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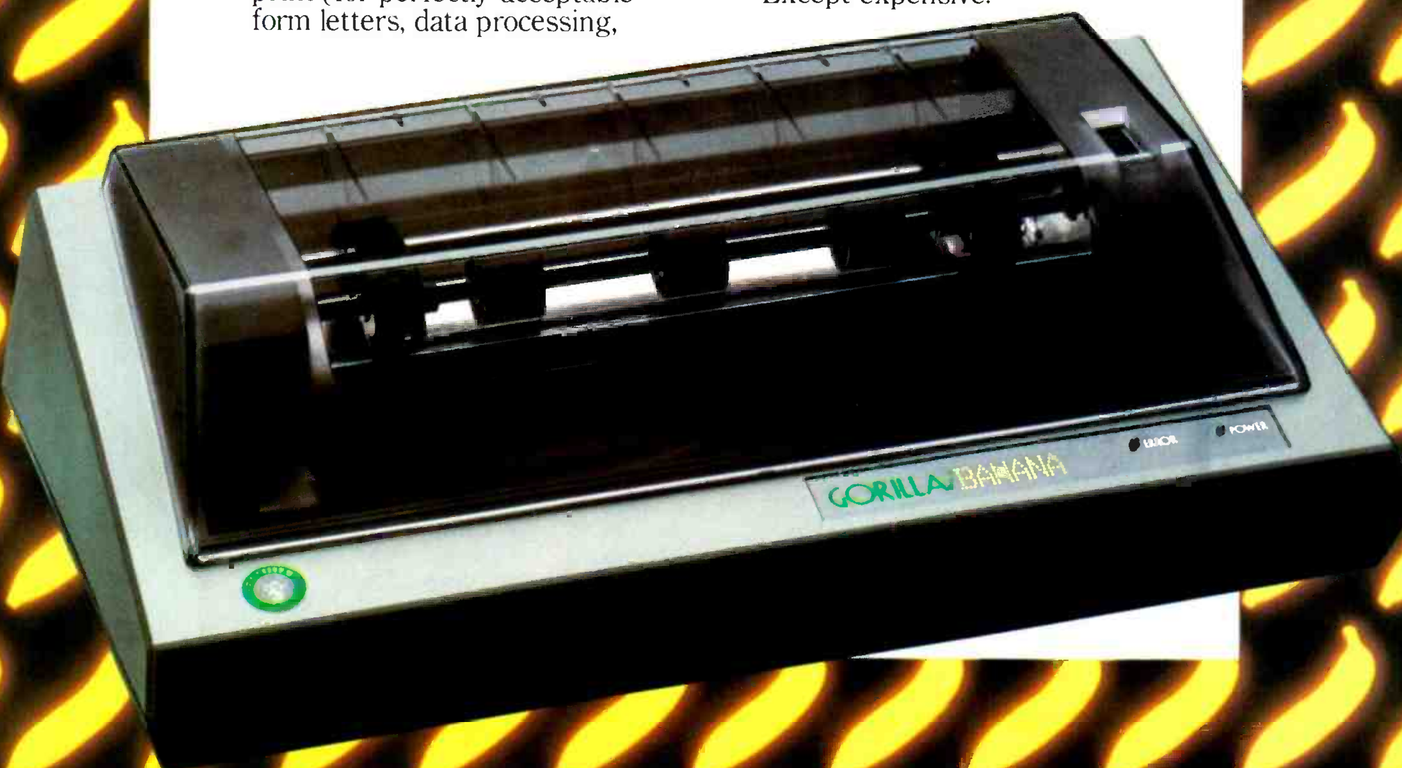

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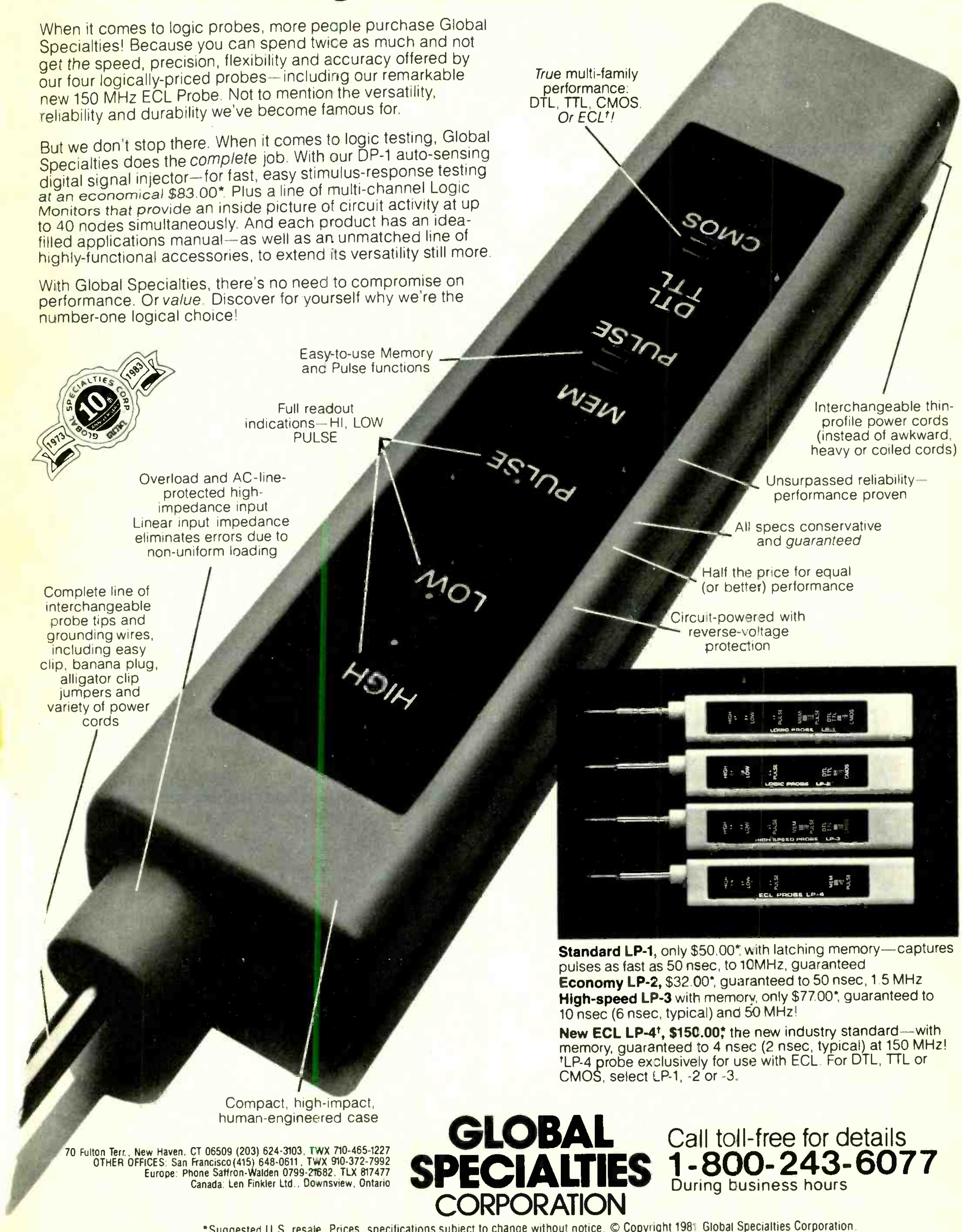

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Computers & Electronics

SEPTEMBER 1983 VOLUME 21, NUMBER 9

FEATURE ARTICLES

COLUMNS

DEPARTMENTS

COVER ART BY A. DANIELS

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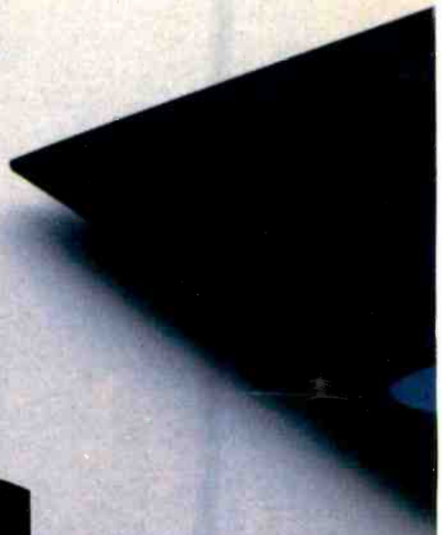
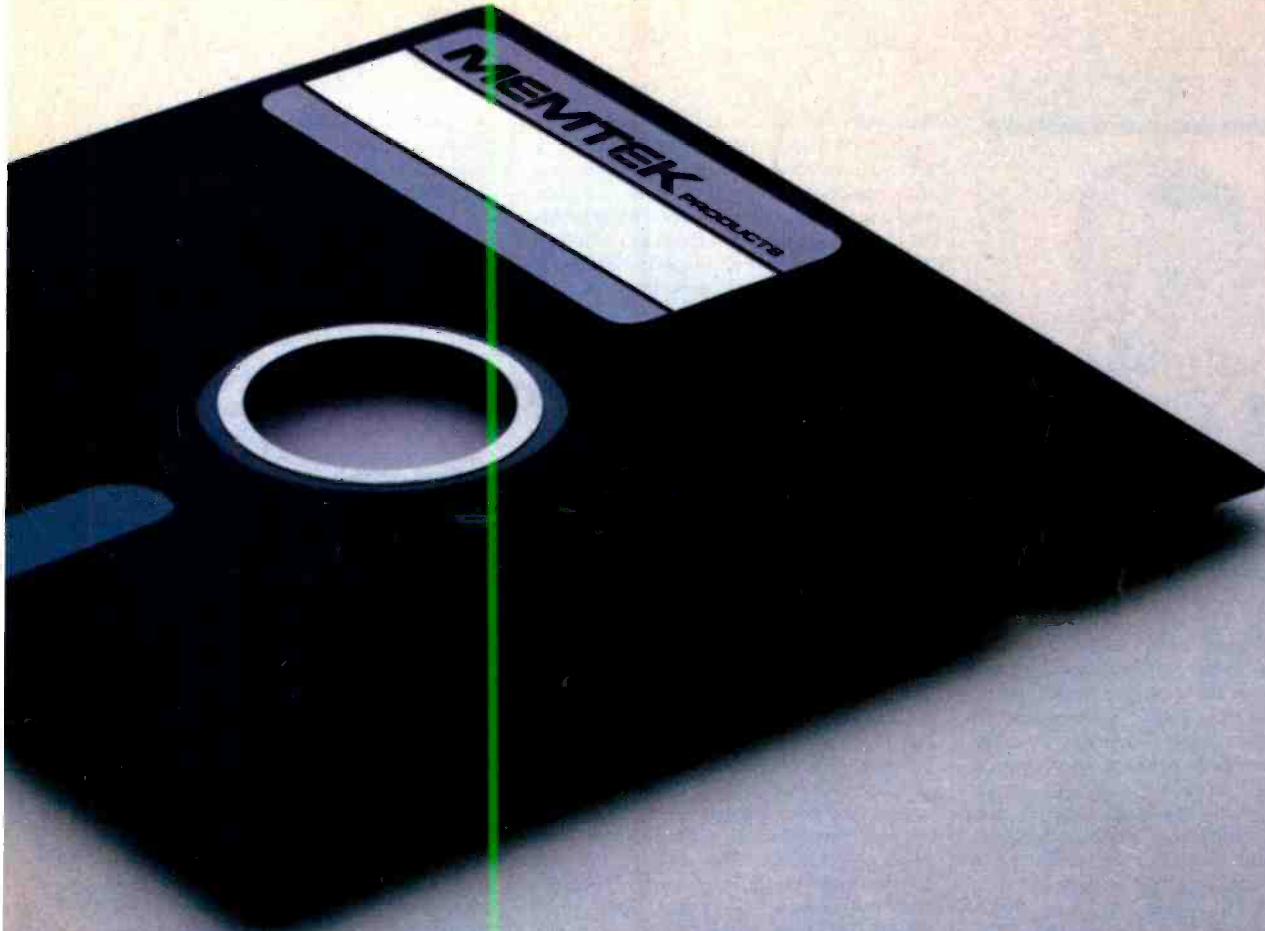


THE HA

A disk is built with certain safeguards. The technology is widely known. That's why most disk makers offer guarantees that the product you receive comes to you error free. We at Memtek Products are concerned that the minidisk remains error free, once put into use. *Every* time you use it. After exposure to dust, cigarette smoke, fingerprints, even wear caused by your computer. And so, we have built safeguards around the disk, as well.

The hub ring. Designed to prevent our minidisks from jamming in your machine.



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Rigid. Durable. Reinforced. To maximize disk life and improve alignment.

Memtek Products' latest innovation... acknowledgment of a real world beyond the laboratory.

The coating. A critically-controlled coating of high-energy magnetic oxide particles that covers the disk's surface, which is then micro-polished to improve head to disk contact. This process not only helps prevent dropouts, it also lowers head abrasion.

The lubrication system. A constant lubricant protects both the disk surface and the drive head from wear.

The sleeve. Comes with a soft liner that protects the disk while gently cleaning the surface of dust and debris that can damage drive heads.

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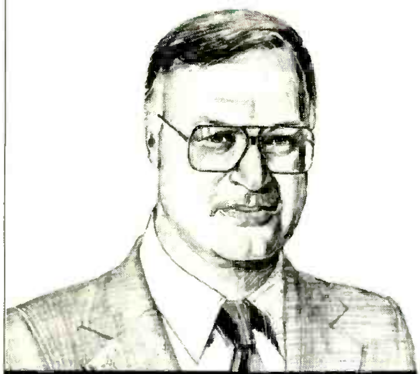
EDITORIAL



Compupunobia

THE fear of using computers—compuphobia—is more widespread than many people imagine, particularly among more mature adults. There are a host of likely causes, led by fear of failure and the challenge presented by linguistics. Mix in poor documentation by manufacturers' sales jargon, a confusing array of competitive machines and software, questionable utility, cost, incompatibility between computers, and even fear and awe of a system that might replace the user.

Some of the foregoing hurdles are slowly being overcome. Too slowly. But "The Force" cannot be denied. Inexorably, computers are encroaching indirectly on virtually everyone today; and more and more people are already eyeball to eyeball with them at work, particularly in professional, executive, technical, educational, and clerical areas.

The tip of the iceberg is clearly in sight. For example, a new computer network planned by Travelhost Inc. is expected to link hotel and motel rooms throughout the U.S., making available to guests a variety of information services such as videotext service, restaurant reviews, and computer data exchange using the hotel room's TV set. This was launched recently in Chicago's Midland Hotel with computer terminals in 100 rooms, according to a company spokesman. Another hotel system designed by HotelTech International, called "Suitetalk," consists of a color microcomputer system that offers word processing, busines programs, and data communications, among other services, for about $9 per hour at night and $20 per hour during the day. Information is presented in magazine-page format, activated by the user pressing a letter or number on a keyboard. Function keys include GAMES, NEWS, STOCKS, HOME-OFFICE, MESSAGES, CALC, and AIRLINES.

For anyone not yet familiar with what a personal computer can do, a trip to a local computer store can be a fruitful outing, especially if he gets a helpful salesperson to demonstrate some software. There's a new in-store information center from Apple Computer, too, that can relieve people who have compuphobia. It consists of an interactive laser videodisc system with a touch-sensitive screen that gives answers to the most commonly asked questions about personal computer applications. For example, if one touches a spot on the screen next to the topic "Word Processing," a list of subtopics is displayed. Touching the screen again to choose a specific segment, say, making text changes or text search, the selected topic is played back on the 13" color monitor.

There are also some interesting efforts being made to demonstrate computer software. Buyers face a choice from among tens of thousands. One "creative" idea was rental of software, in much the same manner as recorded video cassette tapes are rented. However, software makers are more than displeased by this owing to the possibility of a customer's copying a program illegally. In fact, Micropro has filed suit against a software rental company, charging copyright infringement because consumers do not own their software. They are licensed to use it and lending it to others is prohibited.

Another interesting approach to researching software products is the establishment of the National Software Reference Library, a division of PC Telemart, Inc. in Fairfax, VA. This facility is reported to house thousands of microcomputer software programs and associated documentation, along with appropriate personal computer configurations. Members can operate software packages to aid them in purchasing the products ($25 per day). The company plans to establish nationwide on-line data-base equipment for placement in computer and book stores.

Computers are not as easy as they could be to operate. But there is a growing trend to design them with humans in mind—built-in application ROMs, graphic screen menus, function keys, adjustable terminals, etc. The sooner the better, of course, since we are rapidly moving into an awesome information age where hardly anyone will be untouched by computer technology. This being the case, the smart move is to embrace computers as early as you can, not waiting for all the operating conveniences to be in place. Imagine what would have happened if people hadn't learned how to drive automobiles because shifting gears was too complicated.

Art Salsberg

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Communications Electronics has teamed up with Wabash to provide a single-source solution for the diskette duplication requirements of software developers, OEM's and distributors. All service is in-house, to give you fast, dependable service. In most cases, delivery can be completed in five days. Whether you require 100, 1,000, or 10,000 copies per week, call CE first for a no obligation price quote. For additional information, please write us on your letterhead with your requirements.

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8" SSDD IBM Compatible (128 B/S, 26 Sectors)	F131	2.39
8" DSDD Soft Sector (Unformatted)	F14A	2.99
8" DSDD Soft Sector (256 B/S, 26 Sectors)	F144	2.99
8" DSDD Soft Sector (512 B/S, 15 Sectors)	F145	2.99
8" DSDD Soft Sector (1024 B/S, 8 Sectors)	F147	2.99
5¼" SSSD Soft Sector w/Hub Ring	M11A	1.49
5¼" Same as above, but bulk pack w/o envelope	M11AB	1.29
5¼" SSSD 10 Hard Sector w/Hub Ring	M41A	1.49
5¼" SSSD 16 Hard Sector w/Hub Ring	M51A	1.49
5¼" SSDD Soft Sector w/Hub Ring	M13A	1.79
5¼" Same as above, but bulk pack w/o envelope	M13AB	1.59
5¼" SSDD 10 Hard Sector w/Hub Ring	M43A	1.79
5¼" SSDD 16 Hard Sector w/Hub Ring	M53A	1.79
5¼" DSDD Soft Sector w/Hub Ring	M14A	2.69
5¼" Same as above, but bulk pack w/o envelope	M14AB	2.49
5¼" DSDD 10 Hard Sector w/Hub Ring	M44A	2.69
5¼" DSDD 16 Hard Sector w/Hub Ring	M54A	2.69
5¼" SSQD Soft Sector w/Hub Ring (96 TPI)	M15A	2.59
5¼" DSQD Soft Sector w/Hub Ring (96 TPI)	M16A	3.69
5¼" Tyvek Diskette Envelopes - Price per 100 Pack	TE5	12.00

SSSD = Single Sided Single Density; SSDD = Single Sided Double Density; DSDD = Double Sided Double Density; SSQD = Single Sided Quad Density; DSQD = Double Sided Quad Density; TPI = Tracks per inch.

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Wabash diskettes are packed 10 disks to a carton and 10 cartons to a case. The economy bulk pack is packaged 100 disks to a case without envelopes or labels. Please order only in increments of 100 units for quantity 100 pricing. With the exception of bulk pack, we are also willing to accommodate your smaller orders. Quantities less than 100 units are available in increments of 10 units at a 20% surcharge above our 100 unit price. **Quantity discounts** are also available. Order 500 or more disks at the same time and deduct 1%; 1,000 or more saves you 2%; 2,000 or more saves 3%; 5,000 or more saves 4%; 10,000 or more saves 5%; 25,000 or more saves 6%; 50,000 or more saves 7%, 100,000 or more saves 8%, 500,000 or more saves 9% and 1,000,000 or more disks earns you a 10% discount off our super low quantity 100 price. Almost all Wabash diskettes are immediately available from CE. Our efficient warehouse facilities are equipped to help us get you the quality product you need, when you need it. If you need further assistance to find the flexible disk that's right for you, call the Wabash compatibility hotline. Dial toll-free 800-323-9868 and ask for your compatibility representative. In Illinois or outside the U.S. dial 312-593-6363 between 9 AM to 4 PM Central time.

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This all-new self-study course (EE-8088) provides in-depth coverage of 16-bit, state-of-the-art technology.

You will gain a thorough understanding of microprocessors from this 1200 page course. In 10 easy-to-understand units, starting with microcomputer basics, you'll cover all phases of 16-bit microprocessing. Assembly language. Program writing. Addressing modes. Dynamic and static RAM. And hardware interfacing.

And by using your 16-bit Trainer/Learning Computer for hands-on experiments (over 60 included), you'll gain actual circuit interface and software programming experience with an 8088 microprocessor system.

Trainer/Learning Computer

A unique combination of design features makes this versatile microprocessor system much more than a "teaching machine." Use it as a trainer with the Advanced Microprocessor course. Use it as an experimental design computer. And use it to run a wide variety of 16-bit software – including Z-DOS, Multiplan, Z-Basic, Condor File Manager, and much more.

In its most basic form, the Trainer/Learning Computer is a 16-bit, cassette-based microcomputer. Its unique design features access ports and solderless breadboards to allow you to build interfaces, design and modify circuits, or simply experiment with the inner workings of the microprocessor system.

The basic system has an 8088 processor, 32K ROM (including assembler, editor and debugger) and 16K RAM.

The unit also features a serial I/O printer port, cassette interface and a detached 95-key keyboard (including 16 function keys and a numeric keypad) which generates a full ASCII character set. It's available either in kit form or factory assembled.

And you can take advantage of the system's H/Z-100 computer design heritage by easily upgrading it to a disk-based, 16-bit microcomputer that will run H/Z-100 series software and many other forthcoming programs.

Fully Upgradeable

The powerful upgrade package and variety of accessories allow you to make the basic 16-bit system more powerful and versatile. You can add 128K or 192K bytes of RAM. Floppy disk controller. 48TPI double-sided, double-density, single or dual floppy disk drive. Bit-mapped video graphics or full-color graphics. Two RS-232 ports. Programmable timer. And a Centronics-compatible printer port.

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LETTERS

UPGRADING T/S VIDEO

With regard to my article "Upgrading Timex-Sinclair Video" (May 1983), it should be noted that the article and the diagrams were based on the ZX-81, not the ZS-80. However, during the time between the article's conception and its publication, the computer underwent a layout change to accommodate discrete pull-up resistor instead of several single-in-line resistor packages. Schematically, the computer remained the same, but the positions of *D9, R31,* and *R32* changed. They are still accessible, however, and must be removed as in the article. It has also been observed by some of your readers that bending and tearing may occur on some TV sets when inverse characters are displayed while the DVC-2 is operating in the normal mode. This is due to the TV's inability to clamp the horizontal sync pulses properly. Reducing the value of R7 to 3.9 kilohms or 4.3 kilohms will increase the ratio of the sync pulse to video signals and should solve the problem.—*Steve Pence, Phoenix, AZ.*

MORROW IS GREAT

The "Desktop Appliance Computers" (July 1983) review of the Morrow Designs and Cromemco micros was well done. Having just coordinated the purchase of 50 Morrow Designs MD-2 and MD-3 machines for our facility, I can vouch for the fact that they do everything that has been claimed for them. The computers, when delivered, actually included more software than advertised.—*Stephen R. Hample, Montana State University, Bozeman, MT 59717.*

COMPUTER PLACEMENT

I appreciated your article "Maximize Your Computing Comfort and Efficiency" (April 1983) and intend to recommend it to management and occupational physicians and nurses for aid in relieving employee complaints. I have seen computers set up against a west window so that the operator was facing the relatively low-level illumination of the video screen against the exceedingly bright background outside the window—a very difficult visual task!—*J.M. Krichbaum, Occupational Ophthalmologist, Lakewood, CO.*

KAYPRO AND MBASIC

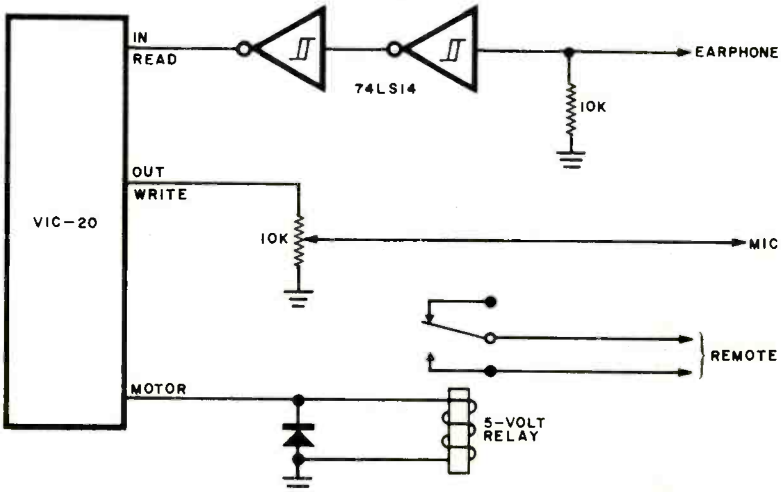
The review of the Kaypro II (June 1983, p. 57) was a pleasure to read but was a little confusing as to the types of software that are available for the computer. The author correctly said that MBASIC comes with Kaypro and then went on to discuss the limitations of SBASIC for the Kaypro. To set the record straight, you should point out that MBASIC-80 from Microsoft now comes with the Kaypro at no extra cost.—*Betsy Wallace, Westminster, MD.*

OUT OF TUNE

In "Data Storage in a Nutshell" (July 1983), on page 48, in the second paragraph, the last few lines should read, "Thus, using semiconductor technology, $16 \times 64{,}000$ or 1.024×10^6 bits per square inch can be created. Compare this with the 10^8 bits per square inch of logitudinal recording and 10^{10} bits/square inch of perpendicular recording.

RECORDING WITH THE VIC-20

With regard to the discussion on using a cassette recorder with the VIC-20 (see "Computer Hotline," March 1983, and "Letters," June 1983), I have been using the circuit below with my VIC-20 for several years and it works fine.—*Joe Little, Atlanta, GA.*



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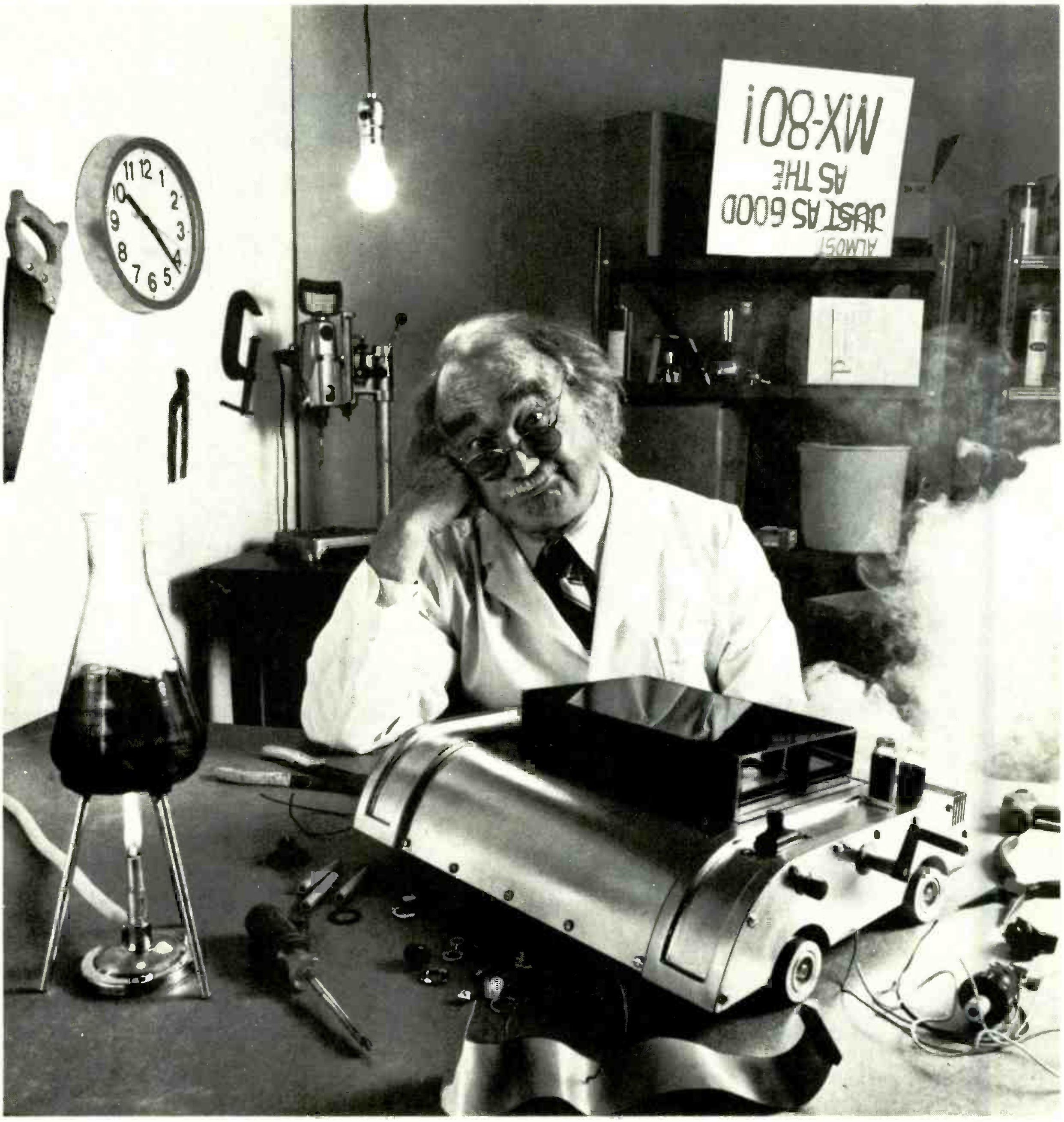

For everyone who's tried to top the MX-80, bad news. We just did.

Epson.

The Epson MX-80 is the best-selling dot matrix impact printer in the world. It has been since its introduction. And despite the host of imitators it spawned, no one has been able to top it. Until now.

FX-80: Son of a legend.

The new Epson FX-80 is far more than just doo-dads added on to last year's model. It's the most astonishing collection of features ever assembled in a personal printer.

For starters, it's fast: 160 CPS. And clean. All the print quality Epson is famous for in a tack-sharp 9x9 matrix.

But that hardly scratches the surface.

Create your own alphabet.

With the new FX-80, you aren't limited to ASCII characters. You can create your own. Any character or symbol that can be defined in a 9x11 matrix can be added to the FX-80's already impressive library of type styles and stored in its integral 2K RAM.

So you can create "Sally's Gothic" or "Tom's Roman" just by downloading and modifying standard characters. Or you can create a custom set from scratch. Either way, you can store up to 256 new characters. And if you don't need a new alphabet, the RAM functions as a 2K data input buffer.

Who knows graphics better than Epson?

Nobody, that's who. And if you don't believe it, witness the FX-80.

With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, but *seven* different dot addressable graphic modes are program selectable. And can be mixed in the same print line. Everything from 72 DPI (dots-per-inch) Plotter Graphics to the 640 dots per line resolution designed to match the remarkable monitor clarity of the Epson QX-10 personal computer.

And *that* is in addition to an astonishing array of 136 different user-selectable type styles including Proportional, Elite and Italic as well as the more conventional faces you get on other printers.

Hard-to-beat hardware.

The FX-80 has all the hardware features you've come to know and love on the MX Series: logic seeking, bidirectional printing, the by-now-famous disposable printhead, and more.

The FX-80 features an adjustable pin platen or optional friction/tractor feed, so you can use fanfold, roll or sheet paper . . . backwards or forwards. The FX-80 even gives you reverse paper feed.

And if you're printing forms, the FX-80 has a feature you're gonna love: a function that allows you to tear off the paper within one inch of the last print position.

Be the first on your block.

We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

And while you're there . . . ask them to show you how it works with our computers.

The New Epson FX-80. See it at your dealer now.

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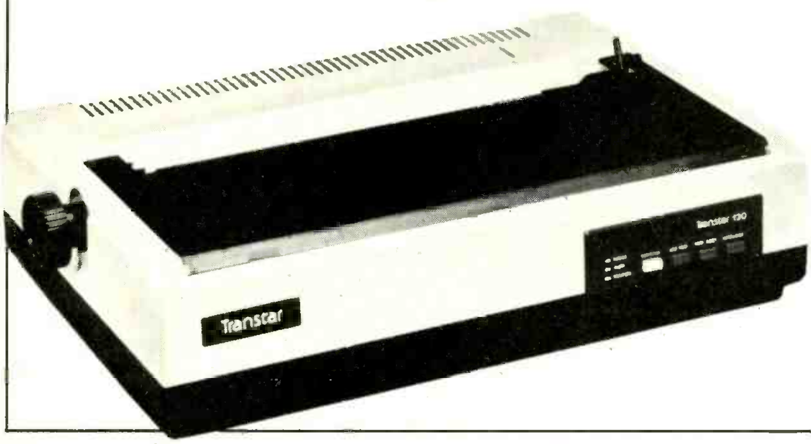
NEW PRODUCTS



LOW-COST LETTER-QUALITY PRINTING

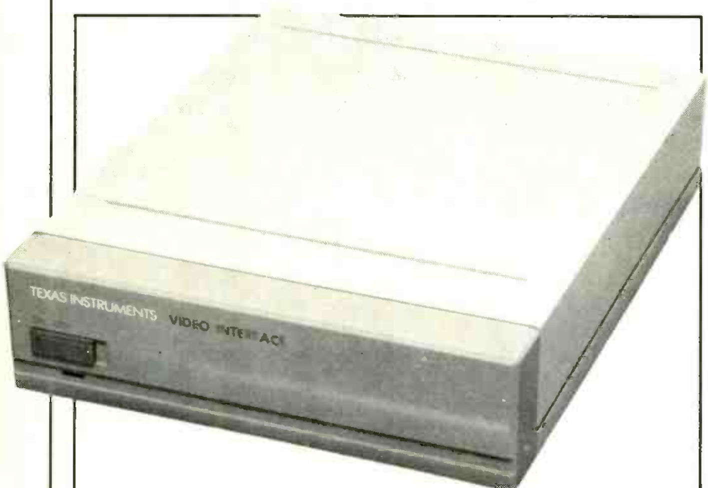
Transtar's Model 120, a $599 daisywheel letter-quality printer, is compatible with major word-processing software using existing Diablo routines for boldface, underscore, superscript, and subscript. Printing speed is 14 cps, and a DIP switch selects 10, 12, or 15 cpi pitch. Automatic paper loader handles cut-sheet paper. Initial offering is with a Centronics-type, 8-bit parallel interface. A serial version will support the DTR protocol as standard ETX/ACK or XON/XOFF and at transmission rates from 300 to 9600 baud.

Circle No. 84 on Free Information Card

MULTI-USER MICROCOMPUTER SYSTEM

CompuPro's new MultiPro Model MP 10 is said to be the first four-user multiprocessor microcomputer offering simultaneous 8/16-bit operation at a price of less than $1800 per workstation. At $4995, excluding terminals, the system supports word/data-processing and communications functions through a shared database at high speed. Has 8-MHz 8088 16-bit CPU with 1M byte of main memory, 7 ports, 384K solid-state disk memory, and dual 5¼" mini-floppy drives; four Z80B 8-bit user CPUs, each with its own 64K of RAM.

Circle No. 85 on Free Information Card



VIDEO INTERFACE

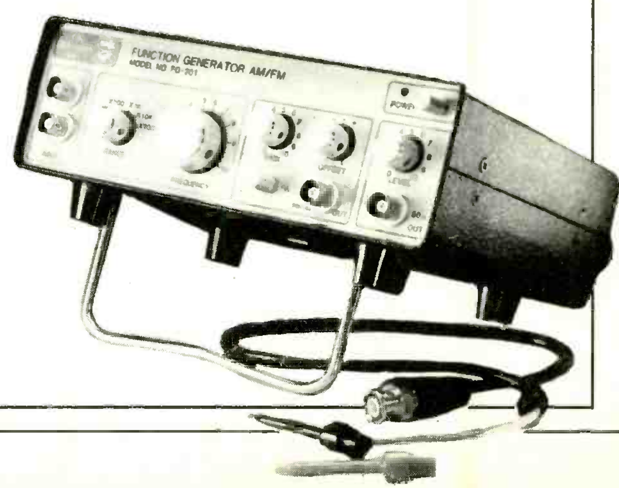
Texas Instruments' video interface gives the TI CC-40 a 450-char × 24-line display on any TV receiver or TI video monitor. The HX-1100 attaches to the CC-40 through the hex-bus intelligent peripheral port, permitting operation in a text mode with limited graphics. Display modes include scrolling and paging. Both modes have top and bottom (first and last) lines protection. "Windowing" function permits viewing up to 80 char/line and display can highlight words by reversing colors. $99.95.

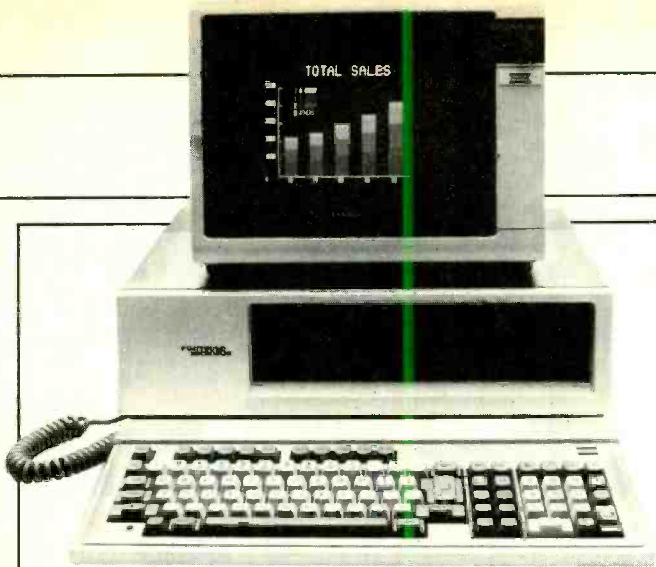
Circle No. 86 on Free Information Card

AM/FM SWEEP FUNCTION GENERATOR

Model FG-201 function generator from OK Industries has a 1-Hz to 1-MHz range, (in six steps) and sine, triangle, and square waveforms. Also, linear 100:1 FM modulation and 0 to > 100% AM modulation. Square-wave output is independently variable, simultaneous and in-phase with the separate sine/triangle output for use as an individual signal source as well as a trigger or synchronizer. Source impedance, 50 ohms and switch-selectable < 5 ohms for sine/triangle; output level, ±10 V p-p. $250.

