ordering please specify model number.



MARK IV — 15 STEP LED POWER LEVEL INDICATOR KIT

This new stereo indicator kit consists of 36 4-color LED's (15 per channel) to indicate the sound level output of your amplifier from -36dB to +3dB. Comes with a well designed silk screen printed plastic panel and has a selector switch to allow floating or gradual output indicating. Power supply is 6-12VDC with THG on board input sensitivity controls. This unit can work with any amplifier from 1W to 200W. Kit includes 70 pcs driver transistors, 38 pos matched 4-color LED's, all electronic components, PC Board and front panel. **MARK IV KIT \$31.50**

FLOURESCENT AUDIO LEVEL MONITOR

This is the kind of VU monitor that is being used by most amplifier manufacturers. IC's are used to simplify circuit layout. Easy to assemble and can be used with all power level amplifiers. Power requirement 12VDC.



TE-221 KIT For Just \$28.50 (Limited Stock)

TA-1000 KIT

\$51.95

Power Transformer \$24.00 ea.

100W CLASS A POWER AMP KIT

Dynamic Bias Class "A" circuit design makes this unit unique in its class. Crystal clear, 100 watts power output will satisfy the most picky fans. A perfect combination with the TA-1020 low 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.

1 WATT AUDIO AMP

All parts are pre-assembled on a mini PC Board. Supply voltage 6-9VDC. **Special Price \$1.95**

6W AUDIO AMP KIT

TBA810 with Volume Control. Power Supply 6-18VDC. **Only \$7.50 ea.**

"FISHER" 30 WATT STEREO AMP

MAIN AMP (15W x 2). Kit includes 2 pcs. Fisher PA 301 Hybrid IC, all electronic parts with PC Board. Power supply ±16VDC (not included). Voltage gain 33dB, 20Hz-20KHz.

Super Buy Only \$18.50

LASER SUPER LATERN

Brilliant fluorescent lantern with 9" 6 watt fluorescent tube. Features include. Powerful direct beam spotlight with 9V pre-focus bulb; Buzzer horn - either constant or time intervals of sonic alarm; Twin blinker - red amber flashing or red & amber flashing on time intervals; Fully adjustable nylon strap. Operates from D size batteries or plugs into vehicle cigar lighter socket.

SPECIAL \$11.95

6-WAY A/C ADAPTOR

Input: 110VAC. Output: 3V, 4.5V, 6V, 7.5V and 12VDC. Current: 300mA.

OUR LOW PRICE \$5.50 ea.

No FCC License Required **OUR PRICE \$49.50** Additional Microphone (Transmitter) Available at \$28.00 ea. **MURA WMS-49**

CRYSTAL CONTROLLED WIRELESS MICROPHONE SYSTEM

Transmitter: FET mic for flat 30Hz-18KHz response. Xtal controlled 49MHz AM Band for drift-free performance. 100mW output (range approx. 1/4 mile) for reliable long range transmission. Powered by a 9V radio battery.

Receiver: Xtal controlled locks on 49MHz transmitter signal. On panel VU meter, monitors the signal strength from the microphone. Standard phone jack outlet connection to a P.A. or other phone input. 9V battery included. This professional set is ideal for on stage, in field, church, in house or outdoor use.



A GOOD BUY at \$65.00 TA-800

120W PURE DC POWER STEREO AMP KIT

Getting power hungry from your small amp? Here's a good solution! The TA-800 is a pure DC amplifier with a built-in pre-amp. All coupling capacitors are eliminated to give you a true reproduction of the music. On board tone and volume controls combined with built-in power supply make the TA-800 the most compact stereo amp available. Specifications: 60W x 2 into 8Ω. Freq Range: 0Hz-100KHz ±3dB. THD: .01% or better. S/N Ratio: 80dB. Sensitivity: 3mV into 47K. Power Requirement: ±24-40 Volts.

WHISTLE ACTIVATED SWITCH BOARD

All boards are pre-assembled and tested. You whistle to its FET condenser microphone from a distance, as far as 30 feet away (sensitivity can be easily adjusted), and it will turn the switch on. If you whistle again it will turn off. Ideal for remote control toys, electrical appliance such as lights, coffee pots, TV, Hi-Fi, radio or other projects. Unit works on 9VDC.

Model 968\$2.50 ea.

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.



UNIVERSAL NI-CD BATTERY CHARGER MW-398

Charges 9V, AA, C or D size Ni-CD batteries all at one time.

Part No. 050-0190 \$11.50 ea.

SUPER FM WIRELESS MIC KIT

This new designed circuit uses high FREQ FET transistors with 2 stage pre-amp. Transmits FM range (88-120MHz) up to 2 blocks away and with the ultra sensitive condenser microphone that comes with the kit allows you to pick up any sound within 15 ft. away. Kit includes all electronic parts, OSC coils and PC Board. Power supply 9VDC.

FMC-105 \$11.50 per Kit

PROFESSIONAL FM WIRELESS MICROPHONE

Made by one of the leading Japanese manufacturers. This factory assembled FM wireless microphone is powered by two AA size batteries. It transmits in the range of 88-108MHz. Element is built in a plastic tube type case with an omni-directional electronic condenser microphone unit. By using a standard FM radio, signal can be heard anywhere on a one acre lot. Sound quality was judged "very good." **MODEL WEM-36 was \$16.50.**

ON SALE \$8.25 ea.

HEAVY DUTY 500mA MULTIPLE AC-DC ADAPTOR

For all battery operated electronic equipment up to 500mA with LED indicator.

Input: 117/220VAC, 50/60Hz
Output: 3, 4.5, 6, 7.5, 9 and 12VDC.
Model SA-8112A \$25.00 ea.

SANYO ANTENNA SIGNAL BOOSTER

This Booster is specially designed for UHF Channels (14-83). After installing (between the antenna input cable and the UHF tuner), this unit will provide a minimum of 10dB gain, that is approximately 2 times better than you are seeing now. Ideal for those who live in apartments that can not put up an outdoor antenna. Small in size, only 2" x 1 1/2" x 1". Supply voltage is 15 VDC.

Model 001-0076 \$12.50

PROFESSIONAL REGULATED VARIABLE DC POWER SUPPLY KIT

All solid state circuitry with high efficiency power transistor 2SD388 and IC voltage regulator MC1733. Output voltage can be adjusted from 0-30V at 1A current limited or 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 TR88A 0-15VDC @ 2A
Model TR88B 0-30VDC @ 1A

\$59.50 per Kit

★ 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 T.I.M. TRANSISTORS 100W + 100W

• Employs Hitachi low noise I.C. for pre-amp • Max. output 16 V P-P (non distortion) • With h-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 Part #370-0340 \$85.00 POWER TRANSFORMER (68V-80V CT 6 AMP) Part #370-0220 \$24.50

60W + 60W O.T.L. AMP

Stereo pre-amp + tone control + power amp. All in one unit, fully assembled! Compact in size: 7"x4"x2 1/2". Can be fitted into most cabinets. Power transistors using 2SC1667 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: 4700µ 75V or better.



MODEL: SA-4520 Part #370-0350 \$39.95 ea. 1 Transformer Part #670-0230 ... \$22.50 ea. 2 Filter Capacitor 4700µF 70V \$6.50 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 MIC. 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 BAR/DOT AUDIO LEVEL DISPLAY KIT

This new designed audio level display unit is using a new integrated circuit from National Semiconductor to drive 20 pieces of color LEDs (green, yellow and red) on each channel. It provides two types of display methods for "selection bar" or "dot". The display range is from -57dB to 0dB. Kit is good for any amplifier from 2 watt to 200 watts! Power supply requires 12V AC or DC. So it is great for cars as well! Kit comes with printer circuit board, all LEDs, electronic components, switches, and silk screen printed professional front panel.

MODEL: TY-45 Part #370-0280 \$38.50

SEND ONE DOLLAR FOR OUR DETAIL CATALOG

Inside California 10%
Outside Calif. (incl. Mexico & Canada) 15%
Overseas 25%

Shipping & Handling Charges
Under \$50.00 Purchase 10%
Over \$50.00 Purchase 5%
15%
20%

Minimum Order \$10.00/Calif. Residents add 6.5% Sales Tax. Phone Orders Accepted on VISA or MC ONLY. NO C.O.D.'s. Prices subject to change without notice.



STORE HOURS MON-FRI-10-7 SAT-10-6

*Apple and Apple II are the trademark of APPLE COMPUTERS, INC.

FORMULA INTERNATIONAL INC.

DEPT. B • 12603 CRENSHAW BOULEVARD • HAWTHORNE, CALIFORNIA 90250 • (213) 973-1921



pinecom™ BREAK THRU!

No more copyright problems!! 100% Apple II Compatible!



Features:

- Upper/lower case
- Full size keyboard with numeric key pad
- Auto repeat keys
- 25 Pre-programmed function keys
- 48K RAM user memories can expand to 192K
- 2W Audio AMP with volume control
- High resolution color display with graphics
- 110/220V 5 AMP switching power supply
- Guarantee to run on CP/M
- Fully assembled and tested

DIRECT SALE \$549.00

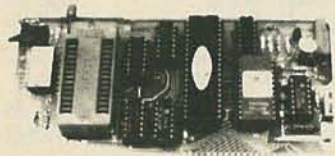
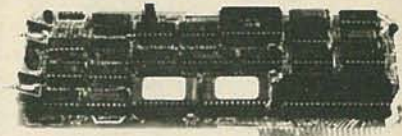
(Add 5% shipping and handling)

NEW IMPROVED KEYBOARD

AUTOTERM™ 80 COLUMN CARD

NEW \$99.95

- 40/80 column auto-selectable
- with NORMAL/REVERSE and HIGHLIGHT functions
- capable to run PASCAL & CP/M
- SHIFT function as typewriter



NEW

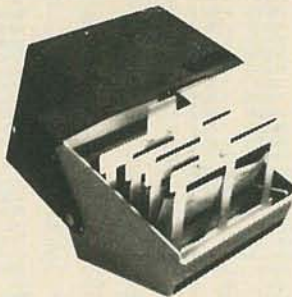
PART # 900-0080

\$75.00

EPROM PROGRAMMER CARD AP-64e

Program any 2716, 2732 or 2764 EPROMS

- Plug to any slot of your apple+ computer.
- No extra equipment needed, completely reliable
- Auto blankcheck, compare, read, copy, monitor functions.
- Automatic verify.
- Errors indicated on screen.
- Burning voltage adjustable.
- Dip switch for different EPROMS
- No jumpers required.
- Firmware included.



ANTI-STATIC PLASTIC MINI-FLOPPY DISK STORAGE CASE

Holds up to 75 5 1/4" diskettes with 4 dividers
color: smoke clear on top with light brown bottom

MODEL: MINI-FILE
\$19.95 EACH

GREAT INPUT.

Introducing the KoalaPad™ Touch Tablet

- Under \$125 with Micro Illustrator™ software.
- Paddle, joystick, keyboard and mouse in one.
- Perfect for computer graphics, games, education.
- Friendliest controller available—perfect for youngsters.
- For Apple®, Atari®, Commodore®, and IBM® personal computers.
- Compatible with most game and educational software.



Introductory Offer \$99⁰⁰



80 Column card for Apple IIe®

NEW

SPECIAL \$49.95 each

Model: 80CIIE

*THIS CARD IS NOT MADE BY APPLE COMPUTER

Apple II+ Compatible



THE MICRO-II

The Apple look-alike and compatible computer, 48K RAM on board with numeric key pad, upper/lower case keyboard

Fully assembled
Special price

\$519.00

SORRY! ROM SET IS NOT INCLUDED!



HEAVY DUTY JOYSTICK

FOR APPLE+ OR PINECOM COMPUTERS

Metal case with 2 fire buttons, 360 degree cursor control, auto centering and two fine trimer

MODEL: THE COMPATIBLE II \$34.95

*Apple II & Apple IIe are registered trademarks of Apple Computer, Inc. U.S.A.

VISA

OUTSIDE CALIFORNIA

PHONE ORDERS ONLY 1-800-672-8758 CALL TOLL FREE



• Apple is a registered trademark of APPLE COMPUTERS, INC.

SHIPPING AND HANDLING CHARGES

Under \$50.00 Purchase Over \$50.00 Purchase

Inside California	10%	5%
Outside Calif (Incl Mexico & Canada)	15%	10%
Overseas	25%	20%

SEND \$1.00 FOR OUR DETAILED CATALOG.

Minimum Order \$10.00 / Calif. Residents add 6.5% Sales Tax. Phone Orders Accepted on VISA or MC ONLY. NO C.O.D.'s. Prices subject to change without notice.

STORE HOURS
MON-FRI — 10-7
SAT — 10-6

CIRCLE 76 ON FREE INFORMATION CARD

CPU'S & SUPPORT CHIPS	8251	4.50
8253	5.95	
8279-5	6.95	
8255	4.95	
8257 (AM9517)	7.95	
8039	6.95	
8080A	2.75	
8085A	5.75	
AMD 2901	8.95	
6202	19.95	
8212	1.80	
8214	3.60	
8216	1.80	
8224	2.25	
8226	1.80	
8228	3.50	
8155	5.50	
8156	8.95	
8237	14.00	
8238	3.95	
8748	19.95	
8755	19.95	
8250	10.95	

SCR's	1.5A	6A	35A	110A
100	35	40	1.40	
200	40	50	1.80	9.00
400	60	1.00	2.40	12.00
600	1.00	3.60	15.00	

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	

EPOXY GLASS VECTOR BOARD	1/16" thick with 1/10" spacing	4 1/2" x 6 1/2"	\$1.95
14 PIN HEADERS			3/\$1.00
16 PIN HEADERS			.70
24 PIN HEADERS			.40
40 PIN HEADERS			1.10
50 PIN EDGEBOARD CONN.			3.95
25 PIN EDGEBOARD CONN.			2.50
50 PIN ANGLE CONN.			3.95

SHIFT REGISTERS	MM1402	1.75
MM1403	1.75	
MM1404	1.75	
MM5013	2.50	
MM5055	2.50	
MM5057	2.50	
MM5050	2.50	

INTER FACE & DRIVERS	4001 <th>25 <th>4043 <th>65 <th>4583 <th>80 </th></th></th></th></th>	25 <th>4043 <th>65 <th>4583 <th>80 </th></th></th></th>	4043 <th>65 <th>4583 <th>80 </th></th></th>	65 <th>4583 <th>80 </th></th>	4583 <th>80 </th>	80
4002	25	4044	65	4586	75	
4006	65	4046	65	4608	27	
4007	27	4047	65	74002	27	
4008	27	4049	65	74004	35	
4009	39	4050	65	74008	35	
4010	45	4051	65	74010	80	
4011	30	4052	75	74014	65	
4012	30	4053	75	74020	27	
4013	35	4054	80	74032	39	
4014	70	4056	45	74042	1.00	
4015	45	4058	35	74074	50	
4016	39	4059	65	74078	70	
4017	65	4070	25	74082	1.40	
4018	50	4071	25	74086	39	
4019	50	4072	25	74088	50	
4020	70	4073	65	74089	2.50	
4021	65	4077	35	74087	1.15	
4022	65	4078	65	74088	1.75	
4023	22	4081	25	74081	1.15	
4024	45	4082	45	74083	1.15	
4025	25	4083	49	74084	1.15	
4026	95	4089	1.75	74087	1.15	
4027	40	4091	65	74088	1.15	
4028	55	4510	65	74089	1.15	
4029	75	4511	65	74090	1.15	
4030	35	4514	1.50	74092	1.75	
4031	35	4515	1.50	74093	1.75	
4035	75	4516	75	74094	1.75	
4040	65	4518	85	74095	1.75	
4042	65	4528	1.00	74096	1.75	
		4539	1.25			

C/MOS	4001 <th>25 <th>4043 <th>65 <th>4583 <th>80 </th></th></th></th></th>	25 <th>4043 <th>65 <th>4583 <th>80 </th></th></th></th>	4043 <th>65 <th>4583 <th>80 </th></th></th>	65 <th>4583 <th>80 </th></th>	4583 <th>80 </th>	80
4002	25	4044	65	4586	75	
4006	65	4046	65	4608	27	
4007	27	4047	65	74002	27	
4008	27	4049	65	74004	35	
4009	39	4050	65	74008	35	
4010	45	4051	65	74010	80	
4011	30	4052	75	74014	65	
4012	30	4053	75	74020	27	
4013	35	4054	80	74032	39	
4014	70	4056	45	74042	1.00	
4015	45	4058	35	74074	50	
4016	39	4059	65	74078	70	
4017	65	4070	25	74082	1.40	
4018	50	4071	25	74086	39	
4019	50	4072	25	74088	50	
4020	70	4073	65	74089	2.50	
4021	65	4077	35	74087	1.15	
4022	65	4078	65	74088	1.75	
4023	22	4081	25	74081	1.15	
4024	45	4082	45	74083	1.15	
4025	25	4083	49	74084	1.15	
4026	95	4089	1.75	74087	1.15	
4027	40	4091	65	74088	1.15	
4028	55	4510	65	74089	1.15	
4029	75	4511	65	74090	1.15	
4030	35	4514	1.50	74092	1.75	
4031	35	4515	1.50	74093	1.75	
4035	75	4516	75	74094	1.75	
4040	65	4518	85	74095	1.75	
4042	65	4528	1.00	74096	1.75	
		4539	1.25			

TRANSISTOR SPECIALS	2N1307 PNP GE TO 5	3.40
2N4004 PNP GE TO 5	3.10	
HEP 60014 - PNP GE TO 3	5.95	
TIP 111 - 5.00 TIP 145	1.35	
2N923 NPN SWITCHING POWER	1.95	
MRF-6004 CM RF TRANSISTOR NPN	1.75	
2N3772 NPN SI TO 3	1.00	
2N4908 PNP SI TO 3	1.00	
TIP 2665 PNP SI	1.70	
2N9222 NPN SI TO 18	7.91	
2N2907 PNP SI TO 18	7.91	
2N3055 NPN SI TO 3	1.60	
2N3054 NPN SI TO 3	1.60	
2N3056 PNP SI TO 92	7.91	
2N6109 PNP SI TO 220	1.55	
TIP 318 NPN SI TO 220	1.40	
TIP 328 PNP SI TO 220	1.40	
TIP 34 PNP SI	1.95	
TIP 121 PNP SI U84	1.60	
TIP 141 NPN SI U87	1.00	
ILJ205	11.75	
DP52000 - DUAL POWER DARL.	43.95	
MJE3055T	1.90	

DISC CONTROLLERS	1771 <th>18.00</th>	18.00
BR1941L	8.95	
CRT5037	18.95	
MM5369	2.50	
TR1602B	3.95	
PT1472	6.95	
AYS-1013A	3.75	
AY8 3600	9.95	

RAM's	2101A-4	1.50
21102-3	.70	
2111A	1.95	
2114-2	1.40	
2147-3	2.50	
TMS3409	1.75	
MK4027-3	1.75	
TMS4050NL	1.25	
MK4096-11	2.95	
MK4092	5.95	
4108-3	1.50	
4118-3	.95	
4118-15	1.50	
4118-15	1.50	
5101E	2.95	
25104-4	2.50	
4118-15	5.50	
4184-15	5.50	
3242	6.00	

CRYSTALS	2.000	6.144
3.000	8.000	
3.579	10.000	
4.000	18.000	
5.000	18.432	
6.000	20.000	

TTLIC SERIES	7400	24	7472	40	74612	60
7401	24	7473	45	74163	60	
7402	24	7474	50	74164	60	
7403	24	7475	50	74165	60	
7404	24	7476	45	74166	70	
7405	24	7480	45	74170	1.80	
7406	45	7483	50	74173	75	
7407	55	7485	55	74174	65	
7408	30	7486	35	74175	60	
7409	28	7489	1.90	74176	75	
7410	24	7490	35	74180	1.90	
7411	24	7491	45	74182	45	
7412	30	7492	45	74190	70	
7413	35	7483	35	74191	70	
7414	45	7494	60	74193	75	
7415	35	7495	55	74194	85	
7416	35	7496	60	74195	45	
7420	24	74107	30	74196	75	
7425	25	74116	1.50	74221	1.00	
7426	25	74121	45	74273	85	
7427	25	74122	50	74279	60	
7430	24	74123	55	74298	65	
7432	32	74126	45	74355	65	
7437	32	74130	60	74367	65	
7438	32	74148	1.10	74390	90	
7440	24	74150	1.10	75325	1.50	
7441	75	74151	50	75492	1.05	
7442	60	74153	40	9601	75	
7445	65	75154	1.10	9602	75	
7446	65	74155	50	8726	1.00	
7447	65	74157	50	8728	1.25	
7448	65	74159	60	8737	1.25	
7450	24	74161	65	8798	90	

4164-2	— \$5.50
4164-2	— 100/\$500.00
4116-2	— 100/\$90.00
2114-2	— 100/\$100.00

2N3820 P FET	..... \$ .45
2N5457 N FET	..... \$ .45
2N2646 UJT	..... \$ .45
ER 900 TRIGGER DIODES	..... 4/\$1.00
2N 6028 PROG. UJT	..... \$ .65

DAQ08EQ	- 3.75	LF356	- 1.00	747	- .50
TL062 CP	-.95	LM358	- 1.50	CA758	- 1.75
TL064 CN	- 1.50	LM381	- 1.75	LM1310	- 1.60
LM201	- .75	LM370	- 1.80	1458	- .60
LM301/748	- .30	LM377	- 1.80	LM1808	- 1.75
LM307	- .30	LM380	- 1.20	LM2901	- .95
LM308	-.65	LM396	-.85	CA3018	- 1.95
LM310	- 1.10	LM387	- 1.25	CA3078AT	- 1.90
LM311	- .50	LM393	- .75	CA3086	- .75
LM318	- .75	LM565	- .34	CA3095E	- 1.75
LM324	- .55	LM566	- .65	AD2700LD	4.95
LM338	- .65	55 8	- 3.50	CA3140	- 1.00
LM348	- .90	565	- 1.25	3900	- .50
LF351	- .65	566	- 1.25	LM 3909	- .80
LF356	- .90	567	- 1.10	4138	- .85
		709C	- .35	N5566A	- 1.50
		711CH	- .40	D6303B	- 1.75
		741CV	- .40	8080CC	- 3.90
				LM13080	- .95
				8700CJ	- 5.95

74LS SERIES	74LS00	35	74LS109	55	74LS240	1.10
74LS01	35	74LS112	60	74LS241	1.10	
74LS02	33	74LS113	60	74LS242	1.10	
74LS03	33	74LS114	65	74LS243	1.10	
74LS04	40	74LS123	85	74LS244	1.30	
74LS05	38	74LS126	80	74LS245	1.75	
74LS08	40	74LS128	60	74LS246	95	
74LS09	40	74LS132	75	74LS247	90	
74LS10	40	74LS136	55	74LS248	1.10	
74LS11	40	74LS137	95	74LS251	70	
74LS12	40	74LS138	95	74LS253	70	
74LS13	55	74LS139	70	74LS257	70	
74LS14	50	74LS147	1.95	74LS258	1.00	
74LS15	50	74LS151	70	74LS259	1.00	
74LS20	40	74LS153	70	74LS266	70	
74LS21	40	74LS154	2.40	74LS273	1.15	
74LS22	40	74LS156	80	74LS279	60	
74LS26	55	74LS156	80	74LS280	1.80	
74LS27	40	74LS157	60	74LS283	8	

WE HAVE QUALITY PARTS, DISCOUNT PRICES AND FAST SHIPPING!

