Includes PCjrWORLD

PC WORLD

April 1984
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The Personal Computer Magazine for IBM PCs and Compatibles

40 New Personal Computers!

Which Ones Meet the IBM PC Standard?

PC Communications Made Simple

Beginner's Guide to Handling Your Files

Microsoft Word's Advanced Features

Win a $20,000 World Class PC

PC WORLD

Volume 2, Number 4

PC Compatibles

• **Parallel Ports** — The parallel port is used for connecting a parallel printer to your PC. A parallel printer typically uses a dot-matrix output which is suitable for high-speed draft quality printouts. The PC allows for the installation of up to three parallel ports.

• **Clock-Calendar** — With the on board battery, the clock-calendar feature will maintain the correct date and time, even when the PC is turned off. This feature eliminates the need for typing in this information each time you power up your computer.

• **Game Adapter** — The game adapter port allows you to connect an IBM-type joystick to your PC so you can play the multitude of arcade-quality games which take full advantage of the PC's graphic capabilities. Or you can use the joystick input for other applications by writing your own programs.

• **SuperPak™** — Every AST Research Multifunction Board comes with an AST SuperPak diskette containing programs for setting and accessing the clock, as well as SuperDrive™ and SuperSpool™, the most powerful RAM disk and print spooler available for PC-DOS. With SuperDrive you can use your PC's memory for simulating one to four floppy drives, from 20K to 360K each. SuperSpool allows you to set aside memory (from 4K to 512K) as a print buffer; SuperSpool sends output to the printer in the background while you execute your program in the foreground. With SuperDrive and SuperSpool, you can significantly improve your PC's operating speed.

• **Proven Compatibility** — All AST Research hardware and software products are 100% compatible with all versions of the PC and PC-XT as well as the Compaq and other PC look-alikes, and are 100% compatible with PC-DOS 1.1 and 2.0.

• **Warranty** — All AST Research products are backed with a one year limited warranty covering parts and labor with an optional paid second year warranty available.

Of course, all AST Research Multifunction Boards come with the **AST "PLUS,"** our unsurpassed reputation for quality, reliabilty, after-the-sale support, and overall design excellence which give our products the best price/performance ratio in the industry!

Optional features may be added by the user at any time by installing an AST Research Upgrade Package.

All products come with extensive documentation as well as all necessary adapter cables.

	MEMORY	Serial Port 1	Serial Port 2	Clock	Printer Port	Game Port	Bus Extension
SixPakPlus	X	X		X	X	X	
MegaPlus II	X	X	X	X	X	X	X
I/O Plus II		X	X	X	X	X	
ComboPlus	X	X		X	X		
MP Expansion	X						

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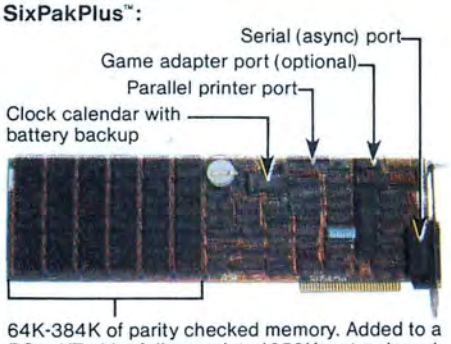
AST Research Micro-to-Mainframe Communications Products:

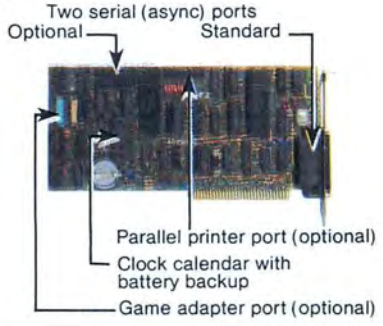
- **AST-SNA** — A family of five products that enable a PC to communicate with a mainframe via the IBM SNA protocol without the use of protocol converters.
- **AST-5251** — An interactive 5251 remote work station emulation package for use with the IBM System 34, 36, or 38.
- **AST-3780** — A hardware/software package which allows an IBM PC to communicate with a mainframe in 2780/3780 bisync protocol.
- **AST-BSC** — A hardware/software package that allows your IBM PC to provide all the features of a 3270 or 2770 terminal in bisync.
- **CC-232** — A programmable card that allows an IBM PC to communicate in async, bisync, SDLC or HDLC protocols.

SixPakPlus™:

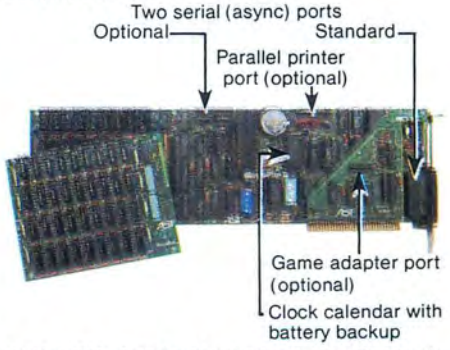


64K-384K of parity checked memory. Added to a PC or XT with a fully populated 256K system board, the SixPakPlus can bring the system memory to 640K, the maximum addressable user memory.

I/O Plus II™:

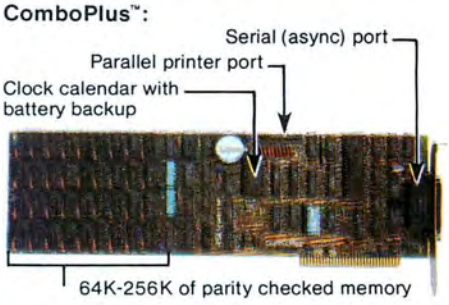


MegaPlus II™:

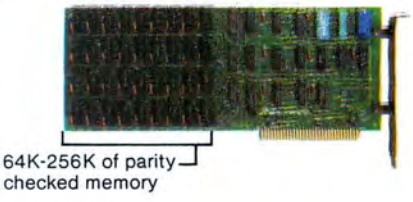


64K-512K of parity checked memory. The basic card expands to 256K, and with the MegaPak extension expands to an additional 128K or 256K of parity checked memory.

ComboPlus™:



MP Expansion Memory:



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- File lock-out
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Circle 18 on reader service card

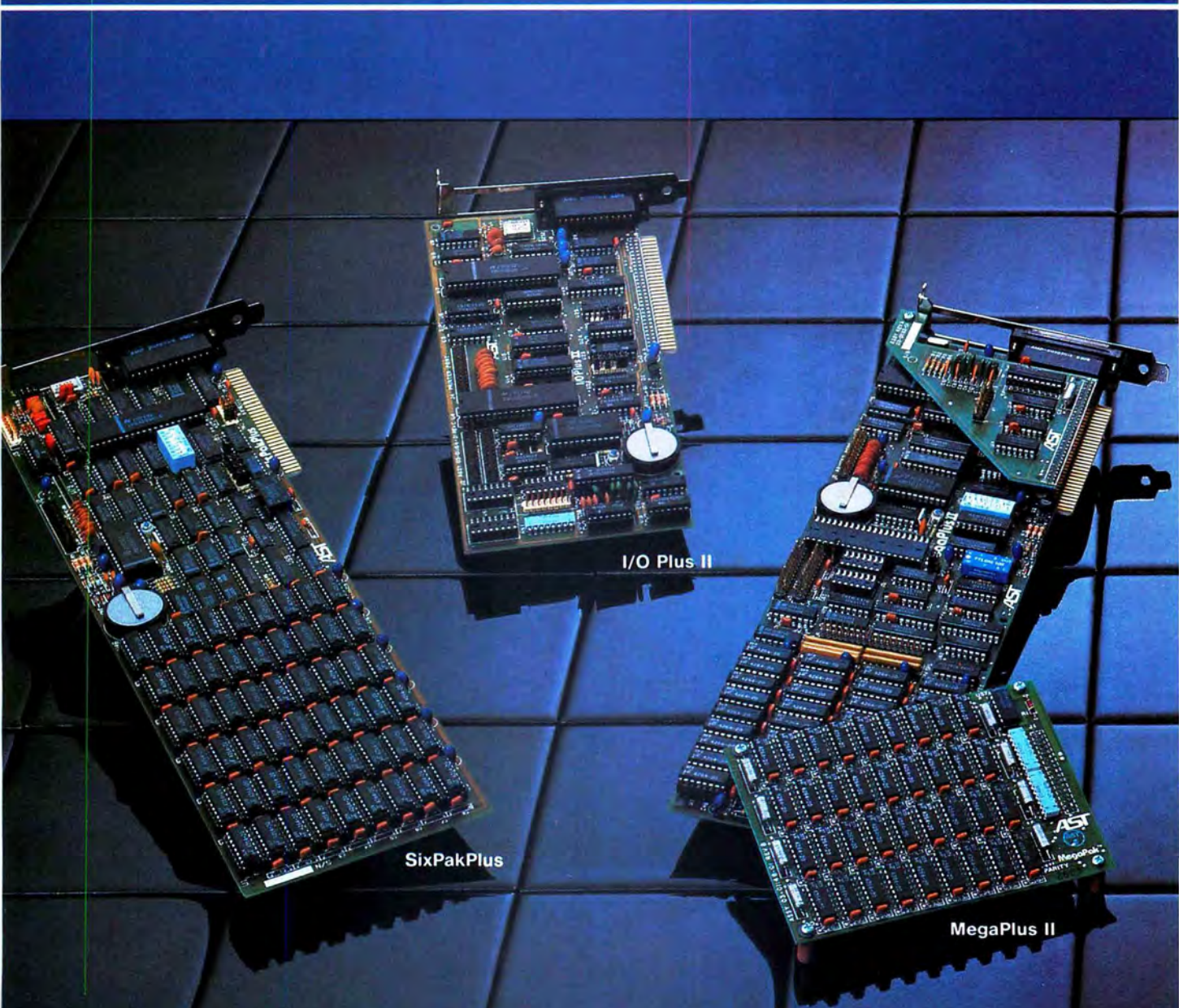
Number One Add-On Products for IBM PC

With an AST Research Multifunction Board, you can realize the full potential of your IBM PC or PC-XT without wasting valuable slot space. By combining your memory and input/output requirements on a single card, you can take advantage of more of the capabilities IBM designed into the PC, while leaving space for future enhancements as they are introduced.

AST Research Multifunction Boards can add the following features to your PC:

- **User Memory from 64K to 512K** — When added to your existing system memory, brings your PC up to its maximum of 640K. This enables you to run larger spreadsheets, create larger in-memory databases, or you can use the additional memory along with the supplied AST SuperPak™ software for print spooling or for simulating floppy drives to increase your PC's throughput.

- **Serial Ports** — By connecting a modem to a serial (async) port, your PC can communicate with other computers over telephone lines. By connecting a serial printer, you can obtain high quality print output. Other serial devices such as a plotter or mouse may also be connected to a serial port. The PC allows for the installation of up to two serial ports.



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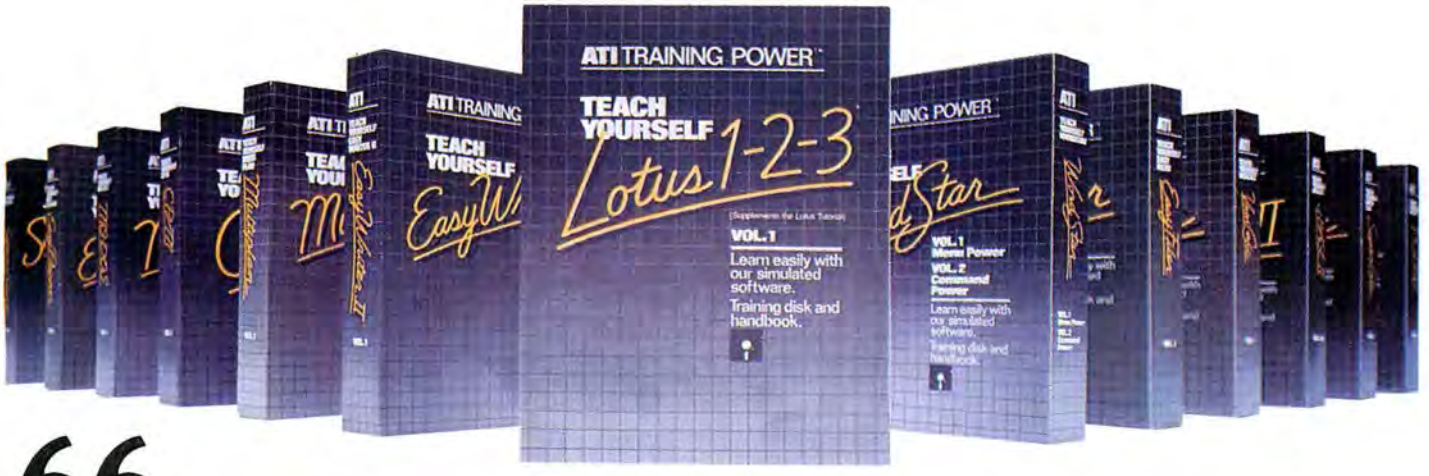

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Circle 7 on reader service card

PC WORLD

The Personal Computer Magazine for IBM PCs and Compatibles

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ANNOUNCING A PROUD ADDITION TO YOUR FAMILY.

The next addition to your family could be the bright little newcomer in the growing *family* of IBM® personal computers.

Name: PC*jr*. Weight: 12 pounds. Heritage: more than 30 years of computer experience.

"Junior" is a powerful tool for modern times. Yet it's simple enough for a child to enjoy.

BRINGING HOME BABY

It's a big day when PC*jr* comes home.

The surprises begin the moment you open the carton.

Surprise #1 is the IBM "Freeboard"—a keyboard that doesn't need a connecting cord. The Freeboard frees you to move around and relax.

Then there's the Keyboard Adventure—an instructional exercise for first-time users. It's built into the computer and explained step-by-step in the Guide to Operations. It will help anyone begin learning as soon as PC*jr* is hooked up to a TV set.

In systems equipped with a diskette drive, there's a program that lets you explore computer fundamentals at your own pace, with PC*jr* as your teacher.

And to get you off and running from the very first day, a sample diskette with eleven useful mini-programs (ranging from a spreadsheet for monthly expenses to a word game and a recipe file) is also included.

But there are still more surprises.

FAMILY COMPUTING MADE EASY

Many IBM software programs written for other IBM personal computers will run on PC*jr*. And inexpensive new ones written especially for PC*jr* are being released.

An easy-to-use diskette word processing program, for example, uses pictures as well as words to guide you along. A comprehensive IBM home budget program makes keeping track of money easier. There's also a selection of educational programs for children at home and at school.

And when the work is finished (or perhaps before), the fun can begin. Just slip in a game cartridge and stand back.

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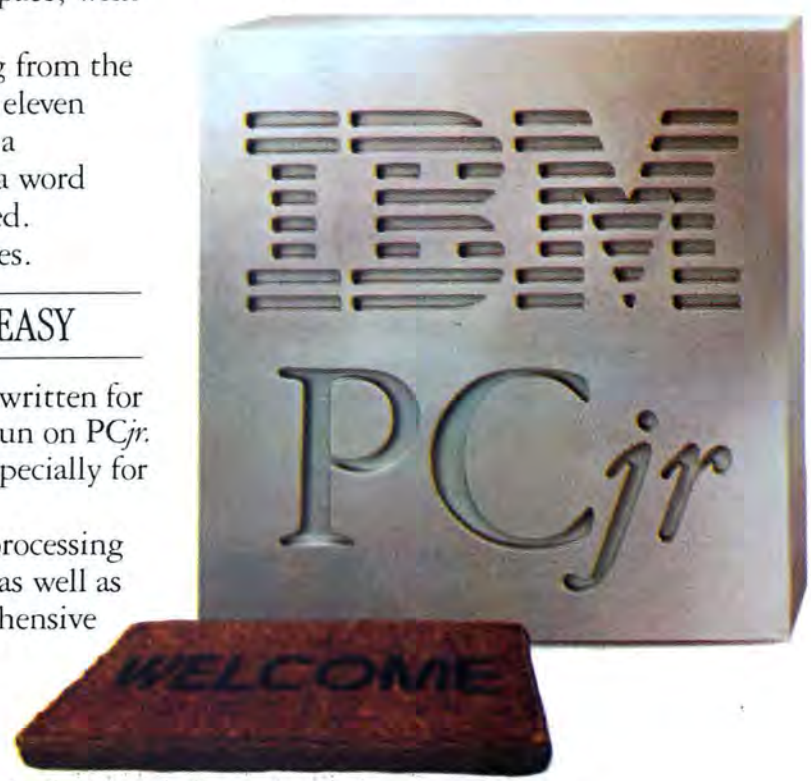
Add a printer. A diskette drive. An internal modem for telecommunications. Increase user memory from 64KB to 128KB. With these and other add-it-yourself options, even the lowest-priced PC*jr* can grow up *real* fast.

PC*jr* is a powerful tool for home, school or college. With its optional carrying case, it's a powerful tool anywhere you care to take it.

SEE JUNIOR RUN

Junior's starting model includes a 64KB cassette/cartridge unit and Freeboard for about $700. A 128KB model with diskette drive is about $1300. (Prices apply at IBM Product Centers. Prices may vary at other stores.)

Your local authorized IBM PC*jr* dealer proudly invites you to see this bright little addition to the family. For the store nearest you, just call 1-800-IBM-PCJR. In Alaska and Hawaii, 1-800-447-0890.



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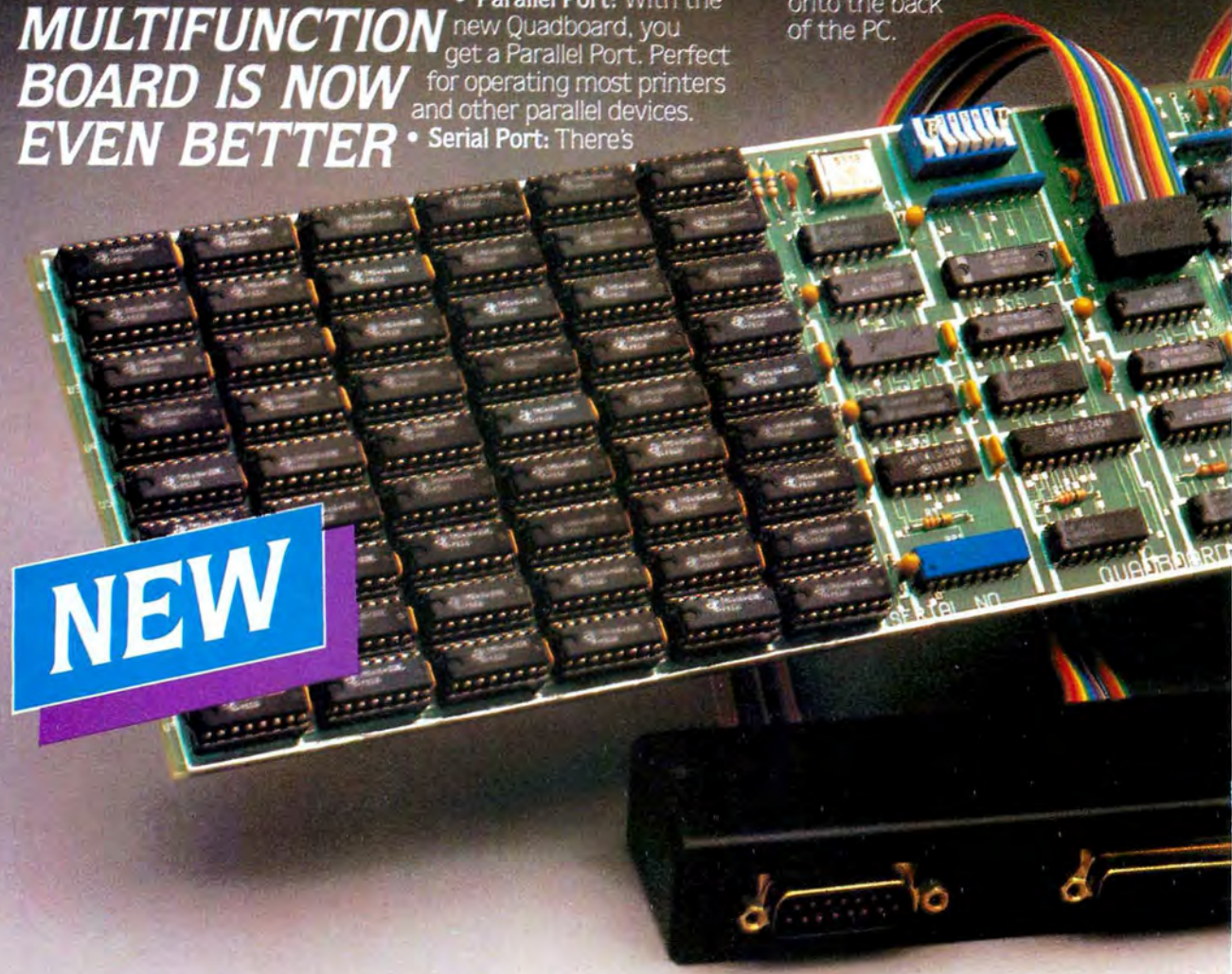
Quadboard now delivers 9 of the most needed PC functions/features. To let you get the most out of your Personal Computer. And help you work better and faster.

EXPANDABLE TO 384K

THE WORLD'S BEST SELLING MULTIFUNCTION BOARD IS NOW EVEN BETTER

All of these features are standard on the new Quadboard:

- **Parallel Port:** With the new Quadboard, you get a Parallel Port. Perfect for operating most printers and other parallel devices.
- **Serial Port:** There's a Serial Port, too. Fully programmable, use it to connect to printers, modems, and other serial devices.
- **Chronograph:** And Quartzwards. Chronograph (Real Time Clock/calendar) keeps your system's clock up to date.
- **Game Port:** The new Quadboard has an IBM compatible Game Port. Plug in a joystick or game paddles, and fire away.
- **I/O Bracket:** Quadboard now comes with a special I/O bracket. Use it to organize your expansion port connectors. Snaps right onto the back of the PC.



QUADBOARD®

• **Expandable to 384K:** The new Quadboard is expandable in 64K increments for up to 384K additional RAM. With full parity checking standard. With the new Quadboard and a fully populated system board, you can take your PC's memory up to the 640K limit.

• **QuadRAM Drive:** Plus, with Quadboard you get advanced QuadMaster Software. Including the QuadRAM Drive program. Use it to set up multiple RAM Drives in Quadboard memory. Solid state drives that let you store and retrieve data quickly and easily. Or take advantage of QuadMaster disk caching. To access frequently used data whenever you need it.

• **MasterSpool:** QuadMaster Software also includes MasterSpool. Use it to set up a software print buffer quickly and easily. This advanced spooler lets you pause at any time, back up or move forward in a file. Choose just the amount of buffer space you need and stop waiting on your printer.

• **Qswap:** Another feature of QuadMaster Software is Qswap. With Qswap change line printers 1 and 2 back and forth, with just a few keystrokes, as often as you like.

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Now more than ever Quadboard is the first and only board your IBM PC or XT may ever need. No other board even comes close. Because Quadboard is designed for performance. Engineered for dependability.

And built in the continuing tradition of Quadram Quality.

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Features/ Functions	Quadboard	SixPakPlus
Memory Available	0-384K	0-384K
Parallel & Serial Port	Yes	Yes
Clock/ Calendar	Yes	Yes
I/O Bracket	Standard	Optional
Game Port	Standard	Optional
Diagnostic Testing	Yes	Yes
Advanced Spooler	Yes	No
Simple Menu Setup	Yes	No
Disk Cache	Yes	No

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David Bunnell

The Amazing PC-Standard Personal Computers

It's amazing... 40 new PC-standard personal computers! In 1982, when I started *PC Magazine*, there was only the IBM PC, and you could count the number of programs for it on your fingers and toes.

This soon changed. IBM chose to encourage outside software developers to write most of the programs, so the PC's library has grown at an unprecedented rate. Today, there are nearly 5000 commercial programs for this one computer.

A burgeoning software base and the fact that IBM assembled its PC from "off-the-shelf" components often manufactured by other companies has led to the inevitable cloning of the IBM PC.

In my last column I proposed that all the PC look-alikes be referred to as "IBM PC-standard personal computers." The sheer weight of IBM will make these PCs become the most numerous ever.

"PC-standard personal computers" are computers that generally run the same software as do the IBM PC, the PC XT, and the PCjr. Some PC-standard personal computers distinguish themselves by having features radically different from those of IBM's computers, while others copy IBM as precisely as possible without violating copyright or patent laws.

Thus, we have a touch screen PC-standard personal computer in

Hewlett-Packard's Model 150, a machine that runs programs faster than the PC does in Radio Shack's TRS-80 Model 2000, and a portable that is as close to a PC as you can get in the COMPAQ.

Some people have mistakenly called *PC World* a "machine-specific" magazine. This has never been true. Our subheading, *The Personal Computer Magazine for IBM PCs and Compatibles*, includes compatibles from IBM such as the PC XT, the PCjr, the XT/370, and the 3270-PC, as well as look-alikes from other companies. *PC World* is the magazine for the fastest growing (and ultimately the largest) base of personal computers.

Luckily for both our staff and our readers, the computers that we write about are software compatible. This isn't true of the early general personal computer magazines, which contain very little information that is truly useful or directly applicable, because their readers use many different computers that are totally incompatible.

We are lucky to be living in such exciting times. Suddenly all the record players play the same songs even if they are not exactly the same records. Thus, we are able to bring new PC-standard users into the market while we maintain plenty of editorial space to devote to more experienced and advanced users.

Our main interest is to serve the PC community. Whether you use an IBM PC or a look-alike, we want to help you grow with us by opening your mind to new PC adventures. By reading *PC World* you can become a more proficient PC user and turn that expertise into greater personal and corporate productivity.

We admit we like IBM and we also like many of its imitators. And we're glad to see an emerging standard, even if it is a so-called "de facto" one.

A few months ago, I declared 1984 "the year of the mouse," by which I meant the year of personal computer pointing devices. On second thought I see that 1984 is the year of the PC-standard personal computer.

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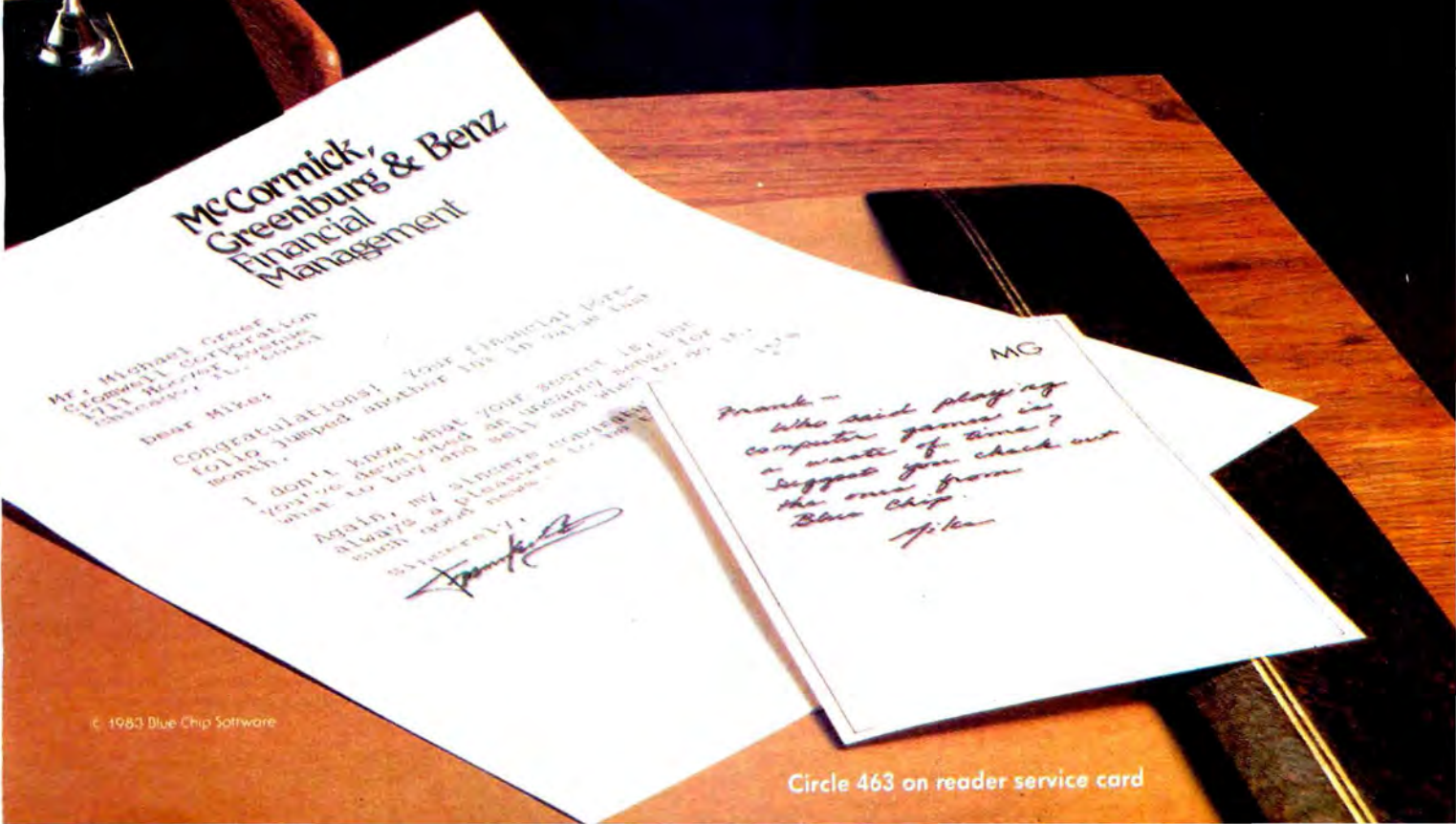

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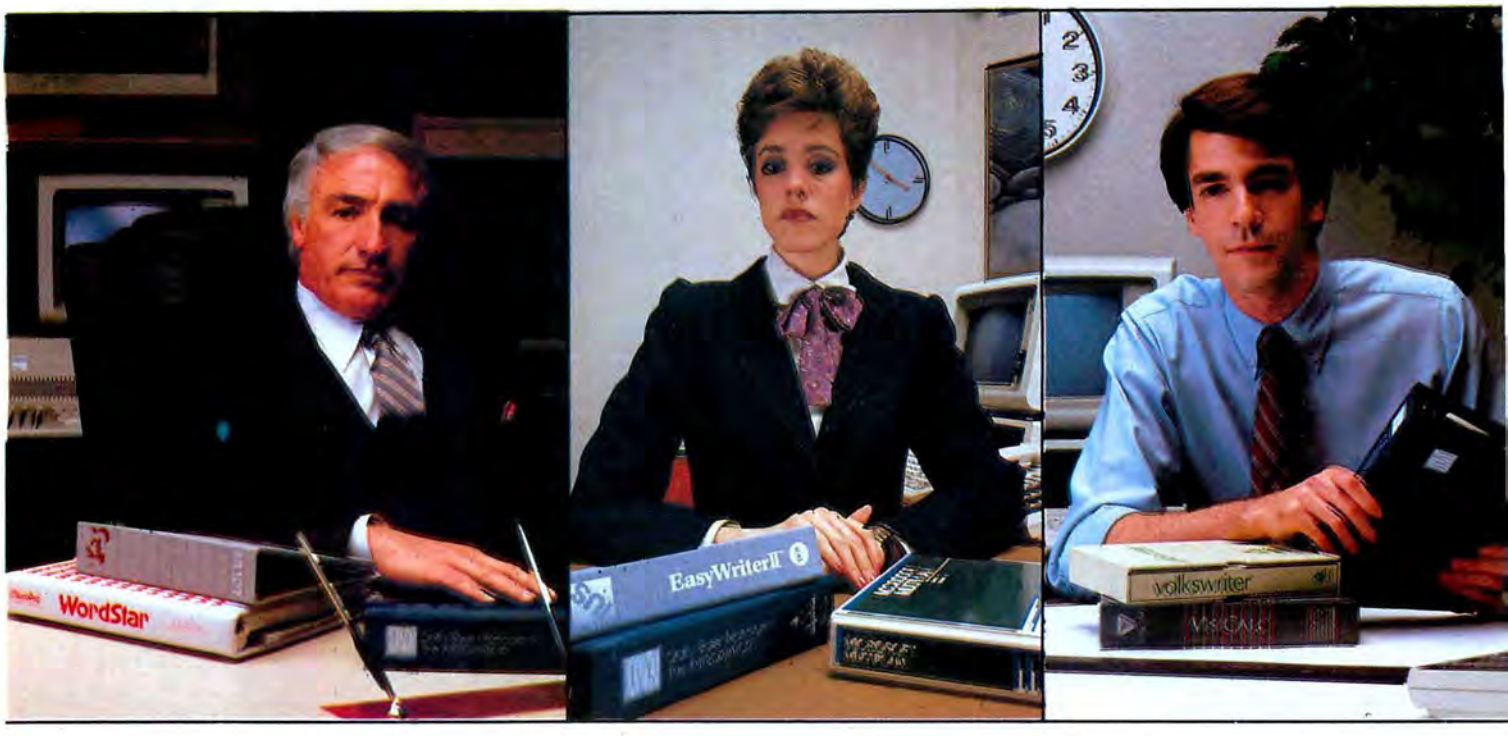

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*DBM II directly reads and writes Lotus 1-2-3 Worksheet (WKS) files. No translating is required.

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Letters

Ergonomic Update

Anita Micossi should be commended for her article, "Ergonomics Is Good Business" [*PCW*, Vol. 1, No. 10]. Employers as well as employees stand to gain when VDT work conditions are improved.

Her mention of pending legislation in six states needs clarification, however. Maine and Connecticut, two of the states on her pending legislation list, passed bills in 1983. In addition, legislation was introduced in the Ohio General Assembly on October 14, 1983, raising the total number of states to seven that have VDT legislation in effect or under consideration.

The Maine measure directs the state's Bureau of Labor Standards to investigate ergonomic health issues and to promulgate rules, if necessary, to protect city, county, and state workers. It was signed into law on June 2, 1983. The Connecticut law authorizes representatives of the state's Academy of Sciences and Engineering, the Products Safety Commission of the Department of Consumer Protection, and two General Assembly committees to review the literature on ergonomics and report their findings to the Legislature in early 1984.

Readers might be interested to learn that a recently released study of Newspaper Guild workers concludes that ergonomic ailments suffered by VDT workers may be responsible for a greater loss of work time than those of workers who don't use VDTs. Dr. Arthur Frank, the study's lead investigator, testified before a congressional subcommittee that this may be costing American businesses millions of dollars a year in lost productivity.

Mark Pinsky
Editor, VDT News
New York, New York

More C Notes

You wouldn't think an article that purports merely to convey basic information about making music could generate so much controversy, but I notice you published two indignant letters relating to Lon Poole's "Programming Sound in BASIC" [*PCW*, *Letters*, *Help Screen*, Vol. 1, No. 4].

I don't believe Mr. McElwain really needs to fear that computers are being taught to misplace middle C. Obviously the author somehow was thinking an octave too high. The second space up on the treble clef is of course A440, not A880 (see Figure 14-1, "Programming Sound in BASIC").

What is worthy of concern, however, is Mr. McElwain's proposal to change standards for naming notes. I am a tuner and technician on pianos, pipe organs, and harpsichords. On all keyboard instruments, it is standard practice to assign the number 1 to the lowest note. IBM's lowest note is the third C below middle C, so by conventional keyboard standards this is properly numbered 1. It is true that on the modern piano this note would be number 4. However, the number 1 note on a pipe organ is the second C below middle C. It would be as logical to number IBM's lowest note -12 to match the organ as it would be to number it +4 to match the piano.

Phil Jones
Bethesda, Maryland

Copyright Correction

"A Protective Net Full of Holes" by Jordan Breslow [*PCW*, *REMark*, Vol. 2, No. 1] is an article full of holes.

Contrary to Breslow's statement that "once you apply for a patent, a detailed description of the product is open to public inspection," the United States Patent and Trademark Office holds all information regarding pending patent applications in secrecy. Even if a patent application is abandoned, its contents are not opened to public inspection.

Contrary to Breslow's statement that "a patent gives an inventor the exclusive right to make, use, or sell an invention for 17 years," a patent is a grant of a *negative* right to exclude others from making, using, or selling an invention. If one's patented invention amounts to an improvement on an invention or inventions patented by others, the grant of a patent may not entitle the patent owner to make, use, or sell anything unless that can be done without infringing the earlier issued, more basic patent(s).

Contrary to Breslow's statement that the copyright law "was written long before the era of computers, and...was modified slightly in 1980," the 1909 copyright law to which Breslow refers has been supplanted by what is known as the Copyright Act of 1976. The 1980 amendments discounted by Breslow represent a major change in the position of copyright laws toward computer software. Many of the provisions of the present copyright law were expressly intended to deal with "the era of computers"; indeed, they include provisions that deal specifically with such things as computer programs.

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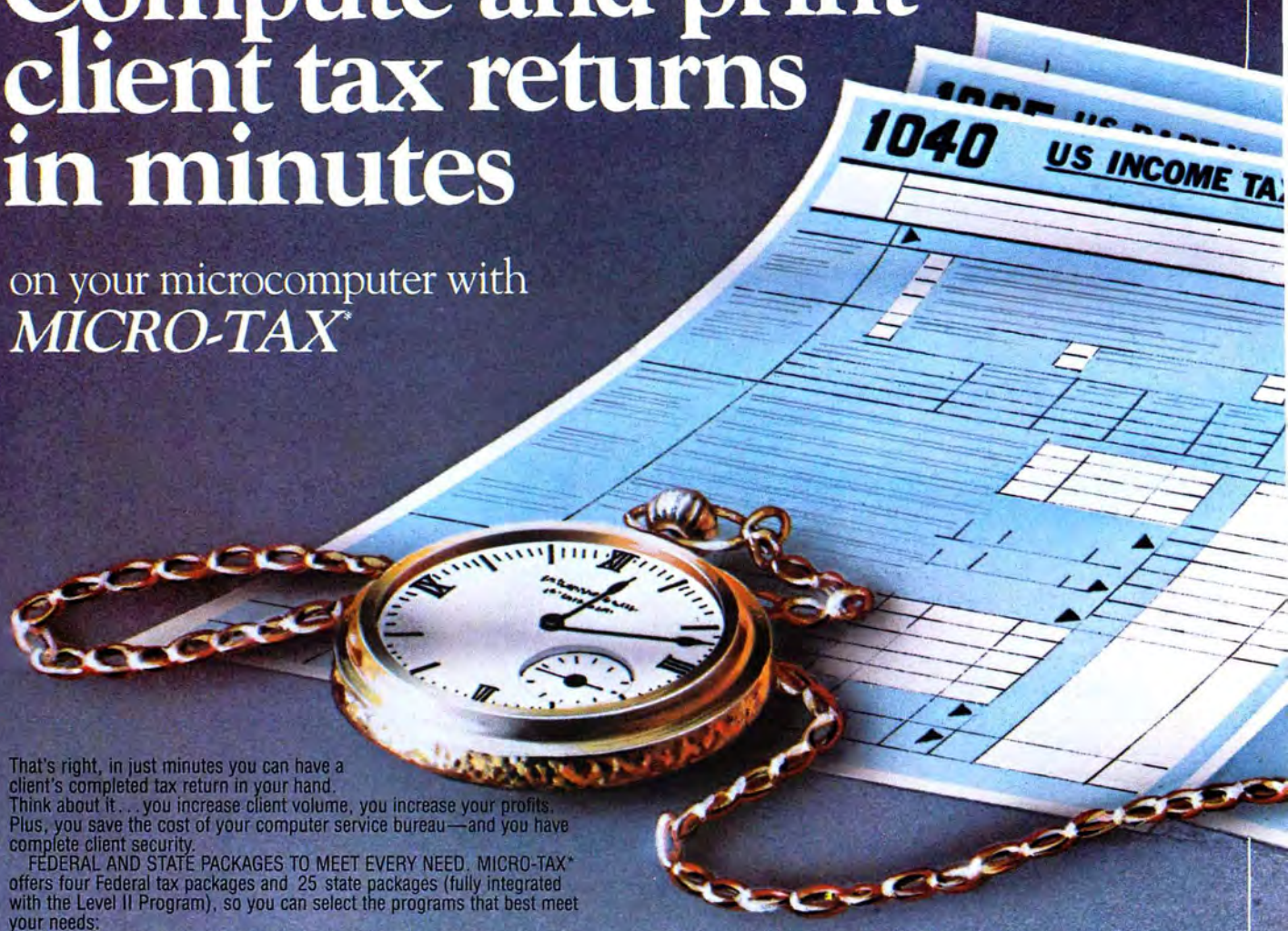

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Protecting computer-related intellectual property is a developing area of the law. As applications of the law to new situations aid in the law's development, the challenge we face lies in providing the specific protections needed to fulfill the constitutional mandate underlying the patent and copyright systems, namely, "To promote the progress of science and useful arts."

David A. Burge, Attorney
Cleveland, Ohio

Resolution Riddle Resolved

Something very profound was uncovered by Charles Branch in his article on combining camera and computer video ["Text Over Video," *PCW*, Vol. 1, No. 10]. He showed that an RGB monitor is higher in resolution than a composite video monitor. He also showed that a TV camera pointed at an RGB monitor displays on its screen clearer images than composite video straight out of the computer. The riddle comes from the fact that the images being compared on the monitors were both composite video. In addition, the better image had to go through a lens and vidicon, both of which would reduce the resolution...or so one would think.

Part of the solution to this fascinating riddle might be Professor Branch's calculation of CRT bandwidth. Although it's true some monitors could show 640 clearly defined dots horizontally, they don't have to. A monitor salesman could easily make a case that the maximum frequency happens when every *other* pixel is on. That would mean 320 cycles rather than 640 bits is the number to use on the bandwidth calculations. That would reduce Professor Branch's bandwidth calculations by a factor of two. A 40-column display would need only 3.6 MHz, but even that is not a hard and fast limit. Most alphabetic characters are very forgiving of reduction errors. In fact the design details of some fonts take that into account in order to increase legibility.

But that still doesn't explain why composite video from the computer is worse than composite video from a camera. Before I offer my explanation I wish to confess my reluctance to do so. I'm brand new to microcomputers. I'm about to buy my first and have been reading computer magazines only since October. My background is in electro-optical systems engineering, so that perspective will put a foreign light on the discussion. Here goes.

The only difference between the two is that one is analog and the other is digital. The digital signal comes on instantaneously, stays on a very brief time, then goes off instantaneously. The analog signal—due to the blurring effects of the lens, vidicon, and preamplifier—is unable to come on and go off quite so fast. That limitation improves things because of the funny method of producing color in NTSE (National Television Systems Committee) composite video. To produce compatibility with black-and-white TV, our forefathers chose to have the color information be an AC signal riding on a DC level, the DC being the black-and-white (luminance) amplitude. That AC signal is a modest 3.58 MHz. But even worse news: it is distinguished into colors by its phase! Realizing that, it is a wonder it even gets to the screen.

You see, when a tone is turned on and off in a time that approaches its own period (as is the case with a 3.58 MHz color subcarrier and a computer output), there is an inevitable phase shift and broadening. This is similar to the broadening of a carrier that is modulated with a high frequency. The effect of the lower resolution camera video is to gradually turn on and off the subcarrier, thus keeping it, one might say, unshocked and more pure.

It may be of interest to note that in their wisdom, the NTSC chose this system to take advantage of the eye's very low resolution in color. Color perception has only a half or a third of the resolution of intensity perception. NTSC color should properly be called color-enhanced monochrome. How could they know that someday we would like to display such tiny detail in color and sit so close to the screen.

Walter Clark
Fullerton, California

Reassuring Words

I want to thank you for January's timely editorial, "PC 1984" [*PCW*, Vol. 2, No. 1]. For me, at least, it couldn't have come at a better time.

I had had no problem seeing how increased domestic electronic surveillance actually promotes civil rights, or how slashing the federal education budget and implementing tuition tax credits for private schools furthers the cause of public education. And it's as easy to see that international law necessitated our invading Grenada as it is that our park land will actually be enhanced once

we get all that coal out from under it.

I admit it took me a little longer than most to realize that all the talk you hear about hungry people in this country is just that.

But there was one thing that I was having an especially hard time with, and that's where your editorial comes in. I just couldn't make out how the most destructive weapon ever built, a weapon whose primary advantage over existing systems is its first-strike capability, was actually a "Peacemaker." Then I read the words that put my mind at ease. You pointed out that the IBM PC has helped "to disperse technology into the hands of millions of people, who in turn will find ways to use it to enhance individuality, productivity, and the ability to relate to one another." Not only that, but, "Many other technological breakthroughs...have helped us rebuild the village or family cultural links torn asunder by the industrial age."

Truer words, I now realize, were never spoken. I hope you print this letter so that people who, like me, were actually worried by Orwell's nightmare can read again your sage words of reassurance, and perhaps learn to think aright about such difficult issues as making peace.

Terry Godlove
Chicago, Illinois

Little Brother

David Bunnell's editorial, "PC 1984" [*PCW*, Vol. 2, No. 1], was at first comforting, but then disquieting. On one hand, he expressed relief that the predictions of George Orwell's *1984* have been held at bay, and further, that personal computers will help in keeping it so. On the other, we are told that "we must have government-sponsored day-care centers."

Since you have opened the *PC World* door to the sociopolitical, perhaps a fresh reading of *1984* and then of published federal government plans in the area of government-sponsored day care would be in order.

John R. Roberts
Victoria, Texas

I believe in full employment and I think one of the keys to this is day-care centers. Government support should be in the form of tax breaks and grants. Some of my friends think corporations should foot the bill, but I am opposed to putting more obstacles in the way of business success, which creates jobs.—David Bunnell

Above and Beyond

David Bunnell's editorial in the *PC World Software Review* implied that disk magazines take unfair advantage of authors of public domain software. To set the record straight: *Mentor... the magazine on disk* makes it a policy to seek out authors who have put software in the public domain and to pay them to republish it. Our policy of paying even public domain authors is above and beyond the call of duty in the legal sense. However, we see it as ethically right and we wish to support those authors.

No hard feelings. We're big fans of *PC World*. After all, we'd never think of reading *Mentor* in the bathtub.

Emil Flock
Editor, Mentor
San Francisco, California

Dow Jones Detractor

Because this is the first letter I've written to *PC World*, I would like to start out by saying how fine the publication has been. Articles and columns; reviews of boards, modems, and PC compatibles; and the excellent discussions on the numerous programs and features of the PC have been very rewarding and are often written by people who apparently are heavy users of the equipment or programs they write about. I have come to rely on your magazine for thoughtful insight and honest discussion about the world of personal computers.

However, I am disturbed by the cursory look given by Andrew T. Williams in his article on the *Dow Jones Market Analyzer* [*PCW*, Vol. 1, No. 8]. Though I do not take issue with what he says, it is obvious that he did not live with this program for any length of time. The article clearly lacks the depth *PC World* is capable of achieving. The *Analyzer* is a very good concept that has been poorly executed. *PC World* readers may be interested in a description of some of this program's bugs.

For starters, it should be noted that the *Dow Jones Market Analyzer (DJMA)* was originally conceived and marketed for the Apple. With the strong impact of the IBM PC, Dow Jones and RTR frantically transcribed the *Analyzer*, almost line for line, from the Apple version to create the current IBM version.

The program is written in advanced BASIC and runs at the interpreter level; this key point is the root of many of its faults. Does the program make good use of the IBM's excellent keyboard? No. Does the program take full advantage of the

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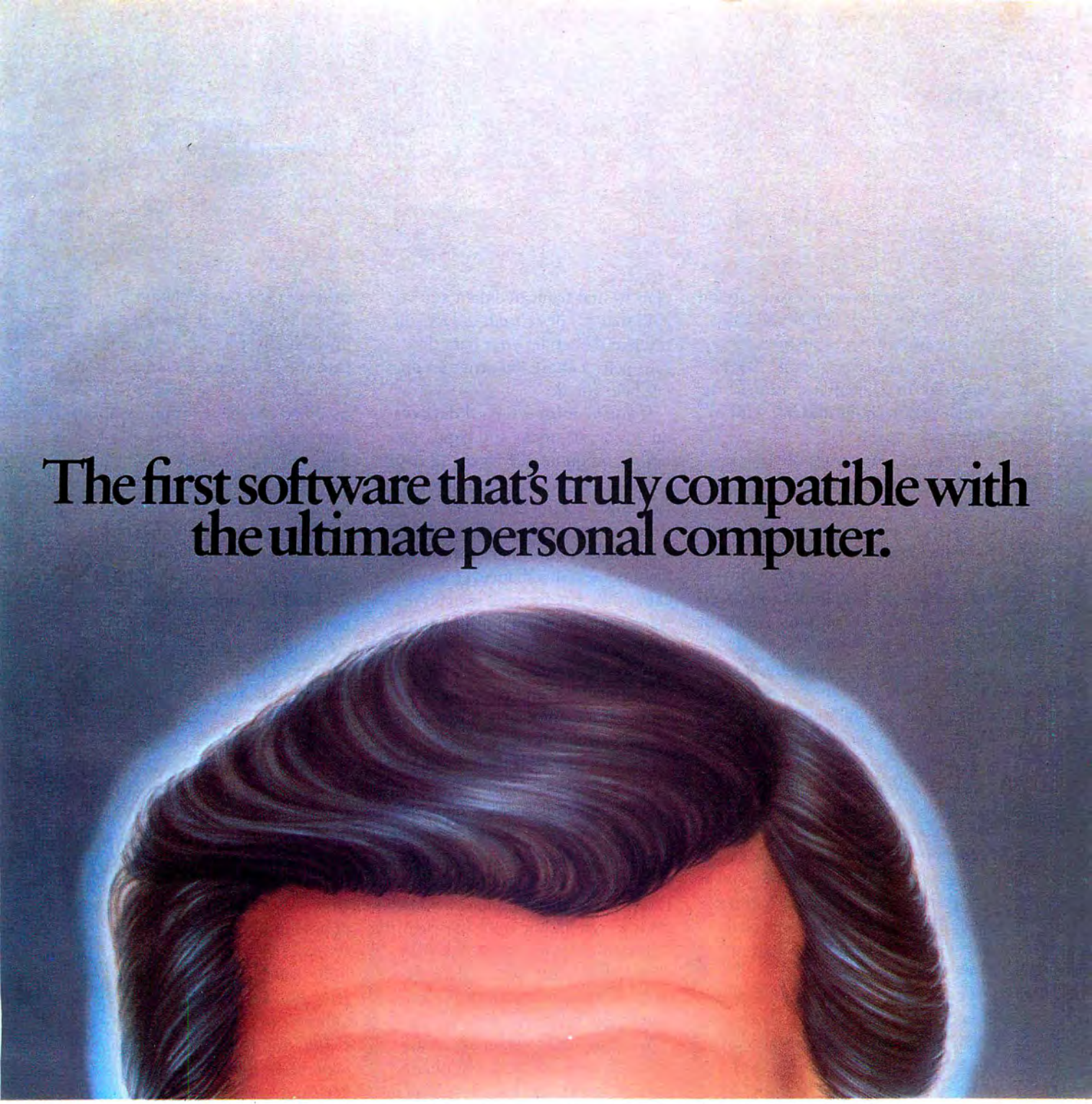

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8088's 16-bit microprocessor capabilities in order to maximize the large amount of number crunching inherent in this type of program? No. Is the program a cheap imitation of the Apple version, bugs and all, with a high price tag? Yes!

Historical quotes are obtained nicely using subroutines written in-house by Dow Jones and added to the analytic package created by RTR. As Williams correctly notes, it takes 5 to 7 minutes to collect 120 days of data or around 15 minutes to collect the 260 or so days of quotes available on line from the News Retrieval Service. If you want data going farther back you must make entries manually, a very tedious chore. *DJMA* doesn't support use of the quote services available from CompuServe or Warner Computer Services. Daily quote updates are somewhat more cumbersome, but performing them is a tolerable task. Retrieval of a day's worth of quotes for 30 stocks takes around 3 minutes to obtain. But what if you missed several days and want to catch up? There's the rub.

The disk I/O protocols are poorly designed and can result in costly on-line time for the user. The data disk has a limit of 300 days of quotes for any one stock. When the quote for day 301 is sent over for storage, the program unloads the data for that stock, truncates the earliest 12 days, moves the remaining 288 quotes up, reloads the disk, and then accepts the entry, which is now the 289th quote. This process is repeated for every stock individually as quote number 301 is loaded and takes about 90 seconds per stock to execute. What happens to that truncated data you've paid for? It's destroyed, unless you track and back up your data disk routinely, a chore the program does not help you do.

If you've missed several days of quotes on 30 stocks and happen to update on quote 301 (every 12 days), you'll sit on line for 45 minutes while the housekeeping chores execute 30 times. Since there is no temporary work disk or equivalent for multiple-day updates, this maneuver is very expensive. Finally, let's say you're using the EZ terminal utility and wish to update your stock, what do you do then? You got it—hang up, switch utilities, and relog onto Dow Jones. You cannot switch between utilities while on line with Dow Jones. Another well-thought-out and useful feature.

If my hunch is correct, many *PC World* readers use a keyboard macro program such as *ProKey* to improve execution. Try loading *DJMA* over *ProKey*. The program loads, you can get it to graph, but you can't clear the screen to chart another stock issue. Wonderful. Want to do a daily quote update? You can't with *ProKey* sitting in low memory.

What about program execution speeds? I assure you that Williams did not spend a real work session in front of the *Market Analyzer*. If he had, he would not have had time to write his article. In order to chart a single stock for 300 days, plot a 50-day weighted moving average, and plot the on-balance volume indicator, the program takes 8 minutes and 44 seconds. Can you believe that? This computer program takes 524 seconds to execute five commands—a total disgrace. Following a portfolio of 30 stocks takes over 3½ hours per session. That doesn't include printing time on the Epson/IBM with Graftrax Plus. Can you store a finished chart for later printing? No. Can the chart be expanded or contracted easily? The answer is a qualified maybe. Certain manipulations of the chart erase the on-screen data and start you fresh, which means you have to replot all your lines. Fun, isn't it?

The poor programming effort made by Dow Jones and RTR in designing and releasing the *DMJA* for the IBM PC somehow was never noted in the pages of Williams's article. The program is expensive to buy, expensive to use on line, and most importantly, wasteful of a user's time.

Dan Lawson, M.D.
Rego Park, New York

I would like to begin by saying how much I appreciate the time and effort that obviously went into Dr. Lawson's letter about my review of the Dow Jones Market Analyzer. *Any physician willing to take time from his practice to compare the programming codes for the Apple and the IBM PC versions line by line is certainly dedicated to computers.*

I do not, however, agree with his contention that the Dow Jones Market Analyzer *is not a well-thought-out piece of investment software. My positive opinion of the* DJMA *was based on intensive use of the program before writing the review, and that opinion has been reinforced by extensive use of it since. The* DJMA *is a useful software package that should be considered seriously by anyone looking for a program to do technical analysis for investment purposes.*

Several of the issues Dr. Lawson mentions, including speed and on-line

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data maintenance, are expected to be addressed in the next release of the program. Until then, when making multiple-day updates, owners of the current version can use the Drop Older Units option on the Utility menu. Use it to verify, off line, that there is room to retrieve 12 days' worth of data or to make more room, if necessary.—Andrew T. Williams

Picture Problem

Oops! Something's not quite right with the drawings in my article ["The Cassette Port Lives," *PCW*, Vol. 1, No. 10]. I showed the pins on the DIN connector in only one of my diagrams; in the others I just used arrows. The artist has drawn the DIN connector in all three diagrams but the wires don't go into it from the same direction in all three, perhaps giving the impression that different pins are being used.

The first of the three diagrams is correct. The wires go, in all cases, to the two pins that are farthest apart (it doesn't matter which of the two is which).

Michael Covington
San Gabriel, California

Words from WordStar

This letter is written in response to "War of the Words" by Burton Alperson [*PCW*, Vol. 1, No. 8].

I realize that since *WordStar* is known as the standard of the industry for word processing it is often positioned as a basis for measurement and criticism when comparing word processing packages. However, I feel that this article's measurement of *WordStar*'s capabilities is unfair. The capabilities of *WordStar* are misrepresented in terms of feature implementation and the productivity that *WordStar* offers to a word processor.

With respect to feature implementation, command control sequences were often counted twice. For example, moving down each line of *WordStar* text was considered a separate keystroke. In actuality, the user would simply depress the key once and hold it down for the entire sequence.

The method used to double-space and justify a block of text is far from the simplest and quickest alternative. As the *WordStar* user's manual describes, the dot command .lh16 provides an easy way to produce a double-spaced document. Using the .lh16 command and a <Ctrl>-B on each paragraph cuts the number of keystrokes in half. (This can even be reduced further, as Alperson indicated, with the <Ctrl>-QQB option.)

With respect to productivity, or "agility," *WordStar* offers the production-oriented word processor an efficient and extremely fast operation for getting the job done. The diamond cursor command set offers the fastest means of typing and editing for the touch typist, since the hands never have to leave the keyboard. Alperson underestimates the movements and overall time required to move a mouse around for cursor control. Positioning the mouse on a specific character takes more than the equivalent of one keystroke.

Jan Swanberg
Product Manager,
MicroPro International
San Rafael, California

Name and Address

Our February issue (Vol. 2, No. 2) included an article called "Making a Date" by Steve Manes, a professional musician in New York City. The author is not to be confused with another New York writer of the same name. That writer, Stephen Manes, is a contributing editor for PC Magazine *and* PCjr *magazine and chairman of Hard/Soft Press.*

The February issue also contained a letter from Bret Salter in which he offered to supply readers with a free memory map for the IBM PC and PC XT. Unfortunately, we neglected to print Mr. Salter's address. If you're interested send a self-addressed, stamped envelope to Bret Salter, Data Base Decisions, 14 Bonnie Lane, Atlanta, GA 30328.—Ed.

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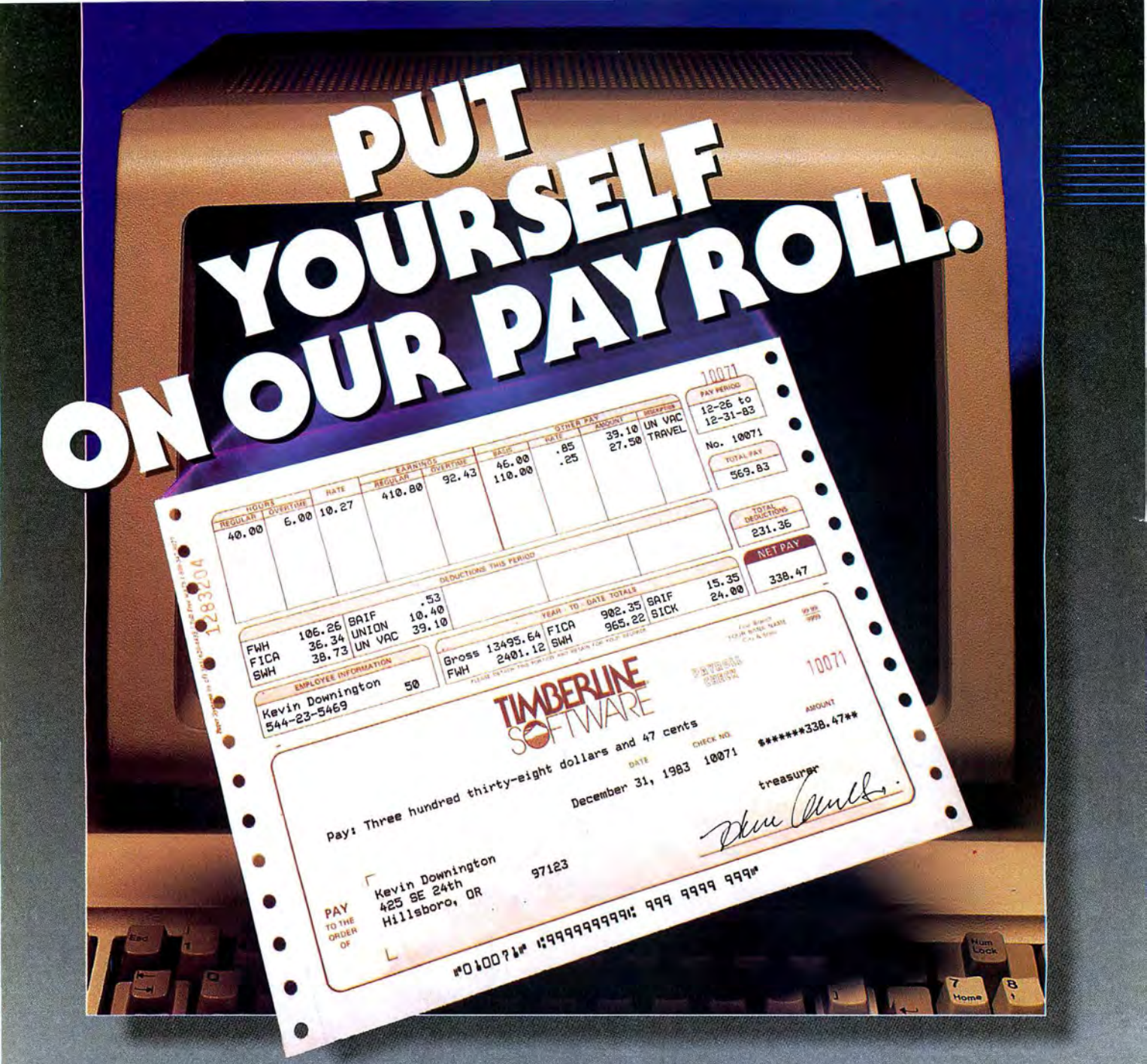

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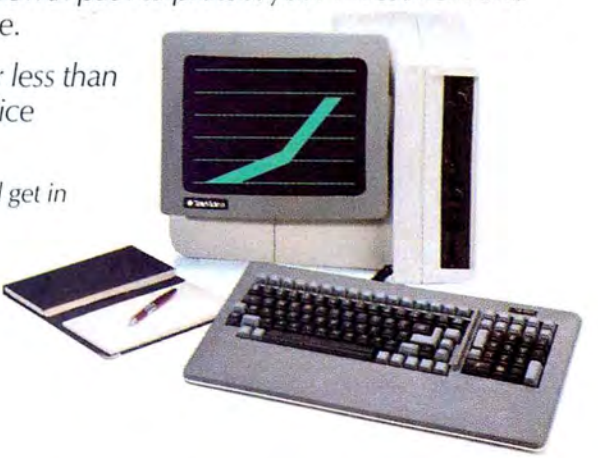

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PC WORLD View

News and notes for the computing community

Miriam Medom

PC World View reports new developments in computer technology, items of interest to all computer enthusiasts, and the most significant and enticing speculation about industry trends and personalities. We reserve the "Grapevine" section of this column for industry reports that are still at the speculative stage.

Grapevine

Long on Lasers

According to industry sources, IBM has ordered 1.5 million compact laser videodisc drives for delivery during the next several months. At press time no confirmation of their potential uses could be obtained, although observers speculate that this high-capacity storage medium may be added to the PC family of products. Reportedly, IBM ordered only the drives and still must develop an interface to connect the videodisc drives to the PC or other computers selected for this project.

The compact disk has begun to take hold in the audio market, and its capacity to store both video images and data seems highly promising for computers. As yet, however, this technology is expensive: recording a videodisc, on which information is permanent, costs several thousand dollars. So these disks will have to contain data that has wide appeal, such as an encyclopedia, a dictionary, a thesaurus, or other reference works. (Has anybody acquired the videodisc rights to the *Guinness Book of World Records*?)

The other current hang-up is technological: as yet, the laser videodisc drives are read-only devices. (Panasonic makes a read-and-write videodisc recorder, but it costs $35,000, so it's not likely to be the machine that IBM wants 1.5 million of.) Until read-write videodisc technology turns out a relatively low-priced product—like floppy drives and hard disks—the laser drives will be terrific as data accessors but useless as data recorders.

Short on Floppies

Another industry report states that IBM has cranked up its disk-drive-making apparatus to try to meet the demand for 5¼-inch floppy disk drives for the PC and the PC XT. Although IBM has multimillion-dollar contracts to purchase floppy drives in volume from both Tandon and Control Data, the computer maker apparently intends to supplement these supplies with its own product.

IBM's manufacturing site for these drives is a plant in Boulder, Colorado, where the company's short-lived 4-inch floppy disk drive was developed. (IBM originally planned to sell its 4-inch drive to other computer manufacturers, but industry demand for the odd-sized drive was not overwhelming, and IBM subsequently abandoned the project.) The future of the industry-standard 5¼-inch drives seems much more secure. One industry observer predicts that by 1986 IBM will need as many as 5 million each year.

Industry Ingenuity

Here's a story of one software company helping another—complete with three happy endings. At the fall COMDEX show in Las Vegas, Microsoft sponsored a kind of lottery designed to bring people together. The Bellevue, Washington, software firm and the computer makers that have licensed Microsoft's MS-DOS handed out buttons on which serial numbers had been printed. There were two copies of each button; the trick was to find the person who had

the same button as you. In a sea of 80,000 people (not to mention five exhibit halls), finding a badge with an obscure 6-digit number on it was no small task.

But one enterprising software firm, Dynamic Microprocessor Associates (DMA) of New York City, decided to become a matchmaker. DMA publishes an applications-generating program called *Formula II*, and when a friend suggested to the people working in DMA's booth that the program would be ideal for locating the people who had matching buttons, the DMA folks readily agreed. After about half an hour's work with *Formula II*, the DMA staff produced a custom-tailored data base to record and compare button numbers and locate the buttons' owners.

On Wednesday, the third of COMDEX's five days, DMA staffers posted flyers inviting showgoers to their booth to register for button matching. Word of this highly appropriate use of computer power spread throughout the convention, and the line at DMA's booth was at least ten deep for the rest of the week. Diana Wilcox, one of the DMA staff members who worked in the company's booth, reports that the button data base had 2500 numbers in it by the end of the show and that *Formula II* had made between 50 and 60 matches.

Everyone whose buttons matched automatically won a copy of *Microsoft Word*, a new word processing program, and all those winners were eligible for a drawing to choose the three big prizes—trips to Paris, Munich, and Hawaii. Of course, to prove that you had matched buttons, you had to find the other person whose button had your number on it, and that's where *Formula II* really

helped. The data base not only matched numbers but also included hotel room number, booth, company affiliation, home phone, and other information useful to help a would-be winner find his or her match. At least two of the three big winners made their matches through the DMA booth, Wilcox notes, and one happy winner took the DMA staff out for champagne.

Program Pedigrees

To help alleviate confusion about which programs run on which IBM PC compatible computers, Software Strategies of Eden Prairie, Minnesota, offers a sort of program pedigree service. The company distributes some 300 programs, and it will certify to makers of PC compatibles that its programs will run on their machines. (Presumably, it will also report which programs won't run on a particular computer.) Manufacturers of PC compatibles will be able to use this information to compile and publish lists of software guaranteed to run on their machines.

Big Blue's News

Popcorn Included?

In a quiet but swift move, IBM has purchased 94 large-screen video projection systems from Inflight Services, a company that supplies movie machinery to the airlines. The systems were ordered by the National Marketing Division of IBM, located in Atlanta, and reportedly will be used in the corporation's "executive briefing rooms." We're wondering if the men and women in blue have to pay $3 for earphones.

It Even Makes Change

IBM recently announced that it will manufacture the first automatic teller machine to dispense coins. Most of the computerized walk-up windows at banks are limited to bills of one denomination (typically $20), but IBM's new 4730 Personal Banking Machine can handle five denominations of bills plus pennies, nickels, dimes, and quarters. The advantage of all this flexibility is that customers can cash their Social Security checks or withdraw just enough cash for an ice-cream cone at the Baskin-Robbins down the street.

Since IBM seems to have adopted the word *personal* for its products lately, we're wondering if the corporation might provide a PCjr-type number pad for the new automatic teller. With just a few handy keys and an infrared signal, you could cash your paycheck from across the street. In case you want one of these personal tellers for your very own, prices start at $20,300.

Competitors Buy Compatibles

Honeywell Information Systems and Control Data Corporation, two of IBM's competitors in the large-computer market, are buying PC compatible microcomputers from another IBM competitor. The recipient of some $45 million in orders from the two firms is Columbia Data Products, maker of both a desktop system, the MPC, and a portable, the VP. A spokesperson for Columbia noted that the firm has been shipping about 200 computers per month to each of the two big buyers. Both Honeywell and Control Data are expected to integrate the Columbia machines into larger systems designed for such special purposes as banking or office automation.

Democrats May Roast

The Democratic Convention is slated for San Francisco this July, and to get this plum for her city, Mayor Dianne Feinstein had to certify that the temperature in the convention hall would stay between 70 and 72 degrees. But the Democrats may find themselves in the ultimate stuffy, hot, and smoke-filled room, because the air conditioners, smoke-removal ventilators, and various other environmental aids are controlled by a computer that has been acting up since the hall opened two years ago.

So far the $1.4 million computer system at San Francisco's Moscone Convention Center has not lived up to its promise. Although it is supposed to control heating, cooling, lighting, and other basic operations, the Honeywell system has been so unreliable that the center's staff still turns everything on and off manually. The machine occasionally takes over without being asked, turning lights off and on and even sending a fire door crashing down on one occasion.

While Honeywell and the center's management firm trade charges about who's responsible for the pesky computer, Feinstein and her staff are hoping for cool weather. Because the building's air-conditioning system was designed for the temperate San Francisco climate, it may not be able to cool the hall during a hot spell. So if the weather and the computer don't cooperate, the Democrats could be in for a real political roast.

Loose Lips

People in the computer industry say some provocative and illuminating things. They sometimes also make pronouncements that, in the cool light of consideration, may sound a bit rash. We'll print a selection of these statements each month and, as always, we'll pay for the material we use. (The check goes to the submitter, not the speaker.) Here are a few pearls.

"The next corporate status symbol will be direct access to the data base. He who doesn't have access doesn't make it in the corporation."—Stephen Caswell, software publisher, on how managers will use desktop computers.

"Everybody now is to some extent at the mercy of IBM."—Mitch Kapor, president of Lotus Development Corporation, on the perils of depending on the PC for a livelihood.

"IBM has really ex officio taken over companies."—James Toreson, president of Xebec, on the fact that supplying hard disk controllers to IBM is dominating his firm's operations.

"The software industry is like a baby who's been eating high-performance vitamins all day and turns into an adult overnight."—Roger Von Oech, president of Creative Think, at the "Success in Software" conference.

"Wowie-zowie technology doesn't sell machines any longer. Computers are sold through traditional marketing methods. It's a matter of who can shove the most commercials into the Super Bowl."—Jean Yates, president of Yates Ventures, on the future of selling computers.