Circle No. 87 on Free Information Card





FUJITSU 8/16-BIT COLOR COMPUTER

Fujitsu's Micro 16s Personal Business Computer has both 8086 and Z80A processors for operation in the 16- and 8-bit worlds. Comes with 128K RAM, optionally expandable to 1M and 52K of video RAM; dual 320K-byte 5¼" disk drives; 300-to-19,200-baud serial and Centronics-type parallel I/O ports; four-channel A/D converter. Software includes CP/M-86, SuperCalc, and Wordstar word processing. Text display can be either 80 or 40 columns by 25 lines, while graphics mode offers 640 × 200-pixel resolution. $3995.

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LIGHT PEN FOR APPLES

The Gibson Light Pen from Micro D enables users to draw high-resolution graphics directly on the screen of an Apple II. Using a stylus the size of ballpoint pen, it works with machine-language software (included). Has area fill/refill, four complete HiRes drawing systems and a HiRes generator. $349.

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HIGH-POWER STEREO AMPLIFIER

Model PM-1.5 professional low-feedback high-headroom stereo amplifier from Carver has a rated output of 450 W/channel and weighs 21 lb. Specs: 0.1% THD full power into 8 ohms; <0.1% IM distortion (SMPTE); frequency response, −3 dB at 3 and 80,000 Hz; damping 200 at 1 kHz; noise better than 115 dB below 450 W A-weighted; 19" W × 10 $^{13}/_{16}$" D × 3½" H.

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INTELLIGENT SERIAL INTERFACE

The SC817 Smart Cable from IQ Technologies, Inc., is designed to solve the problem of RS232 interfacing. It connects any computer to any peripheral with the flick of a switch. On-board logic circuitry "looks" at the RS232 interfaces in the computer and peripheral and connects them for correct operation. An indicator light shows when a software problem exists. $78.

Circle No. 91 on Free Information Card

AUTO-DIALER MODEM FOR IBM PC

Rixon's Model PC212A auto-dialer modem installs in any slot in the IBM PC and offers a choice of two transmission rates. Stores up to 10 telephone numbers and operates at up to 300 baud in the low-speed asynchronous mode or 1200 baud in the high-speed synchronous or character asynchronous mode. Also features an RS232C interface port and eliminates the need for an asynchronous communications adapter card and external modem cable. Internal microprocessor allows total control, operation, and optioning of the modem from the IBM PC. Modem is battery-protected. $495.

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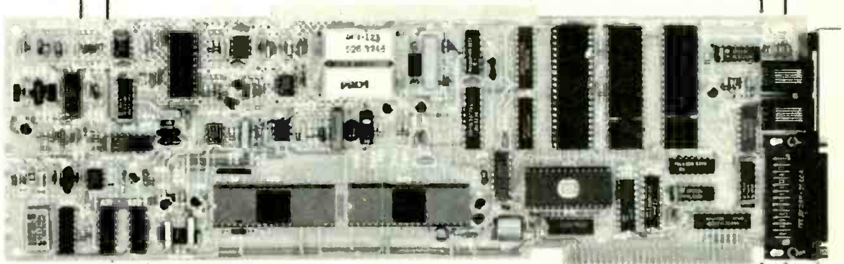

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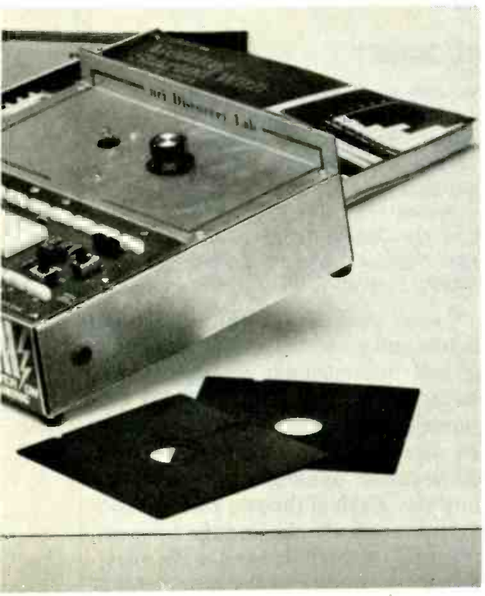

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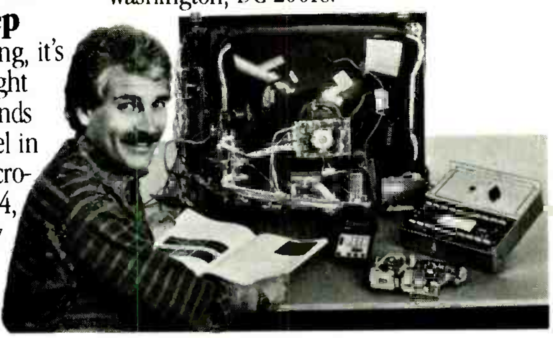

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(TRS-80 is a trademark of the Radio Shack division of Tandy Corp.)

COMPUTER VIDEO GAMES

Hands-On Reviews of Recently Released Game Software

EVERY so often, someone comes along with a really good idea. Such an idea was the Sony 3½" microfloppy diskette, which looked like a logical and sensible approach to computer storage.

This diskette is small enough to slip into a jacket pocket and has a rigid protective jacket and a metal cover that slips over the normally exposed parts that are read by the computer. In short, it's well protected and well designed for easy portability, mailing, and just plain carrying around.

The diskette runs in drives designed to work with the same controllers that operate 5¼" minifloppies, and this is an important area of compatibility. Computer systems don't have to be redesigned to use these new miniaturized diskettes.

What about storage space? In its basic format, the Sony microfloppy can hold more than the most densely packed 5¼" model—up to about 900K formatted. Now that's an awful lot to be able to put on a disk that small; but like all areas of technology, mass storage has been going through its own refinement and development stages.

With all this going for it, you'd think companies would be battering down the doors to sign up for this new format. Some have. But others have decided that they'd out-micro the microdiskette with their own designs. At last count, there were at least *four* different diskettes in the three-inch range vying for industry attention. The leading contender today is Maxell's 3"; and like Sony, Maxell has a lot of camp followers, including some of the industry's biggest guns.

In the meantime, Sony is very unquietly spearheading its drive for 3½" standardization. A special standards committee that includes Sony and Shugart, the latter being a giant O.E.M. manufacturer of disk drives, has established standards that all members have agreed to and can live with. Last summer, Sony signed a licensing agreement with Hewlett-Packard to use its microdiskettes, and this is the biggest single major manufacturer to go along with this development. A couple of new H-P computers use the microdiskettes, and it's certainly gratifying to see someone at least doing something sensible.

What of the other majors who've elected to go with other 3" formats? Most of them will make hardware and diskettes for whatever system will sell, but much of this hassle looks like the old multi-standards battle shaping up with proponents in each camp. There are no longer any 78-rpm records being made, but there are still plently of both 33's and 45's being cranked out. Same is true of VCRs; not only do we have ¾" U-Matic, but also ½" Beta and VHS coexisting rather uncomfortably. And we also have laser discs along with CED video discs. (Now they've finally gone and introduced VHD video discs in Japan with an eye on the U.S. market.)

What's going to happen in the microfloppy diskette battle? We'll probably see at least two different sizes, and as many as four. We've also heard that there's a *four-inch* floppy. Just what the industry has been waiting for! For now, we're going to stick to our 5¼ inchers. At least with these the size is the same, even if you can't necessarily use a disk from one kind of computer on someone else's machine, and one is hard sector, another soft sector . . .but that's a whole other story.

A. E.

Diskette for Atari 400/800
Brøderbund Software, Inc., 1938 Fourth St., San Rafael, CA 94901; 415-456-6424. $34.95
Graphics ★★★★
Gameplay ★★★★
Sustained Interest ★★★
Type: *Joystick action game*
Memory Required: *48K*

The jacket blurb explains that "A. E." is the Japanese word for "ray" as in Manta Ray or Sting Ray. In this case, the A.E. was designed as a pollution-fighting robot and some slipped through quality control at the Mitsubishubuku Company and are running loose in the universe—not destroying or damaging, but being extremely pesky.

Your mission is to destroy enough of the A.E. to drive them out of our corner of the universe. A ship-like cannon moves horizontally (joystick control) and you try to shoot sections or preferably the head of the centipede-like A.E. as it snakes in and around and up and about your city and then your planet. To destroy the A.E. waves, you have to detonate your shooter's missiles directly in their path.

If you succeed in a perfect attack on the A.E. waves—destroying all waves in your play level, you move on to the next level—from the city to planetary orbit, and then beyond. There are five different screens (levels) of play, and if you get really good at this, you can make the game even more difficult by pressing Control H (H = hard) when the disk is booting up.

The game also offers the option of pausing during gameplay to answer the phone, or nature's call, or to get another cup of coffee. It can be controlled either by joystick or paddle.

At first, gameplay seems a little strange; these cruising serpentine A.E.s don't look all that menacing until they "clean up" your cannon, and knock you out of the game. Like other "twitch" type games, your own reflexes and learning ability count for a lot. It's an interesting, action-filled game, and while it's not as good as some others to come out of Brøderbund, it ranks among some of the better computer games we've seen recently.

Yes, it can keep you up late until you unlock the key to ridding the civilized universe of those pesky A.E. robots. And once the universe is safe for polluters once again, you can start all over—this time at the Hard level. Have fun!

RICOCHET

Cassette for Commodore VIC-20.
Epyx (Automated Simulations, Inc., 1043 Kies Court, Sunnyvale, CA 94086. 408-745-0700.) $19.95.
Graphics ★★★★
Gameplay ★★★★
Sustained Interest ★★★★
Type: *Keyboard strategy game.*
Memory required: *8K*

Plug in your 8K or 16K expansion module and go to town with this exciting and unpredictable strategy game. The instructions say there's nothing else to compare it to, and they're quite right. The screen display looks more like a double-ended bowling alley than anything else. Each of the two players (two humans or one human and the computer) has six targets at his end of the alley, arranged bowling-pin fashion. Behind the targets are up to four bumpers that give your opponent a ton of extra points

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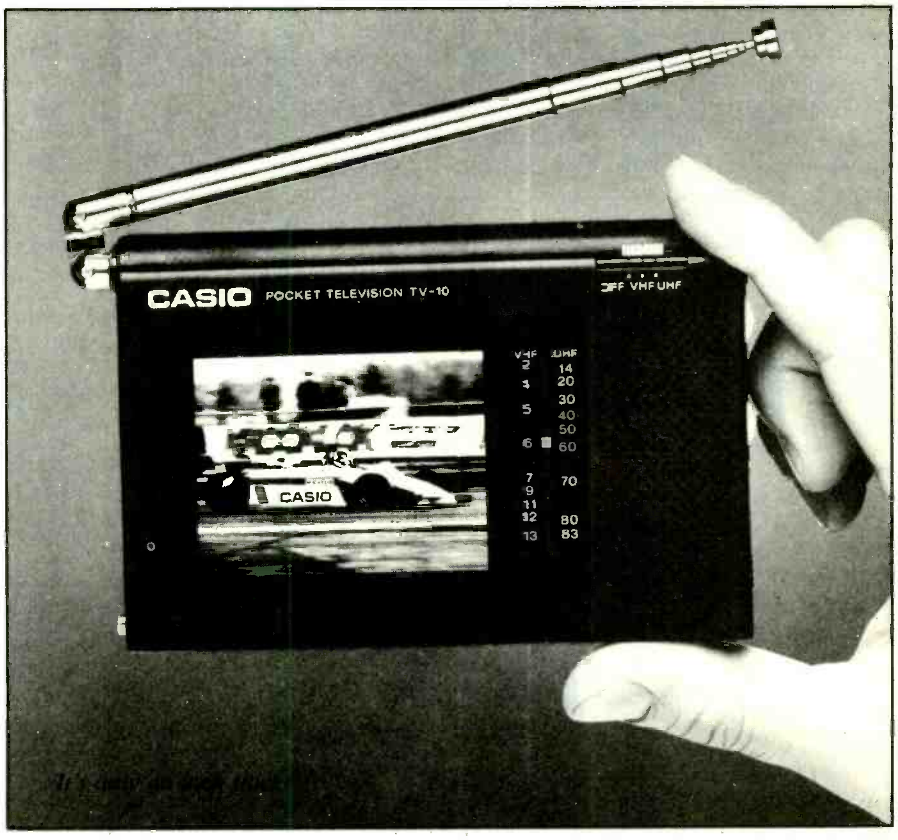
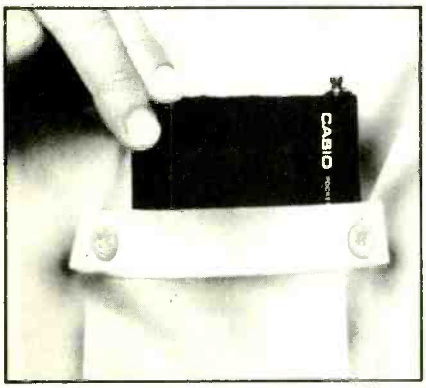


The CASIO POCKET TV



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Technically, it's **nematic liquid crystals** and **electroluminescence.** From your view-point, it's a sharp, brilliant black-and-white picture on every commercial channel, 2 to 83.

Outperforms Sony and Seiko

We didn't say we have the only miniaturized TV set; we said ours has the only **perfect picture.** Sony has a set for $50 more, and Seiko has one for $150 more, and in our opinion neither of them is within light-years of the picture quality ours has. Side by side, our set's picture, like our description, is absolutely clear.

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Three tiny AA batteries will power this TV for hours and hours (power consumption is only one watt). Or use the rechargeable battery-pack, and after viewing, plug it in the wall to recharge overnight.

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Unlike old-fashioned conventional television sets that need a shadow-box in sunlight or a room light inside, the Casio Pocket TV delivers its perfect picture under any lighting conditions.

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if his/her/its missile hits them.

You have two launch positions, top and bottom, and there are times when you may not be able to use one of these launchers. You may use your turn to rearrange the locations of your targets to provide the most advantageous strategy positioning. Figuring out those bounces (or ricochets) in advance can be very complex. The missile ball, projectile, or whatever travels totally free of friction and can create some interesting and infuriating patterns before the turn is completed.

As long as the ball has something to hit, it will continue to ricochet. Each time it strikes a target, bumper or wall, it rebounds at a 45-degree angle and goes on to its next contact point. If there's nothing left to hit, it goes off the play field and the turn is over.

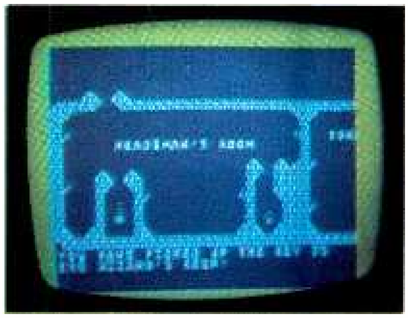
It's especially fascinating to watch the strategy moves the computer makes when you're playing solo. You can't help but wonder what the computer knows that you don't.

There are a number of game variations and choices to make before starting the game. The computer keeps track of the scores and the matches played with unerring impartiality and accuracy, but it's awfully hard to figure out the scoring system itself. Rest assured, the computer won't cheat on this; but it plays an awfully tough game.

This is another of those super-intriguing games that can be habit forming. We've already seen an awful lot of sleep lost over it. So keep that coffee pot percolating. You'll need it.

THE NIGHTMARE

Diskette for Atari 400/800
Epyx (Automated Simulations, Inc.), 1043 Kies Ct., Sunnyvale, CA 94086; 408-745-0700. $29.95.
Graphics ★★★
Gameplay ★★★★
Sustained Interest ★★★★
Type: *Joystick adventure/action game*
Memory Required: *40K*



This one might well be called "Son of Escape from Vulcan's Isle" since it has a number of similarities to that earlier release from Epyx. As the player, you control the movements of a little man (or woman—it really has no gender) who runs around a castle trying to collect goodies and escape the various baddies who try to stop you.

Why is it called nightmare? The manufacturer says because it's so hard to tell reality from what could be simply a bad dream. But dreams should be made of more ethereal stuff; this game has definite characteristics, and urges you on to explore the many byways of the haunted castle while the computer scrolls merrily through one screen after another.

The instructions suggest that the first time you enter the haunted castle, you prepare a rough map to help you keep track of where things are. There are three floors plus a spooky dungeon to explore, and when you bang into a wall or obstruction, there's a sharp clunking noise and the screen flashes the message, "Ouch!" But these bumps and bruises don't cost you points—just time and frustration over trying to negotiate a narrow passage.

You find yourself being pursued by the rat pack, the mistress, and the resident ghost—among others. You do battle with these creatures, and can kill them. It's just a little mind-boggling, though, to read a message such as, "You have killed the ghost." How can you kill a ghost?

This game is lots of fun, good for several evenings of engrossing adventure-type gaming, and best of all, you can save an unfinished game to resume at some future date. The program will only allow you to save *one* game, and the dyed-in-the-wool adventure gamer might find this just a bit constraining. The Nightmare is a good game, and we recommend it.

SUPER AMOK

Rom Cartridge for Commodore VIC-20
U.M.I. (United Microware, Inc.), 3503-C Temple Ave., Pomona, CA 91768; 714-594-1351. $39.95
Graphics ★★★
Gameplay ★★★★
Sustained Interest ★★★★
Type: *Joystick action game*
Memory Required: *Resident 3.5K RAM*

If you remember U.M.I.'s earlier game, Amok, you'll recognize this one immediately. But it's much better in many ways. The original Amok—which somewhat resemble's Atari's "Berzerk," was slower-moving, didn't have graphics as good as this later version, and the original was (and still is) on a cassette which can be super-slow getting loaded into the computer.

Because this is a ROM cartridge, you don't have to be too concerned about such niceties as memory expansion, and the like. Just plug it in and you're ready to go.

This joystick game can be played with one or two people—the latter made possible by the simple expedient of passing the single joystick back and forth between players. This method is needed because the VIC has just one joystick port, but it doesn't have to be a handicap.

Like its predecessor, the game makes you a little man in an uncomplicated maze, surrounded by angry robots who try to shoot you. You try to shoot them first. Then duck, because robots who shoot can miss you and their fire can hit and destroy other robots. They may supposedly represent the pinnacle of technological achievement, but they're slow and dumb. Yet they can get in a lucky shot and zap you, so don't get overconfident. That's when other things start to happen.

Getting safely out of a screen starts you in the next screen and wave of robots, and they get harder as you go along. The robots move faster and you move slower, but you've got a pretty good, fast set of legs and can get out of the way if you keep your wits and don't get flustered.

In general, Super Amok is a worthy successor to its predecessor, and the graphics seem to be much better. It's awfully hard to do a graphically excellent program for the VIC with its limited amount of memory and the very special way its ROM addresses the color video screen. ◇

Finding Invisible Short Circuits in Digital Equipment

THERE are commercial test instruments for almost every type of electronic problem. However, as every computerist knows, there is one potential hardware problem for which there is no test instrument that can be of help.

This is the case where you are confronted by a pc board full of ICs, all soldered in, and the circuit does not work. The best that a logic probe, multimeter, logic analyzer, or scope can tell you is that a particular signal path is *kaput.* Unfortunately, you are left with some difficult decisions since none of these instruments can tell you whether it's the source IC that is not delivering an output, or if it's the IC (or one of the ICs) receiving the signal that has a short at its input, thus effectively removing the signal. All that these instruments can tell you is that there is no signal on a line that should have one. They cannot pin the blame (no pun intended).

Until this time, to hunt down this type of fault, you would have had to start unsoldering ICs, with the attendant possibility of damaging solder pads and slender foil traces. As you have probably found out by now, it does not take many solder/unsolder operations or very much soldering-iron heat to catastrophically destroy a foil pattern.

The short-hunter test circuit shown here can solve the problem of determining which IC is at fault, and there is no need to unsolder anything.

As an extra bonus, despite the fact that this novel instrument—for which there is no commercial counterpart—was originally designed for troubleshooting digital circuits, it can also be used to locate an inoperative IC or transistor in an analog circuit without unsoldering, junction testing, or otherwise removing the semiconductor from the board. It works on the premise that, when a semiconductor is supplied with the proper operating power and input signal, and if the device draws no collector current, the likelyhood is very good that the semiconductor is bad. Operation in this mode will be covered further along.

In almost all digital circuits, one IC usually drives one or more other ICs or transistors. When the driving IC is delivering a high and there is a short to ground at the input of one of the signal receiving devices, current will flow down the trace making the electrical connection between the two. However, a scope, logic probe, etc., will not show the presence of this current and, for all intents and purposes, will indicate that the line is "dead."

Since all conductors have some finite value of resistance, according to Ohm's Law, there will be a voltage gradient (though small in the case of low currents and a low-resistance path), between the current source and ground. If the source IC has failed, and will not deliver a high, then the line will still be dead, but there will be no voltage gradient.

What we need is a device that can respond to these minute voltages. Fortunately, this is the primary electrical property of a semiconductor device called an operational amplifier (op amp) whose differential inputs can respond to voltages down in the microvolt levels to cause the output to switch states depending on which of the differential inputs receives the higher voltage.

In the diagram, note that each differential input of the op amp is connected via a 10,000-ohm resistor to a color-coded probe, biased via 100,000-ohm resistors, with a centering network including a potentiometer provided for zeroing. This potentiometer is adjusted for a zero-type output when the two probes are shorted to each other. The output of the op amp is connected to a pair of inverters, each having a different colored LED, and its associated-current limiting resistor connected at the outputs.

When you make up the probes, use sharp-tipped needles that can penetrate into the copper foil (or through insulation if point-to-point wiring is used in the circuit under test). Although only one inverter/LED combination is required for general-purpose troubleshooting, using two inverter/LED combinations allows you not only to find out which way current is flowing in a trace, but which end has the high polarity and which the low.

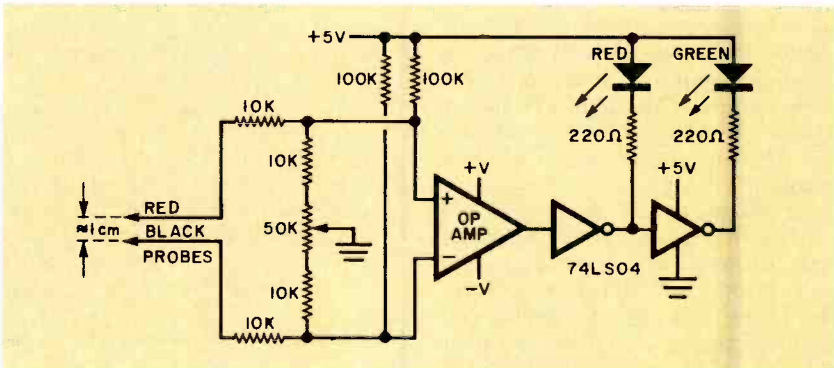
If the polarity of the voltage present at the red probe is higher than the voltage at the black probe, the RED-color LED glows. If the voltage at the black probe is higher than the voltage at the red probe, then the GREEN-color LED glows. These polarities can then be checked against the circuit schematic to make sure that they are correct.

Obviously, if the source IC is not delivering a high, the line being tested will not show a voltage gradient.

For testing analog circuits, insert the needle probes in the foil trace or lead feeding the collector of each transistor or the +V pin of each IC. If the operating power and the base signal are present, but no current flows, then that particular semiconductor should be suspect. Open ground connections to the IC or transistor can also be checked with the short hunter.

In a digital circuit, make sure that the clock is operating, then use the probe on each signal-carrying IC lead. If the signal source IC is good, then the short hunter will find the defective receiving IC. If the line is dead, then the source IC is not delivering a high.

You should experiment with tip spacing, and make tests on an operating board to get the "feel" of this new test device. Since no commercial equivalent is available, you can write your own manual on how to use the circuit. Drop me a line if you use this circuit for any unusual applications. ◇

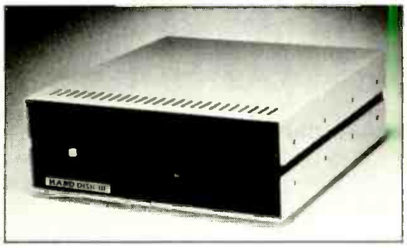


Hardware

Apple Modem. The Summa 300 is a single-slot, 300-baud, direct-connect modem for the Apple II and IIe computers. It contains the modem and communications circuitry on one card without the need for additional peripherals or software. It is also furnished with software that permits the screen image to be captured in the Apple Memory. $119. **Address:** Zoom Telephonics, Inc., 207 South St., Boston, MA 02111.

IBM-PC Color Monitor. The RGB 12-inch color monitor for the IBM-PC will deliver 16 different colors using a special 31-mm dot pitch CRT that can produce 690 x 480 dots. Obviously, the monitor can be used with any type of video output from games to serious business applications. $795. **Address:** Quadram Corp., 4357 Park Dr., Norcross, GA 30093 (404-923-6666).

Winchester Drive. The Hard Disk III is available as a 5M-byte (formatted) fixed or removable disk cartridge. It is also available in other configurations.



Adapters, which include hardware and software, are available for use with IBM-PC, IBM-XT, Apple II, Apple IIe, Franklin, TRS-80 Models I and III, LNW-80, and LNW-II. $995. **Address:** VR Data, 777 Henderson Blvd., Folcroft, PA 19032.

Timex/Sinclair Expansion. The 32K-plus-I/O module adds four parallel I/O ports, and 32K bytes of RAM to the T1000 or ZX81 computers. When plugged into the rear apron connector, this module allows the use of external controls, A/D, temperature measurements, etc. $155 plus $4.95 shipping/handling. **Address:** Wisconsin Electronics, PO Box 332, Milton, WI 53563.

VIC-20 Memory Expander. The Ramex is a 27,648-byte switchable memory for the VIC-20 and has two extension connectors identical to the VIC Memory Expansion connector except for BLK-5. The memory is switchable in one 3K or three 8K sections. Also included are a reset switch, memory and connector safety fuse, operating manual, self-test program, and case. $169. Romax Jr. with 19,456 bytes is $139. **Address:** Apropos Technology, 350 Lantana Ave., Suite 821, Camarillo, CA 93010 (805-482-3604).

S-100 Weighing System. This load cell digitizing card is designed for S-100/IEEE696 systems to enable weigh platforms, hoppers, and tank and truck scales to interface directly with compatible computers. The single-channel converter is compatible with all strain gauge transducers, providing excitation for up to eight 350-ohm bridges. In the high accuracy mode, 17-bit binary output is available four times per second while at 15 conversations per second, 15 bits are available, plus sign and overload. Accuracy is 0.01 percent. A programmable damping filter is provided to reduce vibration effects. $495. **Address:** Scalar Electronix (1982) Inc., PO Box 0863, Champlain, NY 12919-083 (514-634-7026).

Apple Clock. The "dat-a-clock" is fully compatible with all versions of the Apple II. It maintains date, month, and year capability and its EPROM is accessible. An on-board battery ensures a two to three-year life. $85 assembled and $55 in kit form plus $2 shipping/handling. **Address:** P&B Research Consultants, 231 East Grand Blvd., Detroit, MI 48207 (313-259-5951).

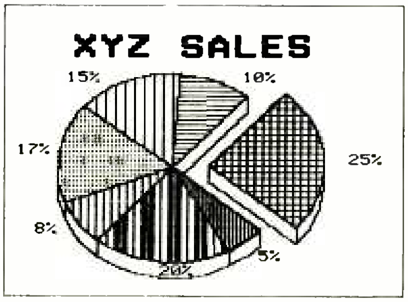
VIC Numerica Keypad. The Keypad for the Commodore VIC-20/64 comes as standard or hexidecimal. The 24-key keypad connects to the computer via a ribbon cable. The standard unit contains 0-9, +, –, *, /, shift, period, comma, colon, semicolon, space, delete, cursor down, cursor right, and return. The hexadecimal version contains 0-9, A-F, shift, period, comma, space, delete, cursor down, cursor right, and return. $79.95. **Address:** Home Computer Corp., 154 Heard Rd., Kathleen, GA 31047 (912-987-0235).

Half-High Winchester. The Space Saver hard disk systems for the Apple and IBM-PC are available as fixed or removable cartridge systems. They are 2¼" high, 5¼" wide, 9½" deep and weigh five pounds. They feature dynamic volume allocation (DVA) for the Apple allowing one or 65K volumes. DOS volumes can be allocated as large as 400K bytes. The user can define the volume size. For the IBM-PC, the device is hardware compatible with the IBM hard file products and operates transparently with IBM-PC DOS 2.0. The fixed system is $995 without controller, while the cartridge is $1325 without controller. For the IBM, the controller is $450. **Address:** Mountain Computer Inc., 300 El Pueblo Rd., Scotts Valley, CA 95066 (408-438-6650).

IBM-PC Speech. The PC-Mate Speech Master hardware and software provide synthetic voice output, text-to-speech conversions, and expanded native vocabulary while occupying a single slot. The Speech master provides two forms of speech synthesis: high-quality with a limited ROM-based vocabulary, and a lower-quality unlimited vocabulary using phonemes. The software operates under PC DOS 1.10 and contains two programs—English that provides for text-to-speech conversion, and Speak which sends screen output to the speech synthesizer for simultaneous spoken output. The Speech Master board is $395, and the Speech Master software support package is $95. A Speech Master Auxiliary Vocabulary Unit is $100. **Address:** Tecmar Inc., Personal Computer Products Div., 23600 Mercantile Rd., Cleveland, OH 44122 (216-464-7410).

Software

Plotting Package. The Prime Plotter is a comprehensive plotting package for business, technical, and scientific applications. Features include data management, statistical analysis, X-Y plotting, pie charts, graphics, and slide show/replay. Users can perform trend analysis and curve fit regressions on data



files. Then the data, fit, or any function/mathematical subroutine can be plotted. Screens can be saved or printed using a graphic printer interface such as the Grappler or Pkaso. Three disks come with the package: a master, a replay, and a user. $240. **Address:** Primesoft Corp., PO Box 40, Cabin John, MD 20818 (301-229-4229).

Cribbage Player. Cribbage Master II features card graphics on the TRS-80 screen with the player's cards moving from his "hand" to the "table". All rules are observed, and although the program may make a mistake in playing, it never makes errors in counting hand or crib points. Some scoring is automatic, but pegging is up to the player. Score is kept on screen. For TRS-80 Model I and III disk systems. $21.95. **Address:** Manhattan Software, PO Box 1063, Woodland Hills, CA 91365 (213-453-6943).

CP/M Communications. MITE allows CP/M based machines to appear as intelligent data terminals for on-line services such as CompuServe or the Source. It also enables the computer to be used as a Western Union TWX or Telex terminal. The menu driven program supports many different protocols and provides full modem control with auto logon if required. Files can be transferred between any two CP/M computers with error checking. Preinstalled versions are available for most computers and installation is easy with other types of computer systems. $150. **Address:** Wordmovers Inc., 15818 Hawthorne Blvd., Lawndale, CA 90260 (213-542-7351).

Commodore Inventory Manager. The Inventory Manager transforms any Commodore 64 or VIC-20 with Data 20 16K Video Pak into an inventory management system. It has a capacity of 2500 separate files with 99,999 items per file. The menu driven software offers sales posting, edit update, display, inventory, inventory master listing, daily and monthly sales listings, selected field listings (over 1000 vendor codes per vendor report, re-stocking reports, department classification reports, sales analysis reports, etc. Two back-up routines that allow saving data files on tape and restore disk from tape are also provided. $99.95. **Address:** Electronic Strategies Inc., 23012 Del Lago, Laguna Hills, CA 92653 (714-770-3246).

Apple Children's Trainer. MATH FACTS LEVEL 1 is a self-paced instructional program for children from 4 to 7. It uses color drawings and large numbers and letters to teach the fundamental concepts of math. The program is formed from 16 units covering numbers from 1 to 20, number placement, number words, and addition and subtraction both with and without symbols. It also features a sound-off option for silent viewing in a classroom. Disk version is $25 (DOS 3.2 or 3.3). **Address:** THESIS, PO Box 147-M, Garden City, MI 48135 (313-595-4722).

IBM-PC Management Utility. The Sales Manager is a professional management information tool for executives in sales, marketing, and general business. It handles the tracking and reporting for Customers, Prospects, Sales Representatives, Quota, Commissions, Planning, Forecasting, Expenses, Sales Analysis, and Personnel. It is menu driven and requires 128K of RAM. $450. **Address:** Market Power, 11780 Rough & Ready Rd., Rough & Ready, CA 95975 (916-432-1200). ◇

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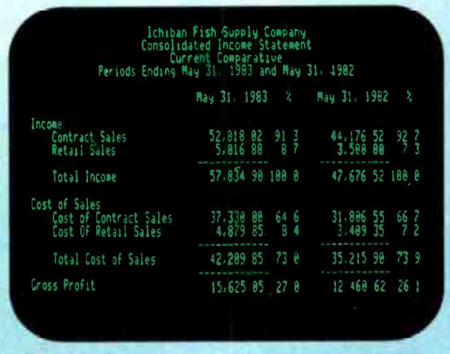

Your Apple can generate instant income statements (with expense ratios) or balance sheets, and let you compare them to last month's or year's, then print them out to suit your banker.

feature allows you to make credit decisions based on the most current information).

You can also list your purchases by discount dates. And take advantage of them in no uncertain net terms. You can even keep payroll records without paying more, because it's part of the same package.

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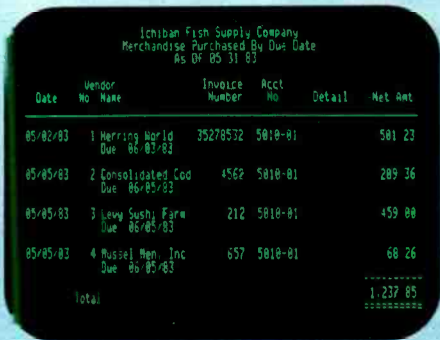
The BPI General Accounting Package also lets your income statements be coded by location, department or product line. So you know where your money's coming from.

And where it's not.



It can also allow you to take full advantage of merchandise discounts. So you'll know whom to pay, when to pay, how much to pay—and save a lot of clams in the process.

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Add an Apple Dot Matrix or Daisywheel printer to your Apple III, and you can print out your entire balance sheet in minutes.

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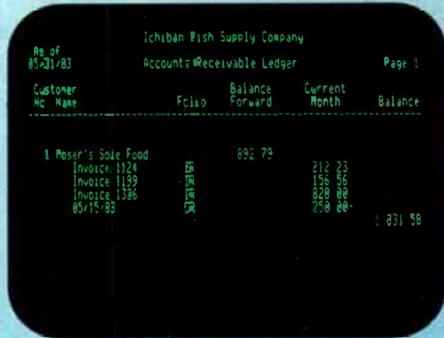

To avoid fishy transactions, you can instantly display customer's payments, charges and current balance. In this case, a few more cans of tuna would put Mr. Moser over his $2,000 limit.

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A NEW BREED OF COMPUTER PRODUCTS

Manufacturers unveiled a host of new computers and related products at recent industry shows

By Joe Desposito

THERE'S a strange phenomenon that occurs at industry computer shows. As you walk up and down the aisles peering at a myriad of new products on display, some of them stop you in your tracks and compel you to investigate more closely. I call them the "eyepoppers"—a select group of products that generate real excitement at first glance.

Here are the ones I've seen at a host of recent shows that stretched from March to date. Most are just coming to market.

Computers

It's been said that Italians talk with their hands, so when I heard that you could "talk" to the Gavilan Computer in this manner, naturally I was interested. And sure enough, when Manny Fernandez, President of Gavilan Computer Corp., displayed his new machine, he held his hand in the air and said, "I am now going to choose an item from the menu." He placed his pointer finger on an area of the computer just above the keyboard, swirled it around, tapped the area, and a word processing program appeared on the screen. This "touchpad," controlled by Intel's 8051 computer on a chip, can be used to move a cursor around the screen and operate in a fashion similar to an electronic mouse.

But that's not all Manny did. He also took a 3" disk and, with a sleight of hand that rivaled a magician's, made the disk disappear into the side of the machine. Now this Gavilan computer is not very big. It's so small, in fact, that it easily fits inside a briefcase. So where did you put the disk, Manny? It seems that there's a 3" disk drive built into this computer.

The screen display is also very intriguing. It had first appeared when Manny pulled at the top of his rather small computer package. Resting on an angle, this small LCD screen displayed 8 lines and more characters per line than I could immediately count (66 it turns out). With a tap of his finger on the touchpad, superb graphics were displayed. The Gavilan computer is truly a breakthrough in computer design.