TRANSFORMERS

120 volt primaries

5.6 VOLTS at 750 MA	\$3.00
6 VOLTS at 150 MA	\$1.25
16.5 V. at 3 AMPS	\$6.50
18 V at 550 MA	\$3.50
18 VOLTS at 1 AMP	\$4.50
18 V.C.T. at 2 AMP	\$5.50
24 VOLTS at 250 MA	\$2.50
24 VCT at 1 AMP	\$4.50
42 V.C.T. at 1.2 AMP	\$4.50

DC WALL TRANSFORMER

ALL ARE 115 VAC PLUG IN

4 VDC at 70 MA	\$2.50
9 VDC at 225 MA	\$3.00
16.5 VAC at 10 VA	\$3.50
17 VAC at 500 MA	\$4.00
22 VDC at 60 MA	\$2.50

2K 10 TURN MULTI-TURN POT

SPECTROL #MOD 534-7161 \$5.00 EACH

VARACTOR DIODE

BB-103 3 for \$1.00, 33 PF 100 FOR \$30.00

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

HELPING HAND

WILL HOLD P.C. BOARD OR OTHER SMALL ITEMS AND ALLOW BOTH YOUR HANDS FREEDOM TO WORK. \$6.50 EACH

MULTI-SWITCHES

3 STATION NON-INTERLOCKING 3-2PDT SWITCHES. EACH OPERATES INDEPENDENTLY. 1/4" BETWEEN MOUNTING CENTERS. \$1.75 EACH

5 STATION INTERLOCKING

MADE BY ALPS. 3-2PDT AND 2-6PDT SWITCHES ON FULLY INTERLOCKING ASSEMBLY. 3/4" BETWEEN MOUNTING CENTERS. \$2.50 EACH

5 STATION NON-INTERLOCKING

SAME AS ABOVE, EXCEPT EACH SWITCH OPERATES INDEPENDENTLY. \$2.50 EACH



MIKE CONNECTOR

5 CONDUCTOR IN-LINE PLUG AND CHASSIS MOUNT JACK. TWIST LOCK STYLE, SAME AS SWITCHCRAFT 12CL5M. \$2.50 PER SET

CRYSTAL

CASE STYLE HC33/U 2 MHZ. \$3.50 EACH

TRANSISTORS

2N706	5 for \$1.00
2N2222A	4 for \$1.00
PN2222	8 for \$1.00
2N2904	4 for \$1.00
2N2905	4 for \$1.00
2N2907	4 for \$1.00
MJ3030	\$2.50
2N3055	\$1.00
2N3585	\$1.00
2N3904	5 for \$1.00
2N3906	5 for \$1.00
2N4401	5 for \$1.00
2N4403	5 for \$1.00
2N4089	\$1.50
D43C	2 for \$1.00
D44C2	.75
TIP 31	.75
TIP 32	.75
TIP 121	.75
TIP 126	.75

MICROWAVE TRANSISTOR

MRF 901 REDUCED TO \$2.00 EACH
N.P.N. SILICON

LIGHTS

GRAIN OF WHEAT T1 SIZE .125" DIA. (3.15mm)

3 to 6 VOLTS 3 for \$1.00
Rated: 55ma @ 5 VOLTS
6 to 12 VOLTS 3 for \$1.00
Rated: 55ma @ 8 VOLTS
12 to 24 VOLTS 3 for \$1.00
Rated: 45ma @ 14 VOLTS

T1 SIZE WITH WIRE LEADS

3 to 6 VOLTS 2 for \$1.00
Rated: 55ma @ 5 VOLTS
6 to 12 VOLTS 2 for \$1.00
Rated: 55ma @ 8 VOLTS
12 to 24 VOLTS 2 for \$1.00
Rated: 45ma @ 14 VOLTS

T1- 3/4 SIZE WITH WIRE LEADS

.163" DIA. (4.14mm)
3 to 6 VOLTS 2 for \$1.00
Rated: 45ma @ 6 VOLTS
6 to 12 VOLTS 2 for \$1.00
Rated: 55ma @ 8 VOLTS
12 to 24 VOLTS 2 for \$1.00
Rated: 45ma @ 14 VOLTS

NEON W/ RESISTOR

DIRECT OPERATION FROM 120 VOLT 7 for \$1.00

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

SOLDERING IRON STAND

SPRING STEEL IRON HOLDER ON WEIGHTED BASE \$5.00 EACH

12 VOLT A.C. POWER UNIT

THIS UNIT CONSISTS OF A 12 VOLT 2 AMP TRANSFORMER, 1 AMP CIRCUIT BREAKER, 4 PRONG CINCIN SOCKET AND A 3 WIRE A.C. CORD ALL MOUNTED IN AN ATTRACTIVE 4 1/2" x 5 1/2" x 3" CHASSIS BOX. GOOD FOR PARTS OR A NICE START FOR D.C. POWER SUPPLY. \$8.50 PER UNIT

METERS

0-20 V.D.C. FACEPLATE BATTERY TEST SET-UP AS INDICATOR \$5.50 EACH

1 MA

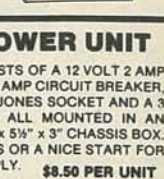
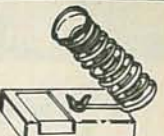
2 5/16" SQUARE PANEL METER MOUNTS IN 2 1/8" HOLE \$5.50 EACH

0-15 V.D.C.

THIS 2-1/4" SQUARE METER MEASURES 0-15 VDC. \$4.50 EACH

METAL OXIDE VARISTOR

2 FOR \$1.50
G.E. # V82Z12 50 VOLTS, NOMINAL D.C. VOLTAGE 5/8" DIAMETER.



SWITCHES

MINI-PUSH BUTTON S.P.S.T. MOMENTARY NORMALLY OPEN 1/4" BUSHING 35¢ EACH
10 FOR \$3.25
100 FOR \$30.00

KEY SWITCH

S.P.S.T. 4 AMPS @ 125 VAC KEY REMOVES BOTH POSITIONS \$3.50 EA

LIGHTED PUSH BUTTON

RED LIGHTED 120 VAC 10 AMP. S.P.S.T. "POWER" PRINTED ON FACE. MOUNTS IN 7/8" SQUARE HOLE. \$1.50 EA 10 FOR \$13.50

FREE! FREE! FREE! SEND FOR NEW LARGER! 48 PAGE CATALOG FREE! FREE! FREE!

POWER SUPPLY

REGULATED FULLY ADJUSTABLE 5 VDC AT 3 AMPS. \$18.50 EACH

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

RELAYS

6 VDC RELAY MINIATURE D.P.D.T. 3 AMP CONTACTS FUJITSU # FBR321D006 \$1.75 EA 10 / 16.00

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.

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

COMPUTER GRADE CAPACITORS

1700 mfd. 150 VDC \$2.00
2 1/2" DIA x 4 3/4" HIGH
3,600 mfd. 40VDC \$1.00
1 3/8" DIA. x 3" HIGH
6,400 mfd. 60 VDC \$2.50
1 3/8" DIA. x 4 1/4" HIGH
18,000 mfd. 75 VDC \$4.00
2 1/2" DIA. x 4 1/2" HIGH
22,000 mfd. 15 VDC 2" DIA. x 2 1/2" HIGH \$2.00
22,000 mfd. 40 VDC 2" DIA. x 6" HIGH \$3.00
24,000 mfd. 30 VDC 1 3/4" DIA. x 4" HIGH \$3.50
31,000 mfd. 15 VDC 1 3/4" DIA. x 4" HIGH \$2.50
72,000 mfd. 15 VDC 2" DIA. x 4" HIGH \$3.50
180,000 mfd. at 6V 2 1/2" DIA. x 4 1/2" HIGH \$1.50
CLAMPS TO FIT CAPACITORS 50¢ ea.

EDGE CONNECTORS

ALL ARE .156" SPACING
15 PIN GOLD SOLDER EYELET \$1.75 EACH
15/30 GOLD SOLDER EYELET \$2.00 EACH
18/36 GOLD SOLDER EYELET \$2.00 EACH
22/44 TIN P.C. STYLE, NO MOUNTING EARS. \$2.00 EACH 10 FOR \$18.00

SOLID STATE RELAY

CONTROL: 3-32VDC LOAD: 10 AMP 140 VAC \$9.50 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
SUB-MINI LED .079" x .098" RED 10 FOR \$1.00
200 FOR \$18.00
GREEN 10 FOR \$1.50
LED HOLDERS TWO PIECE HOLDER FOR JUMBO LED 10 FOR 65¢ 200 FOR \$10.00

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.

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

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

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

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
S.P.D.T. (on-off-on) SOLDER LUG TERMINALS. \$1.00 EACH 10 FOR \$9.00
S.P.D.T. (on-on) P.C. LUGS, THREADED BUSHING. \$1.00 EACH 10 FOR \$9.00
D.P.D.T. (on-on) SOLDER LUG TERMINALS. \$2.00 EACH 10 FOR \$19.00
100 FOR \$180.00

PHOTO-FLASH CAPACITORS

35 MFD 330 VOLT 1" x 5/8" DIA. 45¢ EACH... 10 FOR \$4.00
170 MFD 330 VOLT 1 1/8" x 7/8" 2 FOR \$1.50 10 FOR \$7.00
750 MFD 330 VOLT 2" HIGH x 1 1/4" DIA. \$1.25 EACH 10 FOR \$11.00

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. ALL ELECTRONICS CORP. 905 S. Vermont Ave. P.O. BOX 20405 Los Angeles, Calif. 90006

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.

ramsey

the first name in Counters!



9 DIGITS 600 MHz \$129⁹⁵ WIRED

PRICES:

CT-90 wired, 1 year warranty	\$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than \$300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally, an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz \$99⁹⁵ WIRED



SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as, three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	\$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz \$79⁹⁵ WIRED



PRICES:

MINI-100 wired, 1 year warranty	\$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz \$159⁹⁵ WIRED



SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	\$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95



DIGITAL MULTIMETER \$99⁹⁵ WIRED

PRICES:

DM-700 wired, 1 year warranty	\$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack + AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3 1/2 digit, 1/2 inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

\$29.95 Kit \$39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	\$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

\$34.95 Kit \$44.95 Wired

ramsey electronics, inc.
2575 BAIRD RD. • PENFIELD, NY 14526

PHONE ORDERS
CALL 716-586-3950

TERMS

Satisfaction guaranteed - examine for 10 days, if not pleased, return in original form for refund. Add 5% for shipping - insurance to a maximum of \$10. Overseas add 15% COD add \$2. Orders under \$10, add \$1.50. NY residents add 7% tax.

CIRCLE 79 ON FREE INFORMATION CARD

OCTOBER 1983

HIGH QUALITY ^{UP TO} 55dB GAIN

MICROWAVE TV SYSTEM

Variable from 1.9 to 2.5 GHz



The latest advance in microwave technology with a **SNOW-FREE PICTURE.**

Introductory **SPECIAL**

\$124⁹⁵ Includes Shipping & Handling

THIS UNIT COMES COMPLETE WITH:

- 20" Fiberglass 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



Send Cashiers Check or Money Order to:
(Personal Checks, allow 2-5 weeks to clear)



PROFESSIONAL VIDEO, Inc.

4670 Hollywood Blvd., Hollywood, Calif. 90027

219-0227

For C.O.D. Orders Call (213) 352-9681

CIRCLE 30 ON FREE INFORMATION CARD

TEK-EL

TECHNICAL ELECTRONICS YOUR SUPPLY SOURCE WITH ASSORTMENTS LIKE THESE:

LED ASSORTMENT 25 LEDs at a price everyone can afford! Red, Green, Yellow, Amber in all shapes and sizes.

Stock No. 10-1501 **\$2.95 pkg.**

SWITCH ASSORTMENT 8 general purpose toggle switches. Includes single, double, and three pole switches from top manufacturers such as Cutler-Hammer and others!

Stock No. 12-2230 **\$6.95 pkg.**

FOOT ASSORTMENT Plastic, rubber, snap-fit, felt bottom, stud mount, you name it—it's in this assortment of approx. 100 feet.

Stock No. 49-2398 **\$2.95 pkg.**

SLIDE SWITCH ASSORTMENT Includes SPDT and DPDT slides. 10 pieces per package.

Stock No. 12-1400 **\$1.50 pkg.**

ODDS-N-ENDS BARGAIN BOX 5 pound Random assortment of good quality components and parts. Includes items such as capacitors, diodes, motors, transformers, printed circuit boards, and much much more!

Stock No. 49-3041 **\$10.00 pkg.**

TERMINAL STRIP ASSORTMENT Half pound of approx. 100 pieces. Random assortment of sizes and lengths.

Stock No. 49-2400 **\$2.95 pkg.**

ORDER TODAY! VISA, MASTERCARD & COD accepted for phone orders. Please add \$3.00 for UPS ground. Satisfaction guaranteed. Call or write for your **FREE CATALOG!**

TECHNICAL ELECTRONICS

Dept. L P.O. Box 2361

Woburn, MA 01888 (617) 935-1717

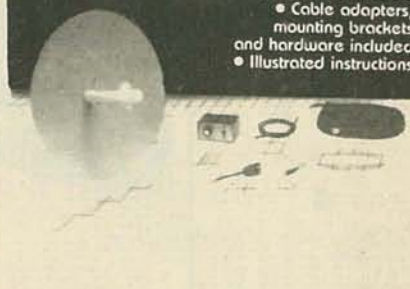
CIRCLE 8 ON FREE INFORMATION CARD

SKYFOX

State-of-the-Art Excellence

SKYFOX DESIGN PERFORMANCE FEATURES:

- Gain 55 db • Frequency 1.9-2.5 GHz
- Range 55 miles maximum • Tuning channels 2-6
- 20 inch Parabolic dish antenna • 60 ft. cable
- Cable adapters, mounting brackets and hardware included
- Illustrated instructions



Receive movies, special presentations and educational broadcasts—ALL FREE—with the SKYFOX deep fringe microwave receiver for homeowners outside the service area of microwave TV stations. SKYFOX receives up to a distance of 55 miles. From microwave transmitters located on buildings or towers in almost all medium and large size cities. SKYFOX does not receive Cable TV or satellite transmissions.

SKYFOX I \$ 79.95 (not pictured, 25 mile line of site)
SKYFOX II \$109.95 (as shown, 55 mile line of site)

ORDERS ONLY: Toll Free 1-800-323/1327

For Information Call: 1-312/564-0104

Visa, Mastercharge accepted, COD, cash or Money Order only. When ordering by mail, Money Orders or Cashiers Checks only. Personal checks, wait 4 weeks for check clearance.

90 day warranty • Conditional money back guarantee

S.E.I. Inc.

657 Academy Drive

Northbrook, Illinois 60062

Available by
Mail Order Only

CIRCLE 55 ON FREE INFORMATION CARD

THE SOLUTION COMPUTER

An Affordable 64K Assembled Computer With These Features:



- Fully compatible with Apple® II +
- Original design!
- Fully assembled and tested!
- Detachable keyboard for easy use.
- Uses 64K x 1 Dynamic Ram.
- 9 on board peripheral connectors for expansion.
- Uses 6502 mpu.

\$675⁰⁰ each (Monitor not included)

Add \$110 for 12" Amber Monitor.

Add 5% shipping and handling.

We believe the Solution Computer will be the answer for people who realize a great product when they see one. Many other peripheral card products are available for the Solution Computer. Send for a free color brochure today.

For Information Call (312) 564-0104

To Order Call (800) 323-1327

Note: Due to the demand of this computer, delivery will vary from 2-4 weeks.

VISA and MASTERCARD acceptable.

Minimum order \$15.00. Add 10% shipping on orders under \$35.00. Orders over \$35.00 add 5%. Illinois residents add 6% Illinois State Tax.

SEI, Inc.

657 Academy Drive
Northbrook, Illinois 60062



JDR SUPER SPECIALS!

THE LEADER IN
COMPUTER
COMPONENTS
BRINGS YOU THESE
FANTASTIC
SUMMERS-END
CLEARANCE BARGAINS

OKI MSM5832RS

MICROPROCESSOR
COMPATIBLE
CLOCK/CALENDAR CHIP
3.95 100/3.25 ea.

32.768KHZ XTAL .95

OTHER CRYSTALS

3.579545MHZ .95
5.0688MHZ 1.95
18.432MHZ 1.95

78M05

VOLTAGE
REGULATOR
TI PART #UA78M05C
STANDARD TO-220 CASE
5 VOLT AT 500MA CAN BE
USED AS 7805T IN MOST
APPLICATIONS

.29 100/.25 EA.

ORDER TOLL FREE

800 538-5000

800 862-8279

(CA Residents)



CONNECTORS

IDP-16 IDC DIP-PLUG .95
IDE-34 IDC EDGE-CARD 1.95
ICC-14 DIP "HEADER" .49
ICC-16 DIP "HEADER" .59
44P-ST PC EDGE-CARD 1.95
DB25PC/P VERTICAL
PC-MOUNT 1.49
DB25PC/S VERTICAL
PC-MOUNT 1.69

TRANSISTORS

2N3904 TO-92 100/7.95
2N3906 TO-92 100/7.95
PN2222 TO-92 100/7.95

CERAMIC MONOLITHIC CAPS AT THE PRICE OF DISC!

.1UF-MONO 100/12.00
.047UF-MONO 100/11.00
.01UF-MONO 100/10.00

PRIME LED'S

JUMBO RED 100/ 8.00
JUMBO YELLOW 100/12.00
JUMBO GREEN 100/12.00
5082-7760 10/ 7.95

JDR DISK DRIVE BLOW OUTS!

SA 410
\$119⁹⁵

SA 460
\$149⁹⁵

★ 1/2 Mb Storage ★ 1 Mb Storage
★ SS/DD ★ DS/DD

★ 80 Track — 96TPI
★ 6 ms — track to track
★ 5 1/4" — Standard
Format

★ 90-DAY GUARANTEE

SALE ENDS SEPT. 30, 1983

MICROPROCESSOR

Z80A-CPU 3.95
Z80A-CTC 3.95
Z80A-PIO 3.95
Z80A-SIO/1 12.95
Z80A-DART 6.95
8086 16-BIT 5MHZ 19.95
68A00 CPU 1.5MHZ 2.95
68A10 RAM 1.5MHZ 1.95
68A21 PIA 1.5MHZ 2.95
68A50 ACIA 1.5MHZ 2.95
6520/6820 PIA 2.95

MEMORY

2102L-4 450NS-LP .55
2111L 450NS-LP 1.49
2112 450NS 1.99
2114 450NS .99
2114-25 250NS 1.09
TMS4027 250NS .99

SPECIAL TMS4060/2107

4096 x 1 DYNAMIC
RAMS TI OR INTEL
YOUR CHOICE .69

SPECIAL THANKS
TO MATT FOR HIS
RECENT SOFTWARE
DEVELOPMENTS
WHICH WILL ENABLE
JDR TO BETTER SERVE
OUR CUSTOMERS

LINEAR I.C.'S

LM1800 1.95
LM1310 .99
MC1330 .99
MC1350 .89
MC1358 .99

HARD TO FIND BLACK CONDUCTIVE FOAM

14" x 26" SHEET 12.00
12" x 13" SHEET 6.00

DISK CONTROLLERS

1771 11.95
1791 18.95
1793 18.95

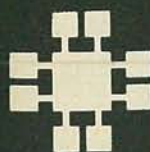
CRT CONTROLLERS

DP8350 19.95
CRT5027 9.95
CRT5037 9.95

D-RAM CONTROLLERS

8202 17.95
8203 32.95
3242 5.95

Visit Our
EXPANDED
Retail Store
NEW SATURDAY
HOURS 10-3



JDR Microdevices

1224 S. Bascom Ave. • San Jose, CA 95128

(408) 995-5430 • Telex 171-110

© 1983 JDR MICRODEVICES, INC.