Call Us RAMada

Ramada Inns, based in Phoenix, has ordered 640 IBM PCs for installation in its motels and hotels throughout the United States and Canada. The computers will be used to take reservations, store information on preferred customers and travel agencies, and exchange data with the company's main computer system in Phoenix.

Ramada has some 97,000 rooms in its 600-plus inns, making it the world's third-largest provider of lodging. It is the first hotel chain to install PCs.

Software News

Computer programs are becoming so abundant and specialized that both buyers and sellers need advice. Two useful publications should help meet this need; one focuses on software marketing, and the other analyzes accounting programs.

Soft-letter, subtitled "Trends & Strategies in Software Publishing," reports developments and offers tips for people in the software business. A recent issue focused on software best-seller lists, explaining how the lists are compiled and questioning the accuracy of those reports. This eight-page opus is published biweekly; annual subscriptions are $135 (63 Sacramento St., Cambridge, MA 02138).

The Knight Accounting Software Reports are intended to help software dealers and accounting firms compare and evaluate the many commercial accounting software packages. Each report covers one accounting module, such as accounts receivable or general ledger, comparing that module's design and use with four brands of software. One of the Knight reports compares two versions of software from Peachtree, the *MBSI* package from RealWorld Corporation, and the *Great Plains* accounting package from Great Plains Computers.

The Knight service produces these comparative reports for $75 each. The authors, Sherry Knight (a CPA) and Steven Yoder, can prepare an in-depth analysis of any brand of accounting software for $500. For more information, contact the Knight Research Corporation, 6644 Heartwood Dr., Oakland, CA 94611, 415/339-8475.

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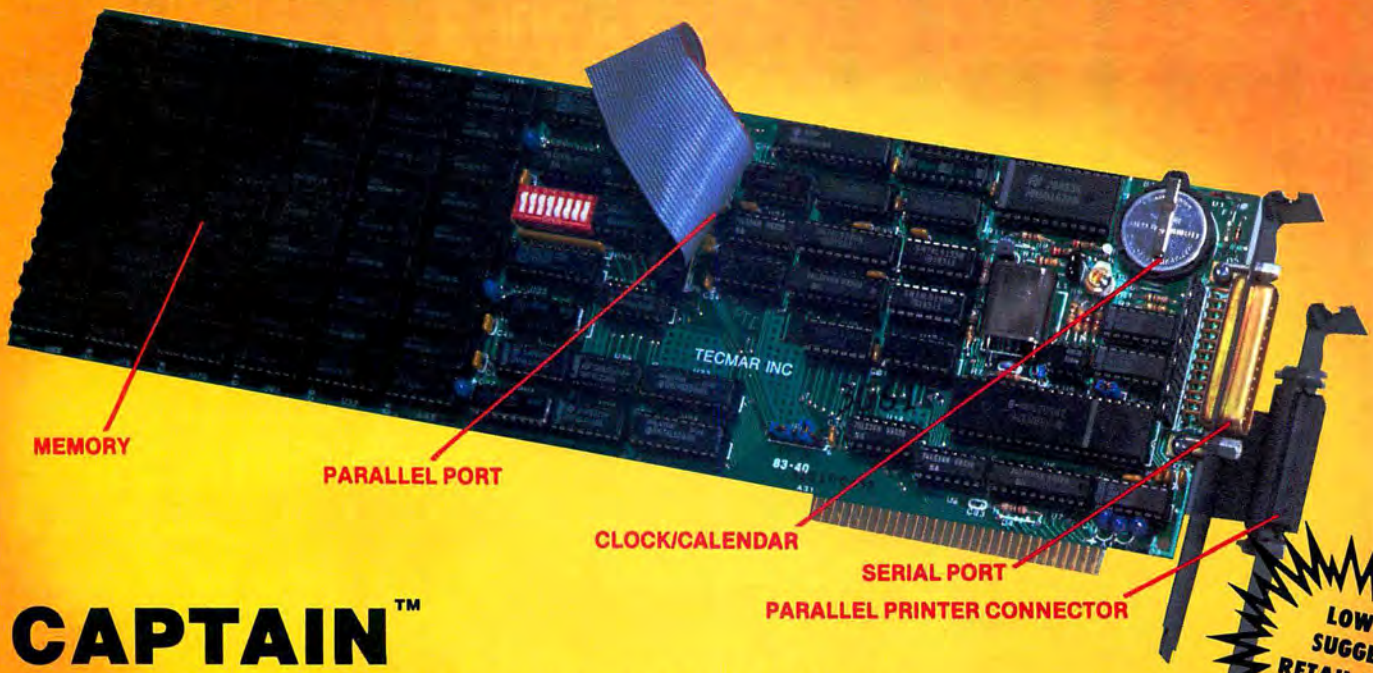

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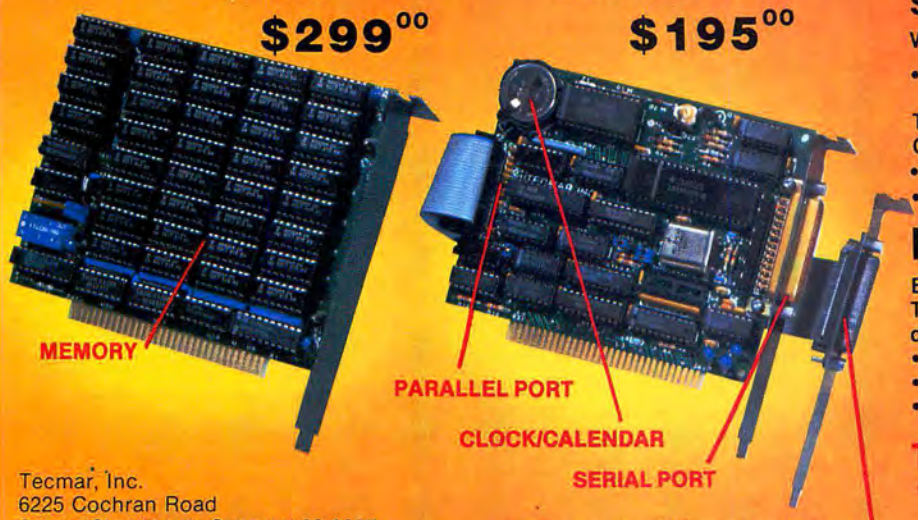

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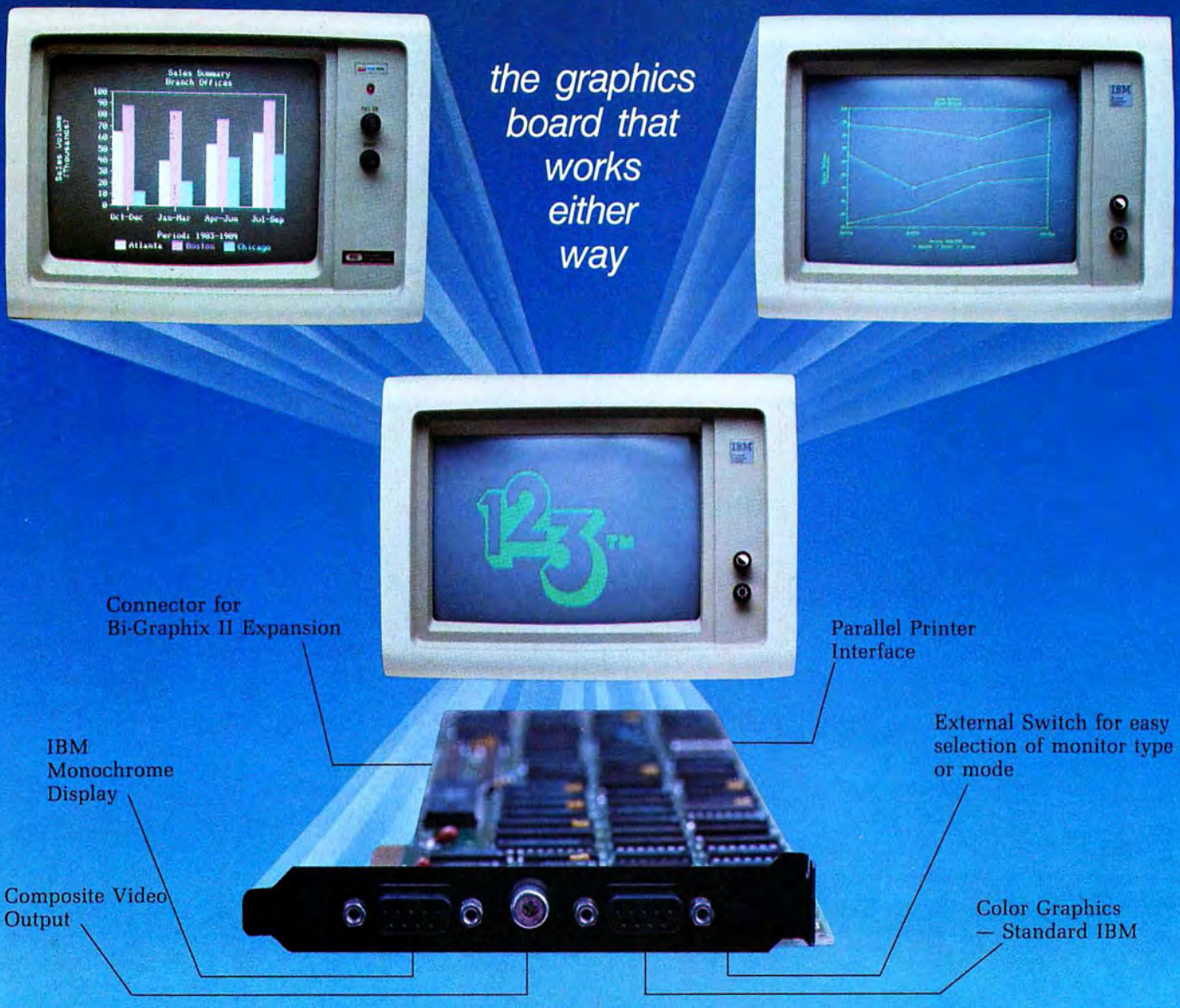

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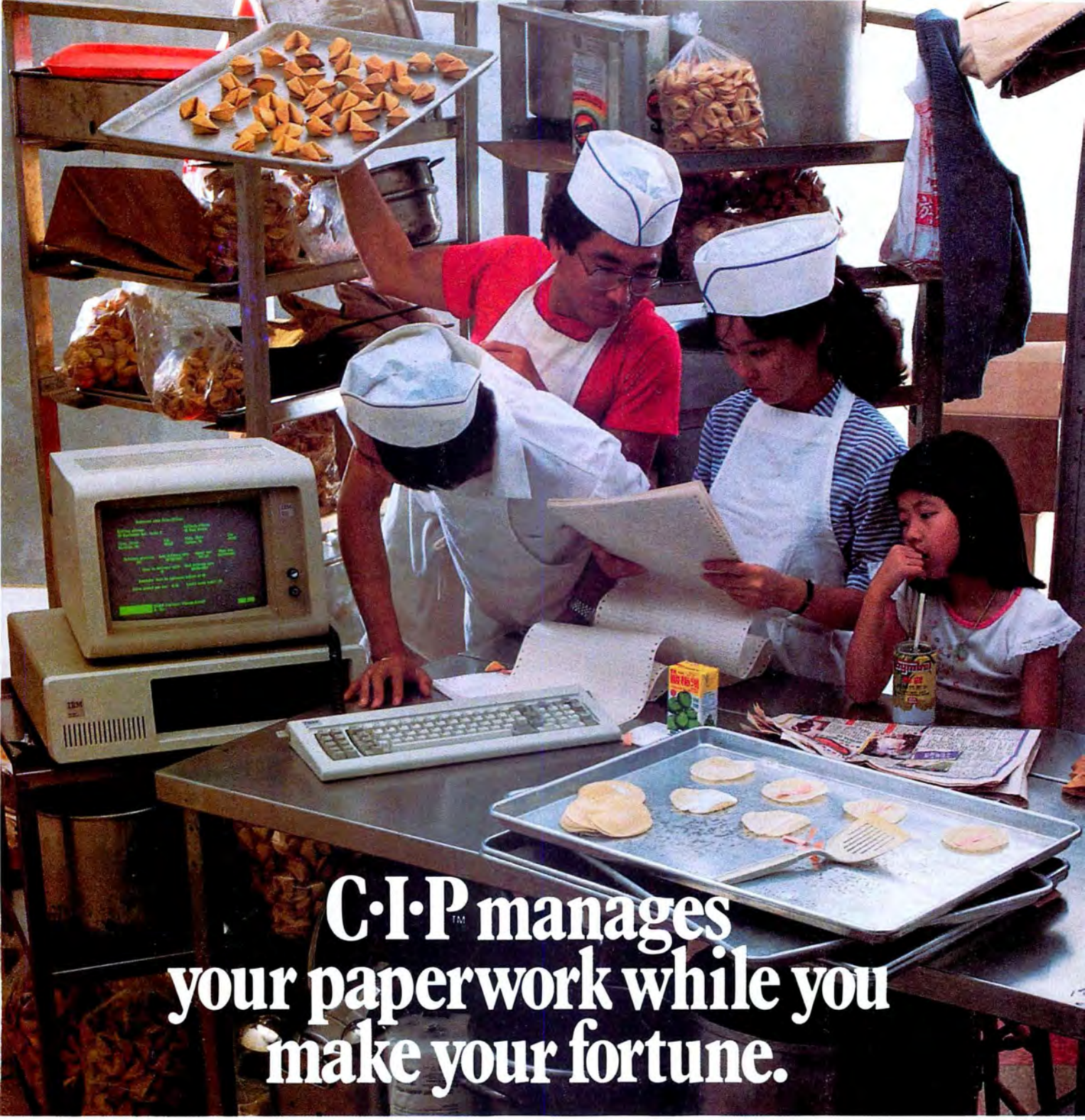

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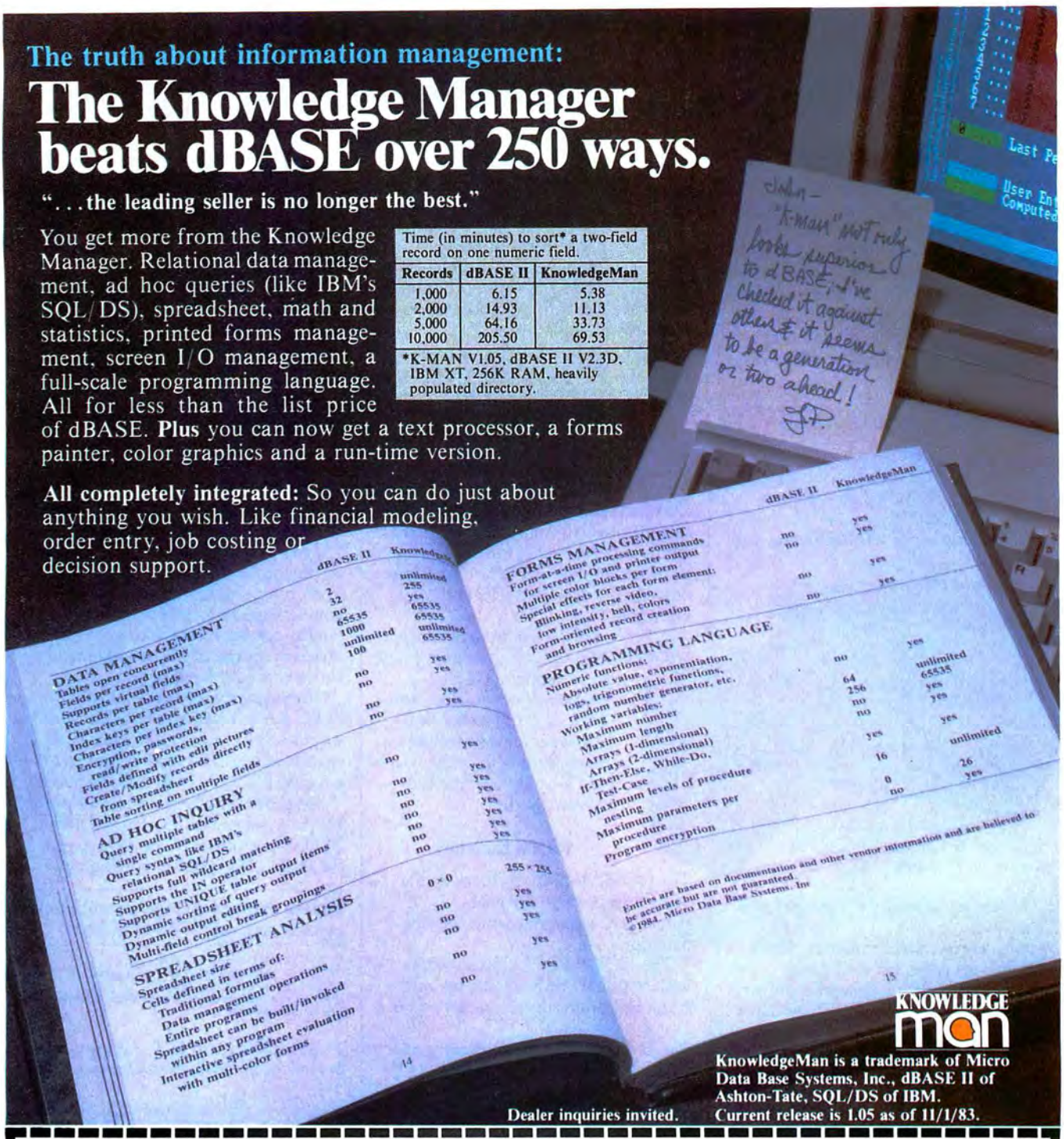

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Let's Get Started

Harry Miller

With this issue we are introducing a new section called "Getting Started." This section is specifically aimed at the growing number of new computer users. Every month thousands of people are either buying computers or starting to learn how to use them. The objectives of the "Getting Started" section are to make both of those activities a little easier and a little more manageable.

We are fond of saying that reading *PC World* will help you get the most out of your personal computer. We're also aware that first you've got to be able to get some kind of useful work out of it. The articles in the "Getting Started" section will help you overcome the obstacles that might prevent you from getting results from your computer. Getting started with your computer requires decisions for which the number and complexity of choices is overwhelming. You are also sure to encounter techniques or commands that just aren't explained adequately in any of the manuals. Some of the toughest obstacles you'll have to deal with might be in the conceptual understanding of what the computer is supposed to be doing. In those cases it's not just the answers that are elusive; it's often hard to know even what the questions are.

This month's "Getting Started" section features an article, "DOS for Beginners," about the most commonly used commands in the PC's operating system (the software program that manages the computer's resources and peripheral devices). No matter what you set out to do with a computer, the operating system is your first level of interaction. Thus, the commands discussed are your first step to gaining control over the computer.

In future issues this section will guide novices through a wide range of applications and system software. For example, you'll learn what spreadsheet programs can do for you (and how to select the right one), how to get the data into and out of your data management programs, and how to use business graphics programs to help get your points across more effectively.

Finally, each month *The Help Screen* will answer your questions about how PCs and software work. No question is too elementary to be covered. Since questions don't usually occur in logical groupings, *The Help Screen* will assist you in solving problems as they come up.

We know what some of the problems are and how frustrating they can be, mainly because we've been there. We aim to help you find the satisfaction that comes from taking control of the computer and getting it to work for you. Let us help you get acquainted and more comfortable with your computer. Then let us show you how to continue to increase the computer's usefulness and, as a result, your productivity.

We haven't quite arrived at what I call the "Second Personal Computer Revolution." The first revolution made computing available to the general public on a one person/one computer basis. But it also forced otherwise normal people to think like computer nerds—using unfamiliar and unnatural commands. The second revolution will feature computers that are smart enough to understand the way people think and the way people normally express themselves. Until that situation is the norm and not the exception, the "Getting Started" section will help you through the transition from computer novice to computer expert.

DOS for Beginners

Before you plunge into your first applications program, get to know the system that allows it to run.

David Arnold

PC-DOS is the disk operating system sold most often with the IBM PC and XT. It is generally compatible with MS-DOS, which runs on many computers similar to the PC. Several other operating systems are available for the PC, including CP/M-86, Concurrent CP/M-86, the p-System, and various forms of UNIX. Yet PC-DOS is by far the dominant operating system.

DOS (disk operating system) is a collection of utilities that manage data in the computer system. More than 40 commands are available, many of which call up complete programs that have their own sets of commands, including EDLIN, DEBUG, and LINK. These more complex DOS features are intended for programmers or advanced users. The most frequently used DOS commands make backup copies of disks and files, display the contents of a file on the screen, indicate the amount of space available on disk or in memory, and erase and rename files. Although this tutorial focuses on DOS 2.00, the basic commands are essentially identical to those found in DOS 1.00, 1.10, and 2.10.

Some DOS functions are essential: you can't run an applications program without them. The essential parts of DOS reside on almost every disk you'll use with the PC. Two of these three basic DOS files, IBMBIO .COM and IBMDOS.COM, are transparent (hidden) and not listed in the directory. The third essential file is a nontransparent utility called COMMAND.COM. These three files are sent into RAM every time you load DOS (by turning the power switch on or by resetting the computer with a DOS system disk in drive A: [see Figure 1]).

> Regardless of whether you can see evidence of its presence, DOS is always there.

Most applications programs make DOS as transparent as possible. They do this by using their own menus or commands to activate DOS. Consequently, most PC users can run their computers without having to learn much about DOS.

Why should you learn how to use DOS if your applications programs do everything for you? That is like asking why you should learn to set the shutter speed and lens opening on your camera when you could set it on automatic. For average pictures in average situations, automatic operation is sufficient, but to get the best results, maximize control and flexibility, and be able to handle unexpected problems, you have to assume control at the source.

Understanding DOS

When the computer loads a program, it copies the program from the floppy disk into memory (RAM) so you can use it. DOS never removes the original file from the disk unless you delete a file with the ERASE or DEL command. When you load a program from drive A: by simply turning the computer on, the computer normally loads DOS at the same time but might keep it transparent, not even displaying the DOS A> prompt. Many programs display their own prompt, such as 'Ok' (BASIC), '*' (EDLIN), '-' (DEBUG), '.' (*dBASE II*), or a flashing cursor (most word processing programs). Regardless of whether you can see evidence of its presence, DOS is always there.

It would waste space to keep all of DOS in main memory (RAM), so when you load DOS, only the most frequently used DOS functions go into memory. When you type a more

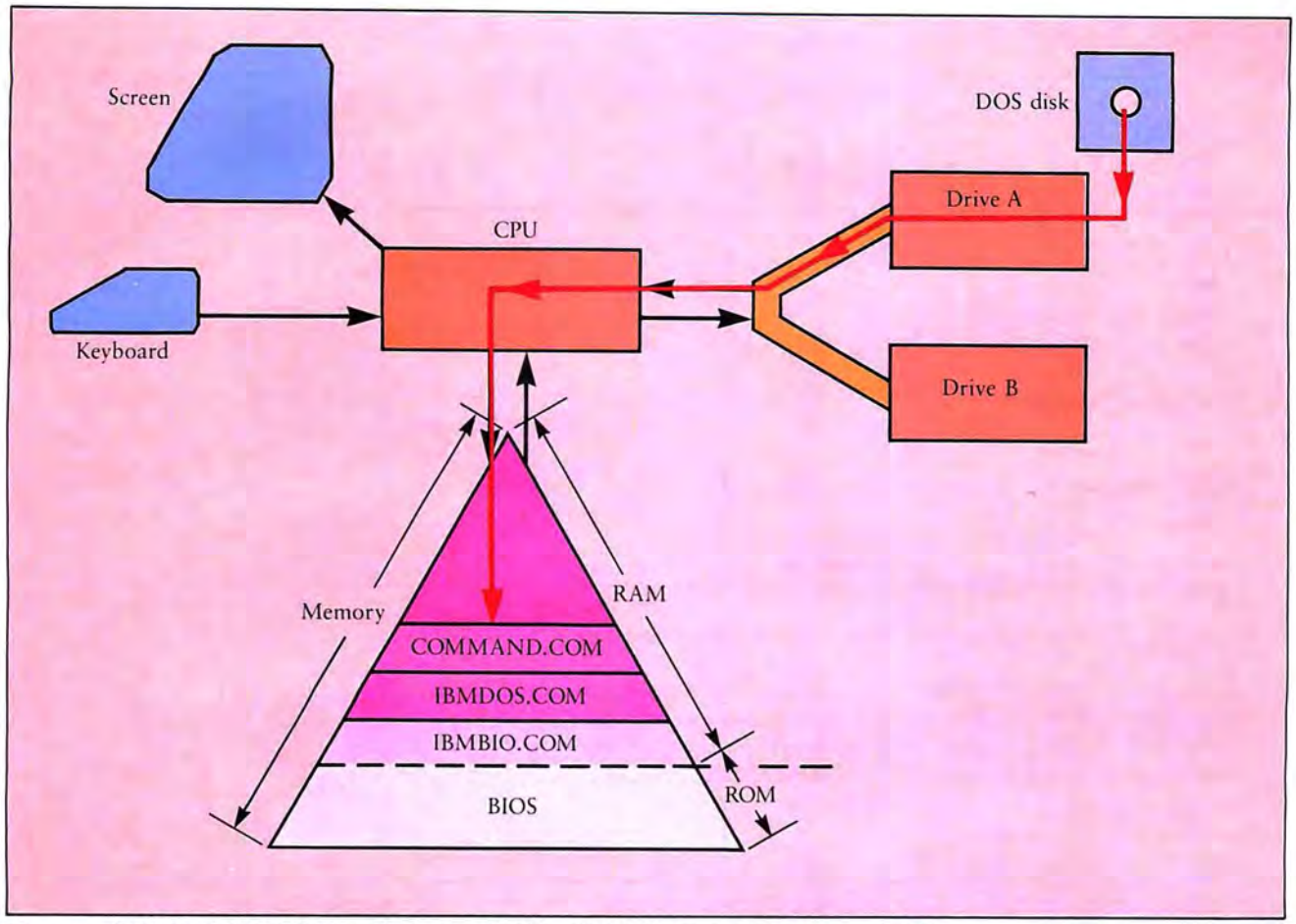


Figure 1: COMMAND.COM and the two hidden DOS files are loaded into RAM.

complex command, such as FORMAT, DOS has to go back to the disk for it. Thus, you must have a system disk (either the DOS distribution disk or another disk with a copy of the DOS system on it) in the disk drive to run DOS. The parts of DOS that reside in memory are called "internal commands"; those that reside on disk and are copied into memory while they are being used are called "external commands."

Once you have loaded DOS, you can remove the system disk and all the internal commands will still be accessible. External commands, however, can only be used if the disk you are using contains the file that executes the desired command. Figure 2 is a list of the internal and external commands covered in this article.

File Specification

While some DOS utilities, such as FORMAT, work on the disk as a whole, most DOS commands operate on individual files. A disk is the equivalent of a file drawer; the mass of information on a disk or in a file drawer is organized into files, and each file is labeled with a name. File folders have a tab, and disk files have a file specification, or filespec. DOS serves as the file clerk. Just as a file clerk might take a file from a drawer, make a photocopy, and put it on your desk, DOS goes to the disk, makes a copy of the file you want, and puts the copy in memory so you can work with it.

The first part of the filespec is called the file name; the second part is called the extension. The file name can be from one to eight characters long. The extension can be from one to three characters long and is always separated from the file name by a period. Filespecs can contain almost any combination of letters and numbers as well as certain punctuation marks. DOS will let you know if you try to create a file name with unacceptable characters; a message such as 'Invalid number of parameters' or 'Bad command or file name' will appear on the screen.

You don't have to use extensions, but they are useful in organizing groups of files and can provide information about a file's contents. Some extensions have a standard meaning: .BAS signifies a program written in BASIC, .COM and .EXE are used for program files, and .BAT indicates a batch file, which is a series of commands that DOS executes sequentially. You can also make up your

INTERNAL

Command	Function
DIR	Lists directory of disk
COPY	Copies file(s)
ERASE	Deletes file(s)
DEL	Deletes file(s)
CLS	Clears screen
REN	Renames file

EXTERNAL

Command	File needed on disk	Function
FORMAT	FORMAT.COM	Formats a disk for use and erases contents
DISKCOPY	DISKCOPY.COM	Copies entire disk and erases contents
DISKCOMP	DISKCOMP.COM	Compares contents of two disks
COMP	COMP.COM	Compares contents of two files
CHKDSK	CHKDSK.COM	Checks disk and displays contents in bytes

Figure 2: Commonly used internal and external DOS commands

own extensions, such as .TXT to designate a file containing text rather than a program, .LET for letters, or .614 for a file created on June 14.

Default Drives

To start using DOS commands, place a system disk in drive A: and turn on the power switch or, if the power is already on, reset (boot up) the computer by pressing <Ctrl>-<Alt>-<Del>. The system first asks for the date. If dating your material is important, type the month, day, and year divided by either slashes or hyphens. For example, for April 23, 1984, you would type 04/23/84<Enter>. Then the system asks for the time in a 24-hour format. For example, for 9:45 a.m. you would type 9:45<Enter>. For 9:45 p.m. you would add 12 hours and type 21:45<Enter>.

If dating and timing your files is not important, simply press <Enter> twice, and you will see an A> prompt appear on the screen. This means DOS is asking for instructions. The A> prompt indicates that you will be issuing a command from the A: (left) drive. This is the default disk drive. For most systems A: will always be the default disk drive. However, if you have an XT or a hard disk and no program disk is inserted in the A: drive, the default drive will be C:.

To temporarily change the drive you are working on, type the letter of the drive followed by a colon and press <Enter>. If the command you issue affects only a file or files on the disk in the default drive indicated by the prompt, no further drive specification is necessary. However, if one or more of the files affected are found on a drive other than the one indicated by the prompt, each remote file must be preceded by the appropriate drive letter and a colon.

You can use the directory (DIR) command to get a list of the files contained on a disk. To check the directory of the disk in the current default drive, type DIR in uppercase or lowercase letters and press <Enter>. The directory provides (from left to right) the file name, the extension, the size of the file in bytes, and the date and time each file was last updated. At the bottom of the list the number of files and the amount of unused space on the disk are displayed.

Some disks have so many files that the list is too long to fit on the screen. In that case the top lines scroll out of sight. There are two

```
A>dir/w

 Volume in drive A has no label
 Directory of  A:\

COMMAND  COM    EXE2BIN  EXE    LINK     EXE    DEBUG    COM    ART      BAS
SAMPLES  BAS    MORTGAGE BAS    COLORBAR BAS    MUSIC    BAS    DONKEY   BAS
CIRCLE   BAS    PIECHART BAS    SPACE    BAS    BALL     BAS    COMM     BAS
ANSI     SYS    FORMAT   COM    CHKDSK   COM    SYS      COM    DISKCOPY COM
DISKCOMP COM    COMP     COM    EDLIN    COM    MODE     COM    FDISK    COM
BACKUP   COM    RESTORE  COM    PRINT    COM    RECOVER  COM    ASSIGN   COM
TREE     COM    GRAPHICS COM    SORT     EXE    FIND     EXE    MORE     COM
BASIC    COM    BASICA   COM    CA1      BAS    NEWDSK   BAK    NEWDSK   BAT
DISCCOPY COM    DISCCOMP COM    CPQBASIC EXE
        43 File(s)              46080 bytes free

A>
```

Figure 3: DIR (directory) command with /W (wide) option

ways to read a directory too large for the screen. One is to add /P (for pause) to your request: DIR/P <Enter>. This command tells DOS to scroll the first part of the file list into view and then pause. Press any key, and the rest of the display scrolls onto the screen.

You can display the directory in another screen format by adding /W (for wide) to your request: DIR/W <Enter>. This time, instead of a single column, the directory displays the file names five across but doesn't provide additional information on file size, dates, and times (see Figure 3). Although the directories of most disks you use will probably fit on one screen, on some disks a directory might take up two or three full screens. With the XT or another hard disk system one directory can contain up to 512 file names.

Format

Before you save any data on a disk, the disk must be formatted by DOS. When you format a disk, you erase any information that's stored on it. Therefore, you must be extremely careful to designate the correct disk drive when using the FORMAT command. Always check that you've given a drive designation (A:, B:, and so on) and that the disk you want to format is in that drive. To be sure that you don't mistakenly erase data by formatting, run a directory (most likely DIR B:). If the disk has not been formatted, a disk error message will appear.

If you have an XT, you must be especially careful when you use the FORMAT command because it could erase and reformat the hard disk as well as the floppy disks. The hard disk on the XT is designated as drive C: (although you can change this to another letter). If you do not include a drive letter in the FORMAT command, drive C: will be assumed, and you will erase all data on the hard disk. If you designate drive A: or B:, the hard disk data will be safe.

To format a disk, leave a disk containing the FORMAT.COM program file in drive A: and put a blank disk in drive B:. From the A> prompt, type FORMAT B:/S <Enter>. This command directs DOS to format the disk in drive B: and put a copy of the operating system (/S) on the disk at the same time. The system consists of the DOS files IBMBIO.COM, IBMDOS .COM, and COMMAND.COM. The computer will respond with 'Insert new diskette for drive B: and strike any key when ready'.

Since you already have a new disk in drive B:, press any key (or insert a blank disk if you're using a single-drive system). Drive B: (the one on the right side) will start whirring, its red indicator light will glow, and the screen will announce 'Formatting 9 sectors per track, 2 sides...'.

Since you can't see the formatting process in action, visualize a large roll of paper, 8½ inches wide by hundreds of feet long. Imagine cutting it into pieces 11 inches long and putting lines and page numbers on each sheet. That procedure would be the nonelectronic equivalent of formatting a disk.

DOS 2.00 creates 40 concentric tracks on each side of a disk. At the same time, it does the electronic equivalent of drawing lines from the center to the edge, dividing each

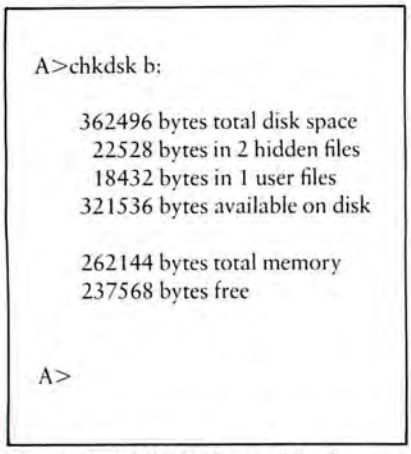


Figure 4: CHKDSK on a blank, formatted double-sided disk

track into nine sectors (DOS 1.10 and 1.00 create eight sectors). This creates a total of 360 sectors on each side of the disk, each of which can hold 512 bytes (characters) of information. That's a grand total of 184,320 bytes per side, or 368,640 per disk if you have double-sided disk drives. Since 1K is 1024 bytes, that works out to 360K of storage space. A double-sided disk formatted under DOS 1.10 has a capacity of 327,680 bytes, or 320K.

DOS 2.00 can read eight-sector and nine-sector disks with equal ease. But DOS 1.10 can read only eight-sector disks, so you cannot read disks formatted with DOS 2.00 when you are using DOS 1.10.

Once the computer has finished formatting the disk and transferring the operating system, the FORMAT program will ask 'Format another? (Y/N)?' Press N to get back to the A> prompt.

CHKDSK

To check if FORMAT has done its job and to ensure that a disk is in good shape you can use the CHKDSK command. CHKDSK, pronounced "check disk," does just what its name implies; it checks a disk and reports in more detail than DIR how much space is available for storing programs or data.

To check the disk you have just formatted, type CHKDSK B:<Enter>. If you're using DOS 2.00 with double-sided disk drives, the screen should look like Figure 4. CHKDSK lists total disk space, hidden files, user files (in this case only COMMAND .COM), and bytes available on the disk. The last number in Figure 4 is the reason most people use CHKDSK—to see how much space is left on the disk. The last two lines, separated from the others by a blank line, show the total main memory (RAM) in the computer (131,072 means 128K RAM) and the number of bytes free. Subtract bytes free from total memory and you discover how much memory is currently in use.

> The DISKCOPY command is handy for backing up disks.

Occasionally, a disk will have a bad sector. When you use the FORMAT command, DOS tests the disk for bad sectors; if it finds any, it marks them off so that no data can be stored on them. If any bad sectors have been found, CHKDSK will report them.

COPY

The COPY command is one of the most useful internal commands that DOS provides. It enables you to copy an individual file or a group of files from one disk to another. As an example you can copy files from the DOS distribution disk in drive A: to the newly formatted disk in drive B: by typing COPY A:FORMAT.COM B:FORMAT.COM <Enter>. When you see the message '1 File(s) copied' followed by the A> prompt, you know the file has been copied. To verify, type DIR B:<Enter>, and you will see FORMAT.COM listed on drive B:. Now type DIR A:<Enter>, and you can see that FORMAT.COM is still on drive A: as well as being on drive B:.

Typing the drive designations before the filespec is not always necessary. If the file to be copied is on the same drive as the prompt displayed, the designation is not necessary. If the name of the file to be copied to remains the same, a further shortcut can be taken by not repeating the filespec. You can type COPY FORMAT.COM B:. The COPY command can also be used to rename a file as it is being copied. If you want the new file to be called DESIGN.COM on drive B:, type COPY FORMAT.COM B:DESIGN.COM.

What if you shorten the command still further by leaving off B:, as in COPY FORMAT.COM? DOS will again default to the A: drive, but if the filespecs are the same, DOS refuses to make a copy and remarks 'File cannot be copied onto itself'. However, if you give the copy a different name than the original, DOS will accept the command. If you type COPY FORMAT.COM DESIGN.COM, you will have two copies of the file on the disk in drive A:, each with a different name.

DISKCOPY

The COPY command is used to copy files one at a time. The DISKCOPY command copies a whole disk at once. This is handy for backing up disks, that is, making a backup copy that is kept separate from the working disk. In DOS 1.10, 2.00, and 2.10, if the target disk hasn't been formatted, DISKCOPY will format it while making the copy. Type DISKCOPY A: B: <Enter>. The prompt on the screen will ask you to put the source disk in A: and the target disk in B: and strike any key when ready. ("Any" means any character key, not a function key or the <Ctrl> key.)

Before you strike the key, you should be aware that DISKCOPY erases everything on the target disk before copying the contents of the source disk. Use DISKCOPY only with a blank target disk or a disk you want to erase. Use the COPY command to add files to a disk that already contains information you want to keep.

Press any key when DISKCOPY is done, and the program will respond with 'Copy complete' and will ask if you want to copy another disk. Press N, and you will return to the A> prompt.

Because DISKCOPY creates an exact duplicate, each file occupies the same tracks and sectors on the new version as it did on the old, and fragmented files remain that way. Accessing fragmented files is slower than working with contiguous files, since more movement is required of the disk drive's read/write head. Once you have revised a number of files on a disk, the fragmentation can slow your work down considerably.

COPY, on the other hand, consolidates files. It copies all of a file into consecutive sectors before starting on the next one. By ridding the disk of fragmented files and gaps, the COPY command can shorten disk access time. However, the actual copying process of DISKCOPY is much faster than duplicating each file individually with the COPY command.

While COPY is an internal command, DISKCOPY is external. Therefore, to take advantage of DISKCOPY's speed you must have the file DISKCOPY.COM on a disk in one of the drives. In summary, DISKCOPY is simpler and faster while COPY is safer, more flexible, and eliminates fragmentation.

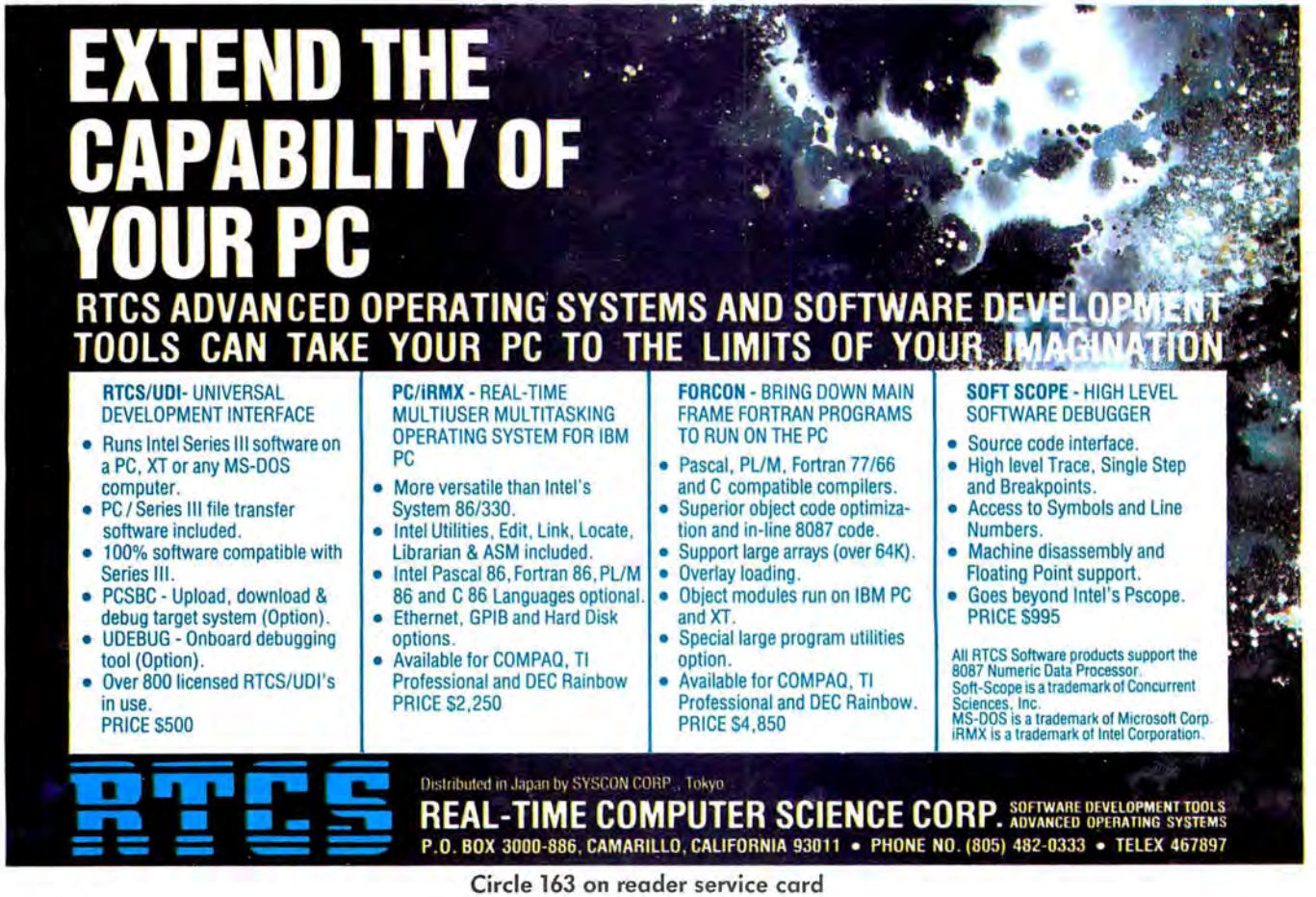
Wild Cards

If you want to copy all the files on a disk, there is a third alternative to DISKCOPY and individual file copying with COPY. DOS offers a shortcut, using global characters called wild cards. DOS interprets a question mark the way a card player interprets a joker, as a wild card that can be substituted for any other character in the same position. For example, you can copy DISKCOPY.COM and

> The COPY command can shorten disk access time.

DISKCOMP.COM with a single command. Type COPY DISKCO??.COM B: <Enter> and both files are copied. However, typing COPY DISK? B: <Enter> won't work. The number of question marks must match the number of variable characters.

DOS recognizes a second global character, the asterisk. Whereas the question mark acts as a wild card for a single character, the asterisk acts as a wild card for everything to the left or right of the filespec's period.



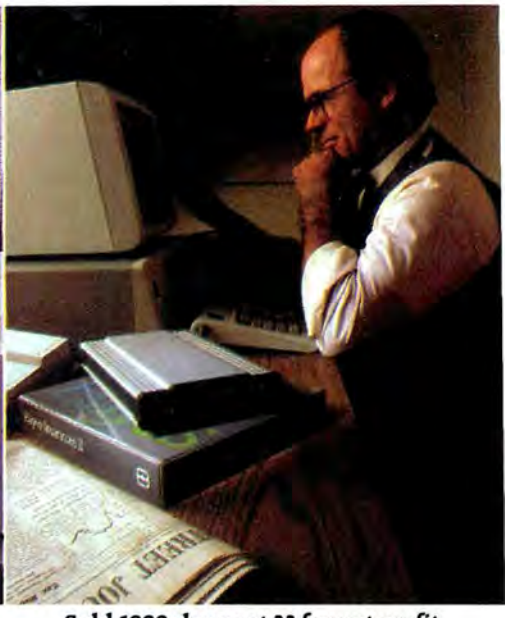
Circle 163 on reader service card

Your computer's telephone.

Hayes™

What will counteract NDC 74-0054-60?

Gary: The pedigrees for next week's auction are as follows...



Sold 1000 shares at 33 for net profit of 6000. Richard.

Wouldn't it be great if you could use your IBM®PC to tap into vast resource libraries across the country? To transfer files to your partner, upstate? Or from your broker, down the street?

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But any modem will send and receive data. Smartmodems also dial, answer and disconnect calls. Automatically. And without going through the telephone receiver, making them far superior to acoustic coupler modems.

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Both work with rotary dials, Touch-Tone® and key-set systems; connect to most time-sharing systems; and feature an audio speaker.

Smartmodem 1200B™ is also available as a plug-in board. Developed specifically for the PC, it comes packaged with Hayes' own communications software, Smartcom II.™

Smartcom II. We spent a lot of time developing it, so you can spend less time using it. Smartcom II prompts you in the simple steps required to create, send, receive, display, list, name and re-name files. It even receives data completely unattended—especially helpful when you're sending work from home to the office, or vice versa.

If you need it, there's always "help." This feature explains prompts, messages, etc. to make communicating extra easy.

With Smartcom II, it is. Case in point: Before you communicate with another system, you need to "set up" your computer to match the way the remote system transmits data. With Smartcom II, you do this only once. After that, parameters for 25 different remote systems are stored in a directory on Smartcom II.

Calling or answering a system listed in the directory requires just a few quick keystrokes.

You can store lengthy log-on sequences the same way. Press one key, and Smartcom II automatically connects you to a utility or information service.

Hayes®

Circle 221 on reader service card

Smartmodem 300, 1200 and 1200B are FCC approved in the U.S. and DOC approved in Canada. All require an IBM PC with minimum 96K bytes of memory; IBM DOS 1.10 or 1.00; one disk drive; and 80-column display.

Smartmodem 1200B. (Includes telephone cable. No serial card or separate power source is needed.)

Smartcom II communications software.

NOTE: Smartmodem 1200B may also be installed in the IBM Personal Computer XT or the Expansion Unit.
In those units, another board installed in the slot to the immediate right of the Smartmodem 1200B may not clear the modem; also, the brackets may not fit properly. If this occurs, the slot to the right of the modem should be left empty.

And, in addition to the IBM PC, Smartcom II is also available for the DEC Rainbow™ 100, Xerox 820-II,™ and Kaypro II™ personal computers.

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Getting Started

Therefore you can type COPY DISK????.* B: and avoid typing .COM. If you want to copy every file that has the extension .COM, type COPY *.COM B:.

COPY A:* B: copies every file without extensions from drive A: to drive B:. To duplicate everything on a disk in drive A: (except hidden files), type COPY *.* B:.

COMP and DISKCOMP

Both the DISKCOPY and COPY procedures are usually error free, but if you are backing up critical disks or files, "usually" may not be good enough. The external command DISKCOMP compares disks to make sure they are the same. If you type DISKCOMP A: B: <Enter>, DOS will compare the two disks to make sure every sector is identical. DISKCOMP is most commonly used when you are copying a program in which every byte is important.

You can also compare individual files. If you type COMP A:DISKCOPY .COM B:DISKCOPY.COM <Enter>, DOS first makes sure that the two special files are the same size and then compares them sector by sector. You can shorten this command to COMP A:DISKCOPY.COM B: or interchange the A: and B: designators. To see what happens if the files differ type COMP A:CHKDSK.COM B:DISKCOPY.COM <Enter>.

CLS

Anytime the clutter on the screen is confusing or not aesthetically pleasing, you can type CLS <Enter> to have DOS clear the screen. The command affects only the screen display, not the contents of memory or a disk.

ERASE

ERASE and DEL are identical commands that delete files from a disk. Perhaps you want to get rid of the DISKCOMP file on the disk in drive B: to save space. Type DEL B:DISKCOMP.COM <Enter>. Confirm with a directory (DIR B: <Enter>), and you will notice that DISKCOMP.COM has been erased. You can also use wild-card characters with the ERASE or DEL command. If you want to delete all the files with .COM extensions from the disk in drive B:, type ERASE B:*.COM <Enter>. The most dangerous DOS command of all, ERASE *.*, wipes the disk clean—but only after you reply affirmatively to the query 'Are you sure (Y/N)?'.

RENAME

To give a file a new filespec use the Rename command REN. As an example, copy FORMAT.COM from drive A: to drive B: using the COPY command. Then rename the file PREPDISK.COM. Type REN B:FORMAT.COM B:PREPDISK.COM <Enter>. Confirm the result by running a directory. You can continue to play with all these commands on the data disk in drive B:.

The commands reviewed here are only the most frequently used DOS functions. Armed with the functions and commands discussed in this article, you'll be able to use the operating system resources to run applications programs and manage files and disk storage. Consult the DOS manual for a description of the full range of DOS functions.

David Arnold is a professor of sociology and the former chair of the sociology department at Sonoma State University in Rohnert Park, California. He teaches a course on computers and society, is the author of The Sociology of Subcultures, *and has also written a book about the IBM PCjr published by Holt, Rinehart and Winston.*

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OMNITERM 2 COMMUNICATIONS WITH YOU IN MIND

What the novice has in mind

You know what you want, asynchronous communications software you can trust to be accessible and uncomplicated. Plus power for the long run as you discover new communications possibilities. OMNITERM 2 from Lindbergh Systems works with you to help get the job done:

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- ☐ single-line editor for correcting and retransmitting mistyped lines while in terminal mode
- ☐ scroll-back feature allows you to review old text while answering electronic mail, reviewing instructions, etc.
- ☐ full control of echo and line feed including the standard options of full or half duplex, plus a setting for use with remote terminals, and an option to define your own unique setting for unusual situations
- ☐ an information packed status line including real-time information on file I/O, several timers, modem status, and more
- ☐ user-definable "pause accept" and "pause request" functions allow automatic two-way handshaking with any computer system
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Circle 623 on reader service card

The Help Screen

PC World offers answers and advice at every level.

Karl Koessel

The growing number of personal computer manufacturers, especially those that make PC compatibles, has a "future computer owner" bewildered. He's not alone, so this month we'll discuss how to compare machines and pick the one that's right for you. Next we learn how to verify copies of crucial files and programs. The importance of creating duplicate files cannot be overstressed, but the copies are all for naught if they are imperfect. Then we learn how a programmer can put programs on a disk and leave space for IBM's DOS files, so that purchasers may add whichever version of DOS they desire. Finally, we see how to view the version date of the PC's ROM.

PC Jungle

Q. What a jungle! Colby, Columbia, COMPAQ, Corona, Eagle, Hyperion, Seequa, and Tava all claim to have products that are software and hardware compatible with the IBM PC. And I hear there are more than 20 other companies about to introduce PC compatibles. Then there are the work-alikes, machines that accomplish many of the same applications as the PC.

To say that it's difficult for the uninitiated to know which computer to buy or what the criteria are to make such a decision is an understatement. Even if one excludes the machines that will not read PC-formatted disks or will not accept expansion cards designed to fit into the PC, there is still a plethora of machines from which to choose.

I see myself as a future computer owner, but just what should one consider when comparing machines? What are the trade-offs involved in purchasing a compatible versus a PC?

Walter J. Manson
Philadelphia, Pennsylvania

A. The primary reason computers are purchased is to do certain jobs. Whether the jobs are word processing, accounting, information storage and retrieval, or programming, the computer can only perform as well as the software it's running. Therefore, the first questions to ask when comparing computer systems should be: Does this machine run the particular software I need? Will it run the additional software (and accept the additional hardware) that will optimize the performance of the applications for which it is being purchased? Don't take anyone's word as truth. It's up to you to see that the system you purchase actually performs as you expect. Test everything, hardware and software, that you intend to have in your system, even if you are not purchasing everything at once.

Next, and equally important, consider the manufacturer's ability to provide support and service. Inspect and compare the quality of the components from which different machines are made. Cheap parts not only break down more often, they indicate the degree of the manufacturer's commitment to the field of computing. And when things do go wrong, how long will it be before your machine is up and running again? If a company is shipping only three machines a day, does it have the time for repairs? Will this company continue to support this particular model? And these days you should also consider whether you can expect the manufacturer to exist at all a year from now.

Having satisfied the conditions above, consider the various system configurations and prices offered by each manufacturer. Do you care about size or weight? How much memory can you put in the standard system before an expansion board is required? How many expansion slots do you need? Is the power supply of sufficient size to support the additional options you will need now and in the future (e.g., expansion boards or an internal hard disk drive)? Is a screen provided with the system and is it satisfactory? Do you save any money because some of the software you will need is included free of charge?

'Just what should one consider when comparing machines?'

See "The Compatibles Line Up" in this issue for a look at many of the new machines being offered. This article summarizes much of the information you'll need to make the right choice when you purchase your first personal computer.

Correct Copies

Q. I am new to computing, but not so new that I haven't seen a co-worker lose days of work. His desk drawer closed on a disk, crushing the sole record of his labor. He didn't have a backup, a duplicate file on another disk.

Hoping to avoid such experiences, I always make a backup of every file that I create or alter. First I place the disk with the file I want copied into drive A, type the command DIR A:filename.ext *(where* filename *is the file's name and* .ext *is the file's extension), and note the size, in bytes, of the file. Next I place another disk into drive B and, using the command* DIR B:, *check the message 'xxxxx bytes free' to see if the disk has sufficient free space to hold the backup. I then use the command* COPY A:filename.ext B: *to perform the copying.*

Today I tried to use the backup (rather than the original) of a file I made yesterday, and it wouldn't work. Switching to the original I found that, fortunately, it was fine. Why won't the copy work? The disk containing the copy has been stored safely, away from magnetic fields, static electricity, and heat. All the other files on it are fine.

Someone here at work suggested the backup wasn't duplicated precisely. If the command COPY doesn't perform reliably, what can be done to check the backup? I can imagine the anguish I'd have suffered if I hadn't discovered my backup was bad until after I had lost or destroyed the original.

Christine Koval
Yellow Springs, Ohio

A. Sounds like your co-worker is right. Very rarely, a backup is made that is not an exact duplicate of the original file. But the COPY command is not to blame. Static electricity, voltage variation, or even stray cosmic particles (very high energy atomic nuclei) may cause such an error to occur undetected. There are, however, steps you can take to ensure a perfect copy.

The COPY command has an optional parameter, /V, which instructs DOS to verify that the sectors written on the target disk are recorded correctly. Simply use COPY as you normally do, but add /V to the end of the command before pressing <Enter> (e.g., COPY *filename.ext* B:/V). Verifying the copied sectors takes a bit longer, but I find the reassurance it provides worth the time.

Verifying copied sectors takes a bit longer, but I find the reassurance it provides worth the time.

Instead of including the /V option in every COPY command, you can instruct DOS to verify the results of all COPY commands. By using the command VERIFY ON, all subsequent COPY commands will be verified until DOS receives the command VERIFY OFF. The current verification status can be checked by using the command VERIFY without the ON or OFF parameter.

Verification of the sectors written will detect disk errors, but on rare occasions the file on the backup disk may not match the original. COPY reads a sector from one disk, placing the data into a portion of memory called a buffer, and then copies the data in the buffer to the second disk. If the data in the buffer is changed for some reason (for example, by one of the circumstances mentioned earlier), then verification will show that the written data matches the buffer data, but the copy will be incorrect.

This kind of error is extremely rare, but it occurs undetected. Therefore, to be sure the backup file matches the original, you need to compare the files byte for byte. The command COMP is provided on the DOS disk for this purpose. To use COMP, place the DOS disk (or any disk with a copy of the file COMP.COM) into drive A and (assuming A is the default drive) type COMP and press <Enter>. You will be prompted to 'Enter primary file name'. At that point insert the disks containing the files to be compared and then type the file name and press <Enter>. Another prompt will appear requesting you to 'Enter 2nd file name or drive id'. Type B: and press <Enter>. A message describing how the files compare will be returned. Using COMP after COPY adds to your labor, but you will be certain that backup copies of your valuable files are correct.

SYSible Disk

Q. Sometimes I don't understand IBM's logic. I have written a program that I would like to sell to some interested businesses. There is only one problem: IBM says (and rightfully so) that its system programs cannot be on the disks I sell.

IBM provides, on the DOS disk, the SYS command, which transfers system files to disks sold without them. But how do I make a disk that includes my program and doesn't include IBM's files? I know I can use FORMAT without the /S option, but such a disk will not accept the system files after my program has been copied to it. I tried everything I know in BASIC and DOS to erase these hidden files, but to no avail. Do you have any suggestions? I know there has to be a way.

Joseph Wadlinger
Charlotte, North Carolina

A. The simplest method is to use DOS 2.00's FORMAT command with the /B option. This will create an 8-sector formatted disk and reserve space for the system files. You can copy your program to this disk (be sure to use the COMP command to compare the program you will be selling against the original) and distribute it legally. Your customers may then transfer the system files for either DOS 1.10 or DOS 2.00 via the SYS command. You can use the DOS 2.00 command FORMAT /1/B if you want your program on a single-sided disk. A disk formatted with this command can be used on any PC but will allow only 160K of storage.

ROM Date

Q. PC World, *Volume 2, Number 1, contained a letter from a reader who had trouble running a program on friends' PCs. As a part of the testing process he somehow accessed the version date of the ROM in various PCs.*

How can I find out the date of the ROM in my PC? I don't believe I've seen that mentioned in PC World.

Robert Olsen
Fullerton, California

A. A few programs, because of the way they are written, work on some PCs and not on others. Knowing whether the ROM in one machine differs from the ROM in another may help in discovering why a program won't run. To view the ROM date in your PC, place the DOS disk in the default drive, type `DEBUG`, and press <Enter>. When the hyphen (DEBUG's prompt) appears, type `DFFFF:0005` and press <Enter>. The ROM date will appear on the right side of the screen, in the first line of DEBUG's output. Type `Q` and press <Enter> to return to DOS.

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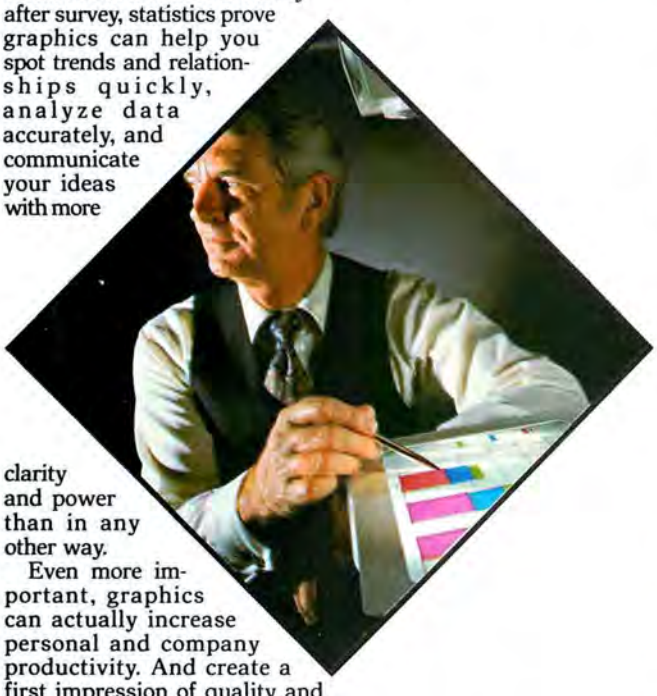

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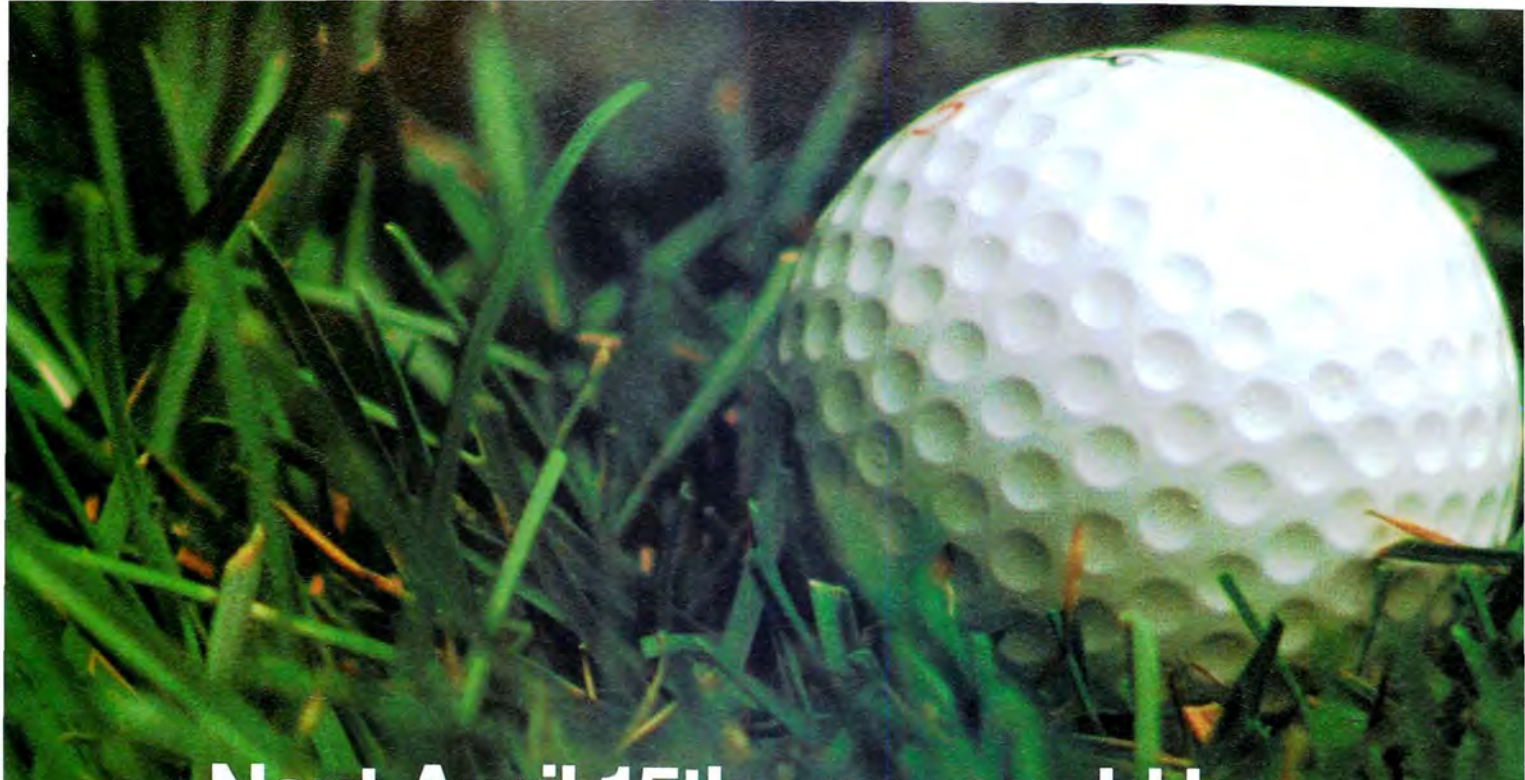

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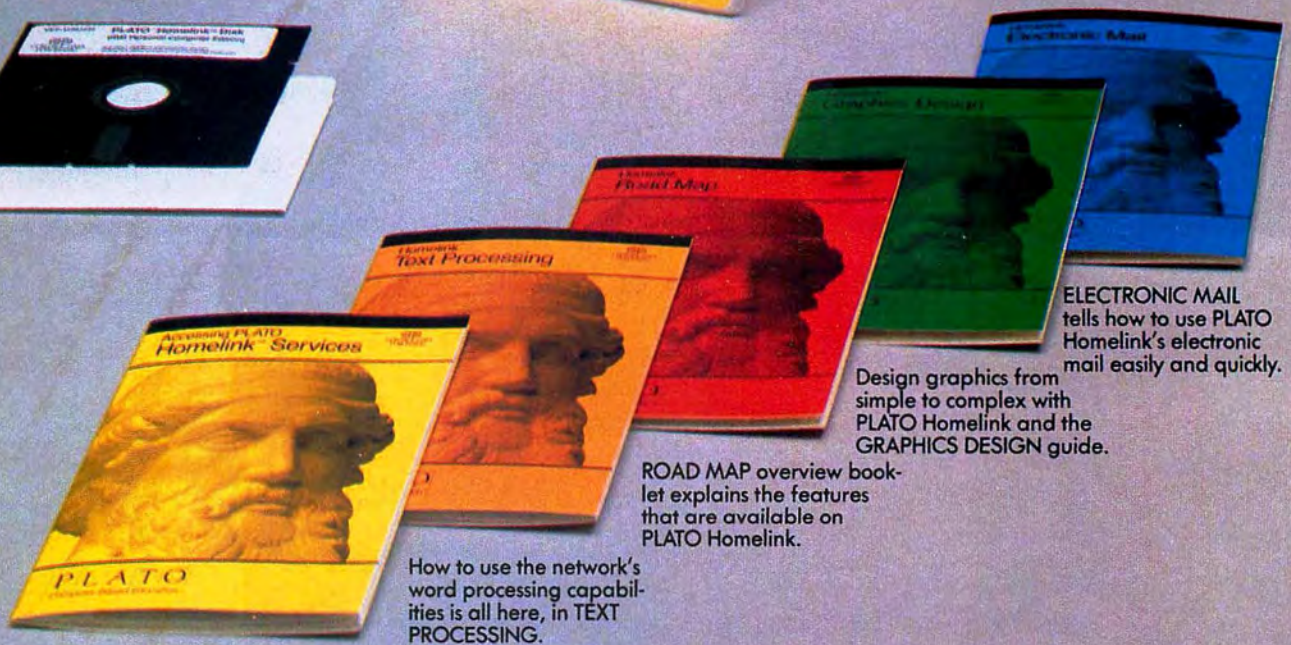

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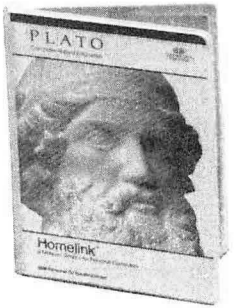

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Cool Chips

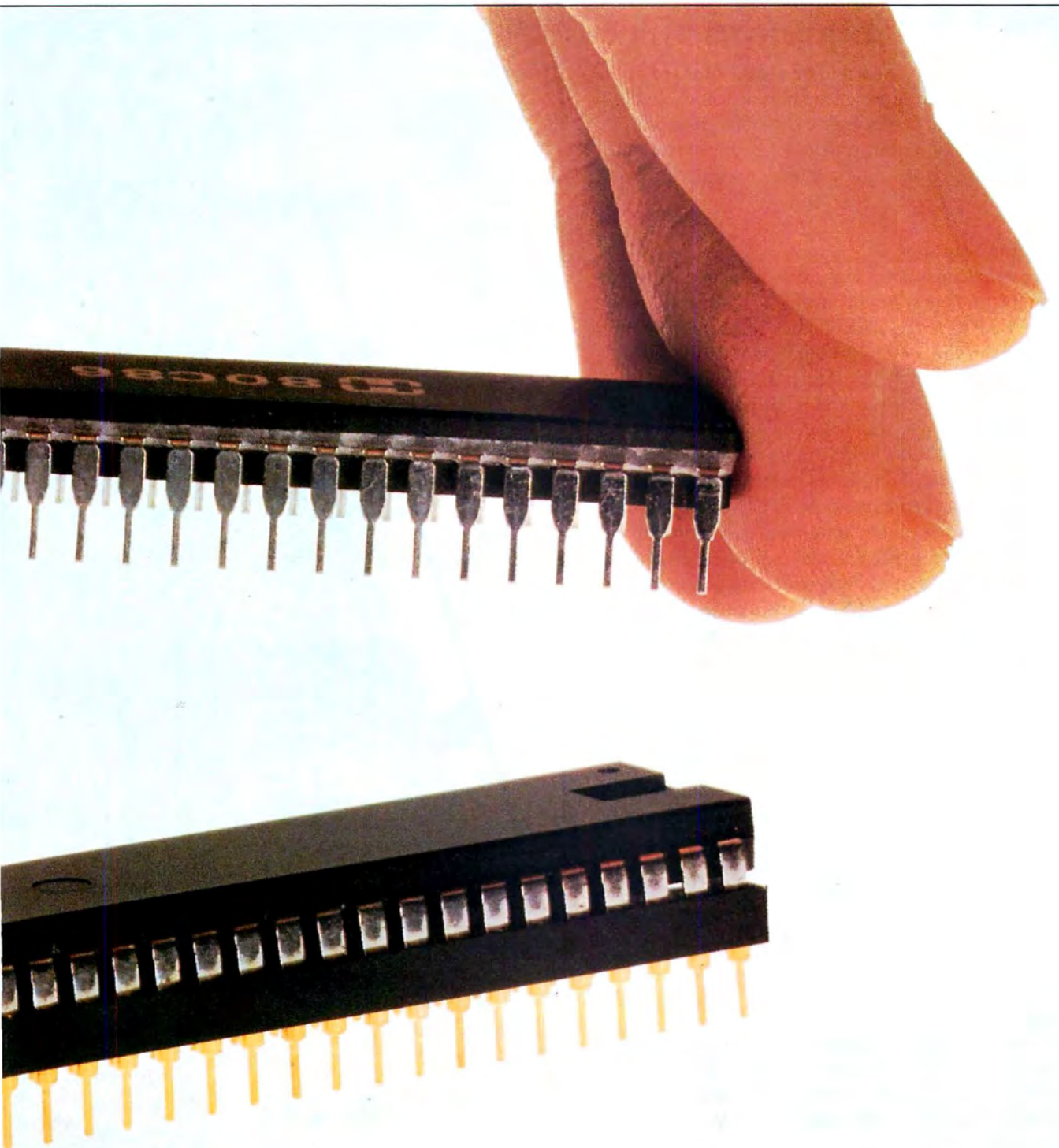
Howard Dicken and Robert Luhn

CMOS (complementary metal oxide semiconductor) integrated circuits traditionally have been used in digital watches, where long life and low power consumption are imperatives. But new advances combined with tried-and-true fabrication techniques point to CMOS as the next step in the evolution of the integrated circuit. As computers get smaller, faster, and more powerful, more and more of the chips that make them go will be CMOS.