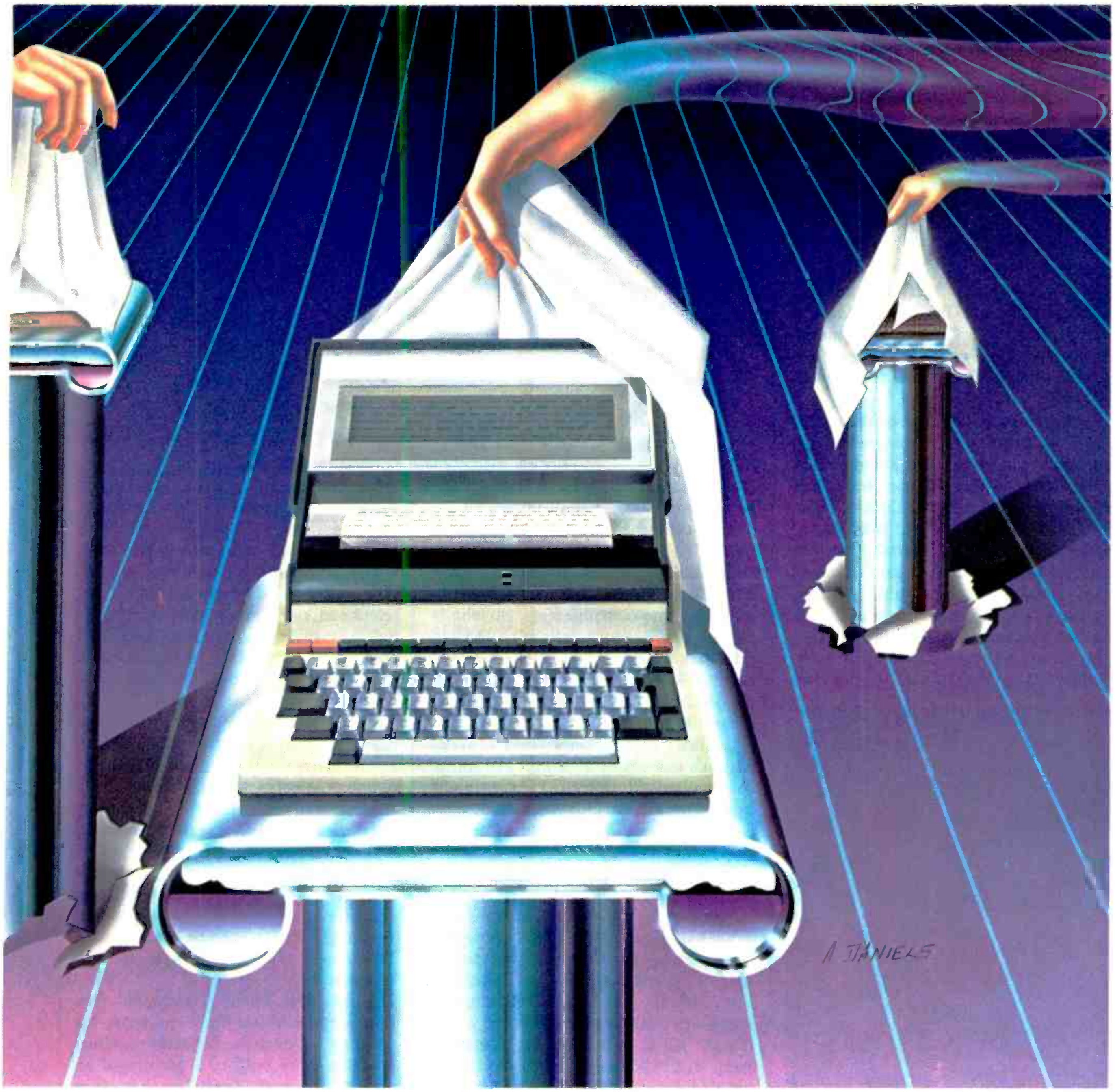
Besides the touchpad, built-in drive, and LCD display, there is a printer (optional) that plugs right into the back of the computer. It adds just 4.9" to the Gavilan's 11.4" length and only 5 lb to its 9 lb weight.

The Gavilan uses an 8088 microprocessor and supports MS/DOS as well as its own operating system. Included standard with the computer is proprietary, integrated, multifunctional software with windowing capabilities. Software is available on plug-in cartridges called CapsuleWare™. The packages include CapsuleWord, CapsuleCalc, CapsuleOffice, CapsuleComm (communications and mail system), and CapsuleForm.

Other features of the Gavilan are a full typewriter keyboard and ten-key pad, built-in 300-baud direct-connect modem, 48K ROM, 32K RAM (expandable to 336K), video interface, I/O bus, rechargeable batteries (that operate for up to eight hours), and an ac adapter and quick recharger. Suggested retail price of the Gavilan is $4000.

The Sharp PC-5000 is another briefcase-sized computer with outstanding features. In particular, the computer comes with 128K of bubble memory. That's right, bubble memory is alive and well. The volatile memory can be used for storage in the same way as a disk drive. Besides the standard bubble memory, Sharp is planning to develop applications software on small bubble cartridges that can fit into one's pocket.

But like Lawrence Welk on a Saturday night, the PC-5000's whole show doesn't depend on bubbles. Exciting features abound in this portable. First there is an eight-line by 80-character liquid crystal display panel that folds flat over a typewriter-style keyboard when the computer is not in use. In the



"A select group of 'eyepoppers' that generate excitement at first glance"

graphics mode, the display is 640 × 80 or 51,200 pixels.

Secondly, there is an optional printer available that plugs right into the back of the unit. The printer is a high-density dot-matrix thermal impact printer that uses thermal paper. However, a carbon ribbon can be inserted if you want to print on bond paper. Print speed is 37 characters per second.

Finally, an optional modem is available, which is both an attractive and functional addition to the computer. Besides using it as a modem, it can be an auto-dial phone and calculator keypad, too! It has a built-in speaker and microphone for two-way conference calling, and can store up to ten numbers. Of course, when used with communications software, it can store many more numbers. The calculator keypad doubles as a pushbutton dialer and a numeric keypad for data entry into the computer. The modem can be stored right in the case of the computer so that it adds nothing to overall size.

The PC-5000 uses an 8088 microprocessor and comes standard with 128K RAM (expandable to 256K). Also standard are word-processor and communications software. The computer weighs 11 lb and operates from a rechargeable battery that will run it for about 8 hr. (An ac adaptor is also supplied.) If needed, a 5¼″ dual-head disk drive is available as an option. Target price is $2500.

There's not a computer on the market that can be all things to all people, although the next machine goes as far to that end as anything I've ever seen. Aptly named the Chameleon, it supports the two most popular operating systems in the 8-bit and 16-bit markets, namely CP/M-80 and MS-DOS. More the size of a suitcase than a briefcase, this transportable comes standard with 128K of RAM, dual 5¼" drives, a 9" green-phosphor display, one serial (RS-232) and one parallel port, an IBM-PC-compatible keyboard, and 320 × 200 color graphics capability. Software included with the unit are Perfect Writer and Perfect Calc. The Chameleon is manufactured by the Seequa Computer Corporation and has a suggested retail price of $1995.

Lest you come to the conclusion that the only exciting new computers are portables, let me tell you about Adam. Adam is not just a computer, but a family computer *system* from ColecoVision. Standard features are an 80K RAM computer, a built-in digital data pak drive, whose plug-ins are said to have a data transfer rate comparable to a floppy disc's and can save up to 250 type-written text pages. A full-travel 72-key plus numeric keypad keyboard, a letter-quality 10-cps daisywheel printer, two game controllers, a built-in word processor called SmartWriter, SmartBASIC (which is Applesoft source-code compatible), and the Buck Rogers Planet of Zoom video game that plugs into Adam's game cartridge slot. "So what's the big deal?" you might ask. The big deal here is price. Only $599 suggested retail!!! Why, up until now, a low-cost daisywheel by itself cost that much.

Fig. 1. Caere type styles.

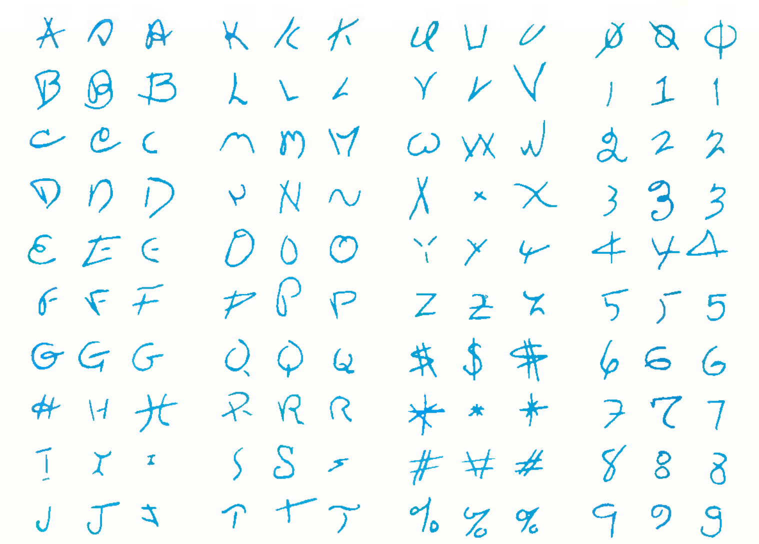


Fig. 2. Pencept recognizes a wide variety of characters.

And there's more! So that you can play those super games from ColecoVision's game player, Adam has something called the ColecoVision graphics operating system. This is not to be confused with the CP/M operating system that Adam is compatible with.

Furthermore, Adam comes up as a word processor. The display is 36 × 24, but an 80 × 24 "window" mode is also available. The SmartWriter program makes heavy use of graphics so that a user can easily learn how to operate it. For example, one of the screens shows a typewriter roller near the bottom and a margin guide at the top. As you type, your words scroll up from the roller, just as they would on a typewriter.

Software

Have you ever wished for a software package that you could use on your machine without having to read a lengthy manual first? Better yet, what if you couldn't speak or read English, but wanted to do word processing in your native tongue? Well someone out there is thinking about you. Commodore has introduced a software series called the Magic Desk. Magic Desk does not use words to convey ideas. Instead it uses graphic symbols (icons) exclusively. It's similar to using a cigarette with a line through it to convey a "no smoking" message.

When the software is run, a picture of a desk with various items on it fills the screen. There is a typewriter, index file, telephone, calculator and financial journal. Alongside the desk is a file cabinet with an artist's easel and digital clock on top of it. Under the desk is a trashbasket.

To operate the program, an external device such as a joystick, trackball, or mouse is used to move a pointing finger to one of the objects on the screen. That object is selected by pressing a button on the device. If you choose the typewriter, a picture of a typewriter roller appears on the screen, and you may begin typing. As you type, the paper scrolls up, just as in a typewriter. The control device (joystick, etc.) can be used to move the paper up and down in the typewriter.

If you want to file a document, you return to the Magic Desk and move the pointing finger to the file cabinet. When you press the button, a picture of an open file cabinet appears on the screen complete with file folders. There is even a sound produced as you riffle through the stack of folders. There are three file drawers, with 10 files in each drawer and 10 pages in each file.

Although used with a disk drive, the Magic Desk will be sold as a plug-in cartridge for the Commodore 64. The first cartridge in the series will be entitled Magic Desk—Type and File with a suggested retail price of $100. Other titles will also be available for Magic Desk at a similar price.

In a software breakthrough for small business and professional use, Quarterdeck announced the first multiwindow operating environment to integrate applications packages from different pub-

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lishers. Named DesQ™, the software package is designed for end-users, software developers, and systems integrators who want to upgrade personal computers into integrated, multi-windowing systems. DesQ, which is based on Quarterdeck's proprietary artificial intelligence-like development language, can be used with packages such as WordStar and dBase II. Several programs can be run at the same time, each in its own window on the video display.

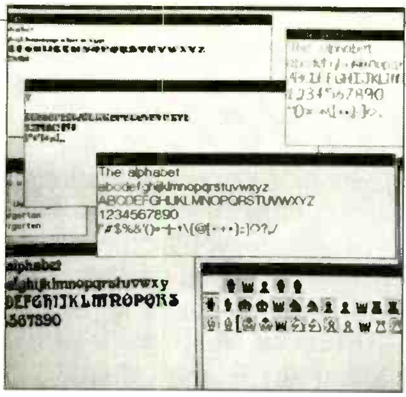
The windowing feature enables a user to mark information in one window and then transfer it to another. For example, a user might mark a column of numbers in a MultiPlan spreadsheet and then transfer it to a specific place in WordStar monthly status report. The software can operate effectively with either a keypad or a mouse. The package is available for the IBM-PC with 256K of RAM, one floppy disk drive, one five-megabyte Winchester, and either a color or monochrome display.

Peripherals

Besides new computers and software, a flock of new peripherals made their debuts at the recent industry shows. Most of those that attracted my attention could be classified as alternate input devices. Alternate input devices were shown that used light, touch, and voice to enter data into a computer.

The Caere (pronounced like "care") Corporation manufactures an optical character reader (OCR) that reads the typefaces found on many familiar items such as electric bills and automobile licenses. Examples of the typestyles are shown in Fig. 1. The Caere OCR system is made up of two parts: the base control unit and either a handheld wand or slot reader. Both the wand and slot reader use a light-sensing photo diode array to "read" information and convert it into electronic impulses that are sent to the control unit. The information is then digitized and "recognized." The OCR devices are available for the IBM PC and Apple III. The Series 500 model for the PC uses a handheld wand and has a suggested retail price of $1145.

If you're one who enjoys letting your fingers do the walking (or inputting in this case), you'll be interested in the Point-1 Monitor from MicroTouch. The Point-1 has an integrated touch-



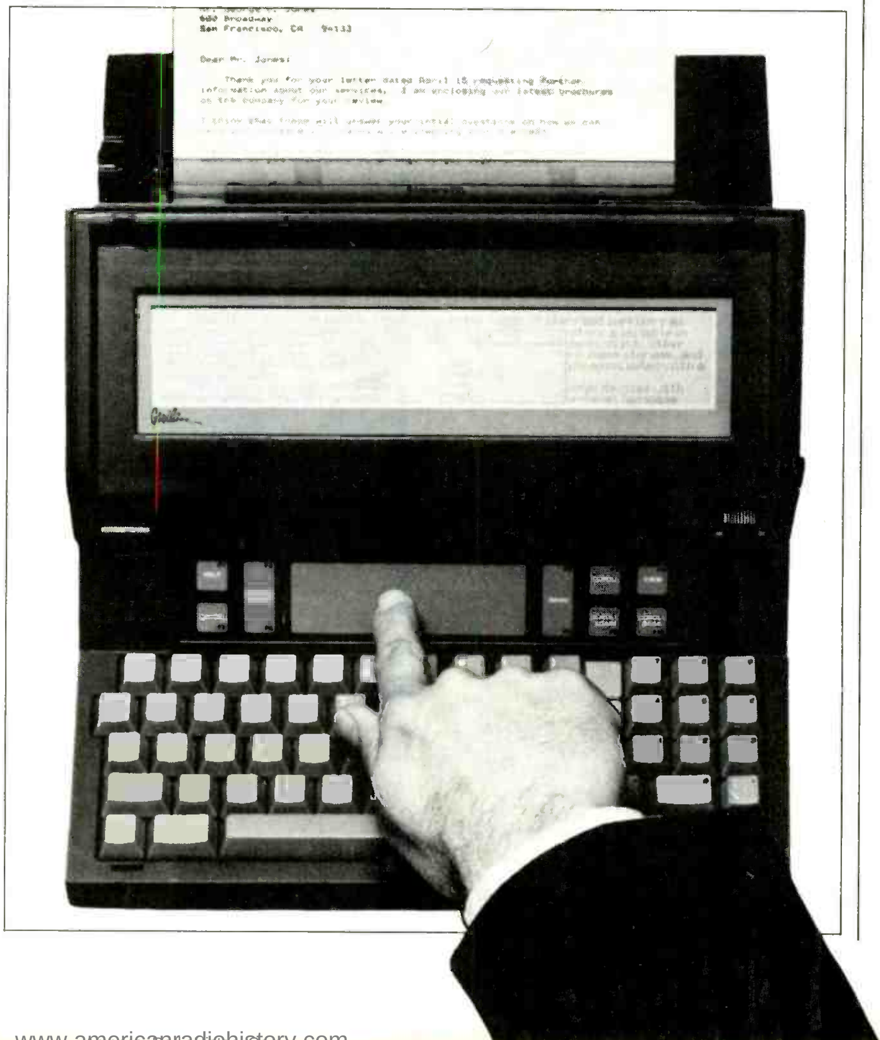
Multiple windows on Diser's Modula Computer.

sensitive screen that allows direct interaction with the computer by simply touching the display screen. For example, if you wish to make a menu selection, you just touch the number on the screen and the item is selected. The monochrome monitor comes in either amber or green and is priced at $1295.

A less expensive fingertip input device is the Koalapad Touch Tablet. Available for the Apple II line, IBM-PC, Commodore-64 and VIC-20, and the Atari line of computers, its suggested retail price is $125 including graphics software. The Koalapad has a 4" square drawing surface that's simple to use. You just rub your finger along the pad and the drawing is displayed on the video screen. If you think this product is similar to the little device that's used on the Gavilan computer discussed earlier, you're right. The inventor of the Koalapad, Dr. David Thornberg, told me that Koala Technologies licensed the touchpad technology to Gavilan.

Another input device that responds to pressure (but with a pen) is Pencept, a product that accepts hand-printed information, for input into a computer. Using dynamic character recognition (DCR) techniques, Pencept allows you to fill out a form by hand and automatically enters the data into the computer. For example, a person in telephone sales could take information over the phone by hand, and Pencept would decipher the handwriting and send the information to the computer. You don't have to print perfectly either, as the Pencept's DCR techniques, can recognize a wide variety of character shapes (Fig. 2).

If you're not into OCR or DCR and feel that you've lost the touch, you might be interested in talking your way into the computer. VoiceDrive by SuperSoft gives you the opportunity to



At right, Gavilan's integrated touch panel.

Shown above is Caere's new wand reader, which is compatible with the IBM PC.

The Sharp briefcase-sized PC-5000 (right) has 128K of bubble memory.

do this! VoiceDrive is a speech recognition software interface that's compatible with ScratchPad, a financial spreadsheet package from SuperSoft. To use VoiceDrive you need the Tecmar voice recognition card and an IBM PC. But you're not constrained to voice input since both keyboard and speech can be intermixed at the discretion of the user. SuperSoft plans to market more application packages in coming months, all utilizing the VoiceDrive software interface. Price of ScratchPad with VoiceDrive is $495. (Bundled with the Tecmar board, it's $995.)

Not all eyepopping peripherals were alternate input devices. Indeed, the following peripheral is an exciting output device. It's the CX4800 printer/plotter available from Leading Edge Products, Inc. What is so special about this printer/plotter? At first glance, the CX4800 might be mistaken for a dot-matrix printer. However, as the copy emerges from the machine, there's no question that it's a four-color plotter. The secret is in the printhead, which consists of four colored pens rather than the usual matrix of pins.

Color changes can be made automatically under software control. The four standard colors are black, red, blue, and green, although other colors are available upon request. Plotting can be done at speeds of 120 mm/s for 0.1 mm depth (60 mm/s for 0.5 mm depth).

The CX4800 can also be used as a printer. It can print a standard 80-character line of a size comparable to pica type at a speed of eight cps. Single or fan-fold paper sheets of standard 9½"-wide sprocket-feed paper can be used with the unit. Suggested retail price is $695.

For those who want colorful output, but need something more sophisticated than a printer/plotter, Sharp has introduced its IO-700 ink jet color image printer. It can reproduce, in seven colors, anything from graphs to detailed computer graphics. Roll paper that is 8-10 inches wide is needed to produce print areas up to 8½" wide. The unit will print a maximum of 120 dots per inch and, when printing characters,

SUPPLIERS

Caere Corporation
100 Cooper Court
Los Gatos, CA 95030

Coleco Industries, Inc.
945 Asylum Ave.
Hartford, CT 06105

Commodore
Computer Systems Div.
1200 Wilson Drive
West Chester, PA 19380

Diser Corporation
385 East 800 South
P.O. Box 70
Orem, UT 84057

Gavilan Computer Corp.
240 Hacienda Avenue
Campbell, CA 95008

Grid Systems Corp.
2535 Garcia Ave.
Mountain View, CA 94043

Koala Technologies Corp.
4962 El Camino Real
Los Altos, CA 94022

Leading Edge Products, Inc.
225 Turnpike St.
Canton, MA 02021

Microtouch Systems, Inc.
491 Massachusetts Ave.
Arlington, MA 02174

Pencept, Inc.
39 Green St.
Waltham, MA 02154

Quadram Corporation
4357 Park Drive
Norcross, GA 30093

Quarterdeck Software
1918 Main St., Suite 240
Santa Monica, CA 90405

Seequa Computer Corp.
209 West Street
Annapolis, MD 21401

Sharp Electronics Corp.
Systems Division
10 Sharp Plaza, P.O. Box 588
Paramus, NJ 07652

Supersoft
P.O. Box 1628
Champaign, IL 61820

Unitronics
2100 Livingston St.
Oakland, CA 94606

Vertimag Systems, Corp.
815 14th Ave.
Minneapolis, MN 55414

uses a 12 × 16 dot matrix. Price of the Sharp IO-700 has not been set but will fall into the $1000-1500 range.

One peripheral that handles both input and output is a low-cost mass storage device for one of the most popular low-cost computers. Available from Unitronics, the Expander and Waferdrive module is a high-speed wafertape drive plus 8K of RAM for the Commodore VIC-20 home computer. It plugs right into the expansion slot at the rear of the VIC-20 (and provides another slot at its rear). The module has a VIC floppy-disk look-alike operating system as well as a filing system. The unit, which uses 64K-byte data wafers, has a data transfer rate that is comparable to the speed of a floppy disk. Price is $99.

Can a computer also be a computer peripheral? If it's Quadram's Quadlink, it can. This peripheral board, which fits into a slot on the IBM PC, is functionally equivalent to an Apple II computer. To run Apple software, you just pop an Apple disk into your IBM drive and press one key. Although not fully compatible, Quadram expects Quadlink to run about 90% of Apple software. Switching back to IBM operation is just another keypress away. Suggested retail price for the board, which comes standard with 64K of usable RAM, is $680.

New Technologies

Computer shows are often a showcase for new technologies that may well drift into lower-cost products. Three companies—Diser, Grid Systems, and Vertimag—had some interesting examples of products based on new technologies.

Diser was showing the Modula Computer, which costs about $22,500. Although priced beyond the range of most people, the interesting aspect of the computer was the language that it used. The language, Modula-2, is the final synthesis of Dr. Niklaus Wirth's widely used language, Pascal, and his research language, Modula.

The Modula Computer was designed to take full advantage of the power of the Modula-2 language. The language makes it much easier to handle complex programming problems. For example, Dr. Richard Ohran, vice-president of research and development at Diser, showed me a PacMan program that was developed by one of his computer science students in 80 hours using Modula-2. I played the game and it ran very much like the original. That's enhanced programmer productivity!

Another computer, the GRiD Compass portable computer, although priced at about $9000 with software, is a showcase of state-of-the-art electronics technology. Most impressive is its amber-color, electroluminescent, flat-panel display. It has a 6" diagonal screen that can display 24 80-character lines. With a resolution of 320 × 240 pixels, the display also offers superb graphics.

The main processor is Intel's 16-bit 8080, which runs under MS/DOS 2.0 or CCOS (compass computer operating system). Another feature is Intel's 8087 80-bit arithmetic coprocessor. The computer has 256K of RAM Standard as well as 384K of bubble memory.

Packaged in a lightweight magnesium case weighing 10 pounds, the GRiD Compass measures just 15" × 11½" × 2". Some of the other features of this portable are a 1200-baud modem and integrated software for word processing, electronic spreadsheet, data base management, graphics, and communications.

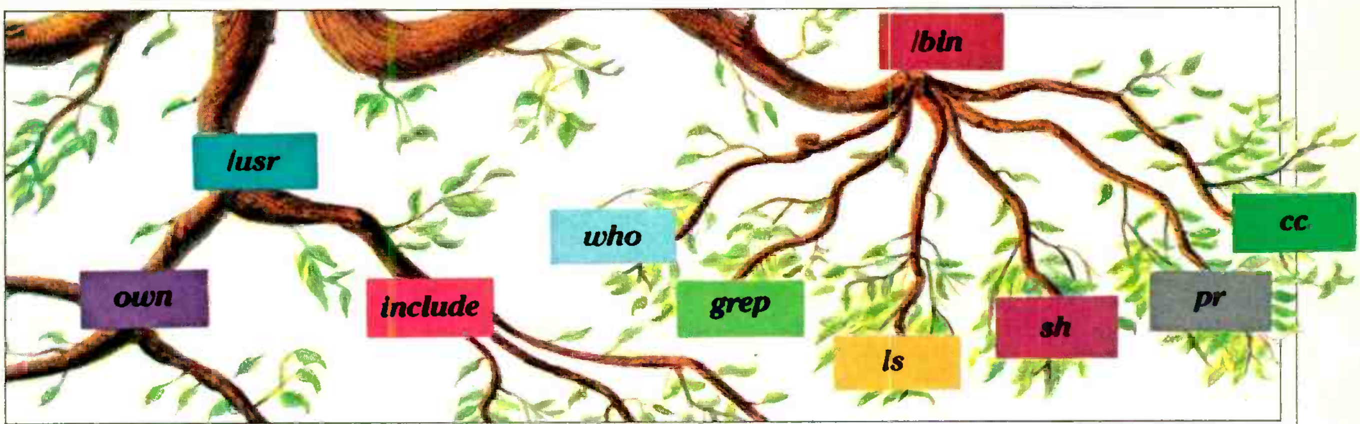
Vertimag is working on ways to increase the storage capacity of floppy disks. Using vertical rather than longitudinal recording techniques, and a disk that is an alloy of chromium and cobalt, Vertimag expects to achieve capacities of 2.5M bytes per side (and more) on a floppy disk. According to the people at Vertimag, the drive will cost about the same as a conventional floppy drive, while the disks will run about $20 each. Production begins in 1984.

Conclusion. As is evident, the recent industry computer shows have produced a plethora of exciting new products. Not all of them are on the market yet and some may never reach it but they should give you an idea of what the companies are trying to do and in which directions the computer industry is going.

Some products that could have been classified as "eyepoppers" may not have been highlighted here for a couple of reasons. A product may have been introduced at other than an industry show and already covered in this magazine; the excitement may have been generated not by an individual product but by a line of them. For example, Atari recently introduced four new computers (600XL, 800XL, 1400XL, and 1450XLD), plus a line of support peripherals and software.

All that's left now is to direct you to the list of addresses that I've included so that you'll know where to find out more information on any product that may have a peculiar attraction for you. ◇

UNIX



THE EASY WAY

This important and versatile operating system, programmed in C language, promises to become increasingly popular

By David Fiedler

THE Unix operating system originated at Bell Laboratories in 1969. Since its release to the general public in the early 1970s, it has gone through several major revisions, been transported to both microcomputers and large IBM mainframes, and has become an important force in the computer industry.

Unix was not developed as a general-purpose commercial operating system, nor even as a product. A Bell Laboratories scientist named Ken Thompson found a DEC PDP-7 (a small, but fairly powerful minicomputer) in a lab that was not being heavily used, and decided that it would be a good machine to implement an idea he had for a new type of file system. He used some innovations that were designed to provide what has been called by Dennis Ritchie "a pleasant environment in which to write and use programs." While any operating system is designed to allow people to use a computer more efficiently, Unix has proved especially "friendly."

Ritchie, one of Unix's earliest users at Bell Labs, found it so fascinating that he began spending a great deal of his time helping Thompson refine it. While the Unix was originally written in low-level assembly language, they became dissatisfied with this approach, especially since they were considering putting Unix on other computers with completely different instruction sets. As a result, the C language was created as an "intermediate-level" language—one that was both highly efficient (fast execution of programs as well as low memory usage) and easily portable to other computers. With Unix largely rewritten in C, the operating system itself became portable. Consequently, widely different computers could run the same programs without the extensive rewriting that was previously necessary.

What's So Good About It? While transportability is important in itself, there are other aspects of Unix that make it increasingly popular. Some of these are described below.

Tree-like file system. Operating systems usually impose a predefined structure of some type on the way files are viewed by their users. In most cases, this structure is a simple "disk directory" that lets one access certain files when the system is used. In Unix, the structure can be viewed as an upside-down "tree" with its single "root" at the top as shown in the diagram. The root is the main directory in Unix; it leads down to all other files and directories. You can add to your own directory, usually located in the /usr directory by creating new files or even new sub-directories. This allows you to create whatever structure you need to manage your data effectively, much like being able to add new filing cabinets with ever more drawers and more file folders.

This is called a "hierarchical" file system because it resembles an organization chart, where the "big boss" (in this case, the root) is at the top. Like some organizations where one individual may have two responsible positions, a Unix file can be accessed by several different names through different paths.

In Unix, every directory is actually just another file, which can be read by user programs. The only difference is that the information contained in a directory file consists of names of files and directions for where to find them on the file system.

I/O simplicity: The input and output devices attached to a computer are what allow humans to communicate with it. Unix permits any device—CRT terminal, printer, laser typesetter, or even main memory—to be accessed by simply reading, or writing a character at a time. This is aided by the Unix view that all files are just a sequence of bytes to be read or written. No external structure is expected by the operating system. Even when a device actually requires data in large blocks (such as a disk drive), Unix hides this dependency by taking care of these details internally.

In fact, all devices on a Unix system appear to the user to be ordinary files found as entries in the /dev directory). Therefore, a program intended for use with a disk file could easily be changed to work with a printer instead, but the process called "redirection" makes even this rewriting unnecessary.

Redirection and piping. Any program that normally "prints" to your terminal can have its output redirected to a disk file, printer, or another device. Similarly, a program's input can be easily directed to come from a file, modem, or any device that can read characters. This allows the same program to serve many purposes. A text-editing program can get its input from a predefined set of instructions, for instance, eliminating errors in repeated complex editing sessions.

The concept of a program that simply operates on its input and transforms it into some output is important. In Unix, these types of programs are termed filters. Many programs in Unix are filters and perform one function only. The output of one can be connected to the input of another in a kind of "pipe" arrangement. By piping them together, it's easy to use them as "building blocks" to perform much more complicated functions without having to write more programs.

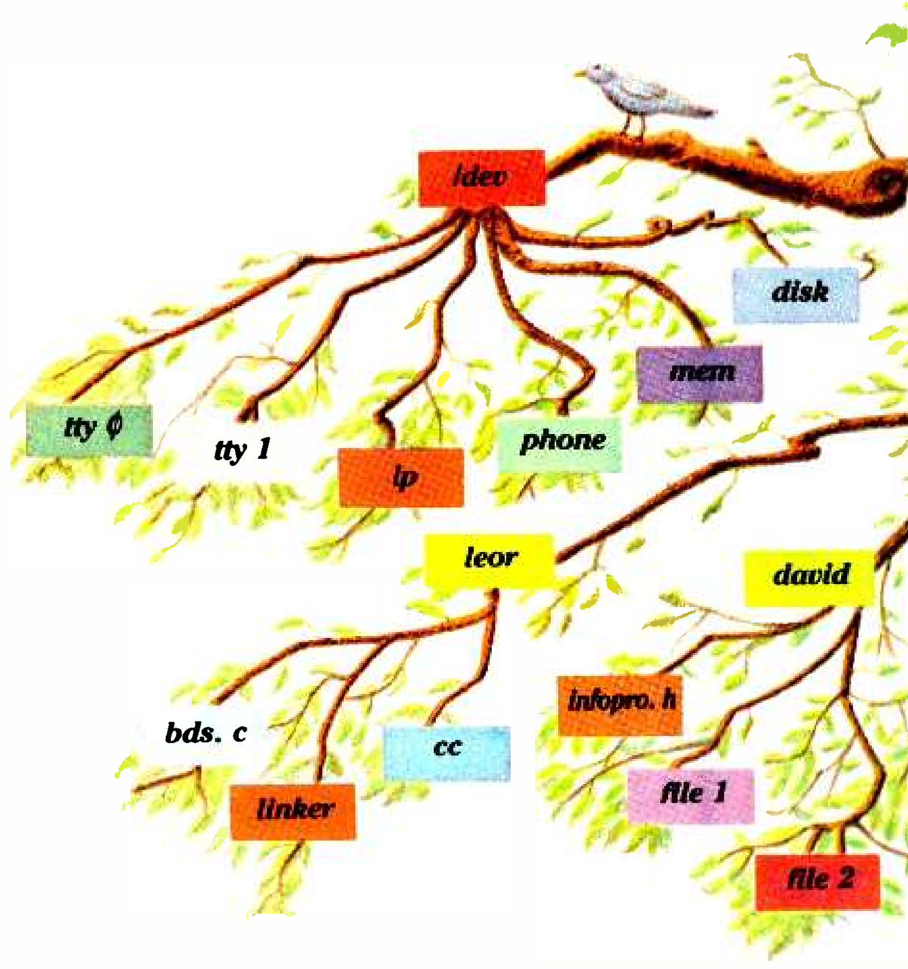
One example of piping that is often used when running Unix involves backups. The disks used to store files on most Unix systems are very large in capacity. Thus, it takes a long time to save all the files onto tapes or floppy disks. To save time, a Unix system administrator will save daily only those files that were actually changed on that particular day or certain files known to be important. The following command line will save to tape all C source files on an entire system:

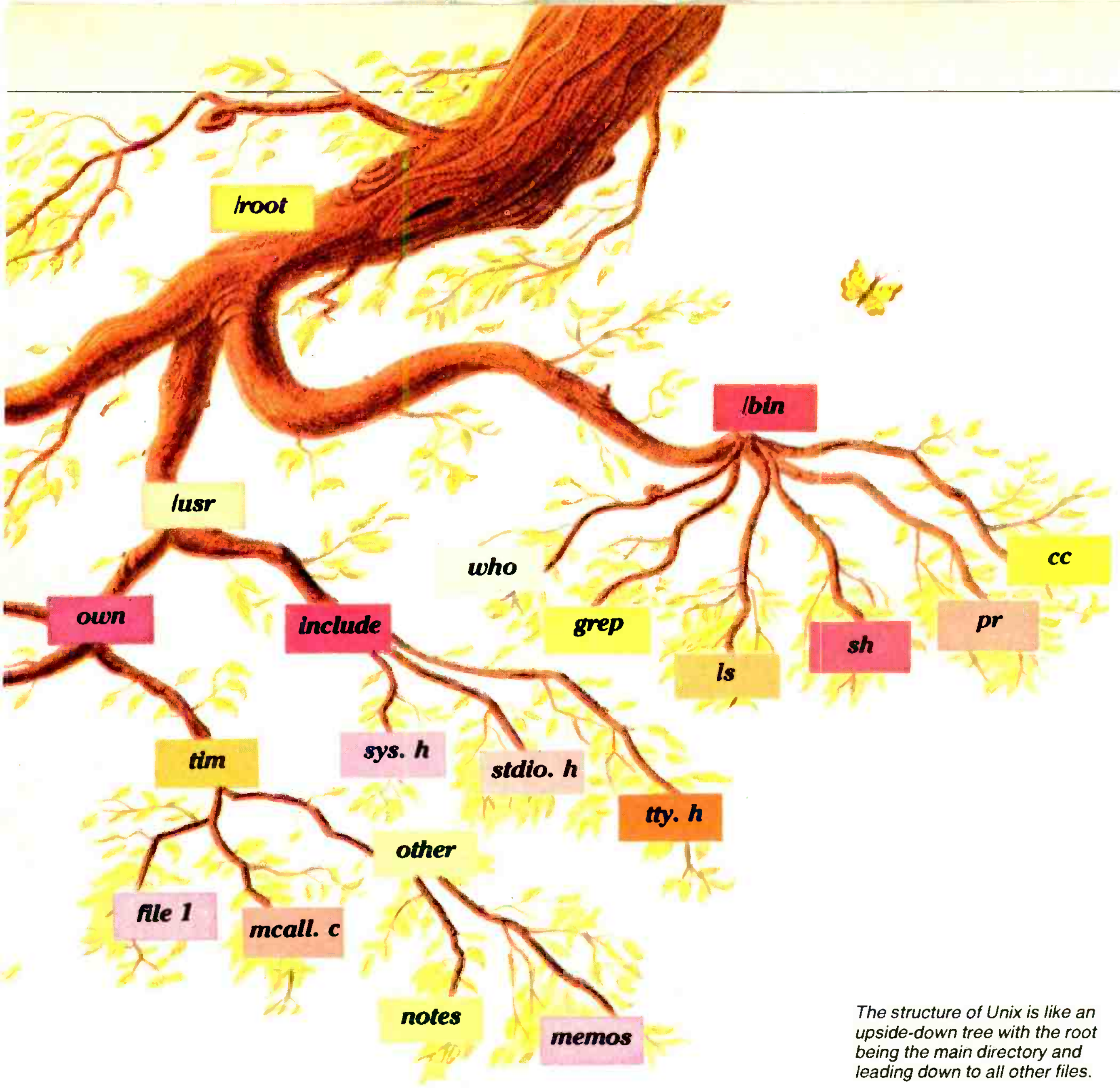
```
find -name "*.c" -print | tar c
```

The "find" command goes through the tree structure, looking for all files that fit the criteria. In this case, it finds all files ending in ".c", and emits a list of filenames. This list is then handed off to the "tar" (or tape archiver) program, which can then go ahead and write each file listed to a new backup tape. (The "c" after tar means to create a new tape.)

The best part of pipes is not just that they are a convenient way of sending information from one command to the next, but that the commands actually run simultaneously. The find takes a long time to go through the tree, and tar takes a while to write to tape. But as each filename is found, the pipe passes it along to be written out. Since both programs run at once, total run time is about halved. One wouldn't want to wait until these programs were finished before using the Unix system, so they run by themselves in what is called the multitasking mode.

Multitasking. Did you ever have to wait for a program to run on your computer before you could do something else? In Unix, you can decide to run a program anytime (or several at once!) in "background," while you continue using your terminal for another project. Just imagine writing a BASIC program, while at the same time a C program is compiling and its documentation printing out! You don't even have to worry about compiler error messages cluttering your CRT screen provided you remembered to redirect those to the print-





The structure of Unix is like an upside-down tree with the root being the main directory and leading down to all other files.

er as well. All you have to do is type a "&" at the end of any command line, and you immediately get the shell prompting you for your next command while your other project goes on its merry way.

• *Multiuser.* On all but the very smallest Unix systems, several people can use the computer at once. Unix will take care of the details. If everyone wants to print simultaneously, the system sets things up so that data doesn't get mixed up in the printouts. It does this by automatically "spooling" or writing to disk files all output that is destined for the printer. It then prints it all in sequence, in background of course. To the user, it appears as if he has a 1,000,000-char/sec printer.