VISIT OUR RETAIL STORE

HOURS: M-W-F 9-5 T-Th. 9-9 Sat. 10-3

PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING
TERMS: For shipping include \$2 for UPS Ground or \$3 for UPS Blue
Label Air. Items over 5 pounds require additional shipping charges.
Foreign orders, include sufficient amount for shipping. There is a \$10
minimum order. Bay Area and Los Angeles Counties add 6 1/2% Sales
Tax. Other California residents add 6% Sales Tax. We reserve the
right to substitute manufacturer. Not responsible for typographical
errors. Prices are subject to change without notice. We will match or
beat any competitor's price provided it is not below our cost.

4164

64K DYNAMIC 200 NS

\$595

TMM2016

2KX8 STATIC 200 NS

\$415

STATIC RAMS

2101	256 x 4 (450ns)	1.95
5101	256 x 4 (450ns) (cmos)	3.95
2102-1	1024 x 1 (450ns)	.89
2102L-4	1024 x 1 (450ns) (LP)	.99
2102L-2	1024 x 1 (250ns) (LP)	1.49
2111	256 x 4 (450ns)	2.49
2112	256 x 4 (450ns)	2.99
2114	1024 x 4 (450ns)	8/9.95
2114-25	1024 x 4 (250ns)	8/10.95
2114L-4	1024 x 4 (450ns) (LP)	8/12.95
2114L-3	1024 x 4 (300ns) (LP)	8/13.45
2114L-2	1024 x 4 (200ns) (LP)	8/13.95
2147	4096 x 1 (55ns)	4.95
TMS4044-4	4096 x 1 (450ns)	3.49
TMS4044-3	4096 x 1 (300ns)	3.99
TMS4044-2	4096 x 1 (200ns)	4.49
MK4118	1024 x 8 (250ns)	9.95
TMM2016-200	2048 x 8 (200ns)	4.15
TMM2016-150	2048 x 8 (150ns)	4.95
TMM2016-100	2048 x 8 (100ns)	6.15
HM6116-4	2048 x 8 (200ns) (cmos)	4.75
HM6116-3	2048 x 8 (150ns) (cmos)	4.95
HM6116-2	2048 x 8 (120ns) (cmos)	8.95
HM6116LP-4	2048 x 8 (200ns) (cmos)(LP)	5.95
HM6116LP-3	2048 x 8 (150ns) (cmos)(LP)	6.95
HM6116LP-2	2048 x 8 (120ns) (cmos)(LP)	10.95
Z-6132	4096 x 8 (300ns) (Qstat)	34.95

LP = Low Power Qstat = Quasi-Static

Z-80

2.5 Mhz	
Z80-CPU	3.95
Z80-CTC	4.49
Z80-DART	10.95
Z80-DMA	14.95
Z80-PIO	4.49
Z80-SIO/0	16.95
Z80-SIO/1	16.95
Z80-SIO/2	16.95
Z80-SIO/9	16.95

4.0 Mhz

Z80A-CPU	4.95
Z80A-CTC	4.95
Z80A-DART	11.95
Z80A-DMA	16.95
Z80A-PIO	4.95
Z80A-SIO/0	16.95
Z80A-SIO/1	16.95
Z80A-SIO/2	16.95
Z80A-SIO/9	16.95

6.0 Mhz

Z80B-CPU	11.95
Z80B-CTC	13.95
Z80B-PIO	13.95
Z80B-DART	19.95

ZILOG

Z6132	34.95
Z8671	39.95

8000

8035	5.95
8039	6.95
INS-8060	17.95
INS-8073	24.95
8080	3.95
8085	5.95
8085A-2	11.95
8086	29.95
8087	CALL
8088	39.95
8089	89.95
8155	6.95
8155-2	7.95
8156	6.95
8185	29.95
8185-2	39.95
8741	39.95
8748	24.95
8755	24.95

8200

8202	24.95
8203	39.95
8205	3.50
8212	1.80
8214	3.85
8216	1.75
8224	2.25
8226	1.80
8228	3.49
8237	19.95
8237-5	21.95
8238	4.49
8243	4.45
8250	10.95
8251	4.49
8253	6.95
8253-5	7.95
8255	4.49
8255-5	5.25
8257	7.95
8257-5	8.95
8259	6.90
8259-5	7.50
8271	39.95
8272	39.95
8275	29.95
8279	8.95
8279-5	10.00
8282	6.50
8283	6.50
8284	5.50
8286	6.50
8287	6.50
8288	25.00
8289	49.95

CRYSTALS

32.768 khz	1.95
1.0 mhz	4.95
1.8432	4.95
2.0	3.95
2.097152	3.95
2.4576	3.95
3.2768	3.95
3.579535	3.95
4.0	3.95
5.0	3.95
5.0688	3.95
5.185	3.95
5.7143	3.95
6.0	3.95
6.144	3.95
6.5536	3.95
8.0	3.95
10.0	3.95
10.738635	3.95
14.31818	3.95
15.0	3.95
16.0	3.95
17.430	3.95
18.0	3.95
18.432	3.95
20.0	3.95
22.1184	3.95
32.0	3.95

CRT CONTROLLERS

6845	14.95
68B45	19.95
HD46505SP	15.95
6847	11.95
MC1372	6.95
68047	24.95
8275	29.95
7220	99.95
CRT5027	39.95
CRT5037	49.95
TMS9918A	39.95
DP8350	49.95

KEYBOARD CHIPS

AY5-2376	11.95
AY5-3600	11.95
AY5-3600 PRO	11.95

DISC CONTROLLERS

1771	16.95
1791	24.95
1793	26.95
1795	49.95
1797	49.95
2791	54.95
2793	54.95
2795	59.95
2797	59.95
6843	34.95
8272	39.95
UPD765	39.95
MB8876	29.95
MB8877	34.95
1691	17.95
2143	18.95

CONNECTORS

RS232 MALE	2.50
RS232 FEMALE	3.25
RS232 HOOD	1.25
S-100 ST	3.95

6800

68000	59.95
6800	3.95
6802	7.95
6808	13.90
6809E	19.95
6809	11.95
6810	2.95
6820	4.35
6821	3.25
6828	14.95
6840	12.95
6843	34.95
6844	25.95
6845	14.95
6847	11.95
6850	3.25
6852	5.75
6860	9.95
6862	11.95
6875	6.95
6880	2.25
6883	22.95
68047	24.95
68488	19.95
6800 - 1MHZ	
68B00	10.95
68B02	22.25
68B09E	29.95
68B09	29.95
68B10	6.95
68B21	6.95
68B45	19.95
68B50	5.95
68B00 - 2MHZ	

6500

1 MHZ	
6502	4.95
6504	6.95
6505	8.95
6507	9.95
6520	4.35
6522	7.95
6532	9.95
6545	22.50
6551	11.85
2 MHZ	
6502A	6.95
6522A	9.95
6532A	11.95
6545A	27.95
6551A	11.95
3 MHZ	
6502B	14.95

UARTS

AY3-1014	6.95
AY5-1013	3.95
AY3-1015	6.95
PT1472	9.95
TR1602	3.95
2350	9.95
2651	8.95
TMS6011	5.95
IM6402	7.95
IM6403	8.95
INS8250	10.95
GENERATORS	
BIT-RATE	
MC14411	11.95
BR1941	11.95
4702	12.95
COM5016	16.95
COM8116	10.95
MM5307	10.95
FUNCTION	
MC4024	3.95
LMS66	1.49
XR2206	3.75
8038	3.95

74LS00

74LS00	.24	74LS173	.69
74LS01	.25	74LS174	.55
74LS02	.25	74LS175	.55
74LS03	.25	74LS181	2.15
74LS04	.24	74LS189	8.95
74LS05	.25	74LS190	.89
74LS08	.28	74LS191	.89
74LS09	.29	74LS192	.79
74LS10	.25	74LS193	.79
74LS11	.35	74LS194	.69
74LS12	.35	74LS195	.69
74LS13	.45	74LS196	.79
74LS14	.59	74LS197	.79
74LS15	.35	74LS221	.89
74LS20	.25	74LS240	.95
74LS21	.29	74LS241	.99
74LS22	.25	74LS242	.99
74LS26	.29	74LS243	.99
74LS27	.29	74LS244	1.29
74LS28	.35	74LS245	1.49
74LS30	.25	74LS247	.75
74LS32	.29	74LS248	.99
74LS33	.55	74LS249	.99
74LS37	.35	74LS251	.59
74LS38	.35	74LS253	.59
74LS40	.25	74LS257	.59
74LS42	.49	74LS258	.59
74LS47	.75	74LS259	2.75
74LS48	.75	74LS260	.59
74LS49	.75	74LS266	.55
74LS51	.25	74LS273	1.49
74LS54	.29	74LS275	3.35
74LS55	.29	74LS279	.49
74LS563	1.25	74LS280	1.98
74LS73	.39	74LS283	.69
74LS74	.35	74LS290	.89
74LS75	.39	74LS293	.89
74LS76	.39	74LS295	.99
74LS78	.49	74LS298	.89
74LS83	.60	74LS299	1.75
74LS85	.69	74LS323	3.50
74LS86	.39	74LS324	1.75
74LS90	.55	74LS352	1.29
74LS91	.89	74LS353	1.29
74LS92	.55	74LS363	1.35
74LS93	.55	74LS364	1.95
74LS95	.75	74LS365	.49
74LS96	.89	74LS366	.49
74LS107	.39	74LS367	.45
74LS109	.39	74LS368	.45
74LS112	.39	74LS373	1.39
74LS113	.39	74LS374	1.39
74LS114	.39	74LS377	1.39
74LS122	.45	74LS378	1.18
74LS123	.79	74LS379	1.35
74LS124	2.90	74LS385	1.90
74LS125	.49	74LS386	.45
74LS126	.49	74LS390	1.19
74LS132	.59	74LS393	1.19
74LS133	.59	74LS395	1.19
74LS136	.39	74LS399	1.49
74LS137	.99	74LS424	2.95
74LS138	.55	74LS447	.37
74LS139	.55	74LS490	1.95
74LS145	1.20	74LS624	3.99
74LS147	2.49	74LS640	2.20
74LS148	1.35	74LS645	2.20
74LS151	.55	74LS668	1.69
74LS153	.55	74LS669	1.89
74LS154	1.90	74LS670	1.49
74LS155	.69	74LS674	9.65
74LS156	.69	74LS682	3.20
74LS157	.65	74LS683	3.20
74LS158	.59	74LS684	3.20
74LS160	.69	74LS685	3.20
74LS161	.65	74LS688	2.40
74LS162	.69	74LS689	3.20
74LS163	.65	74LS783	24.95
74LS164	.69	81LS95	1.49
74LS165	.95	81LS96	1.49
74LS166	1.95	81LS97	1.49
74LS168	1.75	81LS98	1.49
74LS169	1.75	25LS2521	2.80
74LS170	1.49	25LS2569	4.25

DYNAMIC RAMS

TMS4027	4096 x 1 (250ns)	1.99
UPD411	4096 x 1 (300ns)	3.00
MM5280	4096 x 1 (300ns)	3.00
MK4108	8192 x 1 (200ns)	1.95
MM5298	8192 x 1 (250ns)	1.85
4116-300	16384 x 1 (300ns)	8/11.75
4116-250	16384 x 1 (250ns)	8/11.95
4116-200	16384 x 1 (200ns)	8/12.95
4116-150	16384 x 1 (150ns)	8/14.95
4116-120	16384 x 1 (120ns)	8/29.95
2118	16384 x 1 (150ns) (5v)	4.95
4164-200	65536 x 1 (200ns) (5v)	5.95
4164-150	65536 x 1 (150ns) (5v)	6.95

5V = single 5 volt supply

EPROMS

1702	256 x 8 (1us)	4.50
------	---------------	------

2114 450 NS 8/\$995

2114 250 NS 8/\$1095

7400

7400	.19	74132	.45
7401	.19	74136	.50
7402	.19	74141	.65
7403	.19	74142	.85
7404	.19	74143	2.95
7405	.25	74145	.60
7406	.29	74147	1.75
7407	.29	74148	1.20
7408	.24	74150	1.35
7409	.19	74151	.55
7410	.19	74152	.85
7411	.25	74153	.55
7412	.30	74154	1.25
7413	.35	74155	.75
7414	.49	74156	.65
7416	.25	74157	.55
7417	.25	74159	1.65
7420	.19	74160	.85
7421	.35	74161	.69
7422	.35	74162	.85
7423	.29	74163	.69
7425	.29	74164	.85
7426	.29	74165	.85
7427	.29	74166	1.00
7428	.45	74167	2.95
7430	.19	74170	1.65
7432	.29	74172	5.95
7433	.45	74173	.75
7437	.29	74174	.89
7438	.29	74175	.89
7440	.19	74176	.89
7442	.49	74177	.75
7443	.65	74178	1.15
7444	.69	74179	1.75
7445	.69	74180	.75
7446	.69	74181	2.25
7447	.69	74182	.75
7448	.69	74184	2.00
7450	.19	74185	2.00
7451	.23	74190	1.15
7453	.23	74191	1.15
7454	.23	74192	.79
7460	.23	74193	.79
7470	.35	74194	.85
7472	.29	74195	.85
7473	.34	74196	.79
7474	.33	74197	.75
7475	.45	74198	1.35
7476	.35	74199	1.35
7480	.59	74221	1.35
7481	1.10	74246	1.35
7482	.95	74247	1.25
7483	.50	74248	1.85
7485	.59	74249	1.95
7486	.35	74251	.75
7489	2.15	74259	2.25
7490	.35	74265	1.35
7491	.40	74273	1.95
7492	.50	74276	1.25
7493	.35	74279	.75
7494	.65	74283	2.00
7495	.55	74284	3.75
7496	.70	74285	3.75
7497	2.75	74290	.95
74100	1.75	74293	.75
74107	.30	74298	.85
74109	.45	74351	2.25
74110	.45	74365	.65
74111	.55	74366	.65
74116	1.55	74367	.65
74120	1.20	74368	.65
74121	.29	74376	2.20
74122	.45	74390	1.75
74123	.49	74393	1.35
74125	.45	74425	3.15
74126	.45	74426	.85
74128	.55	74490	2.55

LINEAR

LM301	.34	LM340 (see 7800)	LM566	1.49	LM1800	2.37
LM301H	.79	LM348	LM567	.89	LM1812	8.25
LM307	.45	LM350K	NE570	3.95	LM1830	3.50
LM308	.89	LM350T	NE571	2.95	LM1871	5.49
LM308H	1.15	LM358	NE592	2.75	LM1872	5.49
LM309H	1.95	LM359	LM709	.59	LM1877	3.25
LM309K	1.25	LM376	LM710	.75	LM1889	1.95
LM310	1.75	LM377	LM711	.79	LM1896	1.75
LM311	.84	LM378	LM723	.49	ULN2003	2.49
LM311H	.89	LM379	LM723H	.55	LM2877	2.05
LM312H	1.75	LM380	LM733	.98	LM2878	2.25
LM317K	3.95	LM380N-8	LM741	.35	LM2900	.85
LM317T	1.19	LM381	LM741N-14	.35	LM2901	1.00
LM318	1.49	LM382	LM741H	.40	LM3900	.59
LM318H	1.59	LM383	LM747	.69	LM3905	1.25
LM319H	1.90	LM384	LM748	.59	LM3909	.98
LM319	1.25	LM386	LM1014	1.19	LM3911	2.25
LM320 (see 7900)	LM387	1.40	LM1303	1.95	LM3914	3.95
LM322	1.85	LM389	LM1310	1.49	LM3915	3.95
LM323K	4.95	LM390	MC1330	1.69	LM3916	3.95
LM324	.59	LM392	MC1349	1.89	MC4024	3.95
LM329	.65	LM394H	MC1350	1.19	MC4044	4.50
LM331	3.95	LM399H	MC1358	1.69	RC4136	1.25
LM334	1.19	NE531	MC1372	6.95	RC4151	3.95
LM335	1.40	NE555	LM1414	1.59	LM4250	1.75
LM336	1.75	NE556	LM1458	.59	LM4500	3.25
LM337K	3.95	NE558	LM1488	.69	RC4558	.69
LM337T	1.95	NE561	LM1489	.69	LM13080	1.29
LM338K	6.95	NE564	LM1496	.85	LM13600	1.49
LM339	.99	LM565	LM1558H	3.10	LM13700	1.49

H - TO-5 CAN T - TO-220 K - TO-3

RCA

CA 3023	2.75	CA 3082	1.65
CA 3039	1.29	CA 3083	1.55
CA 3046	1.25	CA 3086	.80
CA 3059	2.90	CA 3089	2.99
CA 3060	2.90	CA 3096	3.49
CA 3065	1.75	CA 3130	1.30
CA 3080	1.10	CA 3140	1.15
CA 3081	1.65	CA 3146	1.85
CA 3160	1.19		

TI

TL494	4.20	75365	1.95
TL496	1.65	75450	.59
TL497	3.25	75451	.39
75107	1.49	75452	.39
75110	1.95	75453	.39
75150	1.95	75454	.39
75154	1.95	75491	.79
75188	1.25	75492	.79
75189	1.25	75493	.89
75494	.89		

BI FET

TL071	.79	TL084	2.19
TL072	1.19	LF347	2.19
TL074	2.19	LF351	.60
TL081	.79	LF353	1.00
TL082	1.19	LF355	1.10
TL083	1.19	LF356	1.10
LF357	1.40		

74S00

74S00	.32	74S163	1.95
74S02	.35	74S168	3.95
74S03	.35	74S169	3.95
74S04	.35	74S174	.95
74S05	.35	74S175	.95
74S08	.35	74S181	3.95
74S09	.40	74S182	2.95
74S10	.35	74S188	1.95
74S11	.35	74S189	6.95
74S15	.35	74S194	1.49
74S20	.35	74S195	1.49
74S22	.35	74S196	1.49
74S30	.35	74S197	1.49
74S32	.40	74S201	6.95
74S37	.88	74S225	7.95
74S38	.85	74S240	2.20
74S40	.35	74S241	2.20
74S41	.35	74S244	2.20
74S44	.40	74S251	.95
74S45	.40	74S253	.95
74S74	.50	74S257	.95
74S85	1.99	74S258	.95
74S86	.50	74S260	.79
74S112	.50	74S274	19.95
74S113	.50	74S275	19.95
74S114	.55	74S280	1.95
74S124	2.75	74S287	1.90
74S132	1.24	74S288	1.90
74S133	.45	74S289	6.89
74S134	.50	74S301	6.95
74S135	.89	74S373	2.45
74S138	.85	74S374	2.45
74S139	.85	74S381	7.95
74S140	.55	74S387	1.95
74S151	.95	74S412	2.98
74S153	.95	74S471	4.95
74S157	.95	74S472	4.95
74S158	.95	74S474	4.95
74S161	1.95	74S482	15.25
74S162	1.95	74S570	2.95
		74S571	2.95

IC SOCKETS

8 pin ST	.13	.11
14 pin ST	.15	.12
16 pin ST	.17	.13
18 pin ST	.20	.18
20 pin ST	.29	.27
22 pin ST	.30	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39
64 pin ST	4.25	call
ST - SOLDERTAIL		
8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.69	.58
18 pin WW	.99	.90
20 pin WW	1.09	.98
24 pin WW	1.39	1.28
28 pin WW	1.49	1.35
40 pin WW	1.99	1.80
WW - WIREWRAP		
16 pin ZIF	6.75	call
24 pin ZIF	9.95	call
28 pin ZIF	10.95	call
ZIF - TEXTTOOL		
(Zero Insertion Force)		

LED LAMPS

Red	.10	.09
Green	.18	.15
Yellow	.18	.15

LED DISPLAYS

HP 5082-7760	.6"	CC	1.29
MAN 72	.3"	CA	.99
MAN 74	.3"	CC	.99
FND-357 (359)	.375"	CC	1.25
FND-500 (503)	.5"	CC	1.49
FND-507 (510)	.5"	CA	1.49

VOLTAGE REGULATORS

7805T	.75	7905T	.85
78M05C	.35	7908T	.85
7808T	.75	7912T	.85
7812T	.75	7915T	.85
7815T	.75	7924T	.85
7824T	.75		
7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
7815K	1.39	7915K	1.49
7824K	1.39	7924K	1.49
78L05	.69	79L12	.79
78L12	.69	79L15	.79
78L15	.69		
78H05K	9.95	LM323K	4.95
78H12K	9.95	UA78S40	1.95

C, T - TO-220 L - TO-92 K - TO-3

DIP SWITCHES

4 POSITION	.85
5 POSITION	.90
6 POSITION	.90
7 POSITION	.95
8 POSITION	.95

INTERFACE

8T26	1.59
8T28	1.89
8T95	.89
8T96	.89
8T97	.89
8T98	.89
DM6131	2.95
DP8304	2.29
DS8835	1.99
DS8836	.99

MISC.