Keeping cool is desirable in almost any situation; it's a must when you're one chip among many crammed into the back of a computer. Most silicon components—RAM and ROM chips, telecommunications chips, and other integrated circuits—use only a fraction of the energy they receive, releasing the rest as heat. With a power supply, a disk controller board, and a monochrome adapter board all occupying the same bulky box, system temperatures can climb to 150 degrees Fahrenheit. The result is a computer that feels like a personal space heater. In extreme cases, components overheat and the system crashes, requiring system reboot and destroying all or part of the file you were working on.

Engineers have solved the heat problem in larger computers by wrapping them in water jackets or submerging them in supercooled liquids—an unlikely solution for a PC user. The trend toward smaller, more powerful computers requires the use of multifunction chips that perform multiple processing, handle complex communications tasks, or simply pack more RAM into the same volume. As more circuits are squeezed onto a

Harris Corporation's CMOS versions of Intel's 8088 and 8086 microprocessors



chip, the inefficiency of current designs (expressed as heat) becomes acute. And when chips are more closely packed, as they are in a portable computer, reducing heat is essential. Solutions to date have ranged from the mundane (fans) to the esoteric (bubble memory).

The CMOS Solution

CMOS (complementary metal oxide semiconductor) fabrication methods may be the answer to this vexing problem. The CMOS process is not much different or more expensive than the processes used in fabricating chips common to most computers. The resulting CMOS device works as fast as other chips and requires only a tenth of the power. Less power means less heat; the connections that make up a CMOS circuit can lie closer to one another, increasing the circuit's operating speed. Similarly, circuits can be packed more closely, making for a smaller chip or one that has more circuits and thus more capabilities. The flexibility of CMOS makes possible everything from a smaller 8088 to a single-chip multiprocessor.

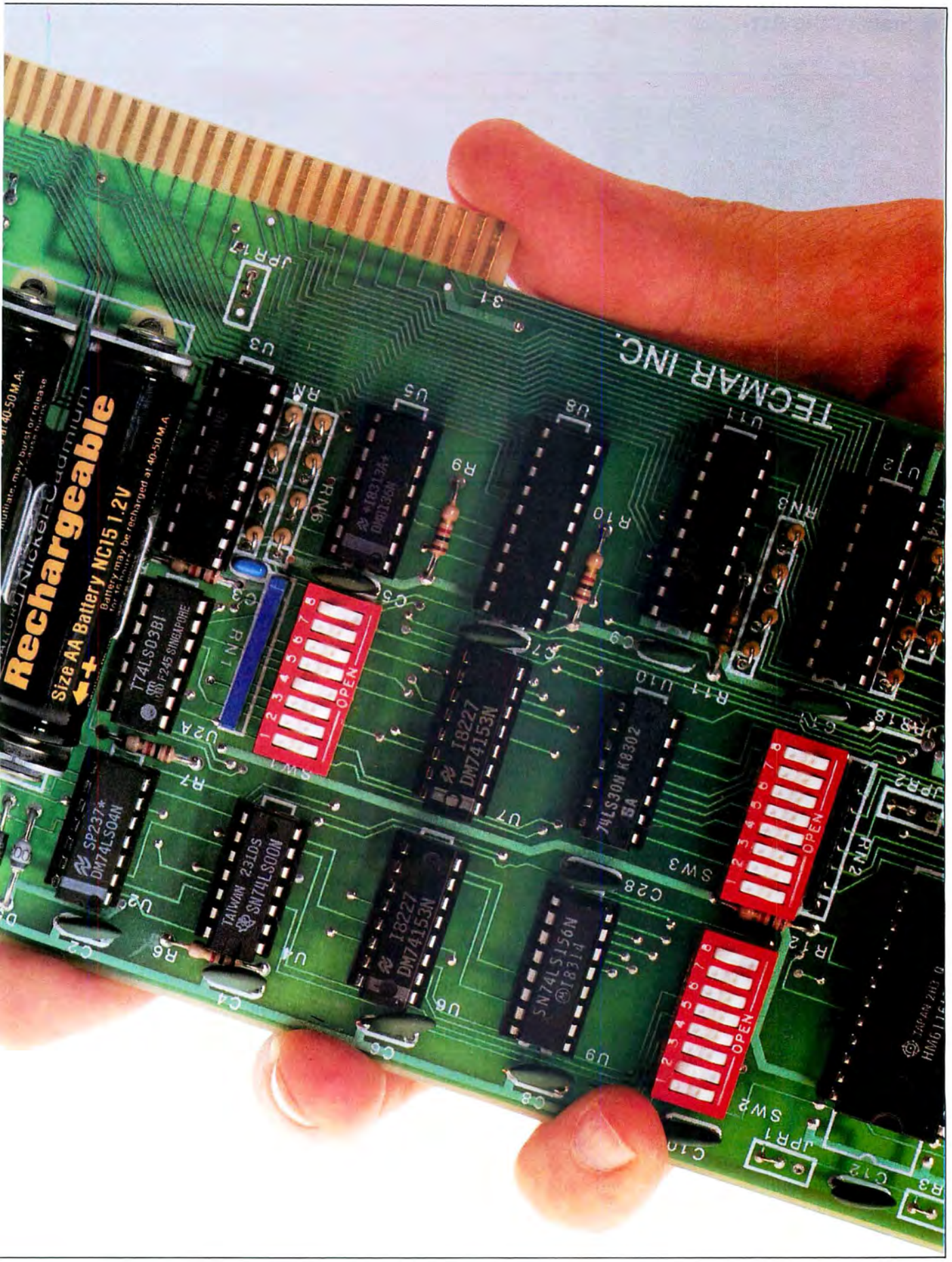
CMOS once was relegated to the industry's back burner because its early designs were slow and difficult to produce. But recent advances in high-resolution optics, which play a major part in the design of miniaturized circuits, make CMOS competitive in price and function. CMOS devices are showing up not only in high-priced briefcase computers but in portable and some desktop models, including many PC compatibles. With power requirements significantly lower, a computer with CMOS components can use a smaller and less expensive power supply; since very little heat is produced, fans can be scaled down or eliminated entirely, giving designers the option of adding more hardware or further reducing the size of the computer.

Making CMOS

Many standard integrated circuits are NMOS (negative-channel MOS) that use negative transistors to control the flow of electrons through a circuit. Less common but based on the same principles and technology are PMOS (positive-channel MOS) circuits that use positive transistors. A CMOS chip combines features of both, which is one reason for its versatility and frugal power use.

Silicon is the key ingredient in the construction of any integrated circuit. Because its crystalline structure does not easily conduct electricity (hence the label semiconductor) and resists the introduction of foreign elements, silicon acts as a stable base. Under the proper

Tecmar's CMOS ForgetMeNot board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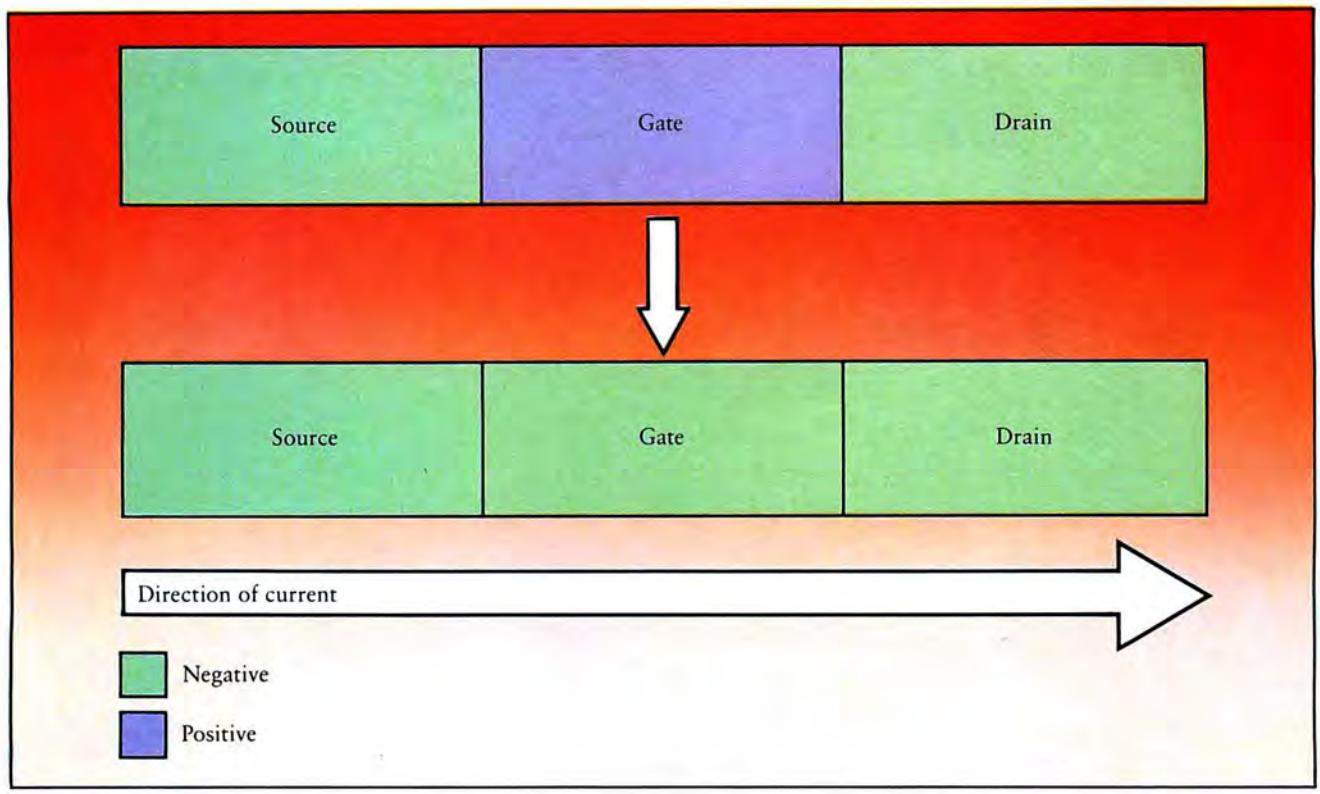

Figure 1: A connection between the source and drain is made by changing the charge of the gate.

conditions a silicon wafer can be embedded with elements that will conduct a charge. When these elements are laid down in predetermined positive or negative channels, electrons representing data can be shuttled and stored throughout the various layers of a chip to perform any number of tasks.

Like its NMOS peers, a CMOS chip comes from an ingot of pure silicon that is sliced into thin wafers. Each wafer becomes the repository of many hundreds or thousands of circuits, transistors, diodes, and other miniaturized components that make up a functioning chip. Once a wafer has been cut successfully and tailored to the proper size, it must be "masked" and "doped"; in other words, the conductive channels that make up the circuits must be laid out and embedded into each layer on the wafer.

First, a circuit diagram is drawn and photographed; then the picture of the diagram is reduced and projected onto a wafer coated with a light-sensitive "photoresist" layer. Those areas of the layer exposed to the light "wash" away when the wafer is put in an acid solution; this reveals the circuit diagram. The circuit pathways are then embedded with either negatively ionized phosphorus atoms or positive boron atoms. Ionized atoms are embedded by an ion implanter that operates much like an electron gun in a television set, firing an extremely narrow beam of particles into the wafer. Another common method of embedding ions is to heat the wafer to 1000 degrees centigrade and expose it to gaseous phosphorus or boron. With either method, the atoms are forced into the crystal structure of the silicon, creating areas in the wafer that have a surplus of positive or negative charge.

Up to ten separate masking steps are required to make a functional CMOS chip. After a wafer has been completely processed, the individual circuits are tested, and the ones that pass muster are put into a multiple-pin package that can be attached to a circuit board in a computer.

CMOS Structure

Circuits in a wafer work in three dimensions, connecting with one another vertically as well as horizontally. Once the necessary circuits are in place, how are they isolated from one another? How do they communicate?

Built into the circuits are diodes, which allow current to flow in one direction only. When a diode connected to a circuit faces another diode, an electrical impasse exists—current cannot pass between them. The circuits in effect are isolated and cannot share data. But part of CMOS's flexibility comes from its switching nature, which permits data to pass in a controlled fashion between circuits that are logically related.

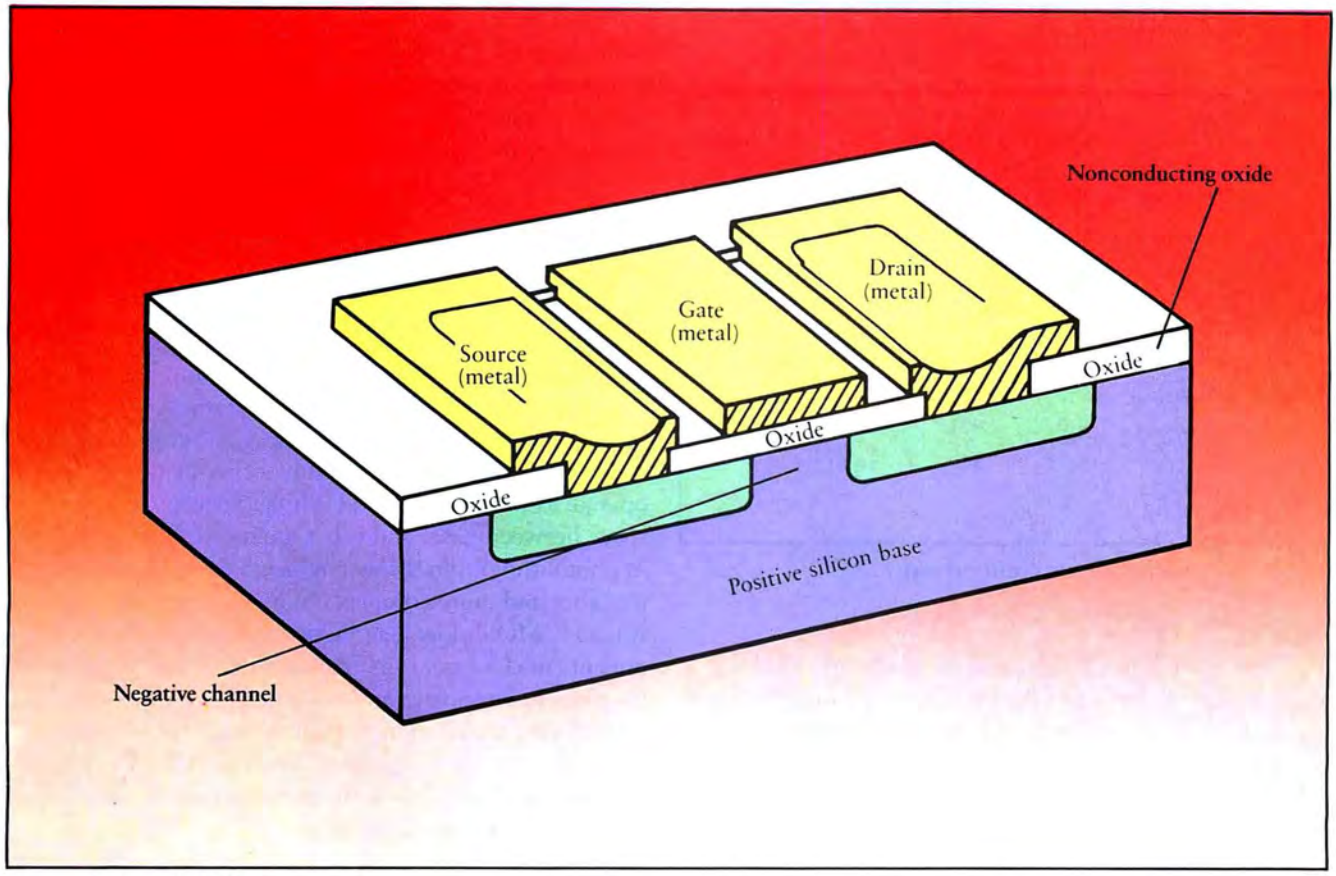

Figure 2: An NMOS transistor

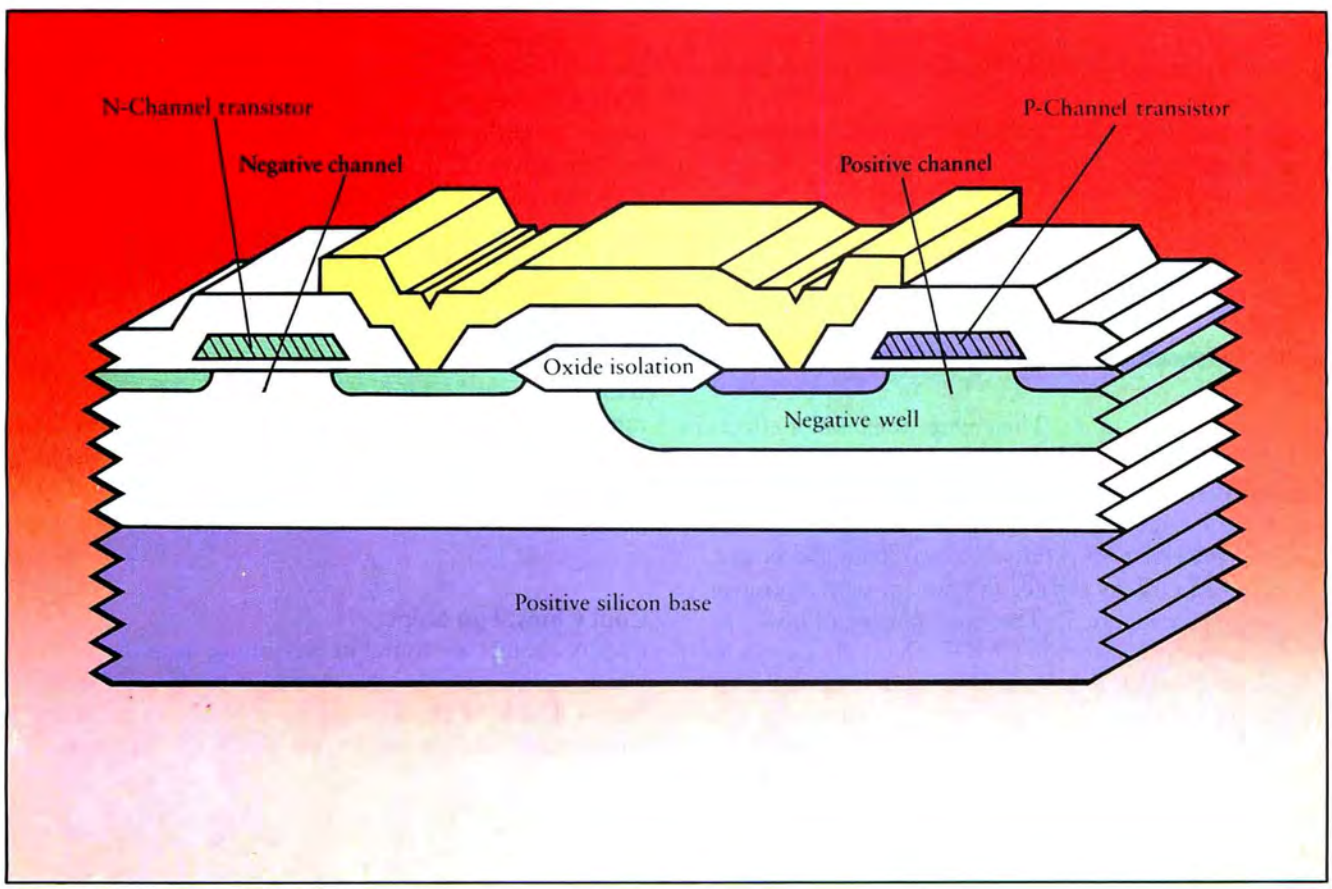

Figure 3: Cutaway of a CMOS device

	CMOS	ECL	TTL	NMOS
Gates per circuit	8000	2800	2400	4000
Gate switching time in nanoseconds	2.0	0.5	2.0	3.0
Power per gate in milliwatts	0.1	2.0	0.4	0.5
Spacing between gates in microns	3.0	4.0	5.0	3.0
Masking steps	10	11	10	9

Table 1: Semiconductor comparison

The switch is actually an area of silicon called the gate, which sits between the ends of two diodes facing each other. If, for example, the ends are both negative, the gate is positive. Current will not pass from one end (the source) into the other (the drain) unless something changes the gate's charge from positive to negative. That is done by sending the appropriate signal through the silicon gate. A new circuit is completed, and the formerly isolated areas are connected (see Figure 1).

NMOS circuits also use gates, but the construction of each circuit centers around a negative transistor (see Figure 2) paired with a load resistor that reduces the flow of electrons in a circuit. The change the resistor effects in the current level is used to represent data—it works like a crude on-and-off switch. But a resistor is not terribly efficient in controlling current; the heat it produces as it "slows" the electrons results in loss of data and power.

> The PCjr uses CMOS in its wireless, battery-powered keyboard.

CMOS circuits replace the resistor with a positive transistor (see Figure 3). The exact pairing of positive and negative transistors in CMOS effectively creates balanced circuits that require little power. Turning the circuit on or off and directing current to a particular area merely require opening or shutting the appropriate gates. As a result, a CMOS circuit uses a tenth of the energy required by an NMOS circuit to control the switching and direction of current. Because CMOS chips operate at such low power levels, a few volts can keep 256K of stored data secure for a week. This alone has made CMOS popular in digital watches and briefcase-sized computers that use batteries as the main power source.

Fast Chips

For reasons relating to the physics of semiconductors, circuit speed is greatly affected by the distance between two diodes—the longer the gate, the longer current takes to flow. The relationship is geometric; doubling the gate length effectively quadruples the time involved.

Although CMOS chips use less power than standard semiconductors manufactured by other methods, they operate as fast. The key to CMOS's speed is reduced space between gates and other junctions. Improvements in photolithography allow engineers to design and project finer and more complex circuit diagrams onto silicon wafers. CMOS's low heat dissipation, which keeps components in close quarters from fusing, makes it possible for gates to be shorter and connections to be closer. CMOS's increased miniaturization truly proves the adage that "small is beautiful" and enables CMOS devices to match or surpass the performance of competing semiconductors (see Table 1).

In the Chips

The price of CMOS technology has decreased considerably in the last year, but the cost of producing a CMOS chip can still be as much as 20 percent more than its NMOS equivalent. Nevertheless, more and more companies are producing CMOS circuits as replacements of or alternatives to their existing semiconductor devices. CMOS versions of 8- and 16-bit microprocessors; RAM, ROM, and EPROM chips; and the circuits that drive liquid crystal displays are being produced by companies such as Harris Corporation, IT&T, Motorola, National Semiconductor, and Texas Instruments.

Noteworthy is Intel's agreement with Inmos to develop high-speed CMOS RAM products. Under this arrangement, hardware manufacturers considering the CMOS alternative will have two supply sources for the same components. Intel's interest in this technology alone should assure the acceptance and use of CMOS.

Cool Chips, Hot Ships

CMOS circuits are found in everything from digital watches and space shuttle computers to lap-sized computers. The IBM PC does not use CMOS devices at the moment because the higher cost of CMOS offsets any

CMOS Manufacturers

CMOS products mentioned in the article are produced by the following companies:

ForgetMeNot board
Tecmar
6225 Cochran Rd.
Cleveland, OH 44139
216/349-0600
List price: $450

Harris Corporation
Semiconductor Sector
P.O. Box 883
Melbourne, FL 32901
305/724-7800

Hitachi America, Ltd.
1800 Bering Dr.
San Jose, CA 95112
408/292-6404

Inmos
P.O. Box 16000
Colorado Springs, CO 80935
303/630-4000

Intel Corporation
3065 Bowers Ave.
Santa Clara, CA 95051
408/987-8080

National Semiconductor Corporation
2900 Semiconductor Dr.
Santa Clara, CA 95051
408/737-5000

RCA
P.O. Box 3200
Somerville, NJ 08876
201/685-6000

advantages gained by lower power requirements. But when users demand a smaller computer with the same computing power and memory as a PC, the resulting thermal density problems will require a change to CMOS. A number of PC compatible portables are already using CMOS technology, and more are likely to do so as production costs for CMOS continue to drop.

This is not to say that IBM is resisting CMOS technology. The PCjr uses CMOS in its wireless, battery-powered keyboard. Since the keyboard's infrared link to the CPU soaks up most of the unit's power, energy-efficient CMOS components are a must. Harris Corporation, which makes CMOS-based microprocessors for Digital Equipment Corporation, has released CMOS versions of the PC's 8088 microprocessor and its true 16-bit peer, the 8086. The latter processor is being used already in several PC compatible computers.

Also near the forefront of CMOS technology is Tecmar's ForgetMeNot plug-in board for the PC, which features 32K of CMOS RAM and a rechargeable battery pack. Preselected portions of a program or a text file can be saved for up to a year without an external power supply. The company notes that four of these boards can replace one single-sided disk drive.

Intel offers a 64K dynamic RAM CMOS chip that operates four times faster than its NMOS equivalent. The part requires only 2 percent of the NMOS's standby power and is a likely choice for users wanting high-performance memory in portable computers or faster RAM disk drives. Other CMOS applications include a 64K EPROM from Hitachi (for computer and instrument use), a radiation-hardened 4K RAM from RCA (for satellites and military computers), and National Semiconductor's 300 bps modem-on-a-chip that is built into a computer or terminal.

CMOS devices accounted for nearly a third of semiconductor sales in 1983; industry analysts expect CMOS to dominate the semiconductor market by 1987. Though its uses are only starting to be explored, CMOS is likely to keep computers cool for a long time—or at least until engineers replace the integrated circuit. ●

Howard Dicken is president of DM Data, a high technology consulting firm in Scottsdale, Arizona, that specializes in semiconductors, computers, and artificial intelligence. Robert Luhn is an Associate Editor at PC World.

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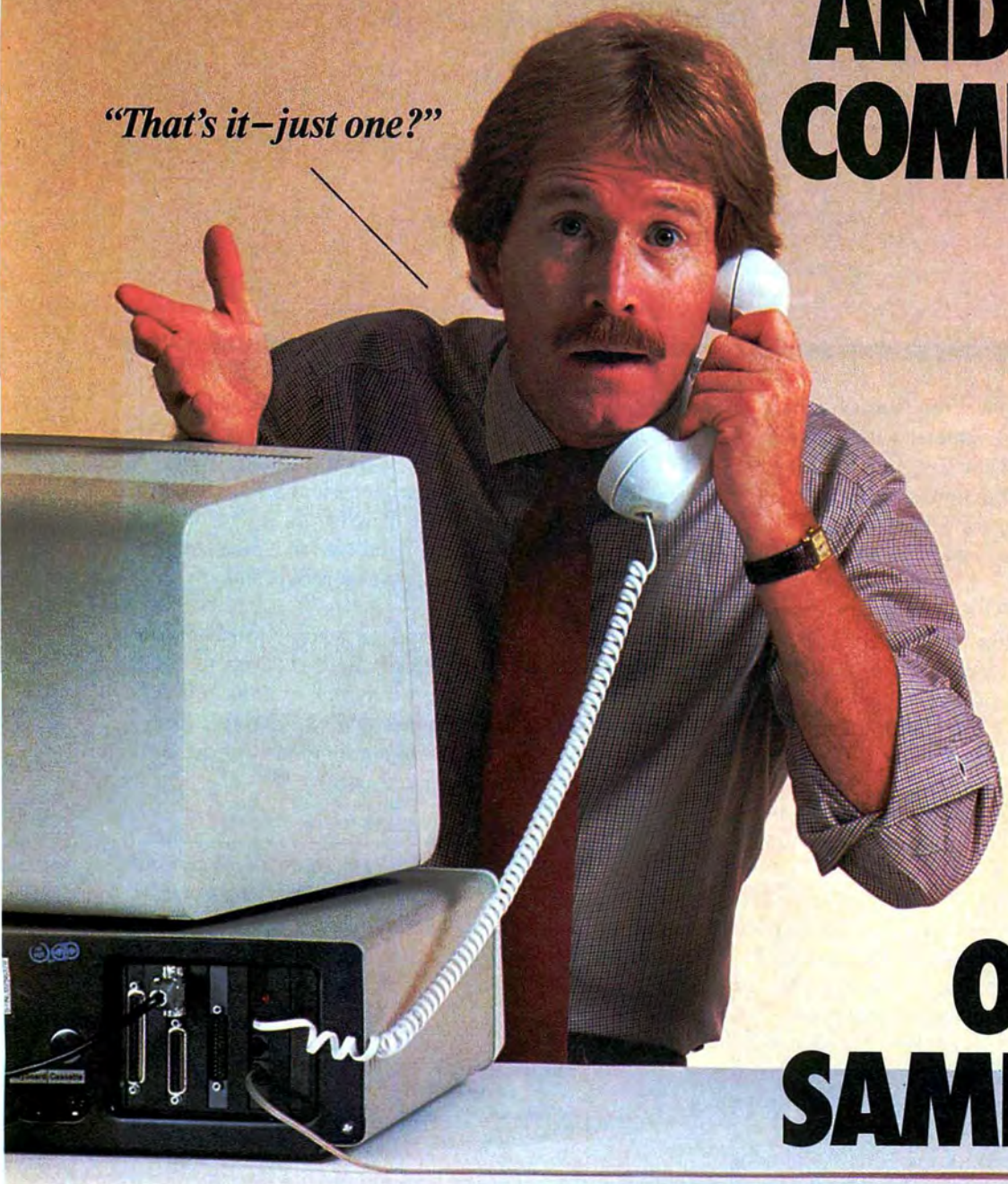

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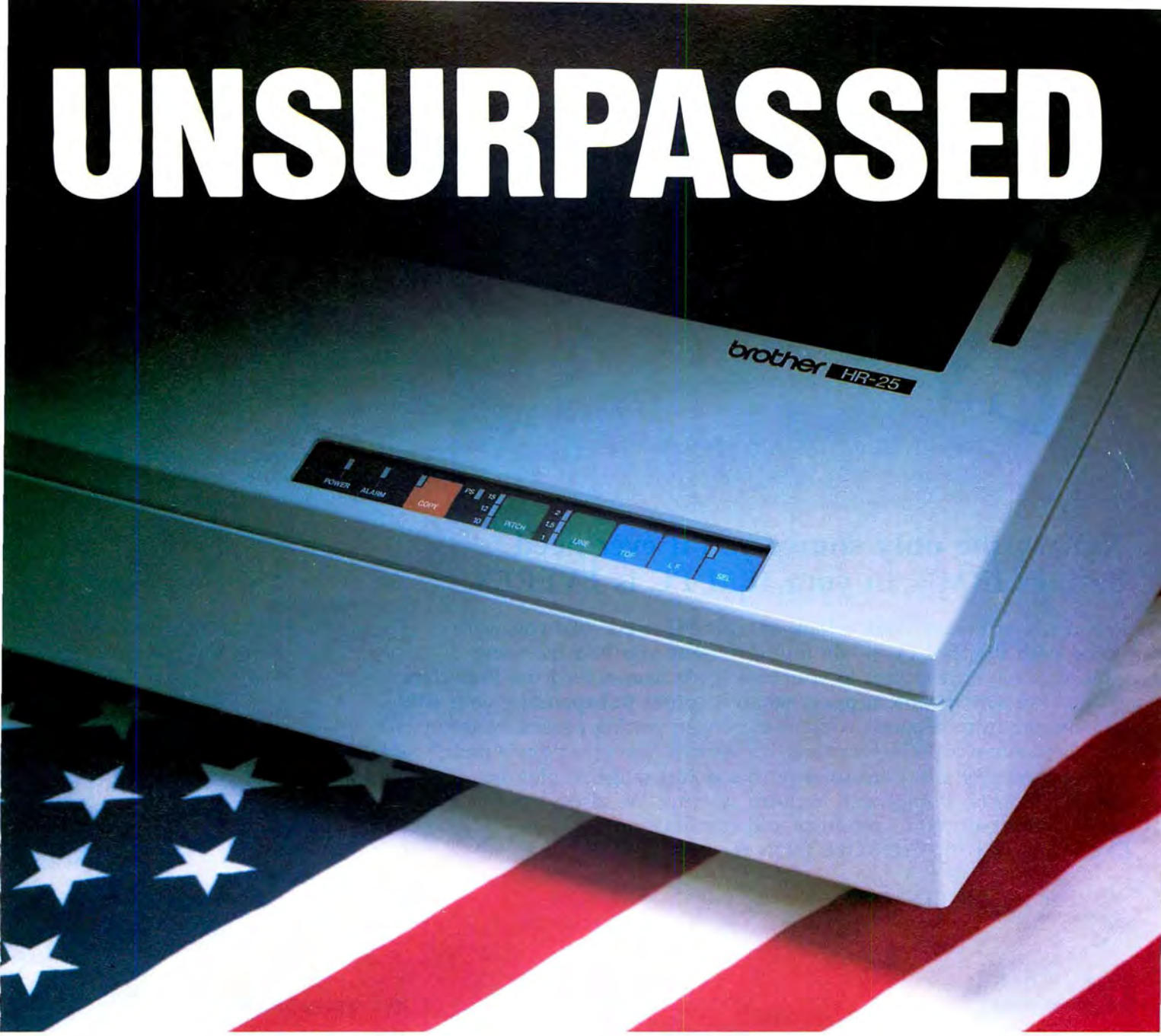

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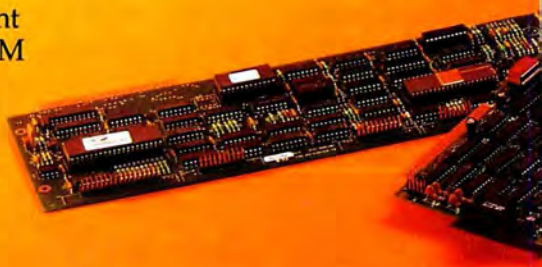

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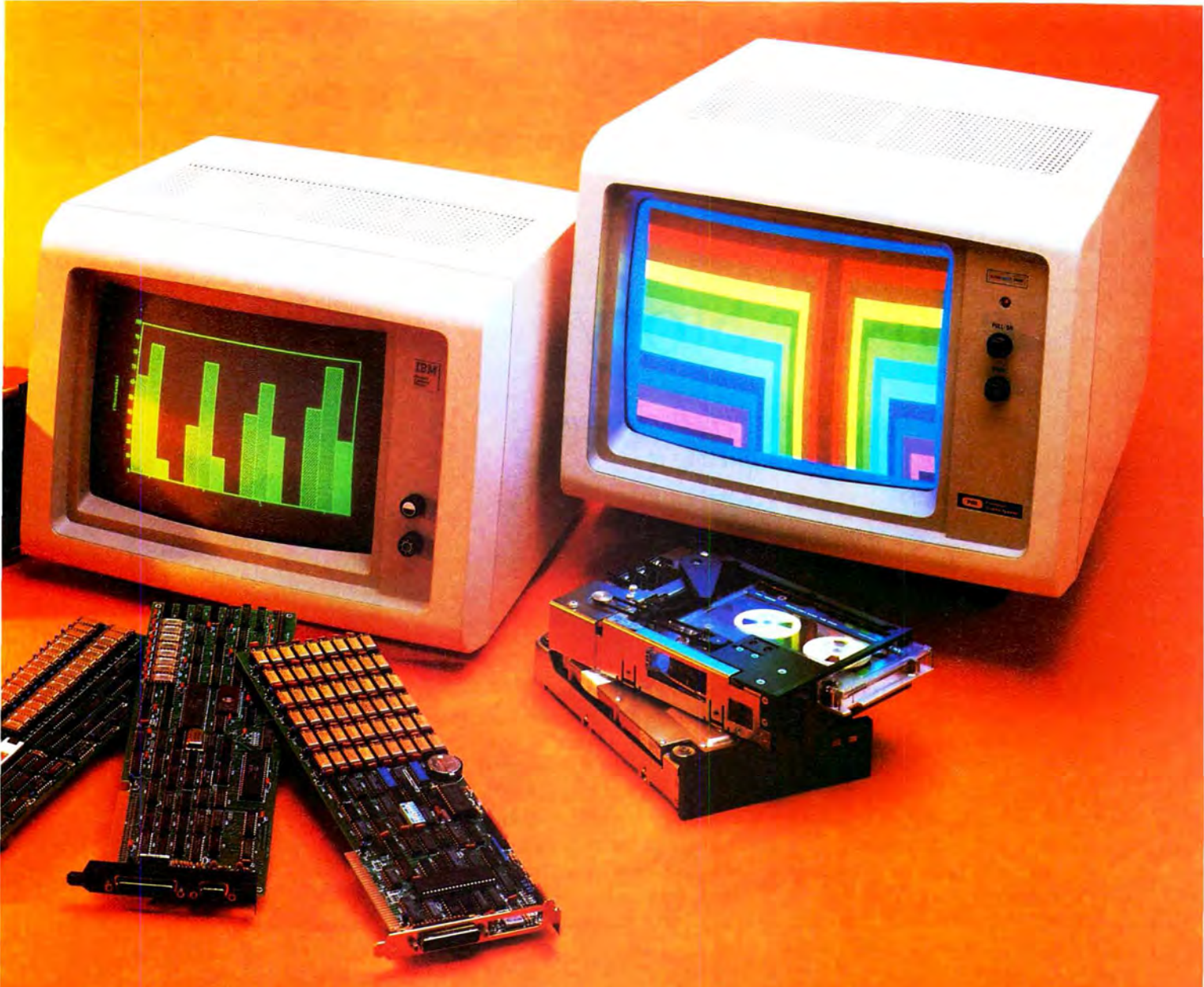

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Modems: The Inside Story

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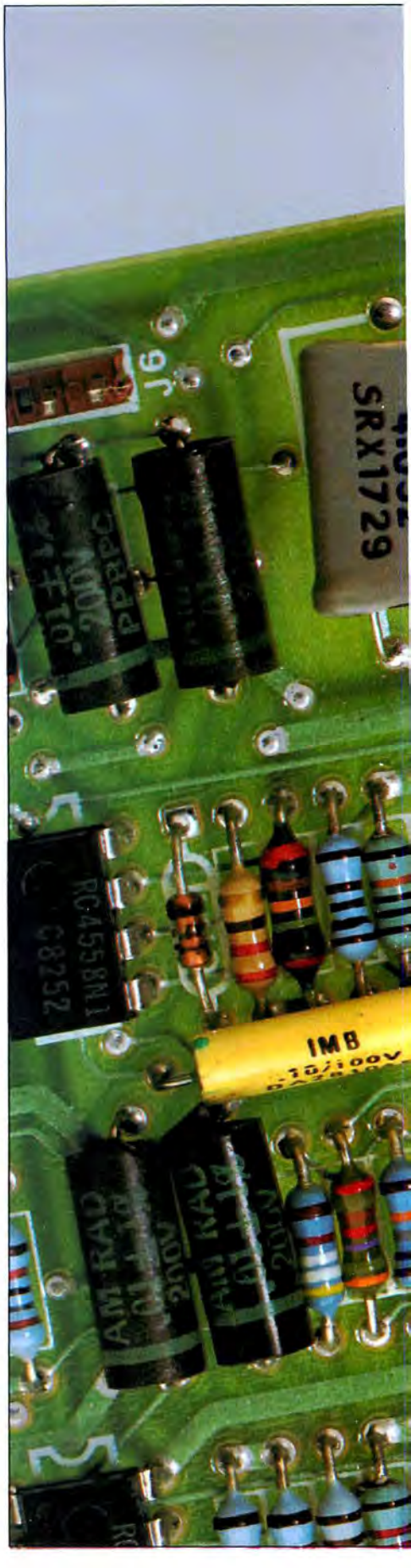


Jack Powers

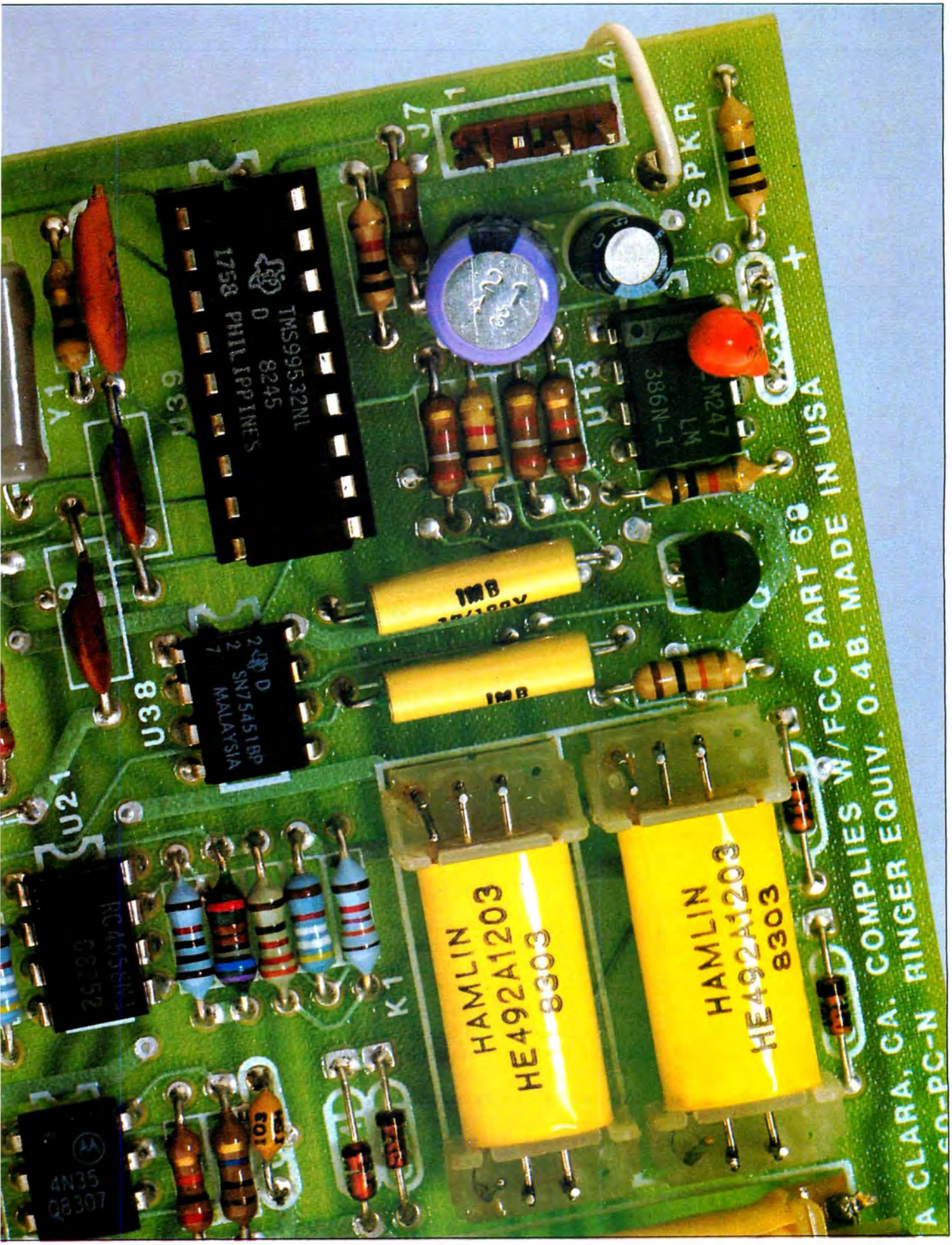
The personal computer is no longer mute. The same technological magic that created the 16-bit microprocessor makes it possible for almost any personal computer to communicate by telephone. Modems, the devices that link computers to phone lines and thus to the outside world, have gotten cheaper and smaller. Most of the functions that once were stored in a cabinet the size of a breadbox are now available on a single chip.

Before the micro revolution of the late 1970s, Bell Telephone had a virtual monopoly on the modem business, and even 300 bps modems were bulky, expensive, and often hard to get. The Bell 103A modem, originally used with teleprinters and dumb terminals, set the first standard for personal electronic communication. Once Bell's monopoly on the modem business was broken by the courts and the Federal Communications Commission (FCC), the Bell 103A was quickly and widely imitated by dozens of manufacturers in the United States.

On and Off the Bus

Many personal computers are organized around a bus, the paths of signals and electrical connections that transfer information between the microprocessor and the components in memory or peripherals. One of the principal ways computers differ (aside from in the choice of a CPU) is in the structure of their buses. The bus acts like an electronic highway, enabling various components within a computer to communicate with the processor and memory.

Figure 1 illustrates the data path a received or transmitted signal takes as it travels through a modem between a PC bus and the telephone line. All the parts within the dotted line may be placed on a board in the PC, or they may be split between a board (such as the asynchronous communications adapter) and an external modem unit. The modulator-demodulator (modem) is only one of three functions required for telecommunications; the other two are the bus interface and the data access arrangement (DAA). Miniaturization of these functions has progressed since the advent of the Bell 103A, making internal modem boards a reality for personal computers.



Top center: Texas Instruments TMS99532 modem chip

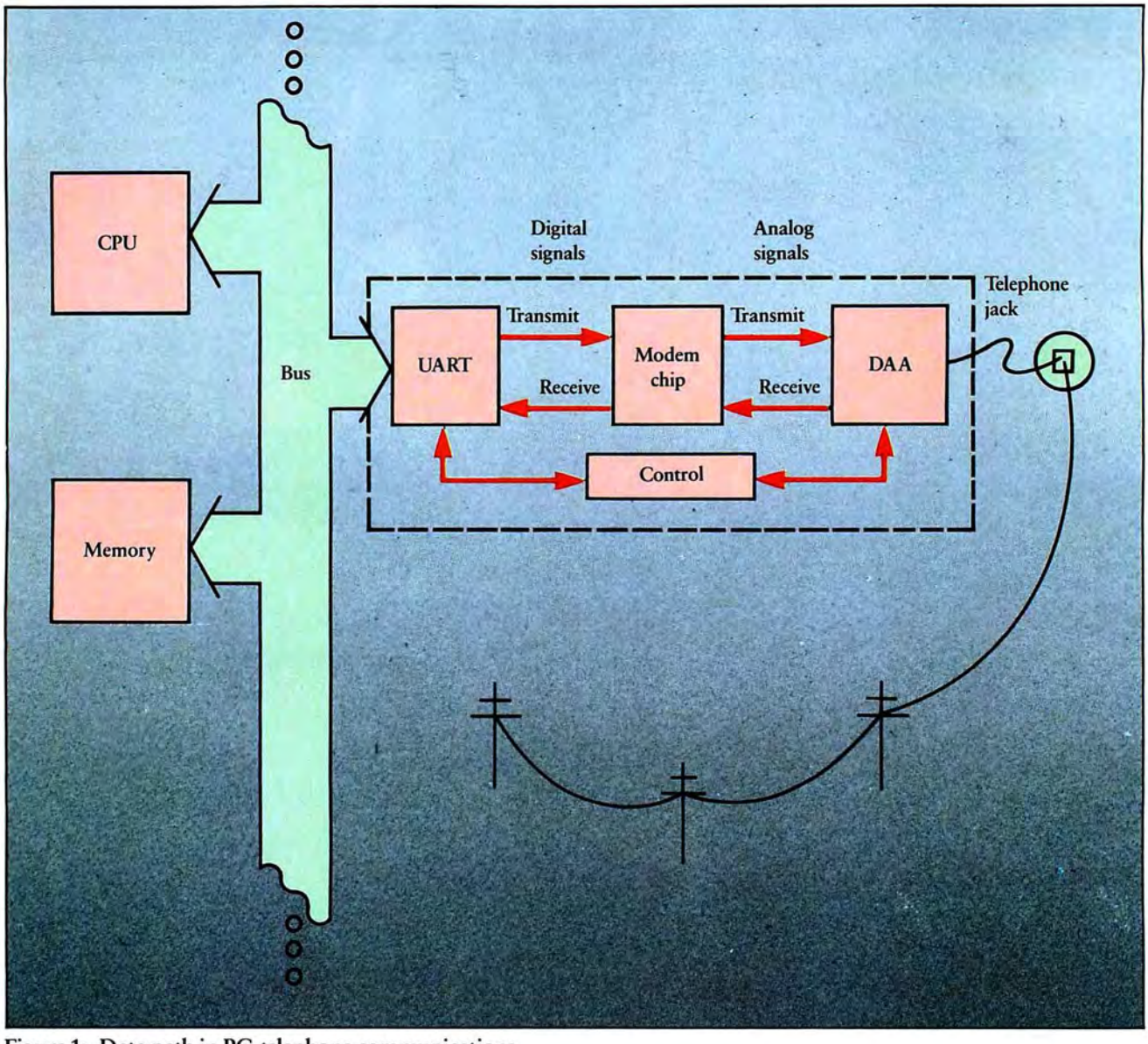


Figure 1: Data path in PC-telephone communications

Data is delivered over the bus in parallel form one byte at a time. Before transmission the data must be "serialized." The bits in each byte are separated and sent in single file to the modulator in the modem chip. At the other end, when external data is received by the demodulator, the separated bits must be reassembled into bytes for delivery over the bus to the program. The device responsible for this assembly and disassembly is the Universal Asynchronous Receiver-Transmitter (UART). The UART is the principal component of the IBM Asynchronous Communications Adapter and the asynchronous port sections of the many multifunction boards available for the PC. Some modem boards include an extra UART so that both DOS devices COM1: and COM2: are available.

Modulation and Demodulation

Unfortunately, digital information leaving the UART is not suitable for telephone line transmission. The modulator portion of the modem converts digital signals into telephone-compatible analog signals; a demodulator at the other end of the line converts them back into digital information.

Modulation is achieved in several forms, the most common being frequency and amplitude modulation. The Bell 103A standard uses a type of frequency modulation called frequency shift keying (FSK), which is similar to the frequency modulation method used in FM radio transmission. FSK telephone transmissions

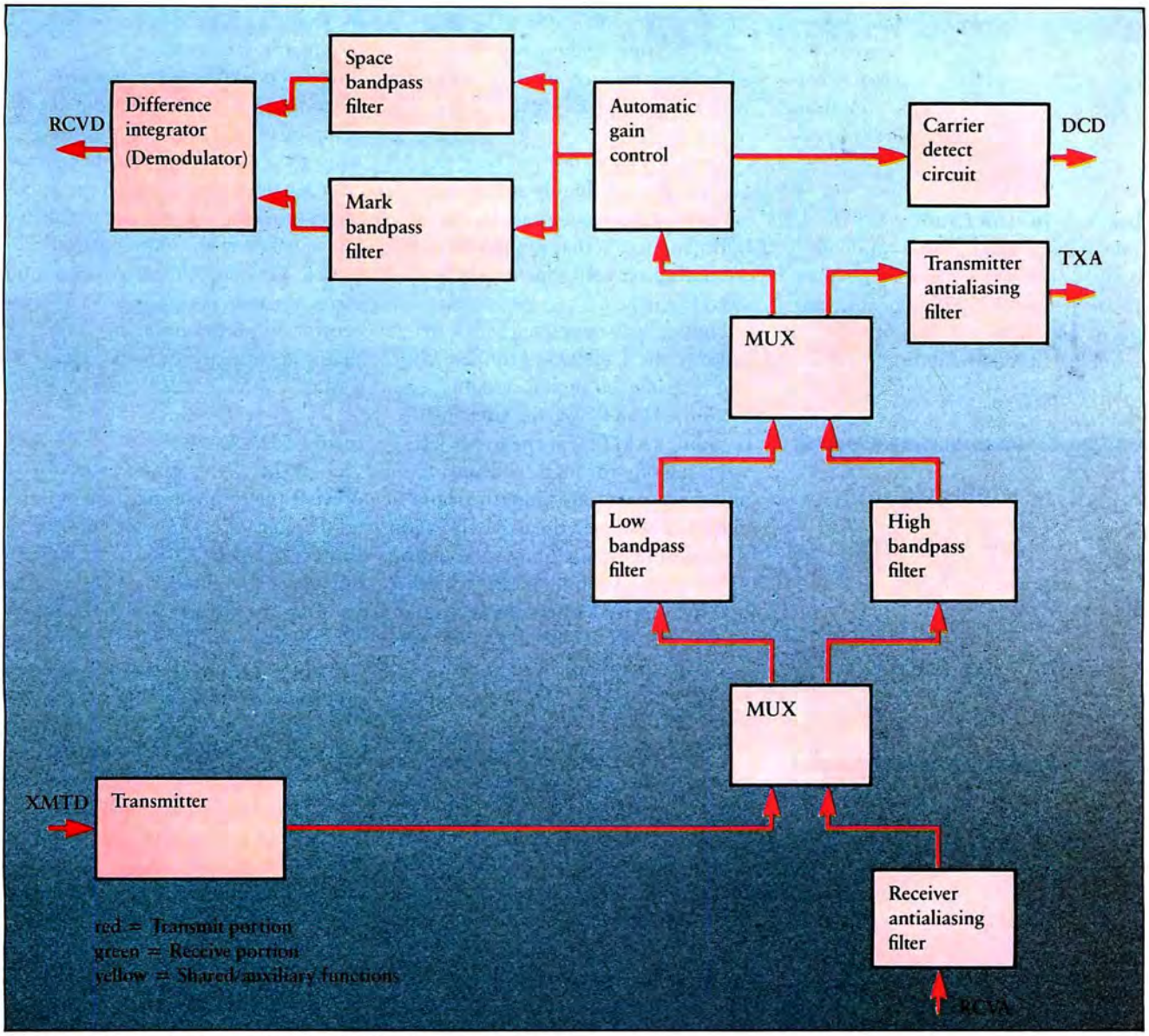


Figure 2: Block diagram of the TMS99532 modem chip

switch back and forth between two audio frequencies, one representing binary 0 (called the mark) and the other representing binary 1 (called the space); digital information is thus represented.

The ability to decode marks and spaces accurately is greatly enhanced by filtering out the line noise inherent in a telephone transmission. As its name implies, filtering selects the desired frequencies of a transmitted or received signal and rejects the noise. Filtering also prevents the transmitter output from overwhelming the receiver in the same modem and removes irregularities in the transmitted signal before it reaches the phone line.

When the FCC allowed manufacturers other than Bell to sell modems to the general public, it had to protect the world's most advanced telephone system from poorly designed and poorly built products. At first, the FCC required that all modems use a piece of Bell equipment known as a data access arrangement (DAA). The DAA isolates the telephone network from disruptive or dangerous input and enforces operation that is compatible with the telephone network's billing equipment. The FCC later allowed certified independent companies to produce DAAs, and finally allowed them to integrate the

State of the Art

DAAs into approved modem packages. Today a manufacturer may design a DAA and have it certified, or purchase a hybrid module containing integrated and discrete parts in precertified form.

Inside a Modem Chip

The heart of the internal modem board is the modem chip. The Texas Instruments TMS99532 is an example of one such chip that provides all modulation, demodulation, and filtering required to communicate with other Bell 103A-compatible modems. This 18-pin chip includes the following features:

> One of the DAA's major tasks is to prevent the modem from transmitting too strong a signal down the telephone line.

Originate and answer mode operation. The Bell 103A standard uses two carrier frequencies, one for transmission and the other for reception. Selection is determined by whether the modem is calling or being called.

Analog loopback test mode. Both analog and digital data paths within the chip may be given a complete test.

External analog input. Other devices such as tone synthesizers (as in Touch Tone phones) and other modem chips may be connected to the central modem chip.

NMOS technology. N-channel metallic oxide semiconductor fabrication makes the TMS99532 chip small, reliable, and energy efficient and allows for easy interconnection with other chips fabricated under different processes.

Switched capacitor filtering. Digital circuits that are highly stable and easily tuned replace resistors and bulky inductors that sample the signal and select components of the desired frequency.

Figure 2 is a simplified block diagram of the TMS99532 modem chip. The transmitted digital signal is sent from the UART over the transmit data line (XMTD) at the lower left. After passing through the transmitter and the appropriate filter, the signal exits as a modulated carrier signal on the transmit analog line (TXA) at the upper right. A modulated carrier that is being received enters the receive analog line (RCVA) at the lower right and departs to the UART on the receive data line (RCVD) at the upper left.

The transmit path is slightly simpler than the receive path. The transmitter is a digital waveform generator programmed to approximate a sine wave representing the digital data on the XMTD line. The frequency values used depend on whether the chip is in the originate (caller) or the answer (called) mode. After filtering, the output appears on the TXA line where it is amplified outside the modem chip before entering the phone line.

Received signals enter the RCVA line, are filtered, and eventually reach an intelligent amplifier called the automatic gain control. This control "knows" how strong a received signal should be and automatically adjusts its gain to keep the signal as close as possible to that value before it enters the mark and space filters to the demodulator. Rather than looking for the presence of either a mark or space frequency, the demodulator compares the output amplitudes from the mark and space filters, then chooses the stronger signal. In short, the demodulator looks not for absolute values but for comparative values. This decoding approach minimizes the effects of line noise by concentrating on the frequency rather than the strength of the received signal.

Inside a DAA

One of the DAA's major tasks is to prevent the modem, because of misadjustment or equipment failure, from transmitting too strong a signal down the telephone line. The DAA contains a level detector that monitors the transmitted signal; if the signal is too strong, the DAA acts like a circuit breaker, reducing the signal level drastically. This detector protects other channels on the same cable or radio path from interference. The DAA similarly protects the computer from power surges in the phone line that occur during electrical storms and equipment failures.

Not all the DAA's functions are protective. The DAA assists modem operation by providing ring detection, two- to four-wire conversion, and DC loop control. In ring detection, the higher voltage of the telephone ring is sensed by the DAA, which then places the modem in the answer mode and presents a ring interrupt to the program. In two- to four-wire conversion, the DAA separates the transmit and receive signals going to and from the modulator and demodulator while matching the impedance of the telephone line. Lastly, the DAA controls pulse (rotary) dialing and the on/off status of the "hook."

Although the DAA effectively isolates the modem from the telephone line, it usually is comprised of bulky discrete transformers and relays that are difficult to miniaturize. So the desire of users for a true single-chip modem including a DAA may not be fulfilled soon.

Putting It Together

The area within the dotted lines of Figure 1 represents an example of a modem board built around the TMS99532 chip. Such a board can fit easily into a PC, PC XT, or expansion unit. Due to their small area and limited number of components, modem boards tend to be less expensive than stand-alone units. Two popular Bell 103A standard modem boards on the market are the PConnection and the PC Modem Plus.

An important decision facing designers is how much intelligence to build into a modem board. Some manufacturers rely on the computer's microprocessor for most control functions, but as time goes by more and more modem boards will likely include microprocessors.

Future Chips

Current modem boards are capable of transmitting and receiving at speeds of up to 300 bps using the Bell 103A standard. Chips like the TMS99532 have made small, inexpensive, and reliable 300 bps modem boards possible.

The Bell 212A modem standard, which allows full-duplex operation at 1200 bps, is also popular among personal computer users. Both single-board and external modems that meet this standard are available from a number of manufacturers. It is only natural to wonder how long it will be before we see an equivalent chip for the 212A modem. By comparison the 103A standard is far simpler; a 212A chip is "several years away," according to Mike Eaton, joint holder with his company, Bizcomp Corp., of a landmark patent in the modem field. The major difficulty lies in the 212A's use of phase-shift keying when operating at 1200 bps. In addition to requiring a much more complex modem chip, a 212A must be compatible with the slower 103A standard when used at 300 bps. Combining both of these standards on a single chip is a tough engineering challenge.

Jack Powers is a communications systems programmer for a large research organization in the San Francisco Bay Area.

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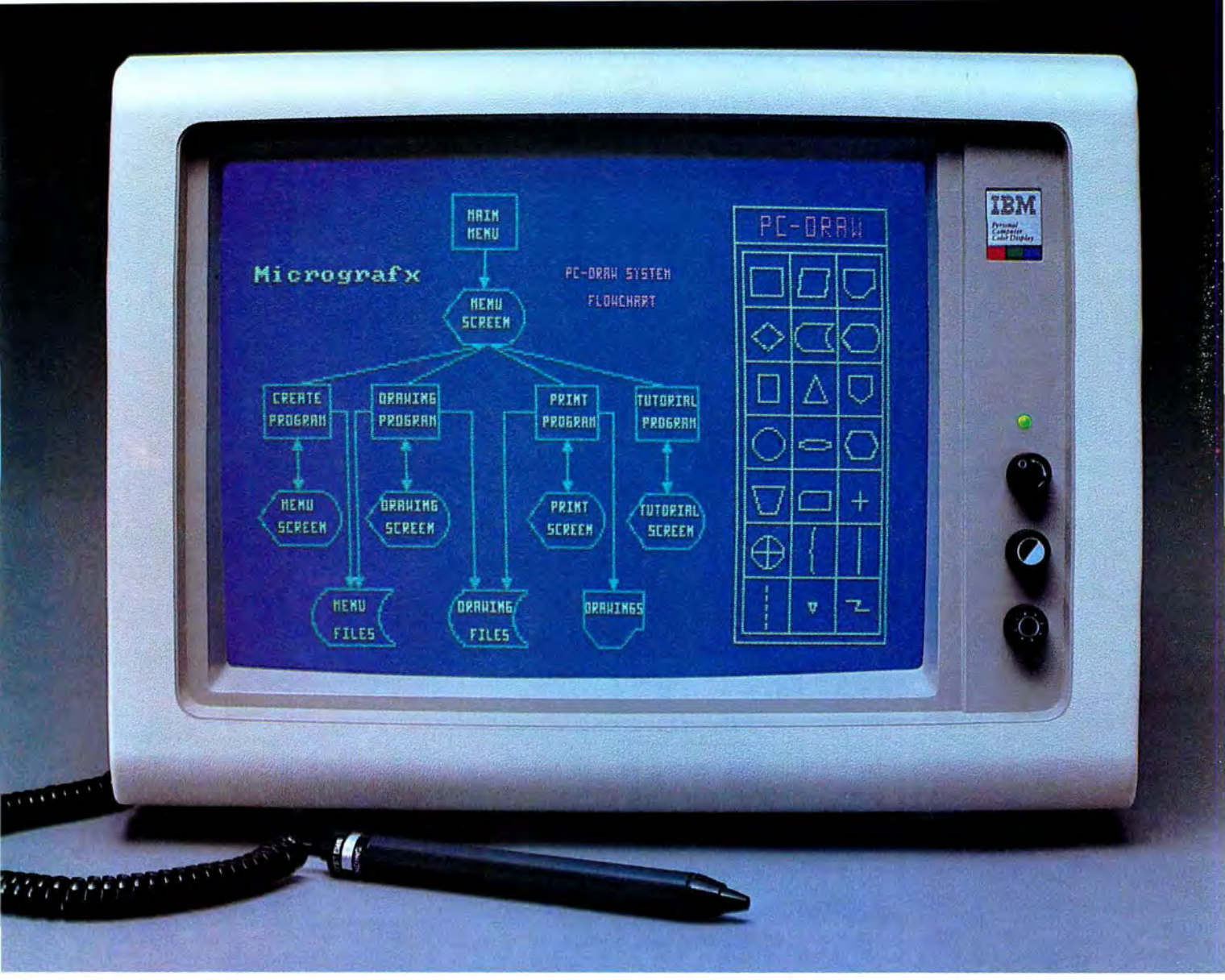

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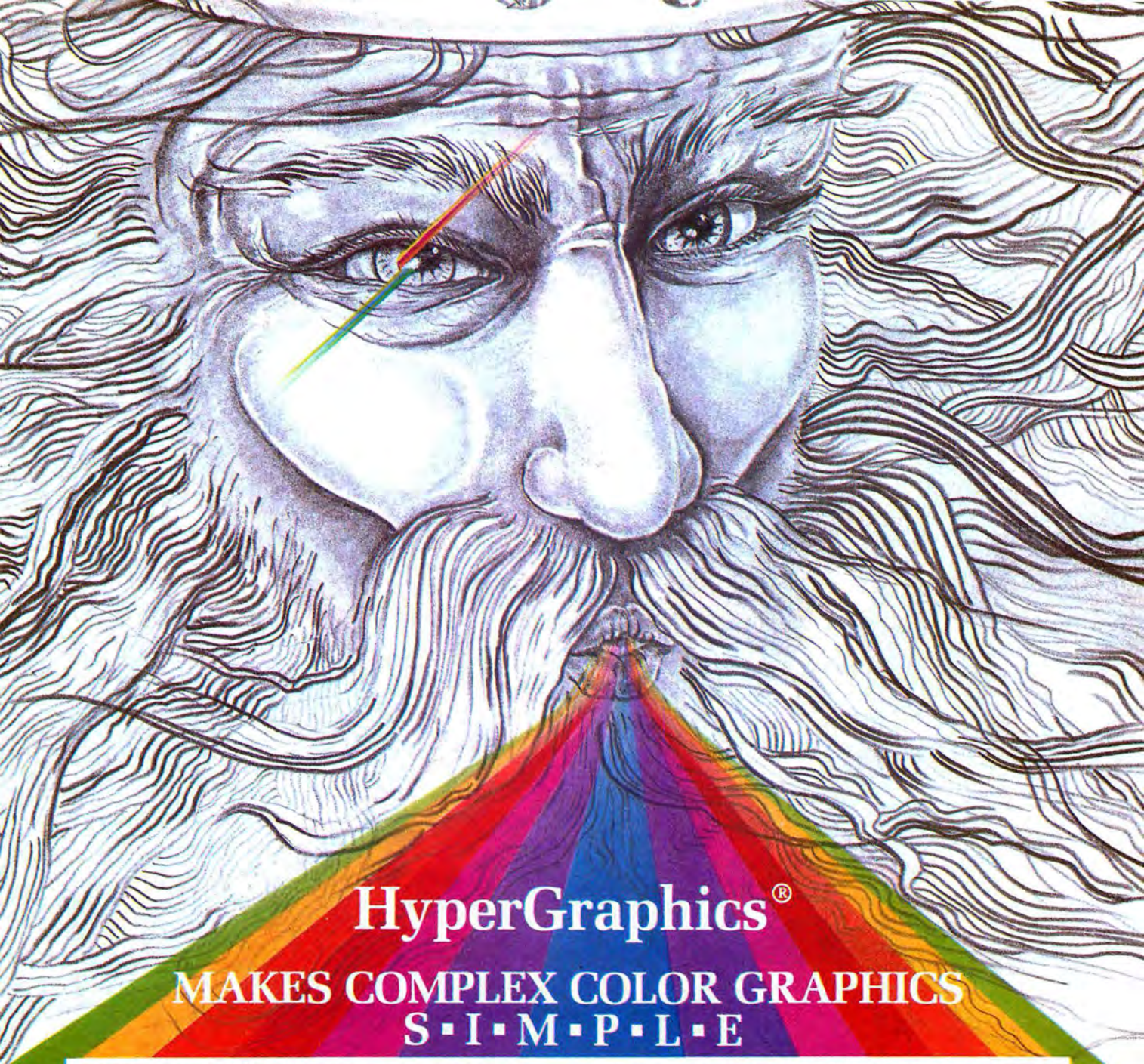

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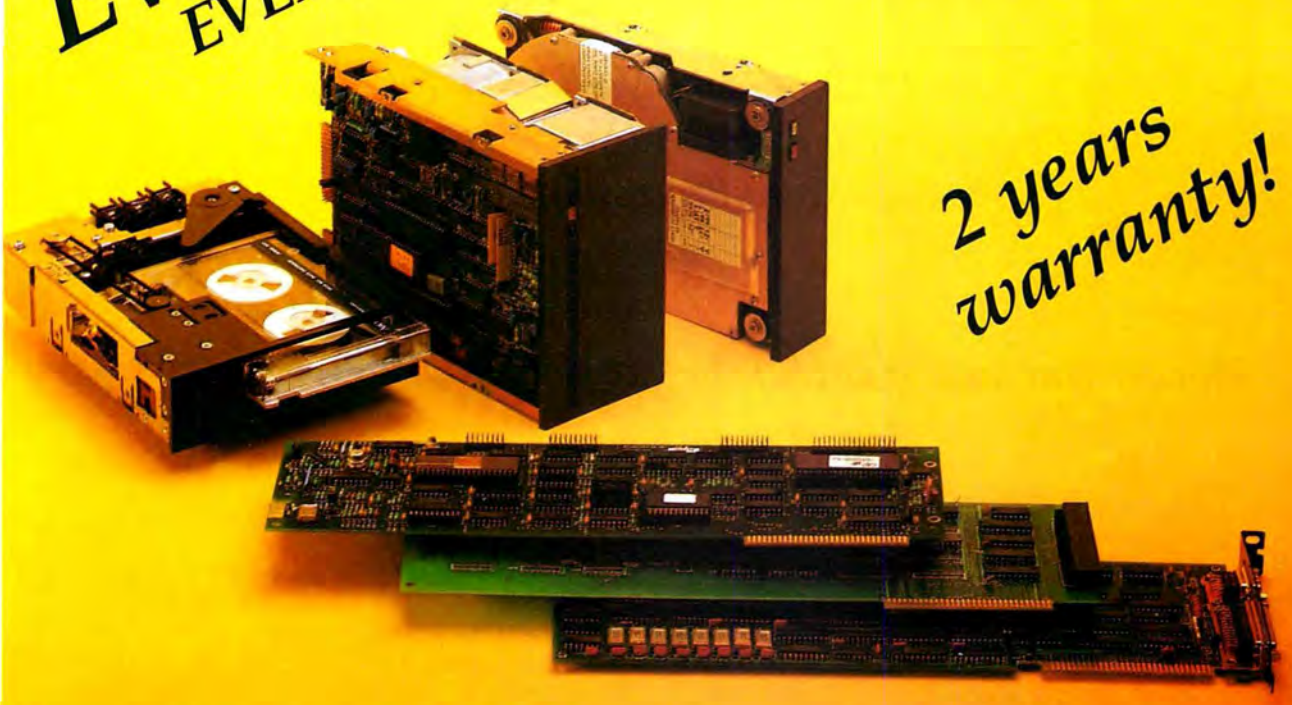

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A revolution in the home computer world started on November 2, 1983, when IBM introduced PCjr. Like other revolutions, PCjr's arrival had been predicted by many observers. Months before the announcement day, cryptic reports began appearing in the *Wall Street Journal* about a low-cost, high-performance personal computer, code-named "Peanut," that would be compatible with the IBM PC.

As in the case of the original PC, very little is new about PCjr technology. It is ironic that semiconductor giant Texas Instruments, fearing the aftermath of the inevitable IBM home computer takeover, abandoned the home computer market just a week before PCjr's official unveiling.

Back in late 1979, the Dark Ages of personal computing, Texas Instruments introduced a truly revolutionary home computer, the TI 99/4. Unlike earlier personal computers such as the Apple II and the TRS-80 Model I, the TI 99/4 had a 16-bit microprocessor and a provision for plug-in software modules, commonly called ROM or program cartridges. These cartridges enabled people to run programs by inserting a small plastic-encased cartridge into a rectangular slot in the computer. Although not a commercial success, the TI 99/4 set a trend followed by such companies as Atari, Commodore, Radio Shack, and, most recently, IBM.