Modems are supported, so people can call the system remotely. (Unix can change the baud rate to match the caller.) People can also send messages to each other, either while they are logged on the system or as electronic mail files to be read at any time. Using the "uucp" package you can even send mail to people at other Unix systems. If your program directs, your machine will dial their machine when the phone rates are lowest, and transfer the message unattended.

Naturally, with all these people on one system, havoc could result if a program (or unfriendly user!) ran wild. So Unix provides various levels of protection by different mechanisms. The first comes when you initially log in to the system. If you don't enter the right password, you can't get in at all! The next level is by protection bits. Any user can set the protection on his own files and directories, so that other users or programs can be prevented from reading, writing, or executing them. The highest level is by actual encryption of data, which is done easily on Unix by the inclusion of a special encoding program.

Development tools and languages. Unix boasts an impressive range of utilities, languages, and development tools that are either expensive add-ons or unavailable with other operating systems. Here are some examples.

• The "diff" program can show the exact differences between two text files, and can also help you change one file to match the other.

• A compiler for the C language and an assembler are included. There are also versions of FORTRAN, ratfor, Snobol, and a dialect of BASIC supplied as standard. Available for many systems are COBOL, Business BASIC, and Pascal. Cross-compilers and assemblers are common tools, allowing you to develop software for an entirely different machine.

• Powerful software tools such as

"yacc," "lex," and "M4" let you develop compilers for other languages or computers. You can develop your own language for a particular application. "Yacc" (Yet Another Compiler-Compiler) will generate a compiler for a new language once that language has been adequately described. "Lex," a lexical analyzer generator, can virtually write a program on its own for transforming data in prespecified ways. M4 is used to add macro facilities to an existing language.

• Word processing and typesetting can be done with "nroff" and "troff" programs and the appropriate peripherals. Such devices as the Diablo series of precision printers, Tektronix graphics terminals, and Versatec plotters are supported, and can be used as easily as their more ordinary counterparts such as "dumb" terminals and line printers.

• Utilities such as "make" and the Source Code Control System allow programmers to keep track of changes to their files. The latest versions of their programs, or a specified older version can be made to compile and run automatically, even if the source code is spread out over many files managed by different people.

The Shell. The "command interpreter" is the program that you spend most of your time interacting with when you use an operating system. Much of the power of the system comes from it. It not only handles the I/O redirection mentioned above, but is actually a programming language in itself. Complex data management functions, testing, and file manipulation can be done with shell commands alone, without having to "write programs" in a more traditional way.

Shell programming features include loops, if-then-else, "case" constructs, error handling, and process synchronization. Since the shell interprets commands as they are typed in, often such a "shell program" is composed right at the terminal, and it can be easily saved for future use. The shell also permits you to "customize" the way Unix responds to your commands. You can change the prompt character, have the system search in particular places for commands, use your own favorite names for Unix commands, and run a predefined series of commands each time you log on to the system.

Is Anything Perfect? With all these attributes going for it, Unix seems like an idea system. But there are a few disadvantages that while relatively unimportant to a home user, could hamper its acceptability as a general-purpose commercial operating system.

• *Security:* In theory at least, Unix prevents unauthorized users from accessing or destroying data that doesn't belong to them. In practice, a great deal of caution is necessary when running a Unix system to ensure file security. There are several fairly well-known ways of bypassing the usual Unix security checks. Also, the system does not adequately protect against runaway programs that can use up all available system resources and cause Unix to grind to a halt. An experienced Unix System Administrator is usually needed to watch over things.

• *Priority constraints:* It is presently impossible to ensure that an important program will have exclusive use of the machine if necessary for high-speed calculations. Further, system resources such as memory or special devices cannot be reserved in advance, meaning a program that needs these resources will simply "bomb" (instead of waiting for the resource) if they are not available. Real-time response, critical for certain kinds of projects, is simply not there in standard Unix. Segments of code needed for high-speed access could be "swapped out" to disk at any time, making them temporarily unavailable.

"Its full power is within reach of most small business."

• *Reliability:* Unix systems are generally thought of as "fragile," a holdover from earlier versions that needed an expert available on an almost constant basis due to the complexity of the file system. Current versions are more robust and include programs to fix the file system automatically in case of a crash, but an expert will still be needed on certain occasions. Also, while a system might not be destroyed after a power failure, current state-of-the-art for commercial systems requires that all programs running before the failure pick up where they left off. This will not happen with Unix! While Unix may not be perfect in this regard, it's also a good deal smaller than those commercial operating systems. They are far too big to fit on a microcomputer and need a full-time team of experts to keep them running at all.

Owing to the way Unix implements its terminal interface, the practical maximum number of terminals usable on a Unix system is less than might be otherwise. Unix (designed as a time-sharing system for the purpose of efficient program development) is not always the appropriate choice for a large-scale applications-based computer center. However, the sheer power of some of the newer Unix computers on the market, and their low cost, ensures that many installations will be running Unix anyway!

What Machines Run Unix? The first machines to run Unix were the DEC PDP-7, PDP-11/34, and PDP-11/70. For this reason (also because they tend to be powerful yet, moderately priced) the DEC PDP-11 line of minicomputers has been most often associated with Unix. Larger minis such as the VAX are also popular, and Unix has even been "ported" or moved onto the IBM 370 series of mainframe computers.

By far the most exciting news for the greatest number of people is that Unix has now been ported to almost every 16-bit microprocessor on the market, thus bringing its full power within the reach of most small businesses and even some personal computer enthusiasts. Also, new operating systems (known as Unix "look-alikes") developed by companies other than Bell Labs have come on the market, offering capabilities similar to Unix without the licensing headaches sometimes associated with the "real" Unix system. Yet since AT&T announced the new System III version of Unix, "binary" licenses (no source code included) to "real" Unix are available from systems houses for as little as a few hundred dollars.

The most popular microprocessor to use Unix at present is the Motorola 68000 due to its powerful instruction set, 32-bit internal data paths, and large addressable memory space. Typical of the many 68000-based computers that are now using Unix are:

• The Dual System 83: an S-100 machine which was one of the first micro-based Unix machines to be compatible with an industry standard bus.

• The Altos ACS68000, one of the most powerful machines on the market, dollar for dollar. It has a 40-megabyte hard disk and 512K of dynamic RAM, and supports 8 serial RS232 ports with an intelligent I/O controller.

• The Pixel AP/100, one of the fastest small machines around, with high-level

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Microsoft BASIC
Multiplan
SuperCalc
WordStar
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Accounts Payable
Inventory Control
Sales Invoicing
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PeachText 5000
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Cobol-86
Pascal
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- The Fortune 32:16 has the distinction of being one of the smallest and least expensive ($4995 with 1 limited floppy disk) Unix machines. It has a "user-friendly" menu system that makes operation easy, but hides most of the power of Unix.
- Radio Shack Model 16 with dual processors now runs Microsoft Xenix, which is a licensed Version of Unix.

Then there are Z8000 and 8086/88 computers. Zilog and Intel both sell their own Unix-based machines. Zilog, the first microcomputer maker to support Unix, has several high-performance Z8000-based computers available starting from around $14,000. Intel's latest 86/300 series uses its standard Multibus, and is slightly more expensive. There are several other companies using these CPUs as well, including InterSystems' Z8000-based DPS-8000, which runs Coherent (a Unix look-alike from Mark Williams Co.).

Even the IBM Personal Computer can run Coherent for about $500, or you can get a real Unix derivative, Venix, for $900 from VenturCom, Inc., including several useful applications packages. The fastest-growing section of the market (after the 68000 onslaught) is expected to be in the 8086/8088-based desktop computers that can run MS-DOS, since Microsoft is attempting to make future versions of MSDOS compatible with its Xenix version of Unix.

What about 8-bit machines? A few enterprising Companies such as Morrow Designs and Microware actually have Unix-like, multiuser, multitasking systems that run on Z80 and 6809 computers. Morrow's Decision I S100-based system features a Z80 CPU, 256K of RAM, a 10M-byte disk drive, and floppy backup. It can support several simultaneous users, and emulate CP/M at the same time. The Decision I runs the Micronix operating system (written at Morrow's company), which is compatible with Unix Version 6.

Several companies sell software that can simulate the Unix commands and shell on current 8-bit computers running CP/M. These are not really operating systems, but rather utility packages, although they can be quite useful. The most useful of these is possibly Microshell from New Generation Systems ($150). Microshell can be called up at any time to actually replace the user interface of CP/M. This allows you to perform redirection, piping, automatic command search, and even shell programming, just like on Unix. The best

BUYERS GUIDE TO UNIX SYSTEMS

Vendor	Operating System	Real Unix?	CPU	Price	Comments
Advanced Digital Products Suite 205 1701 21 Ave., S. Nashville, TN 37212 615-383-7520	uNETix	No	8086/8088	$350	IBM PC
AT&T Technology License Guilford Center PO Box 25000 Greensboro, NC 27420 919-697-2000	Unix System III	Yes	PDP-11, VAX	43,000	Source license only
Charles River Data Systems 4 Tech Circle Natick, MA 01760 617-655-1800	Unos	No	68000	3,000	Version 7 compatible, Real time extensions
Cromemco 280 Bernardo Ave. Mountain View, CA 94043 415-964-7400	Cromix	No	Z80, 68000	600	Not call compatible, CDOS emulation
Mark Williams Co. 1430 W. Wrightwood Chicago, IL 60614 312-472-6659	Coherent	No	Z8000, 8086	OEM only	Version 7 compatible, IBM PC
Microsoft Suite 819 10800 NE Eighth St. Bellevue, WA 98004 206-455-8080	Xenix	Yes	PDP-11, VAX, 8086, Z8000	1,000 and up	Version 7, System III
Microware Systems Corp. 5835 Grand Ave. Des Moines, IA 50312 515-279-8844	OS-9	No	6809	200	No bank switching needed
Morrow Designs 5221 Central Ave. Richmond, CA 94804 415-524-2101	Micronix	No	Z80	500	Version 6 compatible, CP/M emulation
Technical Systems Consultants, Inc. PO Box 2570 1208 Kent Ave. W. Lafayette, IN 47906 317-463-2502	Uniflex	No	6809	550	Needs only 96K RAM
VenturCom, Inc. 139 Main Street Cambridge, MA 02142 617-661-1230	Venix	Yes	PDP-11, LSI-11/2 8066	900	IBM PC; includes DBMS, word processor, graphics package
Vortex Technology PO Box 2284 Culver City, CA 90230 213-645-7200	Marc	No	8080	175	Single tasking, CP/M emulation, not call compatible, runs on current BIOS
Whitesmiths, Ltd. 30 Lowell Rd. Concord, MA 617-369-8499	Idris	No	8080, 68000 PDP-11, VAX	2,200	Version 6 compatible

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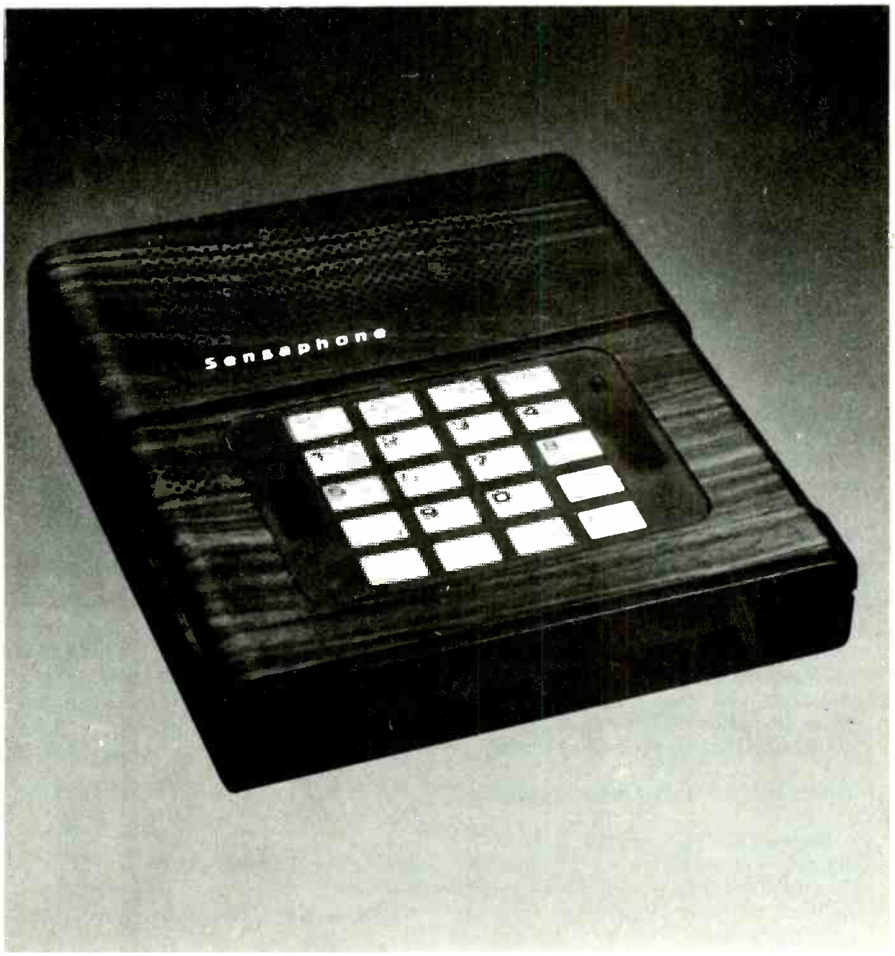

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part is that all this takes place with your current software. Your programs don't have to be rewritten to use these features. Output intended for the printer can be diverted to a disk file for spooling off later. The power of this package is such that an entire user-friendly menu (written in shell commands, of course) is included just as a programming example. Such programs usually are sold as products on their own.

The Unica from Knowlogy ($95) is a group of Z80 utility programs that emulate, as far as possible, some of the most often-used Unix commands. While in some cases they duplicate the functions of programs you probably already have (file copiers and the like), they tend to work in more logical ways. The Unica programs support full "wildcards" in most commands, and redirection and piping among themselves. They allow full use of the usually neglected "user area" feature in CP/M 2.2, permitting easy use of large-capacity hard disks.

It's not really necessary to have a CP/M machine, though, to get a flavor of these systems. If you have a terminal and a modem, you can access several computers for just the price of a phone call, that can give you experience with some of the Unix features. Among these are the following:

CNODES: These systems use Unix-style commands, and provide online libraries of software that can be downloaded into your system. The eventual goal of these systems is to provide inexpensive electronic mail transfer facilities between computer hobbyists. Most software on these is written in BDS C. The systems and phone numbers are: Denver CNODE (the original): 303-781-4937; 24 hr; Norman, OK: 405-364-1373; 8 a.m.-5 p.m. weekdays; State College, PA 814-238-4857; 24 hr, hard-disk storage.

The C Line: this system runs Microshell and some of the Unica programs, and has a bulletin board system and rumor "hot line" especially for Unix and C users, as well as providing some downloadable free software. Call 201-625-1797, 6 p.m.-9 a.m. weekdays, 24 hr on weekends.

Digital Research already feels the competitive pressure, and has put some Unix-style features in its new operating system CP/M-Plus. Quite a bit of competition will be seen as Unix migrates to smaller computers and CP/M moves up to larger computers. The eventual benefactors of this competition? You, as a computer buyer and user, will find better software and hardware for less money. ◇

REDIRECTION MADE SIMPLE

Let's say you have a simple program called "add" that reads two lines of text from your terminal, puts those lines together, and writes them back out. Here is how that might look on Unix. What you type is in *italics*, and Unix responds in **bold face.**

$*add*
This is a
short test of add.
This is a short test of add.
$

When Unix prompts with its "$", you simply type the name of the program to be executed. Then Unix finds this program and begins to run it, with the results as shown. Now suppose you want to save the results of the program in a file instead of printing them out. Instead of rewriting the program to create the file, open it, then write to the file and finally close it (as would be necessary on almost any other operating system). Just let Unix do the work. Simply type:

$ *add > resultfile*
This is another
test of the add program.
$

Notice that this time, Unix returned immediately with its prompt. A file called "resultfile" has been automatically created by the system. If we were to look at it, we would see its contents were simply

This is another test of the add program.

The notation " > ", is clear in its meaning: send the results the way it points. The command line would usually be read aloud as "add, redirected to resultfile." This redirection of output can, as mentioned, be done to almost any device. The actual devices are accessed through their entries in the device directory, as if they were files. To send the output of the add program to the printer, for example, you could type

$ *add > /dev/lp*
This is yet another
test of the add program.
$

If you went over to your printer ("lp" is the general term for the system printer, actually short for "line printer") at this point, you would see that

This is yet another test of the add program.

had been printed on the last line of the paper (though we have to print it as 2 lines here). Input can also be redirected. Suppose a file called "twolines" contained the two lines
Well, I'll be a
hog-tied varmint.

Then "add" could be used to show them at your terminal by typing
$ *add < twolines*
Well, I'll be a hog-tied varmint.
$

Of course, both input and output can be redirected at the same time by a line somewhat like this:
$ add < twolines > resultfile
$

Notice that the prompt is again immediately returned, since we have taken the input from the file "twolines" and sent it to the file "resultfile." Suppose we had another filter-type program called "reverse," which reversed the order of space-separated words fed into it. If we gave it

useful amazingly be can towel a

we would get:

a towel can be amazingly useful

Now suppose a file named "towel" had the lines separate and backwards:

useful amazingly be
can towel a

By redirecting several times, we can get the final result:

$*add < towel > temp*
$*reverse < temp*
a towel can be amazingly useful
$

But on Unix, we don't need the temporary file "temp." By piping the output of add directly into the input of reverse, we can get the same result in a much cleaner fashion:

$ add < towel reverse
a towel can be amazingly useful
$

Not only is this easier to understand, it is more efficient. A temporary file is not created by Unix as you might expect; rather, the programs are actually run *simultaneously*, with the second program getting its input only when the first program has generated its ouput. ◇

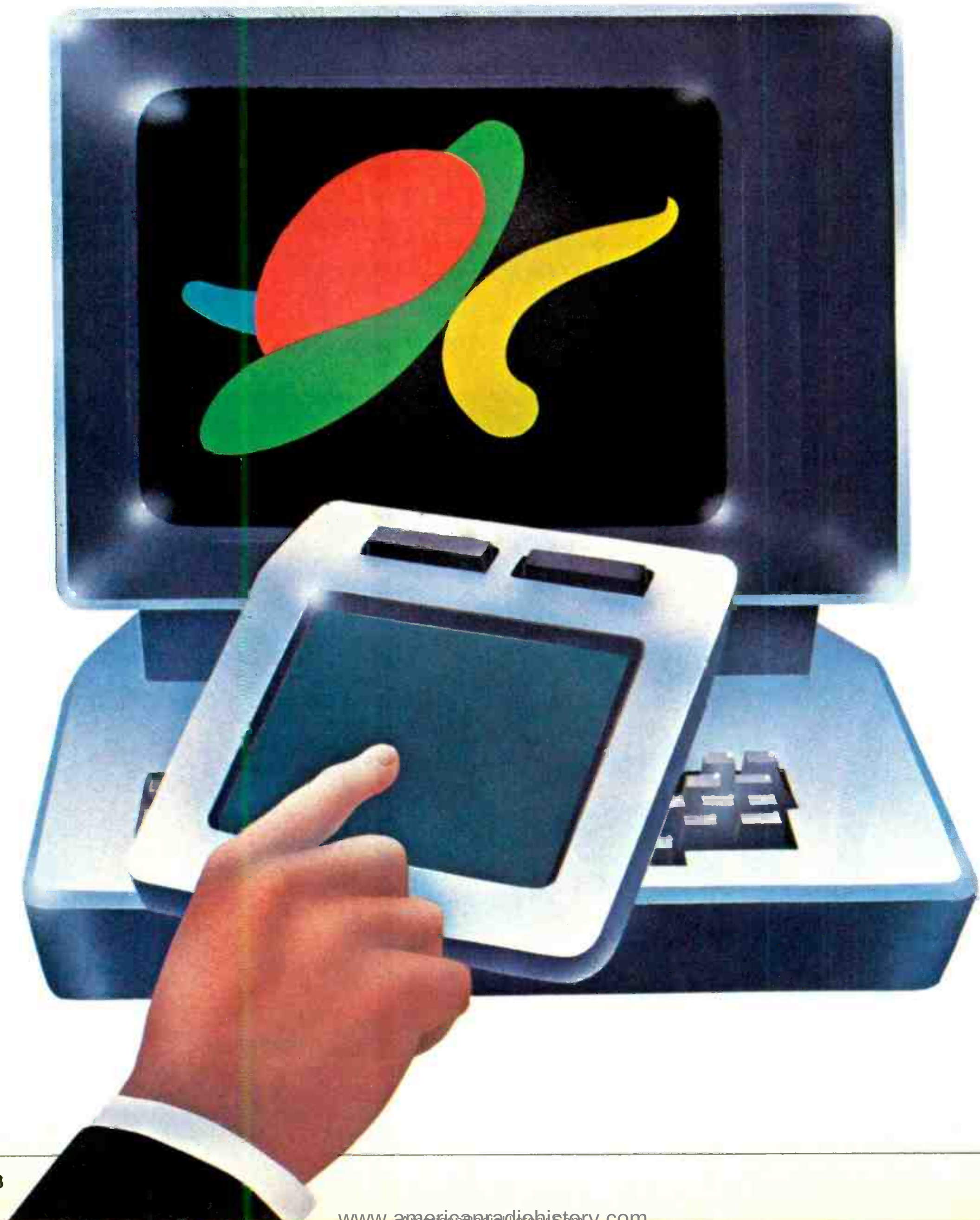
Fast and Easy Graphics with a low-cost Touch Tablet

The Koalapad and Micro Illustrator team up to make sophisticated graphics a snap

By Joe Desposito

ANYONE who uses a computer to create screen graphics probably has a keyboard bypass device on his most-wanted list. The new Koalapad Touch Tablet from Koala Technologies Corp., Los Altos, CA, makes it easy for this to come true. At $125, it adds a new dimension to computing for Apple, Atari, Commodore, and IBM personal computer owners.

The Tablet comes with disk software called the KoalaWare Micro Illustrator



to get one started, with other software packages priced at less than $50 each. This ability to permit the user to draw and point to images on the video display while ignoring the keyboard is the Koalapad's forte.

The Tablet. The Koalapad is relatively small (8" × 6" × 1") and lightweight (1 lb) so a person using it naturally holds it in his hands. The active pad surface is a 4" square that's slightly recessed with two pushbuttons located above it. The unit is contoured in such a way that it can be grasped easily in the left hand with the left thumb pushing one of the buttons and the right forefinger or a stylus doing the drawing (or vice versa if the person is left-handed). The Koalapad is easy to interface with the Apple II+ (which is what I used it on). It plugs right into the game port.

Software. The software package reviewed here, the Micro Illustrator, is menu driven, though the menu is not the usual kind. Menu choices are acccompanied by visual images and each command occupies a rectangular area of the screen. Selecting an item from the menu is as easy as moving one's finger.

One rectangular box on the middle-left portion of the menu is labelled "Cursor." This is an automatic function. When the Koalapad is used and a finger is moved around the pad, the cursor follows it on the screen.

As an example of how other portions of the menu are used, consider the box labelled "Draw." To use it, the cursor is placed somewhere in the box, and a button on the tablet is pushed.The Draw mode is then in effect. With another push of the button, the screen goes blank and anything can be drawn just moving a finger around the pad surface.

Other commands can be selected in the same way. Two areas of the menu are not commands. One is for a "brush" set and the other for a "color" set. The brush set varies the width and shape of the lines drawn on the screen, while the color set permits varying the colors. There are two color sets. Each works well with colors from its own set; but if colors from different sets are mixed, peculiar color reactions may occur.

Let's review in more detail the commands on the menu. "Draw" permits drawing straight lines and curves in any direction all over the screen. "Point" leaves a single dot on the screen each time the button on the pad is pressed. With "Line," a single straight line is drawn in any direction. "Lines" is for making continuous lines. In other words, after a line is drawn, the button on the tablet is pressed to indicate the endpoint of the line. When the cursor is moved to another spot, another line is drawn from the end of the first line. "Ray" gives a fan effect. If a line is drawn, the button is pressed, and the finger is moved again, a whole set of lines fans out from the original line.

The "Frame," "Box," "Circle," and "Disc" commands are for drawing squares, rectangles, and circles. For a rectangle or square, a button on the tablet is pressed to establish a corner point. Then the finger is moved away from the point. A rectangle begins to form and grows larger as the finger is moved farther away from the corner point. When the proper size is reached, the button is pressed again and there is a rectangle (or square).

A circle is created the same way except that the starting point is the center

A typical business application of the Koalapad.

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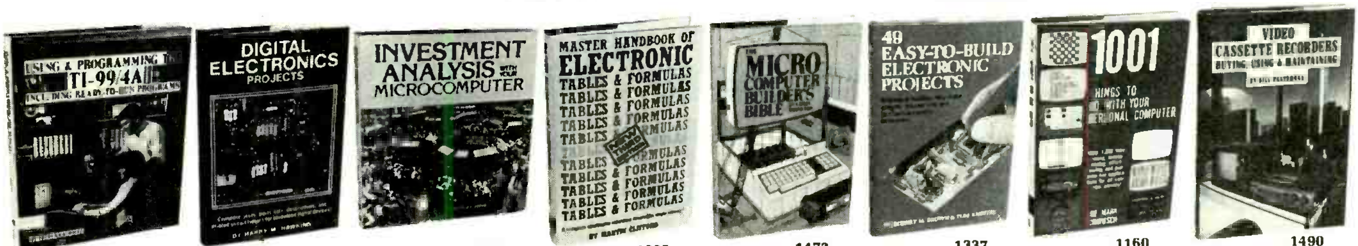

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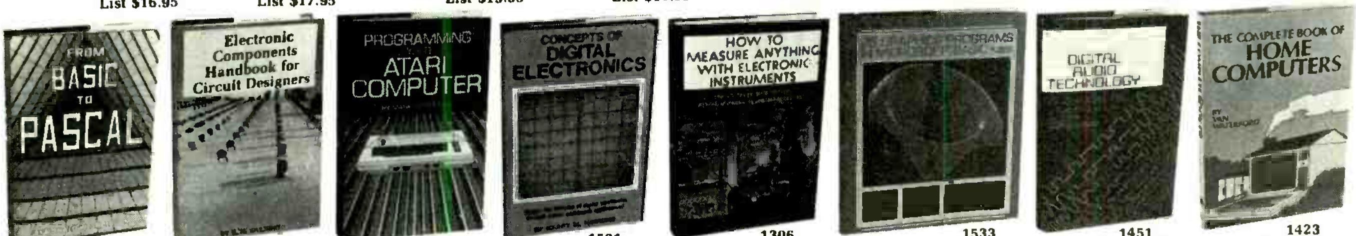

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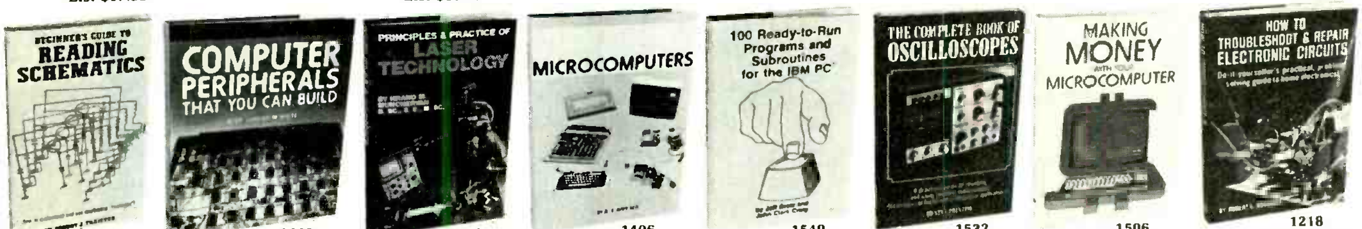

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of the circle. For a shaded rectangle or circle, the "Box" or "Disc" mode is used.

The "Fill" command will color any enclosed area. However, one must be careful and not leave an opening in the area or the color will "leak" out of the area and eventually fill the whole screen.

An "Erase" command permits erasing the whole picture on the screen, but not part of it. If a mistake is made and it is desired to erase just a small part, the color of the brush must be changed to the background color and the part to be erased must then be wiped out. It's like a typist using "White-Out" to correct a mistake on a letter. However, the procedure is not that simple since the finger is on the pad and the drawing is on the screen. There are no markings on the pad that will indicate a corresponding location on the screen.

What I found to be the easiest way to eliminate mistakes was to use the "Magnify" command. This enlarges the screen seven times. Thus, it's like looking at the drawing under a magnifying glass. There is also a large cursor that guides one to selected points.

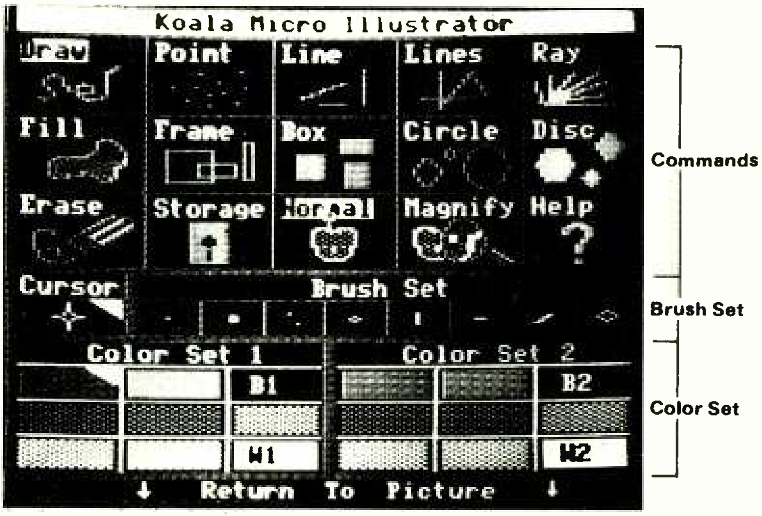
The "Magnify" command is also useful when doing detailed work. For example, I drew a small box on the screen and wanted to put a letter in it. Using the magnified screen, I was able to create the letter dot by dot. When I entered "Normal" mode again, the letter looked perfect.

The "Storage" command permits saving artwork to disk. One of the problems I found with the Micro Illustrator is that it had no provision for a screen dump. Thus, if a file is saved, it can only be loaded back onto the screen again. (Screen dump software and hardware is available through other sources, however.)

Finally, the "Help" command gives assistance on screen so it is not necessary to refer to the manual. I thought this feature was rather poor, however, because it only referred to a few commands. So I used the manual to clarify any points about the program.

A short manual is included with both the Koalapad and the Micro Illustrator. The manuals are easy to read, direct and to the point. I still found it a little difficult getting used to working with the pad and the program (although my nine-year old son took to it more readily). However, after playing with it for a while, I became accustomed to it.

User Comments. My reaction to the Koalapad and Micro Illustrator was very favorable. It gave me the opportunity to create graphics with the Apple II that I could do before only on a much more expensive graphics tablet. There were some problems, however. Every so often, while in the "Draw" mode, a line would jut out seemingly at random. I tried to discover if there was a flaw in the pad, but I couldn't duplicate the glitch at any specific point on the pad. This is annoying because, as I mentioned, it's not that easy to erase a part of a drawing. (I spoke to Dr. David Thornberg of Koala about this and found that the problem was in the software, which has been corrected.)



The menu for the Micro Illustrated is shown above just as it appears on the screen. Choices are accompanied by visual images, each command occupying a rectangular area of the screen. The cursor function is automatic and it moves around the screen in response to the movement of the finger on the Koalapad.

Also, I tried to determine the optimum speed for drawing on the pad. I discovered first that it is not necessary to keep a finger on the pad while drawing. If I lifted my finger off and moved it to another point, the line was drawn between the points.

What this means is that a straight line can be drawn as fast as desired (although there is some delay until the line catches up). However, I also tried drawing a Z for Zorro. Since a Z is made up of four points, it can't be drawn too fast or the lines will be in the wrong places.

The Koalapad Touch Tablet is available for the Apple II, II+, and IIe computers as well as the Commodore VIC-20, IBM PC and Atari 400 and 800 models. Besides its use with the Micro Illustrator and other packaged software, the Koalapad tablet data can be incorporated into your own programs using subroutines in the manual.

Koala expects to market a variety of software packages aimed at education and entertainment for the home market, as well as productivity enhancements for business and financial applications. In fact, the Koalapad has overlay locations that can turn the pad into a custom keyboard for certain applications.

The Koalapad and Micro Illustrator are a synergistic combination that produces a remarkable end result. I saw it first at an industry show in April and was impressed with it then. When I got a review sample and worked with it a while, my initial impression was reinforced.

The combined package enables one to create sophisticated graphics in a matter of minutes. And for those who want to spend time creating detailed computer art without spending too much money, this package is the perfect tool. I recommend it highly. Others must share this view since the company, founded in 1981, is reported to have recently raised almost $5 million in venture capital from a six-member group that includes Hewlett-Packard, Allstate Insurance, and Boston University. ◇

The Modularized Computer

SONY'S NEW SMC-70

By Stan Veit

SONY is certainly living up to a reputation as an innovative manufacturer with its new SMC-70 Z80A-based microcomputer (a 16-bit 8086-CPU adapter will reportedly be available soon). It's the most modularized system we've seen in a long time, in contrast to a trend toward all-in-one packages. Moreover, it uses 3½" disk systems, as well as having provisions for Winchester-type hard disks.

The SMC-70 system examined consists of a main computer unit that includes a keyboard ($1475), a 3½" microdisk system ($650 for one drive/controller and $1100 for two), a 12" composite/RGB color video monitor ($875), and a 136-character-line dot-matrix printer ($725). Software packages were CP/M extended for color and graphics ($150), BASIC ($150), Word Processor ($495), and SuperCalc ($295). Additionally, we had a 256K solid-state disk memory peripheral ($875) and a battery backup unit ($350).

General Description. The main computer unit consists of a rectangular housing containing 64K RAM of main memory, 32K system ROM, and 32K video RAM. The keyboard juts out the front as an appendage that fits into a slot, while the power supply mounts on the back of the main unit. Between the power supply and the main block is a telescoping slide with a ribbon cable and edge connectors mounted on it. Here is where the system expansion modules are plugged in. The Sony's keyboard is a standard 72-key QWERTY type with five function keys mounted on the top of the keyboard. There are also cursor control keys and INS (insert), DEL (delete), CLR (clear), and HOME keys on the top row of the keyboard.

There is also a hole in the keyboard with a red button beneath it for system RESET. To use it you must insert a pencil or stylus into the hole (your finger will not fit). This is to protect the system against accidental reset, though it's rather a stern measure.

There are two ways that an SMC-70 can be expanded. One or two boards may be mounted inside the main computer section by a dealer. In another method, expansion modules are installed between the main unit and the power supply on the plug-in bus. This type of installation can be done either by the user or dealer. However, it is somewhat more complicated than merely opening a cabinet and plugging in modules.

The color video display on the SMC-70 is what you would expect from Sony. I found it to be impressively good. To start, the characters are actually displayed in an 8 × 8 dot matrix, a somewhat unusual arrangement, but one that produces characters that are sharp and good looking. You have a choice of a screen display that is 40 characters by 25 lines or 80 characters by 25 lines, as well as eight colors that can be used for characters alone.

The graphic color display has four resolution modes of operation:

Mode 1: 160 by 100 dots, 16 colors, 4 pages.
Mode 2: 320 by 200 dots, 16 colors.
Mode 3: 640 by 200 dots, 4 colors.
Mode 4: 640 by 400 dots, B & W.

The border area has 16 colors.

Graphics and text have separate display planes, so you can superimpose characters, graphics, and the border areas! The display capabilities are therefore particularly impressive.

Sony has incorporated its 3½" disk system into the SMC-70. Like everything else in this building-block system, the disk system is an add-on. It can be added by the user, but it is strongly recommended that it be done by Sony or a dealer. The disk controller is sandwiched between the power supply and the main unit, while the disk unit mounts on the top of the main unit. There is also provision for mounting external drives.

The Sony 3½" drives use rigid diskettes that can store 280K bytes of data. The floppy disk inside the package is protected by a sliding metal cover. All you have to do to carry them around safely (say, in your pocket, where they fit) is to close the cover slide. They cost $5 each in a "hard pack" box of ten. Double-sided 5¼" diskettes, which hold about the same amount of data, cost the same price.

You can't help being impressed by the KX-121HG Trinitron 12"-diameter component color TV Monitor. It can display either a VCR/TV video signal or a video signal from the computer. This is done by switching signals from the computer if desired. Loudspeakers (8 to 16 ohms) have to be added to the 28.8 lb monitor if one wants sound. The company also makes available the CDP-120 12" green-phosphor tube Monitor that's as good in its own way as the color monitor.

Sony's SMI-7020 dot-matrix printer is a Centronics type parallel printer that is an 80-column machine with selection of type styles and modes from software. It's similar to imported printers sold under various brand names. Other options include a numeric key pad ($90) and a light pen ($175), both of which plug into inputs provided on the computer.

The SMI-7050 Cache disk unit is an interesting module that adds 256K of memory, which is equivalent to adding a super fast disk drive to the system. CP/M recognizes it as a disk drive.

The SMI 7080 Battery Backup Module option will switch to the battery supply to keep the memory alive if power fails. If the power loss is less than 0.5 seconds, the IN USE light comes on and the power is drawn from the battery. If the loss is longer than 0.5 seconds, the beep tone sounds until the ac power is restored. The battery backup will keep the unit alive. However, if the loss exceeds 7 seconds, the backup dc supply will be cut-off. Then the beep will stop and all memory will be lost. This system is not, therefore, an uninterruptable power supply, but it does prevent loss of data when the electric company "blinks" as it often does.

User Comments. This highly flexible general-purpose microcomputer system worked beautifully (color and graphics were superb) once it was connected. Putting it all together, though, can be challenging. Using the computer revealed that the keys are too small and, therefore, somewhat uncomfortable to use as compared to larger, more conventional key designs.