ULN2003	2.49
3242	7.95
3341	4.95
MC3470	4.95
MC3480	9.00
11C90	13.95
95H90	7.95
2513-001 UP	9.95
2513-002 LOW	9.95

CLOCK CIRCUITS

MM5314	4.95
MM5369	3.95
MM5375	4.95
MM58167	8.95
MM58174	11.95
MSM5832	6.95

INTERSIL

ICL7106	9.95
ICL7107	12.95
ICL7660	2.95
ICL8038	3.95
ICM7207A	5.59
ICM7208	15.95

9000

9316	1.00
9334	2.50
9368	3.95
9401	9.95
9601	.75
9602	1.50
96S02	1.95

EXAR

XR 2206	3.75
XR 2207	3.75
XR 2208	3.75
XR 2211	5.25
XR 2240	3.25

DATA ACQUISITION

ADC0800	15.55	DAC0808	2.95
ADC0804	3.49	DAC1020</	

CABINETS FOR 5 1/4" DISK DRIVES

CABINET #1 \$29.95

- * DIMENSIONS 8 1/2" x 5 1/4" x 3 1/8"
- * COLOR MATCHES APPLE
- * FITS STANDARD 5 1/4" DRIVES, INCL. SHUGART
- * INCLUDES MOUNTING HARDWARE AND FEET

CABINET #2 \$79.00

- * COMPLETE WITH POWER SUPPLY, SWITCH, LINE CORD, FUSE & STANDARD POWER CONNECTOR
- * DIMENSIONS: 11 1/2" x 5 1/4" x 3 1/8"
- * +5V @ 1 AMP, +12V @ 1.5 AMP
- * FITS STANDARD 5 1/4" DRIVES
- * PLEASE SPECIFY GRAY OR TAN
- NOTE: Please include sufficient amount for shipping on above items.

CONNECTORS

RS232 MALE	2.50
RS232 FEMALE	3.25
RS232 FEMALE RIGHT ANGLE	5.25
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95
72 pin ST	6.95
72 pin WW	7.95
50 pin ST	4.95
44 pin ST	2.95
44 pin WW	4.95
72 pin SE	3.95

MUFFIN FANS

NEW UN-US

4.68" Square	14.95
3.125" Square	14.95

OPTO-ISOLATORS

4N26	1.00
4N27	1.10
4N28	.69
4N33	1.75
4N35	1.25
4N37	1.25
MCT-2	1.00
MCT-6	1.50
MCA-7	4.25
MCA-255	1.75
IL-1	1.25
ILA-30	1.25
ILQ-74	2.75
H11C5	1.25
TIL-111	1.00
TIL-113	1.75

TRANSISTORS

2N918	.50	MPS3706	.15
MPS918	.25	2N3772	1.85
2N2102	.70	2N3903	.25
2N2218	.50	2N3904	.10
2N2218A	.50	2N3906	.10
2N2219	.50	2N4122	.25
2N2219A	.50	2N4123	.25
2N2222	.25	2N4249	.25
PN2222	.10	2N4304	.75
MPS2369	.25	2N4401	.25
2N2484	.25	2N4402	.25
2N2905	.50	2N4403	.25
2N2907	.25	2N4857	1.00
PN2907	.125	PN4916	.25
2N3055	.79	2N5086	.25
3055T	.69	PN5129	.25
2N3393	.30	PN5139	.25
2N3414	.25	2N5209	.25
2N3563	.40	2N6028	.35
2N3565	.40	2N6043	1.75
PN3565	.25	2N6045	1.75
MPS3638	.25	MPS-A05	.25
MPS3640	.25	MPS-A06	.25
PN3643	.25	MPS-A55	.25
PN3644	.25	TIP29	.65
MPS3704	.15	TIP31	.75
		TIP32	.79

MICROCOMPUTER HARDWARE HANDBOOK FROM ELCOMP — \$14.95

Over 800 pages of manufacturers data sheets on most commonly used IC's.

Includes:

- * TTL — 74/74LS and 74F
- * CMOS
- * Voltage Regulators
- * Memory — RAM, ROM, EPROM
- * CPU's — 6800, 6500, Z80, 8080, 8085, 8086/8
- * MPU support & interface — 6800, 6500, Z80, 8200, etc.

HEAT SINKS

TO-3 style	.95
TO-220 style	.35

DISK DRIVES TANDON

TM100-1 5 1/4" (FOR IBM) SS/DD **229.00**
 TM100-2 5 1/4" (FOR IBM) DS/DD **295.00**

SHUGART

SA 400L 5 1/4" (40 TRACK) SS/DD **199.95**
 SA 400 5 1/4" (35 TRACK) SS/DD **189.95**

SIEMENS

FD100-8 8" SS/DD (SHUGART 801 EQUIVALENT) **189.00**

FD200-8 8" DS/DD (SHUGART 851 EQUIVALENT) **239.00**

PERTEC

FD-200 5 1/4" SS/DD **179.95**

FD-250 5 1/4" DS/DD **199.95**

MPI

MP-52 5 1/4" (FOR IBM) DS/DD **295.00**

NOTE: Please include sufficient amount for shipping on above items.

POWER SUPPLY MODEL 2 \$39.95

MOUNTED ON PC BOARD
 MANUFACTURED BY CONVER

+5 VOLT 4 AMP

±12 VOLT 1 AMP

NOTE: Please include sufficient amount for shipping on above items.

DIODES

1N751	5.1 volt zener	.25
1N759	12.0 volt zener	.25
1N4148	(1N914) switching	25/1.00
1N4004	400PIV rectifier	10/1.00
KBP02	200PIV 1.5amp bridge	.45
KBP04	400PIV 1.5amp bridge	.55
VM48	Dip-Bridge	.35

WE HAVE THE COMPLETE LINE OF DISC, TANTALUM AND ELECTROLYTIC CAPACITORS IN STOCK!

RESISTORS

1/4 WATT 5% CARBON FILM ALL STANDARD VALUES FROM 1 OHM TO 10 MEG OHM

50 PCS. SAME VALUE	.025
100 PCS. SAME VALUE	.02
1000 PCS. SAME VALUE	.015

BYPASS CAPS

.01 UF DISC	100/6.00
.1 UF DISC	100/8.00
.1 UF MONOLITHIC	100/15.00

D-SUBMINIATURE

DESCRIPTION	SOLDER CUP		RIGHT ANGLE PC SOLDER		IDC RIBBON CABLE		HOODS	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	BLACK	GREY
ORDER BY	DBxxP	DBxxS	DBxxPR	DBxxSR	IDBxxP	IDBxxS	HOOD-B	HOOD
CONTACTS 9	2.08	2.66	1.65	2.18	3.37	3.69	---	1.60
15	2.69	3.63	2.20	3.03	4.70	5.13	---	1.80
25	2.50	3.25	3.00	4.42	6.23	6.84	1.25	1.25
37	4.80	7.11	4.83	6.19	9.22	10.08	---	2.95
50	6.06	9.24	---	---	---	---	---	3.50

For order instructions see "IDC Connectors" below.

CALL FOR MOUNTING HARDWARE

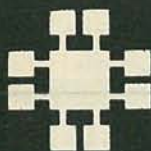
RIBBON CABLE

CONTACTS	SINGLE COLOR		COLOR CODED	
	1'	10'	1'	10'
10	.50	4.40	.83	7.30
16	.55	4.80	1.00	8.80
20	.65	5.70	1.25	11.00
25	.75	6.60	1.32	11.60
26	.75	6.60	1.32	11.60
34	.98	8.60	1.65	14.50
40	1.32	11.60	1.92	16.80
50	1.38	12.10	2.50	22.00

IDC CONNECTORS

DESCRIPTION	SOLDER HEADER	RIGHT ANGLE SOLDER HEADER	WW HEADER	RIGHT ANGLE WW HEADER	RIBBON HEADER SOCKET	RIBBON HEADER	RIBBON EDGE CARD
ORDER BY	IDHxxS	IDHxxSR	IDHxxW	IDHxxWR	IDSxx	IDMxx	IDExx
CONTACTS 10	.82	.85	1.86	2.05	1.15	---	2.25
20	1.29	1.35	2.98	3.28	1.86	5.50	2.36
26	1.68	1.76	3.84	4.22	2.43	6.25	2.65
34	2.20	2.31	4.50	4.45	3.15	7.00	3.25
40	2.58	2.72	5.28	4.80	3.73	7.50	3.80
50	3.24	3.39	6.63	7.30	4.65	8.50	4.74

ORDERING INSTRUCTIONS: Insert the number of contacts in the position marked "xx" of the "order by" part number listed. Example: A 10 pin right angle solder style header would be IDH10SR.



JDR Microdevices

1224 S. Bascom Avenue
 San Jose, CA 95128

800-538-5000 • 800-662-6279 (CA)
 (408) 995-5430 • Telex 171-110

1983 JDR MICRODEVICES, INC

VISIT OUR RETAIL STORE — NEW HOURS —
 M-W-F, 9-5
 T-Th, 9-9 Sat, 11-3
 PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: For shipping include \$2 for UPS Ground or \$3 for UPS Blue Label Air. Items over 5 pounds require additional shipping charges. Foreign orders include sufficient amount for shipping. There is a \$10 minimum order. Bay Area and Los Angeles Counties add 6% Sales Tax. Other California residents add 6% Sales Tax. We reserve the right to substitute manufacturer. Not responsible for typographical errors. Prices are subject to change without notice. We will match or beat any competitor's price provided it is not below our cost.

FOR APPLE COMPUTER USERS

FD-35 DISK DRIVE

- ★ Direct Replacement for Apple Disk II
- ★ Compatible with Apple Controller or other Apple compatible controllers
- ★ Specially designed electronics with low power consumption
- ★ DOS 3.3 and 3.2 compatible
- ★ Owner's Manual and Warranty Card included

NOW
WITH ONE YEAR WARRANTY \$229⁹⁵
CONTROLLER CARD \$89.95

VIEWMAX-80

A Full Function
 80 Column Card for Apple II*
 ★ Soft Video Switch ★ Shift Key Support
2 YEAR WARRANTY
NOW ONLY \$189⁹⁵

5 1/4" DISKETTES VERBATIM DATALIFE

SS/DD SOFT SECTOR **29.95**
 SS/DD 10 SECTOR HEAD **29.95**
NASHUA
 SS/DD SOFT SECTOR WITH HUB RING **\$19⁹⁵**
BEST BUY
 Ask about our full line of Nashua diskettes

THOUSANDS SOLD JDR 16K RAMCARD

- ★ Expand your 48K Apple to 64K
- ★ Fully compatible with Apple Language System — Use in place of Apple Language card
- ★ Provides extra memory for Visicalc™
- ★ Run PASCAL, FORTRAN, Integer Basic with appropriate software
- ★ Highest quality card features: gold edge connector, sockets for all IC's

WITH 2 YEAR WARRANTY
ASSEMBLED & TESTED WITH WARRANTY \$44⁹⁵
KIT — INCLUDES ALL PARTS & INSTRUCTIONS \$40⁹⁵
BARE PC CARD WITH INSTRUCTIONS \$14⁹⁵

APPLE COMPATIBLE POWER SUPPLY \$99.95

- ★ Compact Switching Design
- ★ All Outputs regulated
- ★ Short Circuit and Overload Protection
- ★ Complete with Apple-type plug-in power cord
- ★ Apple Compatible — Yet higher output allows more disk drives and cards without overheating
- ★ +5V @ .5A, +12V @ .3A, -5V @ .5A, -12V @ .5A
- ★ Shielded enclosure: 10 1/4" x 3 1/2" x 2 1/8"

NEW IMPROVED JDR COOLING FAN

- ★ Easy modification — no modification of Apple required
- ★ Eliminates overheating problems
- ★ Switch on front controls fan, Apple, and extra outlet
- ★ Rotron whisper fan is the quietest, most reliable on the market

NOW WITH SURGE SUPPRESSION \$69.95
WITHOUT SURGE SUPPRESSION \$59.95

MONITORS MONOCHROME

NEC JB1201M - 20 MHZ GREEN \$169
 ZENITH ZUM-121 - 15 MHZ GREEN \$99
 TAXAN 18 MHZ AMBER \$139
COLOR
 AMDEK COLOR I - COMPOSITE \$335
 NO C.O.D. ORDERS PLEASE

ORDER TOLL FREE
800-538-5000
800-662-6279
 (CALIFORNIA RESIDENTS)

ACCESSORIES FOR APPLE II & IIE

ALL WITH 1 YEAR WARRANTY BY



PRINTERLINK CENTRONICS PARALLEL INTERFACE

- ★ Simple to use — No configuring required
- ★ Use with any centronics printer — EPSON, OKIDATA, etc.
- ★ Includes Cable & Manual

\$59⁰⁰

MESSENGER SERIAL INTERFACE

- ★ Connects to any RS-232 serial device
- ★ 8 switch selectable drivers for printers, terminals and modems
- ★ Includes Cable & Manual

\$99⁰⁰

TIMELINK REAL TIME CLOCK

- ★ Applications in file management, word processing, communications, etc.
- ★ Exclusive Alarm Clock feature
- ★ Battery recharges automatically

\$84⁰⁰

NEW BUFFERLINK ADD-ON PRINTER BUFFER

- ★ Saves Time — No more waiting for printed output
- ★ Connects easily to any parallel interface
- ★ Expandable from 16K to 64K

\$139⁰⁰ (16K)

ORDER TOLL FREE
ALL MERCHANDISE
100% GUARANTEED

800-538-5000

800-662-6279
 (CALIFORNIA RESIDENTS)

CALL US FOR VOLUME QUOTES



1983 JDR MICRODEVICES, INC.



Active Electronics

**NUMBER ONE IN
QUALITY
SERVICE
AVAILABILITY**

**THE WORLD'S MOST
COMPLETE PROFESSIONAL
AND HOME ELECTRONICS
ENTHUSIAST INVENTORY**

- Semiconductors + Memories
- Microprocessors + Support Circuits
- Microcomputer Systems + Peripherals
- Passive Electronic Components
- Hand Tools, Wire Wrapping, Soldering Equipment + Hardware

**NOW AVAILABLE — FREE
1983 80-page catalog**

A complete listing of products and specifications

Call, write or circle the inquiry card for your free copy today.

P.O. Box 8000, Westboro, Mass. 01581
CALL TOLL FREE: 1-800-343-0874

Mass customers call (617) 366-0500

CIRCLE 3 ON FREE INFORMATION CARD

DON'T FORGET



USE
YOUR
READER
SERVICE
CARD

CABLE TV EQUIPMENT

JERROLD - OAK - HAMMLIN



- Table Top
- Remote Control
- 60 Channel Wireless

SEND OR CALL FOR INFORMATION

The unauthorized use of Cable TV equipment may be illegal, check with your local Cable Co. before ordering.

TO THE PUBLIC SPECIALS

CAR STEREO		AKAI HOME STEREO	
AM FM IN Dash Cass.		AM FM Rec.	
AUDIOVOX 600	\$ 65.00	30 Watt	\$ 183.00
CLARION 3100	86.00	45 Watt	241.00
Imported ELITE	49.00	60 Watt	314.00
EQUALIZERS		B DOLBY Cass. Deck	135.00
10 BAND 150 Watt	59.00	C DOLBY Cass. Deck	150.00
7 BAND 150 Watt	49.00	TURN TABLES	
CLARION 500 EQ B	71.00	BELT DRIVE	73.00
6 X 9 TRIAXIALS		DIRECT DRIVE	98.00
AUDIOVOX	29.00	HOME STEREO SPEAKERS	
CLARION	78.00	PIONEER 100 Watt 4 way	159.00
JENSEN II	60.95	with 12" WOOFER	PR.
Imported	24.95	JVC 100 Watt 4 way	169.00
		with 12" WOOFER	PR.
		EGO 85 Watt 3 way	219.00

Orders sent UPS COD OR PREPAID. CREDIT CARD.
SEND FOR COMPLETE CATALOG.

WANTED: DEALERS • WHOLESALERS • PEDDLERS

Become a CABLE TV giant in your town and get in on the big profits, send or call for DEALER catalog information with special Dealer Pricing, Limited Territories, car stereos AUDIOVOX, CLARION, JENSEN and major imports

KEEP US IN MIND FOR ALL YOUR CABLE TV EQUIPMENT REPAIRS
SYSTEMS COMPLETELY REBUILT - \$45.95

L.I. PUBLIC WHOLESALERS (516) 581-7232
270 ISLIP AVENUE (Rt. 111) ISLIP, N.Y. 11751 (516) 277-4232
1500 Ft. So. of Sunrise Hwy.)

HOURS: M-F 9 to 9 - SAT. 10:30 to 7:30

CIRCLE 44 ON FREE INFORMATION CARD

Components is Our First Name Call Us with Your Requirements

APPLE IIe 64K RAM CARD

80 column x 24 lines
64K RAM
Compatible with
Apple IIe Software

\$149⁰⁰

for APPLE

16K RAM CARD

Language Transparent
COEX FACTORY WARRANTY **\$69⁹⁵**

5 1/4" Floppy DISKETTES

All Certified—100% Guaranteed

BOX of 100... **\$149⁰⁰**
Above with
Hub Rings..... **\$169.00**

FLOPPY DISK DRIVE

Apple IIe Compatible
with • Track Zero Micro Switch
• DOS 3.2.1 & DOS 3.3
• CP/M and PASCAL

DESIGNED FOR YOUR
APPLE™ **\$235⁰⁰**

Controller Card
for above..... **\$75.00**

COEX 80-Ft DOT MATRIX PRINTER

- 9x7 Dot Matrix, 80 CPS, Bi-Directional Printing
- 2K Buffered Memory
- 80, 96, 132 Columns, Graphics and Block Printing
- Selectable Char Pitch, Line Spacing and Feed

PARALLEL

COEX Interface Card to Apple .. **\$49.95**
Commodore Interface Card to
VIC, 64, PET..... **\$79.95**



\$275⁰⁰

VISION-80® **\$229⁰⁰**

80x24 Video Display Card

Vista Computer Company's new Vision-80 board is a sophisticated yet easy to use video display card for the Apple™ computer.

EXTENDER CARDS

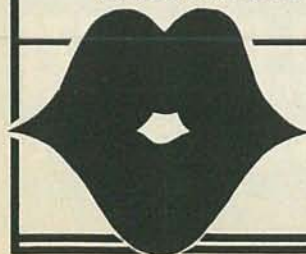
for APPLE... **\$16.95**
for I.B.M..... **\$19.95**

DO YOU HAVE A COMMODORE?

NEW ROM for COEX 80 & DP8480
Allows Full Graphics Compatibility
with All Commodore Computers **\$29⁹⁵**

PARALLEL INTERFACE EPSON TO APPLE

New From **\$49⁹⁵** CABLE INCLUDED



"Have You Kissed Your Computer Lately?"

Components Express, Inc.

1380 E. Edinger • Santa Ana, Calif. 92705 • 714/558-3972

TWX 910-595-1565 • ADVACON SNA • International Orders Welcome

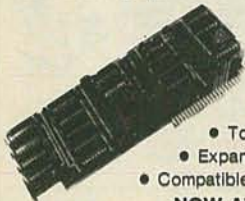
Terms of Sale: Cash, Checks, Credit Cards, M.O., C.O.D. FOB Santa Ana. Calif. residents add 6% sales tax.



ADVANCED COMPUTER PRODUCTS

SEND \$2.00 for 1983 CATALOG

16K Apple™ Ramcard



LIST 195
ACP

\$59.95

- Full 1 year warranty
- Top quality — gold fingers
- Expand Apple II 48K to 64K
- Compatible with Z-80 Software™

NOW AVAILABLE

Apple IIe 64K Add-in Memory with 80 Columns **\$149.95**

32K STATIC RAM

2 or 4 MHz
Expandable
Uses
2114's

16K 4 MHz Kit \$159.95
16K 4 MHz AAT \$179.95
32K 4 MHz Kit \$129.95
32K 4 MHz AAT \$339.00
BARE BOARD 39.95
Bare Bd w/ parts less mem. 99.95

64K CMOS RAMCARD

IEEE Compatible
Uses
Low Power
6116 IC's
6 Volt
Single Supply
Asm and Tested

\$269.00

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 unencoded with SPST keys unattached to any PC board. Solid molded plastic 11" x 4" base.

INTEL 4K STATIC RAM

Super Fast!
Super
Low Power!

Part No. 2147 **\$1.95 ea.**

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 ea.** 10 for **\$34.95**

UV "EPROM" ERASER

Model DE-4
\$89.95
Holds 4 EPROM's at a time.
Model S-52T **\$325.00**

RS232 SIGNAL TESTER

COEX RS232
Line Tester
(7) LED Indicators

only **\$24.95**

Other Styles Also Available

16K Memory Expansion Kits for Apple/TRS-80

8 pcs 4116 16K
200/250's
Specify computer. **\$12.95**
CALL FOR VOLUME PRICING

INTEL CODEC IC

P/N 2910A
For Digital Voice

\$9.95 ea.