More than any other feature, the provision for plug-in software sets PCjr apart from the PC. The two slots located directly underneath the single disk drive opening will have a profound effect both on how people use their computers and how software producers develop and distribute their programs.

cartridge exposed

A ROM cartridge functions something like a phonograph record. However, while records usually store music, ROM cartridges hold permanently stored programs ranging from languages to games. ROM, which is an acronym for read-only memory, is like an open book inside a glass case in a museum. You can read the displayed pages, but you cannot change what they say. ROM is sometimes referred to as firmware, since it is software that resides permanently in hardware; in ROM cartridges the hardware is specialized circuit boards that contain memory chips.

Because loading a program stored on a ROM cartridge is as easy as turning on a television set, the PCjr cartridges may help alleviate cases of computerphobia and related ailments. With a ROM cartridge program you just plug the cartridge into the slot, and the program is loaded. You bypass typing in the program name at the PC-DOS prompt and avoid waiting for mechanical disk drives or cassette recorders to load the program. You're also spared from using DOS to make a backup copy of your program, since the program is permanently stored on the ROM cartridge and cannot be erased.

Perhaps you are wondering whether ROM cartridges for PCjr have made your floppy disk drive obsolete. The answer is a resounding no.

Obsolete Disk Drives?

Perhaps you are wondering whether ROM cartridges for PCjr have made your floppy disk drive obsolete. The answer is a resounding no. Unless you wish to use your PCjr as little more than a glorified video game player, the two ROM cartridge slots are supplements to a disk drive or, less commonly, a cassette recorder. Without a storage device such as a floppy disk drive or a cassette recorder, you cannot save any information. If your PCjr's only storage medium is ROM cartridges, you have to retype all your information, such as text files or your home budget data, each time you run a particular program.

ROM cartridges for PCjr can hold from 8K to 64K, or from 8192 to 65,536 characters of information. A standard PCjr floppy disk, on the other hand, can store considerably more—360K.

So far IBM has announced five program cartridges for PCjr. Four of them are the games *Mouser, ScubaVenture, Crossfire,* and *Mine Shaft.* The fifth cartridge is IBM PCjr Cartridge BASIC, which supplements the Cassette BASIC that resides in PCjr's 64K of built-in ROM. Cartridge BASIC provides the features of BASICA, which is supplied with PC-DOS on disk, as well as graphics and sound commands for PCjr. Because Cartridge BASIC is needed to run IBM programs such as *Dow Jones Reporter, Bumble Games,* and *Home Budget, jr.,* many people will undoubtedly use it.

Making PCjr Useful

The greatest disadvantages of even the enhanced PCjr model when compared with the popular PC are the home computer's limited memory and single disk drive. While the PC is designed to be able to directly access 640K of user memory, or random access memory (RAM), PCjr is limited to 128K. (RAM is different from the ROM on PCjr cartridges. ROM cannot be changed, while RAM is memory that is available on the computer for temporary storage of data and programs.)

When a program stored on disk rather than on cartridge is loaded on PCjr, the program goes into the 128K RAM area. The problem is that many applications programs take up as much as 64K or 128K. With so much RAM given up to a program, little memory is left for temporary data or document storage.

One important advantage to ROM-based software is that when a cartridge is inserted, the program doesn't take up any of PCjr's 128K of RAM; the entire 128K is available for storing data. With a program loaded from a disk or cassette, however, some RAM is taken up by the program.

When IBM introduced its first personal computer in August 1981, the company also announced a configuration with only 16K of RAM and no disk drives. This low-budget version of the PC was designed to get people started with personal computing. The system gained popularity only among bargain hunters who planned to add memory and disk drives at lower than IBM cost.

The entry model PCjr, on the other hand, is practical even though it lacks a disk drive. The computer is useful because of its 64K of RAM and its two ROM cartridge slots. Games and educational software are two kinds of programs that can be put on PCjr ROM cartridges. With cartridge software, schools that can afford to purchase only the entry model will be able to enter the computer age with an inexpensive but useful machine.

With cartridge software, schools that can afford to purchase only the entry model will enter the computer age with an inexpensive but useful machine.

Cartridges and the Software Industry

Because of PCjr's memory limitations, software producers will have to take advantage of the machine's ROM cartridge capability in order to make some of the sophisticated applications programs developed for the PC available for PCjr. Developers of integrated applications software such as Lotus *1-2-3* and Context *MBA*, both of which require more than 128K, are likely to investigate putting their programs on PCjr cartridges.

For software publishers, ROM cartridges provide a mixed blessing. One advantage of the cartridges is that software piracy, the illegal copying and distribution of copyrighted software, becomes difficult. ROM cartridges, however, because of their plastic cases, printed circuit boards, and memory chip components, cost more than floppy disks. Cartridges also have a smaller storage capacity than floppy disks. Furthermore, because software is rarely free from errors, software publishers often provide updates for registered owners at little or no cost. Putting updates on ROM cartridges would undoubtedly be more expensive than putting them on floppy disks. However, PCjr's ROM cartridges can be opened easily. People conscious of the hazards of static electricity should be able to open a cartridge, remove old ROM chips, and insert new ones containing updated software without any difficulty.

Fortunately, considering the high price of software, manufacturing costs are unlikely to deter many software publishers from providing software on ROM cartridges instead of floppy disks. What will deter publishers, however, is that a ROM-based program designed for PCjr will run only on PCjr. IBM PCs and XTs cannot run ROM cartridges.

The Future

PCjr's two cartridge slots are sure to be a promising key to unlocking the full potential of the new computer. With the right programs, the cartridges can transform PCjr into an accountant, a secretary, a teacher, or an entertainer. Cartridges can also open the way for sophisticated programs, previously available only for far more costly machines, to run on PCjr.

PCjr has permanently altered the home computer world. The cartridge slots that differentiate PCjr from the PC are one of the most exciting features of the IBM personal computer family. Clearly, some time will pass before people begin to take full advantage of the cartridge slots. The home computer revolution has scarcely begun.

Seth Novogrodsky is a Contributing Editor to PC World Books.

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Megabytes

News and notes for the PCjr community

Katie Seger

Megabytes *reports about the people, products, and developments in the computer world. We give you up-to-date information on the events and trends as well as the occasional speculations that arise in this rapidly expanding world that PCjr has joined.*

And You Thought It Was an IBM Machine

Having found a manufacturing strategy that works for the Personal Computer, IBM is continuing the plan with PCjr. As with the PC, most of the parts and components for PCjr will be made by outside suppliers. Industry sources have named some of these third-party manufacturers.

Qume, of San Jose, California, has signed a contract with IBM to supply the half-height, 5¼-inch floppy disk drives for PCjr. The computer's infrared keyboard is made by Advance Input Devices, an Idaho company located in Coeur d'Alene. Texas Instruments is supplying PCjr's sound chips, which enable the computer to make sounds and music. And AMP, the Harrisburg, Pennsylvania, company that makes connectors (or sockets) for the PC, is also supplying connectors for the new home computer.

IBM is not continuing the PC assembly scheme with the new computer, however. Unlike the PC, which is assembled at IBM plants in three locations (Boca Raton, Florida; Greenock, Scotland; and Wangarata, Australia), PCjr will not be made in IBM assembly plants. Instead, the new computer is being assembled and packaged by Teledyne, a diversified company that produces, among other things, on-board flight control computers for military and NASA aircraft. The PCjr will be made at the company's Lewisburg, Tennessee, plant. An interesting footnote to Teledyne's role in the PCjr story is that Teledyne's chairman, Henry Singleton, is on the Apple board of directors.

A True Ever-Ready

Scientists at Hitachi Electronics in Japan have developed a battery that lasts 50 years and is as small as a baby's fingernail. The battery, which is as thin as a human hair and has a surface area of 4 square millimeters, can only power an electronic watch for ten days but can be recharged up to 2000 times.

A Hitachi spokesperson said the battery still needs "a lot of work," so it looks like flashlights, Walkmen, and PCjr keyboards will have to get along with old-fashioned alkaline batteries for a while longer.

PCjr Plays Vegas

COMDEX/Fall is the computer industry's largest trade show. Five COMDEX shows are held annually, three in the United States, one in Europe, and one in Japan. The autumn event takes place during the week following Thanksgiving in Las Vegas. At last fall's Nevada show PCjr was one of IBM's star attractions.

Since the trade show took place before PCjr demonstration models were in the stores, the computer crowd was anxious to try out the machine. IBM obliged by giving demonstrations and training throughout the five-day event. Hands-on lessons using 72 PCjr Enhanced Models and the *IBM PCjr Sampler* were available every half hour. Tickets for the training

were free, and the majority of the sessions had two people to each machine. At most training sessions PCjr played to a full house.

Life, Liberty, and the Pursuit of Video Games

The United States Supreme Court has ruled that local governments can ban or regulate video games. The decision set a precedent that can be cited in other disputes over video game restrictions.

In 1982 the town of Marshfield, Massachusetts, adopted a ban on video games. The town's ordinance prohibits the operation of "mechanical or electronic amusement devices, whether coin-operated or not." The ordinance exempts jukeboxes and video games used in private homes.

A group of Marshfield store, restaurant, and business owners who had video games in their places of business challenged the ordinance claiming that the ban was unconstitutional. Their suit argued that video games are a form of expression protected by the First Amendment's guarantee of free speech. The justices voted seven to two to reject the merchants' claim when the case was brought to the Supreme Court last November.

Perhaps the business people should take solace in the notion that if the Founding Fathers had played *PacMan* and *Donkey Kong*, they never would have had time to write the Constitution.

Bank on It

Home banking has long been hailed as a perfect application for personal computers. The subject of much testing and research, banking at home is now a reality for Bank of America customers. The California bank introduced its HomeBanking service in the last quarter of 1983 and expects to have 25,000 customers signed up by the end of this year.

The best feature of the Bank of America system is that it works with any personal computer equipped with a monitor and a modem. HomeBanking customers can pay bills, transfer funds between accounts, make account balance inquiries, and review current checking account statements—all without leaving home.

To use the HomeBanking service, a Bank of America customer fills out a request form and is given identification and code numbers. Using any communications program and a modem, the customer calls a local number, connects with the service, and performs banking and bill paying chores. HomeBanking is available between 6 a.m. and midnight and costs $8 per month in addition to regular monthly checking account charges. The system also includes an electronic mail service that allows customers to ask questions about their accounts and statements. Bank personnel respond to questions within 24 hours.

Bank of America is providing technical information about the system to independent software developers. You can expect to see some software packages that combine different applications like home budgeting and communications to make even better use of the HomeBanking system.

Kiosk Que C'est?

Computer kiosks are springing up all over. Most stands are making their appearance in computer stores and bookstores, but they're also showing up in record shops, grocery stores, and airline terminals.

After a successful experiment in the Washington, D.C., area, PC Telemart of Fairfax, Virginia, has placed more than 100 kiosks in computer stores and bookstores throughout the country. People can use the kiosk computers to search through PC Telemart's software data base to find program listings for their work and home needs. The data base contains descriptions and hardware requirements for more than 21,000 commercially sold software packages; reviews are also included for many listings.

Softsmith Corporation, a California company that licenses independent software and then rewrites the documentation and repackages the programs under its label, has more than 300 kiosks set up nationwide. Softsmith kiosks are found in computer and software stores, bookstores, record shops, drug stores, and even a Tennessee gas station. The kiosks are designed to encourage customers to try out Softsmith programs on a computer before they buy the product. At present Softsmith sells programs for Apple, Commodore, Atari, Tandy, and IBM personal computers. Its IBM library, which includes *Home Accountant +*, *Championship Blackjack*, and *MultiRAM*, will soon feature programs for PCjr.

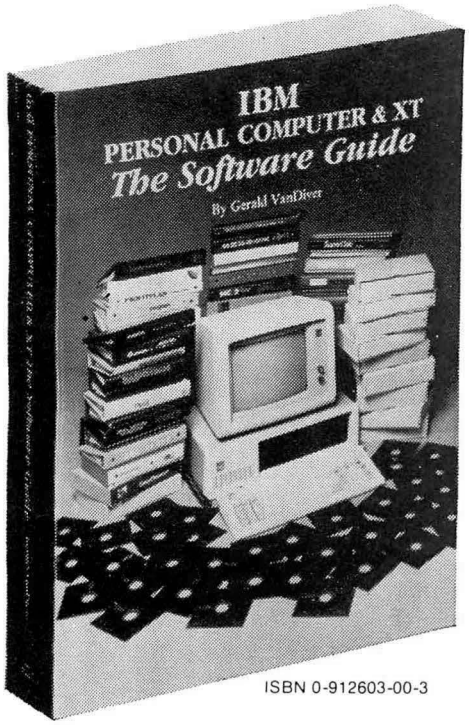
An electronic kiosk test being conducted in the San Francisco Bay Area may change the way consumers shop for noncomputer merchandise, too. Shoppers can view and order merchandise from national mail-order companies at 100 kiosk terminals set up in grocery and drug stores, health clubs, airline terminals, and hotel lobbies.

Each terminal combines a touch-sensitive video screen, laser-disc, microprocessor, keyboard, credit card reader, and printer. Shoppers view merchandise and place orders by pressing pictures of the items on the screen. Size, color, number, and shipping details are typed on the keyboard, and orders are charged to Visa, MasterCard, or American Express accounts. Shoppers receive a paper receipt of their purchases. The test, which is conducted jointly by Compufill, a division of McKesson Corporation, and ByVideo Inc., will run through the end of 1984. The two companies will then decide whether to expand the kiosk stations nationwide.

Don't Leave Home without It

American Express Company has published a new, computer-specialty mail-order catalog that allows customers to order computer hardware and business and game software through the mail. Called *The Best of the Best*, the catalog was sent to 400,000 American Express cardholders in the last quarter of 1983. An American Express spokesperson said that if consumer response is favorable, the company will publish another computer catalog this year.

Megabytes welcomes contributions of interesting items. Send them to Megabytes, PCjr World, *555 De Haro St., San Francisco, CA 94107. Please include your name, address, and phone number.*



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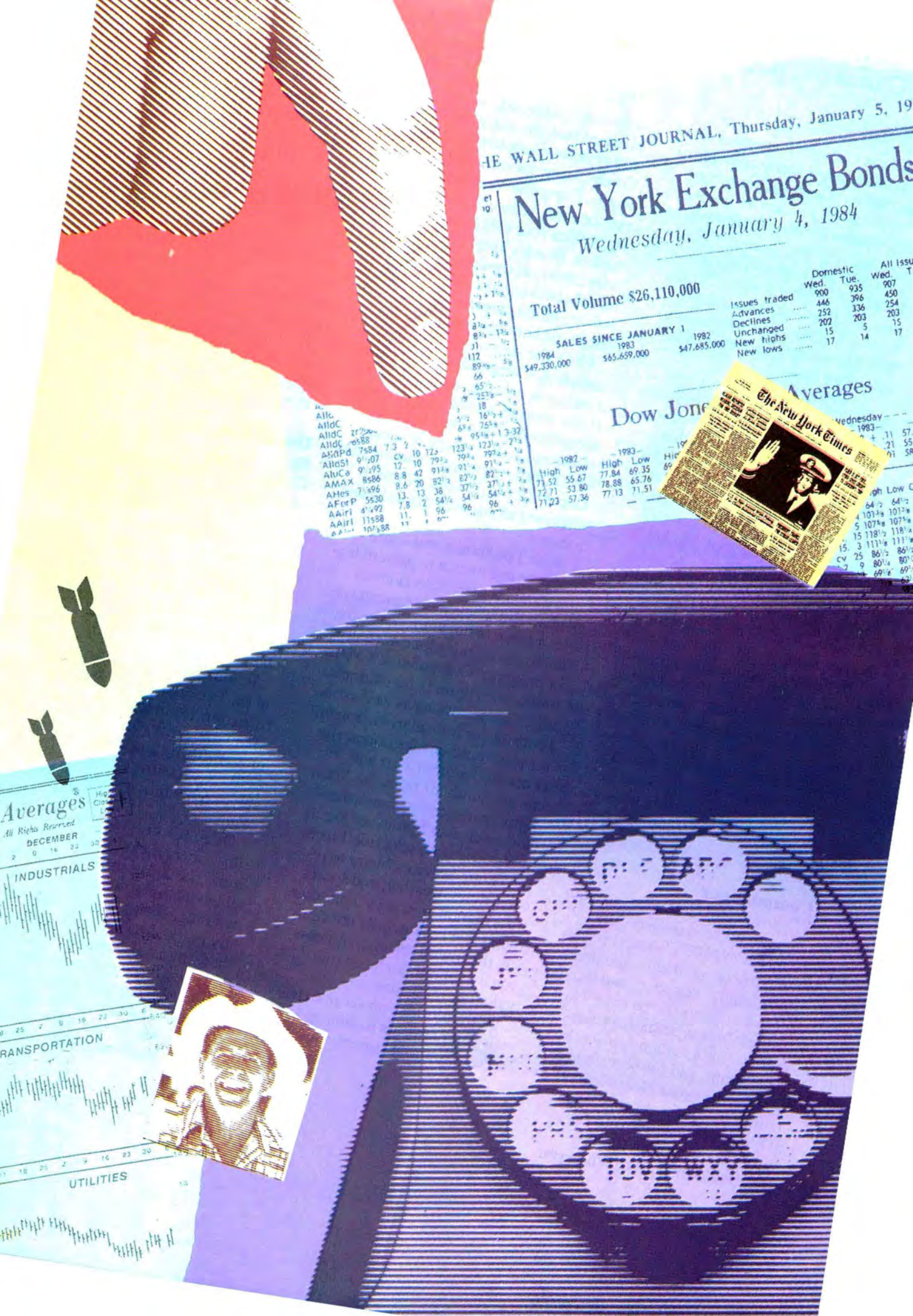
The Source and CompuServe link PCjr to other computers, major newspapers, Wall Street, and Dungeon and Dragon worlds.

Dial Up News and Entertainment

Janette Martin

Just as Aladdin had his magic lamp, home computer owners now have the power at their fingertips to beckon an obliging genie. The mythical genie materialized like a vaporous cloud when Aladdin rubbed his lamp. Today's genie comes not through a lamp but through computers when information services are called up over the telephone.

Two popular 24-hour information services are The Source and CompuServe. Both provide news, entertainment, mail, stock and financial reports, games, and other useful and fun electronic services. CompuServe is a subsidiary of H & R Block and claims nearly 86,000 subscribers after four years of service. The Source Telecomputing Corporation, a division of Reader's Digest, has been in business for almost five years and has approximately 40,000 subscribers.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To use the information services you either pay a registration fee or purchase a starter kit, and then you are given an identity number and a password that permit you to connect with the system. Thereafter, you pay monthly charges based on connect time to the service. Charges vary from $6 per hour at night and on weekends to $25.75 during office hours, which are prime time.

If you want to call up either service with PCjr, you must have an enhanced model equipped with an internal or external modem. You need a communications program such as *Personal Communications Manager, PC-Talk III,* or *Hostcomm* so that you can call the system using your regular telephone line.

Most subscribers to The Source and CompuServe call the services with a local rather than a long-distance phone call. Both services maintain numbers in approximately 400 cities in the United States and Canada. The Source provides an 800 number for subscribers who live outside covered areas. CompuServe customers who live away from those areas, however, must make long-distance phone calls to connect with the service.

CompuServe

When you call CompuServe, your computer screen displays the word 'CONNECT' once the system answers your call. You press the <Enter> key once, and the service displays the prompt 'Host Name:'. You type **CIS** (for CompuServe Information Service) at the prompt, and the service asks you to enter your identification number with the prompt 'User ID:'. After you enter your ID number, the prompt 'PASSWORD:' is displayed. When you enter your password, don't be alarmed that you can't see what you type; as a security precaution CompuServe doesn't display passwords. CompuServe checks your number and password and then authorizes your entry onto the system. Besides keeping nonsubscribers off the system, the record checking also ensures that you are billed properly for your telephone connect time.

Once the sign-on procedure is complete, CompuServe gives you a welcome message and tells you if any messages addressed to your identification number are on the electronic mail system. You can check these messages by using the Electronic Mail Menu, which is displayed along with the welcome message.

Both The Source and CompuServe use menus to present feature and program selections to subscribers. Successive menus offer a range of broad to increasingly narrow selections for each feature or program. CompuServe's Main Menu (see Figure 1), for example, offers six selections as well as the H option for information. You enter your number selection at the command prompt '!'. If you choose number 1 from the Main Menu, your screen shows the Home Services Menu (see Figure 2). If you choose selection 1 from the Home Services Menu to receive news, weather, and sports information, you get yet another menu (see Figure 3). By continuing this menu selection process, you can obtain and read individual news stories.

Both information services permit you to bypass menus and access programs directly by entering simple, usually abbreviated commands. With practice the commands can save both money and time. CompuServe allows you to call up selections with the page numbers that appear in the upper right-hand corner of each CompuServe screen. For example, if you want to jump directly to the News/Weather/Sports Menu from any part of CompuServe, you type **GO HOM-10** at any prompt. This command tells the system to go to Home Services page 10. Similarly, you can always retrieve the Main Menu by entering **GO CIS-1** or **T** (for top menu).

The CompuServe Repertoire

CompuServe's news service includes stories from the *Washington Post*, the *St. Louis Post-Dispatch*, and the Associated Press news wire. Some news service selections such as the *Washington Post* require a surcharge of $5 per month or $45 per year in addition to regular connect charges.

Serious programmers can call up the Personal Computing feature from CompuServe's Main Menu and write, compile, and run programming languages such as FORTRAN using CompuServe's software instead of buying their own.

Other features for CompuServe subscribers include Comp-U-Store, the department store of the telephone lines, where shoppers can order steaks from Omaha or buy marked-down items from the "bargain databasement." A 21-volume electronic encyclopedia, *Grolier's Academic American Electronic Edition*, is available through the service. Horoscope listings, biorhythm charts, soap

```
COMPUSERVE                          PAGE CIS-1

COMPUSERVE INFORMATION SERVICE

1  HOME SERVICES
2  BUSINESS & FINANCIAL
3  PERSONAL COMPUTING
4  SERVICES FOR PROFESSIONALS

5  USER INFORMATION
6  INDEX

ENTER YOUR SELECTION NUMBER,
OR H FOR MORE INFORMATION.

!
```

Figure 1: CompuServe's main menu

```
COMPUSERVE                          PAGE HOM-1

HOME SERVICES

 1  NEWS/WEATHER/SPORTS
 2  REFERENCE LIBRARY
 3  COMMUNICATIONS
 4  HOME SHOPPING/BANKING
 5  DISCUSSION FORUMS
 6  GAMES
 7  EDUCATION
 8  HOME MANAGEMENT
 9  TRAVEL
10  ENTERTAINMENT

LAST MENU PAGE. KEY DIGIT
OR M FOR PREVIOUS MENU.

!
```

Figure 2: CompuServe's Home Services Menu

opera summaries, and movie reviews are also popular with subscribers.

To sign off of CompuServe type BYE or OFF at any prompt. Signing off properly is important because you are billed for your telephone connection time. Although CompuServe automatically disconnects any call after 15 minutes of no activity from your computer, you will still be charged for those 15 minutes.

The Source

Logging onto The Source is similar to logging onto CompuServe. After you call and make a telephone connection, The Source displays 'CONNECT' on the screen. Wait a few seconds and then press <Enter> twice. The prompt 'TERMINAL = ' then appears on the screen. Type **D1** and at the prompt '@' enter your individual account number. When the prompt '>' appears, type **ID** followed by your identification number, a space, and then your password. Like CompuServe, The Source checks for mail and notifies you of any waiting messages.

To get a welcome screen (see Figure 4) that allows you to call up information, type **ENTRY** at the '>' prompt. If you want to bypass the welcome screen and call up the Main Menu (see Figure 5), type **MENU** at the prompt. At any menu screen you can type **QUIT**, and the command prompt '->' appears on the screen. Using the prompt and program commands listed in The Source's *User's Manual*, you can bypass menus and go directly to features or programs. The command MOVIES, for example, brings up current movie reviews. Like the GO commands of CompuServe, these one- or two-word commands can save you time and money.

Many help files are available on The Source to explain commands, menus, and files. Files such as HELP SYSCOM, which produces a list of all system commands, come in handy as you are weaving your way through the system's many features.

The Source Specials

The Source provides many services that are similar to CompuServe's, including electronic mail, games, Comp-U-Store, busi-

ness and financial news, and newspaper and press wire stories.

The By-line News Features selection on the News and Reference Resources Menu lets you track news information by title, author, date, or key word. This Source feature is an excellent way to research school papers or keep up with a news topic of special interest to you. For example, I used the feature to search by key word for news on Grenada. I then narrowed my search to news on Grenada during November 1983. Forty news items were reported for the month.

The Creating and Computing option from The Source's Main Menu is for serious programmers and people knowledgeable about computers. Financial management programs and programming languages are software resources that subscribers can use to their advantage. The extensive Financial Modeling program, for example, lets you analyze financial situations and project outcomes. The program analyzes profitability, cash flow, budgeting, and present net worth. Other options let you write and compile programs in BASIC, FORTRAN, and Pascal.

But The Source is not all work. An *I Ching* program, found in the Advice selection of the Home and Leisure Menu, looks into your future and gives answers to pressing personal questions. *I Ching*, or the *Book of Changes*, is the reference for an ancient Taoist divinatory system that involves interpreting

```
COMPUSERVE                              PAGE HOM-10

                  NEWS/WEATHER/SPORTS

NEWS SERVICES
1  THE WASHINGTON POST ($)
2  ST. LOUIS POST-DISPATCH
3  AP VIEWDATA WIRE

4  NOAA WEATHER WIRE
5  OFFICIAL PGA TOUR GUIDE
6  HOLLYWOOD HOTLINE ($)
7  AMERICAN SKI ASSOCIATION
$  INDICATES SURCHARGED SERVICE

LAST MENU PAGE. KEY DIGIT
OR M FOR PREVIOUS MENU.

!
```

Figure 3: CompuServe's News/Weather/Sports Menu

```
WELCOME TO THE SOURCE

1  USING THE SOURCE
2  TODAY
3  BUSINESS UPDATE
4  THE SOURCE MAIN MENU
5  WHAT'S NEW
6  COMMAND LEVEL

Enter item number or HELP
```

Figure 4: The Source's welcome screen

the throw of coins. The translation used by The Source for interpretations is *I Ching: Taoist Book of Days* by Khigh A. Dhiegh (Ballantine, New York, 1978).

The Source's *I Ching* asks you to concentrate on your question and then, instead of throwing coins, you press the C key. A diagram representing the heads and tails of the coin toss appears on the screen.

To log off The Source type **OFF** at any prompt. As with CompuServe, it is important that you correctly log off The Source so that you are not charged for extra telephone time.

Sign-up Costs and Service Charges

CompuServe

CompuServe subscribers sign up for the service by purchasing a Starter Kit from retail stores such as Radio Shack. Each kit includes a manual, identification number, and password, and costs between $19.95 and $39.95.

Connect charges are assessed by minutes of use with no monthly minimum connect time required. Subscribers pay by major credit card or through an account whose funds are electronically transferred from the subscriber's bank account to CompuServe's account.

Connect Charges	Prime Time *5 a.m. to 6 p.m.* *Monday–Friday*	Non-Prime Time *6 p.m. to 5 a.m.* *Monday–Friday* *All day Saturday,* *Sunday, and holidays*
1200 baud modem	$15 per hour	$12.50 per hour
300 baud modem	$12.50 per hour	$6 per hour

The Source

Registration fee for The Source is $100. Individual subscribers must have a major credit card to sign up for the service. Commercial subscribers can be billed through their business and pay by check.

Subscribers must complete registration contracts, obtained from The Source or independent retail stores such as ComputerLand. Upon registration subscribers receive an account number, identification number, password, and command guide. The Source's *User's Manual* can be purchased separately if it is not included in a registration package from a retail store. The Source charges a minimum of $10 per month for connect time, used or not.

Connect Charges	Prime Time *7 a.m. to 6 p.m.* *Monday–Friday*	Non-Prime Time *6 p.m. to 7 a.m.* *Monday–Friday* *All day Saturday,* *Sunday, and holidays*
1200 baud modem	$25.75 per hour	$10.75 per hour
300 baud modem	$20.75 per hour	$7.75 per hour

Let Your Fingers Do the Talking

Communications programs are among the most popular services available on The Source and CompuServe. The programs allow people in the same city or different states to converse with one another via their computers.

The Source and CompuServe offer several communications options. Both have electronic mail services that let you leave messages for other subscribers by directing correspondence to their user ID numbers. CompuServe has a bulletin board service that allows you to post general public messages for other subscribers, and The Source has a Post program that enables you to list classified ads under various categories. The Source also has a Mailgram Messages program provided through Western Union that sends hand-delivered messages to anyone in the United States. A message of up to 100 words costs $5.15.

One of the most popular communications programs is CB Simulator on CompuServe. CB Simulator is similar in format to CB radio; people "talk" with one or many other people, who are known by their "handles." The Source offers a similar service called Chat. However, Chat permits only two people to talk at one time.

If you want to confer on a specific topic, you can join a special interest group, known as a SIG, on either service. To join a SIG you use CompuServe's Discussion Forums program or The Source's Participate program. Discussion Forums on CompuServe include CBers, Hamnet (ham radio operators), and Work-At-Home (home-based businesspeople). Using the Discussion Forums program, you can leave and read messages and bulletins left by other SIG members, and you can participate in specially scheduled on-line conferences that often feature guest speakers. Unlike CompuServe, The Source has no permanently listed SIGs. Special interest groups change regularly; you simply join in a Participate topic that is listed. If you don't see one of interest, you can start your own

The Source's I Ching *program looks into your future and gives answers to pressing personal questions.*

SIG. Some of the topics listed when I used Participate were politics, PCjr, and the family and computers.

At Ease On Line

It takes time to master The Source and CompuServe, so plan to spend several hours on line trying out and becoming familiar with either service. You'll want to keep a pen and paper handy so you can jot down for quick recall information such as commands and numbered selections on menus.

```
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4  HOME AND LEISURE
5  EDUCATION AND CAREER
6  MAIL AND COMMUNICATIONS
7  CREATING AND COMPUTING
8  SOURCE*PLUS

Enter item number or HELP
```

Figure 5: The Source Main Menu

The Source and CompuServe can be used effectively with the help information presented on line, but you may want to print out this information for future reference so you don't waste connect time reading it. As useful as the help information is, a command guide and manual available from each service are essential tools for gaining a thorough understanding of the organization and features of both systems.

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Janette Martin is a Contributing Editor for PCjr World *and* PC World. *She also owns an information processing company in the San Francisco area that specializes in training for the IBM PC.*

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A graphics program to help you make bar charts of your monthly bills

Free and Simple BASIC

Adrian Mello

How would you like to add to your software collection without spending any money? You can take advantage of programs that appear in magazines and books simply by typing them into the computer and saving them. If you learn a few rules and follow simple procedures, you can start making graphs with the DATAGRAF program included in this article (see Listing 1). The knowledge you acquire in the brief time it takes you to type and use the program will enable you to build a collection of free software and also give you an introduction to computer languages and programming.

DATAGRAF lets you plot a graph that compares such things as monthly checking account balances, automobile expenses, or long-distance telephone charges. The graph in Figure 1 shows the use of natural gas over a one-year period.

First Remarks

The DATAGRAF listing demonstrates some of the conventions of BASIC. You'll notice that all lines begin with line numbers, which increase by ten with each new line. Line numbers can increase in increments as small as one, but programmers prefer multiples of ten because that numbering scheme enables them to insert corrections or additional lines. The computer follows the instructions line by line, according to the rules of the BASIC language.

BASIC statements are reserved words that tell the computer to perform a predefined task. DATAGRAF contains many BASIC statements, such as PRINT, COLOR, SCREEN, LOCATE, and INPUT.

Remarks, or comments, are another programming convention. These lines don't accomplish tasks, but they inform whoever is reading the listing about the intended purpose or significance of a particular part of the program.

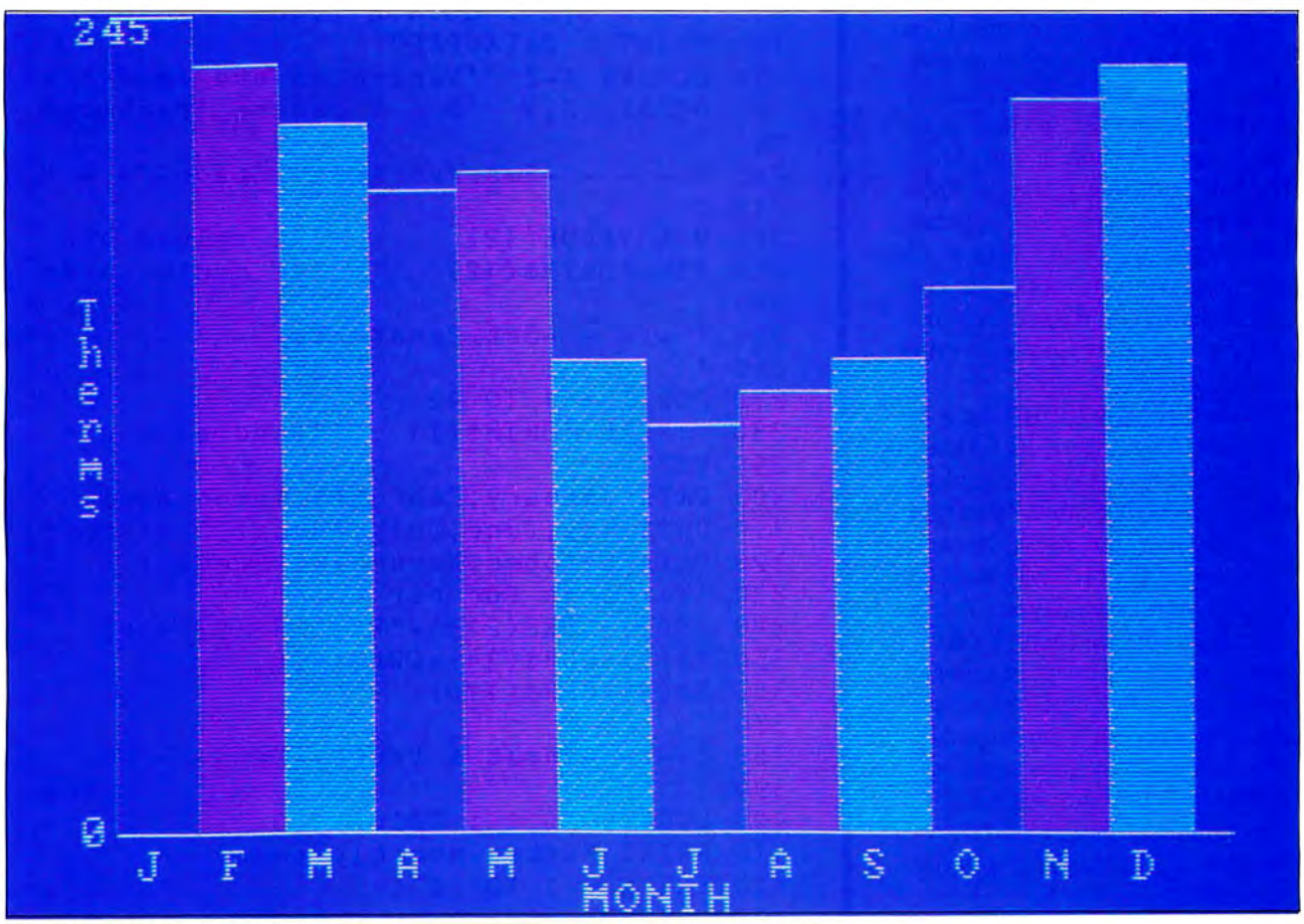

Figure 1: A graph of natural gas use over a one-year period

Remarks can be indicated in a number of ways. In DATAGRAF they're marked with a single quotation mark (') at the beginning of the phrase. Lines 10 through 90 are remarks that tell you the program's name and purpose. Line 120 tells you that the command WIDTH 40 sets the monitor screen width to 40 columns. Other remarks, such as lines 190 through 210, describe the purpose of an entire section of the program.

Typing the Program

To run DATAGRAF you need Cartridge BASIC. If you want to save the program, you'll need a cassette tape recorder or a disk drive. Turn on the computer and enter the date and time at the PC-DOS prompts. When the 'A>' appears, type BASICA and press <Enter>. The 'Ok' prompt in the upper left corner of the screen means that the computer is ready for you to enter information.

Start typing in the listing with the first line number, 10, followed by a single quotation mark and a series of asterisks. After you type the complete line, press <Enter>. Now repeat the process for each of the following lines. Type the lines exactly as you see them. Don't worry about the exact number of blank spaces or asterisks unless the spaces appear within quotation marks. Most spaces and asterisks function like remarks; they make the listing readable but aren't essential to the program's operation.

If you make a typing mistake, use the arrow keys to move the cursor backward or forward to make the correction. You can type over the mistake or delete it with the <Del> key. Additional

```
10 '************************************
20 '
30 '    NAME: DATAGRAF
40 '
50 '    PURPOSE: Plots a bar graph of
60 '             data for the 12 months
70 '             of a year.
80 '
90 '************************************
100 SCREEN 0,0  'Set for text mode
110 COLOR 2,0
120 WIDTH 40    'Set screen width to 40
130 KEY OFF     'Turn 25th line off
140 CLS         'Clear screen
150 COLOR 0,2 : LOCATE 3,16
160 PRINT " DATAGRAF"
170 DEFINT A-Z  'Variables are integers
180 DEFSNG S,V  'S & V can be fractions
190 '
200 ' - - - -Reserve Array Space- - - -
210 '
220 DIM VALUE(12)       '12 values and
230 DIM MONTH$(12)      '12 month names
240 '
250 ' - - - -Set Constants- - - -
260 '
270 FOR I = 1 TO 12
280   READ MONTH$(I)    'Read each name
290 NEXT
300 DATA January,February,March,April
310 DATA May,June,July,August,September
320 DATA October,November,December
330 'Textures for bar coloring
340 T$(1)=CHR$(213)+"W"+CHR$(93)+"u"
350 T$(2)=CHR$(34)+CHR$(136)
360 T$(3)=CHR$(170)
370 '
380 ' - - -Input & Verify Data- - - -
390 '
400 LOCATE 20,1 : COLOR 3,0
410 PRINT "Enter monthly amounts"
420 FOR X = 1 TO 12
430   GOSUB 650
440 NEXT
450 LOCATE 20,1 : PRINT SPACE$(39)
460 LOCATE 20,1,1 : COLOR 3
470 PRINT "Are these values correct?";
480 ANS$=INPUT$(1)
490 IF ANS$="y" OR ANS$="Y" THEN 780
```

Listing 1: DATAGRAF

```
500 IF ANS$="n" OR ANS$="N" THEN 520
510 BEEP : GOTO 450
520 FOR I = 1 TO 12
530   LOCATE I+5,1
540   IF I<10 THEN PRINT " ";
550   PRINT I
560 NEXT
570 LOCATE 20,1
580 PRINT"Enter the month # to ";
590 INPUT "change: ",X$ : X=VAL(X$)
600 IF X<1 OR X>12 THEN 450
610 GOSUB 650 : GOTO 450
620 '
630 ' - - - -Enter Monthly Data- - - -
640 '
650 LOCATE X+5,5 : COLOR 2
660 PRINT MONTH$(X);SPACE$(23)
670 LOCATE X+5,15 : INPUT "= ",V$
680 'Test for valid response
690 VALUE(X)=VAL(V$)
700 IF VALUE(X)>=0 THEN 740
710 'Erase an invalid entry, retry
720 LOCATE X+5,16 : PRINT SPACE$(23)
730 BEEP : GOTO 670
740 RETURN
750 '
760 ' -Find MAX and Enter Y-axis Label-
770 '
780 FOR I = 1 TO 12
790   IF VALUE(I)>VALUE(MAX) THEN MAX=I
800 NEXT
810 LOCATE 20,1 : PRINT SPC(39)
820 LOCATE 20,1
830 INPUT "Enter Y-axis label "; L$
840 '
850 ' - - - -Draw Graph- - - -
860 '
870 CLS
880 SCREEN 1,0  'Medium resolution
890 COLOR 1,1  'Blue screen-CMW palette
900 DRAW "BM18,180U180" 'Draw y axis
910 DRAW "BM18,180R300" 'Draw x axis
920 LOCATE 24,4
930 PRINT "J  F  M  A  M  J";
940 PRINT "  J  A  S  O  N  D";
950 LOCATE 25,19 : PRINT "MONTH";
```

(continues)

editing techniques and commands are described in the PCjr BASIC manual in the "BASIC Program Editor" section.

Saving and Loading

After you finish typing the program, you are ready to run it. Before you do so, however, you should save, or store, the program on a floppy disk or a cassette tape. If you don't have a storage device, the program will work only as long as it stays in the computer's memory. If you load another program or turn the computer off, you'll have to type DATAGRAF again the next time you want to run it.

To save DATAGRAF, type the command SAVE" or press the <Fn> key followed by the function key <F4>. Then type the name of the program, DATAGRAF, and press <Enter>.

A stored program can be recalled by typing the LOAD" command or <Fn> and <F3>, followed immediately by the program name, DATAGRAF, and <Enter>.

Viewing the Program

After you load the program, you can run it or look at the listing. If you want to look at the program to review what you have typed or to make corrections, type the command LIST and press <Enter>. When you list DATAGRAF you'll notice that the listing contains more lines than can be displayed on the screen at once. If you want to stop the listing to look at part of the program, press the <Ctrl> and <Break> keys together.

```
960 LOCATE 23,2 : PRINT "0";
970 LOCATE 1,1 : PRINT STR$(VALUE(MAX))
980 IF LEN(L$)>17 THEN LN=4 : GOTO 1000
990 LN=12-(LEN(L$)/2)
1000 FOR I = 1 TO 22-LN      'Print
1010   LOCATE LN+I-1,2       ' label
1020   PRINT MID$(L$,I,1);   '  sideways
1030 NEXT
1040 'Determine graph scale
1050 SCALE = 180/VALUE(MAX)
1060 'Draw blank move to graph origin
1070 DRAW "BM18,180"
1080 'Loop to graph data
1090 FOR X = 1 TO 12
1100 ' Determine bar height
1110   HEIGHT = INT(VALUE(X)*SCALE)
1120 ' Draw a bar
1130   DRAW "C3U=HEIGHT;"   'Left side
1140   DRAW "R24"           'Top
1150   DRAW "D=HEIGHT;"     'Right side
1160 ' Fill bar with a color
1170 '    Don't fill small bars
1180   IF HEIGHT<2 THEN 1270
1190 '    First, move inside bar
1200   DRAW "BM-12,-2"
1210 '    Select next bar color
1220   C = (X MOD 3)+1
1230 '    Paint bar with selected color
1240   PAINT STEP(+0,0),T$(C),3
1250 ' Move over to draw next bar
1260   DRAW "BM+12,+2"
1270 NEXT
1280 LOCATE 2,1 'Move cursor below HOME
1290 X$=INPUT$(1) 'Wait for keystroke
1300 END          'to end program
```

Listing 1: *(continued)*

You can also use the LIST command to look at a specific section of the program. Type LIST followed by the line number that begins the section, a hyphen, and the line number that ends the section. LIST 300-500, for example, would display lines 300 through 500.

Making the Program Work

When you're ready to start drawing graphs, load DATAGRAF, type RUN, and press <Enter>. To give the program the information it needs to draw the graph you must give it an amount for each month. Figure 2 shows the screen as it appears when you enter monthly amounts. The prompt 'January =' appears at the top of the screen followed by the blinking cursor. Enter the amount and press <Enter>. Type only the number at this time. The program will prompt you to enter the units later.

The program repeats the enter-amount operation for each month until 12 months of data have been input. If you don't want to enter an amount for a month, for example if you want to make a graph for summer or winter months only, just press <Enter>.

After you enter the amounts for each month, the program lets you make corrections. If you're satisfied with the amounts that you entered, answer the question 'Are these values correct?' by pressing the Y key for "yes." If you want to make any changes, press N for "no." When you press N, you are asked which month you want to change. Choose the number of the first month you want to change and press <Enter>. Then type the corrected amount and press <Enter> again. Repeat the process until all your corrections are made. Finish up by answering Y to the question 'Are these values correct?'.

The program next asks you to enter the units for your data. The units depend on the data you record. You can enter any kind of unit, from dollars to gallons to kilowatts. The graph in Figure 1 shows therms, the unit on your monthly gas and electric bill that measures the amount of gas used to heat your home.

After you enter the unit, the final step is to press <Enter>. The program will then draw a graph of your data. DATAGRAF prints the units along the y-axis on the left side of the screen. At the top of

```
DATAGRAF

January   = 269
February  = 253
March     = 225
April     = 198
May       = 185
June      = 155
July      = 130
August    = 140
September = 167
October   = 203
November  = 235
December  = 257

Enter Y-axis label ? Therms_
```

Figure 2: A DATAGRAF screen with monthly figures entered

the y-axis the program prints the number for the largest monthly amount. That amount corresponds to the graph's tallest bar. To run the program again press any key and type RUN. The program starts over and once again asks you for the January amount.

You can apply the procedures you learn by running DATAGRAF to collect other useful programs printed in computer publications. While you type the DATAGRAF listing to add to your software library, you also learn BASIC.

This tutorial shows that typing program listings is like following a new recipe: you not only learn something about cooking, but you also get to enjoy the results.

Adrian Mello is an Assistant Editor for PC World Special Editions.

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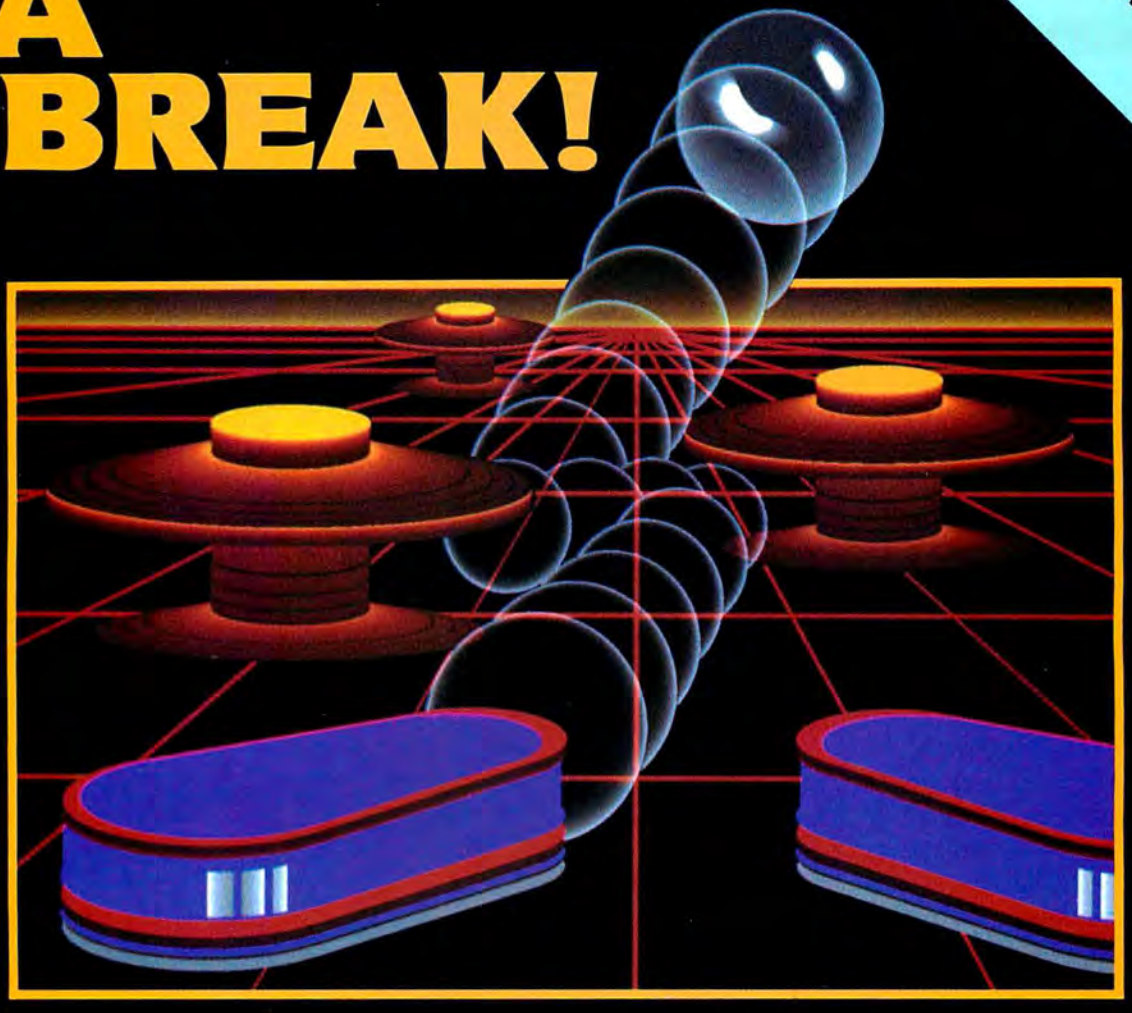

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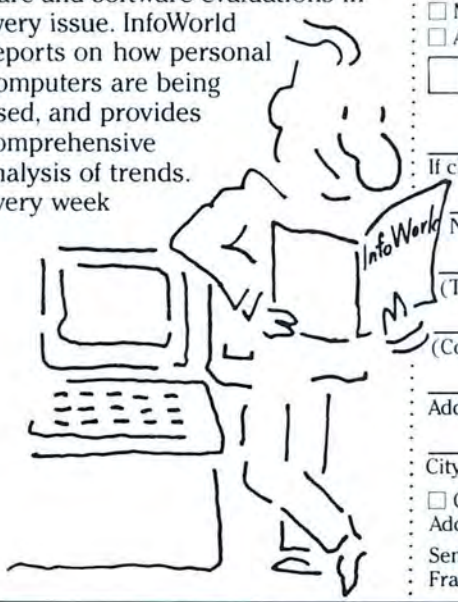

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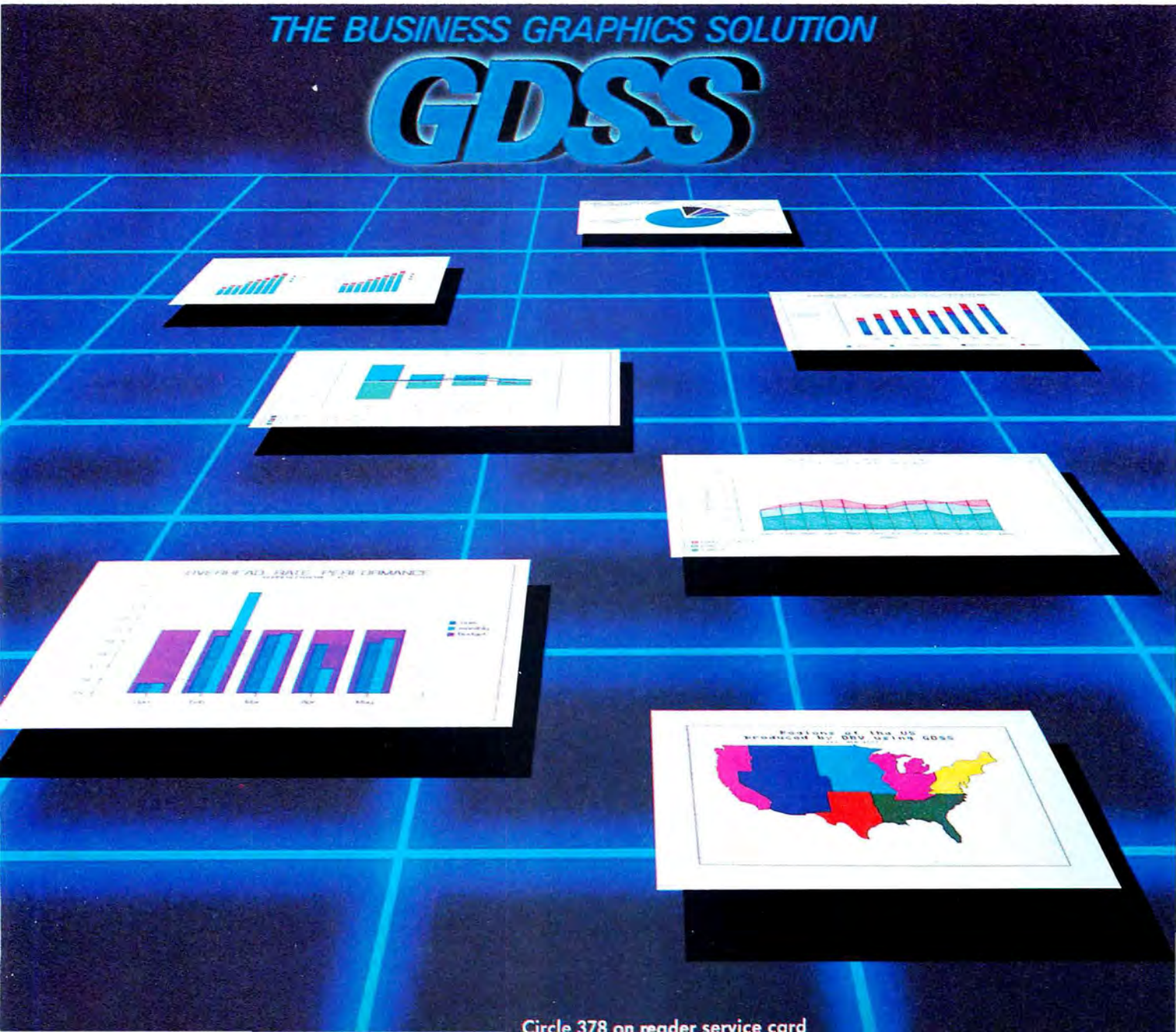

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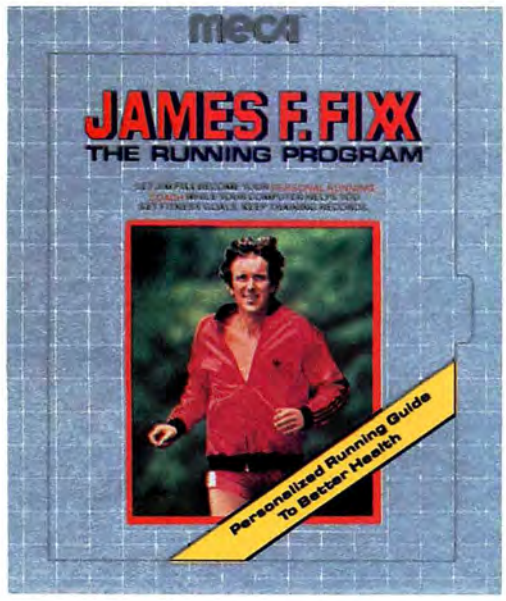

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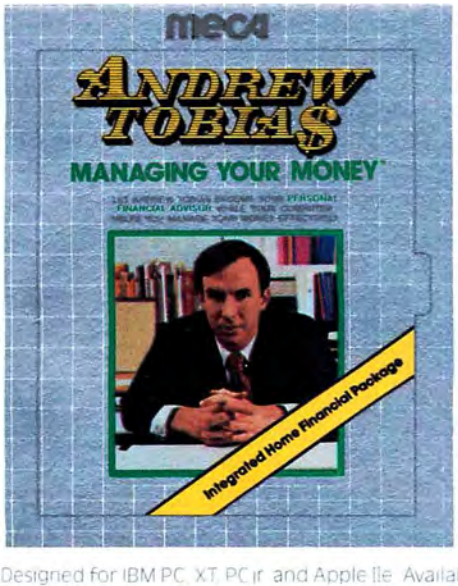

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The Compatibles Line Up

Robert Luhn

They are called PC-standards, clones, compatibles, or lookalikes, and they come in every conceivable size. Some are large and ungainly like the IBM PC, while others are elegant and slim. Some duplicate the PC from RAM to ROM to keyboard; some are more adventurous and step out of the PC's shadow. But whatever their function or appearance, all are designed to replace or complement the PC.

Many of the logos gracing the PC compatibles at the fall COMDEX trade show in Las Vegas were from companies noted for other achievements: Xerox, ITT, Sperry, and Texas Instruments. Small companies, such as MAD, Seequa, and JONOS, are newcomers to the compatibles competition. And the firms that led the compatibles charge—COMPAQ and Corona—now find themselves sandwiched between the two groups.

The compatibles race is on and the companies that win may be those that spend generous sums on advertising, packaging, and dealer support. Such things do not come cheaply, and the companies with Fortune 500 bank accounts may dominate the market on the basis of resources rather than on the merits of their hardware. But some of the most important questions facing buyers considering an alternative to the PC concern hardware: Is this machine compatible? Does it run off-the-shelf PC software? If not, are versions of most PC programs available for it? Can the compatible at least read PC-formatted data disks?

The compatibility question (see "How Compatible Is Compatible?" *PCW*, Vol. 1, No. 1) is vital not only to the buyer but to the seller as well. A computer store has only so much space; one dealer noted that if he had to stock three sets of Lotus Development's *1-2-3* for three different compatibles, he'd rather not carry the machines at all.

ACT Apricot

Visual Commuter

Intertec HeadStart 512

Leading Edge PC

Panasonic Sr. Partner

MAD-1

Review

Confusion reigns when there are nearly 50 compatibles on the market. Telling them apart is a frustrating game complicated by each manufacturer's claim that its compatible is unique, yet like the PC—only better. Accessory madness has taken hold as companies scramble for the buyer's attention. (See Tables 1 and 2 for a list of compatibles' features.) Once-esoteric features such as streaming tape drives, bubble memory, on-board modems, multiple processors, and miniature hard disks are standard on many new compatibles.

The Market

While it's hard to follow all of the trends in the compatibles market—there is a surprising amount of diversity—small, sleek, and more powerful machines are becoming increasingly common. Many companies, not wishing to butt heads with IBM in the desktop market, have introduced stylish portables and briefcase-size machines. The PC's standard 8088 microprocessor is being replaced by the 80188 and the more powerful, true 16-bit 8086 and 80186. But a price is paid in compatibility, since some PC software is sensitive to the 8088's timing—a problem that apparently doesn't bother compatible makers.

In both RAM and disk storage the compatibles are far ahead of the PC. Typical basic system configurations are 128K or 256K of RAM. Many units feature half-height 5¼-inch or 3½-inch floppy disk drives that store twice as much information as standard PC drives. Most manufacturers also offer their own 5- and 10-megabyte hard disk versions of the XT. Built-in modems and other communications peripherals are finding their way into compatibles as well.

Manufacturers have kept a keen eye on the business customer. System prices are competitive, and most of the compatibles can be linked to a local area network or can support IBM mainframe protocols. Promotional ploys such as free software, one-year warranties, on-site repair, and 48-hour parts availability are being promised to business users.

Of course, compatible makers include some of the above features as a way to differentiate their products. But many compatible designers insist that while they are forced to more or less follow the PC's de facto standards, they are not obliged to make a machine that "lives down to the IBM," as one engineer put it. Though including an 80186 microprocessor or a 3½-inch drive may flout conventional market wisdom, a number of companies are doing these things because in the long run they make for a better machine.

Otrona Attache 8:16

Eagle PC Spirit

Sperry PC

Seattle Computer Gazelle II

Radio Shack TRS-80 2000

Stearns Desktop

Review

Desktop Compatibles

CAD Counsel Protean

The Protean is a graphics-oriented compatible designed for the corporate engineer or designer who wants to create and edit electromechanical drawings. A number of drawing functions are supported, such as circles, arcs, solid-filled areas, and pattern generation; drawn objects can be copied, modified, and rotated. The machine is capable of 256 "electronic transparencies" and features a user-definable character set. The 8088-based system uses an IBM-style keyboard and includes a digitizing tablet for drafting; a 31-color, high-resolution graphics board; and *Auto-CAD* drafting software. List price: $7300. CAD Counsel, 231 E. Lemon, Monrovia, CA 91016, 213/359-6091.

Canon AS-100

The AS-100 is an 8088-based, MS-DOS compatible machine that runs a number of popular software packages (notably the MicroPro family of software led by *WordStar*) and the *Canobrain* integrated business package of calc, graph, file, word processing, and communications programs. The AS-100 is well constructed and offers a sophisticated keyboard that is different from the PC's. The system can be equipped to emulate IBM mainframe terminals and work in the Corvus Omninet local area network.

As a PC compatible, the AS-100 is somewhat limited. The system cannot read PC-formatted disks; all data must be formatted onto Canon disks under MS-DOS. List price: $3995. Canon U.S.A. Inc., One Canon Plaza, Lake Success, Long Island, NY 11042, 516/488-6700.

Digigraphic EXTRA Model 70

The Model 70 is a flexible development system and network server that claims software and hardware (plug) compatibility with the PC and the XT. Like the Micro Craft Dimension, the Model 70 can accommodate any number of 16- and 32-bit microprocessors in its ten expansion slots. The system includes an IBM-style keyboard, two 360K floppy disk drives, one fixed 5-megabyte hard disk drive, and one removable 5-megabyte drive. With its 250-watt power supply, the Model 70 is capable of supporting up to 70 megabytes of hard disk storage as well as a number of peripherals. List price: $5995. Digigraphic Systems Corporation, 10273 Yellow Circle Dr., Minnetonka, MN 55343, 612/935-9111.

Hyperion

ITT XTRA

COMPAQ-Plus

Columbia VP

Colby PC 3.2

Texas Instruments Portable Professional

Olivetti PC

Logical LX-T

Compucorp OmegaMite

Review

Eagle PC Plus and PC Spirit

Eagle Computer has produced several personal computers, notably the PC compatible PC-1 (see "Bird of a Feather," *PCW*, Vol. 1, No. 8). Designed for business and personal use, Eagle's new desktop, the PC Plus, and a portable, the PC Spirit, are hardware identical and very compatible with the IBM PC. Both machines offer a choice of an enhanced IBM-style keyboard or a 105-key version featuring 24 function keys. Standard configuration is 128K, expandable to 640K on the motherboard. The Spirit has a built-in color graphics board, a feature that is optional on the PC Plus. Both compatibles are available in XL versions that replace one floppy disk drive with a 10-megabyte hard disk drive. List price: PC Plus $2795, PC Spirit $3295, hard disk version of either machine add $1500. Eagle Computer, Inc., 983 University Ave., Los Gatos, CA 95030, 408/395-5005.

Electro Design's IMP-12 is one of the few machines that nearly lives up to its claim of 100 percent PC compatibility.

Electro Design IMP-12

Electro Design's IMP-12 is one of the few machines that nearly lives up to its claim of 100 percent PC compatibility. Designed to be either a stand-alone computer or part of the IBM expansion system, the IMP is essentially a chassis with either 6, 12, or 18 expansion slots. Configuring the IMP is a matter of connecting the power supply and adding the proper processor and expansion boards. Sixteen-color graphics and a light pen are supported by the system.

Construction is simple and solid, and the system comes with an IBM-style keyboard or a PCjr-like "chiclet" keyboard that is surprisingly easy to use. The IMP ran all the test software, with the expected exception of *Xenocopy*. List price: $4044. Electro Design Inc., 690 Rancheros Dr., San Marcos, CA 92069, 619/471-0680.

Future Computers FX-20

From Britain comes the FX-20, a stand-alone compatible that easily ties into Future Computers' proprietary local area network. Billed as "British and beautiful," the FX-20 is an 8088-based MS-DOS compatible with 800K disk drives. The FX-20 character set can be altered to include a number of fonts. System compatibility is currently limited by the FX-20's inability to read PC disks.

The system operates under MS-DOS, CP/M-86 Plus (which is included), Concurrent CP/M, and MP/M. Current software available for the FX-20 includes *dBASE II*, *WordStar*, *SuperCalc*, and a number of bisynchronous communications packages. A Z-80 microprocessor is optional. List price: $2995. Future Computers Ltd., 654 Bair Island Rd. #302, Redwood City, CA 94063, 415/369-2855.

Intertec HeadStart 512

Intertec's dual-processor business computer is an MS-DOS compatible machine that features the 8086 and the Z-80A, 512K or 1 megabyte of RAM, a RAM disk, multiuser networking capability, and a single 3½-inch disk drive. The HeadStart is small by desktop standards (15 by 12 by 11 inches) and weighs approximately 25 pounds. Though it functions as a single-user computer, the HeadStart is easily integrated into Intertec's 255-work-station network, which supports electronic mail, file locking, and password security. A 5¼-inch disk drive is available for storage and downloading software to the system's standard 3½-inch drive. Though applications software has not been formally announced, several popular MS-DOS programs (such as *1-2-3*) run on the system. List price: $3495. Intertec, 2300 Broad River Rd., Columbia, SC 29210, 803/798-9100.

ITT XTRA

In keeping with its corporate image, ITT has produced a very professional compatible. The XTRA is not functionally superior to the PC, but the machine is solidly built and backed by a company as ubiquitous as IBM. The system offers features similar to the PC's; supports a monochrome or a color display, a mouse, and *Microsoft Windows;* and according to company literature, "complements" ITT's Courier 3270 data terminals.

ITT claims that the XTRA is software and hardware compatible with the PC. ITT allowed a preproduction XTRA to be tested at their COMDEX booth until one program, GW BASIC, failed to load on the system. But *WordStar*, PC-DOS 1.10 and 2.00, *1-2-3*, and *Flight Simulator* were successfully run, indicating that the XTRA is likely to be very compatible with the PC. List price: $3500. ITT Courier Terminal Systems, Inc., 1515 W. 14th St., Tempe, AZ 85281, 602/894-7797.

Leading Edge PC

The Leading Edge PC is relatively software and hardware compatible with the IBM PC. Though the system ran DOS 1.10 and 2.00, *WordStar,* and *1-2-3* at COMDEX, it failed to run *Flight Simulator* and the IBM *Advanced Diagnostics* keyboard test. The graphics samples under GW BASIC also failed, possibly due to the lack of an installed graphics board.

The system's general design is adequate, though the IBM-style keyboard is light, flimsy, and difficult to use because of gaps between some of the keys. List price: $2895. Leading Edge Products Inc., 225 Turnpike St., Canton, MA 02021, 617/828-8150.

Logical LX-T

The LX-T is an XT compatible that functions as a business machine and a sophisticated applications tool. The standard LX-T comes with 192K of RAM, an IBM-style keyboard, a 10-megabyte hard disk drive (expandable to 60 megabytes), a 320K disk drive, and a 12-inch amber display. The system includes Logical's "natural" language, which allows programs to be developed and modified using simple English verbs and nouns. A word processor, a spreadsheet, and a print spooler are also available.

The LX-T resembles the PC XT but is not as solidly built. Though the LX-T tested was a prototype, the majority of the test software ran successfully, with the exceptions of *Flight Simulator, Keynote,* and *Xenocopy.* List price: $5985. Logical Business Machines, 1294 Hammerwood Ave., Sunnyvale, CA 94086, 408/744-1290.

MAD-1

The MAD-1 is the Yves St. Laurent of PC compatibles. Though it is not as compatible as a number of other machines, its "modular advanced design" is eye-catching and designed to reduce heat buildup and ease system expansion. The system uses Intel's 80186, a faster version of the 8086, and is aimed at the small-business user. The MAD-1 supports a 10-megabyte hard disk and an onboard 300/1200 bps modem and is compatible with the EtherLink and PCnet local area networks.

The MAD keyboard has soft but responsive action. However, key placement is somewhat whimsical: a <Ctrl>-<Alt>-<Del> is difficult to execute because the requisite keys are too far apart; the <NumLock> key is large and occupies the PC's <Enter> key position. the PC. The keyboard is light and probably too large to use comfortably in your lap.

The system would not boot PC-DOS 1.10 or 2.00, though it ran *WordStar* and *1-2-3* under MS-DOS and the DOS 2.00 samples under MS-BASIC. The company does not claim total software or hardware compatibility. IBM data disks can be read from and written to, and peripherals for the PC (with the exception of RAM expansion boards) can be used. A large number of applications programs, from *SuperCalc3* to *Crosstalk XVI,* are available for the MAD-1. List price: $4195. MAD, 3350 Scott Blvd. Building 13, Santa Clara, CA 95051, 408/980-0840.

Micro Craft Dimension

Micro Craft's personal computer features the MC68000L8 32-bit microprocessor, which can address a breathtaking 16.7 megabytes of RAM. The system is normally configured with 128K of RAM and is PC compatible through the addition of an 8086 processor on an expansion board. Besides reportedly performing "direct execution of substantially all [PC] software," the Dimension is compatible with Apple, TRS-80, Osborne, Kaypro, and other personal computers. Operating systems include MS-DOS, UNIX, the UCSD p-System, and CP/M-86. List price: $3995, MS-DOS emulator card $495. Micro Craft Corporation, 4747 Irving Blvd. #241, Dallas, TX 75247, 214/630-2562.

NEC PC-8801A

NEC's PC-8801A is an 8-bit CP/M machine that is MS-DOS compatible upon addition of an 8086 expansion board. High-resolution monochrome and color graphics are incorporated in the system, text and graphics overlay is possible, and more than 60 colors can be generated when using three screens. Voice synthesis and voice recognition boards are also available. Software packages included with the PC-8801A are *WordStar, MailMerge, Multiplan,* N80 and N88 BASIC, and CP/M. Custom versions of *dBASE II* and *Friday!* have also been created for the system. List price: $3092. NEC Home Electronics, Inc., Personal Computer Division, 1401 Estes Ave., Elk Grove Village, IL 60007, 312/228-5900.

An Informal Test

Determining a machine's PC compatibility usually involves more than testing software packages. A comprehensive test, in addition to running software (which works with the machine at an operating system and hardware level), should include a review of the compatible's hardware from expansion slots to disk drives. Do expansion boards for additional RAM (random access memory) and peripherals work properly? Is the system's microprocessor an Intel 8088 (or 8088 compatible) and does it operate at the PC's standard 4.7 MHz clock rate? (This is a particularly finicky measurement of compatibility, since little software is attuned to the PC's timing.) Are there significant differences in the BIOS (input/output) routines stored in the compatible's ROM (read-only memory) chips? Do the compatible's disk drives properly read and write IBM-formatted disks?

Testing a selection of software on a compatible can answer some of these questions. Any machine that claims full compatibility with the PC should run DOS and all PC applications software. The programs chosen for this compatibility test are all standard, off-the-shelf IBM PC software, with the exception of GW BASIC. The results of this test (as summarized in "Compatibility at a Glance") should provide an informal measure of a compatible's compatibility. The following programs were tested:

PC-DOS 1.10 and 2.00. These programs are not the acid test, but any computer claiming full compatibility should at least run PC-DOS 2.00. The ability to run 2.00 indicates that the ROM and the DOS itself are implemented on the compatible in a manner very similar to their implementation on the PC.