Its expansion bus method, while neat in theory, is cumbersome in practice. Just getting the solid-state board to work took three tries.

Using the SMC-70 is simple enough. You insert the CP/M system disk and set a small switch on the left side to DISK position, and turn on the computer and the video monitor. The system does a self-check and the disk drives come on. The CP/M System Disk contains a few exceptional programs that are not found

Typical business configuration includes basic unit, dot-matrix printer, monitor and stand, numeric keypad, and two floppy disk drivers mounted on the unit.

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on the usual CP/M system disk. These include DIAG, a complete diagnostic check of the SMC-70 that includes all the peripherals. This is one of the most complete diagnostic programs I have ever seen in a user package. Then there is a BACKUP program. Selecting it from the directory enables the newest user to perform all of the disk format, system transfer, and backup functions, under the direction of the computer.

Expansion modules are installed between the main unit and power supply.

Another helpful program is SETUP. This presents a setup menu with programs selectable by number, including Time & Date Setting, Screen Attributes (such as color or monochrome with white letters), Disk Configuration (what drives are installed and active), and Automatic Program Execute.

These programs simplify using the SMC-70, especially when employed with the packaged applications programs supplied by Sony or other vendors.

We received a Word Processor and SuperCalc with our test machine as examples of the software being distributed by Sony. Calling major distributors of CP/M software to find out the extent of support for this computer, we learned that Lifeboat and most others will configure their complete catalog of CP/M-80 software in Sony format. A definite plus for Sony!

Of the programs supplied, we found the Word Processor very complete and thorough, but unwieldy to use and hard to learn. We suggest that a new owner buy one of the standard CP/M word processors in place of this one, unless he is very experienced with word processors. On the other hand, the DBMS (Data Base Management System) is first rate, and easy to use and to learn. It guides the user step-by-step through the system providing menus for every operation. Not only that, but the power of this DBMS will match, or exceed any I have seen used with CP/M.

The SuperCalc implementation is not quite "standard" in that Sony has used color to enhance the spreadsheets so that they are easy to read and to use. This is one of the most imaginative uses of color for business programming that I have ever seen. It is not restricted to the SuperCalc, either, since it is used throughout Sony's software. I am sure others will adopt these methods. Bravo Sony! When it comes to the use of color, it takes a back seat to none.

The documentation is really great, consisting of loose-leaf volumes of manuals protected by slip cases and illustrated with clear, understandable diagrams and photos.

Conclusions. What a strange beast this one is. Its very strength (flexibility) creates a great weakness (cumbersomeness). A complete setup is a klutzy-looking affair. The main computer section with a different-height power supply at its rear and an attached keyboard at its front that looks like it's a third element gives the setup disconcerting lines.

Top the foregoing off with a monitor that must be located on a stand that straddles the computer to get the proper viewing height and distance, coupled with a plug-in numeric keyboard that sits off to a side, and you get the picture.

The price marks aren't bad considering the obvious high quality and expandibility of the system, and the evident hardware and software support that Sony seems to be putting behind it. In sum, the technical side of the SMC-70 is super, while the modular going-their-own-way design offers great flexibility at the cost of some setup and appearance awkwardness. ◇


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TRS-80
MODEL II
MICRO
COMPUTER
TRS-80
CERTIFIED

A Computerized DIALING SYSTEM FOR THE TRS-80 MODEL II

Enhance the utility of this business machine beyond billing, inventory, and other office-type applications

By James Barbarello

Most TRS-80 Model II computers are used in a business environment. The utility of the computer in such cases can be expanded by adding the simple, inexpensive telephone dialer presented here. With a minor hardware addition and a little software, a TRS-80 Model II computer can "dial" any telephone number, maintain a phone book, and, when used in conjunction with the internal real-time clock, originate calls when desired. No modification of the Model II is required.

Phone Dialing. If you lift the handset of a conventional telephone and look at the cradle, you will see a pair of buttons that are normally depressed when the handset is in place.

When the handset is lifted from the cradle, these buttons automatically extend and close internal contacts (called the "hook switch") within the telephone body. If you could measure the dc voltage between the red and black leads attached to the telephone, you would note that about 48 volts will be present when the handset is in place. When the handset is lifted, current flows through the telephone and energizes a relay in the telephone office. This action also causes the dc voltage to drop to a low value. When the system in the phone office senses that "your" relay is operating, it searches for an idle dialing circuit to connect to your phone. When this occurs, you hear the familiar dial tone.

In a rotary telephone system, the dial acts as a short circuit until it is released and is spring returned to the rest position. As the dial rotates, it opens and closes the telephone lines as many times as the digit being dialed. Another switch contact within the telephone disconnects the earpiece until the dialing is finished.

Thus, for the purposes of dialing, a telephone system represents a simple series circuit that is interrupted by the operation of the dial.

Since we are dealing with a series circuit, dialing can occur at any point on the line where it can be interrupted. The schematic for the computerized dialing system is shown in Fig. 1.

Circuit Operation. Prior to dialing, the computer signal to *J1* is a steady 5 volts dc. Since dc will not pass through capacitor *C1*, the voltage divider formed by *R1* and *R2* holds the trigger input of *IC1* (pin 2) above the trigger level, thus keeping the output at pin 3 close to ground. In this state, current flows through *R4*, *LED1*, and pin 3 to cause *LED1* to glow. Also, since no power is applied to the coil of relay *K1*, its normally closed contacts complete the dc circuit between PHONE jack *J3* and telephone LINE jack *J4*. In this state, the telephone works normally and is ready for everyday use.

When the computer signal drops from the +5-volt level to ground, the negative-going step passes through *C1* and triggers *IC1*. When this occurs, the output at pin 3 goes high to simultaneously turn off *LED1* while powering relay *K1* through *R5*. When the relay operates, it breaks the PHONE-LINE circuit in just the same manner as the rotary dialer. The time constant associated with *IC1* keeps pin 3 high for approximately 60 ms which is the same as the "break" time that is prescribed by the telephone company.

At the conclusion of the 60-ms interval, *IC1* times out, relay *K1* is de-energized, and *LED1* glows. Thus, by controlling the pulses coming from the computer, any number can be "dialed" just as is done when using the conventional rotary dialer. Power is provided by a 9-V, 100-mA dc plug-in supply through POWER connector *J2*.

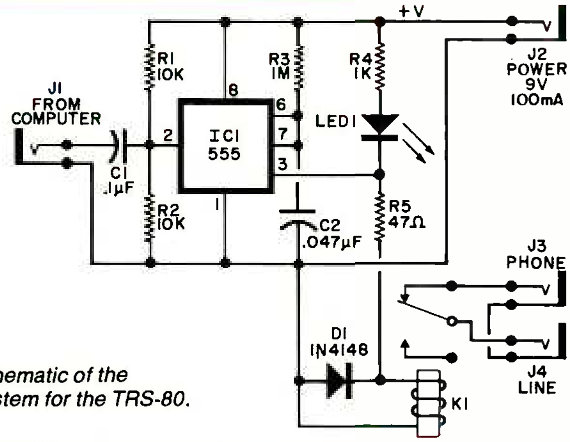

Fig. 1. Schematic of the dialing system for the TRS-80.

PARTS LIST

C1—0.1-μF disk capacitor
C2—0.047-μF disk capacitor
D1—1N4148
IC1—555 timer
J1—3⁄32″ phono jack
J2—1⁄8″ phono jack
J3, J4—1⁄4″ phono jack
K1—spst subminiature relay (Radio Shack 275-216 or similar)
LED1—Red light-emitting diode
R1, R2—10-kilohm, 1⁄4-watt resistor
R3—1-megohm, 1⁄4-watt resistor
R4—1-kilohm, 1⁄4-watt resistor
R5—47-ohm, 1⁄4-watt resistor
Misc.—9-volt/100-mA wall-mounted power supply, suitable cable, phono connectors, AP Products female header #929975, press-on type, suitable enclosure, mounting hardware.

Note: The following are available from J.J. Barbarello, R.D. #1, Box 241H, Tennent Rd., Englishtown, NJ 07726: diskettes containing all three programs (TRS-80 Model II, TRSDOS 2.0) at $20, assembled interconnect cable that allows line printer and interface at the same time at $15. NJ residents please add 5% sales tax.

Software. Three programs are required. Two, written in BASIC, maintain the computerized phone book and provide reports on phone usage, while the third is a machine-language program that controls the interface (Program 1). In this program, lines 110 and 120 turn off the real-time clock that would otherwise interrupt operation every 25 ms. Line 130 retrieves the digit to be dialed and stores it in the E register, while line 140 places a delay constant in the BC register pair for later use.

The actual dialing is performed in the loop of lines 150 through 200. Line 150 loads a 1 into the A register (this value is arbitrary), while line 160 sends this data to I/O port 0E1H the Parallel Printer Port (PPP) connector on the rear of the Model II. Whenever we send data to the "printer" via the PPP, we must inform the printer that valid data is on the lines. Pin 1 of the PPP connector (STROBE*) goes negative for an instant for this purpose. A special cable connects pin 1 of the PPP connector to *J1* of Fig. 1. Thus, by sending "data" to the "printer," *IC1* can be triggered. In Program 1, lines 170 and 180 use the delay constant previously loaded in the BC register pair (line 140) for a delay of 100 ms. (See the TRSDOS manual for an explanation of SVCs.) Line 190 decrements the number of times the phone line must be pulsed. If there are pulses remaining, line 200 returns operation to line 150 (loop); otherwise, line 210 returns to the BASIC program.

Program 2 contains the BASIC program that maintains a computerized phonebook. Line 10 clears 5000 bytes for string storage, and resets protected memory to EFE0H (one place below where the machine-language hardware controller will reside). It then loads "Phoner", the controller program. Line 15 gets the date entered when you started up the computer and converts it to a MM/DD/YY format, while line 20 opens the data file containing the phonebook entries and checks to see that it exists. If it does, it calls the subroutine at line 11000 to field buffer 1, which will be used to transfer data to and from the file. If it finds there are no entries, it initializes the file by placing blanks in all the records (line 30).

Lines 40 through 100 draw a graphic representation of a phonebook on the screen. Line 110 prompts you to press ENTER, whereupon lines 130 through 240 "open" the phone book to the first page which contains the instructions. Line 260 prompts you to press a letter key between A and Z to select that page in the phone book (both upper and lower case are accepted). When the selected letter is entered, lines 290 through 320 retrieve the data from the file and "turn" the page to that letter.

Line 330 calls a subroutine to print a prompt at the bottom of the screen. At this point the arrow keys are used to move the cursor to the row and column to be added to or modified. When the cursor is at the desired position, depressing "M" adds to, or modifies the data the cursor is pointing to. This takes place in lines 340 through 400.

When the "D" key in depressed to request dialing, line 580 draws an arrow in front of the number on the line the cursor is currently positioned on. You are then requested to depress ENTER when a dialtone is available, or ESC if you decide not to dial (or cannot get a

```
                00010       ;****************************************
                00020       ;*     SOURCE=PHONER/ASM - - OBJ: PHONER    *
                00030       ;*     VERSION 1.0            13 JUNE 1982  *
                00040       ;*       c 1982 by J.J. Barbarello          *
                00050       ;*     For use with Phone Dialing Hardware  *
                00060       ;*                                          *
                00070       ;****************************************
                00080       ;
                00090       ;
EFE1            00100       ORG    0EFE1H  ;In BASIC,use CLEAR 5000,&HEFE0
EFE1 3E81       00110       LD     A,129   ;Use Register A contents to
EFE3 D3FF       00120       OUT    (255),A ;  turn off Real-Time Clock.
EFE5 5E         00130       LD     E,(HL)  ;Number of pulses into E register.
EFE6 01BC3D     00140       LD     BC,15804;Delay to=.100 Sec (6.5*(BC-1)+22)
EFE9 3E01       00150 LOOP  LD     A,1     ;Load "1" into Register A.
EFEB D3E1       00160       OUT    (0E1H),A;Send it to the "Line Printer".
EFED 3E06       00170       LD     A,6     ;Do DELAY Svc
EFEF CF         00180       RST    8
EFF0 1D         00190       DEC    E       ;One less pulse to do.
EFF1 20F6       00200       JR     NZ,LOOP ;Go Back to LOOP unless E=0.
EFF3 C9         00210       RET            ;Return to BASIC calling program.
0000            00220       END
00000 TOTAL ERRORS

LOOP     EFE9
```

Program 1. Machine-language program to control the interface.

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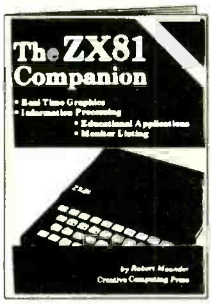
By Bob Maunder



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```
1 REM**           HARDWARE/SOFTWARE PROJECT
2 REM**           NAME: PHONBOOK
3 REM**           LATEST UPDATE: #6, 9 OCT 19
  82
4 REM**
10 CLS:CLEAR 5000,&HEFE0:SYSTEM"LOAD PHONER":D
   EFUSR=&HEFE1:DEFSTR A-D:DIM A(21,1):DLN=STR
   ING$(79,150):DR=CHR$(26):DN=CHR$(25)
15 DTE=MID$(DATE$,16,2)+"/"+MID$(DATE$,7,2)+"/
   "+MID$(DATE$,11,2):FORI=1TO4:IFMID$(DTE,I,1
   )=" "THENMID$(DTE,I,1)="0":NEXT ELSE NEXT
20 OPEN"D",1,"PHONBOOK/DAT",48:FIELD 1,48 AS A
   DAT:IF LOF(1)<>0 THEN GOSUB 11000
30 IF LOF(1)<520 THEN CLS:PRINT@(10,35),"INITI
   ALIZING...";:LSET ADAT=SPACE$(48):FOR I=1 T
   O 520:PUT 1,I:NEXT:CLS:GOSUB 11000
40 FOR I=2 TO 21:A(I,0)=SPACE$(34):A(I,1)=SPAC
   E$(14):NEXT
50 PRINTCHR$(2);TAB(10);STRING$(60,155)
60 FOR I=1 TO 3:PRINT@(I,10),DR;"   ";DN;"  ";
   DR;"  ";DN;TAB(68);DR;"  ";DN:NEXT
70 PRINT@(4,10),DR;"   ";DN;"  ";DR;"  ";DN;TAB
   (22);"A U T O M A T I C   P H O N E B O O K
   ";TAB(68);DR;"  ";DN
80 PRINT@(5,10),DR;"   ";DN;"  ";DR;"  ";DN;TAB
   (22);STRING$(37,150);TAB(68);DR;"  ";DN
90 FOR I=6 TO 20:PRINT@(I,10),DR;"   ";DN;"  "
   ;DR;"  ";DN;TAB(68);DR;"  ";DN:NEXT
100 PRINTTAB(10);DR;STRING$(60,152);DN
110 PRINT@(23,33),"Press ";DR;" ENTER ";DN;CHR$
    (1);
120 A=INPUT$(1):IF ASC(A)<>13 THEN 120
130 PRINTCHR$(2);
150 PRINT@(4,17),"                  I N S T R U C T I
    O N S                    "
160 PRINT@(5,17),"                  ****************
    ******                   "
170 PRINT@(6,17),"                                  "
180 PRINT@(7,17),"     The Automatic Phonebook
    contains 26 Pages          "
190 PRINT@(8,17)," (A-Z). Each page may contain
    up to 20 Names and         "
200 PRINT@(9,17)," Phone Numbers. The last line
    on the screen will         "
210 PRINT@(10,17)," always tell you what to do
    next.                      "
220 PRINT@(11,17),"      To use the Automatic P
    honebook to dial a         "
230 PRINT@(12,17)," number, the AP hardware mus
    t be connected, and        "
240 PRINT@(13,17)," you must have a dialtone."
260 PRINT@(23,24),"Press a LETTER between A and
    Z...";CHR$(1);
280 A=INPUT$(1):A=CHR$((A>"Z")*32+ASC(A)):IF A<
    "A" OR A>"Z" THEN 280
290 PRINT@(23,0),CHR$(23);:PRINT@(23,28),"Page
    -";A;"- selected. ";DR;" WAIT...";DN;:RN=(A
    SC(A)-65)*20+1:J=2:FOR I=RNTORN+19:GET1,I:A
    (J,0)=LEFT$(ADAT,34):A(J,1)=RIGHT$(ADAT,14)
    :J=J+1:NEXT I:CG%=0
310 PRINT@(1,17),"|..NAME...............-";A;"
    -........|..NUMBER......|"
320 FOR I=2 TO 20:PRINT@(I,17),"|";A(I,0);"|";A
    (I,1);"|":NEXT:PRINTCHR$(1);
330 GOSUB 10200
340 PRINT@(2,18),;:P=2:NC=18
350 A=INPUT$(1):NU=ASC(A):IF NU=9 THEN 350
360 IF NU=31 AND P<20 THEN P=P+1
370 IF NU=30 AND P>2 THEN p=P-1
380 IF NU=29 AND NC=18 THEN NC=53
390 IF NU=28 AND NC=53 THEN NC=18
400 IF A="M" OR A="m" THEN 530ELSE IF A="D" OR
    A="d" THEN 580
410 IF NU=1 THEN 430
420 PRINT@(P,NC),;:GOTO 350
430 IF CG%=1 THEN PRINT@(23,0),CHR$(23);TAB(12)
    ;"Do you wish to SAVE the CHANGES you have
    made ?(Y/N)...";:GOSUB 10010:GOTO 440 ELSE
    PRINT@(23,0),CHR$(23);:PRINT@(23,7),"No cha
    nges made. ";:GOTO 445
440 IF A="N" THEN PRINT@(23,0),CHR$(23);"    AL
    L CHANGES CANCELLED. "; ELSE 480
445 PRINT"Press a LETTER (A-Z) or ";DR;" F2 ";D
    N;" to CLOSE the book...";
450 A=INPUT$(1):A=CHR$((A>"Z")*32+ASC(A)):IF AS
    C(A)=2 THEN 10050
460 IF A<"A" OR A>"Z" THEN 450
470 PRINT A;:GOTO 290
480 REM**   SAVE PAGE        **
490 PRINT@(23,0),CHR$(23);TAB(30);DR;" SAVING P
    AGE...";DN;
500 J=2:FOR I=RNTORN+19:LSET ADAT=A(J,0)+A(J,1)
    :PUT 1,I:J=J+1:NEXT I
510 PRINT@(23,0),CHR$(23);TAB(10);"PAGE SAVED.
    ";:GOTO 445
520 REM**   MODIFY ENTRY      **
530 PRINT@(23,0),CHR$(23);"Type in New informat
    ion, then press ";DR;" ENTER ";DN;" (or pre
    ss ";DR;" ENTER ";DN;" for NO change)...";:
    PRINT@(P,NC),DR;A(P,(NC=18)+1);DN:PRINT@(P,
    NC),;:LINE INPUT A:IF LEN(A)=0 THEN 560
535 IF NC=18 THEN A(P,0)=LEFT$(A,34)+SPACE$(34-
    LEN(A)) ELSE A(P,1)=LEFT$(A,14)+SPACE$(14-L
    EN(A))
540 IF NC=18 THEN A(P,0)=LEFT$(A,34):IF LEN(A(P
    ,0))<34 THEN A(P,0)=A(P,0)+SPACE$(34-LEN(A(
    P,0)))
550 IF NC=53 THEN A(P,1)=LEFT$(A,14):IF LEN(A(P
    ,1))<14 THEN A(P,1)=A(P,1)+SPACE$(14-LEN(A(
    P,1)))
560 PRINT@(P,18),A(P,0);"|";A(P,1):GOSUB 10210:
    PRINT@(P,NC),;:CG%=1:GOTO 350
570 REM**   DIAL PHONE NUMBER        **
580 PRINT@(P,50),DR;"->";DN;" ";:PRINT@(23,0),C
    HR$(23);TAB(9);"Press ";DR;" ENTER ";DN;" w
    hen DIALTONE is available, or ";DR;" ESC ";
    DN;" to abort...";
590 A=INPUT$(1):IF ASC(A)<>13 AND ASC(A)<>27 TH
    EN 590 ELSE IF ASC(A)=27 THEN640
600 PRINT@(23,0),CHR$(23);TAB(35);"DIALING...";
    CHR$(2);
610 NC=53:PRINT@(P,NC),;
620 FOR X=1 TO 14:J=ASC(MID$(A(P,1),X))-48:IF J
    <0 OR J>9 THEN NEXT X:GOTO 635
630 PRINT@(P,52+X),DR;CHR$(J+48);DN;:GOSUB 1010
    0:PRINT@(P,52+X),CHR$(J+48);:NEXT X
635 GOSUB 12000
640 GOSUB 10200:PRINT@(P,18),A(P,0);"|";:NC=18:
    PRINT@(P,NC),CHR$(1);:GOTO 350
9990 '******************************** UTILITIES *
     ********************************
10000 REM**   YES/NO UTILITY  **
10010 A=INPUT$(1):A=CHR$((A>"Z")*32+ASC(A))
10020 IF A<>"Y" AND A<>"N" THEN 10010ELSE PRINTA;
      :RETURN
10050 REM**   CLOSE BOOK      **
10060 PRINT@(23,0),CHR$(23);TAB(35);DR;" WAIT..."
      ;DN;CHR$(2);:FOR I=1 TO 20:PRINT@(I,10),DR;
      "   ";DN;SPACE$(52);DR;" ";DN;"  ";DR;"   ";
      DN:NEXT
10070 CLOSE:PRINT@(23,0),CHR$(23);:PRINT@(10,30),
      "PHONEBOOK CLOSED":PRINT@(11,30),STRING$(16
      ,150)
10080 PRINT@(23,0),CHR$(23);:PRINT@(19,14),"c 198
      2 by J.J. Barbarello, Englishtown, NJ 07726
      ";:END
10100 REM**   DIAL     **
10110 J%=INT((J=0)*-10+J):Y=USR(J%):FOR Y=1 TO 40
      0:NEXT:RETURN
10200 REM**   PRINT PROMPT AT BOTTOM OF PAGE  **
10210 PRINT@(23,0),"Use ";DR;" ARROW KEYS ";DN;"
      to move Cursor.Press ";DR;" D ";DN;" to dia
      l,";DR;" M ";DN;" to Modify,";DR;" F1 ";DN;
      " when done.";:RETURN
11000 REM**   OPEN PHONELOG
11010 OPEN"D",2,"PHONELOG/DAT",72:FIELD 2,72 AS A
      FIL:RETURN
12000 REM**   LOG CALL
12010 GOSUB 13000
12030 PRINT@(23,10),"Press ";DR;" ENTER ";DN;" wh
      en call begins, or ";DR;" ESC ";DN;" to ABO
      RT logging...";
12040 A=INPUT$(1):IF ASC(A)<>13 AND ASC(A)<>27 TH
      EN 12040 ELSE IF ASC(A)=27 THEN 13010
12050 T$(1)=TIME$:GOSUB 13000:PRINT@(23,18),"STAR
      T: ";T$(1);". Press ";DR;" ENTER ";DN;" whe
      n done...";:SYSTEM"CLOCK ON"
12060 A=INPUT$(1):IF ASC(A)<>13 THEN 12060
12070 T$(2)=TIME$:SYSTEM"CLOCK OFF":PRINT@(0,65),
      STRING$(5,155);
12080 FORI=1TO2:S(I)=VAL(LEFT$(T$(I),2))*3600+VAL
      (MID$(T$(I),4,2))*60+VAL(RIGHT$(T$(I),2)):N
      EXT
12090 S=S(2)-S(1):T$(3)=STR$(INT(S/3600)):T$(4)=S
      TR$(INT((SMOD3600)/60)):T$(5)=STR$(SMOD(60)
      )
12100 FORI=3TO5:T$(I)=RIGHT$(T$(I),LEN(T$(I))-1):
      IF LEN(T$(I))=1THENT$(I)="0"+T$(I)
12110 NEXT:T$(3)=T$(3)+"."+T$(4)+"."+T$(5)
12120 GOSUB 13000:PRINT@(22,30),"SAVING DATA...";
12130 LSET AFIL=DTE$+T$(1)+T$(3)+A(P,0)+A(P,1):PU
      T 2,LOF(2)+1
13000 REM**   CLEAR COMMAND LINE       **
13010 PRINT@(22,0),CHR$(24);:RETURN
```

Program 2. BASIC program to maintain a computerized phonebook.

dialtone). Line 600 informs when dialing has begun, line 620 searches through the 14 positions in the number column, and disregards all but those containing digits 0 through 9, while line 630 makes the digit in question black on white (reverse video) to highlight which digit is presently being dialed. It then calls the subroutine at line 10100 to perform the actual dialing. When dialing is complete, line 635 passes execution to the Log Call subroutine, starting at line 12000. When the call has been completed, execution returns to line 350.

The Dial subroutine (line 10110) checks for a "0" and converts it to the decimal number 10. The routine then calls the controller program (via the USR command), passing the digit to be dialed (J%), and waits for approximately one second and returns.

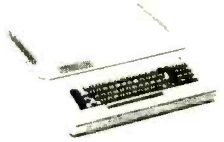
The Log Call subroutine (Lines 12010 through 12130) starts by prompting you to press ENTER when the call begins, or ESC to abort logging. If you press ENTER (ASCII 13), line 12050 obtains the current time (HH.MM.SS.), prints it as "START:", and asks you to press ENTER when the call is completed. Line 12050 also turns on the real-time clock display, which is shown in the upper right of the screen. This allows you to monitor how long the call is lasting. When you finish the call and press ENTER, line 12070 gets the current time, turns off the real-time clock presentation, and restores the graphics that were erased by the clock. Lines 12080 through 12130 calculate the call length, then store it, the start time, date, and the phone-book entries for the name and number of the person called. This information is stored in the Phonelog/Dat file for later access. At this point, execution continues through line 13010, which clears the command line and returns from the subroutine.

Phonelog Report Generator (Program 3) is a menu-driven program that retrieves the logging data and prints a report (to the screen or to a line printer). The three menu options are subroutines beginning at lines 1000, 2000, and 3000 respectively. The END option (starting at line 3000) closes the file and ends the program. The remaining two options are essentially identical, except that one provides the data to the screen and the other to any 80-column line printer.

The report may include all data in the file, or you can select a range of months of logging data. In this way, you can maintain a full calendar year of data, printing only what you wish each time. To retain this data after the year's end, rename the data file (i.e. Phonelog/83) using BASIC's Name command (see your user's manual for details). Then a new Phonelog/Dat file will be automatically started the next time you use the Phonbook program.

To print data for a single month, enter the same month number for both Start and Finish. If you enter a Start number less than 1 or greater than 12 you will be informed that this is an *Invalid Input* and allowed to try again, or return to the menu. Similarly, if you enter a Finish number that is less than the Start or greater than 12, it will also be treated as an *Invalid Input*.

FRANKLIN



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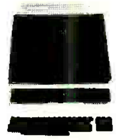

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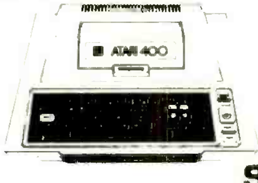

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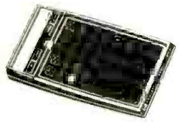

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CIRCLE 11 ON READER SERVICE CARD

```
    1 REM**           PHONELOG REPORT GENERATOR
    2 REM**           NAME:PLOGRPT
    3 REM**           LATEST UPDATE: # 0, 9 OCT 1
      982
    4 REM**
   10 CLS:CLEAR 1000:DEFSTR A-D:DLN=STRING$(79,15
      0):DR=CHR$(26):DN=CHR$(25):ON ERROR GOTO 15
      000
   20 OPEN"D",1,"PHONELOG/DAT",72:FIELD 1,8 AS DT
      E,8 AS START$,8 AS TTL$,34 AS NME$,14 AS NU
      MBER$
   30 CLS:PRINT@(4,15),"P H O N E   L O G   R E P
       O R T   G E N E R A T O R":PRINTDLN
   40 PRINT@(8,20),"TASKS:"
   50 PRINT@(10,25),DR;" 1.";DN;" Print Report to
       SCREEN"
   60 PRINT@(12,25),DR;" 2.";DN;" Print Report to
       PRINTER"
   70 PRINT@(14,25),DR;" 3.";DN;" END."
   80 PRINT@(18,24),"Press ";DR;" NUMBER ";DN;" o
      f TASK desired...";
   90 A=INPUT$(1):IF VAL(A)<1 OR VAL(A)>3 THEN 90

  100 ON VAL(A)GOSUB 1000,2000,3000:GOTO 30
 1000 CLS:PRINTTAB(22);"T A S K  # 1: Print Repor
      t To SCREEN":PRINTDLN:Z=0
 1010 GOSUB 11000:IF A="R" THEN RETURN
 1020 GOSUB 10000:IF A="R" THEN RETURN
 1030 CLS:PRINTTAB(15);"Phone Usage Report for Mo
      nths ";DR;SM;DN;" through ";DR;FM;DN:PRINTD
      LN
 1040 PRINT"DATE";TAB(10);" START";TAB(20);" USAG
      E";TAB(30);"PHONE NUMBER";TAB(45);"PHONEBOO
      K ENTRY FOR PERSON CALLED":PRINTDLN
 1050 FORI=1TOLOF(1):GET1,I:IF VAL(DTE)<SM OR VAL
      (DTE)>FM THEN 1080
 1060 PRINTDTE;TAB(10);START$;TAB(20);TTL$;TAB(30
      );NUMBER$;TAB(45);NME$:Z=Z+1
 1080 NEXT:PRINT:PRINTZ;"ENTRIES FOUND. ";:GOTO11
      110
 2000 CLS:PRINTTAB(22);"T A S K  # 2: Print Repor
      t to PRINTER":PRINTDLN:Z=0
 2010 GOSUB 11000:IF A="R" THEN RETURN
 2020 GOSUB 10000:IF A="R" THEN RETURN
 2030 PRINT@(2,0),CHR$(24);:PRINT@(10,20),"PREPAR
      E PRINTER. ";:GOSUB 11110
 2040 PRINT@(10,15),"PRINTING REPORT. Place print
      er ";DR;" OFF LINE ";DN;" to Abort...";
 2050 LPRINT TAB(15);"Phone Usage Report for Mont
      hs ";SM;" through ";FM:LPRINTSTRING$(79,"-"
      )
 2060 LPRINT"DATE";TAB(10);" START";TAB(20);" USA
      GE";TAB(30);"PHONE NUMBER";TAB(45);"PHONEBO
      OK ENTRY FOR PERSON CALLED":LPRINT STRING$(
      79,"-"):LPRINT
 2070 FORI=1TOLOF(1):GET1,I:IF VAL(DTE)<SM OR VAL
      (DTE)>FM THEN 2100
 2080 LPRINTDTE;TAB(10);START$;TAB(20);TTL$;TAB(3
      0);NUMBER$;TAB(45);NME$:Z=Z+1
 2100 NEXT:LPRINT:LPRINTZ;"ENTRIES PRINTED."
 2110 PRINT@(12,18),"REPORT COMPLETED. ";:GOTO 11
      110
 3000 CLS:PRINTTAB(30);"T A S K  # 3: END":PRINTD
      LN
 3010 GOSUB 11000:IF A="R" THEN RETURN
 3020 PRINT@(10,35),DR;" WAIT...";DN;
 3030 CLOSE:PRINT@(10,32),DR;" PROGRAM ENDED ";DN
      :PRINT@(18,0),;:END
10000 PRINT@(3,0),"Enter START Month for Report (
       1 - 12 )...";CHR$(23);:LINE INPUT A
10010 SM=VAL(A):IF SM<1 OR SM>12 THEN PRINT@(3,50
      ),"*INVALID INPUT*":GOSUB 11020:IF A="R"THE
      N RETURN ELSE 10000
10020 PRINT@(5,0),"Enter FINISH Month For Report
      (";SM;"- 12 )...";CHR$(23);:LINEINPUT A
10030 FM=VAL(A):IF FM<SM OR FM>12 THEN PRINT@(5,5
      0),"*INVALID INPUT*":GOSUB 11020:IF A="R"TH
      EN RETURN ELSE 10020
10040 PRINT@(10,10),"REPORT FOR MONTHS";SM;"THROU
      GH";FM;". O.K. (Y/N)?...";
10050 GOSUB 11210:IF A="N"THEN A="R":RETURN ELSE
      RETURN
11000 REM**   CONTINUE/RETURN QUERY SUBROUTINE
11010 PRINT@(2,0),CHR$(24)
11020 PRINT@(22,0),CHR$(23);STRING$(21,150);">";:
      PRINT@(22,60),"<";STRING$(18,150);:PRINT@(2
      2,28),DR;" C ";DN;"ontinue, or ";DR;" R ";D
      N;"eturn...";
11030 A=INPUT$(1):IF ASC(A)>96 THEN A=CHR$(ASC(A)
      -32)
11040 IF A<>"C" AND A<>"R" THEN 11020ELSE PRINT@(
      22,0),CHR$(23);:PRINT@(2,0),;:RETURN
11100 REM**   PRESS ANY KEY UTILITY   **
11110 PRINT"Press ANY key to continue...";
11120 A=INPUT$(1):RETURN
11200 REM**   YES/NO ANSWER UTILITY
11210 A=INPUT$(1):NU=ASC(A):IF NU>96 THEN NU=NU-3
      2:A=CHR$(NU)
11220 IF A<>"Y" AND A<>"N" THEN 11210ELSE PRINT A
      :RETURN
11400 REM**   LOWER/UPPER CASE SHIFT UTILITY - SH
      IFT STRING=A     **
11410 FOR X=1 TO LEN(A):NU=ASC(MID$(A,X,1)):MID$(
      A,X,1)=CHR$(NU+(MID$(A,X,1)>"Z")*32):NEXT
11420 RETURN
15000 REM**           ERROR TRAPPING ROUTINE
15010 PRINT DR:CLS:PRINT@(9,25),"ERROR #";ERR;"OC
      CURRED IN LINE #";ERL
15020 IF ERR=56 THEN PRINT@(10,25),"(Printer Not
      Available)"
15030 PRINT@(11,25),"Press ANY Key to Continue...
      ";
15040 A=INPUT$(1):PRINT DN:RESUME 30
```

Program 3. Phonelog report generator program.

Construction. Since there is nothing sensitive in the circuit and it is simple, any type of construction can be used.

The finished board is mounted within any type of enclosure with *LED1*, and the four jacks (*J1* through *J4*) mounted on the front panel and suitably marked. Power can be obtained from any wall-socket supply that can deliver 9 V at 100 mA. The power comes through *J2*.

The interconnecting cable between the computer and dialer is fabricated from a 4-foot (approximate) length of shielded audio cable. One end is terminated in a phono plug that mates with *J1*, and the other end is terminated on a header that mates with the parallel printer port edge connector on the rear apron of the computer. Solder the braid to pin 24 of this connector and the center lead to pin 1.

This header uses an AP Products female header 929975, cut so that there is a double row of 19 contacts.

Loading Software. Enter Program 2 and save it under the name Phonbook. Then enter NEW and enter Program 3, saving it under the name Plogrpt.

The easiest way to load machine-language Program 1 is to use the TRSDOS utility Debug. Enter SYSTEM to enter the TRSDOS Ready mode. Now enter DEBUG ON. When TRSDOS READY appears again, enter DEBUG. Next, press M, type EFE1, and then the F1 key (do not press ENTER). The top portion of the screen will appear similar to Program 4, with the cursor at the first position on the EFE1 line. Type in the characters on the EFE1 and EFF1 lines (do not press the spacebar or ENTER key). Then check to see that all characters were entered correctly. If you find an error, use the arrow keys to position the cursor over the incorrect entry and type in the correct character.

When all characters are correct, press the F2 key to transfer the code to memory. Press O (letter) to turn Debug off. Now type DUMP PHONER (START=EFE1, END=EFF3) and press ENTER. When TRSDOS READY again appears, enter DIR and note that you now have a new program named Phoner. Before proceeding, make a backup of the disk containing all three programs—just in case. Finally, enter the TRSDOS Ready mode and type Auto BASIC Phonbook -F:2 and press ENTER. This will cause the computer to automatically load BASIC and run the Phonbook program the next time you start up your Model II with this disk.

Using the System. Before using the system, you will have to prepare your phone line. This consists of cutting the tip (red) wire and connecting the two resulting ends to the tip lugs of two ¼" phono plugs. All remaining wires in the incoming cable should remain intact. Whether to cut or not must be your decision, since there are many possibilities of phone hookups. If you have a modular plug system, you may wish to keep the cable intact, and use modular jacks wired into the interface. In any event, you must interrupt the tip (red) wire before it enters the phone, and connect the resulting wires to the *J3-TIP* and *J4-TIP* points.

When the *J3* and *J4* plugs (or connections) have been made, connect the interface cable to the Model II and the interface. Finally, connect the power supply cable to *J2* and plug it into a 120-V ac outlet. If the power supply does not have a ¼" phono plug on the dc end, you can either use a mating jack for *J2* or connect a ¼" phono plug to the dc end. If you modify the supply, be sure the +9-volt lead goes to the tip of the ¼" phono plug, and the remaining wire goes to the phono plug's "plug" lug.

Run the Phonbook program. Then follow the directions that appear on the last screen line. Select a page in the book and enter some phone numbers. Save the new (modified) page, and continue on to other pages.

Now select a number to dial. Note that *LED1* on the interface is glowing. Pick up your handset, and obtain a dialtone. Then press ENTER to begin dialing. You will note that *LED1* pulses in unison with the dialing. Since you are not using the phone's dial, its muting

```
TRS-80 Model II DEBUG Program
EFE1    3E 81 D3 FF 5E 01 BC 3D   3E 01 D3 E1 3E 06 CF 1D   >...^..=>...>...
EFF1    20 F6 C9 00 00 00 00 00   00 00 00 00 00 00 00 13    ...............
F001    FF FF FF FF FF FF FF FF   FF FF FF FF FF FF FF FF   ................
F011    FF FF FF FF FF FF FF FF   FF FF FF FF FF FF FF FF   ................
F021    FF FF FF FF FF FF FF FF   FF FF FF FF FF FF FF FF   ................
F031    FF FF FF FF FF FF FF FF   FF FF FF FF FF FF FF 00   ................
F041    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
F051    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
   PC     SP   SZHPNC  AF   BC   DE   HL   IX   IY   AF'  BC'  DE'  HL'
 2800   21FE   000000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
```

Program 4. Debugging program.

function is not available. Therefore, you will hear loud clicks as the number is dialed. This is normal. When dialing is completed and you have reached your party, press ENTER to begin logging. When the call is completed, press ENTER again to end the logging. You may continue dialing, changing the phone number data, or you can "close" the book. In any event, the last screen line will always tell you what to do next.

You might have noted that, while dialing was taking place, as each digit was dialed it appeared in reverse video. If you had entered non-numeric data in the number column (such as dashes) you would have noted that such data was automatically skipped.

Note: You must advise your local telephone company that you plan to interface a device to their lines in the event they have certain requirements that must be met for the installation.

To obtain a report of phone usage, you must end the Phonbook program (by "closing" the book) and then enter RUN"PLOGRPT". This menu-driven program allows you to select all data or only data for a given month (or range of months). You can print the data to the screen (TASK 1) or to any 80-column printer (TASK 2). When finished, select the END task.

Modifications. Different phone lines will accept different dialing rates. If your interface dials too fast for your line (or, on the other hand, your line can accept faster dialing) you can modify the rate. This is a two-step process. First, you can change the pulse time by modifying the values of either *R3* or *C2*. (The rate is approximately $1.1 \times R3 \times C2$ milliseconds, with *R3* in megohms and *C2* in microfarads.) If you change the pulse time significantly, you should also change the time between pulses so the ratio remains at about 60/100. To do this, change bytes EFE7 and EFE8 in the Phoner program per the formula Delay (μs) $= 6.5 \times$ (BC-1) $+ 22$. We originally loaded BC with 15804 (3DBC Hex). Calculate the new constant, and convert it into Hex notation. Then patch the Phoner program with the new values. As an example, to change the time between pulses to 90 ms (90,000 μs), use a constant of 13844 (3614 Hex). Since the hex number is entered as Least Significant Bit, then Most Significant Bit, we would patch Phoner A = EFE7, F = BC3D, C = 1436. ◇

Learning

16-BIT MICROCOMPUTER TECHNOLOGY

Part 7: How to use the monitor to create software

By George Meyerle

LAST month we introduced the ROM-based monitor and its entry commands. Here we will show how to use the monitor to create software.

All monitor commands require one or two character entries plus their optional address and/or iteration fields. Command lines are terminated by operating the carriage return key which starts execution of the command.

Following is a list of conventions used:

1. The > character is the monitor video prompt. When it is displayed, the monitor is waiting for a command entry.
2. The < character indicates that a carriage return must be initiated. This character does not appear onscreen, and is used here only to indicate carriage return.
3. Any values within parenthesis are optional. The parenthesis are not entered but appeared for clarity only.
4. The value "FA" represents the Full Address i.e.: an address that may contain both a segment and an offset address value. The segment and offset are always separated by a colon as in the form CS:IP (CS = segment register; IP = instruction pointer). The segment value is optional and if it is not used, then the current code segment is assumed to be operative.
5. The value "AD" represents an *offset* address value. No segment address is allowed within a "AD" field.
6. Any register pair designation may be used in place of an address.
7. All address fields must be separated by one or more spaces.
8. All entries are in hexidecimal with the exception of the iteration count which is in decimal.
9. The iteration count is entered by typing in an asterisk followed by a numeric value. The default iteration count is 32.

The Command Set.

DISPLAY

The format is:

D (FA) (AD) <

D (FA) *nnnn <

Example:

D F000:E000 *5 <

In this example, F000 is the code segment start address (however, since we are dealing with a 16-bit processor, this is actually F0000), E000 is the offset address found in the instruction pointer), and 5 is the number of bytes required to be displayed.

The absolute hex address where the monitor will actually go to is found by adding the code segment and offset addresses as follows:

F000	code segment
E000	offset address
FE000	absolute hex address

Thus, if the command D F000:E000*5 were executed, the first five bytes of whatever started at address FE000 (1,040,384 decimal) would be displayed. In our case, this happens to be FA B4 D5 9E 73, first five bytes of the Explorer-88 ROM-based monitor program as shown in Fig. 19.

The same absolute address can be obtained by using any combination of code segment and instruction pointer values that, when added, equal the absolute value FE000

Being able to set the code segment value at 64K boundaries has the advantage of breaking up the 1 million memory addresses into sixteen 64K blocks which is convenient. Keep in mind though, that the flexibility of almost endless combinations of segment and offset addresses can be very useful. Because of its complexity, it would require a small book on 8088 addressing modes to describe how this addressing scheme is employed. The reader should consult any of the currently available 8086/8088 books for details.