For Filter P/N 2912A ... **\$4.95 ea.**

CORCOM FILTER

Popular CORCOM Filter

\$4.95

6 amps
Compatible Line Cord Add ... **\$3.50**

SURGE SUPPRESSOR "Surgeon's"

Power Sentry
15 Amps 250 Volts
transient suppression
ACP
Low Price **\$39.95**

9 pcs 4164 D-RAM

\$50.00

CONNECTORS

DB25P (RS232) \$3.25
DB25S Female 3.75
Hood 1.25
Set with Hood, Sale 7.50
22/44 S/T, KIM -2.95
43/86 S/T, MOT 6.50
50/100 S-100 Connector W/W 4.95
50/100 S-100 Connector S/T 3.95

AMD MODEM IC

P/N AM7910
1200Baud
5 Volts

Special ACP Price **\$99.00**

PARALLEL ALPHA NUMERIC PRINTER

19 Column Printer prints 16 numerical columns plus 3 columns which have math, alpha and other notations. Each wheel has 12 positions with position 12 blank. Used adding machine tape and a dual color ink ribbon. Input data parallel with four bit BCD comparator circuit. Print rate, 3 lines per second. Operating voltage 22-28VDC with typical cycle time of 340mS. Size 6 1/2" W x 3 3/4" H x 5 1/2" Dp. New. **\$8.95 ea. \$3/25**

MICROPROCESSORS

Z8001	\$90.00	8008-1	\$14.95	8802P	14.95
Z8002	80.00	2901	9.90	8035	14.95
Z8003	9.95	2901A	14.95	8038	12.95
Z8004	11.95	9900A	49.95	8073N	34.95
F-8 (3800)	10.95	8902	9.95	8765	49.95
8902A	10.95	8902	9.95	8748	49.95
1802	9.75	IM810	29.95	8609	30.00
8080A	4.75	8800	11.75	8086	49.95
8085	14.95	8800B	19.95	88000	129.95

RAMS

6116/2016	\$7.95	2147	\$5.99	5290	\$1.99
8204-64K	5.95	411	5.99	5298	1.49
4118-2	1.99	414	4.89	8608	4.40
4118-2 B/12.95	11.01	899	8.59	8516	6.79
2102	3.99	1103	4.99	8601	3.79
2102	7.99	4027	4.69	8604	3.99
21L02-2	1.49	4040	3.99	8605	3.99
21L02-4	1.29	4080	4.89	9130	8.99
2111	3.49	4080	4.69	9140	8.99
2112	3.49	4098	3.99	9341 S	6.99
2114	1.99	4115	1.49	9342S	6.99
2114L-2	3.25	4200	7.95		
2114L-4	2.29	4402	1.99		
2125	6.99	6280	4.60		

SUPPORT

8185	\$9.95	8269	\$8.95	86047	\$22.95
8186	9.95	8275	19.95	86488	19.95
8202	29.95	8279	9.50	86500	22.95
8205	2.69	8610	4.75	8520	6.95
8212	2.75	8620	5.50	8522	9.95
8214	4.95	8621	6.50	8530-X	24.95
8216	2.75	8628	10.50	8532	17.95
8224	2.95	8634	18.95	8551	19.95
8226	2.95	8645	22.95	Z80-PIO	6.50
8228	3.95	8647	27.95	Z80A-PIO	9.50
8243	9.50	8650	5.25	Z80-CTC	6.50
8260	14.95	8651	6.50	Z80A-CTC	24.95
8261	6.50	8660	10.95	Z80-DMA	19.95
8263	11.95	8662	10.95	Z80A-DMA	27.95
8265	4.50	8675	5.95	Z80-SIO	24.95
8267	9.50	8680	2.49	Z80A-SIO	29.95

MOS PROMS

2764 (16Kx8) TS	\$69.95	2708 (450x8)	\$5.75
2732 (4Kx8) TS	12.95	2708 (650x8)	6.25
2718/2618, 6V		1702A	6.75
(2Kx8) TS	7.95	MM5203AQ	14.50
TM52718, 6V, 12V	17.95	MM5204C	9.95
2765, 5V, (450x8)	3.50		

HI-TECH

2513-001 (8V) Upper	\$9.50	DA008	\$9.95
2513-009 (8V) Lower	10.95	DA010	9.95
2513-013 (8V) Lower	14.95	8338 Function Generator	4.50
MC166710 ASCII Shifted 12.95	MC4204 VCO	2.95	
MC166740 Math Symbol 13.95	LM566 VCO	1.95	
MC166750 Alpha Control 13.45	XR2205 Function Generator	5.25	
1771-01 6" & MiniFloppy	TR1602B (8V, 12V)	3.95	
1791-01 Dual Floppy	AY15013 (8V, 12V)	4.95	
1791-02 Dual Floppy	AY15014/12 (15-14V)	4.95	
1792 DD, DS Floppy	44.95	IM462	7.95
1793 DD, DS Floppy	44.95	IM463	8.95
1991 Data Separator	18.95	2350 USRT	2.95
2143 Clock Generator	18.95	18719 Astros	24.95
8700 8 bit Binary	12.95	MC1411	11.95
8701 10 bit Binary	22.00	4202	14.95
8702 8 bit TS	13.50	WD0181	4.95
9400 Volt to Freq Conv.	7.25	COM5018	19.95
8750 3 1/2 Digit DC	13.95	IN58250	15.95
1408L 8 bit	3.95	AV5-2376	13.75
1408L 8 bit	5.95	AV5-2380	13.75
DA001 to A	5.95	MM5740AC	8.95

SOCKETS

1-24	25-49	50-100	
8 pin LP	.16	.15	.14
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.24	.23	.22
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
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	.90	.89	.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

LOW PROFILE SOCKETS (TIN)

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

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	.90	.89	.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
78M05	1.49	LM1458CN/N	.49
LM1084H	1.49	MC1489N	.99
LM300H	2.95	MC1489N	.99
LM301CN	.95	LM1489N	.89
LM304H	1.95	LM1558N	1.50
LM304H	1.95	LM1820N	.95
LM304H	1.95	LM1820N	.95
LM308H	3.25	LM1888N	3.10
LM307CN	.29	LM2111N	.75
LM308CN	.95	LM2900N	1.99
LM309K	1.49	LM2901N	2.50
LM310CN	1.25	LM2917N	2.95
LM311D/CN	2.99	LM3017	2.19
LM312H	1.75	CA3018T	.99
LM317T	1.70	CA3021T	1.49
LM318CN	1.49	CA3023T	2.99
LM318N/H	1.25	CA3035T	2.75
LM320K-XX*	1.35	CA3039T	1.29
LM320T-XX*	1.39	CA3048N	1.29
LM323K	4.95	CA3069N	3.19
LM324N	.95	CA3080N	3.19
LM337K	5.95	CA3082N	4.95
LM337N	6.95	CA3095A	1.49
LM339N	.95	CA3080T	.20
LM340K-XX*	1.75	CA3081N	1.69
LM340H-XX*	1.25	CA3082N	1.89
LM344H	1.95	CA3083N	1.55
LM348H	1.20	CA3089N	.80
LM350K	5.80	CA3098N	3.49
LM358CN	.95	CA3097N	1.99
LM380N	1.49	CA3130T	1.30
LM372N	1.95	CA3140T	1.19
LM378N	3.75	CA3148N	2.40
LM380CN/N	2.75	CA3150T	1.19
LM381N	1.79	CA3190N	1.95
LM383T	1.95	MC3423N	1.49
LM388N	1.25	MC3460N	3.95
LM388T	1.95	MC3054N	3.95
LM390N	1.95	CA3800N	3.95
NE531V/T	3.75	LM3900N	5.99
NE555V	.39	LM3905N	1.19
NE558N	.95	LM3909N	.95
NE561T	19.95	LM3914N	3.75
NE568H/V	1.25	LM3915N	3.95
NE568H/V	1.75	LM3918N	3.75
NE567V/H	1.50	RC4131N	2.95
NE592N	2.75	RC4138N	1.10
LM702H	1.99	RC4181N	3.70
LM705H/V	.29	RC4194T	4.95
LM710N	.75	CA4195T	6.40
LM711N/H	.99	ULN2001	1.25
LM716N	1.95	ULN2003	1.50
LM723N/H	.65	SN75450N	.69
LM733N/H	.98	SN75451N	.35
LM737N	1.15	SN75452A	3.10
LM741CN/H	.33	SN75453N	.49
LM741CN-14	.19	SN75454N	.49
LM747N/H	.75	SN75491N	.89
LM748N/H	.95	SN75492N	.89
LM760CN	2.95	SN75493N	.89
LM761CN	1.90	SN75494N	.99
MC1390	1.95	TL494CN	4.20
MC1390	1.95	TL496CP	1.65
MC1398	1.75		

74S00

74S00	\$.39	74S124	3.69	74S244	\$2.99
74S02	.43	74S133	.54	74S251	1.35
74S03	.45	74S134	.66	74S253	1.35
74S04	.52	74S135	1.16	74S257	1.29
74S05	.52	74S136	.49	74S258	1.29
74S06	.49	74S138	1.29	74S260	.75
74S09	.49	74S139	.23	74S280	2.79
74S10	.42	74S140	.79	74S287	2.99
74S11	.42	74S151	1.29	74S288	2.55
74S15	.42	74S153	1.29	74S373	3.10
74S20	.42	74S157	1.49	74S374	3.10
74S22	.42	74S158	1.29	74S381	2.75
74S30	.42	74S160	2.79	74S387	2.75
74S32	.49	74S174	1.49	74S472	7.95
74S38	1.19	74S175	1.49	74S473	



POPULAR TELEVISION CIRCUITS

Misite SATELLITE TELEVISION RECEIVER

\$349.95

SATELLITE TELEVISION

\$349.95

- ★ 6' FIBERGLASS DISH
- ★ POLAR MOUNT AND FEED

SINE WAVE

- Fully Illustrated Instructions
- NO Internal Connection to T.V.
- Continuous Audio/Video Modulation
- AGC FOR STABILITY
- Quality Circuit Board
- Silk Screened Parts Layout

- P.C. Board and Plans \$20.00 • \$3.00 Shipping and Handling
- All Parts and Wood Grained Cabinet \$99.95 • \$5.95 Shipping and Handling
- P.C. Board, Plans, All Parts and Wood Grained Cabinet \$119.95 • \$5.95 Shipping and Handling

- AVAILABLE BY MAIL ORDER ONLY
- COMPLETE REPAIR SERVICE • HOBBY USE ONLY, NOT FOR UNAUTHORIZED RECEPTION OF T.V. SIGNALS



CERTIFIED REPAIR AND WORK CENTER
THREE MONTH WARRANTY
PERSONAL CHECKS HELD FOR 3 WEEKS
FOR CLEARANCE
MASTECARD AND VISA APPROVED



WESTECH ELECTRONICS • 4242 SOUTH 48TH STREET, PHOENIX, ARIZONA 85040
INFO PHONE: (602) 829-6700 ORDERS ONLY: (800) 243-6700

CIRCLE 13 ON FREE INFORMATION CARD



- Minimum Order \$9.00
- Please include \$1.50 for shipping (UPS)
- We accept VISA and MASTERCARD
- EXTRA FAST SERVICE

P.O. BOX 27038, DENVER, COLO. 80227
PHONE ORDERS: 303-781-5750

120VAC VARIABLE STROBE LIGHT KIT

Complete variable rate strobe light kit produces brilliant flashes of light. Operates from standard 120VAC. Reliable design—thousands of these are in use throughout the world. Overall size of completed board: 3" L x 2" W x 3" H.



C3871 \$8.95

3VDC ELECTRONIC WARNING FLASHER KIT

This portable battery operated device continuously emits bursts of intense light at a fixed repetition rate. Can be seen for great distances making it a great safety device. Features xenon flashtube. Operates on 3VDC (two 1.5V Batteries). Size of board: 2 1/2" L x 2" W.



C3207 \$7.95

FABRICATION STAR KIT

Produces an "exploding star" visual effect using 25 LEDs and IC circuitry. The center LED lights first then the next group of LEDs light and then another set of lights until the outer edge of the star lights up. The process then reverses itself. Operates from 9V battery.



C4432 \$10.95

SEQUENTIAL LED FLASHER KIT

This kit combines IC circuitry and 10 jumbo red LEDs to produce a unique visual display. LEDs continuously light sequentially from right to left. Easy to build kit. Operates from 9V battery. Size of board: 5.25" x 1.5".



C4431 \$8.75

MICRO-MINIATURE SPEAKER

Only 1/4" dia. mounted on a 1" square PC board.



C4832

\$1.49 ea.

SOLID CARBIDE PC DRILL BIT

#65 .035 Standard size for PC boards.



C4800

\$1.49 ea.

10 for \$12.00

KESTER PC TYPE SOLDER

6 foot coil of ultra thin diameter low melting temperature 60/40 rosin core.



C4456

\$1.00

Kits!!!

We offer over 70 complete electronic kits. Send for our free catalog.

CIRCLE 34 ON FREE INFORMATION CARD

MICROWAVE TV ANTENNA SYSTEMS

Freq. 2.1 to 2.6 GHz • 34 db Gain +



COMPLETE SYSTEMS

- (as Pictured)
- Commercial 40" Rod Style \$ 89.95
- Parabolic 20" Dish Style \$ 79.95

COMPONENTS

- Down Converters (both types) \$ 34.95
- Power Supplies (12V to 16V) \$ 24.95
- Data Info (Plans) \$ 9.95

TWO YEAR WARRANTY PARTS & LABOR



CALL OR WRITE FOR KITS, PARTS, INDIVIDUAL COMPONENTS

We Repair All Types Down Converters & Power Supplies

Phillips-Tech Electronics

P.O. Box 34772
Phoenix, AZ 85067
(602) 265-8255

Special Quantity Pricing
Dealers Wanted



CIRCLE 9 ON FREE INFORMATION CARD

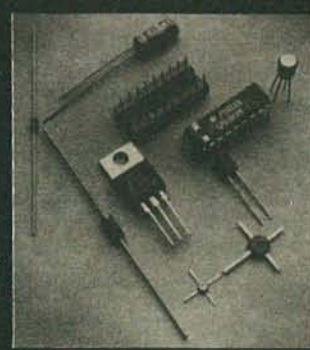


KCS ELECTRONICS CORPORATION

SEMICONDUCTOR PARTS & PRODUCTS

FACTORY PRIME DEVICES INCLUDE:

- Capacitors all types & styles
- Chokes & Coils
- Connectors
- Digital & Linear IC's
- Hardware & Accessories
- IC Sockets
- Memory
- Microwave Semiconductors
- Resistors fixed & variable
- Transformers
- Transistors & MORE!



MANUFACTURERS SUCH AS: Motorola, National, NEC, J.W. Miller, Texas Instruments and more!

WE STOCK & SUPPLY DEVICES FOR: OEM's, Distributors, Hobbyists, Magazine Projects, Engineers, Schools, Technicians & You!

Call or Write for Quantity Pricing and FREE Catalog.

P.O. Box 33205
Phoenix, AZ 85067 (602) 274-2885

CIRCLE 83 ON FREE INFORMATION CARD

BETA Electronics

1700 E. DESERT INN RD., SUITE 222 LAS VEGAS, NEV. 89109

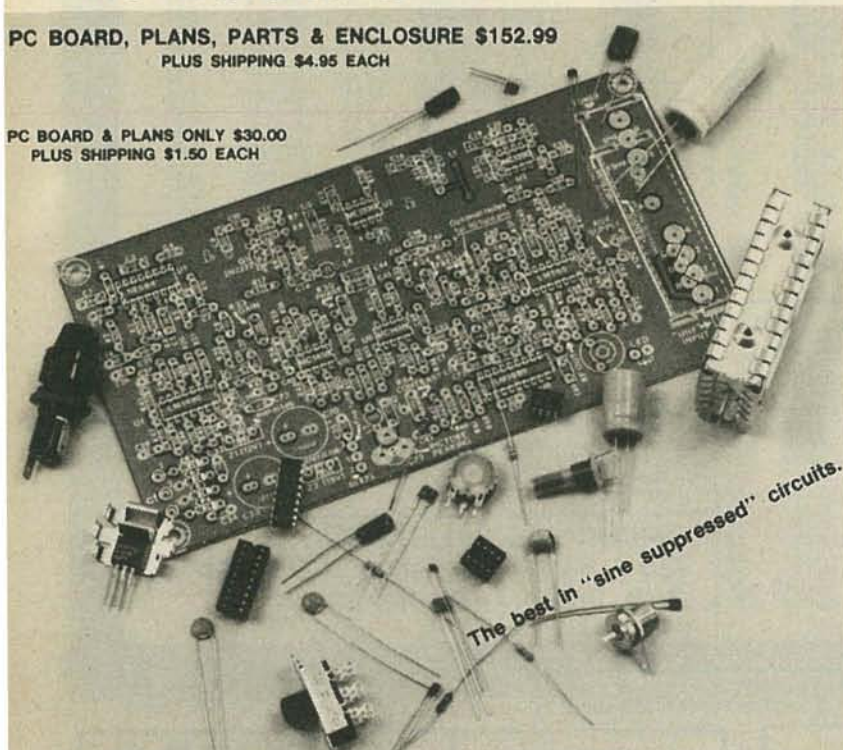
TOLL FREE 800-782-2701

"LEADER IN THE BEST
VIDEO CIRCUITS FOR THE
EXPERIMENTERS."

"The Deluxe II"

PC BOARD, PLANS, PARTS & ENCLOSURE \$152.99
PLUS SHIPPING \$4.95 EACH

PC BOARD & PLANS ONLY \$30.00
PLUS SHIPPING \$1.50 EACH



The best in "sine suppressed" circuits.

The ultimate in UHF sine wave converter technology with modulated audio.
Easy to build with fully illustrated plans. Outstanding video clarity and stability.

TWO CHANNEL SELECTOR SWITCH

PC BOARD, PLANS & PARTS \$5.95
PLUS SHIPPING \$1.50 EACH

6044



FITS DIRECTLY INTO YOUR DELUXE II
FOR CONVENIENT CHANNEL SELECTION.

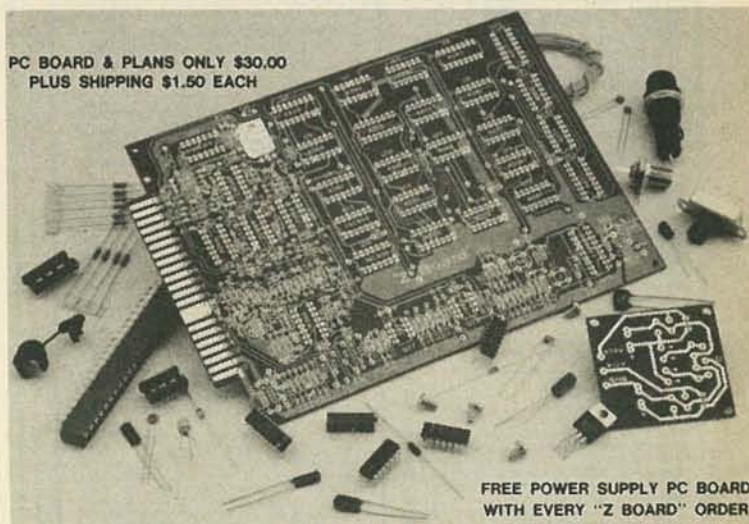
SPECIAL

NE 564 SUBSTITUTE CIRCUITS AVAILABLE
(PLUGS DIRECTLY INTO THE NE 564 POSITION)
\$4.95 EACH PLUS \$1.50 SHIPPING.

"THE Z BOARD"

PC BOARD, PLANS, PARTS & ENCLOSURE \$119.95
PLUS SHIPPING \$4.95 EACH

PC BOARD & PLANS ONLY \$30.00
PLUS SHIPPING \$1.50 EACH



FREE POWER SUPPLY PC BOARD
WITH EVERY "Z BOARD" ORDER

A powerful circuit with a challenge.

The best in UHF "pulse suppressed" circuits.
Suppressed horizontal synchronization with video inversion and
modulated audio that mates with your Zenith M1 module.

Fully illustrated plans for easy assembly.

QUANTITY DISCOUNTS AVAILABLE

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CALIF. ORDERS ADD 6% SALES TAX

VISA/MST MONEY ORDERS NO PERSONAL CHECKS

CIRCLE 67 ON FREE INFORMATION CARD

UHF AMPLIFIER KIT

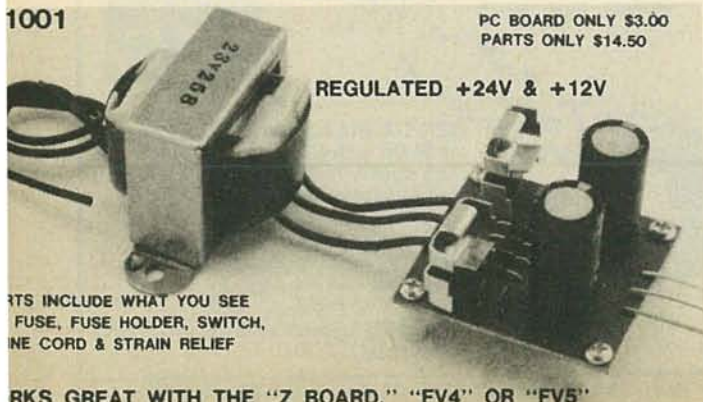
PC BOARD, PLANS & PARTS \$19.99
PLUS SHIPPING \$1.50 EACH

EASY TO BUILD & NO SPECIAL EQUIPMENT REQUIRED.
IMPROVES RECEPTION WITH 12db GAIN.