WordStar 3.30. Earlier versions of this word processing standard make calls to DOS for screen display and will run on every MS-DOS machine. *WordStar 3.30,* however, ignores DOS and writes directly to the screen. This test determines if the compatible's video display is mapped to the same memory addresses as the PC's.

Lotus 1-2-3, Version 1.0. Like *WordStar 3.30, 1-2-3* writes directly to the screen. But *1-2-3*'s method of copy protection also tests a compatible's disk controller. *1-2-3* expects a particular result to be returned after certain types of disk activity. If the compatible's disk controller is different than the PC's controller, it will return a different result to the program.

Flight Simulator. Microsoft's popular simulation program makes all of its own hardware calls and does not require an operating system. *Flight Simulator* expects speaker, display, and other circuitry to be located at specific memory addresses. The program also performs sophisticated manipulations of the video controller chip within the PC. If a compatible has improved upon the PC's graphics capabilities or uses a different video controller, chances are *Flight Simulator* will not run. This is a test of the compatible's internal architecture.

Olivetti PC
Olivetti's PC closely mirrors the IBM PC in design and features. The Olivetti uses the 8088 processor, an IBM-style keyboard, and 320K disk drives; it includes standard serial and parallel ports. The system can be configured with a 10-megabyte hard disk drive.

RAM disk software is standard with the Olivetti, along with MS-DOS, GW BASIC, *PC Tutor,* and *WordStar* and five other MicroPro packages. List price: $3295. Docutel-Olivetti Corporation, P.O. Box 222306, Dallas, TX 75222, 214/438-1818.

Olympia People
This MS-DOS compatible machine from Olympia is aimed primarily at business professionals with little computing experience. High-quality monochrome and color graphics are emphasized. The People's 12-inch display has its own 128K screen memory and supports character mode and bit-mapped graphics.

The People is solidly built and uses a non-IBM keyboard. Though the system is designed to be PC compatible, a prototype could not run *WordStar* under PC-DOS or Olympia's MS-DOS. List price: $3595. Olympia USA Inc., Box 22, Somerville, NJ 08876, 201/722-7000.

Advanced Diagnostics. This IBM program is designed to diagnose various hardware ills afflicting your PC. Among other things, *Advanced Diagnostics* checks the system board ROM, the system memory, the graphics mode, the monochrome mode (including the keyboard), and the color graphics board. Since this is a PC-specific program, every compatible failed at least one of the tests. The system board test always produced an error message because no compatible can exactly duplicate the PC ROM without violating IBM's copyrights. Almost all of the compatibles passed the memory test; the various graphics diagnostics indicated the similarity of character sets and video circuitry.

Keynote. The PC's BIOS ROM contains a number of I/O subroutines used by DOS and various software programs. Each subroutine has a particular entry point on the ROM defined by an "interrupt." When you turn your PC on, these entry point addresses (called interrupt vectors) are copied into a specific section of RAM. When you run DOS or a program, the computer finds the necessary subroutines in ROM by first looking at the appropriate interrupt vector.

A popular program that redefines standard keyboard values, *Keynote* changes the keyboard interrupt vectors. When you redefine a key, *Keynote* directs the computer not to the ROM subroutine for that key, but to an altered copy of that subroutine elsewhere in RAM. If you try to run *Keynote* on a compatible and a 'vector in use' or 'keyboard in use' message appears, the compatible's keyboard subroutines are either in a different location in its BIOS ROM or have interrupt vectors located in a different section of RAM. If *Keynote* does work, the compatible manufacturer was either very lucky or was careful to match the PC's ROM addresses.

GW BASIC 2.0. GW BASIC is Microsoft's disk equivalent of the PC's ROM and disk BASIC. The COMPAQ version of GW BASIC is very close to IBM BASIC and was used to run the *SAMPLES* program provided with DOS 2.00. Among the demonstrations run were a music program (sound), a mortgage program (8088 computation), and a pie chart generator (graphics). This test compares the compatible's hardware architecture with the very PC compatible COMPAQ.

Xenocopy. This is the acid test. *Xenocopy* copies differently formatted data (be it on Kaypro or Osborne disks) onto IBM-formatted disks. *Xenocopy* manipulates the BIOS ROM subroutines, but unlike *Keynote* directly accesses the ROM itself. *Xenocopy* expects disk subroutines to be at specific ROM addresses. Predictably, none of the compatibles, including the COMPAQ, could run *Xenocopy.* A few compatibles did manage to display several program menus, which indicates that some video subroutines were at the same address.

OSM-PC

This 8088-based compatible from OSM is aimed at the business looking for a less expensive alternative to the IBM PC. The OSM is capable of supporting up to 20 megabytes of hard disk storage and of working in the company's ZeusNet local area network with seven other OSM-PCs, IBM PCs, or other compatibles. On-site installation and service will be available from RCA.

The OSM is a solidly built unit that uses an IBM-style keyboard. The company claims the OSM is highly compatible with the IBM PC, though the prototype tested was unable to run PC-DOS 2.00, *Keynote*, or the *Advanced Diagnostics* program. The OSM-PC did display the first *Xenocopy* menu—something only system-level compatibles seem to be able to do. List price: $2995. OSM Computer Corporation, 655 Clyde Ave., Mountain View, CA 94043, 415/961-8680.

	List price	Processor	8087 socket	RAM (min.)	RAM (max.) on mother-board	RAM (max.) including expansion	Ports	PC expansion slots
IBM PC	$3245	8088	yes	64K	256K	640K	1 parallel	5
CAD Counsel Protean	$7300	8088	yes	256K	—	900K	1 parallel 2 serial	12
Canon AS-100	$3995	8088	no	128K	128K	512K	1 parallel 1 serial	0
Digigraphic EXTRA Model 70	$5995	8088	yes	256K	—	640K	1 parallel 3 serial	7
Electro Design IMP-12	$4044	8088	yes	64K	—	750K	1 parallel 1 serial	11
Future Computers FX-20	$2995	8088	yes	128K	128K	1M	3 serial	1
Intertec HeadStart 512	$3495	8086, Z-80A	no	512K	512K	1M	1 parallel 1 serial	0
ITT XTRA	$3500	8088	yes	128K	256K	640K	1 parallel 1 serial	5
Leading Edge PC	$2895	8088	yes	128K	—	640K	1 parallel 1 serial	7
Logical LX-T	$5985	8088	yes	192K	256K	1M	1 parallel 2 serial	5
MAD-1	$4195	80186	yes	128K	512K	704K	1 parallel 2 serial	1
Micro Craft Dimension	$3995	MC68000 L8, 8086, others	yes	128K	524K	16.7M	1 parallel 1 serial	0
NEC PC-8801A	$3092	8086, Z-80A	no	128K	—	128K	1 parallel 1 serial	0
Olivetti PC	$3295	8088	yes	128K	512K	512K	1 parallel 1 serial	4
Olympia People	$3595	8086	yes	128K	512K	512K	1 parallel 1 serial	4
OSM-PC	$2995	8088	no	128K	—	1M	1 parallel 1 serial	8
Polo	$3995	80188, Z-80A	no	128K	768K	—	2 serial	0
Pronto	$3200	80186	no	256K	1M	1M	1 parallel 2 serial	0
Radio Shack TRS-80 2000	$2999	80186	no	128K	256K	768K	1 parallel 1 serial	0
Seattle Computer Gazelle II	$6995	8086	yes	256K	1M	1M	1 parallel 2 serial	0
Sperry PC	$3119	8088	yes	128K	128K	640K	1 serial	7
Stearns Desktop	$2945	8086	yes	128K	—	896K	1 serial	1
Tava PC	$1995	8088	yes	128K	256K	640K	1 parallel 2 serial	5
Toshiba T-300	$2795	8088	yes	192K	256K	512K	1 parallel 1 serial	0
Victor 9000	$3495	8088	yes	128K	256K	896K	2 parallel 3 serial	0
Wyse WY-1000	$3090	80186	no	128K	768K	768K	1 parallel 4 serial	0

Table 1: Desktop compatibles

Disk drives			Hard disk supported	Power supply	Display				Keyboa	
size (in.)	storage[1]	dens./side[2]			type	resolution[3]	colors	format[4]	IBM layout	fully definable
5¼	360K	DD/DS	10M	63.5W	mono color	720 × 350 320 × 200	16	80 × 25	yes	yes
5¼	500K	DD/DS	21M	125W	color	640 × 200	16	80 × 25	yes	n/a
5¼	640K	DD/DS	10M	150W	mono color	640 × 400 640 × 400	8	80 × 25	no	no
5¼	360K	DD/DS	10, 20, 43, 60M	250W	n/a	n/a	n/a	n/a	yes	yes
5¼	500K	DD/DS	10–32M	125W	mono color	720 × 340 600 × 440	16	80 × 25	yes	no
5¼	800K	DD/DS	—	n/a	mono	640 × 260	—	80 × 24	no	no
3½	500K	DD/SS	10, 50M	n/a	mono	924 × 240	—	132 × 25	no	yes
5¼	360K	DD/DS	10M	128W	mono color	640 × 200 640 × 200	16	80 × 25	yes	yes
5¼	320K	DD/DS	5, 10, 15M	96.5W	mono color	640 × 240 640 × 400	16	80 × 25	yes	yes
5¼	320K	DD/DS	10–60M	165W	mono color	640 × 200 320 × 200	16	80 × 25	yes	yes
5¼	360K	DD/DS	10M	110W	mono color	720 × 350 640 × 200	16	80 × 25	no	yes
5¼	817K	DD/DS	10–50M	100W	mono color	640 × 500 160 × 500	16	92 × 50	yes	no
5¼	640K	DD/DS	5, 10, 15M	70W	mono color	640 × 400 640 × 400	8	80 × 25	no	no
5¼	320K	DD/DS	10M	110W	mono color	640 × 325 n/a	n/a	80 × 25	yes	no
5¼	655K	DD/DS	10M	133W	mono color	640 × 475 640 × 475	16	80 × 25	no	n/a
5¼	320K	DD/DS	10, 20M	125W	mono color	640 × 320 640 × 320	16	80 × 25	yes	yes
5¼	360K	DD/DS	10M	75W	color	640 × 200	16	80 × 25	no	yes
5¼	800K	DD/DS	5.6M	130W	mono color	720 × 350 640 × 480	8	80 × 25	yes	yes
5¼	720K	DD/DS	10M	120W	mono color	640 × 400 640 × 400	16	80 × 25	no	n/a
8	1.2M	DD/DS	15.7M	250W	n/a	n/a	n/a	80 × 24	n/a	n/a
5¼	360K	DD/DS	10M	96.5W	mono color	640 × 240 640 × 400	16	80 × 25	yes	yes
5¼	640K	DD/DS	5, 10, 20M	200W	mono	720 × 364	—	80 × 26	no	n/a
5¼	320K	DD/DS	10M	130W	mono	n/a	—	80 × 25	yes	yes
5¼	640K	DD/DS	10M	109W	mono color	640 × 500 640 × 500	16	80 × 25	no	yes
5¼	600K	DD/DS	10M	100W	mono color	800 × 400 n/a	4	132 × 50	no	yes
5¼	362K	DD/DS	10M	87W	mono color	800 × 327 800 × 286	16	132 × 26	no	no

[1]Per drive [2]Double-density; double-sided (DD/DS)
Double-density; single-sided (DD/SS)
[3]Maximum possible resolution
[4]Columns × lines

full IBM char. set	function keys	Operating system	Software included	Hardware included
yes	10	PC & MS-DOS 1.10/2.00/2.10, CP/M-86, CCP/M-86, UCSDp, others	ROM BASIC	disk controller, video controller
yes	10	MS-DOS 1.10/2.00/2.10, CP/M-86	*AutoCAD*	clock, color graphics board, digitizing tablet
no	12	MS-DOS 1.25, CP/M-86	MS-DOS 1.25, Canon BASIC, GW BASIC, *MailMerge, SpellStar, WordStar*	—
yes	10	MS-DOS 1.00/1.25/2.00/2.10, CP/M-86, UCSDp	MS-DOS 2.10	disk controller, monochrome adapter, SASI interface, hard disk drive
no	10	MS-DOS 1.10/2.00, CP/M-86	MS-DOS 2.00	clock, disk controller, color graphics board, 24-channel I/O board
n/a	20	MS-DOS 1.10/2.00, CP/M-86, CCP/M-86	CP/M-86, CCP/M-86, *Spellbinder, WordStar*	disk controller, network interface
no	18	MS-DOS 1.10/2.00/2.10, CP/M-80/86	MS-DOS 2.00, CP/M-80, LAN-DOS	disk controller
yes	10	MS-DOS 1.10/2.00/2.10, CP/M-86, UCSDp	MS-DOS 2.00, GW BASIC	disk controller
yes	10	MS-DOS 1.25/2.01, CP/M-86, CCP/M-86, UCSDp	MS-DOS 2.01, GW BASIC, *Leading Edge Word Processor, Multiplan*	clock, disk controller, video controller
yes	10	MS-DOS 2.00	MS-DOS 2.00, *L-BASE*	clock, 10M hard disk drive, video controller
yes	10	MS-DOS 2.00, CP/M-86, CCP/M-86	MS-DOS 2.00	clock, disk controller
no	10	MS-DOS 1.10/2.00, CP/M-80/86, MP/M-80, UCSDp, UNIX	CP/M-80/86, ROM BASIC, 86000 assembler	clock
no	5	MS-DOS 2.00, CP/M 2.2	CP/M 2.2, BASIC, *MailMerge, Multiplan, WordStar*	clock
yes	10	MS-DOS 1.25/2.00, CP/M-86, UCSDp	MS-DOS 2.00, GW BASIC, *PC Tutor, WordStar*, 5 MicroPro packages	—
yes	12	MS-DOS 1.10/2.00/2.10, CP/M-86, CCP/M-86	MS-DOS 2.10, CP/M-86, CBASIC	—
yes	10	MS-DOS 2.00	—	—
yes	12	MS-DOS 2.00/2.11, CP/M-80/86	MS-DOS 2.11, BASIC, *Multiplan, pfs:Write/ Graph/File/Report*, 2 others	color graphics board, modem, printer
yes	10	MS-DOS 2.00/2.11	MS-DOS 2.10, MS-BASIC, diagnostics applications	clock
yes	12	MS-DOS 1.10/2.00	MS-DOS 2.00, MS-BASIC, *Executec*	—
n/a	n/a	MS-DOS 1.25/2.00/2.10, CP/M-86, MP/M-86, UCSDp	MS-DOS 2.00, *Flash Disk, Flash Print*, utilities	disk controller
yes	10	MS-DOS 1.25/2.00, CP/M-86, UCSDp	MS-DOS 1.25, GW BASIC, diagnostics	clock
yes	10	MS-DOS 1.25/2.00, CP/M-86, CCP/M-86, MP/M-86, ST-DOS	MS-DOS 1.25	—
yes	10	MS-DOS 1.10/2.00, CP/M-86, UCSDp	—	—
yes	10	MS-DOS 1.10/2.00/2.10, CP/M-86	MS-DOS 2.10, TBASIC-16, *MultiMate, Multiplan*	—
no	10	MS-DOS 1.10/2.00/2.10, CP/M-86	MS-DOS 2.10, CP/M-86, BASIC	disk controller
no	16	MS-DOS 2.10	MS-DOS 2.10, *Graphics GSX*	—

	List price	Processor	8087 socket	RAM (min.)	RAM (max.) on mother-board	RAM (max.) including expansion	Ports	PC expansion slots	Disk d size (in.)	Disk d storage
IBM PC	$3245	8088	yes	64K	256K	640K	1 parallel	5	5¼	360K
ACT Apricot	$3190	8086, 8089	yes	256K	256K	768K	1 parallel 1 serial	0	3½	315K
Colby PC 3.2	$2795	8088	yes	128K	256K	640K	1 parallel 1 serial	4	5¼	360K
Columbia VP	$2995	8088	yes	128K	256K	512K	1 parallel 1 serial	1	5¼	320K
COMPAQ-Plus	$4995	8088	yes	128K	256K	640K	1 parallel	5	5¼	360K
Compucorp OmegaMite	$2995	80188, Z-80A	no	64K	—	512K	3 serial	0	5¼	320K
Corona Portable PC	$2545	8088	yes	128K	512K	1M	1 parallel 1 serial	4	5¼	320K
Eagle PC Spirit	$3295	8088	yes	128K	640K	1M	1 parallel 2 serial	4	5¼	360K
GRiD Tempest	$14,995	8086, 8087	yes	256K	256K	256K	1 serial	0	5¼	360K
Hyperion	$3195	8088	yes	256K	256K	640K	1 parallel 1 serial	0	5¼	328K
JONOS 2150i	$3695	8088	no	64K	128K	1M	1 parallel 2 serial	4	3½ 5¼	322K 1.2M
Otrona Attache 8:16	$3495	8086, Z-80A	yes	256K	256K	—	2 serial	0	5¼	320K
Panasonic Sr. Partner	$2495	8088	yes	128K	512K	512K	1 parallel 1 serial	1	5¼	320K
Seequa Chameleon	$1995	8088, Z-80A	yes	128K	256K	704K	1 parallel 2 serial	0	5¼	160K
Sharp PC-5000	$1995	8088	no	128K	256K	256K	1 serial	0	5¼	360K
STM Pied Piper	$3000	80186	no	256K	512K	—	1 parallel 2 serial	0	5¼	800K
Strategic Technologies PC Traveler	$4495	two 80186s	no	128K	256K	1M	1 parallel 1 serial	0	5¼	360K
TeleVideo TPC-II	$2995	8088	yes	128K	256K	640K	1 parallel 1 serial	1	5¼	360K
Texas Instruments Portable Professional	$2395	8088	yes	64K	768K	768K	1 parallel	5	5¼	360K
Visual Commuter	$1995	8088	yes	128K	512K	1M	1 parallel 1 serial	0	5¼	360K
Xerox 1810/1850	$2495	8088, Z-80, NSC-800	no	128K	512K	512K	1 parallel 1 serial	0	5¼	250K

Table 2: Portable and briefcase compatibles

[1]Per drive

ives:		Hard disk	Power	Display				Keyboard				
	dens./side[2]	supported	supply	type	resolution[3]	colors	format[4]	IBM layout	fully definable	full IBM char. set	function keys	Weight (lbs.)
	DD/DS	10M	63.5W	mono color	720 × 350 320 × 200	16	80 × 25	yes	yes	yes	10	—
	DD/DS	10M	n/a	mono	800 × 400	—	132 × 50	no	yes	yes	14	14.2
	DD/DS	10M	65W	mono color	640 × 200 640 × 200	16	80 × 24	yes	yes	yes	10	25.5
	DD/DS	—	100W	mono color	640 × 200 320 × 200	n/a	80 × 25	yes	no	yes	10	32
	DD/DS	10M	120W	mono color	640 × 200 320 × 200	8	80 × 25	yes	yes	yes	10	26
	DD/DS	—	n/a	mono	800 × 305	—	80 × 25	yes	yes	yes	22	25
	DD/DS	10M	110W	mono color	640 × 325 640 × 200	16	80 × 25	yes	yes	yes	10	28
	DD/DS	10M	n/a	mono color	720 × 352 320 × 200	16	80 × 25	yes	yes	yes	10	33
	DD/DS	10M	60W	mono	320 × 240	—	80 × 24	no	no	first 96	20	13.5
	DD/DS	10, 20M	90W	mono	640 × 250	—	80 × 25	no	no	yes	10	18
	DD/DS DD/DS	5, 10, 15M	50W	mono color	640 × 240 640 × 240	8	80 × 25	no	yes	yes	10	36
	DD/DS	10M	120W	mono	640 × 250	—	80 × 25	no	no	no	0	20
	DD/DS	5, 10, 15M	100W	mono color	640 × 200 320 × 200	8	132 × 25	yes	yes	yes	10	28.7
	DD/SS	10M	80W	mono color	640 × 200 320 × 200	16	80 × 25	yes	yes	yes	10	28
	DD/DS	—	—	LCD	640 × 80	—	80 × 8	no	no	yes	8	9.5
	DD/DS	1, 2M	n/a	mono color	640 × 400 320 × 200	16	132 × 25	no	yes	yes	10	17
	DD/DS	10M	200W	plasma	512 × 256	—	80 × 25	yes	yes	n/a	10	26
	DD/DS	10M	70W	mono color	640 × 200 320 × 200	16	80 × 25	no	yes	yes	10	30
	DD/DS	5, 10M	250W	mono color	720 × 300 720 × 300	8	80 × 25	no	yes	first 96	12	32
	DD/DS	10M	40W	mono color	640 × 200 320 × 200	16	80 × 25	yes	yes	yes	10	16
	DD/DS	5, 10, 15M	85W	mono color	640 × 200 640 × 200	16	80 × 24	no	no	first 96	10	5.15

[2]Double-density; double-sided (DD/DS)
Double-density; single-sided (DD/SS)

[3]Maximum possible resolution

[4]Columns × lines

Dimensions (in.)	Monitor size (in.)	Battery pack	Operating system	Software included	Hardware included
—	—	—	PC & MS-DOS 1.10/2.00/2.10, CP/M-86, CCP/M-86, UCSDp, others	ROM BASIC	disk controller, video controller
17×4×13 11×9×10	9	no	MS-DOS 2.00, CP/M-86, CCP/M-86, UCSDp	MS-DOS 2.00, CCP/M-86, BASIC, *SuperCalc 3*, *SuperPlanner 3*, communications	—
15×17×9	9	yes	MS-DOS 1.10, CP/M-86, UCSDp 2.0/2.1	—	disk controller, video controller
18×16×8	9	no	MS-DOS 1.25, CP/M-80/86, CCP/M-86, MP/M-86	MS-DOS, CP/M-86, BASIC, macro assembler, 10 applications	—
19×15×8	9	no	MS-DOS 1.10/2.00/2.10, CP/M-86, UCSDp	MS-DOS 2.10, GW BASIC	10M hard disk
21×19×8	9	no	MS-DOS 2.00, CP/M-86, Omega DOS	Omega DOS	—
20×19×10	9	no	MS-DOS 1.10/1.25, CP/M-86, UCSDp	MS-DOS 1.25, GW BASIC, *MultiMate*, *PC Tutor*, 7 utilities	disk controller
19×16×8	9	no	MS-DOS 1.10/2.00/2.10, CP/M-86, CCP/M-86, UCSDp	MS-DOS 2.10, CCP/M-86, BASIC	—
15×12×2	6	yes	MS-DOS 2.00, GRiD OS	MS-DOS 2.00, GRiD OS	clock
18×11×9	7	no	MS-DOS 1.10/2.00, CP/M-86	MS-DOS 2.00, MBASIC, Aladdin DBMS	clock, color graphics board, modem board
17×13×7	9	no	MS-DOS 1.10/2.00/2.10/3.00	MS-DOS 2.00, *Multiplan*, *Spellbinder*	clock, disk controller
17×12×6	5½	yes	MS-DOS 2.10, CP/M-86	MS-DOS 2.10, CP/M-86, *Charton II*, *Valet*	clock, disk controller
18×13×8	9	no	MS-DOS 1.10/2.00/2.10	MS-DOS 2.00, GW BASIC, *WordStar*, 4 applications	thermal printer, RGB adapter
18×16×8	9	yes	MS-DOS 1.25/2.00, CP/M 2.1/2.2, CP/M-86, CCP/M-86, UCSDp	MS-DOS 1.25, MBASIC-86, *Perfect Calc*, *Perfect Writer*, 3 applications	color graphics
13×12×4	—	yes	MS-DOS 1.10/2.00	MS-DOS 2.00, GW BASIC, *SuperComm*, *SuperWriter*	—
20×11×4	—	yes	MS-DOS 1.10/2.00/2.10, UCSDp	To be announced	modem, printer
20×17×8	9½	no	MS-DOS 2.00	MS-DOS 2.00, GW BASIC	printer
18×15×8	9	no	CP/M-86, TeleDOS 2.11, UCSDp	TeleDOS 2.11, TeleBASIC	—
19×16×5	9	no	MS-DOS 1.10/2.00/2.10, CP/M-86, CCP/M-86, UCSDp	—	—
18×15×3	—	no	MS-DOS 1.10/2.00/2.10, CP/M-86, CCP/M-86, UCSDp	MS-DOS 2.10, GW BASIC	disk controller
16×9×2 18×12×3	—	yes	MS-DOS 2.00/2.10, CP/M-80/86	—	modem, disk controller

Review

Polo

Though the Polo is an MS-DOS compatible and cannot run most PC software, it is, in the words of one engineer, "a sexy machine." Designed as an integrated personal computer work station, the Polo comes outfitted with almost everything needed to start computing. The system includes a non-IBM keyboard (with built-in game and mouse ports); a 120-cps printer; a 12-inch, 16-color monitor; and a solidly built CPU unit that houses 80188 and Z-80A microprocessors and a Bell 103 modem. BASIC and five unannounced office software packages will be available with the system. List price: $3995. Polo Microsystems, Inc., 2570 El Camino Real W, Mountain View, CA 94040, 415/948-2990.

Pronto

Pronto Computers offers 15 versions of its basic 80186, MS-DOS Series-16 compatible. The standard unit comes with 128K of RAM (expandable to 1 megabyte), standard ports, a real-time clock, and an 800K disk drive. Different desktop and portable models support a second floppy disk drive, hard disk drives, system security ROM, a programmable character set, and high-resolution monochrome and color graphics.

Though this stylish compatible is said to run "virtually all popular applications software," when tested it was unable to run any of the test software except *1-2-3* (to the second menu) and GW BASIC—both under Pronto's MS-DOS 2.11. List price: $3200. Pronto Computers, Inc., 3730 Skypark Dr., Torrance, CA 90505, 213/539-6400.

Radio Shack TRS-80 2000

Radio Shack states that its TRS-80 2000 is strictly MS-DOS compatible and advertises this fact in its literature. The machine is better crafted than most Radio Shack products and supports high-resolution, bit-mapped monochrome and color graphics; a 10-megabyte hard disk drive; a mouse; and the *Microsoft Windows* operating environment.

The TRS-80 2000 uses an 80186 microprocessor and can read, but not write, PC data disks. However, the 2000 can write to PC data disks that have been copied over to the 2000's DOS format. Radio Shack also provides a list of popular PC programs that will and will not run under their MS-DOS. In the former category, some programs (such as Open Systems' accounting software) must be copied over to the TRS-80 2000 format, while others require that BASIC.EXE be copied to the system's disk. Some programs that will not run on the TRS-80 2000 include *Smartcom* and *Crosstalk* (communications); *EasyWriter* and *WordStar* (word processing); *1-2-3*, *Graph*, *CalcStar*, and *VisiCalc* (spreadsheets); and the majority of VisiCorp software. List price: $2999. Tandy Corporation/Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102, 817/390-3731.

Seattle Computer Gazelle II

This 8086 system is primarily designed for software development, engineering, scientific, and business applications. The Gazelle is housed in a single cabinet and includes 256K of RAM (expandable to 1 megabyte); two double-sided, double-density, 8-inch disk drives; and room for a 15.7-megabyte hard disk drive. The system uses an 18-slot S-100 board that precludes the use of IBM expansion boards. Software provided with the system includes MS-DOS, *Flash Disk* (a RAM disk), and *Flash Print* (a print-buffering utility). The system can use *WordStar*, *Multiplan*, MS-BASIC, several other standard languages, and XENIX. List price: $6995. Seattle Computer Products, Inc., 1114 Industry Dr., Seattle, WA 98188, 206/575-1830.

Sperry PC

Sperry has been in the computer business even longer than IBM. The Sperry slogan is "We understand how important it is to listen," and after two years of constantly hearing talk about the IBM PC, Sperry decided to get into the market. Sperry's personal computer is a solidly built IBM lookalike that offers nearly identical performance for a few dollars less. The machine emulates the Sperry UNISCOPE and the IBM 3270 terminals upon the addition of appropriate interface cards. XT compatible machines are also offered.

The Sperry PC features an IBM-style keyboard and a pedestal-mounted 12-inch monochrome display. The system ran most of the test software and went several menus further in *Xenocopy* than any other compatible tested. List price: $3119. Sperry Corporation, P.O. Box 500, Blue Bell, PA 19424, 215/542-4459.

Stearns Desktop

The Stearns Desktop is a software compatible machine that functions as a multitasking, stand-alone computer or a work station in the ICS local area network. The system supports the IBM 3270 protocol; an 8087 coprocessor; 5-, 10-, or 20-megabyte hard disk drives; and full-page screen display.

PC-DOS 1.10 and 2.00, *WordStar*, GW BASIC, and *1-2-3* ran easily on the Stearns; hardware-specific programs such as *Flight Simulator* did not. The Stearns has one PC compatible expansion slot and ST-DOS, an 8086 PC-DOS emulator. List price: $2945. Stearns Computer Systems, 10901 Bren Rd. E, Minneapolis, MN 55440, 612/936-2000.

Tava PC

The Tava PC strongly resembles the IBM PC in looks and operation. The system has power-on diagnostics and mirrors the PC in keyboard design and character set. The Tava's standard equipment includes 128K of RAM (expandable to 640K) and dual 320K disk drives. The system runs MS-DOS 1.10, 2.00, and 2.10 and includes a USI board that supports monochrome and color displays.

The system ran all the test software except *Xenocopy*. Rebooting in the middle of a program is easy and quick. The Tava's IBM-style keyboard has a soft action and may be frustrating for fast typists. List price: $1995. Tava Corporation, 1711 Corinthian Way #1011, Newport Beach, CA 92660, 714/261-0200.

Toshiba T-300

Toshiba's T-300 is a solidly built, nicely styled MS-DOS compatible. The unit comes with 192K of RAM, two 640K disk drives, a 12-inch monochrome monitor, and several software packages. High-resolution, 16-color graphics are supported by the system.

The T-300 keyboard is 20 inches wide and was designed with word processing and spreadsheet programs in mind. It features separate cursor keys and a 16-key numeric keypad. The keyboard is probably too large for lap computing. The T-300's layout is different from the PC's, and a <Ctrl>-<Alt>-<Del> is not easily accomplished. List price: $2795. Toshiba America, Inc., 2441 Michelle Dr., Tustin, CA 92680, 714/730-5000.

Victor 9000

Victor's entry in the compatibles sweepstakes is a modified version of the Victor 9000 business computer. For $995, their three-board PlusPC conversion kit will supposedly enable most PC disks to run directly in the Victor 9000. Company literature notes that the PlusPC lets you take advantage of the Victor's higher storage capacity (600K per single-sided disk and 1.2 megabytes per double-sided disk), thus reducing the total number of program and data disks.

The literature doesn't note, however, that the Victor 9000 may have difficulty converting some PC disks to Victor's disk format. The prototype tested could run only *WordStar* and could only boot *1-2-3*—both under Victor's MS-DOS. The Victor 9000 is a sophisticated machine that offers high-resolution graphics, a 2000-symbol character set, greater disk storage and internal memory than the IBM PC, integrated communications ports, and emulation of IBM mainframe terminals. Questions of compatibility may be resolved when the PlusPC is finally released. List price: $3495. Victor Technologies, Inc., 380 El Pueblo Rd., Scotts Valley, CA 95066, 408/438-7000.

Wyse WY-1000

The Wyse WY-1000 is a slickly styled MS-DOS compatible desktop computer designed to occupy a minimum amount of desk space. The system uses the 80186 microprocessor and produces high-resolution, bit-mapped graphics on its standard pedestal-mounted 14-inch screen. A 10-megabyte hard disk can replace one disk drive. List price: $3090. Wyse Technology, 3040 N. First St., San Jose, CA 95134, 408/946-3075.

Portable and Briefcase Compatibles

ACT Apricot

ACT calls the Apricot a "fourth generation" personal computer, one that combines state-of-the-art technology with ease of use. Though ACT does not claim PC compatibility for the Apricot, most PC data files can be downloaded to the system with the aid of a special port and communications software.

The Apricot is compact and impressively crafted. It features an 8086 microprocessor and an 8089 (for I/O processing), space for the 8087, 3½-inch floppy disk drives, an on-board modem, and very high resolution monochrome graphics. One plus is the system's "intelligent" keyboard, which can process data and display it on a built-in, two-line, 40-character LCD. Data can later be sent to the computer, or the computer can download text to the keyboard—enabling the Apricot to be used without a monitor. The intelligent keyboard also enables the user to display function key values on the LCD instead of the main display. The Apricot uses BASIC, Pascal, C, FORTRAN, and COBOL; versions of popular PC software are available for the system. List price: $3190. ACT Ltd., 3375 Scott Blvd. #336, Santa Clara, CA 95051, 408/727-8639.

Colby PC 3.2

Colby Computer offers something no other compatible maker can: an IBM PC. The Colby PC is basically a shell designed to hold the IBM's motherboard, expansion boards, disk drives, and keyboard. The result is a 26-pound, 15- by 17- by 9-inch IBM portable computer. The company provides a high-resolution 9-inch monochrome monitor, the power supply, a durable magnesium case, and all internal wiring.

Colby options that replace IBM hardware include a smaller, rugged, IBM-style keyboard that attaches to the front of the unit; a 128K motherboard; a disk drive controller and a half-height disk drive; and a battery pack.

A Colby PC using IBM parts should be 100 percent compatible; the unit tested was a Colby PC 3.2 built around the company's motherboard. Most of the tested software ran, except for *Flight Simulator* and the GW BASIC graphics samples, which require a graphics board that was not installed in the unit. The Colby system managed to display several *Xenocopy* menus. List price: Colby PC $899, Colby PC 3.2 $2495. Colby Research Industries, Inc., 849 Independence Ave., Mountain View, CA 94043, 415/968-1410.

Columbia VP

Columbia Data Products offers three PC compatible machines: a portable and two desktops that copy the PC and XT in features and design. The new VP portable, like the older models in the line, is hardware and software compatible with the PC. The VP features an 8088, 128K RAM, two 320K disk drives, high-resolution monochrome graphics (color is not available), and a 9-inch monitor.

The VP, which is identical with the other Columbia compatibles, easily ran all the test software except *Xenocopy*. Columbia's catalog of PC software runs to 500 titles; every Columbia compatible comes with 15 software packages, including the entire Perfect Software family, MS-DOS, CP/M-86, MS-BASIC, *Macro/86 Assembler, Home Accountant Plus, MPC Tutor,* and RAM disk software. List price: $2995. Columbia Data Products, 9150 Rumsey Rd., Columbia, MD 21045, 301/992-3400.

COMPAQ-Plus

When the COMPAQ first arrived in 1982 it set an industry standard for PC compatible machines that has rarely been matched. Another standard has likely been set with the release of the COMPAQ-Plus, a 10-megabyte hard disk version of the machine. Though a number of com-

Compatibility at a Glance

Compatibility is a relative term. There are only a few machines that use almost all of the PC's software and expansion boards. As you move from one level of compatibility to the next, a compatible generally resembles the PC less and less in terms of its CPU, keyboard, graphics generation, and the expansion hardware it will accept. All compatibles, however, should be able to read and/or write to PC data disks. The machines reviewed fall into one of four categories:

99$^{44}/_{100}$% System Compatible

The compatible is nearly identical to the PC in all respects. The machine will run almost all PC-specific software, use the 8088 microprocessor, and accept most PC expansion boards. The compatibles at this level are:

- Colby PC
- Columbia VP
- COMPAQ-Plus
- Electro Design IMP-12
- Sperry PC
- Tava PC
- TeleVideo TPC-II
- Visual Commuter

66% System Compatible

The machine is very compatible at the software level, but may have difficulty accepting some PC expansion boards. The compatible should run most off-the-shelf PC software, use the 8088 or 8086 microprocessor, and duplicate the PC's video mapping. The compatibles at this level are:

- Corona Portable PC
- ITT XTRA
- Leading Edge PC
- Logical LX-T
- OSM-PC
- Seequa Chameleon

33% System Compatible

The machine is relatively compatible and uses some PC software but few if any expansion boards. The system may have difficulty running programs such as *Flight Simulator* that make extensive calls to its BIOS ROM. The compatible may use the 8086 or 80186 microprocessor and feature a non-IBM-style keyboard. The compatibles at this level are:

Hyperion
MAD-1
Stearns Desktop

MS-DOS Compatible

The compatible runs only a few PC programs under its own version of MS-DOS or uses MS-DOS versions of popular PC-software. The unit will read a PC-formatted disk but may have difficulty writing to it. The system's microprocessor is the 8086 or 80186; the keyboard is not necessarily similar in layout to the PC's. The compatibles at this level are:

Canon AS-100
Intertec HeadStart 512
Olympia People
Otrona Attache 8:16
Polo
Pronto
Texas Instruments Portable Professional
Toshiba T-300
Victor 9000

The compatibles not available for testing were:

ACT Apricot
CAD Counsel Protean
Compucorp OmegaMite
Digigraphic EXTRA Model 70
Eagle PC Spirit, PC Plus
Future Computers FX-20
GRiD Tempest
JONOS 2150i
Micro Craft Dimension
NEC PC-8801A
Olivetti PC
Panasonic Sr. Partner
Radio Shack TRS-80 2000
Seattle Computer Gazelle II
Sharp PC-5000
STM Pied Piper
Strategic Technologies PC Traveler
Wyse WY-1000
Xerox 1810/1850

Keep in mind that there are ranges of compatibility within the above categories. Some manufacturers claim that their machines are 100 percent compatible with the IBM PC—which is unlikely, if only because of copyright laws. One company that proudly announced 100 percent compatibility revised its opinion after its machine failed to run Vertex's *Xenocopy*.

Not every compatible mentioned here has been tested (see "An Informal Test"). Some machines tested required 3½-inch disks; other machines were prototypes for display only. Some companies (perhaps for reasons relating to truth in advertising) exhibited their compatibles on a "look but don't touch" basis. In considering the production models and prototypes that were tested, keep in mind that changes affecting compatibility can be made literally days before a machine's official release.

If compatibility is important but you don't want to buy a PC, test the compatible in question with the most demanding and PC-specific software and peripherals available. Remember, though, a compatible may not run some programs at first because of memory limitations. *1-2-3* and DOS 2.00 combined exceed the 128K configuration of many systems. If compatibility is not your major concern, make sure the computer in question runs the software you use (at least under MS-DOS) and reads data from PC disks.

patibles are sporting hard disk drives, COMPAQ has taken special care in shock mounting the 3½-inch drive installed in the Plus. (See "COMPAQ Gets a 10," *PCW*, Vol. 2, No. 2.)

Aside from the hard disk drive (which replaces one floppy in the machine), the COMPAQ and the COMPAQ-Plus are nearly hardware identical. (It's interesting to note, though, that the COMPAQ-Plus is two pounds lighter.) Upgrading a COMPAQ to a COMPAQ-Plus requires the hard disk drive and its controller board and several ROM chips. The only test software the COMPAQ-Plus did not run was *Xenocopy*. List price: COMPAQ-Plus $4995, upgrade kit $2500. COMPAQ Computer Corporation, 12330 Perry Rd., Houston, TX 77070, 713/890-7390.

COMPAQ has taken special care in shock mounting the 3½-inch drive installed in the Plus.

Compucorp OmegaMite

OmegaMite is dubbed by Compucorp as the "first true portable office" because it not only functions as a desktop OmegaNet work station but is small and light enough to take on a business trip. The system is configured at 64K RAM and is equipped with a 9-inch monochrome monitor, a choice of keyboards (including a PC compatible one), and one 320K disk drive. Options include a 300 bps modem and an extra disk drive.

Originally designed as an 8-bit, Z-80A-based system, the OmegaMite is outfitted with an 80188 for PC compatibility. The company claims the machine is keyboard, display, and MS-DOS compatible. List price: $2995. Compucorp, 2211 Michigan Ave., Santa Monica, CA 90404, 213/829-7453.

Corona Portable PC

Corona was one of the first companies to produce a PC compatible, and in keeping with market trends, it has introduced a portable that is internally identical to Corona's other computers. The Corona portable comes with 320K floppy drives, a 9-inch monochrome display, four PC expansion slots, and several software packages.

Notable is the Corona's 640- by 325-pixel resolution; the character matrix is 16 by 13 (versus the PC's 7 by 5), and the display is accordingly sharp. The IBM-style keyboard is very light to the touch; this may be a plus or a minus depending on your typing style. The Corona is relatively software and hardware compatible with the PC and ran most of the test software, except *Flight Simulator*, the GW BASIC sample graphics, *Keynote*, and *Xenocopy*. The unit tested was not equipped with a color graphics board, which may account for its failure to run the first two programs. List price: $2545. Corona Data Systems, 31324 Via Colinas #110, Westlake Village, CA 91361, 213/707-0672.

GRiD Tempest

GRiD Systems is mostly known for its high-tech, high-priced GRiD Compass briefcase computer. The GRiD Tempest is similarly sleek, powerful, and expensive. Outfitted with both an 8086 and an 8087, the Tempest comes with 256K of RAM, 384K of bubble memory, a 300/1200 bps modem, a clock, and a bit-mapped, electroluminescent display—all in a 13½-pound box not much larger than a binder.

The Tempest includes a complete set of GRiD's integrated management and communications software. These programs are available on disk or they can be downloaded from GRiD's central mainframe or any number of "servers" throughout the United States. The system can drive a 10-megabyte hard disk drive, a letter quality or dot matrix printer, and a pen plotter. MS-DOS applications available for the Tempest include *WordStar, Multiplan, dBASE II, Condor DBMS*, and *1-2-3*. List price: $14,995. GRiD Systems Corporation, 2535 Garcia Ave., Mountain View, CA 94043, 800/222-4743.

Hyperion

The Hyperion is a small, sturdily built compatible that has been on the market (in one form or another) for well over a year. The company's claim that "IBM invented the wheel, so we refined it" falls a little flat. While the Hyperion is very easy to cart around, it is not as compatible as the company claims.

The Hyperion has a number of useful features: a RAM disk, an IBM-style keyboard, a high-resolution monochrome display that is timed to turn off to protect the video components, and a built-in 300 bps modem. The system can drive a 10- or 20-megabyte disk and run a streaming tape drive. An expansion chassis with seven PC compatible slots is also available.

The Hyperion has difficulty running most standard PC software—at least under PC-DOS. Company literature claims that the Hyperion, from its "MS-DOS operating system to its internal electronic architecture," is PC compatible. Elsewhere the literature says that the ma-

chine can read and write to PC disks. But most of the software tested on the Hyperion did not run. PC-DOS 1.10 and 2.00 did, and *WordStar* got as far as the first menu, but the system would not read a data disk in drive B. GW BASIC samples ran, but other programs would not even boot. Attempting to run the programs under Hyperion's MS-DOS did not yield better results. List price: $3195. Bytec-Comterm, Inc., 8 Colonnade Rd., Ottawa, Ontario, K2E 7M6 Canada, 613/226-7255.

JONOS 2150i

Encased in a rugged steel shell and weighing about 31 pounds, the JONOS 2150i is the B-17 of portable computers. JONOS computers have been used on Coast Guard ships, at construction sites, in machine shops, and in other unfriendly environments. Designed for professionals in industry and the military, the JONOS offers everything from 3½-inch disk drives to streaming tape drives.

The standard 2150i comes with an 8088; a choice of two 322K 3½-inch drives, two 640K 5¼-inch drives, or two 1.2-megabyte 5¼-inch drives; a 9-inch monitor; a clock/calendar; serial and parallel ports; and a solid, Selectric-style keyboard. The 2500i upgrade includes a fixed 5-megabyte hard disk drive and a removable 5-megabyte hard disk drive. JONOS claims the 2150i and 2500i are media and software compatible with the PC. List price: $3695. JONOS International Inc., 1835 Dawns Way, Fullerton, CA 92631, 714/999-6661.

> JONOS computers have been used on Coast Guard ships, at construction sites, in machine shops, and in other unfriendly environments.

Otrona Attache 8:16

As the name implies, Otrona's new portable is a dual-processor unit. With a Z-80A and an 8086 in the unit, the 8:16 (an upgrade of the company's standard Attache) is capable of running both CP/M 2.2 and PC software. The 8:16 includes 320K dual disk drives, a 5½-inch monitor for high-resolution graphics, *Charton II* (graphics), *Valet* (a time management system), CP/M, and MS-DOS; options include an 8087 and a 10-megabyte hard disk drive.

The 8:16 is extremely rugged and has a detachable Selectric-style keyboard with a snappy response. Dedicated function and <Alt> keys are not included, but their equivalents can be produced with several keystrokes. A 10-key numeric keypad can also be added to the keyboard. Otrona claims the 8:16 will run only PC software that makes standard DOS calls. True to the company's word, the system ran *WordStar* and *1-2-3* under MS-DOS. Of special note is that many CP/M and MS-DOS data files can be swapped between the two operating systems on the 8:16. List price: $3495, *WordStar* and *Multiplan* together $500. Otrona Advanced Systems Corp., 4725 Walnut St., Boulder, CO 80301, 303/444-8100.

Panasonic Sr. Partner

Panasonic, one of the biggest names in home electronics, has entered the compatibles market with a machine aimed at corporations, computer professionals, and small businesses. The Sr. Partner is about the size and weight of a COMPAQ and features a built-in thermal graphics printer that is versatile enough to print out text, spreadsheets, or bar charts. Both monochrome and color graphics are supported and, according to Panasonic, the machine is hardware and software compatible with the PC.

Beyond this, the Sr. Partner is a competent and well-built machine that stays close to the PC's specifications. Software packages included with the Sr. Partner are *WordStar, VisiCalc, pfs:File, pfs:Graph, pfs:Report,* and GW BASIC. A one-year warranty comes with each machine, and company literature wryly notes that, unlike some "blazing stars of the computer world," Panasonic is one company that is here to stay. List price: $2495. Panasonic, One Panasonic Way, Secaucus, NJ 07094, 201/348-7182.

Seequa Chameleon

The Chameleon is another dual-processor portable that uses the 8088 and the Z-80A, and it offers features similar to those of the PC. A typical system is configured at 128K and includes two 160K drives, a 9-inch monochrome monitor, and standard serial and parallel ports. Options include the 8087, an external 10-megabyte hard disk drive, and a battery pack. An XT compatible is also available.

The Chameleon's construction is not particularly solid, the IBM-style keyboard is mushy, and the disk drives are sluggish. The monochrome display is crude and marred by random pixels and lines. Company litera-

ture claims the Chameleon is hardware and software compatible with the PC. The system ran all the test software with the exceptions of *Keynote* and *Xenocopy*. A one-year warranty is available for $245, and a PC compatible expansion chassis with eight slots will be released in late 1984. List price: $1995. Seequa Computer Corporation, 8305 Telegraph Rd., Odenton, MD 21113, 301/672-3600.

Sharp PC-5000

Sharp's briefcase-size PC-5000 is not a typical compatible. It offers an 8-line LCD display, 192K of ROM (of which 64K is removable), 128K of RAM, and 128K of bubble memory. This system is designed for the traveling businessperson, as is evidenced by the availability of an optional printer (that slots in behind the keyboard), a battery pack, and a sophisticated, hand-held, direct-connect modem.

PC Traveler's program execution is nearly ten times faster than the PC's.

The PC-5000 uses the 8088 and MS-DOS; PC data disks can be used by the machine, and versions of popular PC software are available on disk or bubble cartridge. List price: $1995. Sharp Electronics Corporation, 10 Sharp Plaza, Paramus, NJ 07652, 201/265-5600.

STM Pied Piper

STM's Pied Piper is aimed at the mobile professional who needs computing power and telecommunications. Featuring two 800K disk drives and 256K of RAM, the STM also includes a 16-line LCD display, a 40-column thermal printer, a 1200 bps modem, MS-DOS 2.00, and five software packages. The system supports PC compatible color and high-resolution monochrome graphics.

The Pied Piper is almost too light; the keyboard is flimsy and keys are irregularly spaced. The Pied Piper is billed as "fully IBM PC compatible" and "98 percent compatible," but the company would not allow their demonstration model to be tested. List price: $3000. STM Electronics, 530 Middlefield Rd. #250, Menlo Park, CA 94025, 415/326-6226.

Strategic Technologies PC Traveler

Another powerful briefcase computer is the PC Traveler from Strategic Technologies. The machine uses two 80186 microprocessors, and program execution is nearly ten times faster than the PC's. The Traveler is MS-DOS compatible and can read and write PC data disks. Standard configuration is 128K (expandable to 1 megabyte), a 6.2 megabyte removable cartridge drive or two 360K floppy disk drives, a built-in printer, and a 9-inch plasma display.

Options include a 300/1200 bps internal modem and a terminal emulation board. List price: $4495. Strategic Technologies, Inc., 7001 Peachtree Industrial Blvd. Building 3, Norcross, GA 30071, 404/441-8070.

TeleVideo TPC-II

The TPC-II portable is a hardware and software compatible from TeleVideo, a company better known for its terminals and, more recently, its Z-80 CP/M computers. Though it may not be as exciting as some of the machines discussed, the TPC-II is pleasantly styled and display resolution is superior.

The system is also very compatible—it ran most of the test software. A *1-2-3* spreadsheet would not load, which may have been due to insufficient memory in the machine or differences between the disk controller TeleVideo uses and that of the PC. TeleVideo's list of PC software that runs on the TPC-II omits *1-2-3* but includes PC-DOS 1.10, which would not boot on the machine tested. TeleVideo also produces two desktop compatibles (the TS-1605 and the 10-megabyte TS-1605H) that are hardware compatible with the TPC-II. List price: TPC-II $2995, TS-1605 $2995, TS-1605H $4995. TeleVideo Systems, Inc., 1170 Morse Ave., Sunnyvale, CA 94086, 408/745-7760.

Texas Instruments Portable Professional

Texas Instruments' Portable Professional is an MS-DOS compatible that is fully compatible with the company's desktop Professional Computer. Like the TI desktop, the Portable is well crafted and offers superior color graphics. The system expands to 768K RAM and supports TI's voice recognition technology, the EtherSeries (3Com) local area network, and a 10-megabyte hard disk drive.

The Portable will run PC software under MS-DOS 2.00 that is not hardware dependent; when tested, the system booted PC-DOS 2.00, ran GW BASIC, and later ran *WordStar* under MS-DOS. A full range of popular software from *1-2-3* and *dBASE II* to *SuperCalc* and *Peachtext 5000* is available in TI Professional format. List price: $2395. Texas Instruments Inc., P.O. Box 402430, H-689, Dallas, TX 75240, 800/527-3500.

Visual Commuter

The Commuter is a briefcase-size machine that is light (16 pounds), durable, and very PC compatible. Monochrome and color monitors and TVs can be used for display. The Commuter also has a built-in, 16-line LCD display. It comes with 128K of RAM, one 360K disk drive, and a dual disk controller, and supports bit-mapped and color graphics.

The IBM-style keyboard is somewhat mushy, but the prototype tested had little difficulty in using any of the test software, with the exception of *Xenocopy*. Some programs (notably *WordStar* and *1-2-3*) lost a small part of the lowest displayed line on a standard monitor. This may indicate that the Commuter uses a slightly different character matrix than the PC. List price: $1995. Visual Computer Inc., 135 Maple St., Marlboro, MA 01752, 617/480-0000.

Xerox 1810/1850

The Xerox 1810/1850 is actually two computers using three microprocessors. The 1810 is a briefcase-size portable that uses an 8-bit microprocessor, microcassette storage, LCD display, and software in ROM cartridges. The 1850 is a "base station" unit that contains both the Z-80 and 8088 microprocessors and is expandable to 512K. The 1850 also comes with a built-in direct connect modem and two 250K dual-sided disk drives.

The 1810 is outfitted with telephone, serial, parallel, data line, TV, composite video, and speaker ports. List price: $2495. Xerox Corporation, Xerox Square, Rochester, NY 14644, 203/965-7500.

Robert Luhn is an Associate Editor at PC World.

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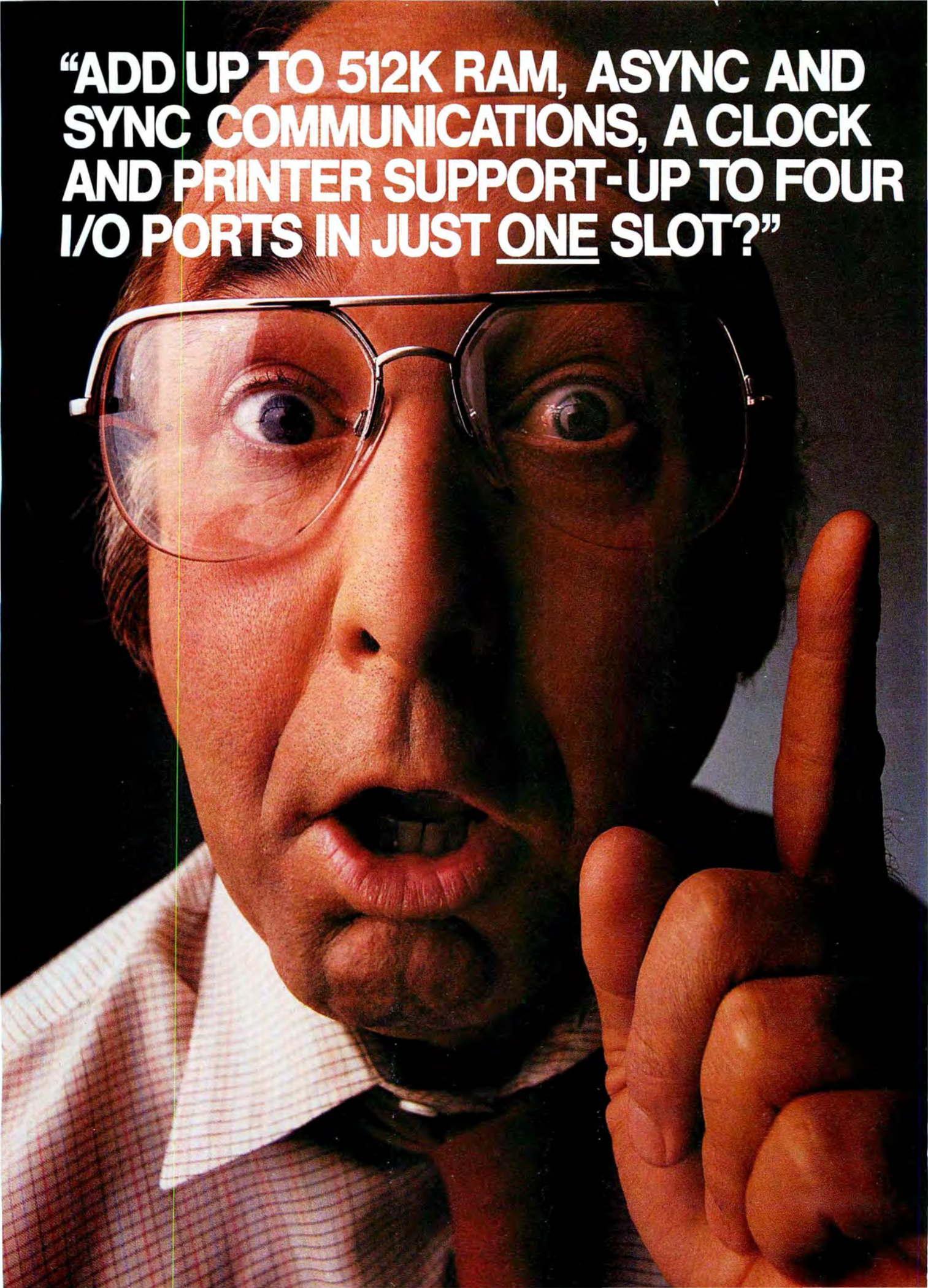
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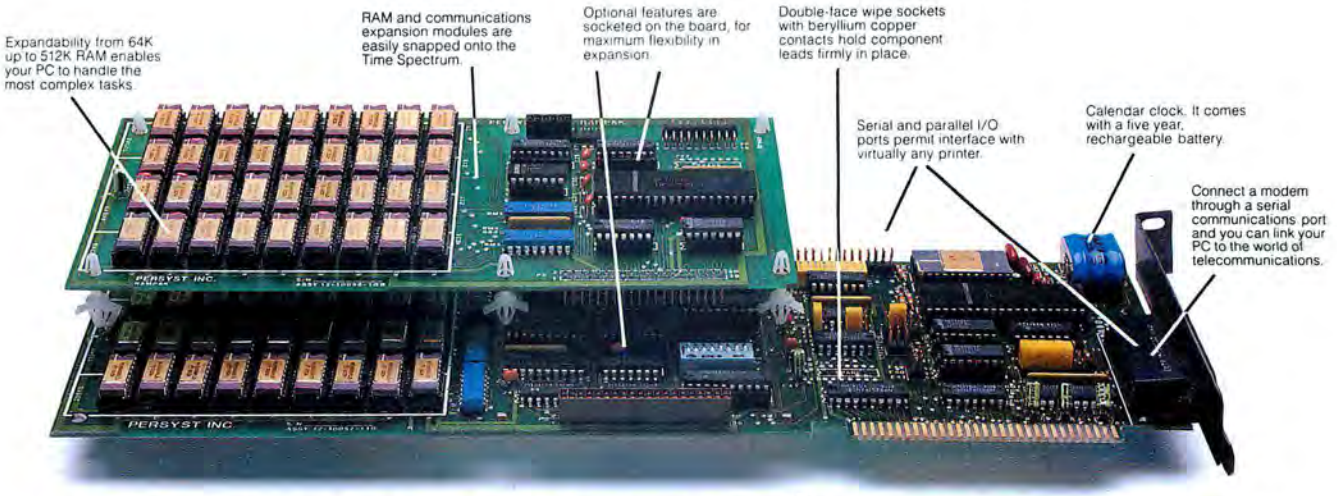

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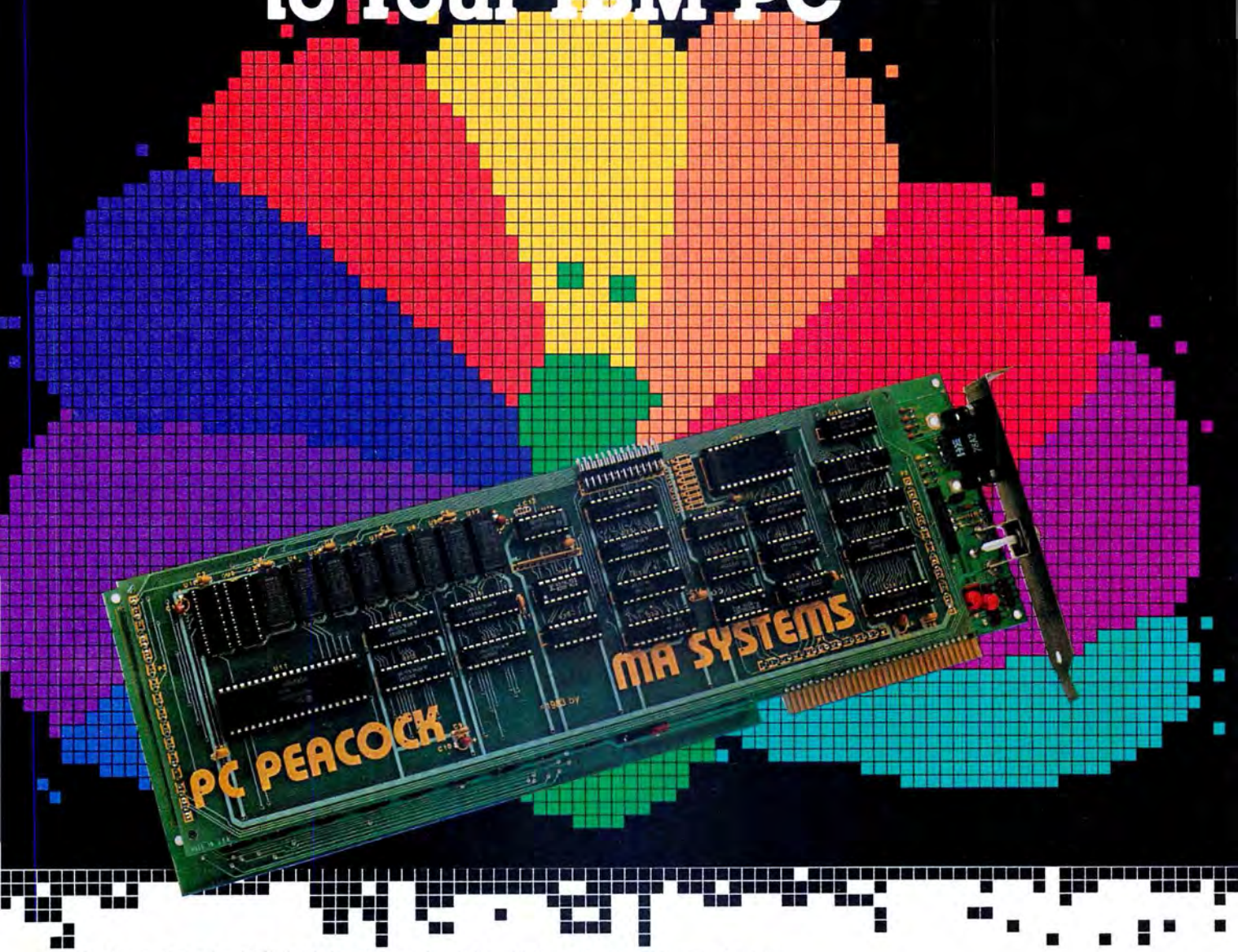

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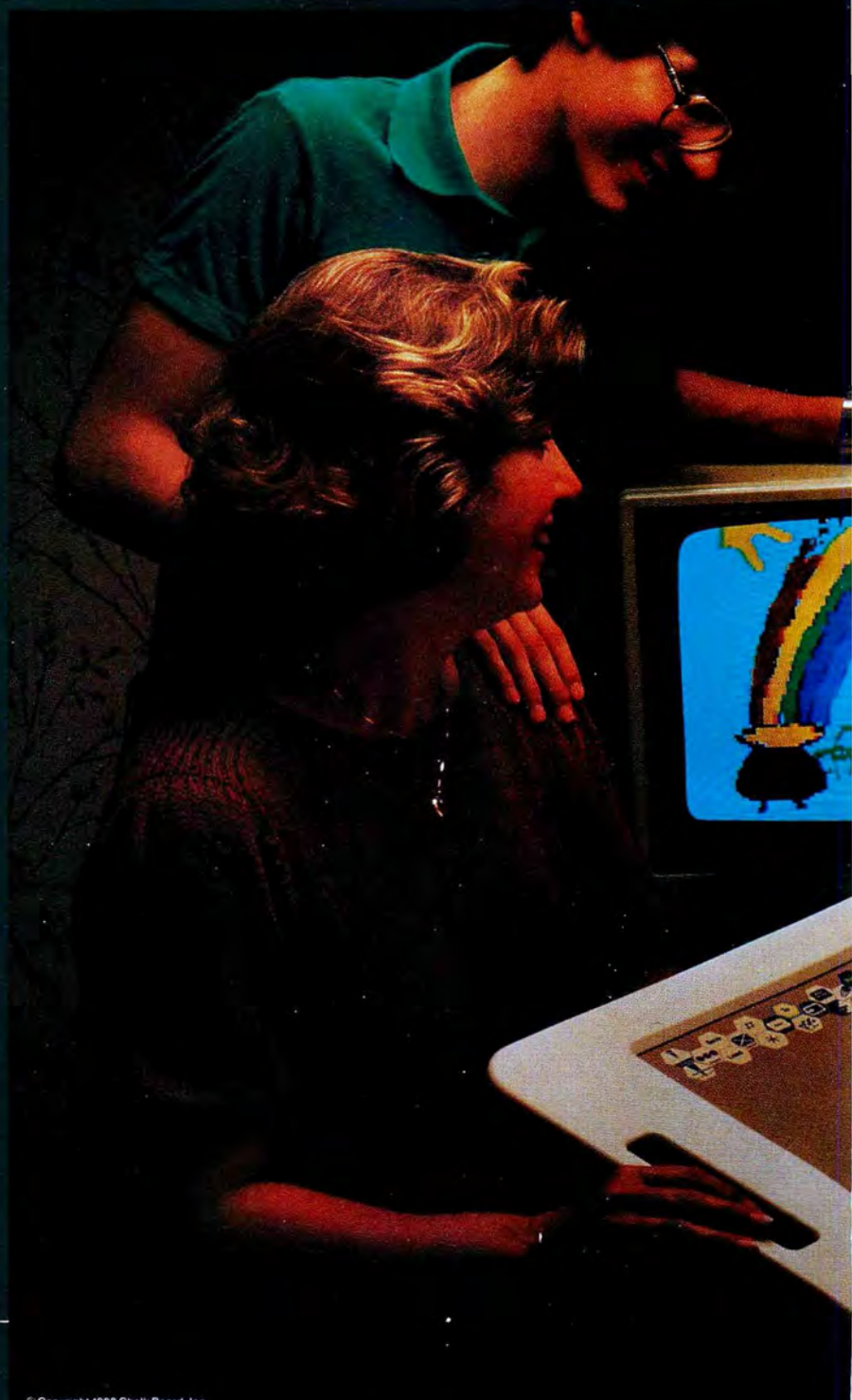

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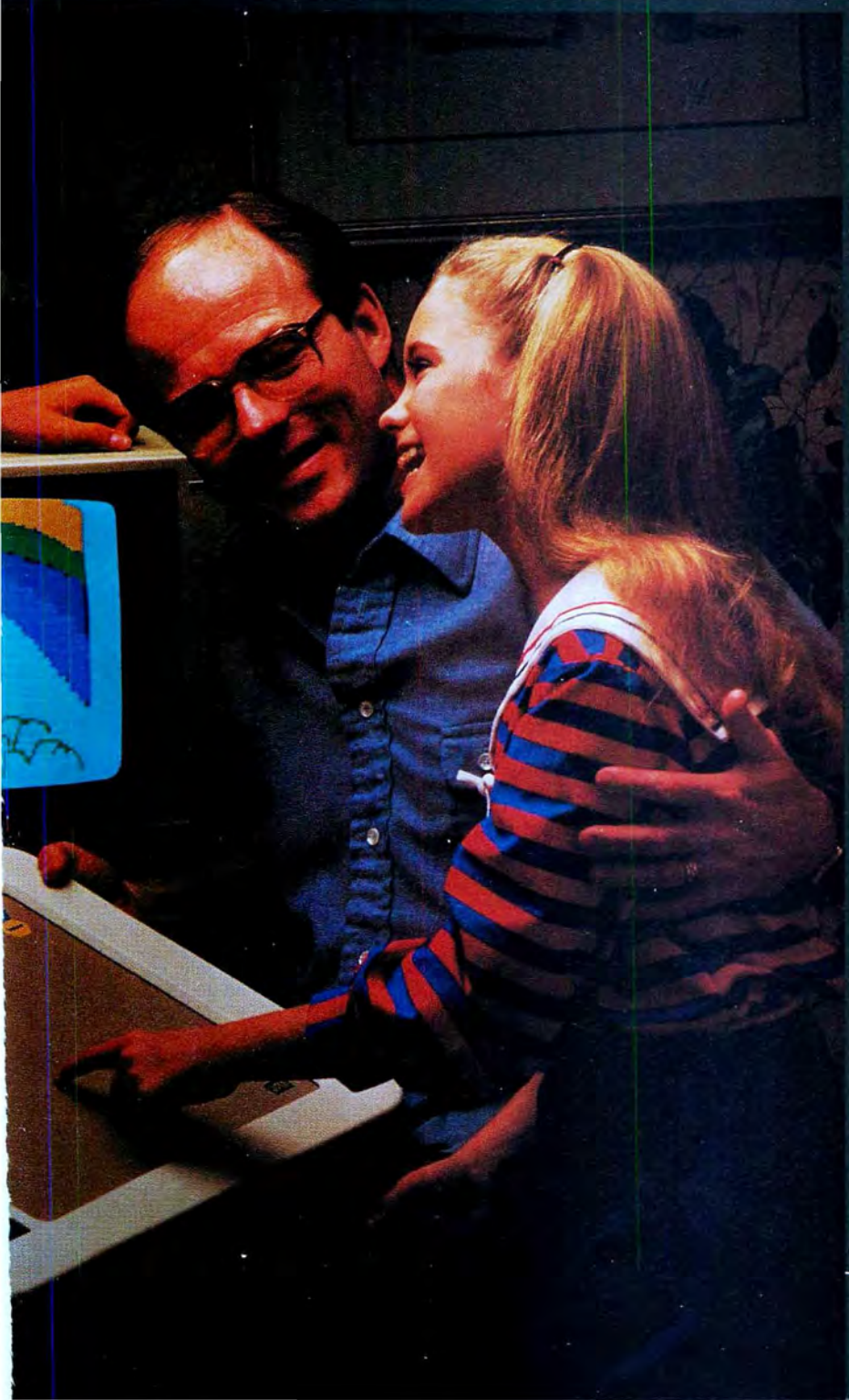

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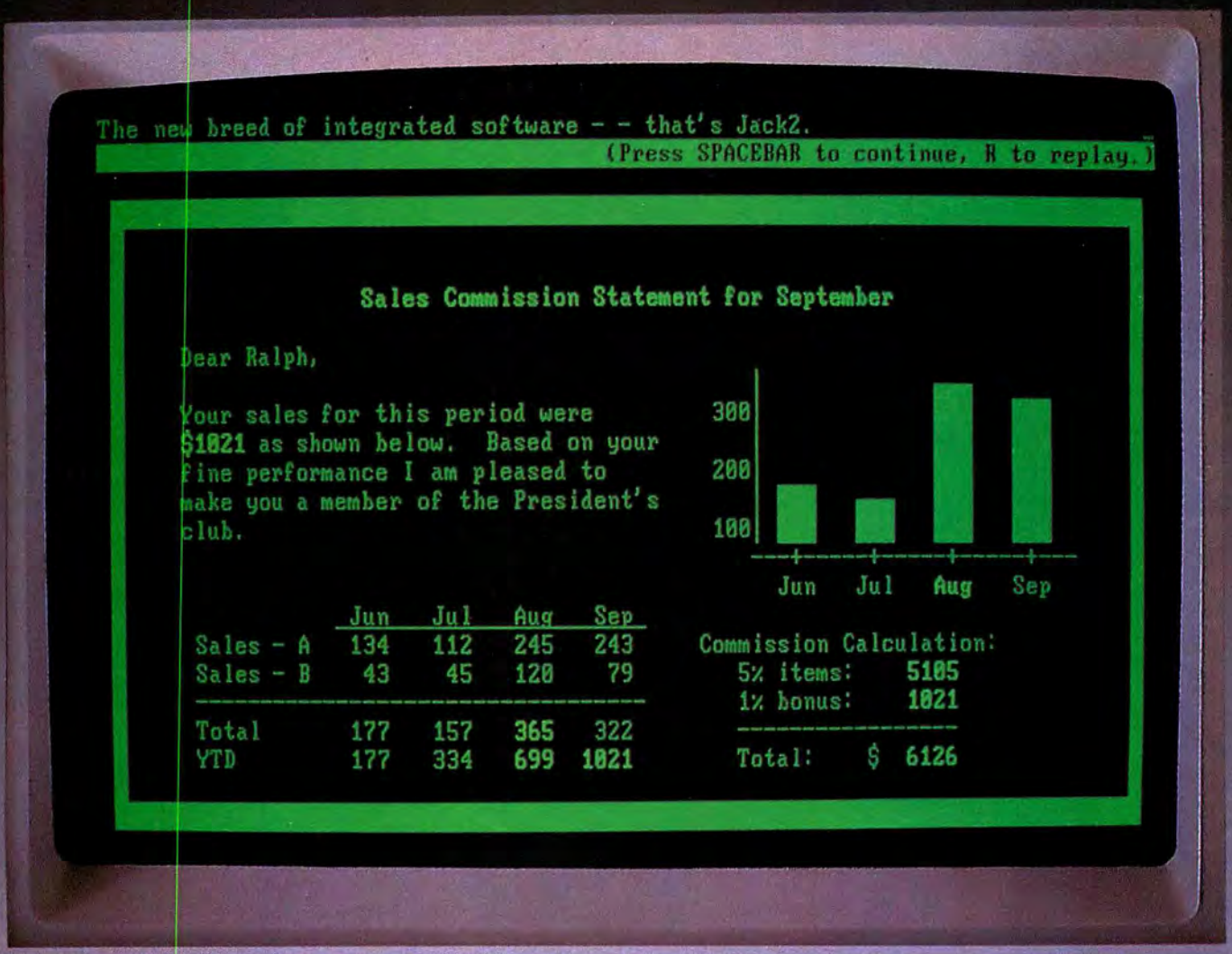

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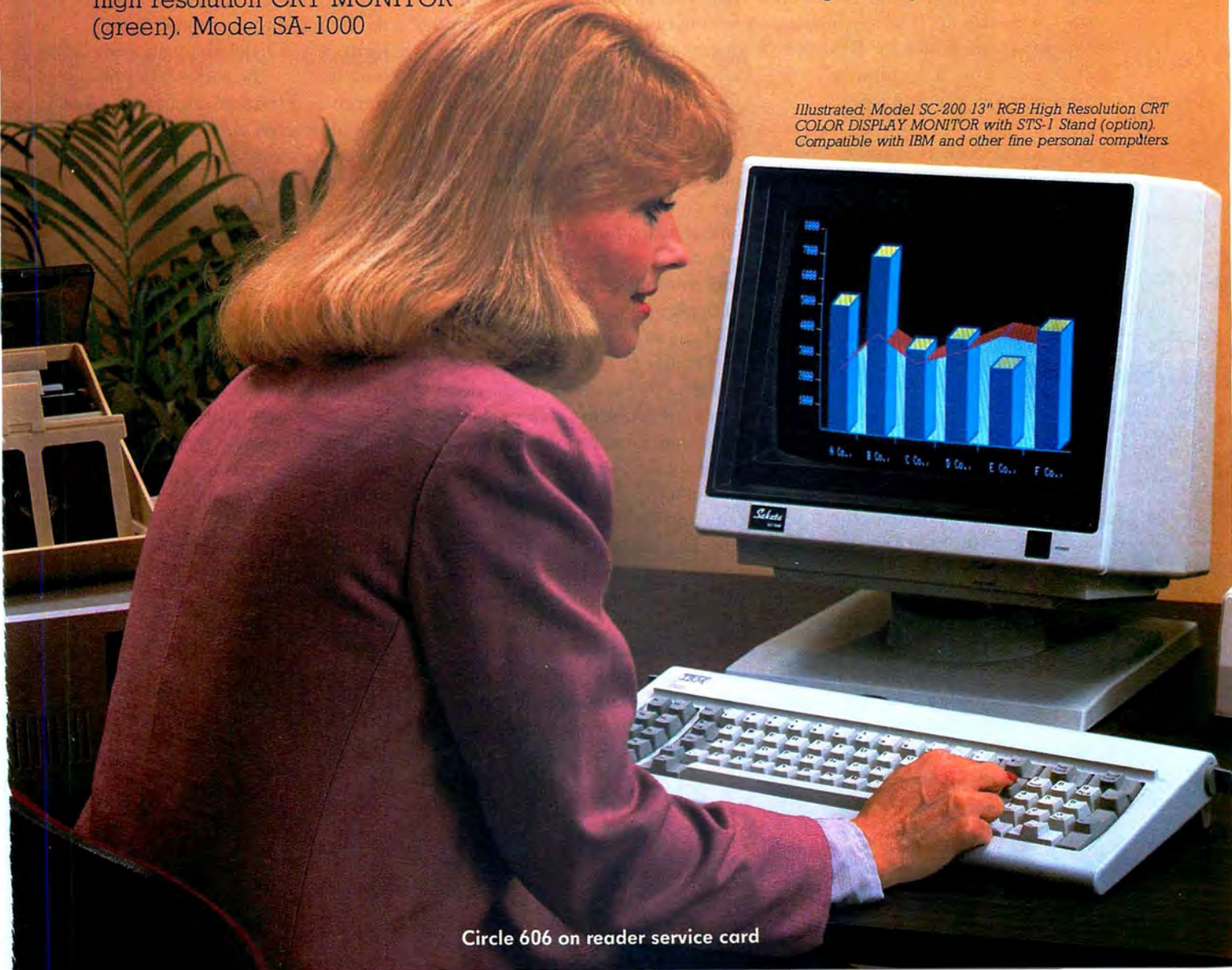

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The Turtle Grows Up

Logo isn't kid stuff anymore. Dr. Logo, PC Logo, and Waterloo Logo take advantage of the power of the PC.