```
E000    INIT     LABEL   NEAR
E000    FA       CLI              ;INTERRUPTS MUST BE OFF
E001    B4 D5    MOV     AH,0D5H  ; SET FLAGS
E003    9E       SAHF
E004    73 4E    JNC     ERR01    ;JUMP IF CF NOT SET
E006    75 4C    JNZ     ERR01    ;JUMP IF ZF NOT SET
E008    7B 4A    JMP     ERR01    ;JUMP IF PF NOT SET
```

Fig. 19. First five bits of the monitor program.

The "D" command, can also be used to display the following:

D SS:SP *2 < (SS is stack segment while SP is stack pointer) displays the first two bytes of the stack pointer.

D 0:0 FF < Displays the absolute locations

00000 to 000FF. Note that the first 32H bytes displayed are the interrupt jump vectors.

D DS:0 < Displays the first 32 bytes of the data segment (DS).

REGISTER

Format R <

Example R (RP)

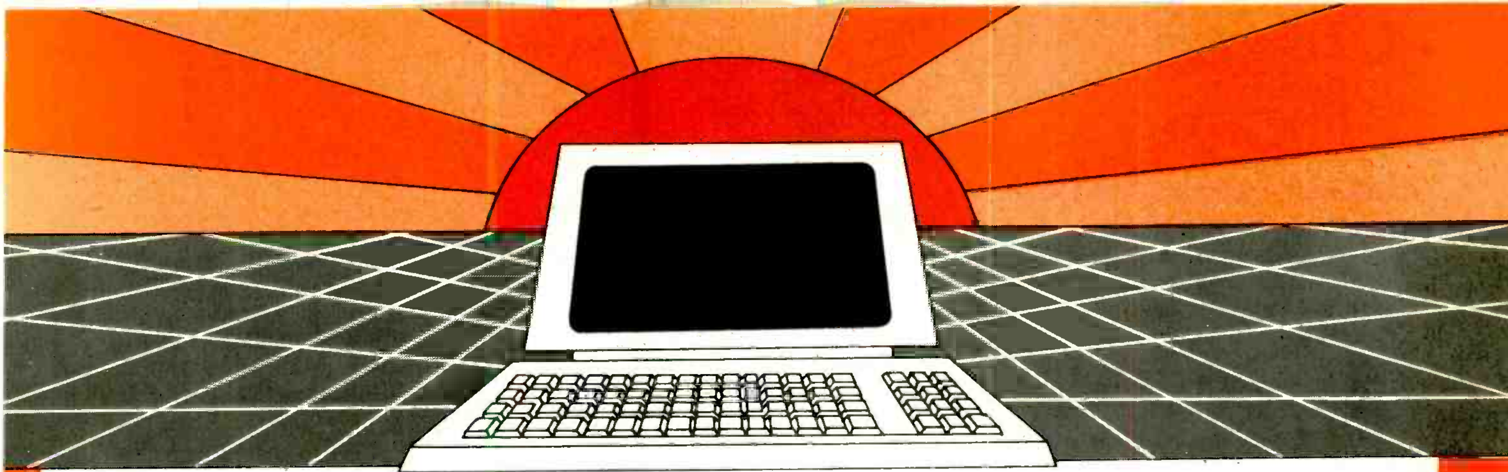
This group of commands is perhaps one of the most important features of the monitor. To know what has happened in your program, you must be able to review what has happened to the registers inside the microprocessor.

The 8088 registers are shown in Fig. 20. The general registers are subdivided into two sets of four registers each. Each segment is separately addressable which means that one register can be used as one 16-bit, or two 8-bit registers. All other registers are 16 bits wide. In addition to the registers, nine status flags are available.

An R followed by a carriage return will cause a display of *all* the internal 8088 registers. An R followed by a register pair designator (RP) will cause the selected pair to be displayed and allow modification of that pair. If a change is required, enter the change followed by a < (carriage return). If no change is required, entering a < will terminate the review.

A typical register display might look like this:

DX	= 0000	SP	= 007E
CX	= 0000	BP	= 0000
BX	= 0000	SI	= 0000
AX	= 04FF	DI	= 0000
SS	= 0FFB	CS:IP	= E8
ES	= 0000		
DS	= 0FF0	FL	= 0000
CS	= F000	IP	= EDB7



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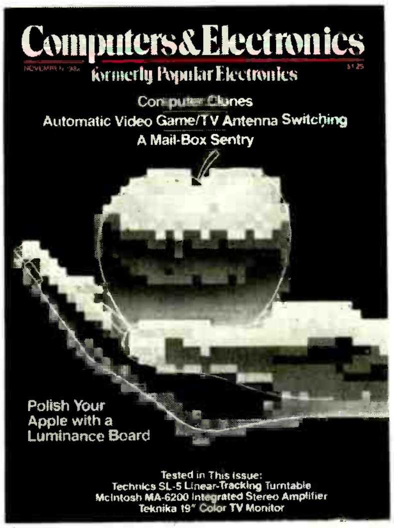

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BLOCK MOVE

The block move command is helpful to relocate a program/subroutine, or, if you want to fill a portion of memory with a constant. The formats are as follows:

B FA AD AD <

B FA AD *nnnn <

The first address is the beginning address of the block to be moved. The second address is the beginning address of where the block is to be moved to. The third address is the last address of the destination block which could alternatively be replaced by the iteration count designator which is simply the number of bytes to be moved.

The command: B 0:0 500 5FF < will move the data in locations 00000-000FF to 00500-005FF. The data in the source field is not changed.

The command B 0:0 500 *1000 < will fill 1000 locations starting from 00500 with the data value stored at location 00000.

MEMORY

The M command opens memory locations for display or modifications, and is used to enter programs. The format is:

M (FA) <

After inputting the M command, the designated memory location is displayed followed by a dash. If a space is entered the next sequential location will be displayed.

If a change is desired, enter the new data followed by a space. A carriage return will end the command. If a memory location cannot be changed (as would be the case if ROM or bad or nonexistant RAM were addressed) a bell or beep will be outputted.

INPUT

The I command inputs one byte from the specified I/O address to the Accumulator and displays the value on the terminal.

Format: I AD <

Entering I 61 < inputs and displays the state of the dip switch S1 on the mother board of the Explorer-88.

OUTPUT

The O command outputs one byte to the output device specified.

Format: 0 AD xx <

Where xx is the value of data outputted to port address AD

CASSETTE

The cassette read and write commands will not be discussed in any detail since the format used is the same as for the IPM PC.

TRACE

The T commands are perhaps the most important in the monitor. They allow you to single-step through a program tracing the execution of each instruction and observing the registers at every step. After execution, control is returned to the monitor and the new value of CS:IP along with the next instruction to be executed is displayed. Optionally, all registers may be displayed if the T command is followed by an R (TR command). This command also allows tracing more than one instruction at a time by entering an asterisk followed by the desired iteration count value. The formats are:

T FA <

T FA *nnnn <

TR FA <

TR FA *nnnn <

As an example of how to use the trace command, lets trace the P(ROM) test portion of the hardware test. Before we start the trace, we have to make sure that code, data, and stack segments are set to match the definitions established when the monitor program was written.

Using the register commands, modify the following registers.

CS= F000 DS=0FF0 SS=0FF8

Now enter

TR F000:ECDO *5 <

This command will begin tracing the first 5 steps of the ROM testing program which starts at the absolute address FECDO. Note that the next address to be executed is EDB7. To complete the trace to the end of the test will require in excess of 16,000 steps because all 8K locations of the ROM are added together and checked for the proper result. Step through the first part checking the registers against the results you might expect.

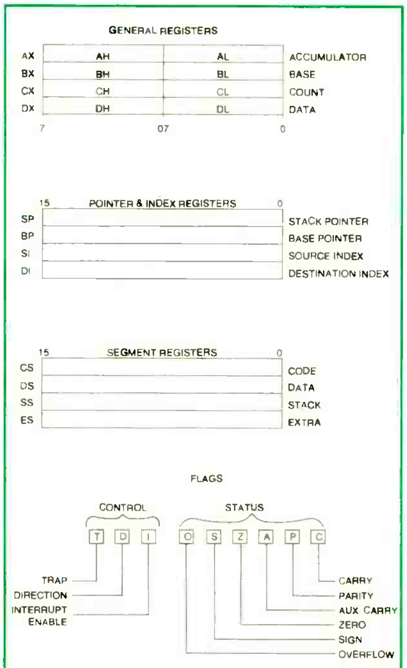

Fig. 20. 8088 registers.

GO

The G command starts program execution at the Full Address specified. If no address is specified, then execution starts at the current CS:IP location. There is an optional break-point address that can be entered to cause control to be passed back to the monitor if the break-point is entered, the monitor looses control of the system. A dash or hyphen entry must precede the break-point address. All registers may be displayed after the break-point is reached if the "GR" command is used. Format:

G (FA) (-AD) <

GR (FA) (-AD) <

Try the Go command by going to the beginning of the monitor hardware test which begins at F000:EDB7. Make sure that the CS, DS, &SS registers are set as described in the trace test. Enter

G F000:EDB7 <

The hardware tests should now be executed just as if they were called directly by the monitor. To test the breakpoint enter GR F000:EDB7-EE05. This will cause the program to break at the beginning of the cassette test.

HARDWARE TEST

The format is: HT <

The final test described is a complete hardware test to perform diagnostics.

1. Read only memory
2. Random Access memory
3. The cassette interface
4. The interrupt controller
5. The timer circuitry
6. The DMA controller
7. The RS 232 port (not tested in the IBM compatible version)

Enter:

HT <

Conclusion. Keep in mind that the 8086 and 8088 are almost "clones," although the 8088 has an 8-bit external data path to memory and I/O and the 8086 can transfer 16 bits at a time, the two processors are otherwise identical. Software written for one CPU can run on the other, without alteration.

What is more important is to experiment with the commands within the Explorer-88 monitor. There is no way you can cause physical harm to the system by issuing wrong or faulty commands. The worst thing that can happen is for the system to "hang up." In this case, simply reset and start over. ◇

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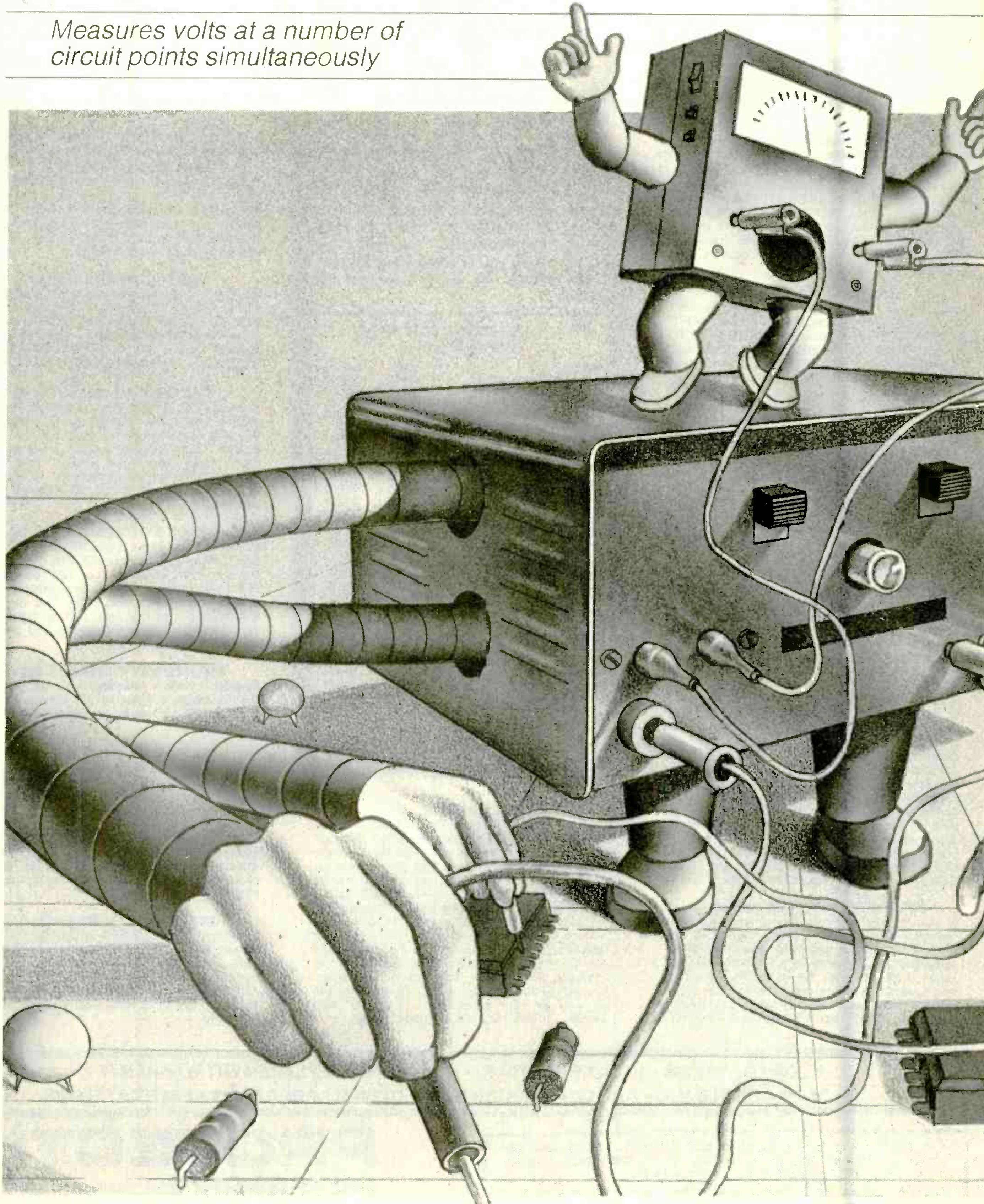
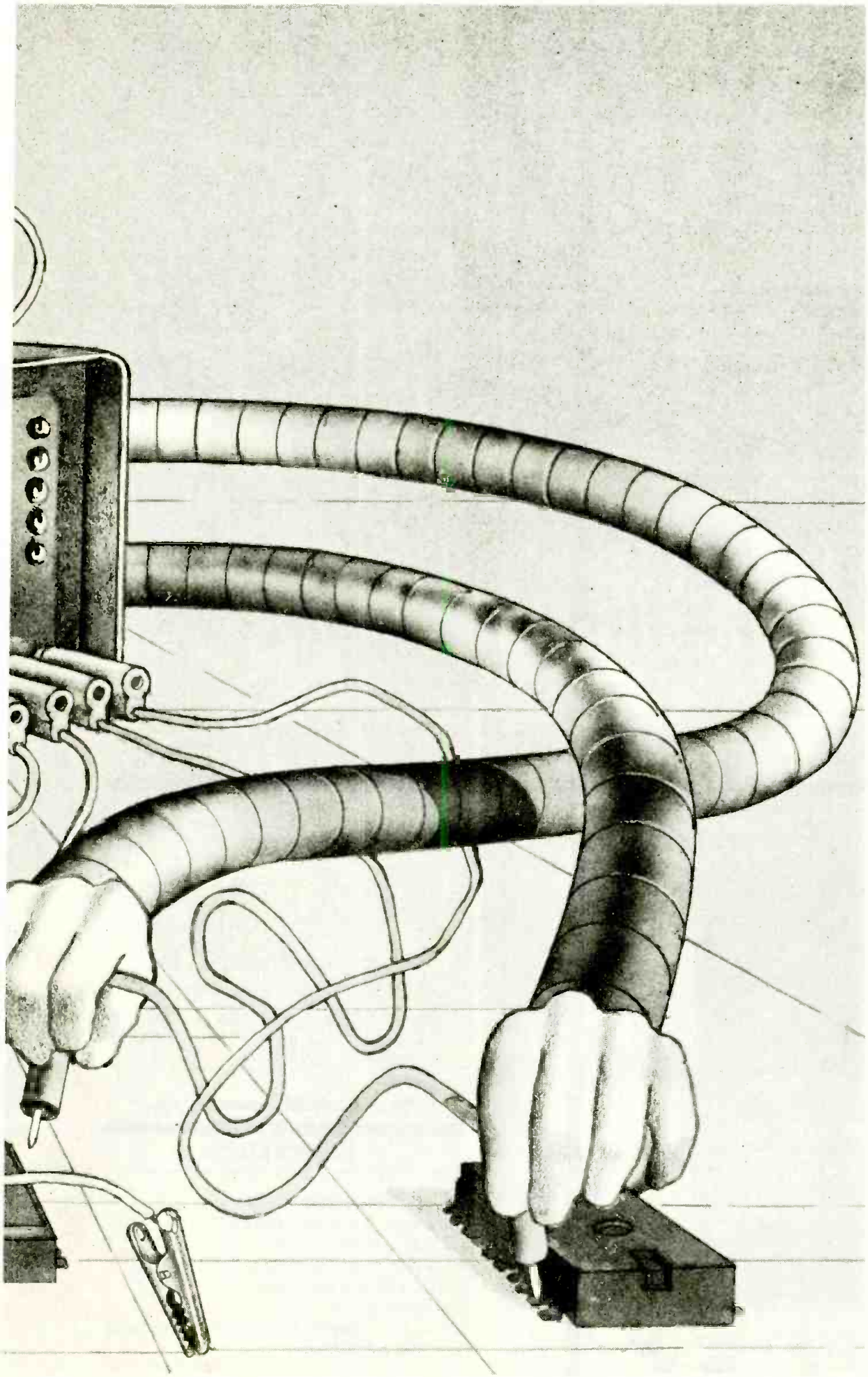


MONITOR

By George Gooder

HAVE you ever had a situation arise in troubleshooting or aligning an electronic circuit when adjustments of a potentiometer, capacitor, or coil caused two or more test point signals to vary simultaneously? When this happens, you must either move your test equipment inputs from one point to another or use several pieces of the same equipment to monitor each test point at the same time.



The Multiple Test-Point Monitor described in this article overcomes this problem. It can measure up to four test points at intervals of 1 to 10 seconds. All four test points can have the same polarity, or two can have positive polarity and the other two negative. The monitor can also be set to operate on two test points only or "look" at one preselected test point indefinitely.

Circuit Operation. As shown in Fig. 1, the circuit is based on *IC2*, a 4-bit shift register. The inputs to this register are loaded with a binary "1000" when pins 4, 5, and 6 are low, and pins 9 and 10 are high.

When pin 10 is forced low and the right shift is activated by a signal on pin 2, clock pulses from *IC1* shift the 1 bit to the right thus changing the binary word at pins 12 through 15. After a 2- or 4-bit shift (whichever is selected by *S2*), the 1 bit returns to the A output (pin 15).

Switch *S2* performs two functions. It initializes the *IC2* ABCD inputs to binary 1000 and sets the system to shift 2- or 4-bit positions. When *S2* is momentarily activated, it places a low at pin 1 of *IC3A* (a set-reset flip-flop) which forces its pin 3 high. This high is coupled to pin 10 of *IC2*. With pin 9 of *IC2* tied to high, the next clock pulse will initialize *IC2*. The low-to-high transition at *IC3A* pin 3 is also fed to the clock input of *IC6A* to toggle this flip-flop. When *IC6A* is set, *IC2* shifts 4 bit positions, and when *IC6A* is reset, *IC2* shifts 2 bit positions. The shift is actuated by a closure of momentary switch *S2* for one clock pulse.

Transistors *Q1* and *Q2* are driven by the A and B outputs of *IC2*, while *IC4A* and *IC4B* gate bits C and D from *IC2* to transistors *Q3* and *Q4*, with *IC6A* inhibiting or enabling the two gates. When *IC6A* is set, the gates are enabled, and when *IC6A* is reset, they are inhibited. Gate *IC4B*'s output at pin 6 is also fed to *IC5A* to reenter the 1 back into the shift register A position after 4 shifts, while *IC4C* shifts the 1 back to the shift register when the system is in a 2-bit monitor position. Gate *IC4C* is enabled or inhibited by *IC6A* depending on whether the latter IC is set or reset. Gate *IC5B* puts bits A and B from *IC2* through to one section of *S3* to activate *Q5*. Transistor *Q5* and relay *K5* form a polarity-switching network that allows negative signals to be monitored at *J1* and *J2* without changing the voltmeter leads.

The clock signal generated by *IC1* can be adjusted from one pulse per second to one pulse every 10 seconds by potentiometer *R3*. The clock output is fed to one input of AND gate *IC4D*, whose other input comes from the set-reset

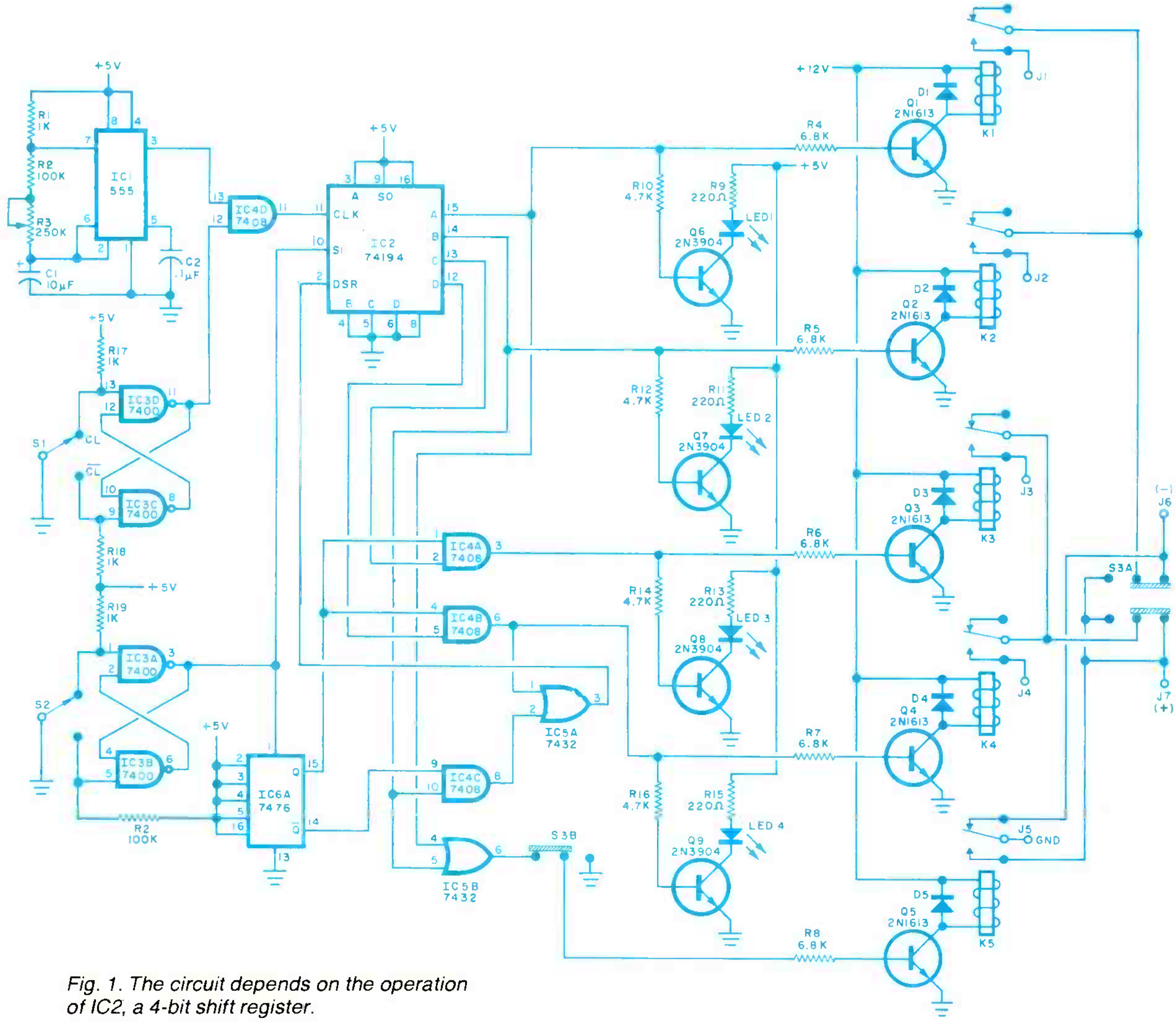
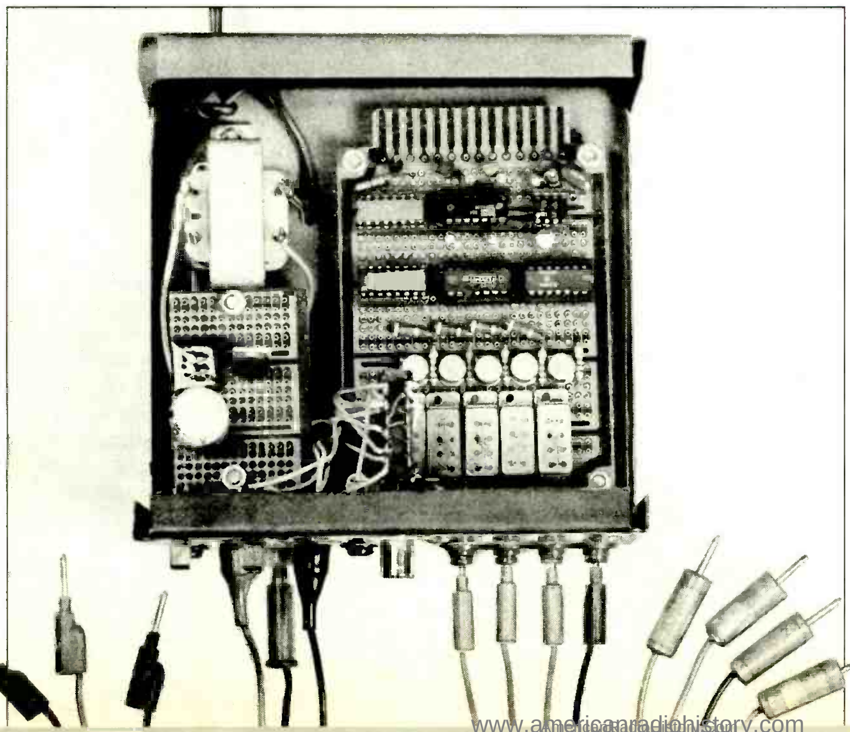


Fig. 1. The circuit depends on the operation of IC2, a 4-bit shift register.



At left is a view of the inside of the author's prototype.

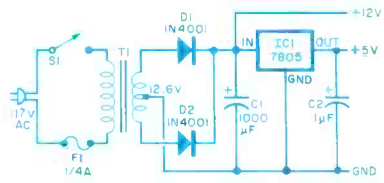


Fig. 2. A suitable power supply.

PARTS LIST

C1—1000-μF, 25-V electrolytic
C2—1-μF, 10-V electrolytic
D1,D2—1N4001 diode
F1—¼-A fuse with holder
IC1—7805 5-V regulator
S1—Spst switch
T1—12.6-V center-tap transformer (Triad F-25X or similar)

PARTS LIST (Fig. 1)

C1—10-μF electrolytic
C2—0.1—μF capacitor
D1 through D5—1N914 diode
IC1—555 timer
IC2—74194 4-bit shift register
IC3—7400 quad 2-input NAND gate
IC4—7408 quad 2-input AND gate
IC5—7432 quad 2-input OR gate
IC6—7476 dual JK flip-flop
J1 through J7—Banana connector
K1 through K5—Spdt relay
LED1 through LED4—Red light-emitting diode
R1,R17 through R20—1-kilohm, 5%, ½-W resistor
R2—100-kilohm, 5%, ½-W resistor
R3—250-kilohm potentiometer
R4 through R8—6.8-kilohm, 5%, ½-W resistor
R9,R11,R13,R15—220-ohm, 5%, ½-W resistor
R10,R12,R14,R16—4.7-kilohm, 5%, ½-W resistor
S1—Spdt slide switch
S2—Spdt momentary-contact switch
S3—3pdt slide switch
Q1 through Q5—2N1613 transistor
Q6 through Q9—2N3904 transistor
Misc.—Suitable enclosure, knob, press-on types, etc.

flip-flop formed by *IC3C* and *IC3D*.

The *IC3* flip-flop is switched by the operation of *S1* to either enable or inhibit the clock signal from reaching *IC2*. Stopping the clock signal allows indefinite monitoring of one selected test point.

The four lines driving relay drives *Q1* through *Q4* are monitored by transistors *Q6* through *Q9*, each of which has a LED and associated current-limiting resistor as a collector load. When the line goes high, it activates both sets of transistors thus selecting one line and indicating it by the glowing LED.

Construction. Since parts placement is not critical, any type of construction can be used. Once a board has been constructed, it can be mounted with the associated relays and a power supply (see Fig. 2 for a circuit) in a convenient enclosure. The front panel should mount the four input banana connectors *J1* through *J4*, the system ground connector *J5*, clock speed control *R3*, and the three switches (*S1* through *S3*).

Input connectors *J1* through *J4* are connected to the signals of interest, while *J5* is connected to the tested system's ground. Connectors *J6* and *J7* connect to the monitoring device being used (voltmeter, scope, etc.) in accordance with the polarity specified by *J6* and *J7*. ◇

BEEP! BEEP! BE....

Add a power-failure sensor to any ac digital clock

By James Antonakos

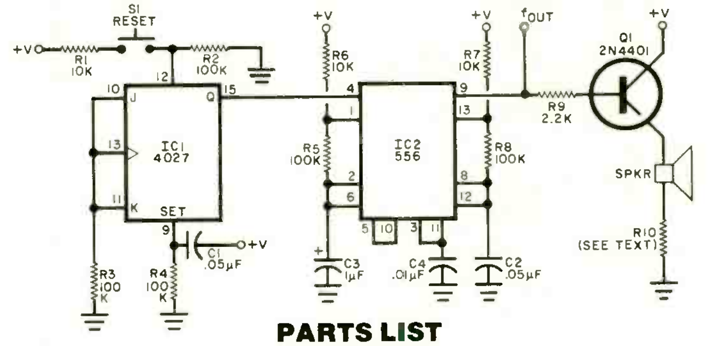
MOST digital clocks do not have the backup circuits (reserve power supply and oscillator) necessary to keep them running during a power outage. Thus, it is possible that someone glancing casually at a clock can be misled as to the time. One way to combat this problem is to install the "Power Out Sensor" in your digital clock. After a power failure, the circuit will "beep" until you reset the clock.

Circuit Operation. When power is first supplied to the circuit, a positive spike, produced by *C1*, is applied to the SET input of flip-flop *IC1*. This causes the Q output to go high and enables one half of the dual timer, *IC2*. The latter oscillates at about 5 Hz, alternately enabling the other half, a 1-kHz oscillator. The circuit will continue to oscillate until the flip-flop is reset by momentarily closing *S1*. This forces Q low and disables the timer. The circuit will remain in this state because the inputs to the 4027 are grounded through *R3*. Therefore, the circuit is actuated only when power is shut off and then re-applied.

The output from *IC2* is applied to emitter follower *Q1*, which drives the speaker through *R10*. The value of the latter resistor is selected for the desired audio level. If the clock is a radio alarm, its speaker can be used, or any small type of speaker can be added. If desired, the audio oscillator output from pin 9 of *IC2* can be used to drive any external audio system.

Construction. Assembly is not critical. The prototype was built on a standard perf board cut to fit into the clock to be used. A printed-circuit board could be used but is not required and is time-consuming to prepare.

Because CMOS integrated circuits are used, the supply voltage can be any value between 5 and 18 V, a range suitable for most applications. The current drain for the alarm is only 30 mA and can be safely drawn from most clock power supplies. ◇



PARTS LIST

C1, C2, C4—0.05-μF capacitor
C3—1-μF, 35-V electrolytic
IC1—4027 CMOS dual JK flip-flop
IC2—556 dual timer
Q1—2N4401 transistor
R1, R6, R7—10-kilohm, ¼-W resistor
R2 through R5, R8—100-kilohm, ¼-W resistor
R9—2.2-kilohm, ¼-W resistor
R10—See text
S1—Normally open pushbutton switch
SPKR—8-ohm speaker
Misc.—Mounting hardware, perf board, IC sockets, etc.

Improving TIMEX/SINCLAIR Tape Loading

Reduce troublesome dropouts and noise problems

By Tim Stoner

THE Sinclair/Timex ZX81/1000 is an excellent computer for its price. However, as a result of design compromises made to keep the price low, there are some shortcomings. The most annoying of these is the delicate nature of the tape loading process. Frequently, a cassette has to be run several times before a good load occurs.

Although the tape SAVE/LOAD function within the computer is designed well, tape hiss, dropouts, and other forms of noise from low-cost tape can cause problems. The use of high-quality tapes may not solve the problem either since distortion produced by inexpensive cassette recorders can also make tape loading a frustrating experience. The purpose of the "Z-Dubber" described in this article is to improve tape loading and also allow the user to reliably copy a tape.

The Tape Signals. An idealized pulse train that drives the input of the cassette is shown in Fig. 1A. A sync pulse, or clock burst, consists of four pulses. If the data is a "one," the four pulses are followed by a "silent period" of approximately the same width as the series of four pulses. A "zero" consists of eight pulses, rather than four.

The purpose of this specialized waveform can be seen in Fig. 1B. When the pulses are played back into the computer, they are applied to a one-shot multivibrator within the multipurpose chip. This circuit modifies the input (as shown in Fig. 1B) by creating an "envelope" of the pulse train. The four pulses become one clock pulse, which is used to synchronize the loading sequence. A gap after the clock pulse represents a "one." However, when eight pulses occur, the period following the clock stays at the same level as the clock and represents a "zero."

This scheme is said to be self-clocking, and is very tolerant of playback speeds that are faster or slower than the original recording speed. The data stream provides a series of evenly spaced clock pulses, each of which is followed by a data pulse. The synchronization circuit in the computer waits until the arrival of a clock pulse, then starts looking for a "one" or a "zero."

It would appear that missing or misinterpreted data bits are eliminated by the conservative save/load design. However, the preceding explanation gave no consideration to the distortion introduced by the cassette recorder.

One of the principal reasons for tape-loading difficulties is that Sinclair/Timex does not supply or recommend a particular cassette recorder for use in conjunction with its computer. As a result, virtually every conceivable make and type of cassette recorder is being used to save and load Sinclair/Timex program tapes.

The pulses shown in Fig. 1A are those applied to the cassette recorder. The ideal waveform from the earphone jack of the cassette shown in Fig. 2A was generated from the waveform shown in Fig. 2B, the one that was used to make the recording. Unfortunately, these ideal waveforms are seldom seen. Inadequate high-frequency response can produce a distorted waveform such as that shown in Fig. 3A. Notice that the area where the one-zero information resides is predominantly positive. Depending at what level the computer makes its decision, the gap can become either a "one" or a "zero." If one single bit is wrong, a checksum error will occur at the end of the tape, and it's rewind time again.

Poor transient and high-frequency response combined can make the ideal waveform look like Fig. 3B. This is a very common type of distortion created by cassette recorders with a slow acting automatic volume control circuit.

Another form of distortion commonly encountered is poor low-frequency response that results in the tilt of the gap in Fig. 3C. This improper waveform can cause the circuit to make an improper one-zero decision.

The Mystery Buzz. Just before the computer starts to SAVE to a cassette, a 60-Hz "buzz" occurs for a few seconds. Some users have blamed this on "motor noise" from the cassette. Actually, this is the sound of vertical sync pulses leaking out of the computer into the tape recorder. The Z-Dubber circuit will filter this noise below the level where it is troublesome. However, when making copies of existing tapes, it is a good idea to fast-forward the tape past the point where the buzz ceases.

Circuit Operation. As shown in the schematic diagram on page 86, the circuit is designed around *IC1*, a quad operational amplifier. Only three sections of the device are used. This particular op amp was selected since it is able to operate efficiently when powered by ±1.5 volts.

The input at *P1*, connects to the earphone jack of the cassette recorder. Resistor *R1* provides a load for the recorder audio, while *R2* couples the signal

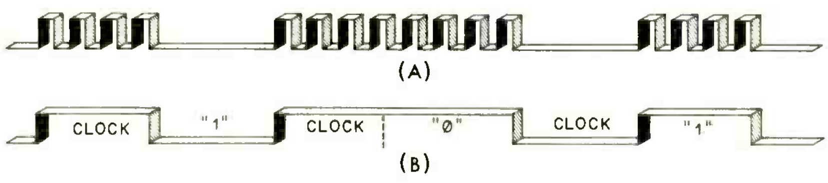


Fig. 1. Idealized pulse train representing zeros and ones.

"One of the principal reasons for tape-loading difficulties is that Timex/Sinclair does not supply or recommend a particular cassette recorder for use with its computer."

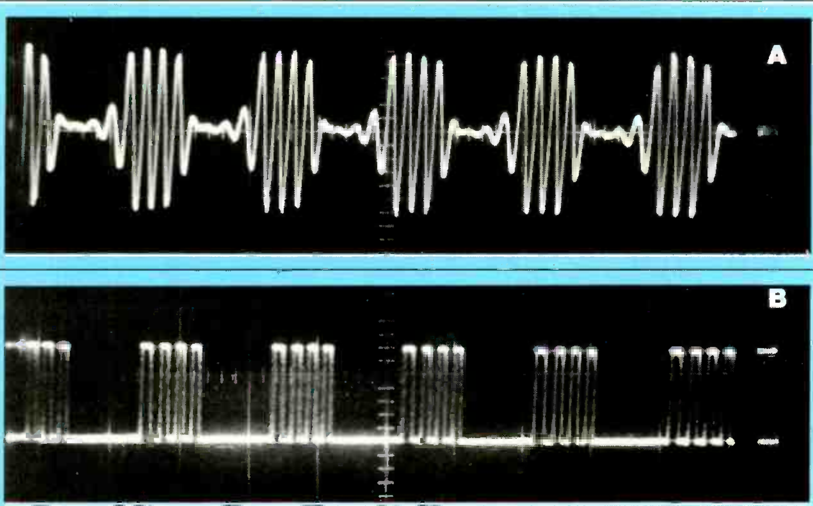


Fig. 2. Output of IC1A is shown at (A), which is amplified in IC1B, whose output is at (B).

into an active filter formed by *IC1A* and its associated components. This type of circuit passes and amplifies the resonant frequency, and attenuates all others. The center frequency of the *IC1A* filter is approximately 3000 Hz, which appears to be the approximate frequency of the recorded pulse bursts. This responds only to sine waves and ignores distortion which appears between the pulse bursts. The output of *IC1A* is nearly ideal and is shown in Fig. 2A. This is the signal that would have been produced if there were no distortion generated by the cassette recorder.

The output of *IC1A*, feeds the inverting input of *IC1B* and appears greatly amplified at the output of *IC1B*. A small amount of the output is fed back to the noninverting input through *R8*. The feedback provides a small amount of hysteresis, which causes the circuit to switch states slightly above and below the centerline. The hysteresis prevents this stage from switching at zero crossings and thus ignores "glitches" and noise pulses which might get through the active filter.

The output consists of a series of four or eight square waves (depending on whether a one or zero is present). The signal is shown in Fig. 2B and is an exact reproduction of the waveform which originally made the recording. This output is coupled to the computer input jack via *C5* and *P2*.

Since the original waveform has been reproduced, it can be used to feed the microphone input (via *PL3*) of a second, or "slave," cassette recorder. This can be extremely useful for making backup copies of machine-language programs and other difficult-to-copy tapes. The signal is fed to the "slave" recorder through *R10* and *C6*, with *R11* acting as a voltage divider to reduce the signal level. This is necessary to prevent overloading the microphone input of the slave recorder. The value of resistor *R11* can be increased or decreased if the recording level for your cassette proves to be too low or too high.

The noninverting input of *IC1C* is pulled high by *R12*. Since the inverting input is grounded, the output on pin 14 is also high. Thus, no current flows through *LED1*. However, when pulses appear at the output of *IC1B*, the cathode of *D2* is brought low. This causes the output of *IC1C* to go low and allows current to flow through the LED, thus causing it to glow. When the pulses make the cathode of *D2* go high, the relatively slow discharge of *C4* keeps the noninverting input of *IC1C* low between data pulses. Thus, the output remains low as long as data is passing through and *LED1* steadily glows. This is useful for setting the correct level of the playback cassette.

Testing and Using. The circuit can be wired point-to-point on perforated board, or a pc board using the foil pattern shown in Fig. 4 and the component installation of Fig. 5 can be used.

Before installing the two AAA cells, set switch *S1* to the ON position. Connect one lead of an ohmmeter to the shielded braid of one of the cables (ground). Measure the resistance to the plus and minus battery terminals. The reading should be in excess of 1000 ohms. If it is not, look for solder splashes, semiconductors inserted backwards, and so on. Don't insert the batteries until the condition is corrected.