DUAL POWER SUPPLY

PC BOARD, PLANS & PARTS \$17.50
PLUS SHIPPING \$2.50 EACH

1001



REGULATED +24V & +12V

PC BOARD ONLY \$3.00
PARTS ONLY \$14.50

PARTS INCLUDE WHAT YOU SEE
FUSE, FUSE HOLDER, SWITCH,
POWER CORD & STRAIN RELIEF

WORKS GREAT WITH THE "Z BOARD," "FV4" OR "FV5"

CIRCUIT SPECIALISTS

YOUR SEMICONDUCTOR SUPERMARKET

74LS00 SALE

74LS00	.20	74LS123	.50	74LS249	1.25
74LS01	.24	74LS125A	.50	74LS251	.80
74LS02	.24	74LS126A	.50	74LS253	.60
74LS03	.24	74LS132	.80	74LS256	1.50
74LS05	.24	74LS133	.80	74LS257A	.60
74LS08	.24	74LS136	.40	74LS258A	.60
74LS09	.24	74LS137	1.00	74LS259	1.25
74LS10	.24	74LS138	.80	74LS260	.55
74LS11	.24	74LS139	.80	74LS266	.55
74LS12	.24	74LS145	1.30	74LS273	1.25
74LS13	.45	74LS147	1.65	74LS279	.55
74LS14	.60	74LS148	1.65	74LS280	2.25
74LS15	.32	74LS151	.55	74LS283	.90
74LS20	.29	74LS153	.55	74LS290	.80
74LS21	.32	74LS155	.85	74LS293	.90
74LS22	.32	74LS156	.80	74LS295A	.95
74LS26	.32	74LS157	.80	74LS298	.90
74LS27	.32	74LS158	.80	74LS299	2.60
74LS28	.32	74LS160A	.85	74LS322A	4.60
74LS30	.32	74LS161	.85	74LS323	4.60
74LS32	.32	74LS162	.80	74LS348	1.75
74LS33	.32	74LS163A	.80	74LS352	1.25
74LS37	.40	74LS164	.80	74LS353	1.25
74LS40	.35	74LS165	1.25	74LS365A	.55
74LS42	.60	74LS166	1.25	74LS366A	.55
74LS47	.89	74LS168	1.25	74LS367A	.55
74LS48	1.00	74LS169	1.25	74LS368A	.55
74LS49	1.00	74LS170	1.75	74LS373	1.35
74LS51	.29	74LS173	.80	74LS374	1.25
74LS54	.29	74LS174	.55	74LS375	.55
74LS55	.29	74LS175	.60	74LS377	1.25
74LS73A	.42	74LS181	2.25	74LS378	1.25
74LS74A	.42	74LS182	1.25	74LS379	1.25
74LS75	.45	74LS183	2.75	74LS385	3.50
74LS76A	.45	74LS190	.85	74LS386	.55
74LS77	.70	74LS191	.85	74LS390	1.25
74LS78A	.49	74LS192	.85	74LS393	1.25
74LS83A	.75	74LS193	.85	74LS395	1.25
74LS85	.90	74LS194A	.80	74LS398	2.25
74LS86	.45	74LS195A	.80	74LS399	1.25
74LS90	.45	74LS196	1.00	74LS490	2.10
74LS91	1.10	74LS197	1.00	74LS540	2.10
74LS92	.55	74LS198	1.00	74LS541	2.10
74LS93	.55	74LS221	1.25	74LS542	3.99
74LS95B	.65	74LS240	1.25	74LS568	3.99
74LS107A	.45	74LS241	1.25	74LS569	3.99
74LS109A	.45	74LS242	1.25	74LS620	2.00
74LS112A	.45	74LS243	1.25	74LS621	2.00
74LS113A	.45	74LS244	1.25	74LS622	2.00
74LS114A	.60	74LS245	1.75	74LS623	2.00
74LS122	.80	74LS247	1.25	74LS640	2.00
		74LS248	1.25		

7400

7400	.20	7475	.50
7401	.29	7476	.38
7402	.29	7485	1.10
7403	.29	7486	.35
7404	.31	7489	2.40
7405	.32	7490	.52
7406	.38	7492	.52
7408	.31	7493	.52
7410	.30	7495	.67
7411	.31	7496	.73
7413	.46	74107	.35
7414	.59	74121	.40
7417	.32	74123	.58
7420	.29	74125	.52
7425	.31	74145	.75
7427	.32	74147	1.67
7430	.30	74151	.75
7432	.31	74153	.75
7437	.31	74154	1.17
7438	.31	74157	.75
7440	.29	74164	1.05
7441	1.00	74165	1.05
7442	.60	74174	1.00
7446	.83	74175	.83
7448	.83	74177	.80
7450	.29	74190	1.08
7472	.35	74192	.99
7473	.35	74193	.99
7474	.35	74196	.80

VOLT-REGS

7805	.80	LM317T	1.00
7806	.80	LM317K	3.75
7808	.80	LM323K	6.95
7812	.80	LM350T	3.25
7815	.80	LM350K	5.50
7818	.80	LM338K	7.60
7824	.80	LM337T	1.90
7905	1.30	78L05	.40
7906	1.30	78L12	.40
7908	1.30	78L15	.40
7912	1.30	79L05	.80
7915	1.30	79L12	.80
7918	1.30	79L15	.80
7924	1.30	78H05KC	9.25
		78H12KC	9.25

LINEAR IC'S

LM301AN	.48	LM3900	.75	MC1489P	1.10
LM307N	.56	LM3909	1.00	MC1496P	1.48
LM308N	.71	LM3911	1.50	MC1723P	.62
LM310N	2.40	LF347	2.35	MC1741CP1	.56
LM311N	.69	LF351	.60	MC3301	.90
LM318N	2.50	LF353	.99	MC3302	.80
LM319N	2.40	LF357	1.10	MC3401	.90
LM324N	.71	NE555	.42	MC3403P	1.30
LM325N	3.30	MC1306P	1.10	MC1648P	3.80
LM326N	3.30	MC1310	4.29	MC1658P	4.50
LM556N	.93	MC1330A1P	1.50	MC4024P	4.49
LM339N	.69	MC1349P	1.17	MC4044P	4.49
LM383T	2.30	MC1350P	.98	ICM7208	15.95
LM377N	2.40	MC1351P	1.70	ICM7207A	6.00
LM378N	3.15	MC1357P	1.49	ICM7217A	9.95
LM379N	4.60	MC1358P	1.30	ICM7205	12.95
LM380N	.90	MC1372P	4.42	ICM7045	15.50
LM381N	2.25	MC1373P	3.54	ICL8038	3.40
LM381AN	3.60	MC1403U	2.71	ICM7555	1.20
LM384N	2.00	MC1405L	9.70	MWA110	7.45
LM386N	.99	MC1413P	1.20	MWA120	7.80
LM565N	1.35	MC1374P	2.61	MWA130	8.25
LM566N	2.30	MC1376P	2.08	MWA310	8.25
LM567N	1.35	MC1458CP1	.77	MWA320	8.65
LM1889	3.20	MC1488P	1.10	ZN414	2.00

CMOS

CD4001	.30	CD4046	1.50	MC14000	.40	MC14023	1.22
CD4007	.32	CD4047	1.40	MC14001	.40	MC14024	1.06
CD4010	.55	CD4049	.45	MC14002	.40	MC14024	.40
CD4011	.32	CD4050	.45	MC14006	1.42	MC14027	7.2
CD4013	.45	CD4051	1.00	MC14007	.40	MC14028	1.02
CD4016	.50	CD4066	.65	MC14008	1.25	MC14032	1.93
CD4017	1.00	CD4069	.32	MC14012	.40	MC14034	3.50
CD4020	1.17	CD4070	.45	MC14013	.72	MC14035	1.86
CD4023	.32	CD4071	.32	MC14014	1.25	MC14038	2.19
CD4024	.83	CD4081	.32	MC14015	1.47	MC14040	1.47
CD4025	.32	CD4093	.60	MC14016	.72	MC14042	1.06
CD4027	.55	CD4510	1.17	MC14017	1.25	MC14043	.99
CD4029	1.42	CD4511	1.20	MC14018	1.15	MC14044	.99
CD4040	1.17	CD4515	2.80	MC14020	1.47	MC14046	1.57
CD4044	.80	CD4518	1.17	MC14021	1.25	MC14049	.72

MOST MOTOROLA CMOS IN STOCK

CIRCUIT SPECIALISTS INC.
738 S. Perry Lane, Tempe, AZ. 85281
Order Phone: 1-800-528-1417
INCLUDE \$1.25 SHIPPING

CIRCLE 7 ON FREE INFORMATION CARD

MICRO MART

508 Central Ave.
Westfield, N.J. 07090
(201) 654-8008

UHF-TV PREAMP

(As featured in Radio Electronics March/May articles, 1982)

This inexpensive antenna mounted pre-amp can add more than 25 dB of gain to your system. Lots of satisfied customers and repeat orders for this high quality kit, which includes all component parts, PC BD, Case, Power Supply and Balun \$34.50 Assembled Version.....\$57.50

APPLE

Heart Rate Monitor KIT-\$39.95

2N3055 (PRIME)	2/81
2N3791 (PRIME)	2/81
555'S (TELEDYNE 355)	3/81
2716 EPROM (450ns)	83.85
NFS 4571 (NPN SILICON TRANS)	10/81
"BOOT" SOLDERING IRON (20w)	.89
"BOOT" SOLDER SUCKER (works great)	.812
LM1310	3/82
CD4047	2/83
RF CHOKE 100H 1/2W FIXED	3/82
LM1889	2/84
BNC T-CONNECTOR	.81
20V 1M EXPLOY ZENERS	20/81
78L06 (5V REGULATOR)	5/81
MOTION DETECTOR BOARDS-92 EACH	7/810
MOTION DETECTOR IC ONLY 1/3/82	20/810
CONDENSER MICROPHONE	3/82
9V BATTERIES	2/81
1000 PIECE RESISTOR ASS'T 1/2W	.55
CRYSTALS-1MHz -2-3.5MHz .81/6MHz .82	
2560.0 KC	.81
22UF 50V SUB MINI EPOXY DISC	20/81
33UF 100V DIP NYLAR	8/81
47UF 25V MINI RADIAL	5/81
4.7UF 40V MINI RADIAL	10/81
6.8UF 35V SOLID TANTALUM	2/81
10UF 50V DIP TANTALUM	3/82
3200UF 50V TWIST LOCK	3/82
11000UF 50V (COMP GRADE MALLDRY)	.82
1000UF 16V TWIST LOCK	2/81
VINYL COATED (FIBERGLASS REINFORCED)	
SLEEPING-1" LENGTHS, 10 DIAMETERS	.83
LED (HIGH INTENS. RED EMITTER, WATER CLEAR LENS) 10/81, 100/87.50, 1000/869	
BATTERY SNAPS	5/81
HEAVY DUTY ALLIGATOR CLIPS	10/83
LIGHTER WEIGHT CLIPS	10/82
74LS174 (PRIME TEXAS INST)	2/81
VERY LOUD BUZZER	2/81
SN75324 IC	5/81

Have Some Fun...Fun...Fun!
PROGRAMMABLE MESSAGES
IN SPACE, with SPACE WRITER
Kit \$39.50

Signalman Mark I Modem-\$99

Direct connect modem/RS-232C; Built in interface cable and connector; Light, compact, Bell 103 compatible Data/Voice switch

BMC-12A,
12" Green Phosphor Monitor \$99

LM1391 (PRIME, HOUSE #D)	3/81
ULN 2001 (UNTESTED)	10/81
R8232 CONNECTOR (DB-25P-A123)	.83
100K TRIMPOT	4/81
10K TRIMPOT	4/81
SN7447	2/81
SN7492	3/81
SN738 2-P (DTL)	5/81
BFD 85 UHF HIGH GAIN AMPS	2/83
WINEGARD KU420 UHF ANT, 48W BONTIE#25	
CONNECTOR FOR RIBBON CABLE 34 PIN, .82	
8243 16 LINE I/O EXTENDER CHIP	.85
7805, 7812, 7905, 7912 MIX/SPCS	4/85
AM/FM RADIO IC (UNTESTED) W/SPCS	10/83
FOUR-LIN TAP/BAND-10K, 100K, 1M	3/82
IC BOX (STORES & LABELS IC'S)	.82
DIP SWITCHES-4, 6, 8 510 POS.	2/83
TV INHIB.	10/81
*****AMBEK COLOR1 MONITOR, \$305*****	
Voltage-Mate (switching regulator kit with adjustable DC/DC voltage conversion; Output voltages: 24 to +50VDC, 5 op. modes (step-up, down, inversion) \$19	
CHIP CAPS (SET OF 4, 2 EACH 2.7K, 3pF) \$3	
FFA104 INFRA-RED EMITTER/SENSOR	.89
MINIATURE SPEAKER (1 1/2")	.81
OKIDATA, EPSON, CENTRONICS PRINTERS/TEL CONVENIENCE PAPER PAKS, CONT. ROLL	
TEAR AWAY RAZOR EDGE, 1K SHEETS	.816
LOWEST PRICES VERBATIM DISKETTES/CLIP TEK/TOOL ZERO INSERTION IC TEST SOCKETS-14 PIN-89	16 PIN-810
47pF 470pF 1KV DISCS (NICE 812E) 20/81	
LM380 (LINE280)	3/81
UDN7180 GAS DISCHARGE DIMP/DRVR	5/85

MICRO-CONTROLLER BOARD
(Kit \$99.50)

Terms: MICRO-MART accepts Visa, MC and telephone COD's. Minimum order \$10.00. Shipping—U.S. orders, \$2.00. Canada and other countries \$3.50 (includes ins.). Shipping rate adjusted where applicable. NJ residents add 5% sales tax.

MICRO-MART • 508 CENTRAL AVE., WESTFIELD, NJ 07090 • (201) 654-8008

CIRCLE 12 ON FREE INFORMATION CARD

Bargains!!!
ACAC-1 OR ACPP-1



10 ft. audio extension cable. \$1.50



UVE-1-A Mitsumi
UHF/VHF combo varactor tuner \$9.75

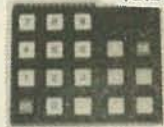
JAVANCO

YOUR PARTS SUPERMARKET
160 2nd Ave. S.,
Nashville, TN 37201

72 ECKA-72 Mini-axial Kit
PCS. PER. KIT \$6.85

ECKR-72 Mini-lytic Kit
\$6.85

Calculator keyboard switch
\$2.25



SPK-100 PIEZO TWEETER \$6.75 each
or \$4.65 with \$15 order!

This quality hi-fi horn is easily installed without crossover.

ECK-251 \$9.35 assorted miniature electrolitics, all good useable values, in a plastic bag. 251 PCS.

1000 long lead resistors, 1/2 and 1/4 watt assortment \$6.75

Out-of-state orders over \$15 call Toll Free 1-800-251-5555
Tennessee residents and information requests call 1-615-244-4444

CIRCLE 29 ON FREE INFORMATION CARD

FREE THE WORLD FAMOUS **ETCO** CATALOG OF ELECTRONICS

• VIDEO
• TELEPHONE
• CABLE TV
• PARTS
• AUDIO
• ELECTRONICS
• and much, much more!

1000's OF FASCINATING FACTORY CLEAROUTS SURPLUS SPECIALS AND BARGAIN OFFERS NOT FOUND IN STORES OR CATALOGS ANYWHERE!

LOW SALES PRICES

NOW 112 PAGES

ETCO ELECTRONICS DEPT. 591
Mailing List Control Center
Box 840
Champlain, N.Y. 12919

I Enclose _____ (cash OK);
Please rush postpaid

\$1 for 1 year subscription to the world famous ETCO catalog.
 \$3 Canadian & Foreign 1 year subscription to the ETCO catalog.
 304 page handbook "BUILD YOUR OWN EARTH STATION". (TA025) \$10.00
 360 pages MASTER HANDBOOK OF TELEPHONES. (TA001) \$11.00
 FREE - sample copy of the bargain packed ETCO catalog. (USA only)

Name _____
Address _____
City _____
State _____ Zip _____

CIRCLE 50 ON FREE INFORMATION CARD

ELECTRONIC KITS FROM HAL-TRONIX

2304 MHZ DOWN CONVERTERS. TUNES IN ON CHANNELS 2 TO 7 ON YOUR OWN HOME T.V. HAS FREQUENCY RANGE FROM 2000 MHZ TO 2500 MHZ. EASY TO CONSTRUCT AND COMES COMPLETE WITH ALL PARTS INCLUDING A DIE-CAST ALUM CASE AND COAX FITTINGS. REQUIRE A VARIABLE POWER SUPPLY AND ANTENNA (Antenna can be a dish type or coffee can type depending on the signal strength in your area.)

- 2304 MOD 1 (Basic Kit) \$19.95
(Less case & fittings)
 - 2304 MOD 2 (Basic/Pre-amp) \$29.95
(less case & fittings)
 - 2304 MOD 3 (Hi-Gain Pre-amp) \$39.95
(Includes case & fittings)
- POWER SUPPLY FOR EITHER MODEL ABOVE IS AVAILABLE. COMES COMPLETE WITH ALL PARTS, CASE, TRANSFORMER, ANTENNA SWITCH AND CONNECTORS (Kit) \$24.95
Assembled.....\$34.95
Slotted Microwave Antenna For Above Downverters.....\$39.95

PREAMPLIFIERS

HAL PA-19—1.5 mhz to 150 mhz. 19db gain operates on 8 to 18 volts at 10ma. Complete unit \$8.95.
HAL PA-1.4—3 mhz to 1.4 ghz. 10 to 12 db gain operates on 8 to 18 volts at 10 ma. Complete unit \$12.95.
(The above units are ideal for receivers, counters, etc.)

- 16 LINE TOUCH TONE DECODE KIT WITH P.C. BOARD AND PARTS.....\$69.95
- 12 LINE TOUCH TONE DECODER KIT WITH P.C. BOARD AND PARTS.....\$39.95
- 16 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS.....\$39.95
- 12 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS.....\$29.95

Complete Sets of P.C. Boards Available For: Unicorn Robot Project and Heart-A-Matic Project.
MANY, MANY OTHER KITS AVAILABLE

Send 20 cents stamp or S.A.S.E. for information and flyer on other HAL-TRONIX products. To order by phone: 1-313-285-1782.



HAL-TRONIX
P.O. Box 1101
Southgate, MI 48195

SHIPPING INFORMATION: ORDERS OVER \$25.00 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN \$25.00 PLEASE INCLUDE ADDITION AL \$2.00 FOR HANDLING AND MAILING CHARGES.

CIRCLE 75 ON FREE INFORMATION CARD

AMAZING DEVICES

PHASORS
PHASOR PAIN FIELD — Patented and recently developed in our labs is being tested by Gov't for riot control. Soon to come under weapons restrictions as an infernal machine. Easily hand-held. Hazardous IF NOT USED WITH DISCRETION.
PPF-1 PLANS (sold for animal control).....\$15.00
INVISIBLE PAIN FIELD GENERATOR — Produces a directional field of moderately intense pain to back of head up to 50'. Cigarette pack size enclosure is easily hidden.
IPG-3 PLANS \$7.00 IPG-3K KIT & PLANS \$44.50
IPG-30 (assembled for animal control).....\$59.50
PHASOR STUN/BURNING WAND — Produces sufficient electrical energy capable of burning flesh. Intended as a personal defense device.
PSW-3 PLANS \$8.00 PSW-3K KIT & PLANS \$59.50

LASERS
RUBY LASER RAY PISTOL — Intense visible red, burns, hazardous, with parts sources.
RUBY PLANS (includes all part sources).....\$15.00
CARBON DIOXIDE LASER — Generates 20-40 watts of continuous power capable of burning, cutting, hazardous (with all part sources).....\$15.00
LASER RIFLE — Produces 200-3000 pulses of 30 watt optical energy. Portable and easily hand-held.
LRG-3 PLANS.....\$10.00
LRG-3K KIT PLANS (minus diode).....\$129.50
POCKET LASER — For the beginner, visible red "optical version", non-hazardous.
LHC-2 \$5.00 LHC-2K KIT & PLANS \$24.50
HIGH POWERED PORTABLE ENERGY SOURCE FOR LASERS AND MAGNETIC WEAPONS — Exploding wires, shockwave, etc. Miniature size.
HPS-1 PLANS \$8.00 HPS-1K KIT & PLANS \$49.50
PARTICLE BEAM WEAPON — PLANS.....\$15.00

SECURITY
INFINITY XMTR — Uses telephone lines for selective home or office listening while away on business or vacation.
INF-1 PLANS.....\$15.00
SEE IN DARK — Long range, total darkness.
SD-4 PLANS.....\$10.00
LONG RANGE WIRELESS MIKE — Crystal clear quality — miniature.
FBT-7 PLANS \$7.00 FBT-7K PLANS & KIT \$34.50
WIRELESS TELEPHONE TRANSMITTER — Long range, automatic.
VWPM-5 PLANS \$10.00 VWPM-5K PLANS & KIT \$34.50

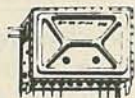
Send for FREE catalog description of above plus hundreds more plans, kits and completed items. We accept MC or Visa or when ordering, send check or money order. We pay shipping charges on orders over \$50.00, otherwise include 10% with remittance.

SEND TO: **SCIENTIFIC SYSTEMS**
DEPT. R8, BOX 716, AMHERST, N.H. 03031

CIRCLE 36 ON FREE INFORMATION CARD

POPULAR CHIPS

LM 301	.39
LM 380	1.25
LM 386	.79
NE 564	2.50
LM 565	.89
MC 1330	1.10
MC 1350	1.00
MC 1358	1.10
MC 1458	.49
MC 1496	1.50
LM 1889	1.95
7808	.75
7812	.75
7815	.75
7818	.75
MV 2109	.69
2N2222A	.30
MC1349	1.39



MITSUMI UES A55F VARACTOR TUNER
CHAN. 14-83
400 ohm INPUT \$17.95

DELUXE PARTS ASSORTMENTS

#1 Resistors & Trimpots
68 - watt, 5% resistors & 5 PT-15 10K trimpots. 1 each - 51, 75, 100, 470, 1.5K, 3.6K, 51K, 470K, 13-1 2K, 2-220, 3-100K, 6-330, 6-12K, 7-910, 9-33K, & 14-4 7K.
\$5.25 each

#2 Capacitor "A"
Monolithics - 1-560pf, 7-1 mfd, & 1-22 mfd
Silver Micas - 2-10pf, & 1 each of 43pf, 110pf, 560pf, 1200pf, 3000 or 3300pf.
\$5.95 each

#3 Capacitor "B"
Mylars 4-.001, 2-.047, 29-.01 Radial lytics 3-10 mfd 16V, 1-1000 mfd 50V, 1-2200 mfd 35V
Disc Caps 1 each of 5, 12, 27, 36, 110, 330pf, 2-120pf, 3-39pf, 3-220pf, and 1 Vari Cap 5-35pf
\$7.50 each

#4 Coil & Chokes
1 each of 15, 33, and 100 (uh) micro henries chokes 1-variable RF coil (same as #49A537MPC)
\$3.25 each

#5 IC's, Sockets, & Semi's
1 each of: NE564, LM565, MC1330, MC1350, MC1496, LM1889, 7812, 7818, 2N2222A, MV2109, heat sink 2-MC1458, 4-1N4002, 4-8 pin, 2-14 pin, 1-16, & 1-18 pin socket.
\$13.25 each

#6 Misc. Hardware
LED & holder, fuse & holder, line cord grommet, SPST switch, DPDT switch, 2-F61 conn & lugs, knob, 4-spacers, 6-screws & nuts, 2-RG-174, matching transformer w/nut.
\$5.95 each

CHOKES

.33 uh	33 uh
.47 uh	100 uh
15 uh	10 mh
18 uh	69¢ each

VARI CAPS

10 - 60 pf	69¢ each
30 - 90 pf	69¢ each

UHF AMP KIT
25 db gain
stripline PC board using (2) BFR-90's
\$9.95
power supply for above \$3.49

METAL BOX—PRE-DRILLED
DIM: 10 1/2" W x 4 1/2" D x 3" H
HOLES: 4 1/2" in back, 1 1/2" in front
2 1/2" in front, 6 #6 on bottom
PAINTED \$10.95 ea., 10/\$99.50
25/\$223.75

NETWORK SALES, INC.