Greg Stone

Logo is a programming language best known for its turtle graphics and its appeal to children. Although it's still a great way to introduce kids to programming, you can throw away the training wheels because the turtle has grown up. The new implementations of Logo for the IBM PC provide powerful programming environments for adults as well as children.

This is especially true of Dr. Logo, the version of the language brought out by Digital Research. PC Logo, marketed by Harvard Associates, and Waterloo Logo, from Waterloo Microsystems, also take advantage of the PC's substantial memory to turn Logo into a serious programming language. Several more PC versions of Logo are expected on the market shortly.

As an Apple Logo user, I found I could skip the documentation with the PC versions and start programming with already familiar commands. The creators of Dr. Logo and PC Logo even retained the Apple control key functions. The marketing strategy is clear: encourage Apple Logo users to upgrade to one of the PC Logos. And if a child is using Apple Logo in school (a common occurrence these days), he or she can use the family PC to practice with one of the Logos reviewed here.

Logo is both a programming language and an educational philosophy. It was developed in the late 1960s by Seymour Papert, a professor of mathematics and education at the Massachusetts Institute of Technology. In creating Logo he drew heavily on the educational philosophy of Jean Piaget, emphasizing natural, spontaneous learning instead of the curriculum-driven education prevalent today. Papert thinks that the computer is being used to program today's children. He would rather see children learn how to think and discover the world on their own through programming the computer.

Logo's program structure allows problems to be broken down into what Papert calls "mind-sized bites." This structure encourages the development of problem-solving strategies by dividing large problems into a series of smaller, simpler tasks. Logo is an interactive process; you type in a command and see the result immediately. The language starts out with a range of predefined commands called "primitives." Each new procedure is defined by a single word that is added to the vocabulary of the language.

Although children can learn other programming languages, Logo is the only language written with educational goals in mind. It is especially useful in introducing mathematics, releasing that discipline from the realm of rote learning and bringing it into the range of personal experience.

Logo provides a bridge between the user and the computer in the form of a "turtle" that can draw lines with its tail. The turtle exists on the screen as a triangle about the size of a small fingernail. The programmer has control over the direction and distance the turtle moves as well as the colors of the line and the background.

All of this is accomplished with simple English commands that are easily abbreviated. For example, to call up the turtle, type SHOWTURTLE or ST. Then type FORWARD with a number indicating the number of turtle steps. Each turtle step is about one millimeter long. To change the direction in which the turtle is heading type RIGHT or LEFT and the number of degrees you want the turtle to turn. Commands can be linked by Logo "procedures" (see "Drawing with the Turtle").

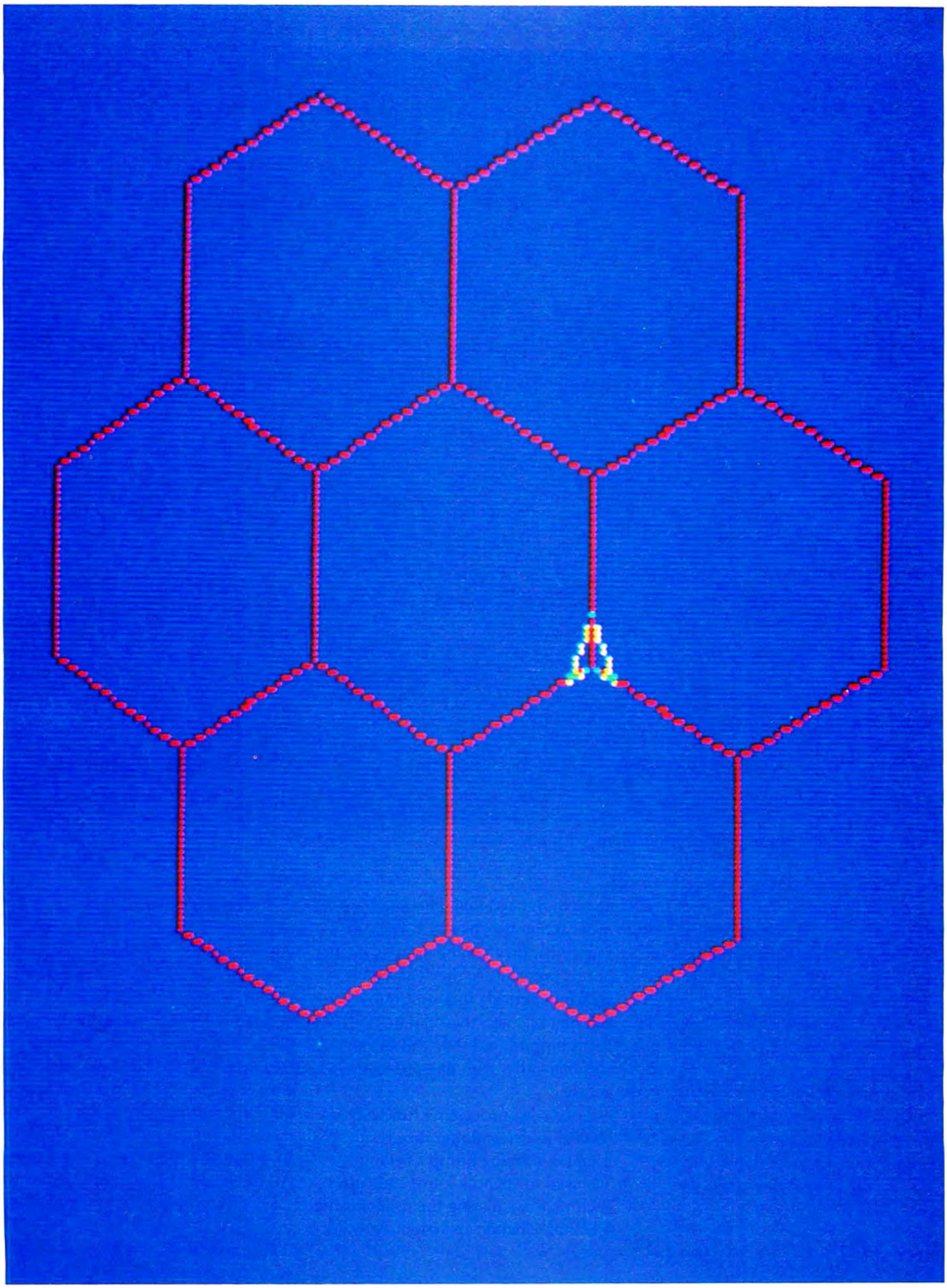

Figure 1: Repeating hexagons drawn with Dr. Logo

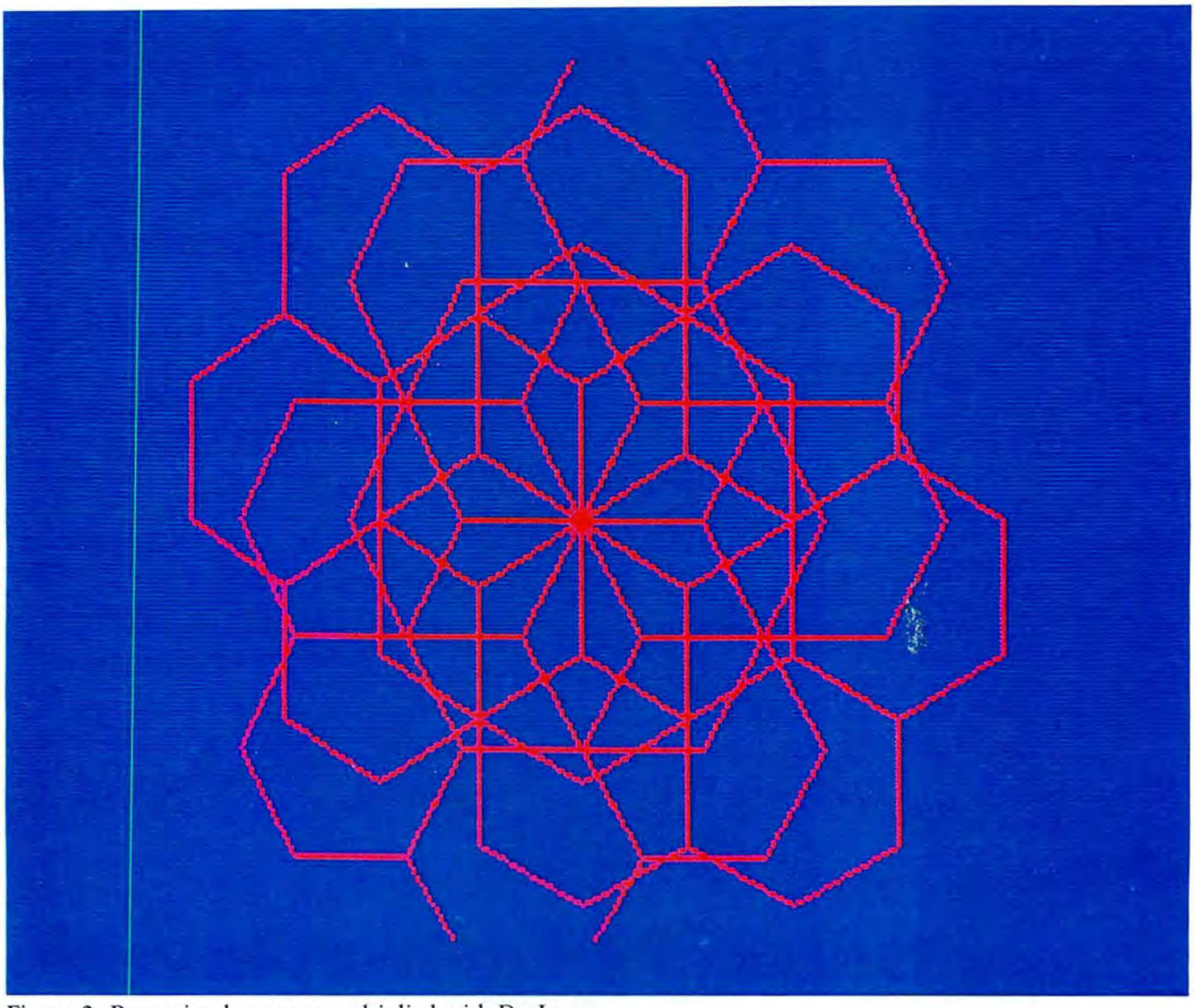

Figure 2: Repeating hexagons multiplied with Dr. Logo

List Processing

Logo was created as a dialect of LISP, the powerful language developed for research in artificial intelligence (see "Playing by the Rules," *PCW*, Vol. 2, No. 1). LISP draws its name from the words *list processing*, so it should be no surprise to find extremely powerful list processing capabilities in Logo. A list is a collection of data in the form of words, numbers, or some combination of words and numbers. With Logo it is easy to take lists apart and reassemble them in a new order. Logo lists have a variety of functions: they can be used as the input to procedures, they can be created interactively in a program, they can be variables, they can be program output, and they can be passed automatically from one procedure to another.

Logo's list processing functions are helpful in determining race results for a sailboat racing group I belong to. We used to spend a lot of time after each race calculating the results using a complex handicap system. Variables include the type of boat sailed, the wind speed at the time of the race, and the time it took each boat to complete the course. Lists of boats, names, times, and handicaps have to be manipulated. Logo provides a simple and effective process by which to handle the lists. The Logo program was simpler to write and easier to explain than a similar program written in BASIC.

Logo on the PC

All three of the Logo packages reviewed require an IBM PC, one disk drive, and a color graphics board. A color monitor is recommended if you want to take full advantage of Logo's

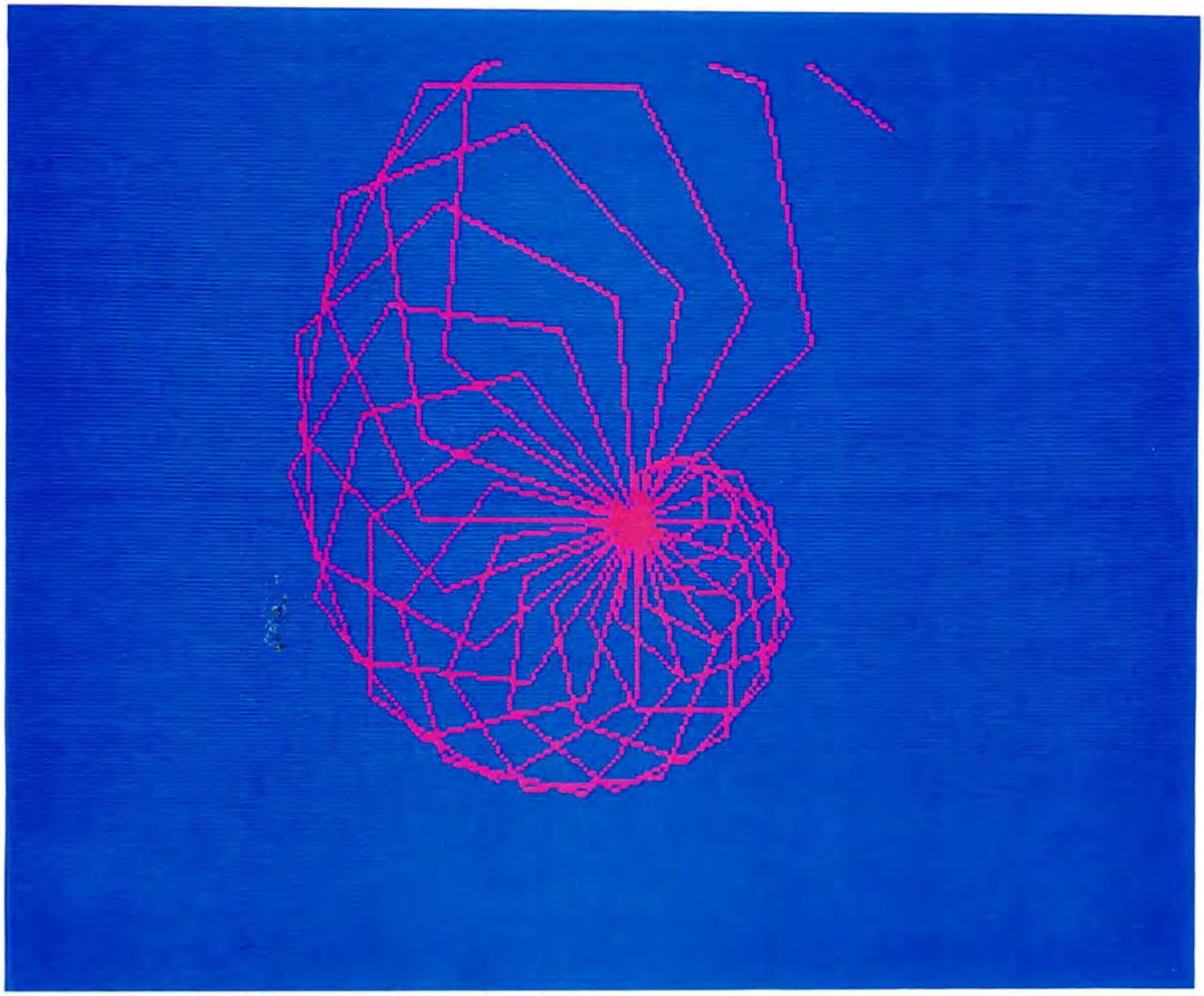

Figure 3: First stop-action shot of tail recursion with Dr. Logo

color graphics capabilities. All three versions support game paddles and a light pen. As of this writing none of the versions supports the use of a mouse. Dr. Logo requires 192K, Waterloo Logo 128K, and PC Logo 64K. I tested the packages on a PC XT with 256K and an Intel 8087 math chip installed, but none of the versions takes full advantage of the extra memory, and only PC Logo took advantage of the 8087 chip.

Dr. Logo includes its own version of CP/M-86, so you don't need a separate operating system to run it. The built-in operating system cannot be used to run other programs. Waterloo Logo also includes its own operating system, but PC Logo must be booted from DOS.

Graphics

When Logo is in the graphics mode, a four- or five-line window displays text at the bottom of the screen. All three versions allow you to switch to a full graphics screen. You can use Dr. Logo to set the size of the text window with a new SETSPLIT primitive (command) to any number of lines up to a full screen.

Dr. Logo can run on two displays simultaneously, running text on a monochrome monitor while related graphics appear on a color monitor. A new Dr. Logo primitive, TURTLETEXT, enables you to place words on the graphics screen and control their location with the position of the turtle. The other two versions cannot mix graphics and text unless you split the screen or program the turtle to draw the letters on the graphics screen.

Dr. Logo is the only version that does not provide a SCRUNCH com-

mand. SCRUNCH changes the aspect ratio of the screen. For example, you can make a circle look like an oval. The IBM color monitor provides a way to adjust this setting temporarily, but without a SCRUNCH command you cannot save a ratio change within a program.

Speed is not necessarily desirable when the object is to use Logo as a learning tool for children. It is helpful, however, in producing graphics for business applications. As a test I used a small graphics program that draws a square 36 times, rotating each new square 10 degrees. Waterloo Logo accomplished this in 14 seconds, Dr. Logo in 8 seconds, and PC Logo in 2 seconds. Without the Intel 8087 chip installed, however, PC Logo graphics slow down to 16 seconds.

Waterloo Logo offers several additional graphics primitives, including ARCLEFT, ARCRIGHT, CIRCLEL, CIRCLER, and PAINT. The most outstanding of these is the PAINT command, which you use to fill an area with color. After drawing a design, move the pen to the interior of the design. Typing PAINT fills the area with the turtle's current pen color.

The other four commands draw arcs and circles. The other two versions achieve the same results when you write short procedures for drawing circles and arcs, but such procedures take up valuable memory space.

Programming in Color

All three versions offer plenty of color choices, but only 4 colors can be shown on the screen at one time. Dr. Logo gives you 12 choices of pen

Drawing with the Turtle

The simplest way to get into Logo programming is through turtle graphics. The turtle is the little triangle in the middle of the screen. To begin writing a Logo program use the word *TO*.

```
TO S
FORWARD 30
END
```

Simple enough. When you type S now, the turtle moves forward 30 turtle steps, drawing a line as it goes.

Now you can "teach" the turtle another word.

```
TO SI
S
RIGHT 60
END
```

The new command, right 60, changes the direction in which the turtle is headed. Notice that instead of typing FORWARD 30 you only type S. Once a word is defined in Logo, it can be used just as if it were part of the regular vocabulary. Keep building.

```
TO SIX
REPEAT 6 [SI]
END
```

What's happening? REPEAT is a Logo primitive. The instructions that appear in the square brackets will be repeated. In this case you want SI performed six times. You just defined SI to mean go forward 30 steps and turn right 60 degrees. When you type SIX, you should see a hexagon on the screen. Now you can put the turtle to work.

```
TO SIX.X.SIX
REPEAT 6 [SIX FORWARD 30 LEFT 60]
END
```

Now you are repeating the hexagon (SIX), and after each time it is drawn you ask the turtle to go forward 30 steps and turn left 60, then draw another. SIX.X.SIX should give you an image like that in Figure 1. Want more? Multiply it by four.

```
TO TIMES.FOUR
REPEAT 4 [SIX.X.SIX RIGHT 90]
END
```

The result should look like Figure 2.

Here's a taste of tail recursion and variables.

```
TO GROW.SIX :SIDE
REPEAT 6 [FORWARD :SIDE RIGHT 60]
RT 18
GROW.SIX :SIDE + 3
END
```

The first line is simple. It draws a hexagon, just as SIX does. The only difference is that you allow the size of the side to be variable. That's why the title of this procedure, GROW.SIX, includes :SIDE. That tells Logo to expect an input. If you type GROW.SIX 10, the first hexagon drawn will have sides of 10 turtle steps each.

But much more is happening here. After the hexagon is drawn, the turtle turns right 18 degrees. That's the second line. The real magic is in the third line, GROW.SIX :SIDE + 3. It simply calls itself, like a dog chases its tail. If we had typed GROW.SIX 10, the first hexagon would have sides of length 10, then the turtle would turn 18 degrees, then another hexagon would be drawn with sides of 10 + 3. This business of larger and larger sides can go on indefinitely, so the program has to be stopped with <Ctrl>-G or another signal that stops program execution. See Figures 3 and 4 for two stop-action photos of this animation.

color; the others offer 6. The extra colors that Dr. Logo provides are actually shades of the original 6. PC Logo and Dr. Logo offer 16 background colors, and Waterloo Logo offers 15. (For some reason white isn't included in Waterloo Logo.)

Lists and Mathematics

Dr. Logo includes six new list processing primitives that make programming easier: LOWERCASE, UPPERCASE, PIECE, SHUFFLE, SORT, and WHERE. UPPERCASE and LOWERCASE can change the capitalization of a single letter or an entire body of text. Using PIECE, you can specify and remove a portion of a list. SHUFFLE rearranges a list in random order, and SORT sorts a list quickly. WHERE returns a number that identifies the location of an item in a list. A clever programmer can find ways to carry out these activities in the other versions of Logo but at the expense of memory space and execution speed.

Besides providing standard math functions, Dr. Logo has added primitives that return the natural exponent of the input number, the natural logarithm of the input number, the base-10 logarithm of the input number, the value of pi, the number of degrees in the input number of radians, and the number of radians in the input number of degrees.

PC Logo provides none of these features but has other new capabilities. Using PC Logo, you can change the base in which numbers are output. If you specify base 2, for example, and then type Print 10, PC Logo will display '1010' on the screen, which is the number 10 in binary (or base 2) notation. Similarly, the base in which numbers are input can be changed. Three primitives, LOGAND, LOGOR, and LOGXOR, return the bitwise logical expression (and, or, and exclusive or) of their input (bitwise logical expressions are expressions that manipulate bits). The primitive LSH returns the first input, logically shifted the number of positions specified by the second input.

Waterloo Logo doesn't offer any unusual mathematics primitives. It does, however, take a step in the direction of clarity by having one symbol that indicates that two numbers are to be subtracted and another symbol that indicates a negative number.

Programming Environment

For the purposes of this article, "programming environment" is defined as everything that makes using the language fast and easy. This includes editing features, debugging tools, and work space management primitives. Logo is noted for its friendly programming environment. Specific error messages in plain English and easy-to-use editing functions are present in all three PC versions.

The most significant programming aids in Dr. Logo are the debugging procedures, none of which are included in any of the other packages reviewed or in Apple Logo. The procedures are controlled by three commands: DEBUG, TRACE, and WATCH.

DEBUG splits the screen. In the top half you can watch a program being executed. The bottom half displays screen output generated by the program.

TRACE displays the name of each procedure as it is called and the name and value of each variable as it is defined. The procedure runs without interruption.

WATCH prints to the screen the entire procedure as it is running, pausing after the execution of each statement to allow interaction with the editor. The user controls the speed at which the procedures run.

When those features are combined, they provide an extremely powerful tool for correcting errors and understanding the construction of a program. Debugging is a cornerstone of the Logo educational philosophy, which encourages the discovery of several solutions to a single problem. In Logo, programs that have bugs are not "wrong," they simply need fixing.

Dr. Logo and Waterloo Logo enable you to add comments to Logo lines. Comments, however, are not as critical in Logo, with its plain English, as they are in more obscure languages such as BASIC. In Dr. Logo the primitive NOFORMAT can be used to remove all comments from the work space, freeing more memory. Similarly, NOPRIM removes the help file from memory.

Debugging is a cornerstone of the Logo educational philosophy.

Dr. Logo's editor is Apple Logo compatible but also takes advantage of the PC function keys. Each editing function can be carried out either with a control key sequence (as in Apple) or with the arrow or function keys of the PC. You can put a single procedure or all the procedures in the work space into the editor at one time. In addition, there's a special feature for demystifying error messages. If the program is stopped by an error message, you can type EDIT and the errant program will be hauled into the editor, where the cursor will be placed automatically at the line where the error occurred.

The PC Logo editor also gives you the choice of using control key combinations or the PC function and arrow keys. All procedures can be

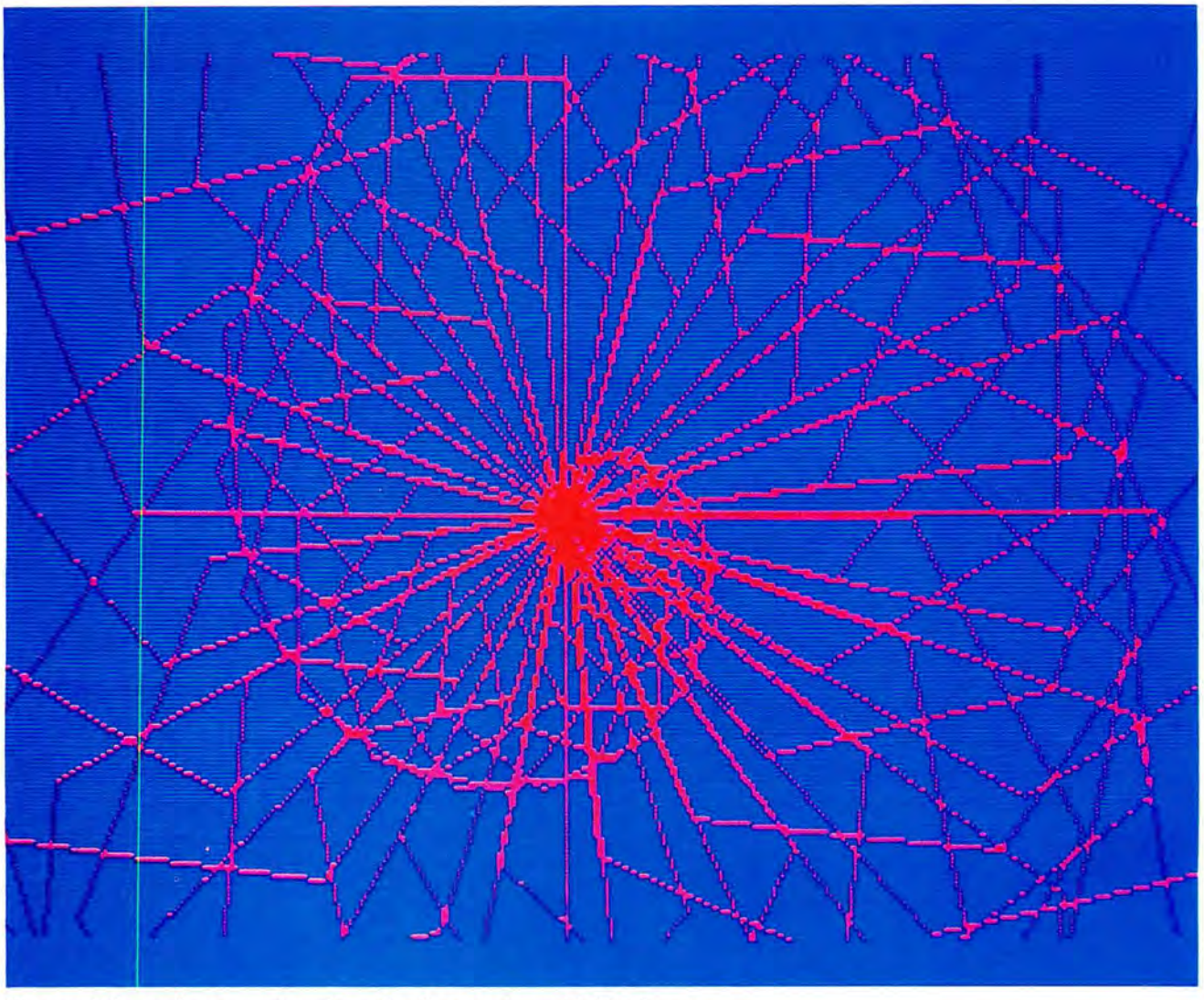

Figure 4: Second stop-action shot of tail recursion with Dr. Logo

loaded into the work space at one time. The search and replace function is one helpful PC Logo feature not available on the other two versions.

With all three versions you can save the procedures and variables with one command and save the contents of the graphics screen with another. However, with Dr. Logo you can save only the code for a graphics routing, not the actual picture. Only with PC Logo's SNAPSHOT command can you save everything at once (procedures, variables, and the contents of the graphics and text screens).

Waterloo Microsystems has not attempted to make Waterloo Logo's editor Apple Logo compatible. Only the PC function and arrow keys are used. When the program is in the editor mode, a message at the top of the screen reminds you of four editing commands: QUIT, PICK UP, PUT DOWN, and INSERT. Each is assigned a function key. Waterloo Logo's editor enables you to highlight and select several lines at once using the <End> key to identify the start of what you wish to move or delete. The <F2> key is used to pick up deleted text, and the <F3> key puts it down elsewhere. <F4> is the INSERT key and is used to open a blank line.

Documentation

Dr. Logo's documentation is superb. In a single looseleaf binder Digital Research has compiled a 97-page tutorial full of illustrations; a well-written, 236-page reference manual with 56 color plates taken from the screen; five appendices; and an index.

You also get a 37-page quick-reference guide to primitives and editing keys.

PC Logo's documentation is also well organized, but it doesn't provide full-color plates or abbreviated guides. The documentation is composed of a well-written, 207-page tutorial in a looseleaf binder and a 158-page reference manual. Both are loaded with drawings and examples.

Waterloo Logo has a quick-reference folding-card guide to primitives and a limited tutorial and reference manual. The manual is correctly described in its own pages as "written for people who already have programming experience using a high-level language." It is spiral bound and contains 101 pages printed on translucent paper.

Special Features

All three packages include methods for printing text and graphics. To control the PC's sound, Dr. Logo and Waterloo Logo provide a simple command that generates a musical note and controls its duration and pitch. Dr. Logo contains several new commands that make life easier for programmers. For example, the FKEY command reprograms the function keys.

PC Logo is the only Logo version that provides for setting up and accessing data files on disk. This is a powerful programming feature, especially when memory space is limited. Using a combination of features (STANDARD.OUTPUT, OPEN, STANDARD.INPUT, and CLOSE), you can redirect the output of a procedure from the screen to the disk. Those features would be perfect for my sailboat racing program. In addition to generating scores from handicaps, tables, and timed results, PC Logo could add them automatically each week and store them in a file that contains only those results.

PC Logo is the only version that comes with a utilities disk. The disk contains more than 20 files, including programs such as BIZGRAPH, which draws bar and pie charts. Some of the files perform useful tasks, while others provide examples of programming ideas that you might want to expand upon or study.

When choosing a version of Logo, consider the hardware limitations. If you have only 64K, your choice is already made; PC Logo is the only version you can run. If you have 128K of memory, either PC Logo or Waterloo Logo can be used. The turtle graphics are more fun with Waterloo Logo's PAINT, CIRCLE, and ARC commands. However, the PC Logo turtle graphics are the equal of Apple Logo's, and the rest of the package is more versatile than Waterloo Logo. I would choose PC Logo for its better documentation and utilities and its ability to direct the output of procedures directly to disk.

> PC Logo is the only version that comes with a utilities disk.

If you have 192K or more of memory, you have a tough choice between the disk file features of PC Logo and the overall programming environment provided by Dr. Logo. The latter has a definite edge with its turtle graphics, list processing, editing, and debugging features. Sometimes it's a small edge, as with the "turtletext" graphics feature. At other times features such as Dr. Logo's sophisticated debugging tools give the program an impressive lead. The only significant feature Dr. Logo lacks is PC Logo's ability to handle disk files from procedure outputs.

All three of the packages offer good implementations of Logo, and Dr. Logo and PC Logo represent significant steps forward for Logo on the microcomputer. It is no longer necessary to have children as an excuse to enjoy this flexible and powerful language.

Greg Stone is director of community relations at Southeastern Massachusetts University. He has taught Logo to both children and adults.

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800/772-3545 ext. 400 in California, 408/649-3896
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PC Logo
Harvard Associates, Inc.
260 Beacon St.
Somerville, MA 02143
617/492-2999
List price: $199.95
Requirements: 64K, one disk drive, color graphics board

Waterloo Logo
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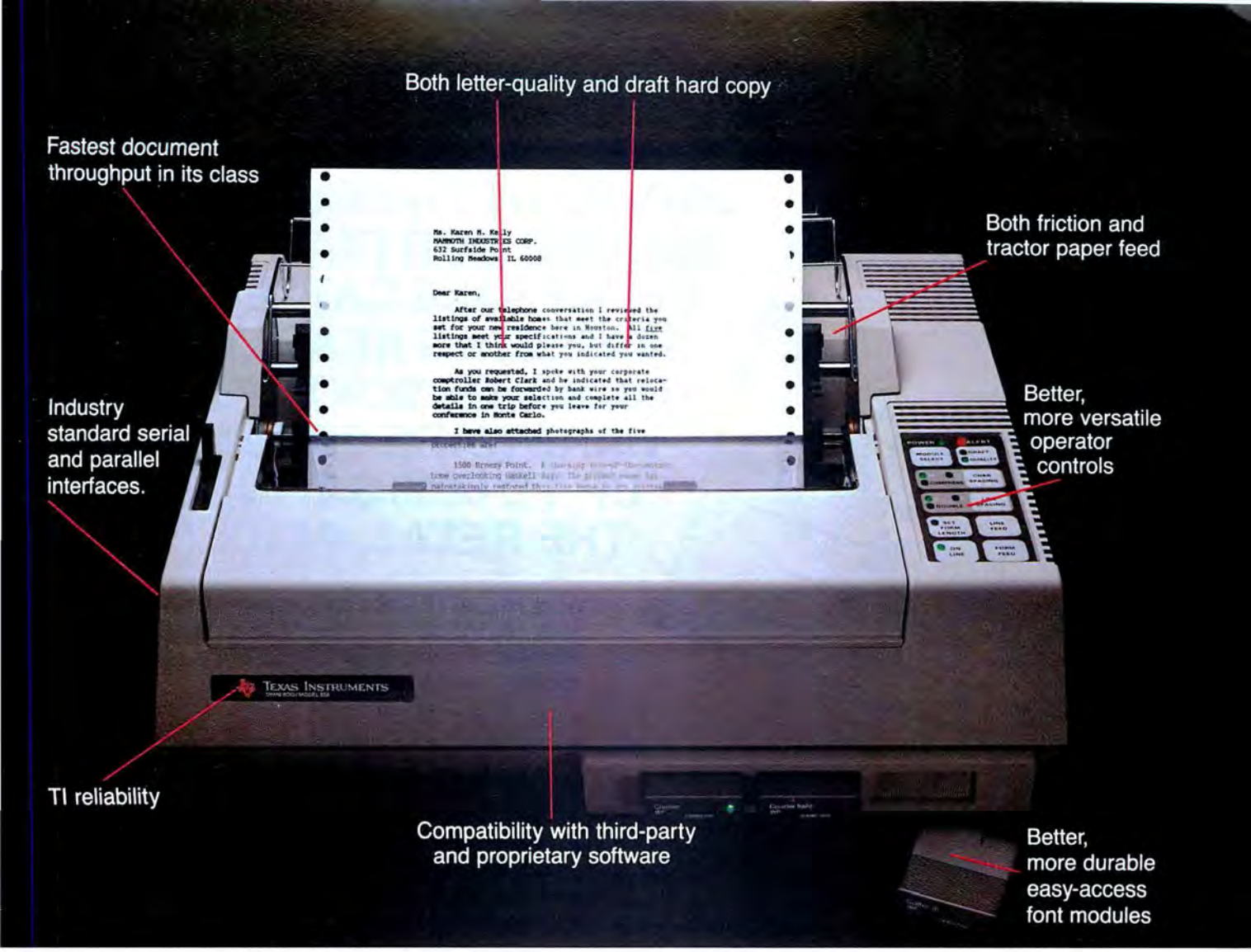

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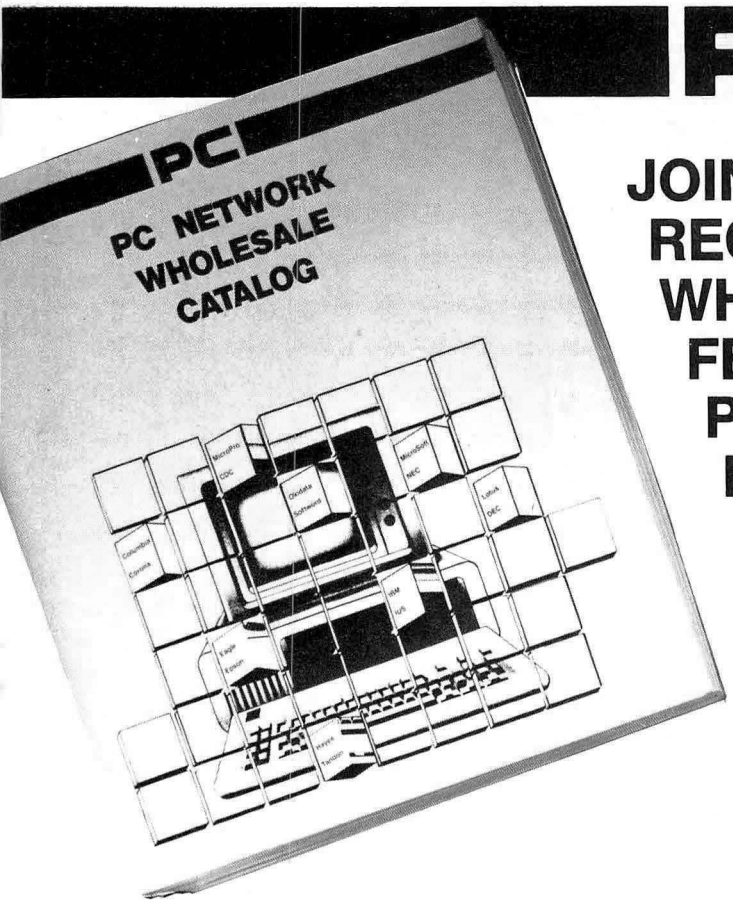

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- ☐ One-year membership for $8
- ☐ Two-year membership for $15 (SAVE $1)
- ☐ Business Software Rental Library for $30 add'l. per year—members only
- ☐ Games Software Rental Library for $10 add'l. per year—members only

Special V.I.P. Membership

- ☐ One-year membership for $15
- ☐ Two-year membership for $25 (SAVE $5)
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_____	*Eagle*	#_____	$	($)
_____	*Columbia*	#_____	$	($)
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☐ Bill my credit card: ☐ VISA ☐ MasterCard ☐ American Express

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NETWORK

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___	**Orion** *JBird*	22.00*
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___	**Sierra On-Line** *Frogger*	21.00*
___	**Sierra On-Line** *Crossfire*	18.00*
___	**Sub logic** *Night Mission Pinball*	24.00*

Qty.		Wholesale Price
___	**Spinnaker** *Alphabet Zoo*	17.00*
___	**Spinnaker** *Delta Drawing*	29.00*
___	**Spinnaker** *FaceMaker*	20.00*
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___	**Spinnaker** *Rhymes & Riddles*	17.00*
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___	**Spinnaker** *Most Amazing Thing*	23.00*
___	**CBS** *Mastering the SAT*	90.00*
___	**CBS** *Goren-Bridge Made Easy*	48.00*

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Please add $2.50 shipping and handling for each title ordered from below.

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___	**Context** *Context MBA*	$417.00*
___	**Conceptual Instr.** *Desk Organizer*	150.00*
___	**Digital Research** *CP M-86*	33.00*
___	**Digital Research** *Micro SPF*	137.50*
___	**Financier** *Financier II*	100.00*
___	**Funk Software** *Sideways*	36.00*
___	**Lotus Development** *Lotus 1-2-3*	CALL
___	**MDBS** *Knowledge Man*	275.00*
___	**Micro Rim** *R Base 4000*	290.00*
___	**Microsoft** *C Compiler*	300.00*

Qty.		Wholesale Price
___	**Microsoft** *Pascal Compiler*	210.00*
___	**Oasis** *The Word Plus*	90.00*
___	**Peter Norton** *Norton Utilities*	48.00*
___	**Rosesoft** *Prokey Version 3.0*	79.00*
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___	**Software Publishing** *PFS: Graph*	82.00*
___	**Software Publishing** *PFS: Report*	68.00*
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___	**Sorcim** *Supercalc III*	217.00*

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Please add appropriate shipping and handling charges (at right in parentheses) to each item ordered from below.

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___	**Amdek** *Video 310A*	140.00* (2.80)
___	**Apparat** *512K RAM Card w 0K*	92.00* (2.50)
___	**AST** *Six-Pack Plus-0K*	210.00* (2.50)
___	**AST** *Megaplus II-0K*	210.00* (2.50)
___	**AST** *I O Plus II*	99.00* (2.50)
___	**AST** *Any Port Option (MG II, SPK, I O+)*	30.00* (1.00)
___	**Epson** *FX-80*	CALL
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___	**Epson** *RX-80*	CALL
___	**Epson** *—Epson to IBM printer cable*	21.00* (1.00)
___	**Hayes** *Smartmodem 300*	183.00* (3.60)
___	**Hayes** *Smartmodem 1200B*	375.00* (7.50)
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___	**Maynard** *Floppy Disk Controller*	155.00* (2.50)
___	**Maynard** *WS1 10Mb Internal Hard Disk/Multifunction*	855.00* (17.60)
___	**Maynard** *WS2 10Mb Internal Hard Disk/Floppy Controller*	960.00* (19.20)
___	**Other:**	
___	**Other:**	

Qty.		Wholesale Price
___	**Maynard** *WS3 10Mb Internal Hard Disk/Sandstar Memory w/0K*	960.00* (19.20)
___	**NEC** *Notebook Computer*	559.00* (11.18)
___	**NEC** *2050 Spinwriter*	875.00* (17.50)
___	**Okidata** *ML92P*	395.00* (7.90)
___	**Okidata** *ML93P*	655.00* (13.10)
___	**Okidata** *IBM to Okidata Cable*	20.75* (1.00)
___	**Plantronics** *Colorplus*	364.00* (2.50)
___	**Princeton Graphics** *HX12*	CALL
___	**Qume** *Sprint II 40 CPS*	1,220.00* (24.40)
___	**Qume** *Sprint II 55 CPS*	1,359.00* (27.18)
___	**Qume** *IBM IFCE w cable*	72.00* (2.50)
___	**Qume** *Daisy Wheels*	6.00*
___	**Qume** *Ribbons*	6.00*
___	**STB** *Graphix Plus*	297.00* (2.50)
___	**STB** *Clock Option*	30.00* (1.00)
___	**Tandon** *TM100-2 (DS DD IBM equiv.)*	200.00* (4.00)
___	**Tandon** *TM50-2 (half height pr. DS DD)*	350.00* (7.00)
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___	**64K Memory Set** *for IBM PC, compatibles, & memory boards*	$45.90* (1.00)
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Options for Dynax DX 15		
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Tractor Feeder	$120	$80*
Keyboard—turns printer into advanced electronic typewriter	$195	$130*
NEC Spinwriter 3550 35 CPS—High Speed IBM Standard! Requires ribbon and print thimble.	$2,550	$1,604*
Options for NEC 3550		
Uni-directional Forms Tractor	$173	$133*
Cut Sheet Feeder	$1,125	$813
IBM Printer Cable Required for printers above.	$40	$26

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Softword Systems: *MultiMate* Word processing—Enhanced Wang look-a-like.	$499	$280*
Microsoft: *Word*	$375	$219*
Microsoft: *Word with Mouse* New generation word processing maximizes the IBM PC's capabilities!	$475	$260*
Training Packages for above, by ATI:		
How To Use MultiMate	$75	$45*
How To Use Microsoft: Word	$75	$45*

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Dynax DX 15	$25.00 ea.	$16.99* ea.
NEC 3550	$22.00 ea.	$13.99* ea.
Diskettes		
BRAND NAME DS/DD **Guaranteed For Life!** Sold in boxes of 10.	$ 6.50 ea.	$ 2.25* ea.
#20 Microfine Perf White † **Word Processing Stock** Continuous form w laser cut perf — invisible when torn. 2500 sheets per box. † **Shipped freight-free!**	$55.00/box	$27.00* box

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For $15 you can judge for yourself. If you already own an IBM PC, XT or compatible, or can get your hands on one, clip the coupon below and we'll send an evaluation package right out.

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Please send my **OMNIFILE™** demonstration package, including program disks, sample data disk, and Demonstration Handbook, all for just $15.00 plus $2.00 postage & handling (New York State residents add 7% sales tax).

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Send C.O.D. ☐ Charge my credit card ☐ Visa ☐ MasterCard

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The make/model of my computer is _____

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PIE à la PC

PIE: Writer demands intelligence and provides versatile word processing in return.

Janis L. Maguire

Compared to other word processing programs for the PC, *PIE: Writer* stands out as a strange mix of old and new. The program has been out on the Apple and other CP/M systems for some time now. While most word processors tend toward what-you-see-is-what-you-get, *PIE: Writer* goes the other way. It is a line-oriented text editor requiring a separate formatting routine to view or print documents as they will actually appear. Once you get used to the editing/formatting dichotomy, *PIE: Writer*'s extensive features allow you to create a wide range of documents. Add the ability to integrate *The Speller* spelling checker with the program, and you have a powerful word processing system.

Starting Up

PIE: Writer must be configured to the specific hardware on which it's going to run, including such variables as the amount of memory, the type of monitor, and the DOS level. If you have several configurations available, you have to make a separate disk for each setup. If you also bought *The Speller,* now's the time to integrate it with *PIE: Writer.* The configuration process is made easy with the help of English prompts and menus.

Six choices are offered on the system menu. The first is the text editor, which enables you to input and revise files. The second choice is the formatter or text processor, which allows a text file to be viewed on the screen as it will print out. The next two choices allow configuring for specific printers and a default format for variables such as line length, tab settings, and page length. If you add *The Speller* to the disk it will be the next menu choice. The last choice lets you exit back to DOS.

Once you get used to the editing/formatting dichotomy, *PIE: Writer*'s extensive features allow you to create a wide range of documents.

When the text editor is selected, you can name a document to work on, or you can choose from a display of the disk directory. Once you enter a document, the bottom of the screen displays the cursor position and the document name. Three entry modes are provided for input. The Manual mode performs like a typewriter; a carriage return has to be typed at the end of each line. PPWrap is *PIE: Writer*'s automatic wrap mode, in which a word that won't fit at the end of the line wraps to the next line. The Indent mode automatically indents text to the point you tab at the beginning of a paragraph. Words can't be wrapped to the next line in this mode, and revisions that affect the evenness of the margin must be corrected manually, line by line.

Depending on which mode you're in, the <Tab> and <Backtab> keys will either move the cursor to tab stops or to the next or previous word. The Tab mode can be toggled to either option by typing <Esc>-W-<Enter> in any of the input modes.

The Wrap and Manual modes can be toggled back and forth by using the <F10> key.

Dot Commands

In addition to entering text you must key in all formatting instructions, which appear on the input screen as "dot commands." Each dot command, a period plus a two-character semi-mnemonic combination, must appear on an individual line of the display; text cannot follow on the same line. For example, .pp means

new paragraph, .sp means a blank line, and .ce means centering. Dot commands can also specify the number of lines to be affected; for example, .bf 3 means three boldface lines.

To underline a word, you begin a new line with .ul. Type the word you want underlined on the next line and begin another new line for the word at which you want underlining to stop. Dot commands provide a high degree of control over the final output format of your document. You can prevent widows and orphans (lines separated from the rest of a paragraph during pagination) and vary the number of lines required to

you're already familiar with one of the CP/M versions. Both <F7> and <Ctrl>-K delete a line of text and store it in memory for later use. Both <F8> and <Ctrl>-O retrieve the line and insert it at the current cursor position.

If you insert text in the middle of an existing line, you can type up to 127 characters before *PIE: Writer* stops you. This situation is easily corrected by splitting the line with <Esc>-<Ctrl>-I. Don't worry if inserts and deletions make messy line endings; the format text processor will adjust everything to fit within the margins, either right justified or ragged.

Extended Features

PIE: Writer offers many sophisticated functions such as headers and footers, horizontal scrolling, print queuing, search and replace with wildcard specifications, and automatic insertion of the current date. Thanks to *PIE: Writer*'s virtual memory buffer, the program provides both split-screen editing for viewing two documents simultaneously and alternate-screen editing for toggling quickly between two files. Other commands allow you to print out copy with line numbers or receive a word count or line count on a particular file.

PIE: Writer's merge features allow you to print envelopes easily and

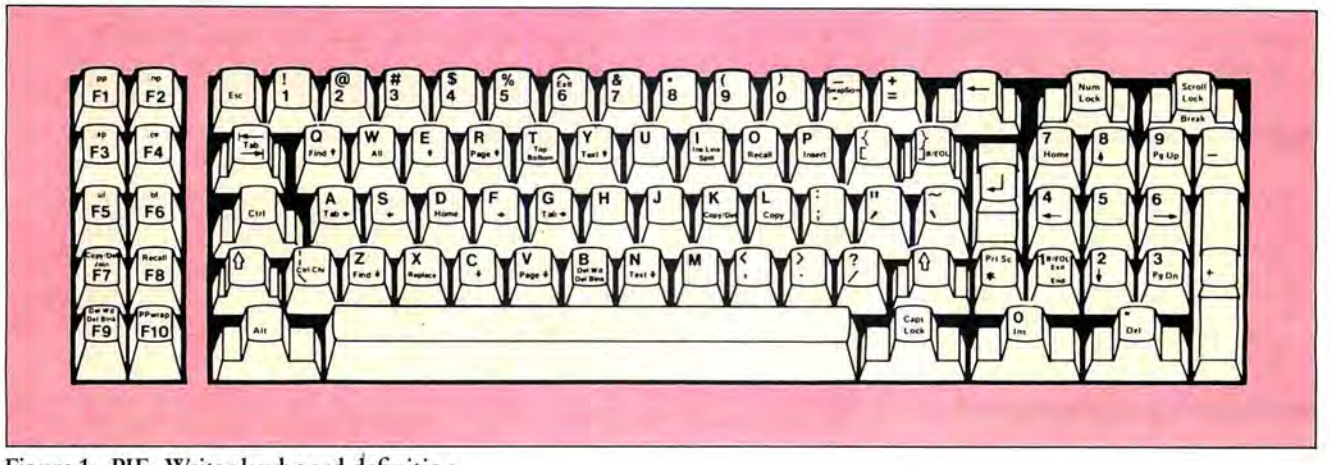

Figure 1: PIE: Writer keyboard definition

go on to the next page. Text can be indented at varying levels by typing .in plus a number. For example, the first paragraph of an outline might be indented five spaces (.in 5). The next indent can be specified by typing .in+5. A five-space indent can be negated by .in-5 or .in.

Sound complicated? Remember that *PIE: Writer* had its origins on multifunction computers that didn't have spare keys for extra word processing instructions. Fortunately, this PC version has incorporated the use of the function keys to generate automatically some of the dot commands and other directions previously invoked by using multikey combinations (see Figures 1 and 2). The program provides the option of using the original combinations in case

What You Format Is What You Print

Now comes the true test of your dot command skills. Once the text is input and edited, run it through the formatter. At the end of the edit session you can bypass the main menu and invoke the formatter directly. <Esc>-F-<End> brings up options to format to the screen or the printer. <Esc>-X-<End> formats directly to screen. Until you're proficient with the dot commands, it's best to have the formatter output first to the screen. You can choose to have the formatter pause at the end of each screen of text or you can let it rush through to the end of the file.

create standard letters with variables. The variable list can be a multifunction file so that the program can skip over fields that are not relevant to a specific merge task. *PIE: Writer* also has the ability to combine other files with the file currently being processed; files can be chained together to print out as one long document.

The Speller

The most innovative feature of *PIE: Writer* is its integration with *The Speller*. *The Speller*'s documentation warns that spelling checkers aren't perfect. They can't tell you that *he* should be *the* or that *there* should be *their*. But, unlike their human counterparts, spelling checkers don't miss

errors if the errors are within their capacity to catch.

The Speller checks all the words in your document, throws out duplicates, and compares words against its 22,000-word stock dictionary or against a dictionary you create. This process is very fast; my 3700-word document (about 13 double-spaced pages) took 1 minute 50 seconds to compare.

After completing the compare process the program asks if you want to display a list of suspect (or legitimate) words, print a suspect (or valid) list, check each word individually, scan the words in the context of the document, run a user-created dictionary, review your corrections, or exit the program.

PIE: Writer provides both split-screen editing and alternate-screen editing.

When using check or scan, you are further prompted to determine whether you want to accept the word as is, accept it and add it to a personal dictionary, replace it with a corrected spelling, or postpone action. For instance, you might be able to verify or correct most of the words from the check option in which each word is displayed individually. There may be a few words on which you want to postpone action until you see them in context. You can then run the scan, and the program will bypass all words accepted during the check process and display only the postponed words. *The Speller* has flexible options for viewing suspect words and for dispensing with them.

When you exit the program, you have the option of adding the accept/save words to your personal dictionary or to a document-specific dictionary. However, you can't direct some words to one dictionary and the others to another dictionary. If any suspect words were changed, the program asks if you would like the file automatically updated.

The entire process took less than 9 minutes on my 3700-word file on the first pass; it took only about 5 minutes after I weeded out most of the suspect words. The program prevents you from altering its main dictionary, but you can put anything you want (including misspelled words) into the personal dictionary. Mistakes can be edited out of the personal dictionary using the DOS editing function.

<F1> Enters a .pp at the cursor, for a new paragraph
<F2> .np, or new paragraph without indents or fill
<F3> .sp, or one blank line
<F4> .ce, or center one line of text
<F5> .ul, or underline one line
<F6> .bf, or boldface one line
<F7> <Ctrl>-K, or delete a line and save it in memory
<F8> <Ctrl>-O, or retrieve whatever is in memory to the screen at cursor
<F9> <Ctrl>-B, delete a word
<F10> <Esc><Enter>, set or reset PPwrap Mode

n = number of lines; t = string divided into left, center, and right fields; str = any string of letters and/or numbers; c = any single character

Figure 2: PIE: Writer function key definitions

True Integration

If you're using *PIE: Writer* with an integrated copy of *The Speller*, you can invoke *The Speller* during the editing process by typing <Esc>-S-<End>. *The Speller* acknowledges any *PIE: Writer* file chaining and checks all the chained files. When you return to the edit mode, any spelling corrections already will have been incorporated into your document file. You can also go straight from *The Speller* to the format processor.

The Speller can also be used with files generated by other word processing programs as long as they are converted to standard ASCII files. This isn't as easy as the integrated configuration, but it still works. If this conversion routine strips out the original format codes, you can use the print function of *The Speller* to list errors, then search and locate the mistakes in the original file.

PIE: Writer does not emulate a dedicated word processor nor does it duplicate the ease of use found in many new word processing programs. The program lacks some of the more obvious capabilities desirable in a word processor, such as background printing, hyphenation, columnar decimal alignment, or underlining spaces or punctuation.

Compared with other word processing programs, *PIE: Writer*'s line-oriented approach to text editing is cumbersome. *PIE: Writer* comes from the other side of the world in terms of what-you-see-is-what-you-get, and for me learning it was like learning a foreign language. Yet it has a long list of versatile features to offer, attested by 105 editor commands, 49 text formatter commands, and 14 communications and auxiliary commands. If you have used *PIE: Writer* on other computers, you can easily migrate to the PC and find additional capability in terms of memory, speed, and functions.

The most important attribute of *PIE: Writer* is its ability to integrate with *The Speller*. If you're looking for a spelling checker and you're not frightened by learning a long list of commands, *PIE: Writer* may be the package to pick.

Janis L. Maguire is a consultant at Peat, Marwick, Mitchell & Co. and has been involved with office automation for 12 years.