With the LED, *B1* and *B2* correctly

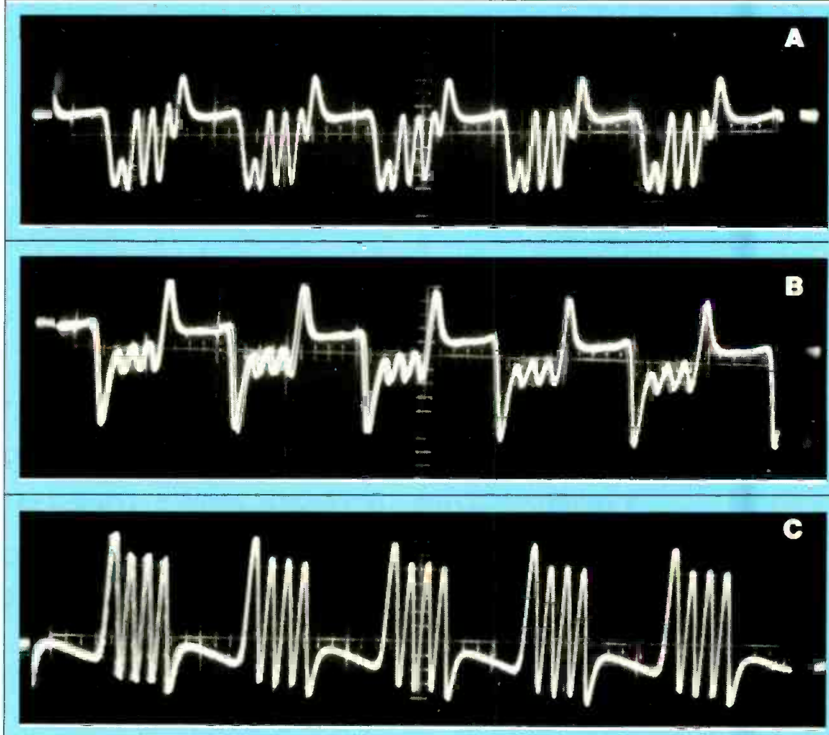


Fig. 3. Three forms of distortion involving poor transient and low- and high-frequency response.

inserted, the LED should glow when pins 1 and 11 of *IC1* are temporarily jumpered.

Insert *P1* into the earphone jack of the cassette with the tape to be loaded. Insert cable with *P2* into the jack labled EAR on the side of the computer. One half of the cable supplied with the computer can be used to connect the MIC jack to the microphone input of the cassette recorder for saving programs, if desired. It is not necessary to use this cable to simply load tapes. The remaining cable from the Z-Dubber *(P3)* can be left hanging until a second recorder is connected for copying.

Before attempting to load a tape, get the "feel" of the volume control. Even though the computer is not yet turned on, the LED should glow at some point as the cassette recorder volume is increased. Notice that as the volume is

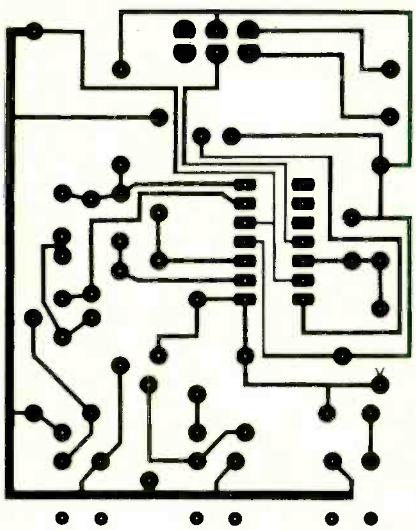


Fig. 4. Actual-size foil pattern for the circuit board.

raised and lowered, the LED goes on and off. The correct setting is 10-20 degrees past where the LED first illuminates. This will ensure that "weak spots" on the tape do not drop below the threshold level. If the volume level is advanced too far, the signal may overload the Z-Dubber.

Once you feel you have the correct setting, rewind the tape to the start of the program (where the musical buzz starts), power up the computer and follow the vendor's instructions for loading the tape.

Normally the LED should remain lit. If it flickers off and on, the volume is set too close to the threshold and should be slightly advanced. As the tape is load-

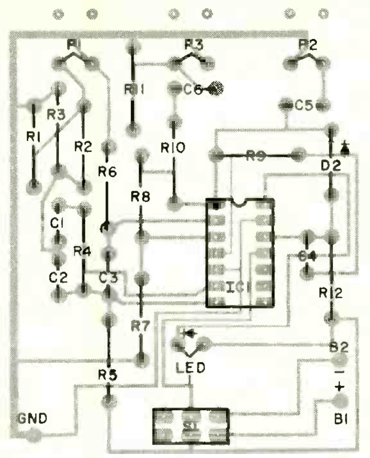


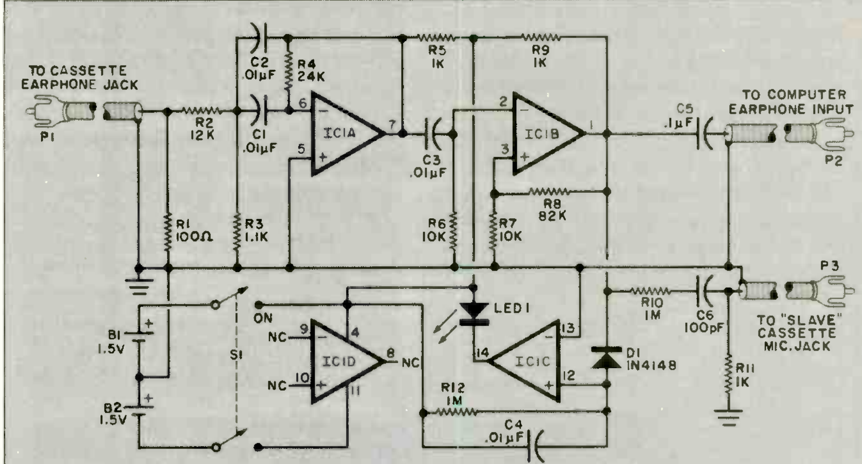
Fig. 5. Component layout diagram.

ing, evenly spaced black-and-white bars should be noted on the TV screen.

It should be possible to get a good load the first time the Z-Dubber is used. However, this may not occur until the user becomes familiar with the relationship between the volume control and the LED. Once the correct setting is found, note the amount of rotation beyond the point where the LED first glows. The correct setting depends on the volume level at which the program was recorded and will vary from tape-to-tape. One will find that different tapes may require different settings of the volume control. Always add the few degrees of volume advance to that required to illuminate the LED.

Making Copies. The procedure for making tape copies is almost exactly the same as for loading tapes. In fact, to ensure a perfect reproduction, the tape should be loaded at the same time the copy is made. When the tape is loaded properly, the user can be assured that the copy is perfect. The signal to the "slave" recorder is essentially the same (except for a much lower level) as is fed to the input of the computer.

As mentioned earlier, the tape being copied should be advanced to just before the point where the buzz sound starts. This way, one can "edit out" the vertical sync noise that appears on some tapes. Always use good quality tape in the slave" recorder and don't forget to leave a 10-second leader at the beginning of the new tape. This will eliminate plastic leaders, wrinkles, and so on. ◇



Schematic diagram of the circuit.

PARTS LIST

B1,B2—1.5-V AAA cell
C1,C2,C3,C4—0.01-µF monolythic capacitor
C5—0.1-µF, 50-V disc ceramic capacitor
C6—100-pF silver mica capacitor
D1—1N4148
IC1—LM324 quad operational amplifier
LED1—MV50 or similar light emitting diode
P1,P2,P3—12" shielded cable, terminated in miniplug
R1—100-ohm, ¼-W, 5% carbon resistor
R2—12-kilohm, ¼-W, 5% carbon resistor
R3—1.1-kilohm, ¼-W, 5% carbon resistor
R4—24-kilohm, ¼-W, 5% carbon resistor
R5,R9,R11-1-kilohm, ¼-W, 5% carbon resistor
R6,R7—10-kilohm, ¼-W, 5% carbon resistor
R8—82-kilohm, ¼-W, 5% carbon resistor
R10,R12—1-megohm, ¼-W, 5% carbon resistor
S1—Dpdt slide switch
Misc.—Suitable enclosure, perforated or printed circuit board, battery holder, for two AAA cells, tie wraps (3), double-sided "sticky" tape for securing pc board.

Note: The following is available from Bytesize Micro Technology, PO Box 12309, Seattle, WA 98111: kit of all parts and materials at $22.95. Also available separately: pc board at $8.50 punched and silk-screened cabinet at $6.50. Postage and handling prepaid.

A VIC-20 CASSETTE ADAPTER

Interface for the Commodore VIC-20 allows any audio cassette recorder to be used

By Bernard J. Sheehan

No longer must one pay almost as much for the VIC "digital" cassette machine as for the VIC-20 computer itself. Frugal owners will be happy to learn that a simple, easily built, dependable circuit, costing about $7, can be used to interface the VIC-20 with any commonplace audio cassette tape recorder.

Circuit Operation. The circuit, shown in Fig. 1, is based on *IC1*, a hex Schmitt trigger package. The main characteristic of such a trigger is that it will convert an irregular input waveform into a train of clean, square-edged pulses at TTL levels. Typical operation of a Schmitt trigger is shown in Fig. 2. Diode *D1* prevents the cassette audio from applying a negative signal to the Schmitt.

As shown in Fig. 2A, the Schmitt has an upper and lower triggering threshold. When the input voltage level rises above the upper-trigger level, the output of the stage goes high and remains high as long as the input voltage level exceeds the lower trigger level. When the voltage drops below the lower trigger level, the stage output drops to zero. This action is shown in Fig. 2B.

Note that, even if the varying input voltage drops below the upper trigger level, as long as it does not go below the lower trigger level, it will not affect the output signal. It is this "dead band" between the upper and lower triggering threshold that gives the Schmitt trigger the capability to ignore random fluctuations in the input signal level.

Since the circuit is not sensitive, any type of construction can be used (point-to-point wiring on perf board or a small pc board). Any pair of gates in *IC1* can be used. Power is obtained from the B line of the VIC-20 cassette port connector (with ground coming from pin A). To minimize chip current drain, ground the *input* of the four unused gates.

The cassette interface is connected to the VIC-20 cassette edge connector through *J1*, which can be made from any edge connector having 0.154" spacing.

Use. Connect *J1*, the cassette interface, to the VIC-20 cassette port, and connect the cassette recorder audio output to *J2*. Then connect *J3* to the microphone input connector on the VIC-20 computer.

To store a program on cassette, type SAVE, with the computer responding by printing PRESS RECORD AND PLAY ON TAPE. At this point, the computer halts. Simultaneously depress the PLAY and RECORD buttons on the recorder, then close *S1* on the interface. The computer sends data to the cassette recorder. The cassette volume control will have to be adjusted for the correct signal level. However, once this is done, the knob position should be marked and never moved.

To load a program from the cassette, type LOAD on the computer, then close *S1*. When the interface is not in use, open *S1*. ◇

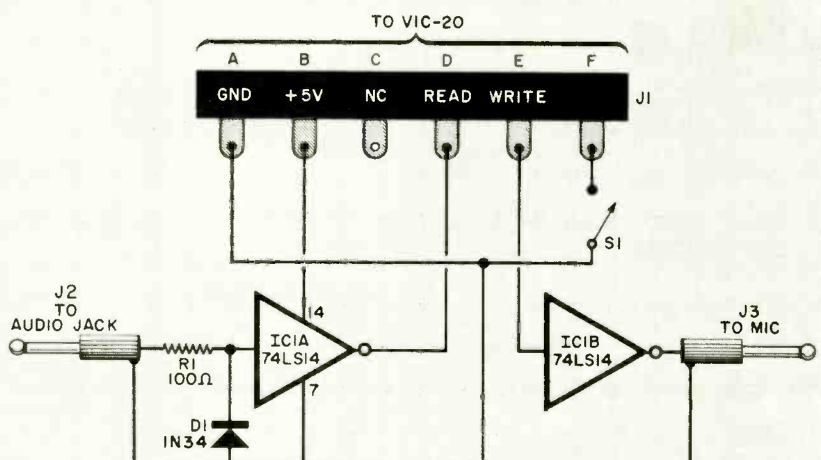


Fig. 1. The circuit uses a hex Schmitt trigger package to convert the irregular input into a train of smooth pulses.

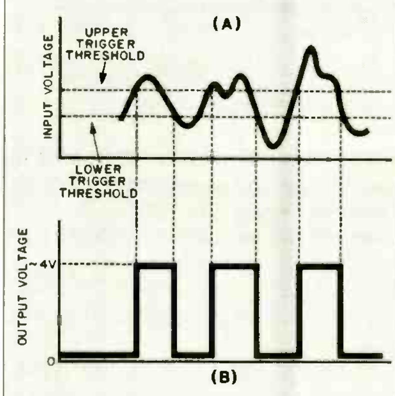


Fig. 2. As shown at (A), the triggering of the circuit is determined by the upper and lower levels of the input signal. Whether or not the circuit is triggered determines the output level at (B).

Digital TV— How Soon?

By Len Feldman

For some three years now, several high-tech consumer electronic companies such as Sony and Panasonic have been demonstrating what they call "high-definition" TV. The television pictures they have shown consist of between 1050 and 1150 lines per frame, or more than twice the number of lines currently in use in standard NTSC TV transmissions (used in the United States and Japan). European TV, which for the most part employs a 625-line format, offers far better definition or picture resolution than U.S. television, but still suffers by comparison with these experimental systems. In addition to the greater number of lines per frame employed in these systems, the aspect ratio (picture width to height) has been increased over the present standard of 4:3. This was done to accommodate motion pictures that were filmed for wide-screen viewing, but are shown on TV with their sides chopped off.

Although high-definition TV is certainly a worthwhile achievement, there is currently no way for such superb-looking TV pictures to be transmitted over the air. Present TV frequency allocations, established in the "dark ages" of television, assign a bandwidth of just 6 MHz for each TV channel, for both vhf (channels 2 through 13) and uhf (channels 14 through 83) service. This 6-MHz bandwidth accommodates the present 525-line system, its associated color sub-carrier signal, and even currently proposed (but not yet approved) stereo or multi-lingual audio channels. But an increase in the number of lines per frame would mean an increase in each channel's frequency bandwidth. The FCC is not about to revamp the entire TV broadcasting frequency band at this time, what with more than 80-million households now owning one or more TV receivers.

There has been talk of developing a new band of frequencies for high-definition TV, way up in the 12 gigahertz (GHz) region. In fact, some have proposed that the FCC make provisions in that "empty" and spacious frequency region not only for high-definition TV, but for *digital* high-definition TV. A digital system might require frequency assignment in excess of 30 MHz per channel, but such wide channel bandwidths are perfectly feasible up at 12 GHz. What's more, the 12-GHz frequency band is being proposed as a new satellite frequency band. This means that if the industrialized nations of the world could get together and agree upon a high-definition TV standard, we might finally have a single, standardized, high-quality TV service for the entire world.

One Form of Digital TV Is On The Way. While we wait for such a system, several manufacturers have been hard at work improving the picture quality of today's TV receivers. At least two of them have indicated that they intend to market "digital" television sets before

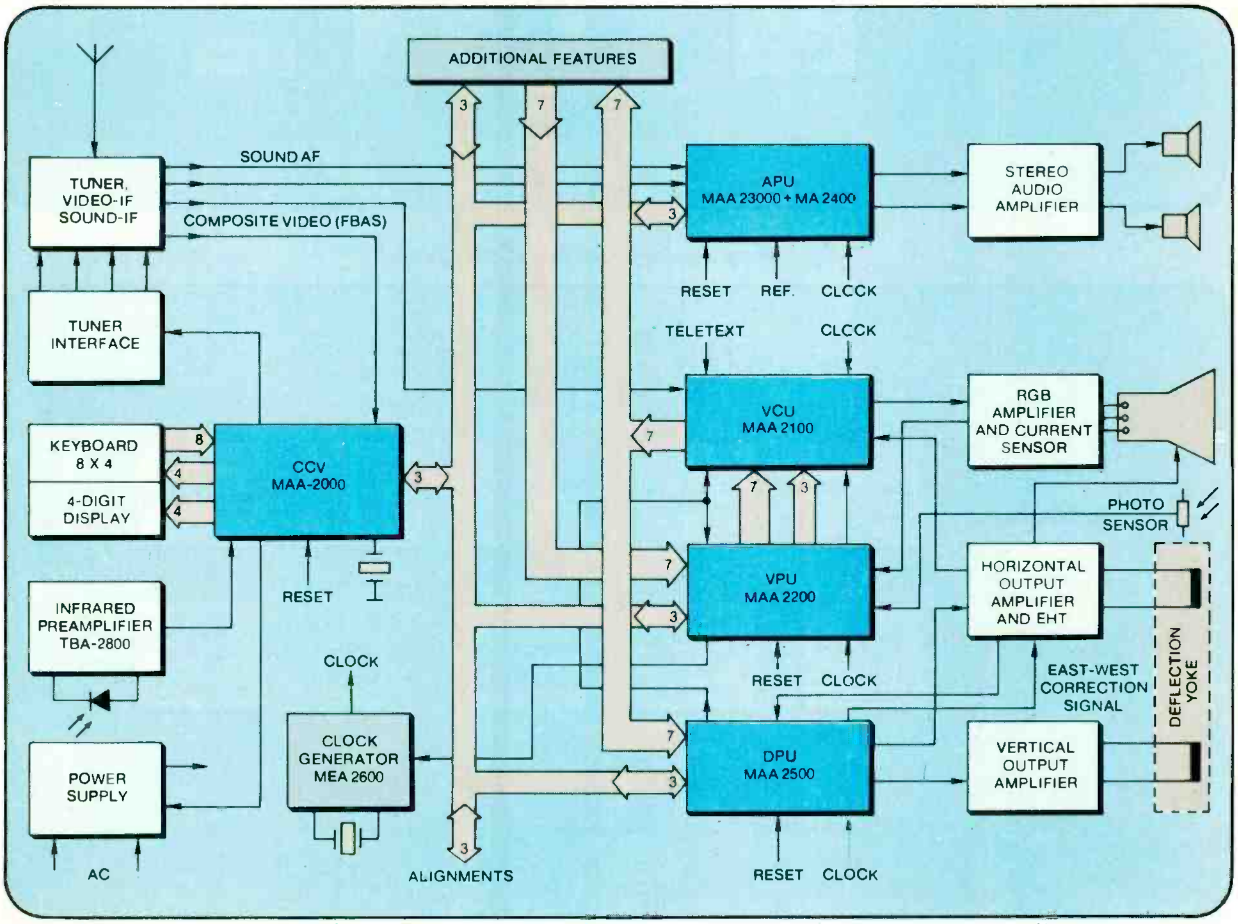


Fig. 1. Block diagram of ITT "digital" television receiver.

the end of 1983. However, these digital TVs will still have conventional (i.e. analog) front ends and I-f sections. The signals demodulated by the analog circuitry, which have a bandwidth of only 4 or 5 MHz, will then be digitized. The signal processing, including the analog-to-digital conversion, will be done by a set of eight chips that contain five VLSI (very large scale integrated) circuits. These chips, which were designed and produced by the International Telephone and Telegraph Corp. (ITT), are said to perform the work of about 300,000 transistors. According to ITT, digital TV sets using this technology can provide better image quality than is now available, at about the cost of today's higher priced sets. Furthermore, the kind of digital signal processing performed by these circuits will allow for the introduction of additional features over the years, such as the ability to zoom in on part of a picture, simultaneous viewing of two station signals (with one picture inset in the other), and the ability to process teletext.

As for better picture quality, ITT claims that at lest partial elimination of ghosts is possible. A digital TV set will be able to lock onto a sync signal to suppress interference from electrical appliances, passing aircraft, etc. Once a video signal is digitized, picture storage becomes possible. Such picture storage capability will provide a number of useful

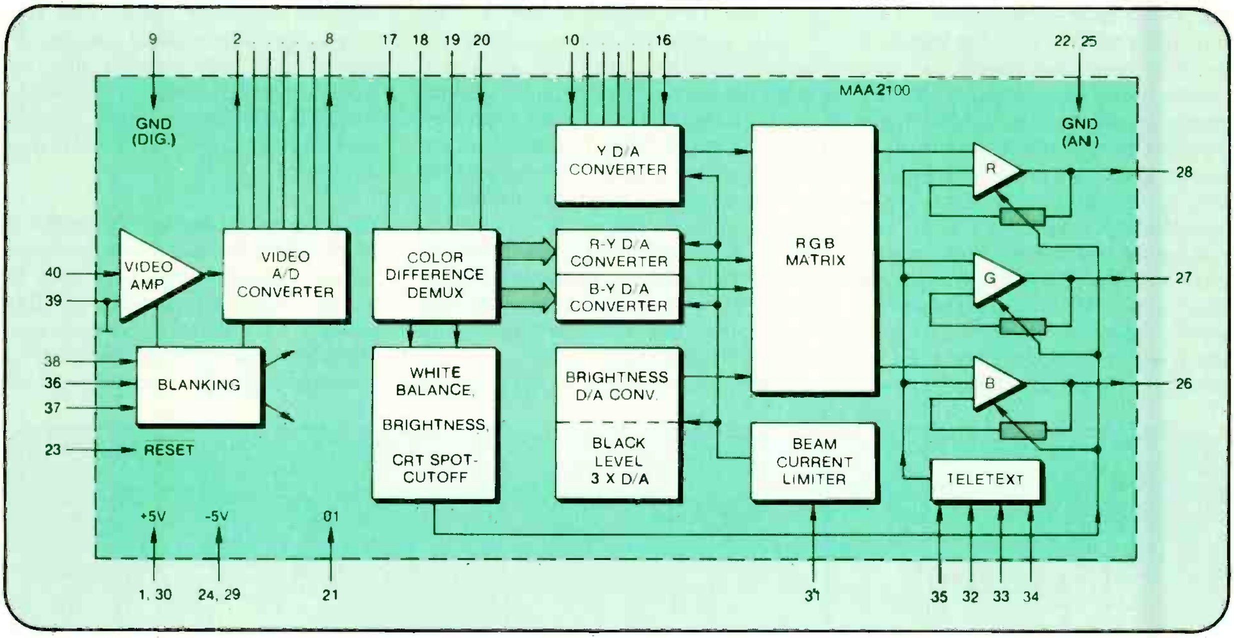


Fig. 2. Block diagram of the video CODEC chip.

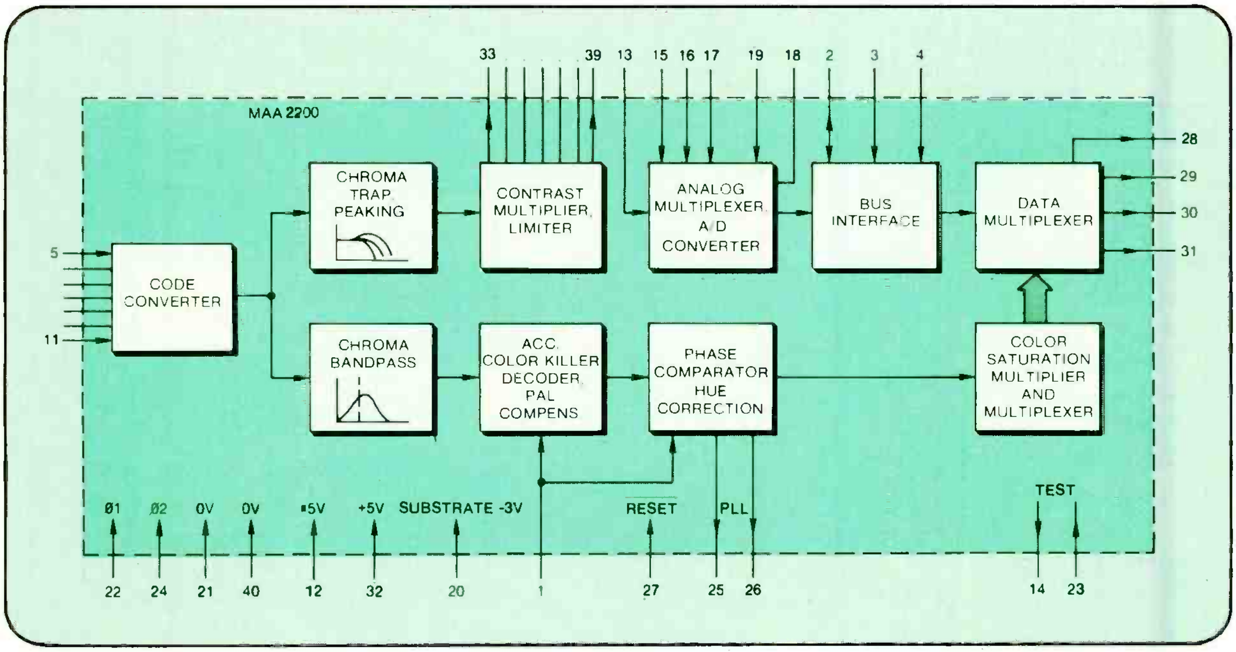


Fig. 3. How the video processor chip works.

features that are not possible using current analog technology. For example, it should be possible to provide a so-called pseudo high-resolution picture. The set would interpolate between scanning lines of a picture and produce additional scan lines that could be positioned between the original lines. This technique which would produce twice as many scan lines, would give the appearance of a high-resolution picture. Not only would a normal-sized picture seem much sharper, but the resolution or definition of pictures projected onto large screens would be greatly improved. If digital TV circuitry should ever be applied to video cassette recorders, the ability to store images would allow the user to watch pictures in slow motion or freeze frame without the usual "noise bursts" now common on analog VCRs.

Digital TV is also expected to be of great importance in the development of DBS (direct broadcast satellite) transmissions. For one thing, it overcomes incompatibility problems between our own NTSC system and European PAL and SECAM color-TV transmission systems. Digital sets can be designed to handle all three types of transmissions. In addition, digital TV would permit direct processing of satellite transmissions that are expected to include digital and multichannel sound transmission (bilingual and/or stereo audio). Normally, in the case of conventional receivers, such digital audio signals would have to be converted into analog form for further processing by analog circuitry.

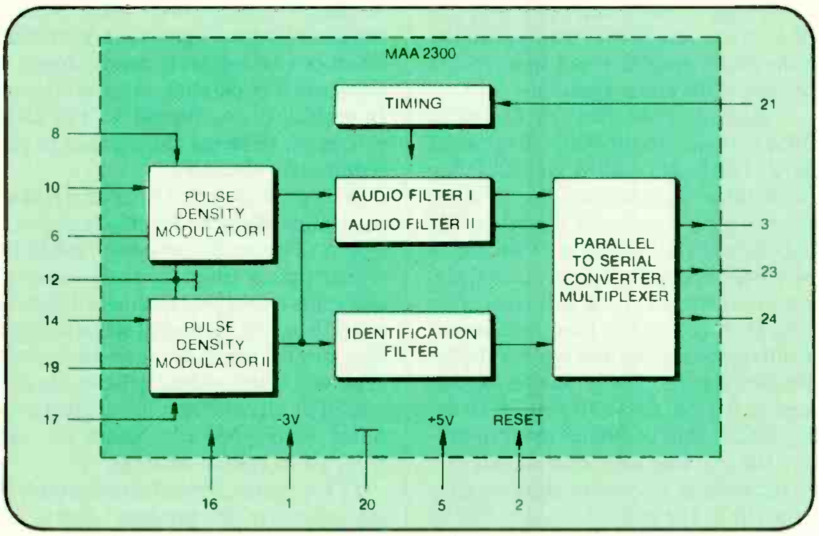


Fig. 4. Simplified diagram of the audio A/D converter.

How Digital TV Sets Work. A digital TV uses analog circuits until the incoming signal has been demodulated. Then both the video and audio demodulated signals are converted to digital form. Experience has shown that an 8-bit code is needed for proper resolution of the video luminance (brightness) signal; 6 more bits are required for the chroma (color) signal; 13 bits are needed, for the deflection signals; and 14 bits are required for the audio signal.

The digital processing is performed by five VLSI chips, aided by a clock generator, a digital amplifier, and a microcomputer that controls the process based upon the user's front-panel control settings. The five chips are a video "codec" (*coder/decoder*), which consists primarily of A/D and D/A converters for the video signal; an audio codec, which performs the same functions for the audio signals; a deflection control unit, which deals with the sweep synchronization signals; and video and audio processor units, which do the filtering and decoding of the video and audio signals. A block diagram of a com-

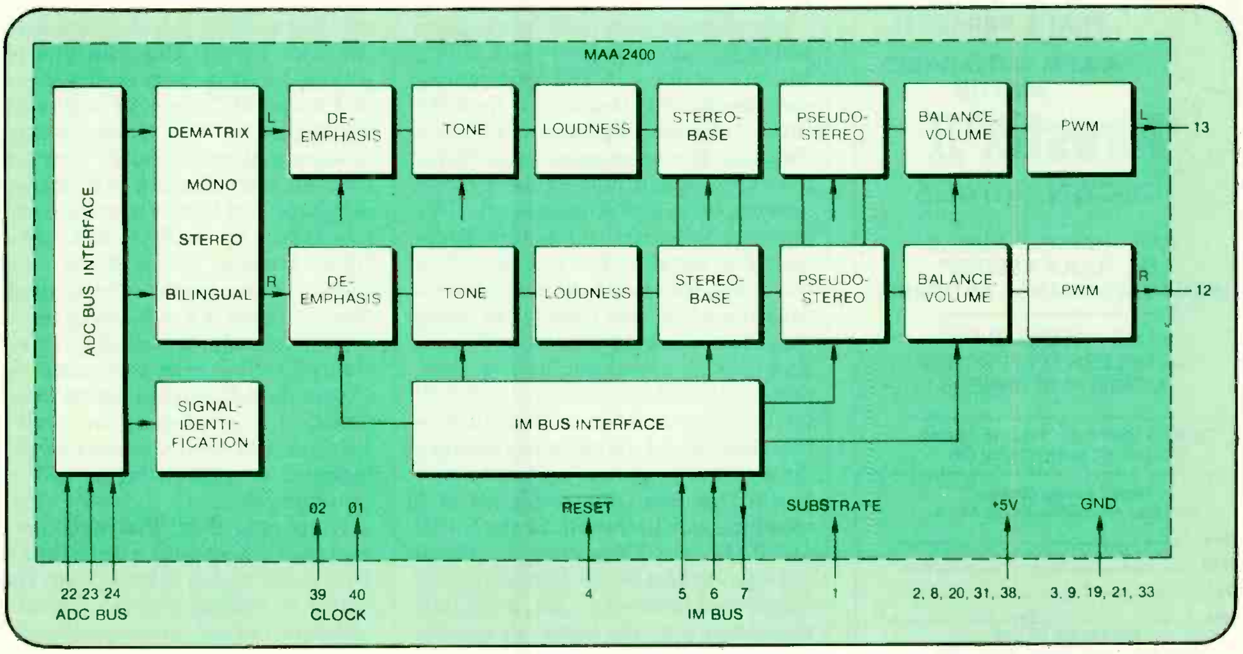


Fig. 5. Block diagram of the MAA2400 audio processor.

plete TV receiver using these chips is shown in Fig. 1.

Demodulated signals from the IF amplifier, at the upper left of the diagram, are fed to the video and audio codec chips, which convert the analog signals into digital. The digital signals are then passed along to the audio and video processor units. These units are controlled by the central control computer, which also receives inputs from the user via a keyboard or an infrared remotely controlled hand-held module. Signals from the video and audio processor units are fed back through the converter where they are changed back to analog and fed to the color beam amplifiers and the CRT (in the case of the video signals) or to the audio amplifier and speakers (in the case of the audio signals).

A more detailed view of the video codec is shown in the block diagram of Fig. 2. This codec is a bipolar VLSI chip which takes signals from the i-f stage and converts them into digital in the A/D block. The signals are then fed to the video processor. The processed signals are converted back into analog by three D/A converters (two for the color-difference signals and one for the luminance signal). These analog signals are then fed into the RGB matrix, an analog circuit that combines them to produce the red, blue and green signals that are fed to their respective electron guns in the CRT. The process is controlled by brightness settings passed on by the control computer from the user. The electron circuits on the chip can also be activated by a teletext input.

Signal processing that takes place within the video processor block of Fig. 1 is detailed in Fig. 3. The video processor takes the digitized output from the video codec and separates it into two channels. The luminance channel is filtered to emphasize high-frequency components, using a peaking network. This improves sharpness and picture definition. The signal is then passed on to a multiplier, which sets the contrast, and from there it is sent back to the codec chip. The chrominance channel signal goes through a bandpass filter, an automatic color control circuit, a comb filter, the color decoder, and then back to the codec. In the chrominance channel, the signal is amplitude controlled by a circuit that keeps the amplitude of a reference signal constant. In the NTSC and PAL color-TV systems, the signal codings for blue-minus luminance and red-minus luminance are amplitude modulated onto the carrier in quadrature (90 degrees apart). In the SECAM system (used in France) frequency modulation is used, with red and blue signals sent during alternate horizontal sweeps.

Processing the Audio Signals. The audio chip has two parallel-processing channels and an arithmetic/logic unit that shares them to carry out the required filtering operations. A block diagram of the audio A/D converter is shown in Fig. 4. It uses a pulse-density modulator and digital converter. The circuit samples a 4-MHz input signal and produces a 1-bit data stream, which is then converted into a 16-bit resolution stream at a 35-kHz sampling rate. A digital identification filter extracts the identification signal that determines whether a broadcast is mono, stereo, or bilingual. The parallel-to-serial converter multiplies the output to the audio processor, reducing the number of pins required for the chip.

A block diagram of the audio processor section of the audio chip is shown in Fig. 5. The audio processor takes the digital signals from the A/D converter and splits it into two channels. Each signal is then sent through a series of filters that control stereo balance, tone, loudness, etc. Filter characteristics are controlled by signals from the control computer chip and are based on user front-panel control settings.

ITT is, so far, the only semiconductor manufacturer to produce digital TV chips. If the chips prove reliable and the yield makes them economical enough to use in consumer products, the company plans to follow up with two-chip and one-chip versions that should make digital color TV sets competitive in price with the least expensive present-day color TV sets. ITT's own TV manufacturing division in West Germany expects to begin making digital TV sets sometime this year. The sets, to be marketed in Europe, will be able to receive signals transmitted by the PAL, SECAM and NTSC systems. Zenith Radio, in this country, also expects to begin production of digital TV sets using the ITT chips, but as of now exact dates or availability have not been announced. Sony Corporation, Sanyo, and Sharp International, all of Japan, as well as Telefunken of West Germany have also indicated an interest in the ITT chip development.

It appears, then, that although we may have to wait quite a while for a new TV system that is digital "from transmitter to receiver screen," digital enhancement of our present system of TV broadcasting may make the wait more tolerable. ◇

Homemade Electroscopes Experimenting with a Geiger Counter

By Forrest M. Mims, III

More About Radiation Monitors

THE subject of nuclear radiation often generates concern about human safety. I was reminded of this recently while gathering information for this column. I had taken a portable Geiger counter into a department store to search for radioactive materials. In the sporting goods department, I found what I was looking for. When I pushed the Geiger counter into a display of a hundred or more Coleman lamp mantles, the counter emitted a chorus of loud chirps. The saleslady was thoroughly alarmed. As you may know (she didn't), lamp mantles contain radioactive thorium.

This month we'll explore the topic of low-level radioactivity. We'll also build from common household materials a couple of electroscopes, a type of early voltage and radiation detector.

Recently I've heard from two manufacturers of radiation monitoring instruments in response to my coverage of this topic for this magazine (see "Solid-State Developments," April 1983). First, Mr. Al Zirkes, Marketing Manager of the Dosimeter Corporation (P.O. Box 42377, Cincinnati, OH 45242), sent a thick package of information about his company's wide ranging line of radiation measuring instruments and related products.

Among its electronic monitors is the MiniRAD-D (Fig. 1), a pocket-sized monitor that displays (on a 4-digit liquid-crystal readout) radiation levels up to 2000 milliroentgens per hour (mR/hr). It includes an audible indication of the radiation level as well as a visual indication provided by flashing LEDs. The MiniRAD-D sells for $375.

Another member of Dosimeter Corporation's family of compact electronic radiation monitors is the MiniCON®II (Fig. 2). It displays radiation levels on a conventional moving-coil meter and includes an audible output. A useful advantage of the unit is its cable-connected, external Geiger tube. This greatly simplifies some measurements since the tube can be placed in locations where instruments with internal tubes will not fit. The MiniCON II sells for $450.

Dosimeter Corporation makes a complete line of electronic radiation monitors like the MiniRAD-D and the MiniCON II, but its best-known product is based upon an operating principle not included in my previous column. Noticing this omission, Mr. Zerkes wrote that I failed to describe ". . . the largest selling and lowest cost personnel radiation detection device, the Direct Reading Pencil Dosimeter, which outsells all of the instruments noted by a factor of at least 100."

I purposely omitted direct reading dosimeters from the previous article since they are not usually considered *electronic* devices. Other such devices include film badges, certain plastics, and phosphor screens.

In a very real sense, however, Dosimeter Corp.'s pocket dosimeters are indeed electronic devices. In fact, they are the modern version of one of the very first electronic instruments, the *electroscope.*

Since Dosimeter Corp.'s pencil dosimeters sell for as little as $95, they are certainly economical. However, since they require a charger that costs another $80 or more, they are not as economical as some competing devices.

For example, Mr. Dan Sythe of Solar Electronics International (156 Drakes Lane, Summertown, TN 38438), the second firm to respond to my earlier article, loaned me one of his company's Monitor 4 radiation detectors. This instrument, which I briefly described in the previous article, indicates alpha, beta and gamma radiation on a scaled moving-coil meter and with audible chirps—not bad for a device that sells for $150. In its nonaudio mode, the Monitor 4, indicates individual counts with a flashing LED. While it lacks the ruggedized construction of its more expensive counterparts, it is compact and has a low power consumption.

Later in this column I'll describe how I've used the Monitor 4 to measure the radioactivity of several objects found in or around most homes. Meanwhile, let's find out more about the operating principles of direct reading dosimeters.