RIBBON CABLE CONNECTOR
These very popular 40 PIN ribbon cable connectors are used by a number of mfgs. of micros for internal board to board terminations and I/O port connections.
W/strain relief \$2.50

DIP SWITCHES
High quality DIP switches mfg. by CTS. Available in the following configurations.

4 POS—80¢	6 POS—80¢
5 POS—80¢	7 POS—80¢

40 CONDUCTOR RIBBON CABLE
gray color 70¢/ft.

DB-25 S (FEMALE)
The most popular computer connector. Mfg. by AMP. .025" gold PC pins with mfg. holes
\$1.95

MINI FAN 3.125" SQ.
40 CMF
115VAC-60hz
REMOVED FROM NEW EQUIP.
TESTED \$6.95

BRIDGE RECTIFIERS

35A	200 PIV	\$2.00
25A	100 PIV	\$1.50
3A	400 PIV	\$1.00

POWER TRANSFORMERS

Pri: 115V AC
Sec: 24 volts @ .350 A
Dim: 2 1/4 x 1 x 1 H

\$1.95 ea. 10/\$15.00 100/\$125.00

THUMBWHEEL SWITCH
\$7.95 BCD 0-9
W/COMPLIMENT (EACH DIGIT ILLUMINATED W/LED)

THUMBWHEEL TRIMMER POTS VERTICAL MOUNT
OHMS 500, 1K, 2K, 5K, 10K, 25K, 50K, 100K, 200K, 500K, 1 MEG.
4/\$1.00 100/\$20.00

4 DIGIT W/END PLATES FOR EASY MTG.

MINI COAX CABLE
RG-174 50ohm .100 OD
10 feet/\$1.00

4 TURN TRIM POTS BOURNS #3339B
1K — 6K R/A — 10K
\$1.49 EA.

SOLID CARBIDE PC DRILL
#55 1/8 in. SHANK FOR USE WITH DREMEL TOOL
\$1.00

RF COIL
Same as #49A537MPC
\$1.50 ea. 10/\$12.50

NETWORK SALES, INC.
2343 W. BELMONT AVE.
CHICAGO, IL. 60618
312-248-3202

TERMS: Visa, M.C., Check, Money Order or COD (add \$3.00). Min. Order \$10.00, Add \$2.50 S&H for USA. Ill. add 7% Tax. **MAIL ORDER ONLY.** Prices subject to change without notice. Phone Orders Welcome. **WRITE FOR OUR MONTHLY UN-ADVERTISED SPECIALS**

©COPYRIGHT 1983 NETWORK SALES, INC.

CIRCLE 90 ON FREE INFORMATION CARD

OCTOBER 1983

205

Touch Tone Generator Mini-Kit
X-1263
\$5.95
10 @ \$5.35
MK5089N & 3.579 MHZ CRYSTAL
PHASE LOCKED LOOP WITH ANY 4 X 3 SWITCH MATRIX
10 PAGE DATA BOOK 95¢

INVISIBLE ALARMS
SCIENCE FAIR PROJECTS
SECRET COMMUNICATIONS
\$1.99 PAIR
10 PR @ \$1.79
INFRA-RED
Emitter/Detector
1-400 PAIR

*** PARTS BONANZA ***
Channel 2 Decoder
HOT DEAL ON SOPHISTICATED DE-
SCRAMBLERS REMOVED FROM
SERVICE, STRIPPED, & THEN
PLACED IN RESERVE UNTIL WE
GRABBED 'EM! POWERED BY 117
VAC, UNIT HAS TWO CONNECTIONS
"IN" AND "OUT"; TWO SWITCHES
'STANDARD' AND 'PREMIUM' AND
AN AC OUTLET FOR YOUR TV.
FEATURES A DOUBLE BALANCED
MIXER FOR STRIPPING INTERFER-
ENCE, A PLL FOR SYNC RE-INSE-
RTION, LOTS OF NICE CIRCUITRY
FOR EXPERIMENTATION! OVERALL
SIZE IS 10 X 6 1/2 X 3" HIGH. MPD
BY JERROLD.
\$15.95
X-1186
10 @ \$14.35
WT 5 LB

CABLE TV
Midband Converter
BRAND NEW PRODUCTION AEL UNIT
TAKES THE 'HIDDEN CHANNELS' ON
MIDBAND AND MOVES THEM TO
CHANNELS 7-13. SWITCH SELECTS
'NORMAL' OR 'MIDBAND' JUST PUT
IN LINE WITH YOUR CABLE AND
SWITCH BACK & FORTH. 115 VAC WITH
OUTLET FOR YOUR TV. ONLY TWO
CONNECTIONS IN & OUT. OVERALL
SIZE IS 6 X 4 5/8 X 2" HIGH
\$15.95
X-1290
10 @ \$22.45
WT 5 LB

REED SWITCH
1-1/8" X
1/8" DIA
B-4808
USE WITH
MAGNET
OR COIL
20/1

SNOOPER AMPLIFIER
X-1550 10/122
NOW WITH AN INTERCOM, BUG-
GING DEVICE, & PA SYSTEM. ALL
ON A 3-1/2 X 1-1/4" PCB BOARD!
RUNS ON 9V, HAS 1-SM16923N AUDIO AMP
IC, 8 Ω SPEAKER, PL-5 AM ELECTRET
MICROPHONE-3/8" DIA X 1/2" LONG

DIGITAL COFFEE TIMER
CLOCK Assy. U-FIX-EM
X-1500 10/25
\$2.95
WT 1/2 LB

POWER TRANSFORMER
PRI 115/230 VAC
SEC 1 28VCT AT 5 AMPS
SEC 2 15VCT AT 2 AMPS
3-3/4 X 3-1/4 X 3-1/8 HIGH
\$11.95
GREAT TRANSFORMER FOR
5 B 1/2V REGULATED SUPPLIES-
THIS IS A COOL RUNNING 1%
QUALITY UNIT. INDIVIDUALLY
BOXED T-0880 WT 6 LB

HERE'S THE GUTS FROM THOSE NEW COFFEE
MAKERS WITH A COMPUTER 'BRAIN' THAT
DIGITALLY CONTROLS THE COFFEE MAKING
A PERFECT EXAMPLE OF MORNING
BLAMS - 9 OUT OF 10 HAVE SOLDER SHORTS,
COIL FOLDS, ETC. - EASY TO REPAIR. STUFF
THE PCB'S CONTAIN A CLOCK/TIMER MODULE, 4 DIGIT
LED DISPLAY, POWER FEMR, 9V SPDT RELAY, ETC.
THE XFMR OR RELAY ALONE IS WORTH IT!

CABLE TV
Converter/Descrambler
THESE AEL CONVERTERS ACCEPT
ANY TWO NON-ADJACENT MIDBAND
OR SUPERBAND CHANNELS, DE-
SCRAMBLE THEM AND OUTPUT THEM
TO CHANNELS 2, 3, OR 4 (SET TO 3
AS RECEIVED). INPUT IS 126-168 MHZ
OR 216-264 MHZ, INSERTION LOSS
1.6 DB MAX, INPUT LEVEL -15 TO
+25 DBMV, FOR USE ON 75 OHM
CABLE SYSTEMS. WE PROVIDE
SCHEMATICS AND OPERATION NOTES
QUANTITIES LIMITED

(602) 971-0990 (602) 971-0996
ARIZONA ELECTRONIC
SURPLUS
Wholesale - Retail - Surplus
Electronic Parts
12627 N. Cave Creek Rd. • Phoenix, AZ 85022

HOT PLATES
\$150

\$100
Carbide Drill & Router Bits

MICROWAVE KIT
\$14.95 COMPLETE
• P.V.C.
• PC Board
• 2 - 2SC2369
• 1 - MRF911
• Resistors
• Capacitors
• "F" Connector
• Chip Cap

C126 D
400 V
12 AMP
SCR
TO-220
CASE
10/29
99¢

NI-CAD BATTERY PACK
GREAT FOR PORTABLE PROJECTS, RC GEAR, AND
RADIOS. HAS LED WITH PUSH-TO-
TEST BUTTON. NEW, INDIVIDUALLY
BOXED. VOLTAGE OUTPUT 14.4 VDC
100 mA/H INPUT CHARGING VOLTS
16 VDC. UNIT MEASURES 4 X 2
X 8" HIGH. CABLE LENGTH 18"
\$6.95
WT 1/2 LB
T-5576

ELECTRONIC BARGAINS
IF YOU'RE NOT ON OUR MAILING LIST, YOU'RE MISSING OUT-
STANDING BUYS ON THE FINEST IN ELECTRONIC PARTS FOR
THE BUILDER. IN 8 YEARS OVER 250,000 HOBBYISTS HAVE
DISCOVERED WHERE TO FIND UNIQUE, UNIQUE OR DOWNRIGHT
STRANGE ELECTRONICS AT GIVEAWAY PRICES.
WHY NOT SEND FOR OUR CATALOG TODAY --- IT'S FREE!!

DIAMONDBACK
ELECTRONICS COMPANY
PO BOX 12095 Dept 102
SARASOTA, FLA. 33578
Phone Orders (813) 953-2829
CONTINENTAL US ADD \$1.60 FOR THE FIRST LB
AND 50¢ FOR EACH ADDITIONAL LB.
WEST COAST ADD \$1.80 FOR THE FIRST POUND &
50¢ FOR EACH ADDITIONAL POUND.
COD & MAIL ORDER \$7 MINIMUM. CREDIT CARDS \$15 MIN.

ACTIVE FILTER PC BOARD
X-1010
CONTAINS TWO LM310'S (20 MHZ BW, 30V, SLEW
RATE) CONFIGURED AS A FOURTH ORDER LINEAR
PHASE LOW PASS FILTER. USING 1% FILM CAPS AND
RESISTORS. SORRY, NO CHOICE OF FREQUENCY (WE
HAVE TOO MANY) BUT THE R'S & C'S ARE EASILY
SCALED TO ANY FREQ. THEY OPERATE FROM 25V TO
18 VDC. ALL ARE MARKED WITH CUTOFF FREQUENCY
DATA SHEET - 25. INCLUDES BOARD LAYOUT, SCHEMATIC, & FORMULAS
FOR BOTH MAXIMALLY FLAT RESPONSE OR LINEAR PHASE OPERATION.

CIRCLE 95 ON FREE INFORMATION CARD

10" FIBERGLASS
SCREW DRIVER
with Plastic Handle
3/\$100
Latching Relay
\$4.95
24V Coil
110V @ 15A D.P.S.T.

NOT A KIT
Regulated
Supply 5V, 2A
w/Transformer and 4" x 2.3" Heat Sink
\$5.50 each -or- 2/\$10.00

Items MC, VISA, COD via UPS
(Plus Shipping/Handling)

CIRCLE 89 ON FREE INFORMATION CARD

TUSA
A WHOLE NEW WORLD OF TV VIEWING WITH TUSA'S
NEW MODEL CVU-45, 45 CHANNEL CABLE TV CONVERTER.
Receive all the EXTRA CABLE TV "MIDBAND" & SUPERBAND
CHANNELS on your UHF DIAL.
Eliminates the need for renting or leasing. This system takes
the "midband" and "superband" channels your TV, VCR or
projector can't receive and converts them to standard UHF
channels that any set can tune in.
A MUST FOR VIDEO-TAPING FROM CABLE TV!
The system allows you to program both pay (pay TV decoder required) and standard
cable channels for taping on any VCR - while you are watching a different channel on your TV.
Simple to install and operate on any make of TV with UHF. **Now \$28.95 ea.**
Plus POSTAGE

WINEGARD
75 OHM UHF YAGI ANTENNAS
OPTIONAL Winegard
UHF Antenna
18db Gain
\$8.95 ea.
19" 1.5db
\$9.95 ea.
12 db GAIN
Specify Channel
\$8.95 ea.
6 OR MORE
\$6.95 ea.
All units are brand new from Sanyo
Call for Quantity Price

NEW 1984
B&K AUTO/MANUAL
RANGING
MULTIMETER
Special Purchase
MV-2109
33pf Tuning Diodes
1-9 \$69 ea.
10-Up 39 ea.
5% MICA CAPS 5%
10pf .42e ea. 500pf .80e ea.
43pf .30e ea. 1200pf .89e ea.
110pf .36e ea. 3000pf 1.39 ea.
Call for Quantity Discount

QUALITY
POWER TRANSFORMERS
24V CT, 400 mA.
\$3.19 ea. 10-49 \$2.75 ea.
50 or more \$2.25 ea.
SPECIAL PRICE!
\$94.00 ea.
BK PRECISION

SONY
SURPLUS UHF-VHF
VARACTOR TUNERS
These tuners receive all chan-
nels 2-53, plus midband cable
channels and are perfect for
home-brew TV circuits etc.
Output Freq. 45 MHz. Hookup
data included. Name Brand.
#852
NOW! \$15.95 ea.

UHF TUNERS
45 MHz Output
Click Stop Defeat Tune
model. Excellent for replace-
ment use or experimental
work building UHF receivers
for ham or TV.
WHILE THEY LAST
\$3.95 ea.
10 or more \$3.25 ea.

AC LINE CORDS
18 gauge wire
6 ft. long cable
Prestriped and tinned ends
for easy installation.
AC-6G 12-Up
49¢ ea.
39¢ ea.

DELUXE
A-B
SWITCHES
Specify Pushbutton
or lever type
For CATV - MATY - VCR
75 ohm - 90 db Isolation
\$6.95 ea.
2 or more \$5.95 ea.

POPULAR
MICROWAVE
PARTS
MRF-01 \$2.39
9-Up 1.95
MRF-011 3.46
9-Up 3.12
MBC-10198
CHIP CAPS -.001 mfd 50
25-Up 30
2146603 (Formerly MRF-800) 11.95

DELUXE
5"
DELUXE
SPEAKER
Handles up to
15 watts, 4 Ohms.
3 oz. Ceramic Magnet
\$1.89 ea.
10 up \$1.49 ea.

POPULAR IC'S
TOP QUALITY
NO SECONDS

TYPE	DESCRIPTION	1-9	10-UP
LM-380N	2 watt Audio Power Amp	\$1.49	\$1.29
LM-380N-3	Low Voltage Audio Amp	1.59	1.19
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	2.06	1.55
MC-1350	Video IF Amp	1.75	1.19
MC-1352	Video IF Amp AGC	2.69	2.09
MC-1356	Audio IF Amp	1.95	1.64
MC-1374P	R.F. Modulator	3.19	2.39
MC-1456	Dual Comp. Op Amp	.88	.59
MC-1469N	Balanced Mod/Modulator	1.79	1.34
LM-1809	Video Modulator	2.79	1.95
LM-7805	5 Volt Positive Volt. Reg.	1.19	.89
LM-7808	8 Volt Positive Volt. Reg.	1.19	.89
LM-7812	12 Volt Positive Volt. Reg.	1.19	.89
LM-7815	15 Volt Positive Volt. Reg.	1.19	.89
LM-7818	18 Volt Positive Volt. Reg.	1.19	.89
LM-7824	24 Volt Positive Volt. Reg.	1.19	.89
NE-864	New Plug in Replacement now in stock - \$5.75 ea. or \$3.50 each with every \$50.00 purchase of other parts.		

UNITECH MODEL DUPIT
TELEPHONE
This handsome contemporary
telephone is Touch-tone,
making it ideal for MCI or
Spirit service, or banking by
phone. Deluxe two piece de-
sign allows for wall or desk
mount. Also on-off ringer
switch. Almond in color.
NOW \$29.95 ea.

PROJECT
BOXES
Woodgrain
This box is 11 1/4" W - 4 1/4" H -
6 1/2" D with a removable
aluminum U-shaped chassis
11" W - 3 1/4" H - 6" D inside.
\$12.50 ea.
4 or more \$10.95 ea.
For Larger Quantities - CALL

POPULAR
MISCELLANEOUS PARTS
1N4001 Diodes
15 for \$1.00
100 for 5.00
1/4w 10K Thumbwheel pots
1-1239
13-Up29
Toroids - T30-1246
20-Up25
Toroids - T37-238
20-Up25

ORDER NOW
TOLL FREE
800-854-4655
OUTSIDE CALIFORNIA
714-635-5090
INSIDE CALIFORNIA
R.F. ELECTRONICS
1056 N. STATE COLLEGE BLVD., DEPT. R
ANAHEIM, CALIFORNIA 92806
PERSONAL CHECKS HELD FOR CLEARANCE - NO MINIMUM ORDER
ALL PREPAID ORDERS 2 LBS OR LESS MUST INCLUDE \$2.50 SHIPPING & HANDLING - SHIPPED SAME DAY RECEIVED
OPEN
TUES - FRI
10-6
SAT 10-5
CLOSED SUN & MON
SEND FOR
FREE
Mail Order
Catalog

RADIO-ELECTRONICS

CIRCLE 27 ON FREE INFORMATION CARD

DoKau Computer Products, Inc.

VISIT OUR RETAIL STORE

2100 DE LA CRUZ BLVD.

SANTA CLARA, CA 95050

EPROMS			STATIC RAMS		
1702	1ns	2.95	2101	450ns	1.80
2708	450ns	2.98	2102L-2	250nsLP	1.44
2716	450ns	3.90	2111	450ns	2.48
2716-1	350ns	5.90	2114	450ns	1.74
2532	450ns	5.35	2114L-4	450nsLP	1.84
2732	450ns	4.90	2114L-3	300nsLP	1.84
2764	450ns	CALL	2114L-2	200nsLP	1.94
DYNAMIC RAMS			TMS4044-4	450ns	3.15
TMS 4027	250ns	.79	TMS4044-3	300ns	3.45
UPD 411	300ns	2.89	TMS4044-2	200ns	3.89
MM 5280	300ns	2.89	MK4118	250ns	9.69
MK4108	200ns	1.74	TMM2016	200ns	4.15
MM 5298	250ns	1.74	TMM2016	150ns	4.89
4027	250ns	2.00	HM6116-4	200ns	5.90
4116	200ns	CALL	HM6116-3	150ns	6.90
4116	150ns	CALL	HM6116-2	120ns	8.95
4164	200ns	CALL	Z6132	300ns	32.95
4164	150ns	CALL			

LP = LOW POWER

8000			
35	4.95	8251	4.39
39	5.95	8253	6.89
80A	3.89	8253.5	7.89
85A	5.89	8255	4.39
86	24.95	8255-5	5.19
88	34.95	8257	7.89
95	7.75	8259	6.85
86	7.75	8272	39.00
86	29.00	8275	29.00
02	27.95	8279	8.89
05	3.45	8279-5	9.89
12	1.79	8282	6.49
14	3.75	8283	6.49
16	1.69	8284	5.49
24	2.19	8286	6.49
26	1.79	8287	6.49
28	3.34	8288	24.95
37	19.00	8289	39.00
38	4.39	8741	34.95
43	4.39	8748	14.95
50	10.49	8755	29.95

DISC CONTROLLERS	INTERFACE
1771	8T26 1.65
1791	8T28 1.95
1793	8T95 .95
1795	8T96 .95
1797	8T97 .95
1797	8T98 .95
6843	DM8131 2.90
8272	DP8304 2.25
UPD765	DS8835 1.89
1691	DS8836 .99

EPROM ERASERS
HOLDS 15 EPROMS
ERASES IN 20 MINUTES
59.95

CONNECTORS
RS232 Male 3.00
RS232 Female 3.50
RS232 Female RA 4.95
RS232 Hood 1.20

6500 1 MHz	
6502	5.25
6504	6.85
6505	7.60
6507	9.85
6520	3.95
6522	4.95
6532	5.95
6545	16.95
6551	10.95

UPGRADE YOUR APPLE or TRS-80 4116 200ns CALL

CRYSTALS			
32.768 KHz	1.90	6.144	2.69
1.00 Hz	4.50	6.5536	2.69
1.8432	4.50	8.0	2.69
2.0	3.90	10.0	2.69
2.097152	3.90	12.0	2.69
2.4576	2.69	14.31818	2.69
3.2768	2.69	15.0	2.69
3.579545	2.69	16.0	2.69
4.0	2.69	17.430	2.69
5.0	2.69	18.0	2.69
5.0688	2.69	18.432	2.69
5.185	2.69	20.0	2.69
5.7143	2.69	22.1184	2.69
6.0	2.69		2.69