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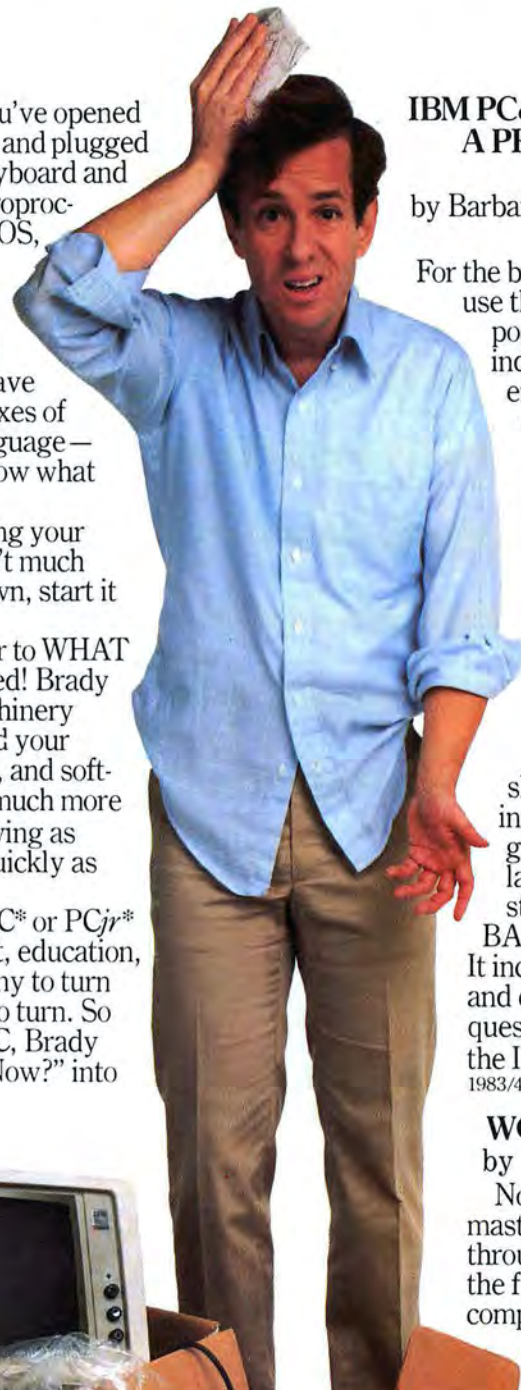

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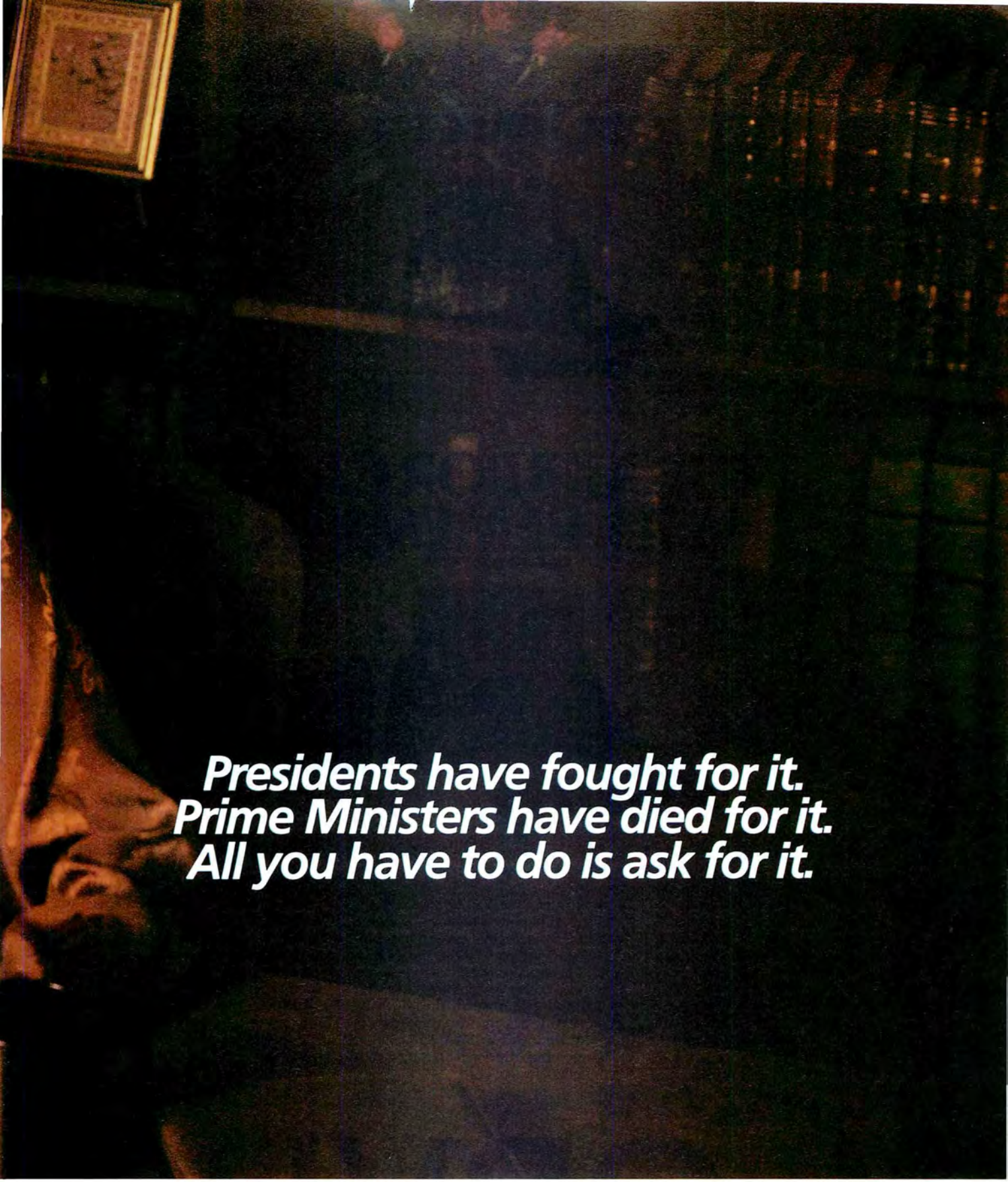

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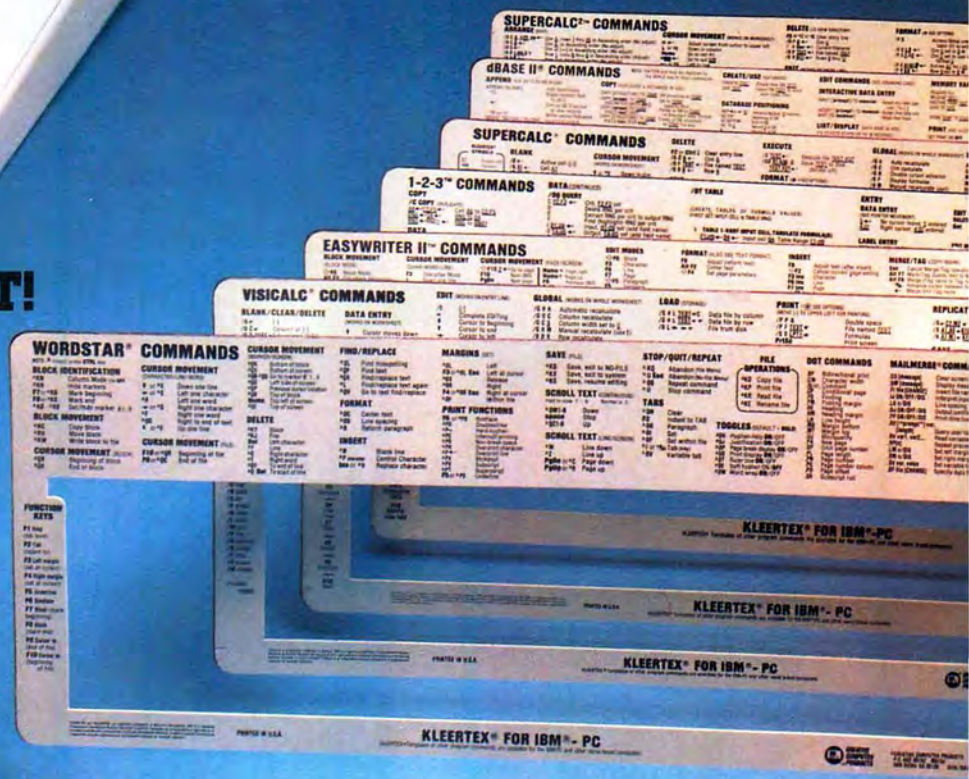

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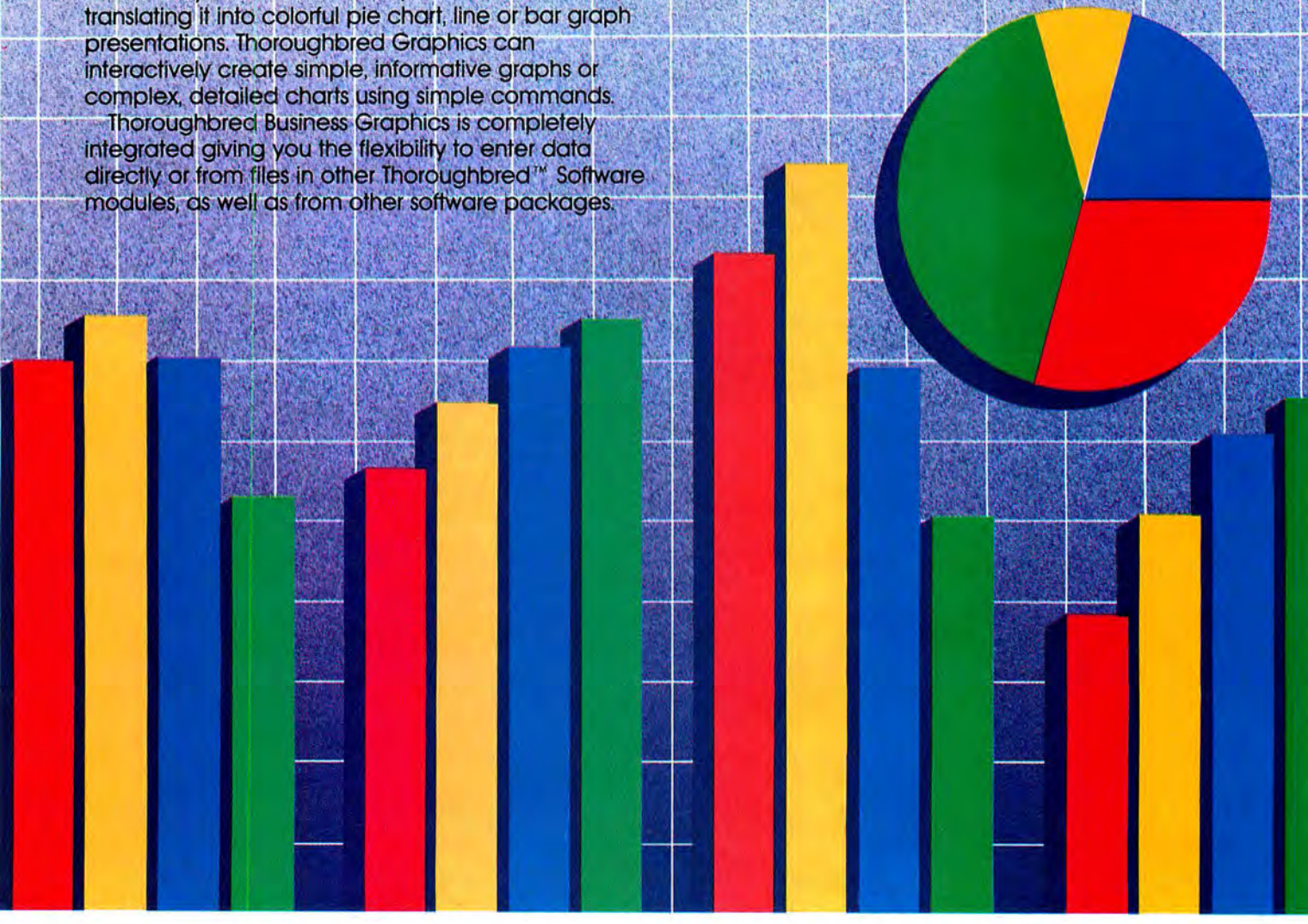

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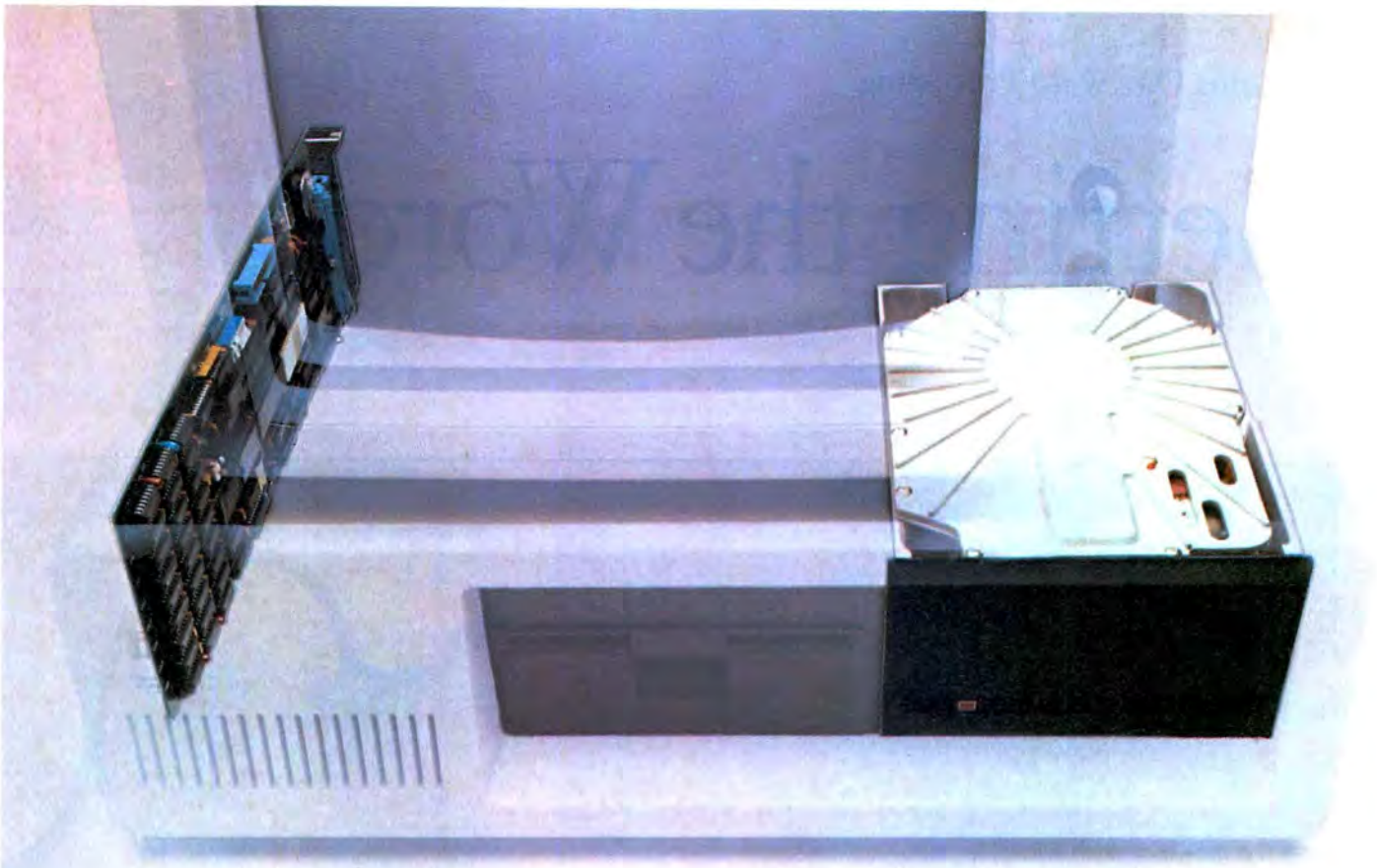

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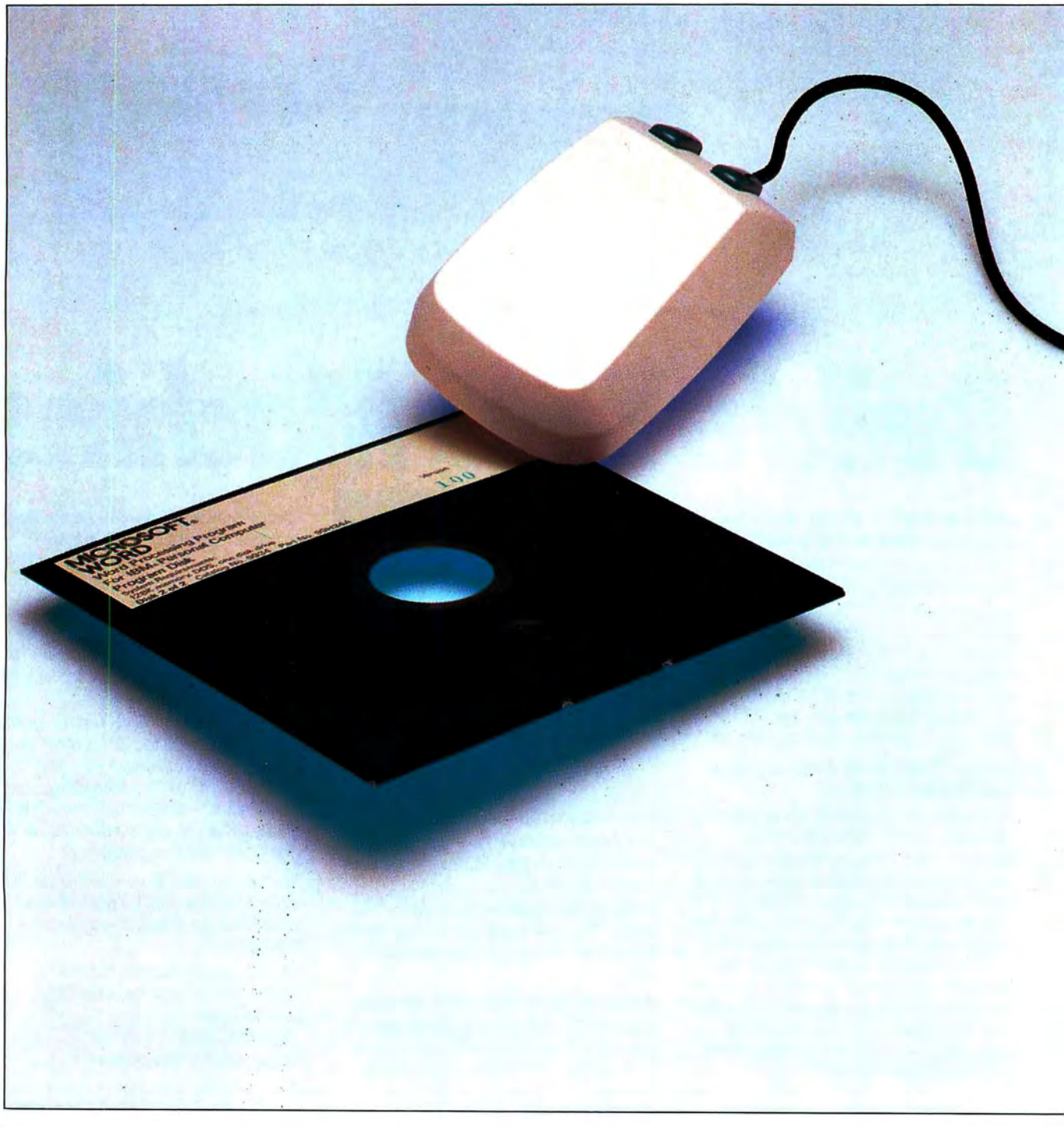
Getting the Word



Burton L. Alperson

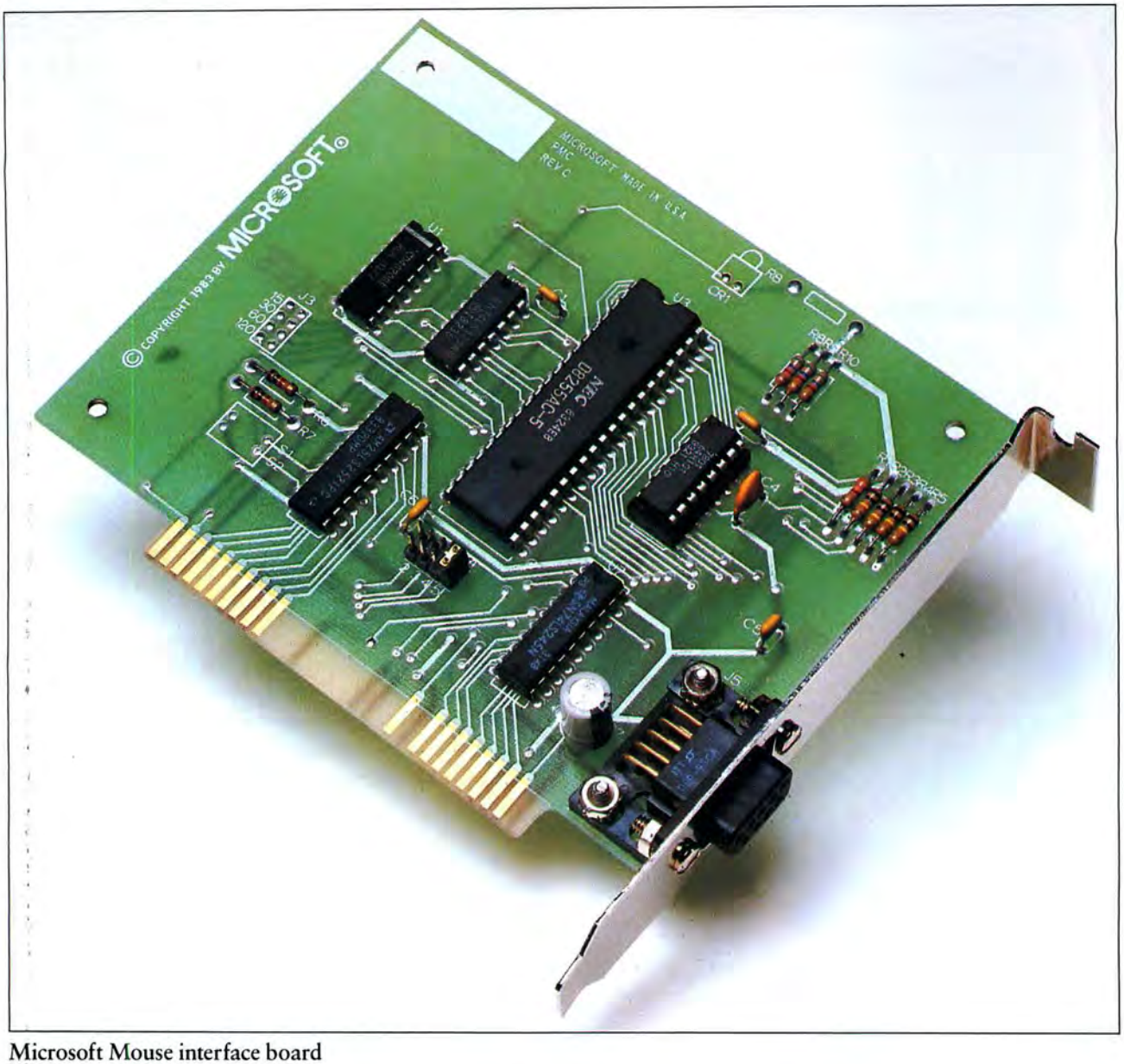
The marriage between screen orientation (what-you-see-is-what-you-get) and complex formatting is still a little rocky in today's word processors, but Microsoft's new word processing program, Microsoft Word, *has managed to integrate these frequently conflicting features.* Word's *flexible formatting capabilities allow you to store one or more style sheets with every document you create. This article guides you through the elemental functions and hierarchies of* Word *and shows you how to set up sample style sheets for a scientific article, a film script, and a file to be displayed on the computer's screen.*

Word provides an embarrassment of riches. While other microcomputer word processors offer some of the features available in *Word*, none has combined features such as screen orientation, different format styles, and stored vocabularies in a single package. These advanced capabilities have been interwoven with outstanding human engineering (see "War of the Words," *PCW*, Vol. 1, No. 8).

However, no major advance in technology can be achieved without penalty. To use *Word* to best advantage, one must master new concepts. While they are not particularly difficult to understand and use, they are unfamiliar to people who have been using other word processors. Microsoft's cryptic documentation makes these concepts unnecessarily obscure.

Word's Hierarchy

Before discussing the advanced features of *Word*, one must address the way the program structures a document. Three concepts are particularly important: divisions, paragraphs, and characters. It is most useful to



Microsoft Mouse interface board

view these concepts as members of a hierarchy: characters exist within paragraphs; paragraphs exist within divisions. In general, a division is any portion of a document that maintains a consistent page layout. For some documents it may be necessary to define only a single division. A term paper, a letter, a memo, and the chapters of a book are examples of documents that probably would require just one division. If the document includes such items as a table of contents, an appendix, a specially formatted title page, and tabular material with special formatting requirements, other divisions become necessary. The definition of a division depends on consistent formatting rather than length.

Formatting a division includes deciding whether you want page numbers and defining the physical parameters of the paper and margins, the placement of page numbers, the type of automatic page numbering (Arabic, uppercase or lowercase Roman, uppercase or lowercase alphabetic), the starting page number, and the locations of footnotes and running heads. You can define or change these parameters only by telling *Word* to format a division; they cannot be selected from any other menu.

A "paragraph" is any block of text that ends with <Enter>. This is a common definition in most word processors. Formatting at the paragraph level enables you to set the alignment of paragraphs (flush left, centered, flush right, justified), the amount and type of indentation for first lines of paragraphs (a negative number

produces a "hanging indent," a positive number produces a normal indent, and 0 produces a block paragraph), the amount of indentation for lines other than the first line (e.g., for extended quotations), line-spacing within and between paragraphs, and whether a paragraph can be broken between two pages.

The lowest level of the *Word* hierarchy is the character. In character formatting you decide how you want any set of characters to look in the document. Many of the parameters under your control at this level are called print enhancements in other word processors. Character formatting controls boldfacing, italics, underlining, small caps, cases, double underlining, subscripting, superscripting, overstriking, print fonts, and font sizes.

> Using *Word* for only the simplest tasks seems like a shameful waste of power.

Galleries and Glossaries

To use *Word* in the simplest possible way, you need learn little more than the keyboard conventions and the concepts of divisions, paragraphs, and characters. The worst that can happen is that you won't have much more power at your disposal than you'd have using *WordStar.* However, using *Word* in this way is like driving a Porsche at 55 miles per hour. It does the job but seems like a shameful waste of power.

A few additional concepts will enable you to take advantage of the full power of *Word.* All the parameters under your control for divisions, paragraphs, and characters may be saved in a special file called a style sheet. If you have created a document with a previously saved style sheet, this style will be applied automatically to the document. Each time you return to the document it will be loaded into memory with all its margins, tabs, and other formatting information intact.

Moreover, you can alter formats by attaching different style sheets to a document. It's useful to have a draft and a final sheet for each style you wish to define. The only difference between the two sheets might be that the draft style is single-spaced and the final style is double-spaced. This practice enables you to have more text on the screen for editing and composing and yet to retain the ability to print a double-spaced final version quickly.

Such a strategy is not practical in other word processors, which require you to reformat manually, paragraph by paragraph. In *Word,* only a few keystrokes are necessary to attach any style to an entire document. Typing <Esc> F S S *style* tells the program to engage the menu (<Esc>), format (F), style (S), and sheet (S) and type the name of the style or point to it in a list of styles (*style*).

You can keep a collection of style sheets on file in a menu called a "Gallery" (*Word*'s term to describe a library of styles). Your gallery might contain separate styles for articles, letters, memos, documents to be telecommunicated, documents formatted for CRT representation, and others. Each of these styles might exist in draft and final forms.

Style attributes are easy to invoke. If you have defined the way you wish a normal paragraph to look and named this attribute "NP," you need only type <Alt>-N P to begin typing normal paragraphs. This attribute will remain in force until you change it by engaging another attribute.

The "Glossary" is another way of saving and retrieving information relevant to a document or document type. If you repeatedly use certain words, phrases, paragraphs, or pages, you may assign an abbreviation to the string in one or more glossaries. Inserting the item in your document requires nothing more than typing the abbreviation and striking <F3>. You can use any glossary with any document, just as you can use style sheets.

Glossaries may contain limited formatting information as well as words and phrases. You can include information about hard page breaks with the text. If a glossary item has been saved in centered format, it will be inserted in centered format if the style of the document permits it.

Creating Style Sheets

Each style attribute you define has a specific purpose. It might exist to format a division, a paragraph, or characters. *Word* suggests several alternative labels for each of these purposes. These labels are called "usages."

When you define the styles for divisions, for example, you can employ the usages Normal, Front Matter, Appendix, Index, Contents, and Other. The names are meant to be suggestions; you don't have to use Appendix as a usage for an appendix. But you must choose one of these labels.

If you call a division Normal, you are telling *Word* that you wish this attribute to be the default for the style sheet. If you name a style sheet Normal, it will load automatically with the program and remain in force until you override it.

The suggested usages for paragraphs are Normal Paragraph, Nested, Footnote, Quotation, Table, Heading, List, Title, Author, Affiliation, Copyright, Running Head, and Other Paragraph. Usages available for characters are Normal Character, Emphasis, Index Term, Figure Reference, Sequence Number, Folio (page number), Superscript, Subscript, and Other Character.

Interpersonal Phenomenology as a Function of Sexual Orientation, Gender, Sentiment, and Sex Roles in Long Term Dyadic Relationships

Studies of marital relationships have demonstrated the importance of factors such as perceived similarity between the person (p) and other (o) (Burgess, Locke, & Thomes, 1971; Dymond, 1954, Murstein & Beck, 1972), p's validation of o's self concept (Laing, Phillipson, & Lee, 1966; Lucky, 1960), p's expectations that o agrees with p (Hawkins & Johnson, 1969; Ort, 1950), p's feelings of being understood by o (Laing, et al., 1966; Navran, 1967), understanding, or the accuracy with which p expects agreement or disagreement (Christensen & Wallace, 1976; Corsini, 1956; Dymond, 1954; Laing, et al., 1966; Murstein & Beck, 1972; Newmark, Woody, & Ziff, 1977; Tiggle, Peters, Kelley & Vincent, 1979) and realization or the accuracy with which p feels understood and misunderstood by o (Laing, et al., 1966). These variables have been shown to be related to enduring and satisfying heterosexual marriages.

Figure 1: Sample manuscript paragraph in APA format

These predefined usages may not supply enough options to meet all your needs. For example, you might need several kinds of headings, such as centered uppercase, centered lowercase, and flush left underlined. Here the concept of a "variant" becomes useful. You can label the most common heading variant 1, the next heading variant 2, and so on.

Scientific Style

When I write a journal article I am required to use a format prescribed by the American Psychological Association (APA). The format is detailed and rigid and has been adopted by many scientific disciplines. Consequently, the APA style serves as a useful model for the construction of style sheets for articles.

Figure 1 shows part of a typical manuscript page in APA format. Listing 1 shows *Word*'s representation of the style sheet responsible for formatting the manuscript. I have saved the style sheet under the name APAPS.STY to indicate that it produces final copy in APA format with proportional spacing. The style sheet in Listing 1 was printed by using the Print command in *Word*'s Gallery menu.

I have rearranged the items in Listing 1 from the order in which they were written so that I can use the screen display of the sheet for fast reference. Items that I seldom need are placed toward the end of the document. Rearranging style attributes is easy, since style sheets can be edited in much the same way as other documents.

```
1      Emphasis a                                    NORMAL CHARACTER
         BoldPS (roman a) 12.
2   U  Emphasis d                                    UNDERLINE
         BoldPS (roman a) 12 Underlined.
3   B  Emphasis b                                    BOLDFACE
         BoldPS (roman a) 12 Bold.
4   C  Other paragraph a                             CENTER TEXT
         BoldPS (roman a) 12/24. Centered.
5   -  Subscript 1                                   SUBSCRIPT
         BoldPS (roman a) 12 Subscript.
6   +  Superscript 1                                 SUPERSCRIPT
         BoldPS (roman a) 12 Superscript.
7   TI Title a                                       APA TITLE PG: TITLE, AU, AFF
         BoldPS (roman a) 12/24. Centered.
8   RH Running head 1                                APA RUNNING HEAD FORMAT
         BoldPS (roman a) 12/24. Flush right, right indent 15 p10.
9      Folio a                                       BOLDPS PAGE NUMBERS
         BoldPS (roman a) 12.
10  H1 Heading 1                                     HEAD-    5 LEVELS
         BoldPS (roman a) 12/24 Uppercase. Centered (keep in one column).
11  H2 Heading 2                                     HEAD-12345 LEVELS
         BoldPS (roman a) 12/24. Centered (keep in one column).
12  H3 Heading 3                                     HEAD-   45 LEVELS
         BoldPS (roman a) 12/24 Underlined. Centered (keep in one column).
13  H4 Heading 4                                     HEAD- 2345 LEVELS
         BoldPS (roman a) 12/24 Underlined. Flush left (keep in one column).
14  H5 Emphasis c                                    HEAD-  345 LEVELS (+TAB & .)
         BoldPS (roman a) 12 Underlined.
15  OP Other paragraph d                             BLOCK PARAGRAPH
         BoldPS (roman a) 12/24. Justified.
16  NP Normal paragraph                              APA PARAGRAPH
         BoldPS (roman a) 12/24. Justified (first line indent 5 p10).
17  EQ Other paragraph b                             CASE STUDY OR EXTEND. QUOTE
         BoldPS (roman a) 12/24. Justified, Left indent 5 p10 (first line
         indent 10 p10).
18  O1 List 1                                        OUTLINE LEVEL 1
         BoldPS (roman a) 12/24. Justified, Left indent 4.2 p10 (first line
         indent -5 p10) (keep in one column).
19  O2 List 2                                        OUTLINE LEVEL 2
         BoldPS (roman a) 12/24. Justified, Left indent 9.2 p10 (first line
         indent -5 p10) (keep in one column).
20  O3 List 3                                        OUTLINE LEVEL 3
         BoldPS (roman a) 12/24. Justified, Left indent 14.2 p10 (first line
         indent -5 p10) (keep in one column).
21  O4 List 4                                        OUTLINE LEVEL 4
         BoldPS (roman a) 12/24. Justified, Left indent 19.2 p10 (first line
         indent -5 p10) (keep in one column).
22  RF List a                                        APA REFERENCE FORMAT
         BoldPS (roman a) 12/24. Justified, Left indent 3 p10 (first line
         indent -5 p10) (keep in one column).
23  ND Normal division a                             APA STANDARD SETUP
         Page break. Page length 110 p10; width 85 p10. Folios Arabic. Top
         margin 15 p10; bottom 15 p10; left 15 p10; right 15 p10. Top running
         head at 7.5 p10. Bottom running head at 5 p10. Footnotes at end.
```

(continues)

Listing 1: Style sheet for APA format

```
24 TD Other division a                                    APA TABLE SETUP
        Page break. Page length 110 p10; width 85 p10. Folios Arabic at 10
        p10 from top 67.5 p10, from left. Top margin 15 p10; bottom 15 p10;
        left 0.79 p10; right 0.79 p10. Top running head at 7.5 p10. Bottom
        running head at 5 p10. Footnotes on same page.
25 TT Heading 6                                           APA TABLE TITLE FORMAT
        BoldPS (roman a) 12/24 Underlined. Flush left (keep in one column).
26 TH Table a                                             APA TABLE HEADERS
        BoldPS (roman a) 12/24. Flush left (keep in one column). Tabs at: 10
        p10 (right flush), 15.83 p10 (right flush), 21.66 p10 (right flush),
        27.5 p10 (right flush), 33.33 p10 (right flush), 39.16 p10 (right
        flush), 45 p10 (right flush), 50.83 p10 (right flush), 56.66 p10
        (right flush), 62.5 p10 (right flush), 68.33 p10 (right flush),
        74.16 p10 (right flush), 80 p10 (right flush).
27 TB Table b                                             APA TABLE BODY FORMAT
        BoldPS (roman a) 12/24. Flush left (keep in one column). Tabs at:
        7.5 p10 (dec. aligned), 13.33 p10 (dec. aligned), 19.16 p10 (dec.
        aligned), 25 p10 (dec. aligned), 30.83 p10 (dec. aligned), 36.66 p10
        (dec. aligned), 42.5 p10 (dec. aligned), 48.33 p10 (dec. aligned),
        54.16 p10 (dec. aligned), 60 p10 (dec. aligned), 65.83 p10 (dec.
        aligned), 71.66 p10 (dec. aligned), 77.5 p10 (dec. aligned).
28    Footnote reference a                                FOOTNOTE REFERENCE
        BoldPS (roman a) 12 Superscript.
```

Listing 1 *(continued)*

The first attribute created was for the basic APA division setup (Item 23). The first line of this item reveals that the key code is ND, which informs you that you can invoke the attribute at any time by typing <Alt>-N D. The usage is Normal Division, variant a. Variant a combined with the word Normal means that this attribute will be the default value. The second line of the attribute shows the paper size (8½ by 11 inches) and indicates that the page numbers (Folios) will be in Arabic numerals.

> No aspect of an attribute is fixed in concrete.

The rest of the information tells you that margins will be 1½ inches all around, with top and bottom running heads at ¾ inch and ½ inch from the top and bottom of the page, respectively. The last notation indicates that footnotes will be placed at the end of the article.

To create a style attribute, engage the Gallery menu (<Esc> G) and then invoke the Insert function (I). Now you can name the attribute, which entails defining the key code, usage, and variant and supplying any remarks.

Having named the attribute, you may define all aspects of the format. Since the usage has been named Normal Division, you may define only division attributes here. Defining a style format is identical to defining a direct format; you simply choose menu items and make appropriate entries. No aspect of this attribute is fixed in concrete. You may return at any time to modify the name or format.

The next attribute I defined was the default paragraph style (Item 16). The technique for creating this attribute is almost identical to the sequence described above. The only difference is that since the usage has been defined as a Normal Paragraph, you can access Character, Paragraph, and Tab formatting. The item shows that these paragraphs differ from *Word*'s own defaults in the print font, the justification, and the amount of the first line indent. The notation 12/24 means that the print size is 12 points (10 pitch) and the line spacing is 24 points (double-spaced).

Items 1 through 6 reinstate *Word*'s default key codes. If you didn't reinstate these codes you would still have access to the functions, but you would have to precede your commands with an X. For example, you

would have to type <Alt>-X C instead of <Alt>-C to center text. Microsoft's choice of defaults is so natural and easy to remember that I prefer to keep them in their original form.

The choice between character and paragraph usage in Items 1 through 6 is governed by what I wish to accomplish. Subscript, Superscript, and the different Emphasis variants are character usages, which means that I can control the style or vertical location of individual characters in a line. The Other Paragraph usage gives me access to centering and line spacing.

Item 7 controls almost all aspects of an APA title page: title, author, and affiliation. The only element that remains to be indicated is the running head, which must appear toward the bottom of the title page. This aspect is controlled by Item 15, Block Paragraph style.

Item 9 (Folio a) is supposed to enable you to define the print font of the page numbers. At this writing, the program has a bug and the item does not work. Consequently, I am forced to respond to a prompt to change the print thimble for each page number when I attempt to print on my letter quality printer. Another alternative, using Draft mode for printing, doesn't work with this style sheet because Draft mode produces strange effects on *Word*'s proportional spacing algorithms.

Microsoft says the inability to define print fonts for folios will be eliminated in Version 1.1, which should be available by the time you read this. Meanwhile, they have found a way around it: enter the Running Head menu, select the page command, and press <Alt>-<Space> <Space>. The program will recognize the style sheet attribute and behave properly.

APA reference style requires the first line in each reference to be flush with the left margin and the remaining lines to be indented by three characters. This is a "hanging indent" in *Word*'s language, and it is accomplished with Item 22.

Headings in APA style must conform to a complicated set of rules. The automatic formatting of all levels of headings in Items 10 through 14 saves a lot of time. The headings are arranged from the highest to the lowest levels. Remarks attached to these items remind me that if I need five levels, I should use the order of subordination H1, H2, H3, H4, and H5. For four levels I should use H2, H3, H4, and H5; three levels require H2, H4, and H5; two levels require H2 and H4; and one level requires H2.

Items 24 through 27 are concerned with tabular material. The techniques described in those items would not work for all APA authors; however, since most of my publications deal with data of a single order of magnitude, shown with two-decimal accuracy, it is helpful to have a consistent table format on file.

Item 24 creates a new division for tables with redefined margins. Items 25 and 26 set up the title and the column headers. Item 26 sets up a series of decimal tabs in the appropriate locations for most of my tabular work. The decimal tabs in Item 27 (Table Body) are coordinated with the flush-right tabs of Item 26 (Table Headers), making it easy to lay out columns with the appropriate headers. I have only to type <Alt>-T D (for Table Division, Item 24) to engage the table format. I can return to standard APA text format at any time by typing <Alt>-N D (for Normal Division, Item 23).

Items 18 through 21 are not part of APA format, but they are so useful that I include them in all style sheets for articles. These items set up any of four hierarchical levels of indentation for outlining. Even if I don't intend to include an outline as part of the text, I can use these items to keep track of the organization of an article. After I've created an outline, I can store it in a file or in the glossary; this technique allows me to refer to the outline rapidly. Another option is to keep the outline constantly in view in one window while working on the text of the article in another window.

Two formatting features in this style sheet, running heads and footnotes, remain to be discussed. *Word* can set up multiple-line running heads with or without page numbers. Item 8 automatically places running heads in APA format (flush right). Creating a running head is a two-step process: definition followed by location formatting.

If you want a flush-right running head consisting of "Getting the Word" on the first line and automatic flush-right page numbering on the next line, first enter the running head area of the document with <Esc> J R (engage menu, jump to running head). Then type Getting the Word<Enter>page<F3>.

Entering page <F3> invokes a special predefined *Word* glossary function that generates automatic page numbering in the indicated location. Since the flush-right format has been defined already as a default in Item 8 of the style sheet, no further action is required for alignment.

However, *Word* still does not know how you want your running head placed on the page. The next step is location formatting. You select the text of the running head, which is still visible on the screen, and engage running head formatting (<Esc>-F R, meaning engage menu, format running head). This option enables you to tell the program where to locate the running head (odd pages, even pages, top or bottom of page) and whether to omit the head on the first page.

Incidentally, one undocumented characteristic of the program can produce problems. You cannot call for page numbering in a division command and also have a running head if the head and the page number are to appear on the same half of the page. The easiest way to solve this problem is to turn off division page numbering and let the running head control page numbering.

CONTINUED:

She tries to get up but cannot. Stuart comes back, a bit annoyed.

MOIRA
I'm too tired.

STUART
No, you're not, you're just talking yourself into it.

He grabs her arm and begins to pull her up.

MOIRA
Please...

STUART
You have to...you have to do it. There's nothing wrong with you.

Moira begins to cry.

MOIRA
Stu, there is...

Looking at her, Stuart's whole demeanor collapses. He plops down next to her and holds her.

STUART
(forcing optimism)
We had to give it a shot, didn't we?

(pause)
We'll come back here again when you're all better. King and queen of the mountain.

Moira looks into his eyes, looks down again, forces a smile. Stuart gently takes her face in his hands and kisses her.

53 ANOTHER ANGLE

From below, CAMERA looks up at Moira and Stuart, including the expansive view behind them.

54 INT. BROWNING BEDROOM - DAY

Moira is standing in front of a full length mirror, as if practicing. She is quite distraught.

CONTINUED:

Figure 2: Sample screenplay format

```
1  C  Heading a                                          CHARACTER
        BoldPS (roman a) 12 Uppercase. Centered.
2  D  Other paragraph a                                  DIALOGUE
        BoldPS (roman a) 12. Justified, Left indent 1.5", right indent 1.5",
        space after 1 li (keep in one column).
3  N  Normal paragraph                                   NARRATIVE (ACTION DESC.)
        BoldPS (roman a) 12. Justified, Left indent 0.75", right indent
        0.75", space after 1 li (keep in one column).
4  P  Heading c                                          PARENTHETICAL
        BoldPS (roman a) 12. Flush right, right indent 3.17".
5  S  Heading b                                          SHOT # & DESCRIPTION
        BoldPS (roman a) 12 Uppercase. Flush left, space after 1 li. Tabs
        at: 0.67" (left flush), 6.75" (right flush).
6     Normal division a
        Page break. Page length 11"; width 8.5". Folios Arabic. Top margin
        1"; bottom 1"; left 1"; right 1". Top running head at 0.5". Bottom
        running head at 0.5". Footnotes on same page.
```

Listing 2: Style sheet for screenplays

Word has an elegant system for automatic footnoting. You move the cursor to the appropriate location for the footnote reference number and engage the Format Footnote mode in the menu (<Esc> F F <Enter>). This action automatically inserts a correctly numbered footnote reference at the cursor location and moves the cursor to the footnote storage area so that you can immediately type the text of the footnote. You can toggle back and forth between the footnote text and the reference location with a Jump command. The footnote reference is appropriately superscripted, since it takes on the default format specified in Item 28 of the style sheet.

Inserting a new footnote reference automatically renumbers footnotes that follow it. Deleting a footnote reference removes the footnote text and renumbers the remaining footnotes appropriately.

Writing in APA format is not normally one of my favorite activities. But I am looking forward to my next journal article so that I can give this style sheet a workout. It is working very well as I write this article.

Script Style

Screenwriters have it tough. In addition to the usual problems that confront all writers, they are faced with complicated and inflexible formatting requirements. Major studios will not even look at an improperly formatted script. *Word* makes producing this format seem like child's play.

Figure 2 is a typical page from a script that has been formatted in the style required by a major studio. Listing 2 shows the style sheet that formatted this script. A separate format is required for each of five aspects of the script. Character references (name of the person speaking) must be uppercase and centered, with no space after the line (Item 1). Dialogue must be in block paragraph style, centered, and indented, with an extra space after each paragraph (Item 2). Narratives or action descriptions must be centered block paragraphs with an extra line after each paragraph (Item 3). The right margin of parentheticals (cues to the actors on interpreting dialogue) must be in the center of the page, and there must be no extra space between the parenthetical and the next line (Item 4). Shot numbers must extend beyond the left and right margins of narratives; shot descriptions (Item 5) must be uppercase.

A script is an interesting application because it demonstrates the usefulness of glossaries. Notice that the word CONTINUED followed by a colon appears in the upper left and lower right corners of the page; studios require this when a given script aspect is continued from one page to the next. The word must appear in the lower right corner preceding the page break and in the upper left corner of the next page. This whole sequence was stored in the glossary under the reference "CP" (a mnemonic for continuation page). After storing it, I had only to type C P-<F3>, and the word and appropriate page break would appear immediately.

```
                    CRT LAYOUT EXAMPLE #1
     This is an example of a CRT layout style.  The paragraph format is an
indented first line with no extra lines between paragraphs.
     You might use a style sheet like this to post a notice on a service
like the one provided by the Source Telecommunicating company called the
SOURCE or the one provided by Compuserve Information Service called
COMPUSERVE.
     Microsoft's WORD  program makes this operation a bit clumsy since it
provides no utility to send formatted ASCII text directly to a file.
```

Figure 3: Sample CRT layout in indented paragraph style

The cast of characters was also stored in the glossary. The first time I typed the character name "Moira," I invoked the Character function from the style sheet with <Alt>-C. This centered the name and displayed it in uppercase. Then I saved this text in the glossary (<Esc> C M, for engage menu, copy to glossary under the abbreviation M). From that point on, I merely had to type M <F3> to make Moira's name appear in character format. All other characters were treated in the same way. I saved the glossary so that I could use it in future sessions without having to redefine the text.

Word gives you the luxury of specifying parameters in inches, centimeters, 10- or 12-pitch characters, or points.

CRT Layout Style

Many microcomputer users frequently need to format documents like the one shown in Figure 3 for display on CRTs (cathode ray tubes). This CRT style is helpful in preparing notices to be posted on bulletin boards or communications services like The Source or CompuServe. One of my few disappointments with *Word* is that the program provides no direct way to accomplish this task. However, a roundabout technique can be employed.

Listing 3 shows a style sheet for CRT formatting. Notice that measurements are specified not in inches but in 10-pitch characters; since the sheet refers to a CRT it is much easier to work in character measurement. *Word* gives you the luxury of specifying parameters in inches, centimeters, 10- or 12-pitch characters, or points. The program automatically handles all necessary conversions.

Items 1 through 3 contain nothing new. They allow for centering, block paragraphs of 74 characters with an extra following line, and indented paragraphs. Item 4 defines the page length to be equivalent to about one screen (23 lines). All margins are set to 0 so that there is no horizontal or vertical offset on the screen.

Word has no direct facility for saving formatted ASCII files. Consequently, after creating your document you must deal with it differently from the way you handle a document for normal printing. The program enables you to save a file in a special form so that you can send it to your printer with all printer control codes intact by using a DOS COPY or TYPE command. Type <Esc> P *filename* (for engage menu, print, *filename*).

To produce a correctly formatted ASCII file, you must trick the program into thinking it is dealing with a crude teletype printer. You can do so by specifying that your printer is a TTY in the Print Options menu; the technique is not particularly elegant, but it works. It would be helpful if Microsoft would add a direct routine for this purpose in a revision of the program.

WordStar to Word and Back

The existence of *Word* puts me in a bind. After a few weeks of using this program, I find it painful to return to *WordStar*. The step from *WordStar* to *Word* feels almost as great as the step from a typewriter to *WordStar*.

```
1  C  Other paragraph b                                    CENTER LINE
        Pica (modern a) 12. Centered, right indent 4 p10.
2  NP Normal paragraph                                     INDENTED PARAGRAPHS
        Pica (modern a) 12. Justified (first line indent 5 p10), right
        indent 4 p10.
3  BP Other paragraph a                                    BLOCK PARAGRAPHS
        Pica (modern a) 12. Justified, right indent 4 p10, space after 1 li.
4     Normal division a                                    CRT LAYOUT FOR TELECOM.
        Page break. Page length 39 p10; width 78 p10. Folios Arabic. Top
        margin 0 p10; bottom 0 p10; left 0 p10; right 0 p10. Top running
        head at 5 p10. Bottom running head at 5 p10. Footnotes on same page.
```

Listing 3: Style sheet for CRT layout

The "house program" currently used by many magazines and journals, including *PC World*, is *WordStar*. Copy telecommunicated or submitted on disk to these periodicals must be in *WordStar* format. Microsoft supplies a *WordStar*-to-*Word* utility with *Word* that converts *WordStar* data files so that they are usable with *Word*. Predictably, they do not supply a utility that works in the opposite direction.

A partial solution to the problem is that *Word* will save unformatted files containing nothing but raw text, including spaces and carriage returns. These files can be read successfully by *WordStar*.

> The step from *WordStar* to *Word* feels almost as great as the step from a typewriter to *WordStar*.

Of course, you must still reformat your document paragraph by paragraph once it is sent to *WordStar*. But at least you end up with a document in a format acceptable to many publications. As clumsy as this procedure is, it is worth the effort to be able to compose and edit text with *Word*. *WordStar* has an established base of users that is unlikely to disappear in the immediate future. There is a real need for a conversion utility that works in both directions.

Word is by no means a perfect program. Some rough edges and bugs should be worked out. Floppy disk access time is very slow (speed enhancements have been promised for Version 1.1). Some of the print routines are problematic, and some of the screen scrolling techniques are disconcerting. In spite of these drawbacks, I would rather use this word processor than any other I have tried. In terms of elegance, power, and potential, it is the *1-2-3* of word processors.

Burton L. Alperson, Ph.D., is a professor of psychology at California State University at Los Angeles and a Contributing Editor to PC World.

Editor's note: PC World *requires that articles be submitted or telecommunicated in "clean" ASCII format—using ASCII characters 32 through 127 only. Most word processors (including* Microsoft Word*) can produce files in this format. We also accept articles prepared in* WordStar*'s document mode, but we request that all submitted articles be devoid of any special formatting control codes.*

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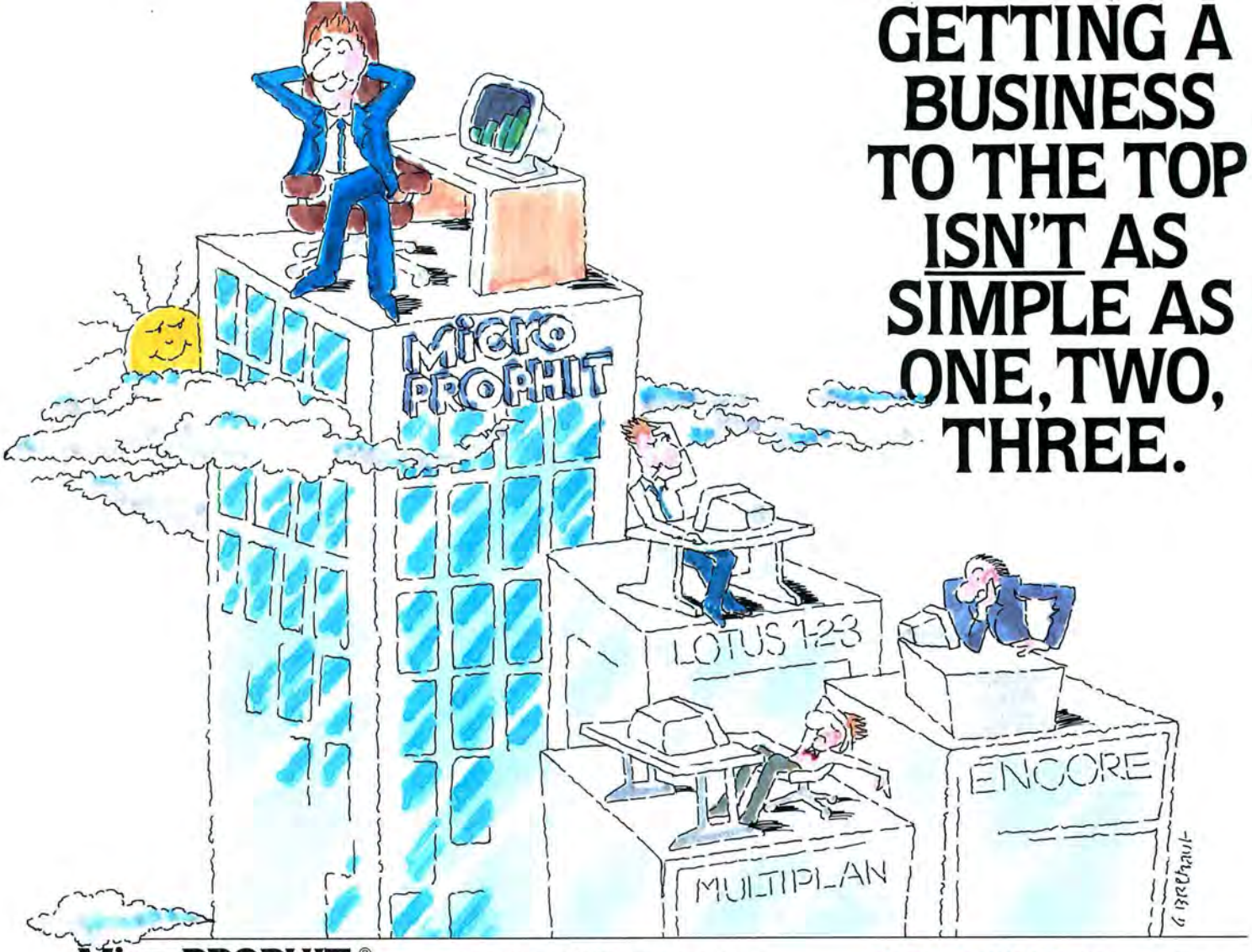

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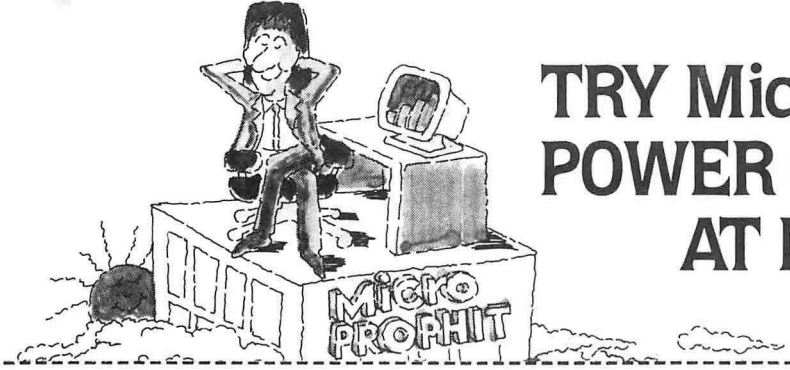

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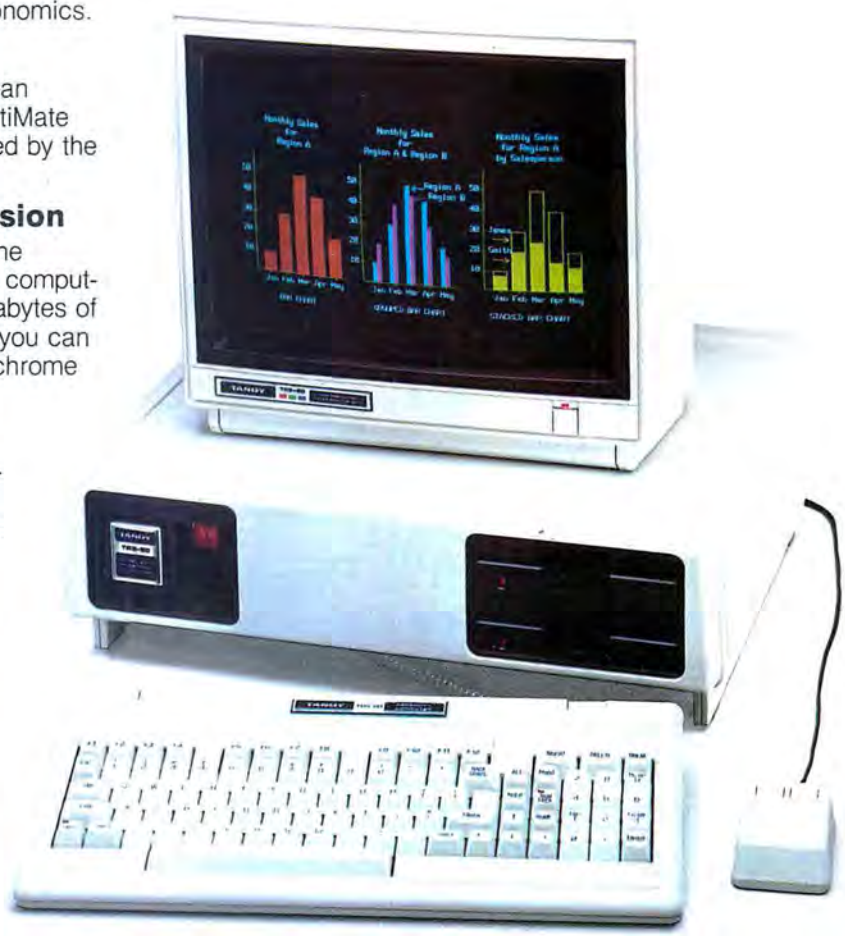

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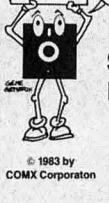

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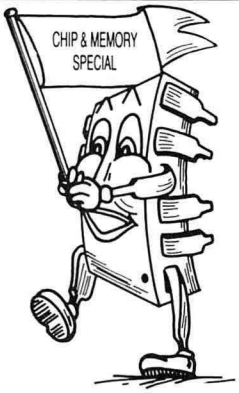

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Communications Concepts

Voyage down the bit stream through the world of full-duplex, half-duplex, simplex, parity bits, and framing errors.

W. David Schwaderer

Telecommunicating with the PC can be a smooth and satisfying experience. In most communications sessions, with a good program and a reliable modem, you don't have to understand how the process works. When troubles pop up, however (and they inevitably do), it is almost impossible to restore the connections unless you have at least a general understanding of communications concepts. Too many telecommunications sessions end in data silence and a phone call to an expensive express-mail service. Here are several frequently misunderstood concepts necessary for effective communications troubleshooting and programming.

The Communications Circuit

A communications circuit connects two data communications devices in a way that allows them to exchange information. (In this article, one communicating device will always be a PC; the other may be another PC, a data provider, or a central computer located at a large computing facility. Whatever the other machine is, it will be called the remote system, even though it may be located only inches away from the PC.) The communications circuit goes by many names: the link, the path, the telephone line, or just the line. The physical composition of a communications circuit may include several media, such as copper wire, fiber-optic cable, or even air, as in the case of microwave transmitters.

A single communications circuit may provide one or more communications channels. For example, a circuit consisting of a fiber-optic medium may support over 1000 telephone calls at the same time, each on its own communications channel. A channel is a single data path on an end-to-end communications circuit. Channels are sometimes referred to as facilities.

When you make a long-distance telephone call, your voice is converted to an electrical signal by the telephone; it then begins its journey on a copper wire circuit. This circuit, technically referred to as a local loop, eventually winds its way to one of the telephone company's central offices.

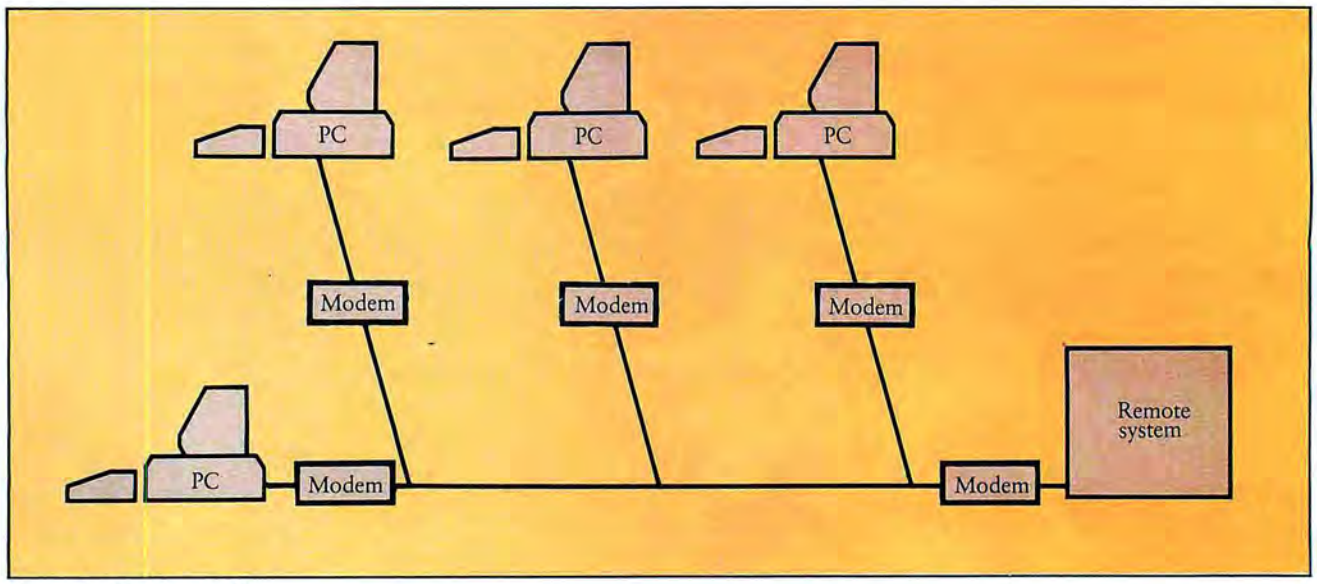


Figure 1: Multipoint line

There, your voice signal may be routed to more copper wires, or it may be digitized, placed on a glass fiber-optic cable with over 1000 other calls, and carried to a microwave transmission system that delivers it, perhaps via satellite, to another telephone company central office near the person you are calling. At the second telephone station your voice signal may be placed on another copper wire for delivery to the person you wish to speak to. In this way, a communications circuit may be composed of several different communications media, each providing more than one data channel.

Types of Connections

If a PC is connected to a remote system via a dialed telephone call, the line used is called a switched line. Switched lines are fine for many types of communications, but for high-speed transmissions requiring a high degree of accuracy, such as financial data transfers, switched lines are inadequate because of their unpredictable transmission line quality and susceptibility to electromagnetic interference. Therefore, it is often necessary either to connect directly to the remote system via an in-house, direct-connect line or to have the phone company install a permanent connection called a leased, or private, line.

Leased lines are more or less permanent and therefore not subject to the random quality of switched line connections, which are constructed "on the fly" to service a call and then dismantled after it is completed. A good way to think of a leased line is to imagine a pipe with no valves or switches.

A leased line costs more, but it can transmit more error-free data traffic per hour than a switched line—an important consideration for businesses. A leased line requires special installation, continued monitoring, and "tuning" by the telephone company. One way to determine if a line is leased is to install telephones on each end. If you can talk to the other end without dialing or hearing a dial tone, you're on a leased line.

Another advantage of leased lines is that you can use the same circuit to link more than one PC to a remote system (see Figure 1). Lines with multiple PCs connected to the remote system are called multidrop or multipoint lines, as opposed to point-to-point lines. Such lines are analogous to telephone party lines.

Data Communications Modes

Suppose you have established a telephone connection between a PC and a remote system. You can use this connection in one of three data communications modes: simplex, half-duplex, or full-duplex (see Figure 2).

In simplex mode data moves in one direction only; one computer acts as the transmitter and the other acts as the receiver. Conventional radio, television, and stock exchange ticker tapes are examples of one-way communications.

In half-duplex mode data can move in both directions, but not simultaneously. If one machine is transmitting, the other is receiving and is temporarily prohibited from

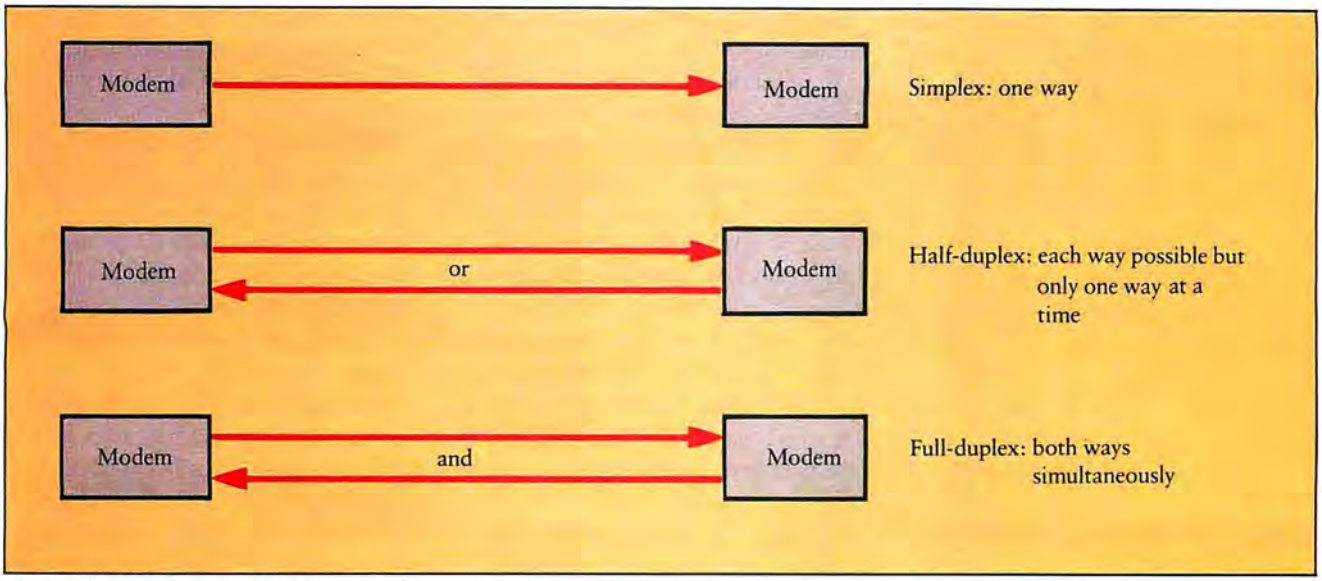


Figure 2: Data communications modes

transmitting. Half-duplex mode is like a narrow bridge that is wide enough for only one car; while cars can proceed both ways, only one direction can be used at a time. Traffic going in one direction must wait for oncoming traffic to clear the bridge. Another example of half-duplex communications is a CB radio; two-way communication is possible, but only one party at a time can talk on a given channel.

In full-duplex mode data communication is both two-way and simultaneous; both computers on a circuit can transmit and receive simultaneously. The two simultaneous transmissions may or may not be related. The two individual transmissions occur on separate communications channels, which combine to form a full-duplex connection. Consider a two-way, multilane freeway. Traffic flows in both directions, and the traffic flows are unrelated.

Two- and Four-Wire Lines

In many communities traffic control authorities have designated certain multilane streets as one-way streets. Even though a given street is wide enough for traffic to move in both directions, traffic is allowed to proceed in only one direction. If two-way traffic is needed in the area, an adjacent street is often designated as one-way in the opposite direction. These conventions lead to a more efficient traffic flow.

> Half-duplex mode is like a narrow bridge that is wide enough for only one car.

A typical telephone line connected to a home telephone has four wires, but only two of them are used to carry your voice. Any data communication over such a connection is referred to as two-wire data communication. Two-wire lines are capable of full-duplex communications, but, as in the one-way streets just mentioned, two-way traffic may not be efficient, or more likely, sufficient. The connection may not let enough traffic pass during rush hour.

One common solution to this problem is to install another telephone line and to designate each line as a one-way path. Each telephone line is therefore considered a big simplex link, even though it is capable of full-duplex communications. Since two telephone lines are involved, each having two communications wires, any data communication over such a connection is referred to as four-wire, leased-line data communication.

Software Line Protocols

Users may determine how a particular line is used, even though the line may have several capabilities. One capability (e.g., transmission simultaneity) can be traded for another (e.g., increased instantaneous single-direction throughput). Telephone line connection hardware (modems) or

software can perform this capability redefinition. However, if a given communications medium is capable of only simplex data flow, you cannot conduct full- or half-duplex communications. Similarly, if a communications medium is capable of only half-duplex data flow, you cannot conduct full-duplex communications.

Some data processing applications (for example, some IBM VM/370 applications) operate in a half-duplex manner even though the connection is capable of full-duplex communications. Such an application sends out a burst, or phrase, of data and then expects to receive a burst in return. Thus, a half-duplex protocol is observed on a full-duplex link.

> In contrast to the start bit, the inclusion of a parity bit with data characters is optional.

This method is different than a half-duplex mode achieved via a modem, because in the case of a modem the hardware trades off transmission simultaneity for increased instantaneous single-direction throughput. Specifically, the modem tells the PC when it can transmit. When the PC begins transmission, it does so at a more efficient transmission rate because it temporarily owns all the "traffic lanes" of the communications circuit.

In practice, the efficiency of this mode of communication is affected by activities collectively referred to as line turnaround. In some communications sessions (e.g., with an IBM VM/370 system), half-duplex line turnaround over a full-duplex line is achieved by software without hardware involvement. Special data characters called turnaround characters transfer transmission "rights," signaling that the transmitting party has completely transmitted its burst of data. For example, a VM/370 application could send your PC a burst of data and then signal that it was ready to receive data from the PC by appending a turnaround character to its burst of data. In CB terms, the VM/370 application is saying "over" and "back to you."

A VM/370 turnaround character that is received by the PC is called an inbound turnaround character. When the PC has finished sending its reply to the VM/370 application's data, it signals the VM/370 by transmitting an outbound turnaround character. The inbound and outbound turnaround characters do not have to be the same data characters.

The VM/370 software signal used in its half-duplex protocol has a major advantage over a hardware signal. The VM/370 software approach does not involve line turnaround inefficiencies, which can be substantial in highly interactive environments. However, to perform instant line turnaround, one of the two half-duplex traffic lanes must always remain idle while the other lane is in use. The turnaround characters act in much the same way as a highway safety crew controlling traffic around a multilane highway construction site. First one direction is allowed to proceed. The last car is identified by placing a special sign or flag on it so that workers at the other checkpoint will recognize it as the last car in the traffic flow. The procedure is then reversed for traffic going in the opposite direction.

This example of half-duplex traffic is different than the one involving the narrow bridge. In this case, traffic is able to proceed in both directions simultaneously but is artificially restrained from doing so. To distinguish this case from the narrow bridge example, it will be referred to as half-duplex protocol on a full-duplex link. This terminology is technically incorrect because the descriptions simplex, half-duplex, and full-duplex are usually applied only to circuits or channels. But the use of "half-duplex" in this context avoids irrelevant debate on communications theory and nomenclature.

Programming considerations for line turnaround are generally much more difficult when hardware (a modem) is involved due to the detailed, exact timings required. This is also true on the PC. In addition to being complex, this kind of line turnaround is largely unnecessary since low-cost, high-speed, full-duplex modems are now available that can readily be used to implement half-duplex software protocols on a full-duplex line.

The Hardware Break Signal

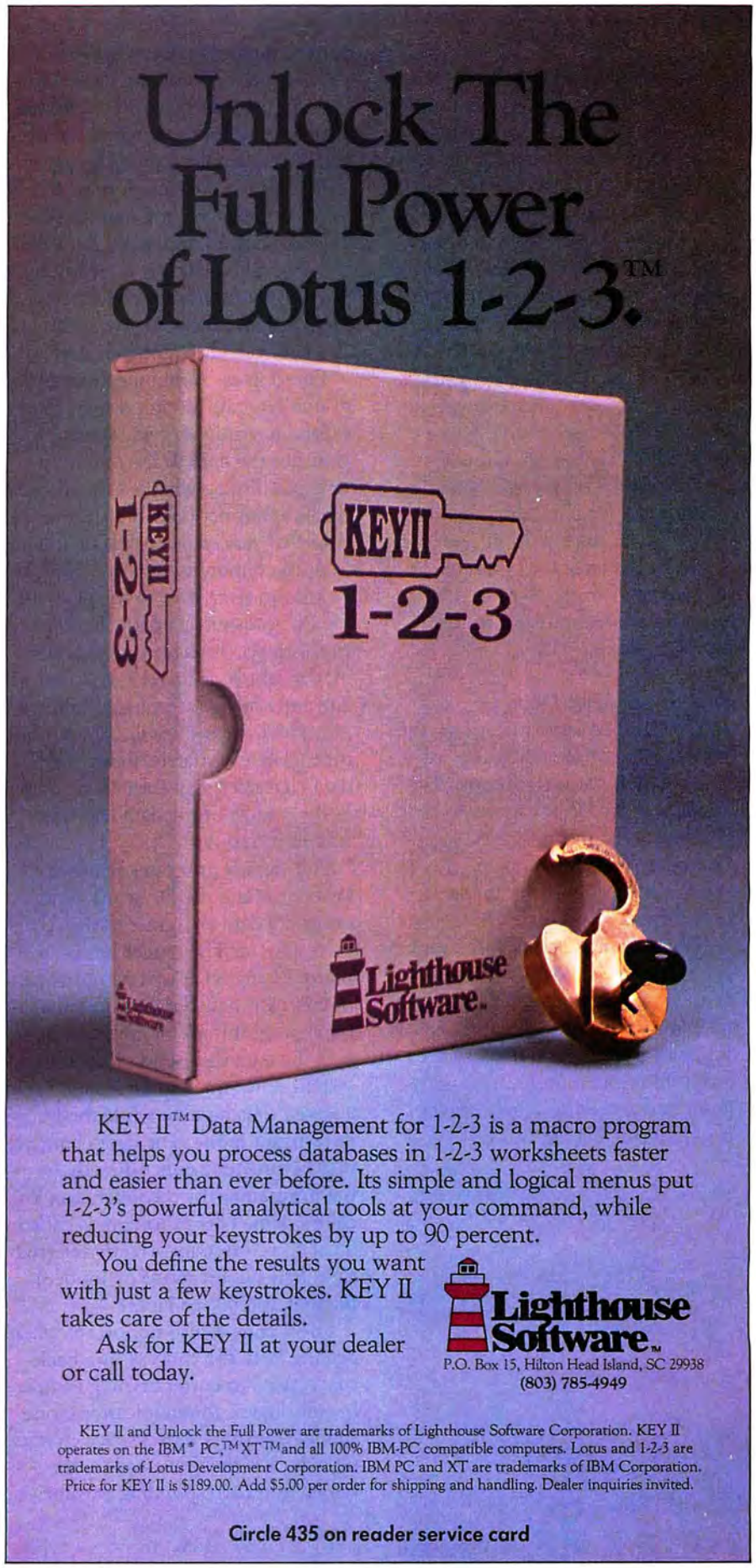
The break signal indicates to a transmitting party that there is a problem at the receiving end of the line. Suppose a remote system begins transmitting a large mass of data to your PC and you discover that you don't want the data or cannot assimilate it at its rate of transmission. In either case, you have a predicament that can be solved by either temporarily or permanently terminating the data

transmission. Somehow, you must be able to signal the remote system that you have a problem.

If you are connected to the remote system via a simplex connection, you probably will have to make a separate phone call and ask someone to shut off the transmission. If you are connected to the remote system via a full-duplex connection, procedures usually exist to interrupt the data transmission either temporarily or permanently by sending a special data control character. However, if you are communicating with the remote system in a half-duplex manner, you are in a difficult situation.

> Turnaround characters act in much the same way as a highway safety crew.

Following the rules of half-duplex transmissions (as determined by either hardware or software conventions), your PC cannot transmit any data character until it receives a signal asking it to. That signal may not arrive for quite a while (days if the remote system's transmission is long enough). Worse, if half-duplex modems are being used, the distant transmitting modem cannot hear any signal from your PC's modem because it is too busy transmitting to listen. (The receive circuits of a half-duplex modem usually are disabled while it is transmitting.)



However, if you are observing a half-duplex protocol on a full-duplex link, you can signal the remote system to halt transmission without having your PC send any data. In such a case, the break signal consists of a continuous transmission of binary zeros for a period of time discernibly longer than it would take to transmit a single data character. The exact amount of time required varies from system to system, but generally it ranges from one-quarter of a second to more than a second.

The break signal should not be confused with BASIC's program break (initiated by pressing <Ctrl>-<Break>). To differentiate between the two, the communications break is referred to as a hardware break as compared to BASIC's program break.

Full- versus Half-Duplex

In full-duplex communications, the remote system frequently uses its transmission path to echo the data characters the PC transmits to it. If the data is the result of a PC keyboard key being pressed and a corresponding data character being transmitted, the echoed character will be readily identifiable, assuming the echo transmissions were performed without error. Such a full-duplex implementation is referred to as echoplex and dictates the structure of a full-duplex communications program as opposed to a half-duplex program (see Figure 3).

Echoplexing enables you to monitor the quality of your connection visually on a continuing basis. However, in some instances the reflected character is not the same as the original. For example, CompuServe echoes only uppercase letters. If a PC sends a lowercase *a*, CompuServe echoes back an uppercase *A*. While the reflected character is clearly related to the transmitted character, from a data processing perspective it is an entirely different character.

Full-duplex communications programs generally do not display data sent to a remote system. Rather, they transmit the data to the remote system and display what is echoed back, which is not necessarily the same data that was transmitted. In addition, the remote system may already be transmitting data to the PC when the PC transmits its data character. In this case, the echoed character may be appended to the data that is currently being transmitted to the PC, which means it will appear some time later. Alternately, the echoed data character may actually pop up in the middle of the data transmission in progress.

Full-duplex programs read the PC keyboard, and the PC sends an appropriate data character to the remote system. The sender has no way of predicting what will be returned. In contrast, half-duplex communications programs are required to display the data they send to the remote system, since the remote system is not allowed to echo data while the PC is in transmit mode. The data character may be provided either directly by the program or by a cooperating local modem. This procedure is called local copy, often incorrectly referred to as half-duplex mode by modem manufacturers (see Figure 4).

Local copy is also important when dealing with the concept of a backspace, used to correct typing errors. In full-duplex communications, one simply transmits a backspace character, which is then reflected on the screen as a corresponding erasure. When communicating with some remote systems, the PC is not allowed to erase data unilaterally on the screen; the remote system must first be notified. There are two reasons for this. First, the remote system must also "forget" the character to be erased and cannot do so if it is never informed of the required backspace. Second, the remote system may be keeping track of the cursor position on the PC display and will not know what the cursor's actual position is if it is indiscriminately moved about the screen for any reason, including character erasure.