Direct Reading Dosimeters. The direct reading dosimeter is a modern form of the venerable electroscope, one of the first devices capable of indicating the presence of static electricity. The electroscope is based upon the well-known principle that unlike charges attract while like charges repel.

Traditional electroscopes are made by folding a rectangular piece of gold leaf into two equal halves and hanging it from a conducting support in a glass bottle. The electroscope is "charged" by touching a positively or negatively charged object or electrode to a metal sphere attached to the conductor emerging from the bottle. This applies an equal charge to both leaves of gold foil. Since like charges repel, the leaves will then fly apart and defy gravity until their charge gradually leaks away into the surrounding air or is intentionally shorted to ground.

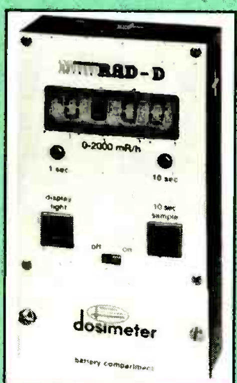


Fig. 1. Dosimeter's MiniRAD-D.

Fig. 2. MiniCON radiation monitor.

So how does the electroscope detect radiation? The charged leaves of the electroscope will gradually give up their charge by transferring electrons to or receiving electrons from the surrounding air. Unless it contains moisture, however, air is a poor conductor of electrons. Radioactive particles and rays have the ability to strip electrons from atoms that form air. These ionized atoms provide a conductive path for the charged leaves of an electroscope. Therefore, assuming no other leakage paths are present, the distance between the leaves of a charged electroscope is proportional to the cumulative radiation which has entered the space around the electroscope's leaves.

Figure 3 is a cutaway pictorial view of a typical pencil dosimeter made by Dosimeter Corporation. The device is prepared for use by first inserting the end containing the contact pin into the socket of a charger. The contact pin is mounted within a flexible metal bellows. When the dosimeter is pressed down into the charger's socket (Fig. 4), the opposite end of the contact pin makes contact with a metal member (the frame) inside the dosimeter. A charge of about 170 V is then transferred to the frame via the contact pin.

The charge is also applied simultaneously to a metal-plated quartz fiber suspended from and in electrical contact with a hinge on the frame. Since the frame and the fiber are given equal and like charges, the fiber swings away from the frame as illustrated in Fig. 3.

The sealed portion of the dosimeter that houses the quartz fiber and its frame is filled with dry air and is called an *ion chamber.* Radiation entering the chamber ionizes atoms of air, thereby providing a conductive path for some of the electrons on the fiber. As the charge on the fiber is gradually diminished by a radiation field, the quartz fiber moves toward the frame.

The position of the fiber can be viewed against a scale inside the dosimeter by peering through the instrument's eyelens while pointing the contact end toward a light source. Light enters the instrument through a glass collar around the contact pin.

A key component of the dosimeter is the contact-pin/bellows assembly. Since the bellows pulls the contact pin away from the frame when the instrument is pulled from the charging socket, the charged quartz fiber is electrically isolated from the outside world. Consequently, a dosimeter typically loses only about 0.25% of its charge per day.

The pencil dosimeter is a very important radiation monitoring device. Unlike most electronic monitors, it is truly pocket-sized. And although, it doesn't provide an indication of the *rate* of incoming radiation, it does give an accurate measure of *cumulative* exposure. Note too, that although it requires an external charger, one charger can be used to service dozens of instruments.

A Homemade Electroscope. Figure 5 shows a simple electroscope you can make from homemade materials. For best results use a heavy-gauge copper wire for the conducting support. Round off both ends of the wire with a small file and fine sanding paper. This eliminates sharp edges and burrs that would otherwise serve as discharge points for the charged leaves. Insert the support wire through a cork and form it as shown in the figure.

Some hobby and craft stores sell gold leaf which you can use to make a traditional electroscope. But I've used both standard and heavy-duty aluminum foil with good results. The standard gauge works best.

Prepare the foil by cutting it with sharp scissors to the size you plan to use. The finished size isn't critical so long as the leaves don't touch the sides of the bottle. Next, smooth the foil by placing it on a flat surface and stroking it a few times with a smooth pencil or your thumb. For best results, the foil should be as flat as possible. But this is not easy since it tends to curl when stroked.

After you smooth the foil, fold it in two equal sections over the edge of a piece of cardboard and hang the foil leaves over the support wired. Insert the cork with support wire and foil leaves into the jar as shown in Fig. 5. The leaves should be closely spaced and parallel to one another.

You can charge this homemade electroscope simply by touching the exposed end of the support wire with a comb you've stroked a few times through your hair. If both your hair and the comb are dry, the leaves will fly apart and remain extended for at least a

Fig. 4. Charging a dosimeter.

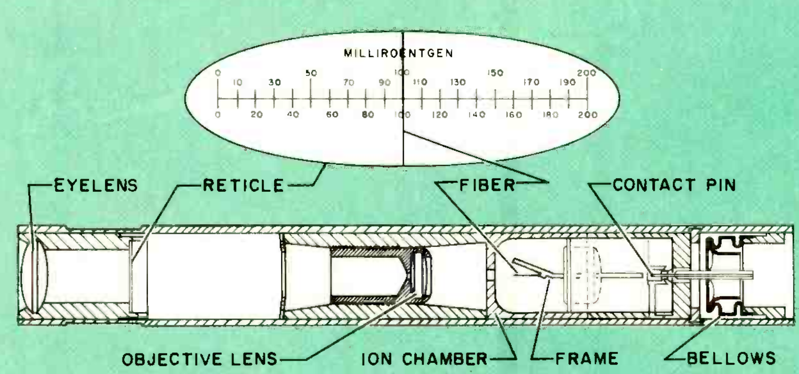


Fig. 3. Cutaway view of the pencil dosimeter.

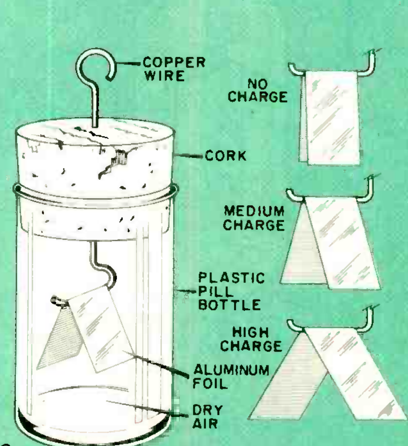


Fig. 5. A simple, do-it-yourself pill-bottle electroscope.

few seconds. On a very dry day, they will stay apart for quite some time.

If the leaves appear to stick to the sides of the bottle, use a larger container or smaller leaves. If the leaves fail to diverge when the electroscope is charged, make sure they have not become attached to one another at any slight nicks or frayed edges along the edge of the foil.

Failure of the leaves to diverge may indicate moist air in the electroscope's bottle (its ion chamber). Assuming everything else checks out, but the leaves still fail to repel one another, it may be necessary to replace the air in the bottle with dry air.

Several companies sell cans of pressurized, filtered, dry air for blowing dust from photographic film and mechanical devices. I've had good results using such air in my homemade electroscopes. Just remove the cork and leaves, squirt a dose of dry air into the bottle, and quickly replace the cork and leaves.

When you place a radioactive sample (see below) near the exposed electroscope wire, the leaves will begin to collapse at a much faster rate than normal. Move the sample away and the leaves will stop falling. This proves that a charged electroscope, even one made with household materials, can indeed detect ionizing radiation.

A Better Electroscope. Figure 6 shows another homemade electroscope with which I've experimented. It differs from the first in that it has but one moving leaf. The second leaf had been replaced by a rigid rectangle of two-sided copper-plated printed-circuit board.

The support member is a copper wire soldered to the back side of the pc board and bent around to the front side to form a support for the movable leaf. The leaf is a strip of smooth, flat aluminum foil. Shape the foil by wrapping one end of it around a wire with a diameter larger than that of the support wire. Then slip the resulting foil tube over the support wire to form a hinged leaf.

This electroscope can be installed in a plastic pill bottle much like the one in Fig. 5. I used, however, a small glass bottle of the type used to ship soft contact lenses. The bottle has a plastic cap into which you can easily insert the support wire. The cap provides a secure seal and is easily removed.

Note that this electroscope doesn't have a protruding wire contact. This greatly reduces the possible leakage paths and preserves the electroscope's charge for a longer time.

A Non-Electronic Electroscope Amplifier. You can amplify the motion of the leaves of an electroscope by reflecting a narrow beam of light from one of the leaves. If the reflected spot of light is directed toward a white card marked with an appropriate scale, you can easily measure movements of the leaf.

Figure 7 shows how you can use a helium-neon laser for this purpose. For best results, make sure the shiny side of the aluminum foil electroscope leaf faces *outward.*

If you place the white card a few feet away from the electroscope, the reflected spot of light may move 6" or more as the leaf falls from its fully charged, extended position. Since the foil surface is not perfectly flat, the reflected spot of light will be fairly large and blurred around the edges. Nevertheless, by arranging the electroscope, laser and card in suitable positions, you should have little difficulty detecting very tiny movements of the electroscope's leaf when a sample of radioactive material is placed near its external electrode.

Radiation Sources. By now you may be wondering where to obtain a radioactive source to check out a homemade electroscope. One possibility is to purchase a source from a manufacturer or distributor of radiation monitors. For instance, Dosimeter Corporation sells a source containing 5-microcuries or cesium 137 for $35.

You can obtain other sources for considerably less, though. The cheapest is probably a thorium impregnated lamp mantle made by Coleman, Aladdin and Gaz. These mantles contain thorium-232, an isotope that can be bred into uranium-233, the fissionable isotope used in nuclear reactors and weapons. Thorium-232 emits alpha particles, and decays through a series of ten *radio-daughters* (subsequent elements), the first being a beta emitter, radium-228.

Another reasonably low-priced radioactive source is the polonium-210 used in Staticmaster dust removers, a product of Nuclear Products Company (Box 5178, El Monte, CA 91734). The Staticmaster is a soft brush equipped with a replaceable cartridge containing a strip of metal coated with polonium-

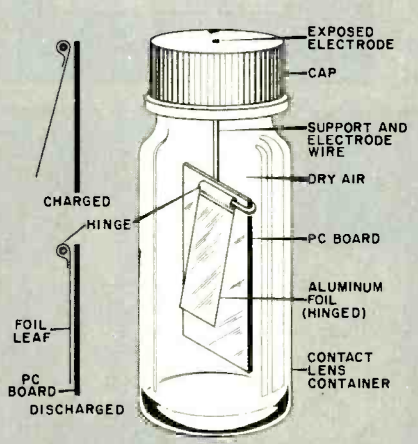


Fig. 6. Homemade miniature electroscope.

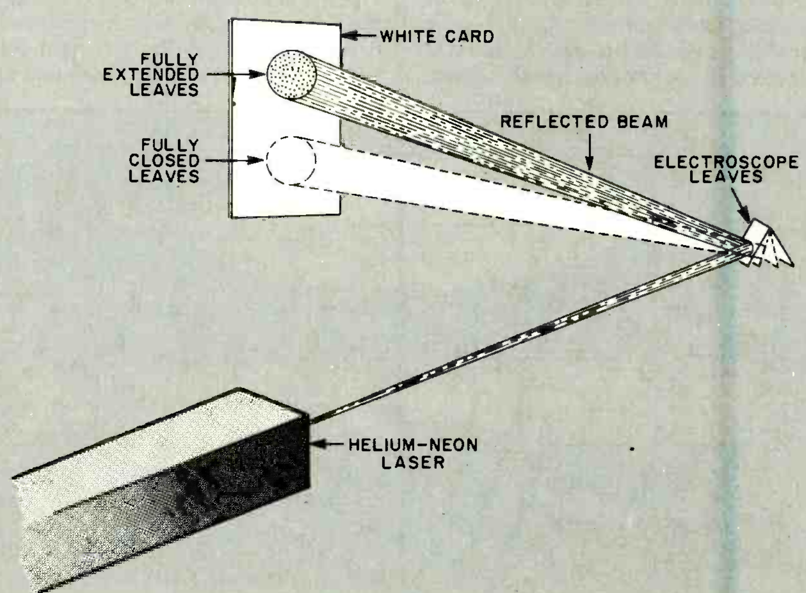


Fig. 7. Amplifying the movements of an electroscope's leaves with a laser.

210 permanently encapsulated in tiny ceramic beads. The polonium-210 emits a potent spray of alpha particles that ionizes the air near the brush. This provides a conductive path for the static charge that attracts dust particles to glass lenses, phonograph records, and photographic film.

STATICMASTER brushes (they come in two sizes) and replacement cartridges are available from some audio equipment and camera stores. If you just want a radioactive source, buy only a replacement cartridge. Be sure to comply with the safety precautions supplied with the cartridge!

Experimenting with a Geiger Counter. Solar Electronics International's Monitor 4 is a compact Geiger counter that indicates radiation levels by means of a moving-coil meter, flashing LED, and an audible chirp generator. The instrument incorporates CMOS circuitry and consumes only about 3 mW in a low radiation field. This provides a life of up to 2000 hours for the 9-V battery that powers the instrument, so long as the radiation level doesn't exceed a nominal background.

The Monitor 4 uses a Geiger tube having a mica end-window to permit the detection of alpha particles. The tube also detects beta particles and gamma and x-radiation.

I've used the Monitor 4 to detect radiation from several sources. For example, a Coleman lamp mantle lying on a flat surface produces a reading of 0.1 to 0.2 mR/hr when the Geiger tube's port is placed directly over the mantle. Rolling the mantle into a tight bundle and placing it next to the port gave a reading of 0.4 to 0.5 mR/hr.

When I placed a sheet of paper between the mantle and Geiger tube, the radiation level was only slightly lowered. Since alpha particles are stopped by paper, the bulk of the radiation appears to be beta particles emitted by the radium-228 byproduct of the thorium in the mantle.

I've also used the Monitor 4 to detect the alpha emission from the polonium-210 microbeads in a Staticmaster IC200 static eliminating brush. When the Geiger tube port is placed directly against the grid over the polonium-210 microbeads, the radiation level exceeds the Monitor 4's maximum detection level of 50 mR/hr. Alpha particles are blocked by only a few centimeters of air. When the grid over the polonium-210 is placed exactly 1-cm from the Geiger tube port, the radiation level is 10 mR/hr. At 2-cm, the level is too low to measure.

Since polonium-210 decays with time, Staticmaster cartridges are stamped with an expiration date. Therefore, the measurements you obtain may differ from those I obtained.

You can use the Monitor 4 and similar monitors to detect very low levels of radiation if you first determine the natural background count. The background count can range from several to more than a hundred counts per minute, although the typical figure is between 10 and 25 counts per minute.

The background count is caused by cosmic rays, the natural radioactivity present in soil, and perhaps the building materials of your home or office. The background count can vary with atmospheric conditions. For instance, a tightly sealed home can collect a higher than usual accumulation of radioactive radon gas emitted by construction materials such as brick and tile.

After you measure the background count, you can proceed to check suspected low-level radiation sources. For instance, on a day when the background was 16 counts per minute (averaged over 5 minutes), the center of the screen of a color television set I use as a computer monitor gave a count of 28 per minute. While this figure is nearly double the background rate, it's still low.

Other radioactive sources around my home, checked on a day when the background averaged 11 counts per minute, include a glazed brick used as a step for a storage building (40 counts/minute) and a ceramic tile entryway (16 counts/minute). An ionization-type smoke detector with an internal radiation source produced no detectable radiation above the background count.

Other household radiation sources include older pieces of earthenware glazed with orange or red pigment containing uranium oxide. And though they are no longer manufactured due to their hazardous properties, watches and clocks with hands and numbers coated with radium impregnated luminescent paint are still around.

Mr. Milo Voss, Manager of Safety, Health and Plant Protection at the Ames Laboratory of the U.S. Department of Energy, is one of many health physicists who have studied low-level background radiation. In a recent telephone conversation, Mr. Voss recounted how aerial surveys have spotted higher than usual radiation levels over some cemeteries and golf courses. Apparently the radiation sources are the granite headstones in the cemeteries and the phosphate fertilizer spread over the greens of the golf courses. Mr. Voss also observed that pilots and passengers of high flying aircraft are exposed to higher than usual levels of radiation.

Summing Up. The subject of nuclear fission always generates considerable controversy, particularly when so-called minimum acceptable exposure levels are discussed. Some health physicists believe no level of exposure can be incurred without some risk to the population. Others feel this view is far too extreme, particularly in light of the naturally occurring background radiation to which we are all subjected.

Milo Voss, for instance, has studied thorium in some detail and concluded in a 1979 report that the material is relatively safe unless it is inhaled or ingested. On the other hand, Walter Wagner, a Veterans Administration health physicist, has filed a $300 million class action lawsuit against the Coleman Company and other manufacturers of lantern mantles. Mr. Wagner is convinced that the thorium in the mantles constitutes a public health hazard.

Despite their divergent views regarding exposure levels, both sides agree that, for better or worse, naturally occurring radioactive sources abound. They are found in granite, bricks, grains, soils, and even in our bodies. The ceramic housing of a DIP integrated circuit can be slightly radioactive!

Another area of agreement is that radiation, no matter its source, is very difficult to accurately measure—much more difficult than measuring light. ◇

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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
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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
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4116-200	16384 x 1	(200ns)	8/12.95
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PR-125T	X	16	15,000	349.00
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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

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

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

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 = 2 MHZ

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
LM566	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
74LS63	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

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HOURS: M-W-F, 9-5   T-Th., 9-9   Sat. 11-3

JDR Microdevices

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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 6½% 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.

2114 450 NS 8/$9.95 2114 250 NS 8/$10.95

7400

7400	.19	74132	.45
7401	.19	74136	.50
7402	.19	74141	.65
7403	.19	74142	2.95
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	.65
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	.99	LM567	.89	LM1812	8.25
LM307	.45	LM350K	4.95	NE570	3.95	LM1830	3.50
LM308	.69	LM350T	4.60	NE571	2.95	LM1871	5.49
LM308H	1.15	LM358	.69	NE592	2.75	LM1872	5.49
LM309H	1.95	LM359	1.79	LM709	.59	LM1877	3.25
LM309K	1.25	LM376	3.75	LM710	.75	LM1889	1.95
LM310	1.75	LM377	1.95	LM711	.79	LM1896	1.75
LM311	.64	LM378	2.50	LM723	.49	ULN2003	2.49
LM311H	.89	LM379	4.50	LM723H	.55	LM2877	2.05
LM312H	1.75	LM380	.89	LM733	.98	LM2878	2.25
LM317K	3.95	LM380N-8	1.10	LM741	.35	LM2900	.85
LM317T	1.19	LM381	1.60	LM741N-14	.35	LM2901	1.00
LM318	1.49	LM382	1.60	LM741H	.40	LM3900	.59
LM318H	1.59	LM383	1.95	LM747	.69	LM3905	1.25
LM319H	1.90	LM384	1.95	LM748	.59	LM3909	.98
LM319	1.25	LM386	.89	LM1014	1.19	LM3911	2.25
LM320 (see 7900)		LM387	1.40	LM1303	1.95	LM3914	3.95
LM322	1.65	LM389	1.35	LM1310	1.49	LM3915	3.95
LM323K	4.95	LM390	1.95	MC1330	1.69	LM3916	3.95
LM324	.59	LM392	.69	MC1349	1.89	MC4024	3.95
LM329	.65	LM394H	4.60	MC1350	1.19	MC4044	4.50
LM331	3.95	LM399H	5.00	MC1358	1.69	RC4136	1.25
LM334	1.19	NE531	2.95	MC1372	6.95	RC4151	3.95
LM335	1.40	NE555	.34	LM1414	1.59	LM4250	1.75
LM336	1.75	NE556	.65	LM1458	.59	LM4500	3.25
LM337K	3.95	NE558	1.50	LM1488	.69	RC4558	.69
LM337T	1.95	NE561	24.95	LM1489	.69	LM13080	1.29
LM338K	6.95	NE564	2.95	LM1496	.85	LM13600	1.49
LM339	.99	LM565	.99	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		

CMOS

4000	.29	4527	1.95
4001	.25	4528	1.19
4002	.25	4531	.95
4006	.89	4532	1.95
4007	.29	4538	1.95
4008	.95	4539	1.95
4009	.39	4541	2.64
4010	.45	4543	1.19
4011	.25	4553	5.79
4012	.25	4555	.95
4013	.38	4556	.95
4014	.79	4581	1.95
4015	.39	4582	1.95
4016	.39	4584	.75
4017	.69	4585	.75
4018	.79	4702	12.95
4019	.39	74C00	.35
4020	.75	74C02	.35
4021	.79	74C04	.35
4022	.79	74C08	.35
4023	.29	74C10	.35
4024	.65	74C14	.59
4025	.29	74C20	.35
4026	1.65	74C30	.35
4027	.45	74C32	.39
4028	.69	74C42	1.29
4029	.79	74C48	1.99
4030	.39	74C73	.65
4034	1.95	74C74	.65
4035	.85	74C76	.80
4040	.75	74C83	1.95
4041	.75	74C85	1.95
4042	.69	74C86	.39
4043	.85	74C89	4.50
4044	.79	74C90	1.19
4046	.85	74C93	1.75
4047	.95	74C95	.99
4049	.35	74C107	.89
4050	.35	74C150	5.75
4051	.79	74C151	2.25
4053	.79	74C154	3.25
4060	.89	74C157	1.75
4066	.39	74C160	1.19
4068	.39	74C161	1.19
4069	.29	74C162	1.19
4070	.35	74C163	1.19
4071	.29	74C164	1.39
4072	.29	74C165	2.00
4073	.29	74C173	.79
4075	.29	74C174	1.19
4076	.79	74C175	1.19
4078	.29	74C192	1.49
4081	.29	74C193	1.49
4082	.29	74C195	1.39
4085	.95	74C200	5.75
4086	.95	74C221	1.75
4093	.49	74C373	2.45
4098	2.49	74C374	2.45
4099	1.95	74C901	.39
14409	12.95	74C902	.85
14410	12.95	74C903	.85
14411	11.95	74C905	10.95
14412	12.95	74C906	.95
14419	7.95	74C907	1.00
14433	4.18	74C908	2.00
4502	.95	74C909	2.75
4503	.65	74C910	9.95
4508	1.95	74C911	8.95
4510	.85	74C912	8.95
4511	.85	74C914	1.95
4512	.85	74C915	1.19
4514	1.25	74C918	2.75
4515	1.79	74C920	17.95
4516	1.55	74C921	15.95
4518	.89	74C922	4.49
4519	.39	74C923	4.95
4520	.79	74C925	5.95
4522	1.25	74C926	7.95
4526	1.25	74C928	7.95
		74C929	19.95

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
74S51	.35	74S244	2.20
74S64	.40	74S251	.95
74S65	.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

	1-99	100
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
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
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 = TEXTOOL (Zero Insertion Force)

VOLTAGE REGULATORS

7805T	.75	7905T	.85
78M05C	.35	7908T	.85
7808T	.75	7912T	.85
7812T	.75	7915T	.85
7815T	.75	7924T	.85
7824T	.75		
		7905K	1.49
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7905	−5 VDC	276-1773	1.59
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1.0	35	272-1434	.49
2.2	35	272-1435	.59
10	16	272-1436	.69
22	16	272-1437	.79

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Axial Leads

µF	WVDC	Cat. No.	Each
4.7	35	272-1012	.49
10	35	272-1013	.59
22	35	272-1014	.69
47	35	272-1015	.69
100	35	272-1016	.79
220	35	272-1017	.89
470	35	272-1018	.99
1000	35	272-1019	1.59
2200	35	272-1020	2.49
3300	35	272-1021	2.99
4700	35	272-1022	3.59
470	50	272-1046	1.59
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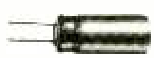

µF	WVDC	Cat. No.	Each
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470	16	272-957	.89
1000	16	272-958	.99
4.7	35	272-1024	.49
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22	35	272-1026	.69
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100	271-1311	15k	271-1337
150	271-1312	22k	271-1339
220	271-1313	27k	271-1340
270	271-1314	33k	271-1341
330	271-1315	47k	271-1342
470	271-1317	68k	271-1345
1k	271-1321	100k	271-1347
1.8k	271-1324	220k	271-1350
2.2k	271-1325	470k	271-1354
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25k	271-336	.49
100k	271-338	.49
500k	271-339	.49

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Ohms	Cat. No.	Each
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1k	271-227	.59
5k	271-217	.59
10k	271-218	.59
50k	271-219	.59
100k	271-220	.59
500k	271-221	.59
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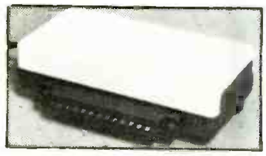

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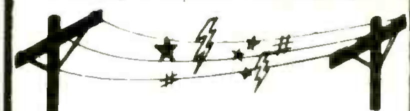

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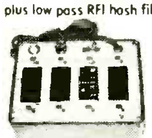

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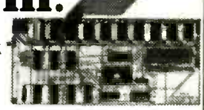

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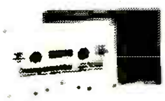

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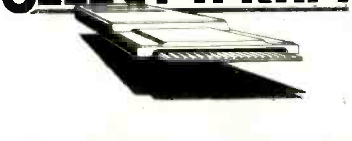

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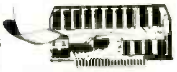

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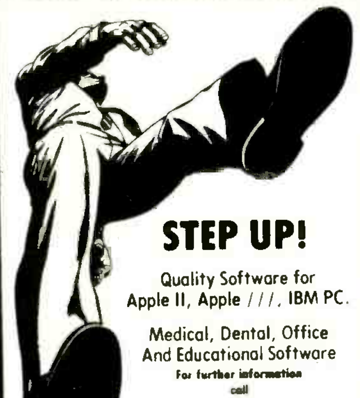

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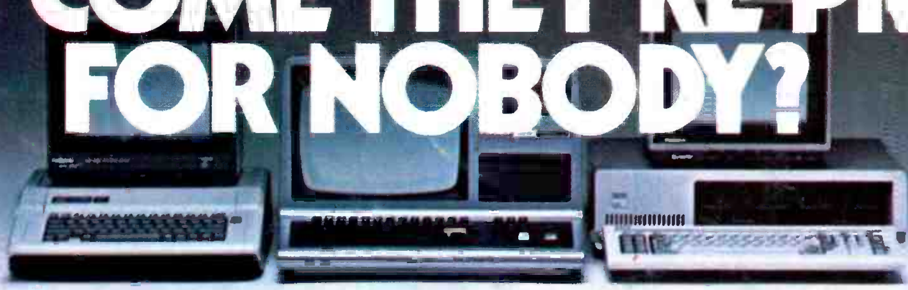

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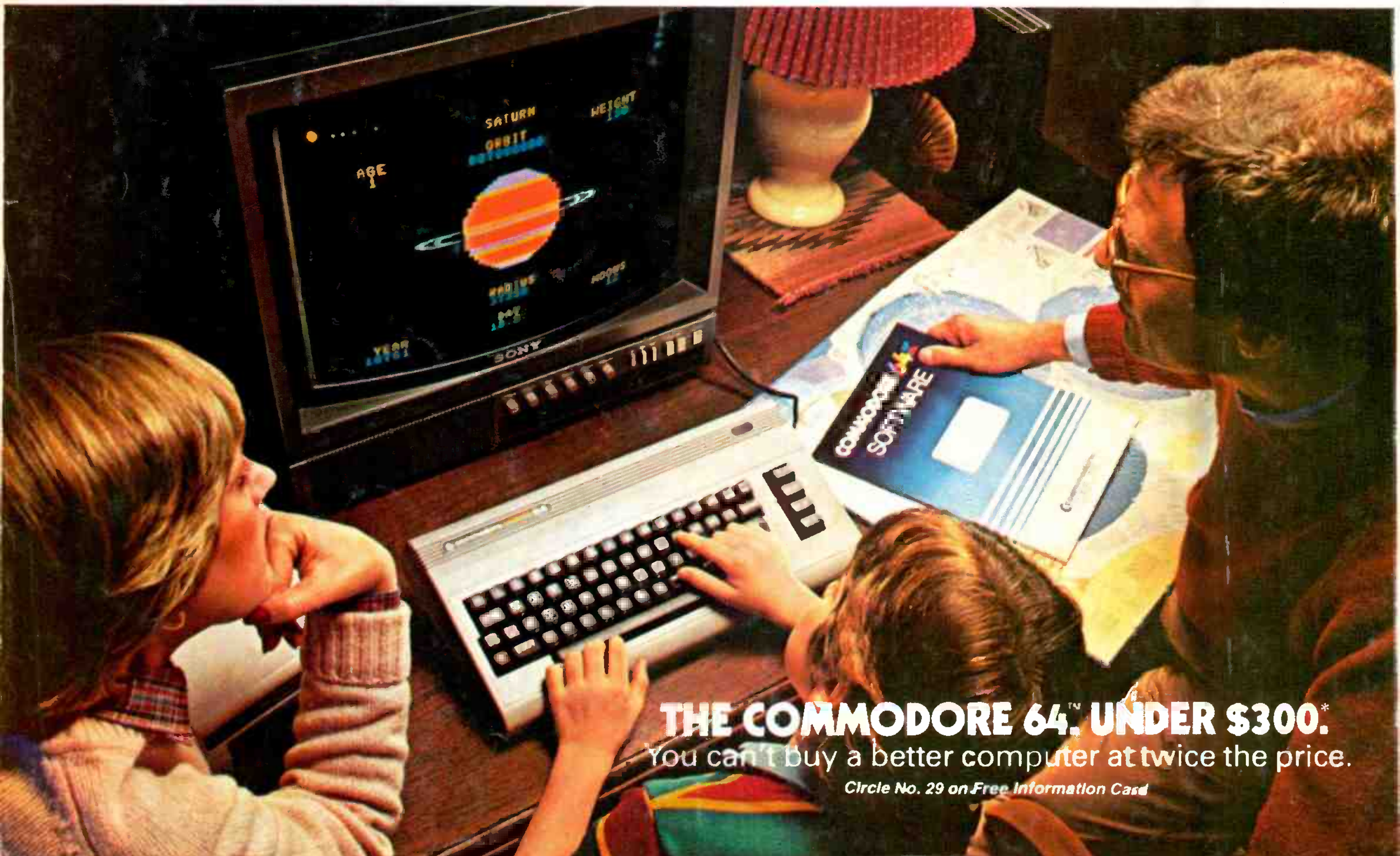

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