74LS00 SERIES					
74LS00	.23	74LS123	.77	74LS253	.57
74LS01	.23	74LS124	2.88	74LS257	.57
74LS02	.23	74LS125	.47	74LS258	.57
74LS03	.23	74LS126	.47	74LS259	2.73
74LS04	.23	74LS132	.57	74LS260	.57
74LS05	.23	74LS136	.37	74LS266	.53
74LS08	.23	74LS137	.97	74LS273	1.47
74LS10	.23	74LS138	.53	74LS275	3.33
74LS11	.25	74LS139	.53	74LS279	.47
74LS12	.25	74LS145	1.18	74LS280	1.96
74LS13	.39	74LS147	2.47	74LS283	.67
74LS14	.39	74LS148	1.33	74LS290	.87
74LS15	.29	74LS151	.53	74LS293	.87
74LS20	.23	74LS153	.53	74LS295	.97
74LS21	.23	74LS154	1.88	74LS298	.87
74LS22	.23	74LS155	.67	74LS324	1.73
74LS26	.29	74LS156	.67	74LS352	1.27
74LS27	.23	74LS157	.63	74LS353	1.27
74LS28	.29	74LS158	.57	74LS363	1.33
74LS30	.23	74LS160	.67	74LS364	1.93
74LS32	.25	74LS161	.63	74LS365	.47
74LS33	.49	74LS162	.67	74LS366	.47
74LS37	.29	74LS163	.63	74LS367	.43
74LS38	.29	74LS164	.67	74LS368	.43
74LS40	.23	74LS165	.93	74LS373	1.37
74LS42	.43	74LS166	1.93	74LS374	1.37
74LS47	.49	74LS168	1.73	74LS377	1.37
74LS48	.74	74LS169	1.73	74LS378	1.17
74LS49	.74	74LS170	1.47	74LS379	1.33
74LS51	.23	74LS173	.67	74LS385	1.88
74LS54	.23	74LS174	.53	74LS386	.43
74LS55	.28	74LS175	.53	74LS390	1.17
74LS63	1.23	74LS181	2.13	74LS393	1.17
74LS73	.37	74LS189	8.93	74LS395	1.17
74LS74	.33	74LS190	.87	74LS399	1.47
74LS75	.37	74LS191	.87	74LS424	2.93
74LS76	.37	74LS192	.77	74LS447	.35
74LS78	.47	74LS193	.77	74LS490	1.93
74LS83	.58	74LS194	.67	74LS668	1.67
74LS85	.67	74LS195	.67	74LS669	1.87
74LS86	.37	74LS196	.77	74LS670	1.47
74LS90	.53	74LS197	.77	74LS674	9.63
74LS91	.87	74LS221	.87	74LS682	3.18
74LS92	.53	74LS240	.93	74LS683	3.18
74LS93	.53	74LS251	.59	74LS684	3.18
74LS95	.73	74LS242	.97	74LS685	3.18
74LS96	.87	74LS243	.97	74LS688	2.38
74LS107	.37	74LS244	1.27	74LS689	3.18
74LS109	.37	74LS245	1.47		
74LS112	.37	74LS247	.73	81LS95	1.47
74LS113	.37	74LS248	.97	81LS96	1.47
74LS114	.37	74LS249	.97	81LS97	1.47
74LS122	.43	74LS251	.57	81LS98	1.47

IC SOCKETS		
ST	W/W	
8 PIN	.10	.49
14 PIN	.12	.50
16 PIN	.15	.57
18 PIN	.20	.85
20 PIN	.25	.99
22 PIN	.25	1.30
24 PIN	.25	1.40
28 PIN	.35	1.50
40 PIN	.40	1.80

ST = Soldertail
W/W = Wirewrap

Z 80 SERIES	
2.5 MHz	
Z80-CPU	3.35
Z80-PIO	3.35
Z80-CTC	3.35
Z80-DMA	12.49
Z80-DART	14.98
Z80-SIO/O	16.95
Z80-SIO/1	16.95
Z80-SIO/2	16.95
Z80-SIO/9	16.95
4.0 MHz	
Z80A-CPU	4.90
Z80A-PIO	4.90
Z80A-CTC	4.90
Z80A-DMA	21.95
Z80A-DART	15.95
Z80A-SIO/O	20.95
Z80A-SIO/1	20.95
Z80A-SIO/2	20.95
Z80A-SIO/9	18.95
6.0 MHz	
Z80B-CPU	14.95
Z80B-PIO	12.95
Z80B-CTC	12.95
ZILOG	
Z6132	32.95
Z8671	38.95

ORDER TOLL FREE
(800) 538-8800
(800) 848-8008
(CALIFORNIA RESIDENTS)
ALL MERCHANDISE IS 100% GUARANTEED

APPLE JOYSTICKS
29.95

APPLE PADDLES
9.95

APPLE SUPER COOLING FANS
49.95
WITH SURG PROTECH
69.95

APPLE* II COMPATIBLE DISK DRIVE CONTROLLER CARD
225.95
79.95

DoKau Computer Products, Inc.
2100 De La Cruz Blvd.
Santa Clara, CA 95050
(800) 538-8800
Calif. Residents (800) 848-8008



TERMS: For shipping include \$2.00 for UPS Ground. \$3.00 for UPS Blue Label Air. \$10.00 minimum order. Bay Area residents add 6 1/2% Sales Tax. California residents add 6% Sales Tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice. Send SASE for complete list.

SPARTAN Electronics Inc.



CALL MAIL
(516) 499-9500
6094 Jericho Tpke.
Commack, N.Y. 11725

Philips Remote Cable Converter

CTC9R
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 line tune • Adaptable to any brand television • One year warranty service

\$139.95

CABLE TV ACCESSORIES

2 set coupler	2.95
Coax Cable 100'	9.95
4 set coupler	4.50
F Connectors	.25
Matching transformer	.99
TV Game Switch	3.95
VHF-UHF AMP-28DB	23.95
Crimp Tool for F Conn.	8.95

700' CORDLESS PHONE

FM duplex circuitry. Last number redial. Base can signal remote to pick-up. Rechargeable ni-cad batteries.

\$89.95



Mura 400

SGL WABER \$35.95

Protect your computer and electronic equipment from voltage spikes

DG115P
DG115S (6 Outlet)
\$45.95



WINEGARD FM CAR ANTENNA BOOSTER

Amplifies FM radio signals an average of 18dB (8 times). Improves car radio reception and extends range to allow greater selection of stations. Switch and indicator light attaches to lower edge of dash. 24" cable with Motorola plugs provided. Installs in minutes. Great for window antennas.

\$26.95

REFURBISHED MONITORS

9", 12", Commercial Grade as low as **\$39.95**



10KM Cordless Telephone

Model 5500M (modified)
\$325.00
External Antenna required
For export use only

BECKMAN CIRCUITMATE 20

8 functions and 30 ranges - Diode-transistor test function - auto-polarity, auto-zero, and auto-decimal - 10 Amps AC and DC Current Capability - Transistor Gain Test (hFE) - Conductance

\$64.95



Jerrold 36 Channel Remote CATV Converter

w/on/off Fine Tuning \$94.95
58 Channel Wireless \$109.95



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

Dealers Welcome
Visa MC, BAC, Amex. All above prices include 4% cash discount. C.O.D. money order, check Add for Shipping

Volume Discounts	
Min. Order \$25.00	
International shipping Add'l	to 75.00 \$2.50
Prices subject to change without notice.	76.00 to 250.00 \$4.50
COD 2.00 Extra	251.00 to 500.00 \$6.00
*Add'l. shipping for monitors	501.00 to 750.00 \$8.50
	751.00 to 1000.00 \$12.00
	Over 1000.00 \$12.50

(516) Mon Th Tu W F Sa
499-9500 9-8 9-6 9:30-5

CIRCLE 47 ON FREE INFORMATION CARD

ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

Free Information Number	Page	
3	Active Electronics	200
—	Advance Electronics	28, 29, 86
80	Advanced Computer Products	201
73	All Electronics	189
51	AMC Sales	48
56	AP Products	25
89	Arizona Electronic Surplus	206
60	BBC Metrawatt	Cover IV
41, 78	Beckman Instruments	46, Cover III
67	Beta Electronics	207
98	BF Electronic Supermarket	179
77	BK Precision Dynascan	62
5	Byte-Ryte	110
7	Calvert	45
35	Cambridge Learning	134
—	C D Electronics	60
18	CEI	26
34	Chaney Electronics	202
—	CIE, Cleveland Institute of Electronics	52-55
7	Circuit Specialists	204
—	Command Production	20
22, 81	Communications Electronics	2, 13
88	Components Express	200
68	Computer Products	—
—	Peripherals	190
21	Cooper Tools	Cover II
84	CRT Factory	179
92	Decoder Distributors	178
95	Diamondback Electronics	206
39	Digi-Key	192, 193
11	Digitron	190
53	Direct Video Sales	50
99	Dokay Computer Products	207
26	Electro Industries	50
14	Electronic Parts Supply	20
59	Electronic Rainbow	117
6	Electronic Specialists	188
72	Electronic Technology Today	60
33	Electronic Warehouse	61
45	Electronics Book Club	177
15	Enterprise Development	50
50	ETCO	205
31	Etronix	48
40	Firestick Antenna	48
—	Fordham Radio	47, 49
76	Formula International	186, 187
—	Gilco International	190
71	Gladstone Electronics	38
10	Global Specialties	21
—	Grantham College of Engineering	15
75	Hal-tronix	205
16, 37	Heath	85, 91
85	Hickok Electrical Instrument	44
—	ICS Computer Training	40
94	Illinois Audio	46
—	ISCET	30
20	Jameco Electronics	184, 185
28	JAN Crystals	46
29	Javanco	204
49	JDR Microdevices	195-199
4	Jim-Pac Electronic Components	31
63	J W Electronics	178
83	KCS Electronics	202
48	Kikisui	9
44	L.I. Public Wholesalers	200
—	McGraw-Hill Book Clubs	142-145
93	McIntosh Labs	42
—	Memo Tech	92
66	MFJ Enterprises	208
—	Micro Management	60
12	Micro-Mart	204
46	Microsignal	60
17	Multidyne Electronics	179
—	Neutronics R D Ltd	134
90	Network Sales	205
—	New Horizons	51, 146
—	Newtonone Electronics	40
—	NRI Schools	16-19, 59
—	NTS Schools	34-36
—	Pacific 1	179
52	PAIA Electronics	42
69	Panavise	33
9	Philips-Tech Electronics	202
97	Pomona Electronics	5
30	Professional Video	194
24	Protecto Enterprises	78
—	Radio-Electronics Reprint Bookstore	38
61, 86	Radio Shack	74, 183
79	Ramsey Electronics	191
42	RCA	27, 32, 33
—	RCA Distributors Special Products	24
—	RCA Technical Publications	41
—	RCD	57
27	R.F. Electronics	206
96	R.I.S.T.	178
87	Robotics Age	134
32	Sams Books	101-109
95	Satellite Receiver Systems	179
36	Scientific Systems	205
25	SCR Electronics Center	188
55	SEI	194
54	Simpson Electric	22
82	Sintec	30
23	Solid State Sales	188
43	Soltec	1
47	Spartan Electronics	208
—	Symmetric Sound Systems	178
38	Taft Electronics	69
8	Technical Electronics	194
74	Tektronix	7
64	Traband Electronics	179
62	Triplett	43
—	T.V. Products	178, 179
65	Ungar	179
19	Vector Electronic	166
91	VIZ Manufacturing	11
13	Westech	202
—	Zenith	23

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

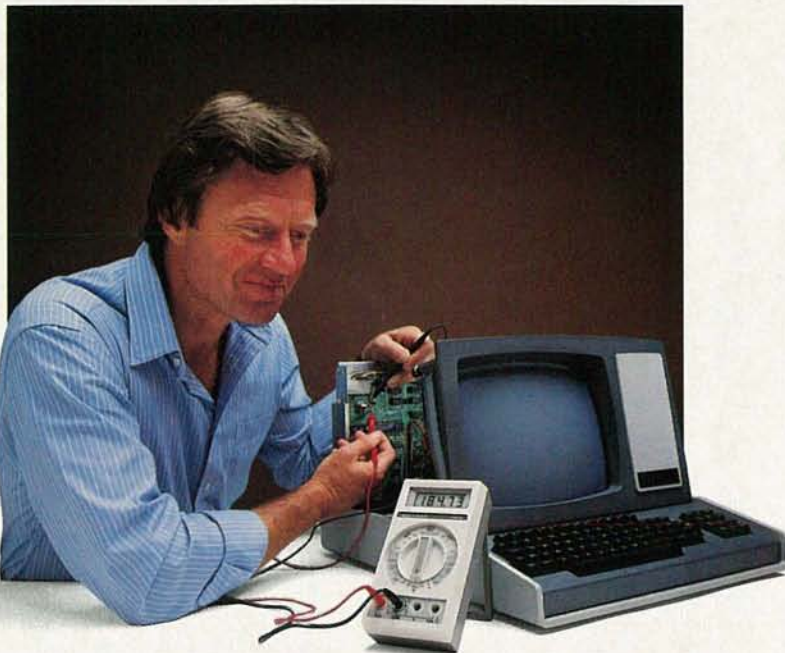
Call 601-323-5869 in Miss., outside continental USA, tech/order/repair info. TELEX 53-4590.

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

CIRCLE 66 ON FREE INFORMATION CARD

RADIO-ELECTRONICS

Our new 4½ digit DMM only acts expensive.



Now you can get 4½ digit resolution plus an unmatched combination of high performance features for just \$239.

Performance Power

The new Beckman Model 4410 DMM gives you precise readings with resolutions down to 10 microvolts and 10 nanoamps. The 4410 offers you 0.05% basic Vdc accuracy plus true RMS Vac capability for accurate readings of complex waveforms. Add to this RF shielding and high input impedance, and you have superior 4½ digit performance.

Easy to use

Built-in 10A ac/dc capability eliminates the need to carry an external shunt. For fast

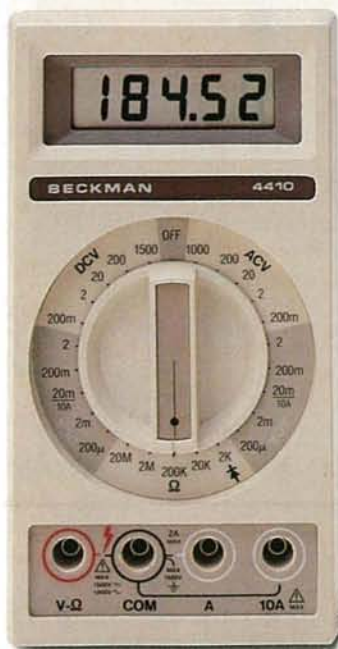
continuity tests, the INSTA-OHMS® continuity indicator works at the speed of a glance. For even more convenience, the single rotary switch makes function and range selection simple and sure.

Built to last

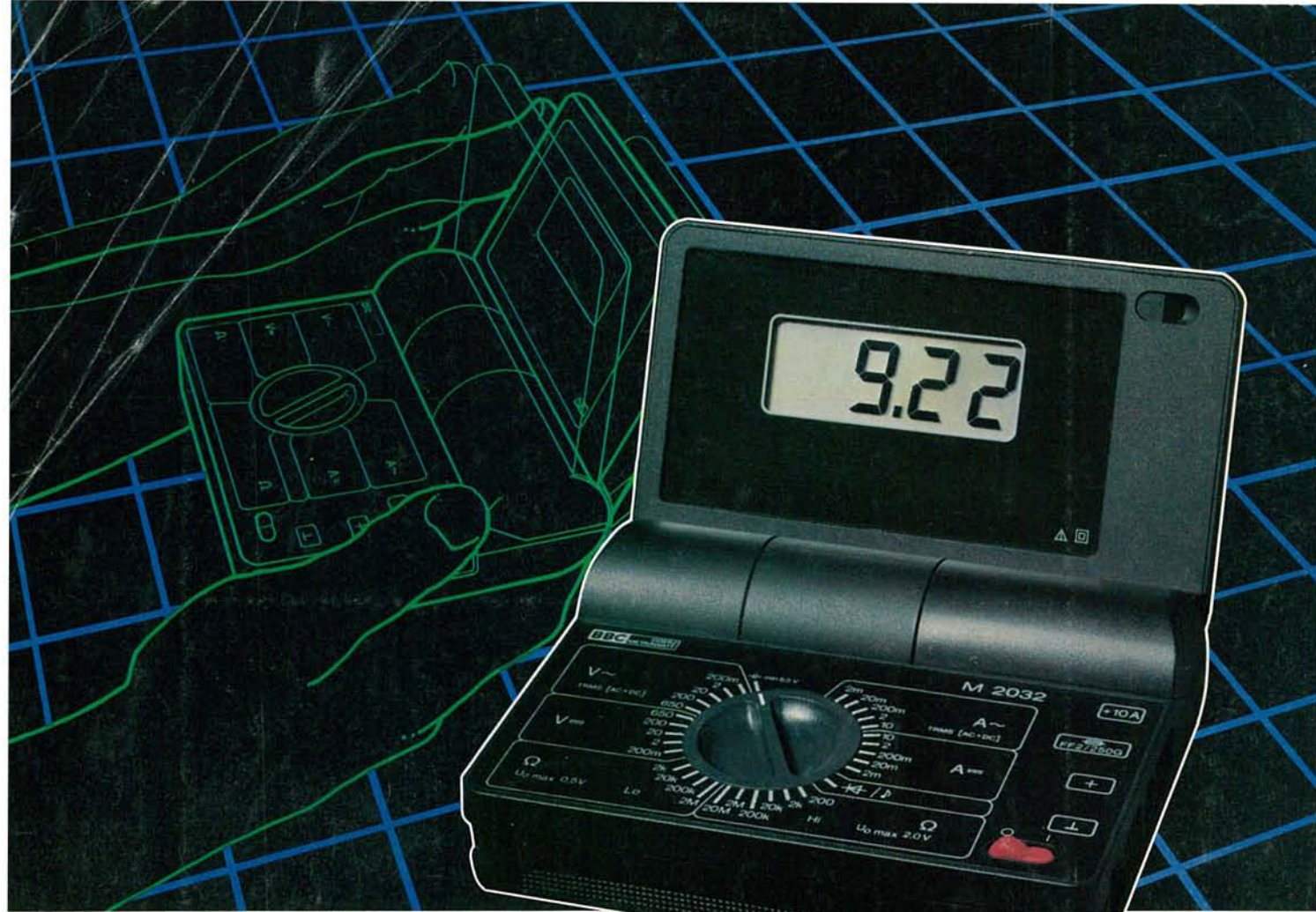
Packed with overload protection, the 4410 is designed for reliable service. It withstands 1500 Vdc or 1000 Vac on all voltage ranges as well as 6kV transients. A rugged 2A/600V fuse protects current ranges and resistance ranges against overloads up to 500 Vdc. For extra long life, the 4410 uses Beckman's custom designed switch and self-cleaning gold contacts.

With so much performance and reliability at your convenience, you'd expect the Beckman 4410 DMM to be expensive—not just \$239.

For more information, see your local distributor today. For the one nearest you, call or write: Beckman Instruments, Electronic Technologies Group/Instrumentation Products, 210 Ranger, Brea, CA 92621; (714) 993-8803.



BECKMAN



performance by design

Folding Meters are Better

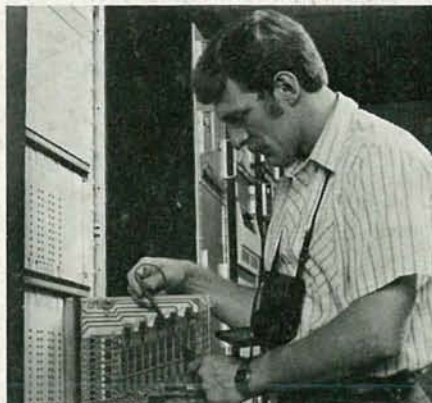
Not all multimeters fold. There's a reason. While other manufacturers were busy copying each others designs, BBC looked at where portable meters were used and how they could be improved.

The result is a unique approach. Folding meters with large displays (18 mm LCDs) and adjustable viewing angles. Now you can have high performance in a meter that excels in the field and on the bench.

Hands Free vs Handheld

In multimeters "hands free" is significantly better than "handheld." You need three hands to operate the typical "handheld" meter in the field. One for the meter and two for the probes. BBC's folding design lets you use a neck strap for the meter. This frees your hands for the probes.

On the bench, the large, adjustable displays pay off. It's a sensible design that lets you make measurements faster and more easily.



A Heritage of Precision

BBC's track record of expertise in precision engineering spans eight decades. All our meters are built to tough VDE and DIN safety standards. The 3½-digit DMM's feature 0.1% basic dc accuracy and externally accessible fuses for overload protection.

CIRCLE 60 ON FREE INFORMATION CARD

Compact, Rugged and Affordable

To design the impact resistant case that protects these DMM's, BBC relied on the industrial design skills of the Porsche Design Studios.

When open, the display angle is easily adjustable. When closed, the display and the controls are protected, and the meters turn off automatically. Competitive pricing is another feature of BBC meters. Prices start at \$193.00.

Available Locally

BBC meters are available throughout the U.S. If your instrumentation supplier doesn't carry BBC yet, we'll gladly tell you who does. Call toll free:

1-800-821-6327
(In CO, 303-469-5231)

BBC - METRAWATT/GOERZ
6901 W. 117th Avenue
Broomfield, CO 80020, Telex 45-4540

Engineering Excellence in Test and Measurement

BBC **GOERZ**
METRAWATT