Echoplexing enables you to monitor the quality of your connection visually.

In half-duplex communications the situation is not as simple, because a backspace character will never be reflected. Therefore, when a backspace character is transmitted, a half-duplex program must attend to its correction details without a signal to proceed from the remote system. When communicating with remote systems that don't provide a remote echo, a full-duplex program or a local modem must provide a local copy capability in the same manner as a half-duplex program.

Data Representation

Over the decades data communications have been achieved by many methods, such as semaphore and Morse code, which use very different methods to represent the letter *a*.

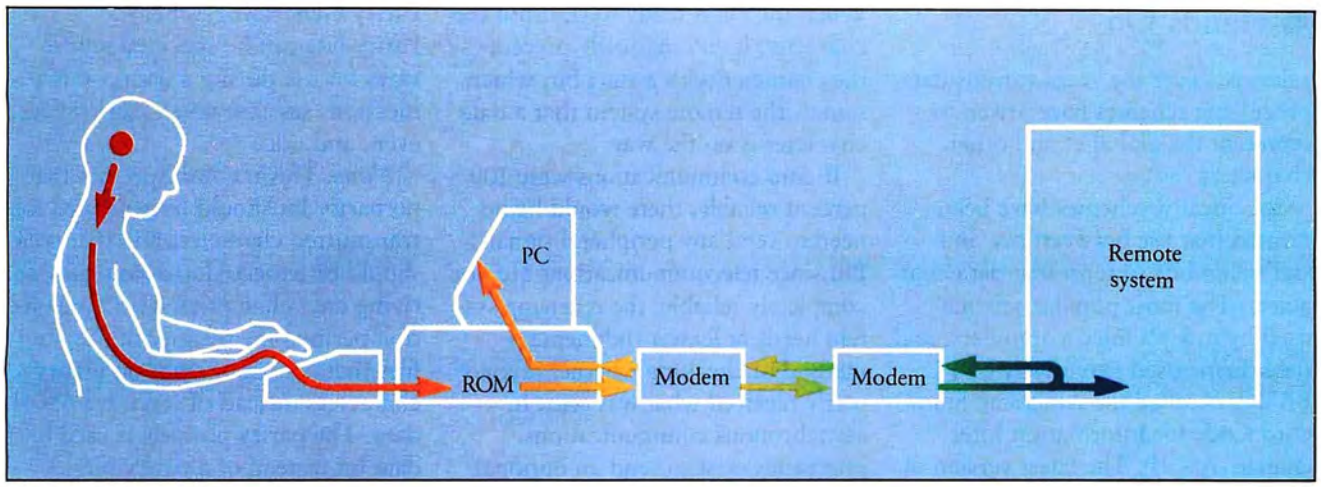


Figure 3: Echoplex

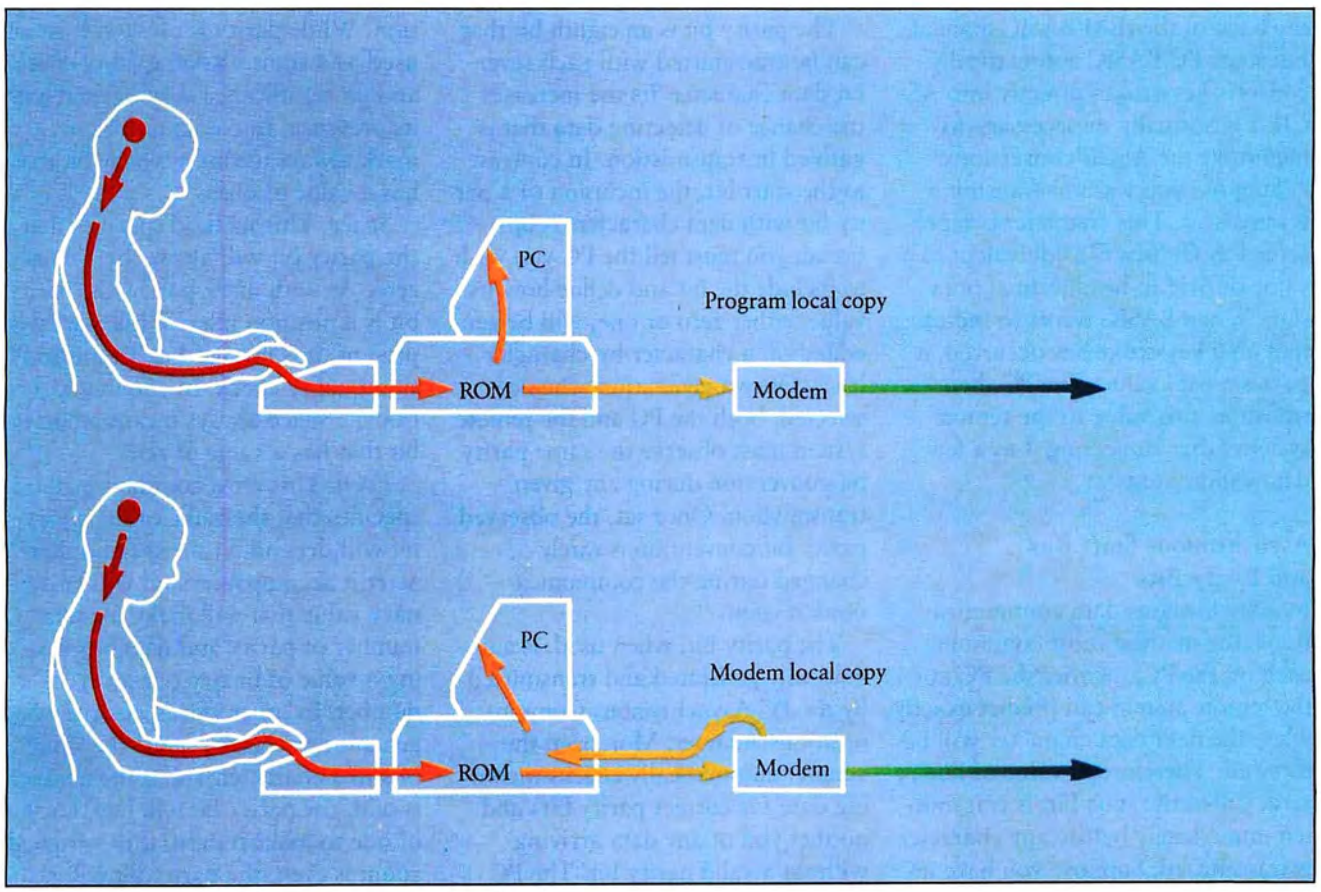


Figure 4: Program local copy versus modem local copy

Likewise, over the years various data processing schemes have arisen to represent the alphabet and other characters.

Specifically, schemes have been created that use between five and eight data bits to represent data characters. The most popular scheme used by today's microcomputers, and the scheme used extensively by PC BASIC, is called the American Standard Code for Information Interchange (ASCII). The latest version of the standard is called the ANSI X3.4-1977, or ASCII 77, standard. ASCII conversions can be found in the back of the IBM BASIC manual, but since PC BASIC automatically converts keystrokes directly into ASCII it is normally unnecessary to memorize the ASCII conversions.

Suppose you want to transmit a lowercase *a*. This character is represented as CHR$(97), equivalent to a value of 61H in hexadecimal notation. When BASIC wants to indicate that an *a* keystroke has occurred, it passes a 61H value. The PC then transmits this value to the remote system (after subjecting it to a few data validity tests).

Asynchronous Start Bits and Parity Bits

In asynchronous data communications (the method most commonly used on the PC), neither the PC nor the remote system can predict exactly when the next data character will be received. Therefore, a value of binary zero, called the start bit, is transmitted immediately before any character is transmitted. Suppose you have instructed the PC to transmit an *a*. When the PC is ready to transmit the character, it automatically precedes the character with a start bit, which signals the remote system that a data character is on the way.

If data communications were 100 percent reliable, there would be no need to send any peripheral signals. But since telecommunications are not completely reliable, the receiving system needs at least a rudimentary method of checking whether it correctly received what was sent. In asynchronous communications, provisions exist to send an optional check bit, called the parity bit, immediately after sending the last data character bit.

The parity bit is an eighth bit that can be transmitted with each seven-bit data character. Its use increases the chance of detecting data that is garbled in transmission. In contrast to the start bit, the inclusion of a parity bit with data characters is optional; you must tell the PC you wish to include the bit and define how its value, either zero or one, will be generated on a character-by-character basis. Once a generation scheme is selected, both the PC and the remote system must observe the same parity bit convention during any given transmission. Once set, the observed parity bit convention is rarely changed during the communications session.

The parity bit, when used, is automatically generated and transmitted by the PC Asynchronous Communications Adapter. Moreover, the adapter automatically checks incoming data for correct parity bits and notifies you of any data arriving without a valid parity bit. The PC and the remote system can sometimes communicate without the same parity schemes, but in such cases the parity will be of no assistance in checking accuracy.

Parity Generating Schemes

Parity bits can be specified in five ways for use during a data communications session: none, mark, space, even, and odd.

None. This method specifies that no parity bit should be generated for transmitted characters and that none should be expected to accompany arriving data characters. The none option permits the transfer of program files that consist of eight-bit binary characters instead of seven-bit ASCII data. The parity position is used by a data bit instead of a parity bit.

Mark. This method specifies that the parity bit will always be a binary one. The parity bit simply fills a position. While parity is present, it is not used as a transmission quality check and no significance is associated with its presence. In communications, a mark always means a binary bit that has a value of one.

Space. This method specifies that the parity bit will always be a binary zero. As with mark parity, the parity bit is a position filler. While parity is present, it is not used as a transmission quality check. In communications, a space always means a binary bit that has a value of zero.

Even. This most common method specifies that the value of the parity bit will depend on the specific character it accompanies and will be a binary value that will make the total number of parity and data bits having a value of binary one an even number. In other words, the parity-generating scheme counts the "one" bits in a character, and if the number is odd, the parity bit will have a value of one to make it even; if the original count is even, the parity bit will be zero to keep it even. Note that if a transmission error changes the value of any two, four, or six bits, this technique will not detect the error. Therefore, using parity bits to check transmission quality is not foolproof.

Odd. This method specifies that the value of the parity bit will depend on the specific character it ac-

ASCII character	Hexadecimal value	Binary value	Parity method				
			Mark	Space	Even	Odd	None
A	41	1000001	1	0	0 (2)	1 (3)	n/a
B	42	1000010	1	0	0 (2)	1 (3)	n/a
C	43	1000011	1	0	1 (4)	0 (3)	n/a
a	61	1100001	1	0	1 (4)	0 (3)	n/a
b	62	1100010	1	0	1 (4)	0 (3)	n/a
c	63	1100011	1	0	0 (4)	1 (5)	n/a

Table 1: Hexadecimal values, binary values, and parity methods for six ASCII characters

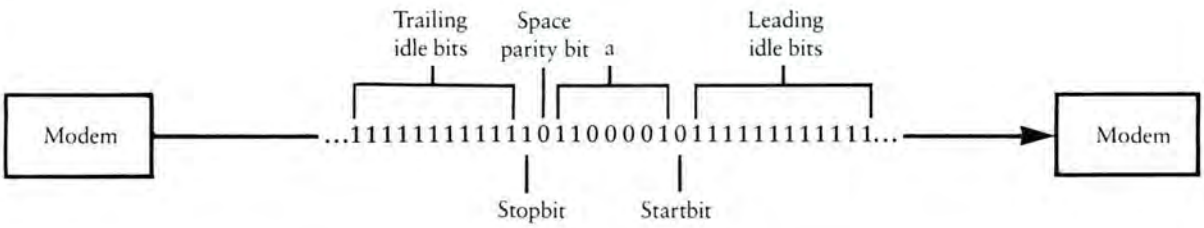


Figure 5: Configuration of bitstream for binary "a"

companies and will be a binary value that will make the total number of parity and data bits having a value of binary one an odd number. Again, if a transmission error changes the value of any two, four, or six bits, this technique will not detect the error.

Whenever an incorrect parity bit arrives, the error is referred to as a parity error. Using the PE option in the OPEN.COM statement, you can tell BASIC 2.00 to notify you when an error occurs so you can determine what to do.

Table 1 illustrates the parity bits that would be generated for six data characters under each of the five parity schemes. The numbers in parentheses indicate the total number of nonzero data and parity bits transmitted for both even and odd parity schemes. The n/a indicates that no parity bit is generated or transmitted when no parity is used.

Asynchronous Stop Bits

Data transmission errors can occur from time to time. You have seen a rudimentary way to check each arriving character for possible errors. Suppose that another type of transmission error occurs that indicates to the PC that a data character is arriving when in fact none is. It would be useful to have a mechanism to test whether a character has actually been transmitted.

This can be partially achieved by terminating the character and optional parity bit with one or two bits used in much the same way as a period at the end of a sentence. These bits are called stop bits and always have a value of binary one.

A data character can be accompanied by one or two stop bits. Four- and five-bit data characters can have one-and-a-half stop bits, but most PC applications use only one. As in the case of parity, both the PC and the remote system should use the same stop bit convention during a communications session.

The stop bit guarantees that a transition from a binary one to a binary zero will always occur when any data character arrives, even when two characters arrive in rapid succession.

This transition is guaranteed because the value of a stop bit is binary one, and a transition to binary zero signals the arrival of a start bit. It follows that the value that is transmitted while a transmitting party has nothing to transmit is binary one.

The constant transmission of binary ones is called the mark state. The Asynchronous Communications Adapter automatically produces a constant stream of ones for the PC. The constant presence of this value on the telephone line allows start bits to be correctly detected. Thus, if the PC communications adapter has received an erroneous indication that a character is arriving, the adapter may sense the error when it does not find a proper stop bit.

Such an error is called a framing error and can also occur when a start bit is not properly received and the parity bit or one of the data bits is interpreted as a start bit by the Asynchronous Communications Adapter. This type of error can cause the loss of several characters until the adapter finds a valid start bit and resynchronizes with the arriving data stream.

Suppose you want to transmit a value of hexadecimal 61, which corresponds to the lowercase ASCII letter *a*. From a programming standpoint all you do (after performing a few previous BASIC specifications such as those for parity and stop bit) is pass the value to BASIC and tell BASIC to have the PC transmit the value for you. If the PC is able to transmit the data, it does so. The letter *a* has a seven-bit binary representation of 1100001. Assuming that the line is idle immediately before and after the character transmission and you are using space parity with one stop bit, the transmitted data bits should look like Figure 5.

Note that in these communications conventions, ten bits (seven data bits, one start bit, one parity bit, and one stop bit) were used to send seven data bits. In other words, 30 percent of the data communications transmission capacity was lost to asynchronous communications overhead.

> When the PC is ready to transmit a character, it automatically precedes the character with a start bit.

You can recover some of that lost potential at the price of some data integrity by eliminating the parity bit. In that case only 22 percent of the transmission capacity will be lost to the asynchronous communications overhead caused by the start and stop bits. However, this loss is a consideration only if you need to upload or download data from one machine to another, as in the case of file transmission. In that case, characters are transmitted with no intervening idle bits that would be present between normal keystroke data characters. Hence, any bits removed between the start and stop bits (i.e., parity) will result in a decrease in file transmission time. Conversely, removal of the parity bits from keystroke data simply increases the intercharacter idle bits by a corresponding amount, resulting in no transmission savings while decreasing the chance of detecting garbled data.

Note that in Figure 5 a series of idle bits precedes the start bit. Looking at the figure might lead you to believe that the idle bit preceding the start bit is completely received before the start bit begins. This is generally not the case. In normal asynchronous communications an idle bit may be only fractionally received before the start bit abruptly begins. Thus, the arrival of a start bit is not usually predictable. In synchronous communications data bits can occur only at specified times because both the sender and the receiver synchronize their clocks and expect the bits to change on clock ticks only. This is a fundamental difference between synchronous and asynchronous communications.

There are several other elements involved in any successful communications system, such as modems and modem cables. To prevent your communications world from turning silent, you must understand the interrelationships of each communications element from a system perspective.

W. David Schwaderer is the author of four communications products sold by IBM, including one for the IBM PC. He is currently assigned to IBM San Jose Research, where he is involved in advanced PC communications projects.

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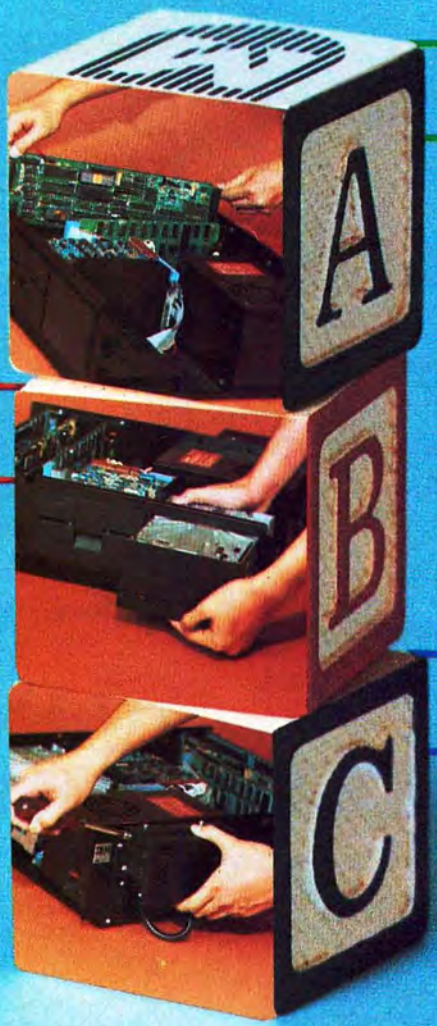

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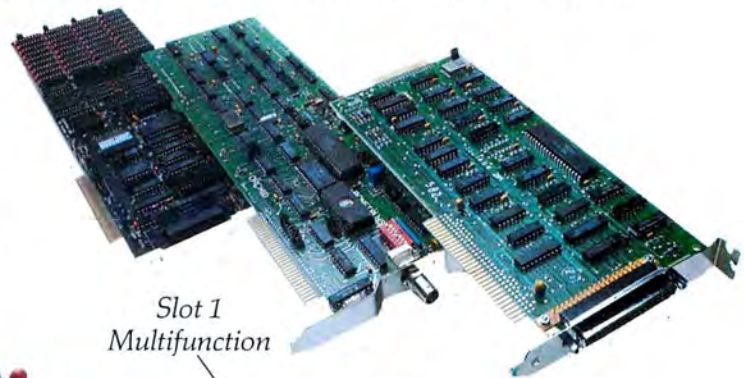

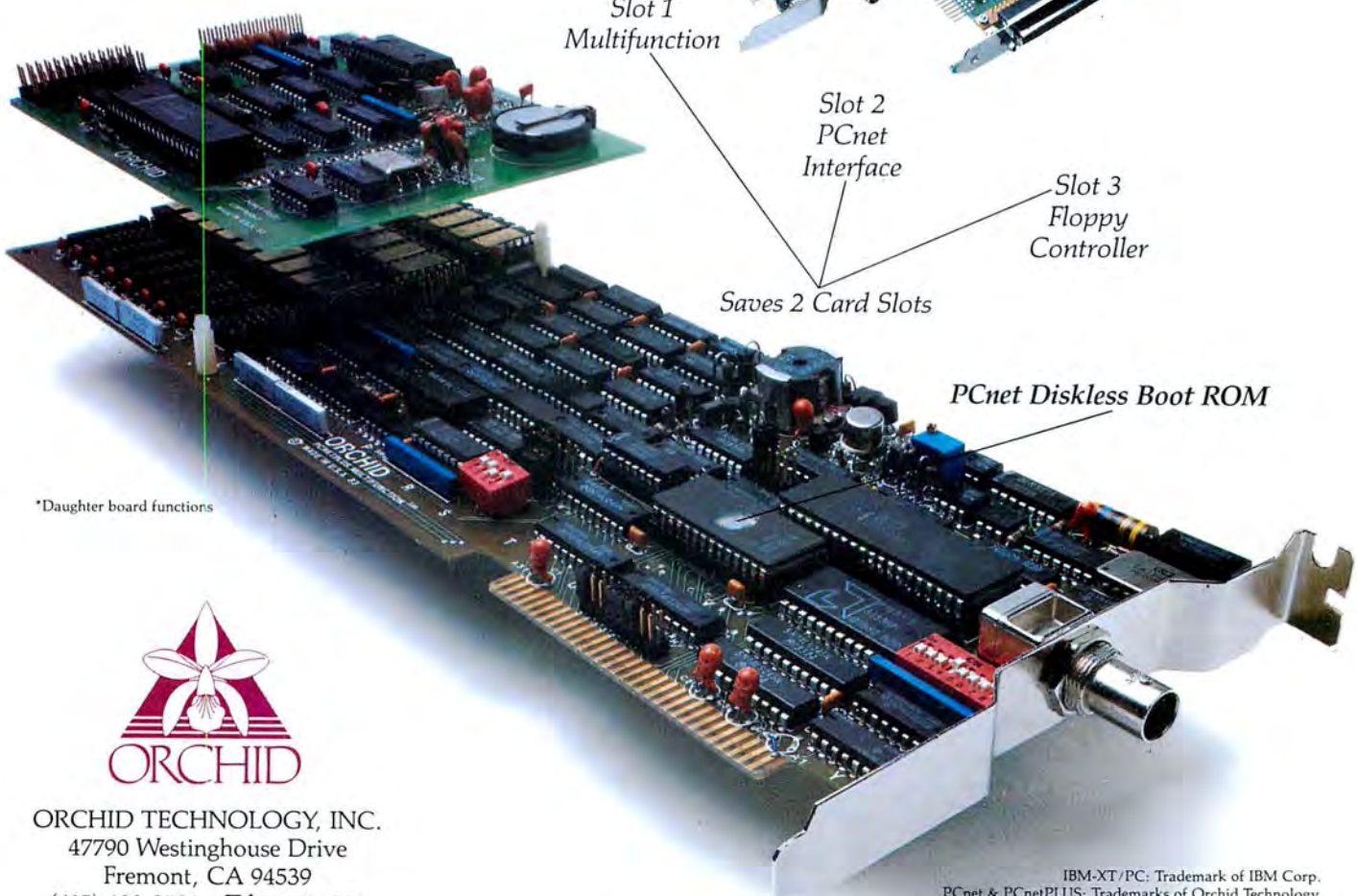

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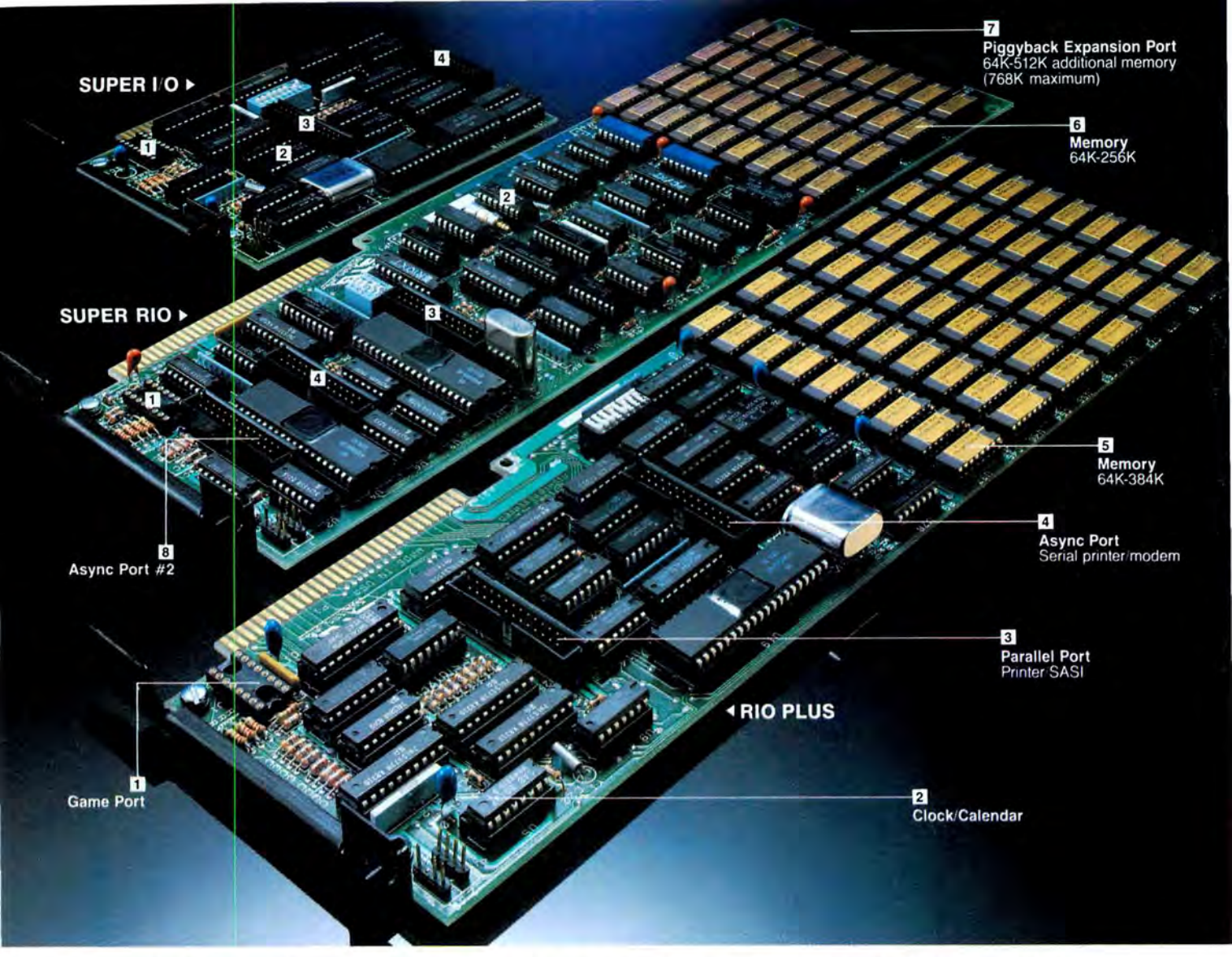

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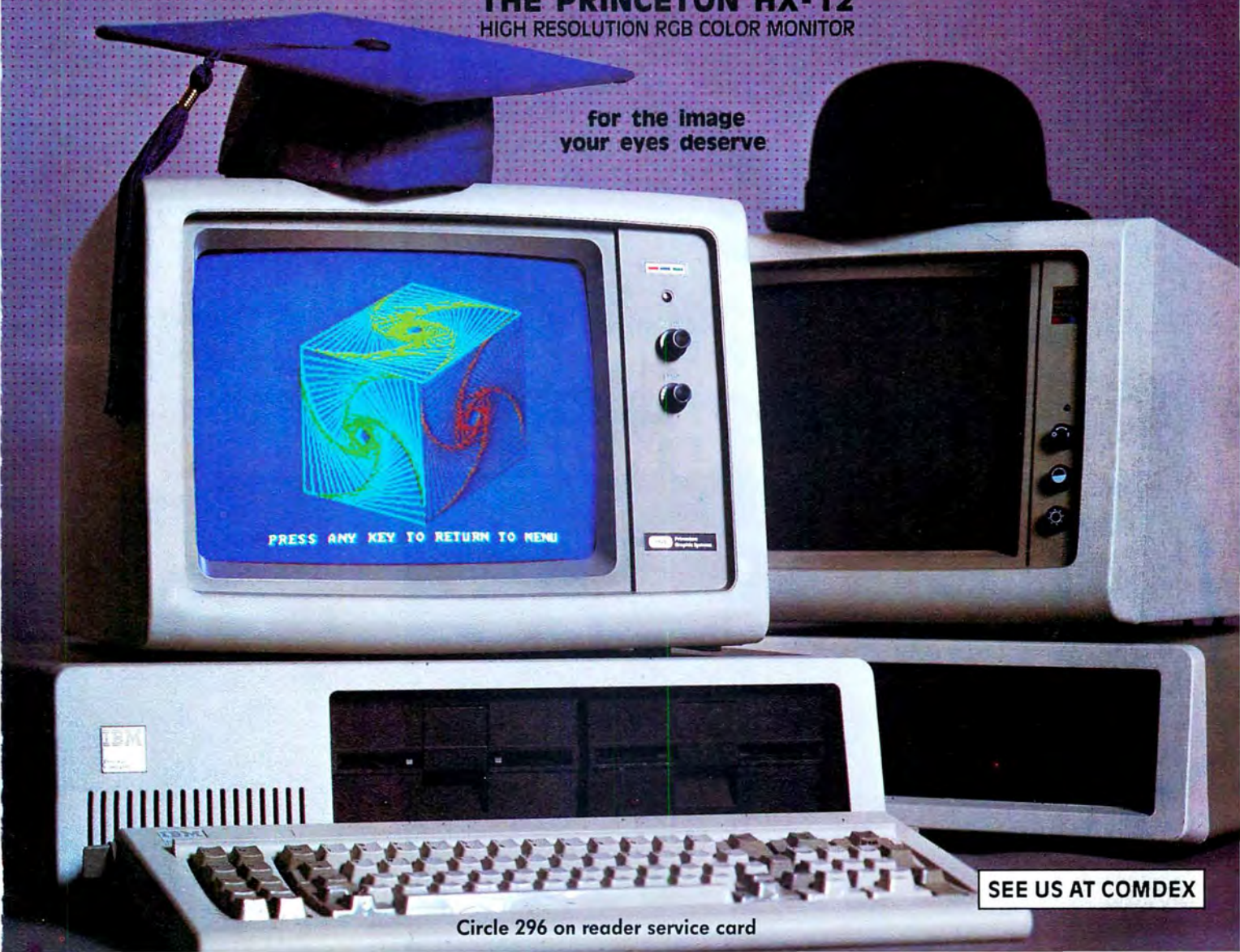

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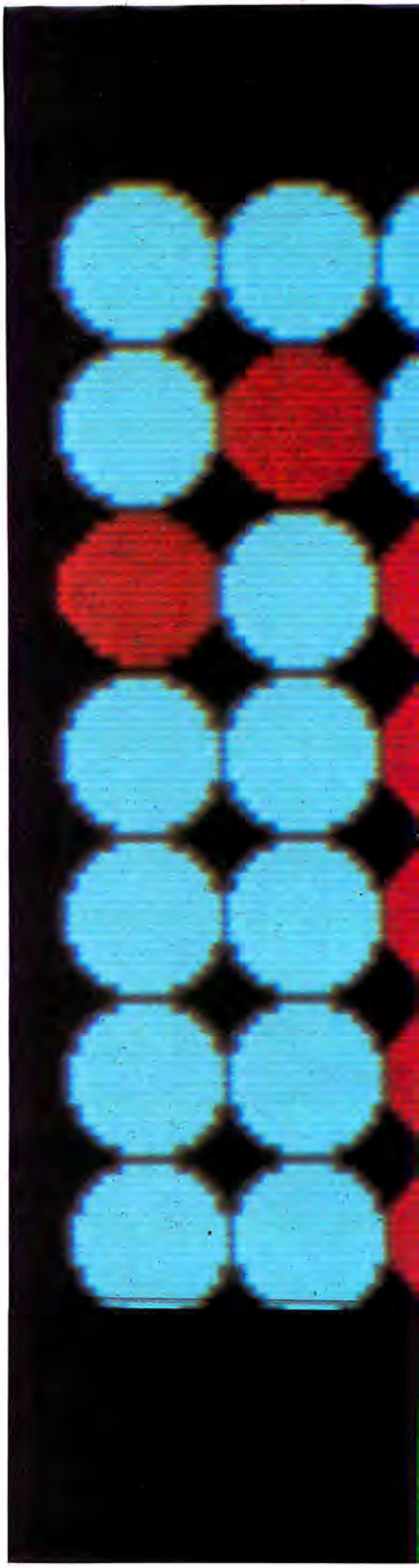
Character Construction

Use a BASIC program and an assembler program to construct special characters and download them to an Epson FX-80.



J. G. Vaughan

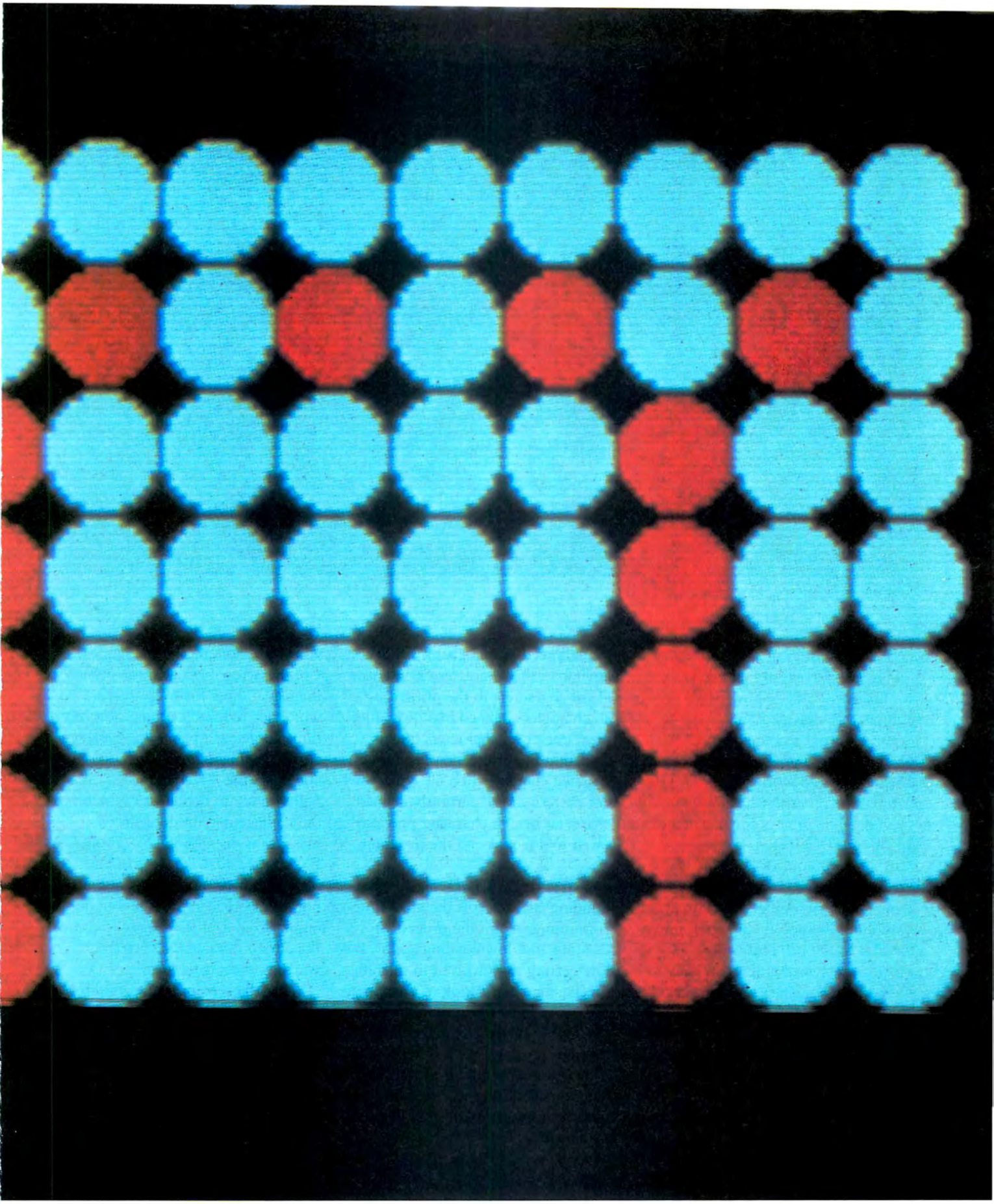
Let's face it. The character sets of printers that work with the IBM PC, or any computer for that matter, are rather limited. Even with its extended character set, the PC still can't display or print many of the special characters used frequently in word processing applications. Scientists, engineers, and foreign language writers have been forced to buy expensive letter quality printers and specialized print wheels to print the characters and symbols they need. These print wheels are often difficult to find.

For those who have graphics dot matrix printers, creating special characters is possible but extremely difficult. The process requires extensive tampering with the word processing program and frequent switching back and forth between text and graphics modes. Each pin of the dot matrix printhead must be individually instructed, and only one character can be sent to the printer at a time. In some cases this process can be simplified somewhat with add-on ROM chips and specialized word processing programs that can send extended fonts. But even those systems are limited to certain character fonts that run only on certain printers.

Several of the newer dot matrix printers such as the Epson FX-80 and the TI 855 accept character fonts that are downloaded from the computer. This feature allows you to send entire fonts to the printer without having to switch back and forth between graphics and text modes.

The main drawback to downloading any dot matrix character or graphics font is that you must first construct a dot pattern from the printhead's allowable dot matrix and transfer it to the printer. This process can be tedious when done by hand. After drawing the pattern on paper, you have to transfer the value of each dot individually to the printer. With the help of the programs described in this article and the IBM PC, however, the process of creating and downloading a font is greatly simplified.

After an alternate character font has been downloaded, any word processing program with the ability to send control codes to the printer can switch back and forth between the normal character set and the alternate font you've created. Most word



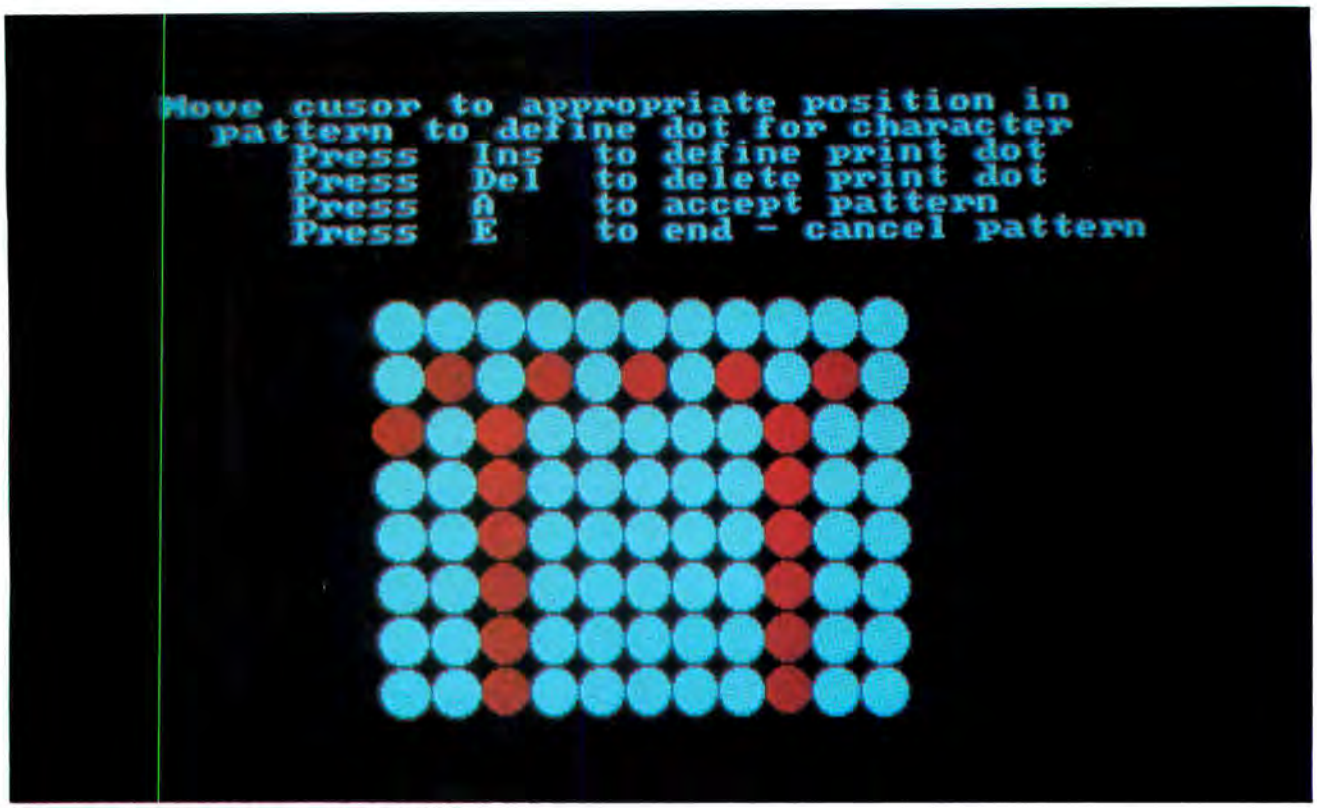


Figure 1: Constructing π with DEFINE

processing programs, including *WordStar,* have this capability.

Listings 1 and 2 show two programs that download an alternate character font to the Epson FX-80 printer. These programs could easily be modified to work on the TI 855 or any of the other new printers that allow downloading of fonts. The first program, DEFINE, is written in BASIC and requires BASICA, a color graphics board, and a graphics monitor. This program lets you construct a symbol or special character, download it to the printer, print it, save it for future downloading, and list and view any characters saved earlier. The assembly language program DOWNLOAD.ASM (Listing 2) contains data for a sample alternate character set and downloads much faster than the BASIC program DEFINE.

DEFINE presents a menu showing seven functions: you can construct a character using the 11- by 8-dot pattern allowed on the Epson FX-80, download this character or an entire file of characters to the printer, list all characters defined in a given file, print one or all characters downloaded to the printer, save a constructed character to a file, view the dot pattern of the currently defined character or of a character previously saved to a file, or end the program.

Constructing a Character

Building characters is the most time-consuming step in the process of creating and downloading a font. Before getting too involved in forming special characters, look in the appendix of the Epson printer manual to see how standard characters are formed.

Selecting option C from DEFINE's main menu clears the screen and displays a printhead pattern 11 dots wide by 8 dots high (see Figure 1). Use the arrow keys to move around the grid. The <Ins> key turns a white dot red, indicating a print position. To delete a print dot, move the cursor to the appropriate position and press the <Del> key.

If you try to define two horizontally adjacent print dots, an error message is displayed. The Epson FX-80 uses adjacent dots for emphasized print mode only, so it will not allow adjacent dots in a non-emphasized font. If you try to move the cursor outside the pattern, a warning message appears.

After the screen display pattern is complete, press the A key to accept the pattern. An E cancels the pattern you have defined and allows you to start over. If you press A, the program asks if you want to continue the definition process. Responding with N allows you to change the pattern, while Y causes the program to accept the pattern, clear the screen, and request a name for the character. You

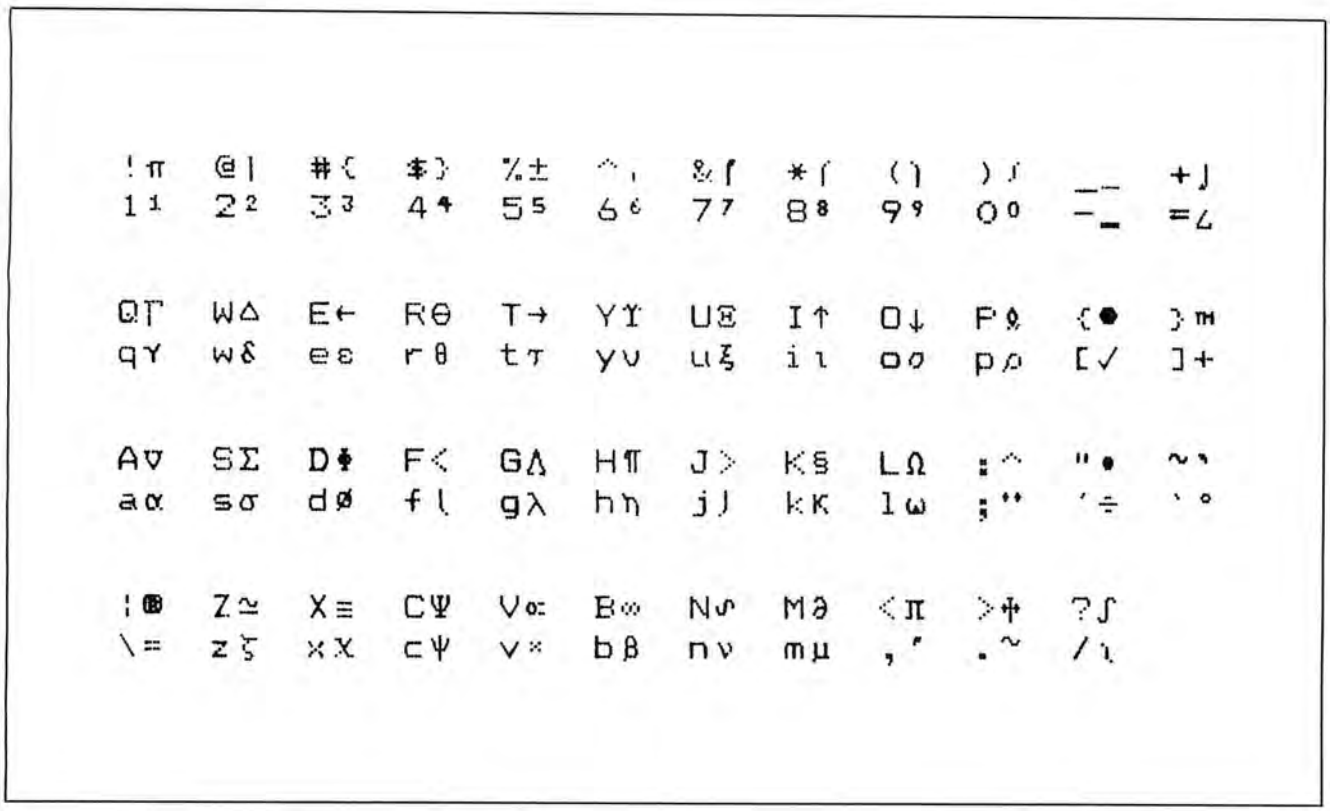


Figure 2: Character map of ASCII character codes

can't use that name for downloading, but it's handy for quickly determining a special symbol's meaning when you review all the stored characters.

DEFINE next asks for the ASCII code the character represents. Allowable answers range from 32 through 255. For example, it would be reasonable to use the ASCII code for a lowercase *a* (97) to define the Greek symbol α. Once the ASCII code has been entered, the program requests spacing information. DEFINE automatically sets horizontal spacing at 11 dots. If you want proportional spacing (in which spacing between letters is varied for a typeset look), you must first supply the starting and ending column of the character pattern. Finally, the program asks if you would like your character to have descender attributes (as in the letters *y*, *j*, and *f*). When this question has been answered the definition process is complete, and the program returns to the main menu.

Within the program code the proportional and descender information is used to define a print attribute. The lower 4 bits of the 8 bytes of the attribute give the starting print position of the defined character. The next 3 bits give the ending print position. If the highest-order bit equals zero, the ninth printhead is used to provide descender printing. The locations to be printed (red dots) are defined by setting the equivalent position of the 11- by 8-dot table equal to one; nonprint positions are equal to zero. The printhead information for the 11- by 8-dot character is then determined by converting the binary code of TABLE(11,8) into a decimal code equal to DOTPAT(11). This is accomplished by multiplying each of the eight rows in a given column of the table by increasing powers of two, thereby converting them to decimal numbers.

Downloading the Character

After the character has been defined it's ready to download. First, check the DIP switches on the FX-80 to make sure switch 1-4 is off. This disables the FX-80's input buffer but makes it possible to download fonts. Then try downloading the character to the printer and printing it to see how it looks.

If you are not satisfied, select option V to view the character's dot pattern and correct it. It should be noted that a character defined from the construction option is held in volatile memory until you select the construction menu option again. At that time the character is overwritten with the new construction pattern. If you are satisfied with the print appearance, press the S key to save the

character definition to a disk file with a name of your choosing. You can create a permanent download definition only by saving the definition to a disk file.

Selections other than the construction options are menu prompted, so they won't be discussed in detail here. Limited error-trapping code within the program catches problems such as failing to turn on the printer or requesting a nonexistent file. These error traps return you to the menu option that will enable you to correct the indicated problem. If an error occurs for which a trap does not exist, the code will exit the program and print the untrapped error code. In such a case you will have to look up the meaning of the error code in the BASIC manual.

Faster in Assembler

Once all the characters and symbols have been constructed and defined, you can load them from the file into the Epson's download character font by using DEFINE's option D. In a word processing environment, however, the assembler program DOWNLOAD.ASM will make this step much easier and faster. For example, you could create the batch file WSALTCHR.BAT containing the commands

```
DOWNLOAD
WS %1
```

which would first download the alternate character set to your printer and then call *WordStar.*

In DOWNLOAD.ASM the download character data is given in INITSTR and BITVAL of the BYTABLE data segment. The data in INITSTR begins with an ESC @ sequence, which initializes the printer and sets the top-of-form to the current paper position. The 7 in the next line beeps the printer to indicate the start of the download definition sequence.

The rest of the INITSTR code defines the sequence ESC, &, 0, 32, 127. This sequence tells the printer to prepare to receive alternate definitions for ASCII characters 32 through 127. BITVAL defines 12 bytes per character in hexadecimal form. These 12 bytes are the print attribute and 11 columns of character definition—the download information the Epson printer is looking for. The data in BITVAL could just as well be in decimal, taken directly from the BASIC construction file. To change back to decimal, eliminate the .RADIX16 statement before BITVAL.

The code segment DOWN sends the data in INITSTR and BITVAL to the printer. LOOP_INITSTR sends the 8 bytes of INITSTR, using the CX register as the loop counter. LOOP_BITVAL sends the 96 characters in BITVAL, with LOOP_COLUMNS picking up the 12 bytes for each of the 96 characters. The data is sent to the printer through SEND using the INT 21H command, with register AH containing the required value of 05H and register DL containing the data to be sent.

Finally, a beep is sent to the printer to indicate the end of the download procedure, and control is returned to DOS.

DOWNLOAD.ASM takes about 1 second to run. The resulting character set is my version of a character-to-character map of the General Scientific 10 Diablo 630 print wheel. Figure 2 shows this special character set mapped to the IBM PC keyboard.

To modify DOWNLOAD.ASM for use with data produced by the BASIC program DEFINE, only a few statements must be changed. First the ASCII codes 32 and 127 in lines 6 and 7 of BYTABLE should be changed to cover the range of code numbers you wish to define. Also, register CX in line 122 of DOWN should be loaded with the number of characters to be defined—in this case, 32 through 127, inclusive, is 96 characters. The data in BITVAL could be kept in hexadecimal, but it would be easier to use the data in decimal form directly from the BASIC construction program.

If you wish to make DOWNLOAD.ASM slightly more flexible for use with data generated from DEFINE, send a modified INITSTR consisting of ESC, &, 0 before every code sequence of BITVAL. However, BITVAL would then have to consist of 14 bytes of information: the ASCII character code represented (sent twice), the print attribute giving proportional and descender information, and the data for the 11 columns of the printhead. That sequence is the same as the data sequence generated by the BASIC construction program, with the exception that the optional character name at the end should be separated from the remaining data by a semicolon. In this way the character definition data for DOWNLOAD.ASM can be copied directly from the saved disk file created by DEFINE. This technique is a little less efficient than the code of DOWNLOAD.ASM, but it is acceptable.

The programs discussed here provide an easy method of constructing custom character fonts and downloading them to an Epson FX-80 printer. The process is time-consuming, but once the characters are defined they can be easily accessed by any word processor or program capable of sending the appropriate download access and ending sequences.

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Copies of Listings 1 and 2 are available from the author on a PC-DOS disk for $10. Address orders and inquiries to J. G. Vaughan, Department of Mechanical Engineering, University of Mississippi, University, MS 38677.

```
100 REM  Program: DEFINE -- Download Character Definition for Epson FX Printer
110 REM
120 REM  Written by:    James G. Vaughan       University of Mississippi
130 REM
140 REM  Copyrighted by James G. Vaughan  1983        Not to be copied for sale
150 REM
160 REM  Requirements:    BASICA and color-graphics monitor/board
170 REM
180 REM  Major Variable Defintions:
190 REM       FILE$         : File name for download character storage
200 REM       TABLE(11,8)   : Table containing binary dot pattern representation
210 REM       DOTPAT(11)    : Array containing decimal dot pattern representation
220 REM       DOTA(11)      : Dummy input array for dot pattern
230 REM       A$            : Answer for menu questions
240 REM       B             : Graphics representation of red circle, radius 8
250 REM       C             : Graphics representation of white circle, radius 7
260 REM       D             : Graphics representation of blue cusor, radius 4
270 REM       N$            : Optional name of defined character
280 REM       CHAR          : ASCII code number of defined character
290 REM       ATTR          : Attribute of defined character giving proportional
300 REM                            spacing and descender information
310 REM       DFLAG         : If = 1 then retain white dot at present cusor
320 REM       EFLAG         : If = 1 then erase error/warning message
330 REM       PFLAG         : If = 1 then retain red dot at present cusor
340 REM       VFLAG         : If = 1 then character defined from previous pattern
350 REM       DEFFLAG       : If = 1 then character presently defined in memory
360 REM
370 REM ============================================================================
1000 REM
1010 REM--Initialize program and Define menu options
1020 CLEAR ,,4000 : CLS : KEY OFF : WIDTH 40 : SCREEN 1
1030 DEFINT I,J,L,X,Y
1040 DIM TABLE(11,8), DOTPAT(11), DOTA(11), B(80), C(80), D(80)
1050 FILE$="-none-"
1060 ON ERROR GOTO 8110
1070 '  Define red circle
1080 CIRCLE (160,100),8,2 : PAINT (160,100),2,2 : GET (152,92)-(168,108),B
1090 '  Define white circle
1100 CIRCLE (160,80),7,3,,,1 : PAINT(160,80),3,3 : GET (152,72)-(168,88),C
1110 '  Define blue cusor
1120 CIRCLE (160,60),4,1 : PAINT(160,60),1,1 : GET (156,56)-(164,64),D
1130 CLS : SCREEN 0 : LOCATE 1,1,1
1140 PRINT "   Download Character Definition for"
1150 PRINT "           Epson FX Printer" : PRINT
1160 PRINT : PRINT "Main Selection Menu" : PRINT
1170 PRINT : PRINT "  C  Construct character from pattern"
1180 PRINT : PRINT "  D  Download character(s) to printer"
1190 PRINT : PRINT "  L  List characters defined in file"
1200 PRINT : PRINT "  P  Print download character(s)"
1210 PRINT : PRINT "  S  Save constructed character to file"
1220 PRINT : PRINT "  V  View dot pattern of previous char."
1230 PRINT : PRINT "  E  End program"
1240 PRINT : PRINT "Make your selection ?";
1250 A$=INKEY$
1260 IF A$="c" OR A$="C" GOTO 2010
1270 IF A$="d" OR A$="D" GOTO 3010
1280 IF A$="l" OR A$="L" GOTO 4010
1290 IF A$="p" OR A$="P" GOTO 5010
```

(continues)

Listing 1: DEFINE

```
1300 IF A$="s" OR A$="S" GOTO 6010
1310 IF A$="v" OR A$="V" GOTO 7010
1320 IF A$="e" OR A$="E" GOTO 8010
1330 GOTO 1250
1340 '
1350 ' ============================================================================
1360 '
2000 REM--Construct and Define character from dot pattern
2010 CLS : SCREEN 1,1 : COLOR 0,1
2020 DEFFLAG=0
2030 PRINT "Move cusor to appropriate position in"
2040 PRINT "  pattern to define dot for character"
2050 PRINT "      Press  Ins  to define print dot"
2060 PRINT "      Press  Del  to delete print dot"
2070 PRINT "      Press  A    to accept pattern"
2080 PRINT "      Press  E    to end - cancel pattern"
2090 YC=48
2100 FOR J = 1 TO 8
2110   XC=48 : YC=YC+16
2120   IF VFLAG<>1
        THEN DOTPAT(J)=0
2130   FOR I = 1 TO 11
2140     XC=XC+16 : PUT(XC,YC),C
2150     IF VFLAG<>1
          THEN TABLE(I,J)=0
          ELSE IF TABLE(I,J)=1 THEN PUT(XC,YC),B,PSET
2160   NEXT I
2170 NEXT J
2180 DFLAG=0 : OFLAG=0 : PFLAG=0 : EFLAG=0
2190 X=144 : Y=128 : PUT (X+4,Y+4),D,AND
2200 A$=INKEY$ : IF A$="" THEN 2200
2210 ALEN=LEN(A$) : X1=X : XX=(X-48)/16 : Y1=Y : YY=(Y-48)/16
2220 IF DFLAG=1 THEN PUT(X1,Y1),C,OR : DFLAG=0
2230 IF EFLAG=1 THEN LINE(0,48)-(320,56),0,BF : EFLAG=0
2240 IF PFLAG=1 THEN PUT(X1,Y1),B,PSET : PFLAG=0
2250 IF ALEN=2 AND RIGHT$(A$,1)="H" THEN Y=Y-16 : GOTO 2360
2260 IF ALEN=2 AND RIGHT$(A$,1)="M" THEN X=X+16 : GOTO 2360
2270 IF ALEN=2 AND RIGHT$(A$,1)="P" THEN Y=Y+16 : GOTO 2360
2280 IF ALEN=2 AND RIGHT$(A$,1)="K" THEN X=X-16 : GOTO 2360
2290 IF ALEN=2 AND RIGHT$(A$,1)="R" THEN 2420
2300 IF ALEN=2 AND RIGHT$(A$,1)="S" THEN 2520
2310 IF A$="a" OR A$="A" THEN 2570
2320 IF A$="e" OR A$="E" THEN VFLAG=0: GOTO 1130
2330 GOTO 2200
2340 '   ==========
2350 '   Move cusor while retaining preset pattern
2360 IF X<64 OR X>224 OR Y<64 OR Y>176
      THEN LOCATE 7,1 : BEEP : PRINT "WARNING Can't move cusor out of pattern"
      : X=X1 : Y=Y1 : EFLAG=1 : GOTO 2200
2370 IF TABLE(XX,YY)=1
      THEN PUT(X1,Y1),B,PSET
      ELSE PUT(X1,Y1),C,PSET
2380 PUT (X+4,Y+4),D,AND
2390 GOTO 2200
2400 '   ==========
2410 '   Define red print dot on screen and in TABLE
2420 PFLAG=1 : PUT(X,Y),B,PSET
```

Figure 1 *(continued)*

```
2430 TABLE(XX,YY)=1
2440 XCONM=XX-1 : XCONP=XX+1
2450 IF XCONM>0
      THEN IF TABLE(XCONM,YY)=1 THEN 2470
                                ELSE 2460
2460 IF XCONP<12
      THEN IF TABLE(XCONP,YY)=1 THEN 2470
                                ELSE 2200 ELSE 2200
2470 LOCATE 7,1 : BEEP : PRINT "ERROR : Can't have two consective dots"
2480 PFLAG=0 : EFLAG=1 : TABLE(XX,YY)=0 : PUT(X,Y),C,PSET
2490 GOTO 2200
2500 '   ==========
2510 '   Erase red dot and replace with white dot on screen and in TABLE
2520 DFLAG=1 : PUT(X,Y),C,PSET
2530 TABLE(XX,YY)=0
2540 GOTO 2200
2550 '   ==========
2560 '   Accept dot pattern and define character parameters
2570 LOCATE 7,1
2580 PRINT "Is pattern okay - press ( Y or N )"
2590 X$=INKEY$
2600 IF X$="n" OR X$="N" THEN LINE(1,48)-(320,56),0,BF
      : IF TABLE(XX,YY)=1 THEN PUT(X,Y),B,PSET : GOTO 2190
                          ELSE PUT(X,Y),C,PSET : GOTO 2190
2610 IF X$="y" OR X$="Y"
      THEN WIDTH 80
      ELSE 2590
2620 PRINT "Input data below to finish the character definition"
     : PRINT "**************************************************" : PRINT
2630 IF VFLAG<>1 THEN 2670
2640 PRINT "Do you wish to keep the previously defined name,"
2650 INPUT "ASCII code, proportional and descender information ( Y OR N )";A$
2660 PRINT : IF A$="y" OR A$="Y" THEN 2820
2670 PRINT "What name will you identify this pattern with (optional)"
2680 LINE INPUT "?";N$
2690 PRINT
2700 INPUT "What ASCII character code number does this pattern represent";CHAR
2710 IF CHAR>255 OR CHAR<32
      THEN PRINT "  Unacceptable number" : GOTO 2690
2720 STARTCOL=0 : ENDCOL=11
2730 PRINT
2740 INPUT "Is this character to have proportional spacing ( Y or N )";P$
2750 IF P$="y" OR P$="Y"
      THEN INPUT "   starting column position ";STARTCOL
      : INPUT "   ending column position   ";ENDCOL : GOTO 2770
2760 IF P$="n" OR P$="N"
      THEN 2770
      ELSE 2730
2770 PRINT : INPUT"Is character to have descender properties ( Y or N ) ";D$
2780 IF D$="y" OR D$="Y"
      THEN DES=0 : GOTO 2800
2790 IF D$="n" OR D$="N"
      THEN DES=1
      ELSE 2770
2800 PRINT
2810 ATTR=ENDCOL+(STARTCOL*16)+(DES*128)
```

(continues)

```
2820 FOR J = 1 TO 11
2830   DOTPAT(J)=0  : I=1
2840   FOR L = 8 TO 1 STEP -1
2850     DOTPAT(J)=(TABLE(J,L)*I)+DOTPAT(J)
2860     I=I*2
2870   NEXT L
2880 NEXT J
2890 DEFFLAG=1 : VFLAG=0
2900 PRINT : PRINT "********************" : PRINT "Definition complete"
     : PRINT "********************" : PRINT : GOSUB 9110
2910 WIDTH 40 : GOTO 1130
2920 '
2930 ' ============================================================================
2940 '
3000 REM--Download Character to Printer
3010 CLS : PRINT "Download Character to Printer" : PRINT
3020 PRINT "Selection Menu"
3030 PRINT : PRINT "   F   File characters downloaded"
3040 IF DEFFLAG<>1 THEN 3070
3050 PRINT : PRINT "   C   Character in present definition"
3060         PRINT "       downloaded"
3070 PRINT : PRINT "   E   End download selection"
3080 PRINT : PRINT "Make your selection ?";
3090 A$=INKEY$
3100 IF A$="f" OR A$="F" THEN 3150
3110 IF A$="c" OR A$="C" AND DEFFLAG=1 THEN 3250
3120 IF A$="e" OR A$="E" THEN 1130 ELSE 3090
3130 '   ==========
3140 '   Select file and download all characters
3150 GOSUB 9010                          'Select and OPEN file
3160 LPRINT CHR$(7)
3170 IF EOF(1) THEN 3210
3180 GOSUB 9210                          'Input character definition from file
3190 GOSUB 9310                          'Send character definition to FX
3200 GOTO 3170
3210 CLOSE#1 : LPRINT CHR$(7) : CLS : PRINT " Download completed"
3220 PRINT "********************" : PRINT : GOSUB 9110 : GOTO 3010
3230 '   ==========
3240 '   Download character in present definition
3250 CHARA=CHAR : ATTRA=ATTR
3260 FOR J = 1 TO 11
3270   DOTA(J)=DOTPAT(J)
3280 NEXT
3290 GOSUB 9310                          'Send character definition to FX
3300 GOTO 3210
3310 '
3320 ' ============================================================================
3330 '
4000 REM--List character(s) already defined in file
4010 CLS : PRINT "List of characters defined in file"
4020 GOSUB 9010                          'Select and OPEN file
4030 WIDTH 80
4040 CLS : PRINT "Character name","ASCII code number"
4050 I=0
4060 IF EOF(1) THEN GOSUB 9110 : GOTO 4110
4070 INPUT#1, CHARA,CHARA,ATTRA,X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,NN$
4080 PRINT NN$;TAB(35);CHARA : I=I+1 : IF I<23 THEN 4060
```

Figure 1 *(continued)*

```
4090 PRINT "Press any key to continue listing; <Esc> to quit"
4100 A$=INKEY$ : IF A$="" THEN 4100 ELSE IF A$<>CHR$(27) THEN 4040
4110 CLOSE #1
4120 WIDTH 40 : GOTO 1130
4130 '
4140 '  ================================================================================
4150 '
5000 REM--Print Download Character(s)
5010 CLS : PRINT "Print Download Characters" : PRINT
5020 PRINT "Selection menu"
5030 PRINT : PRINT "   F   Present FX download ":
             PRINT SPC(10); "characters printed"
5040 IF DEFFLAG<>1 THEN 5070
5050 PRINT : PRINT "   C   Character in present definition"
5060         PRINT "       printed"
5070 PRINT : PRINT "   E   End print selection"
5080 PRINT : PRINT "Make your selection ?";
5090 A$=INKEY$
5100 IF A$="f" OR A$="F" THEN 5150
5110 IF A$="c" OR A$="C" AND DEFFLAG=1 THEN 5260
5120 IF A$="e" OR A$="E" THEN 1130 ELSE 5090
5130 '   ==========
5140 '   Print all downloaded characters requested
5150 PRINT : PRINT "Input ASCII character code range to be   printed"
5160 INPUT "      Starting code number";STCH
5170 INPUT "      Ending code number  ";EDCH
5180 LPRINT CHR$(27);"%";CHR$(1);CHR$(0);    'Set FX to use download characters
5190 FOR I = STCH TO EDCH
5200   LPRINT CHR$(I);
5210 NEXT I
5220 LPRINT CHR$(27);"%";CHR$(0);CHR$(0)     'Set FX to use normal characters
5230 CLS : PRINT "Printing complete" : PRINT "*****************" : PRINT
     : GOSUB 9110 : GOTO 5010
5240 '   ==========
5250 '   Print single character in present definition
5260 STCH=CHAR : EDCH=CHAR : GOTO 5180
5270 '
5280 ' ================================================================================
5290 '
6000 REM--Save defined characters to file
6010 CLS : PRINT "Save defined character to file" : PRINT
6020 IF DEFFLAG<>1
      THEN PRINT : BEEP : PRINT "No character presently defined" : PRINT
      : GOSUB 9110 : GOTO 1130
6030 SAV=-1 : GOSUB 9010 : SAV=0
6040 IF EOF(1) AND RFLAG=0      THEN 6110
6050 IF EOF(1) AND RFLAG=1      THEN PRINT : GOTO 6080
6060 INPUT#1, CHARA,CHARA,ATTRA,X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,NN$
6070 IF CHARA=CHAR THEN RFLAG=1 : PRINT : PRINT : BEEP : PRINT
      "WARNING: Present character has already" : PRINT "  been defined as ("
      ;NN$;")" : PRINT "  code number  : ";CHARA : GOTO 6050 ELSE 6040
6080 PRINT "If you continue, only the present"
     : PRINT "  character definition will be accepted" : PRINT "  on printer"
     : PRINT
6090 PRINT "Press C to continue" : PRINT "Press E to end"
```

(continues)

```
6100 A$=INKEY$ : IF A$="c" OR A$="C" THEN 6110
                 ELSE IF A$="e" OR A$="E" THEN CLOSE #1 : GOTO 1130
                                          ELSE 6100
6110 CLOSE #1
6120 OPEN FILE$ FOR APPEND AS #1
6130 PRINT#1, CHAR;",";CHAR;",";ATTR;",";
6140 FOR J =1 TO 11
6150   PRINT#1, DOTPAT(J);",";
6160 NEXT J
6170 PRINT#1, CHR$(34);N$;CHR$(34)
6180 CLOSE #1
6190 PRINT : PRINT "Save completed" : PRINT : GOSUB 9110
6200 GOTO 1130
6210 '
6220 ' ============================================================================
6230 '
7000 REM--View dot pattern of previously defined charater
7010 CLS : PRINT "View dot pattern of previous character"
7020 PRINT : PRINT "Selection menu"
7030 PRINT : PRINT "   F   File defined character"
7040 IF DEFFLAG<>1 THEN 7060
7050 PRINT : PRINT "   C   Character in present definition"
7060 PRINT : PRINT "   E   End review of dot pattern"
7070 PRINT : PRINT "Make your selection ?";
7080 A$=INKEY$
7090 IF A$="f" OR A$="F" THEN 7140
7100 IF A$="c" OR A$="C" AND DEFFLAG=1 THEN 7330
7110 IF A$="e" OR A$="E" THEN 1130 ELSE 7080
7120 '   ==========
7130 '   Reconstruct dot pattern of character defined in file
7140 GOSUB 9010
7150 PRINT : PRINT "Input name of character pattern to be"
7160 PRINT "  viewed. For any name to be acceptable,  input a  *  character"
7170 INPUT AN$
7180 PRINT : INPUT "Input ASCII code of character";ACHAR
7190 GOSUB 9210
7200 IF ACHAR=CHARA AND AN$=NN$   OR     ACHAR=CHARA AND AN$="*"
      THEN CHAR=CHARA : ATTR=ATTRA : N$=NN$
      : FOR J = 1 TO 11 : DOTPAT(J)=DOTA(J) : NEXT J : VFLAG=1
7210 IF EOF(1) THEN CLOSE#1 ELSE 7190
7220 FOR I = 1 TO 11
7230   L=128
7240   FOR J = 1 TO 8
7250     IF INT(DOTPAT(I)/L) = 1
          THEN TABLE(I,J)=1 : DOTPAT(I)=DOTPAT(I)-L
          ELSE TABLE(I,J)=0
7260     L=L/2
7270   NEXT J
7280 NEXT I
7290 IF VFLAG=1         THEN 2010
7300 BEEP : PRINT "Can't find character ";ACHAR : PRINT "  named ";AN$
     : PRINT : GOSUB 9110 : GOTO 7150
7310 '   ==========
7320 '   Reconstruct dot pattern from present character
7330 VFLAG=1
7340 GOTO 2010
7350 '
```

```
7360 ' ============================================================================
7370 '
8000 REM--Error trapping code and program termination
8010 WIDTH 80 : KEY ON : PRINT "Program Termination"
8020 END
8030 '   ==========
8100 '   Error trapping rountine
8110 BEEP
8120 IF (ERR=24) OR (ERR=27)
      THEN LOCATE ,1 : PRINT "ERROR : TURN PRINTER ON and then"
      : GOSUB 9110 : RESUME NEXT
8130 IF (ERR=5) AND (ERL=1080)
      THEN PRINT "This program requires the color/graphics adapter" : PRINT
8140 IF ERR=53 THEN PRINT "Can't find file ";FILE$;"  - try again" : PRINT
8150 IF ERR=64 THEN PRINT "Your file name ";FILE$;" is illegal" : PRINT
8160 IF ERR=71 THEN PRINT "Requested disk is not ready" : PRINT
8170 IF ERR=73 THEN PRINT "This program requires Advanced BASIC     (BASICA)"
      : PRINT
8180 IF ERL= 9070 THEN RESUME 9010
8190 PRINT "Error trapping unable to recover" : PRINT
8200 ON ERROR GOTO 0 : END
8210 '
8220 ' ============================================================================
8230 '
9000 REM--Subroutine to OPEN default or new file of download character
9010 LOCATE ,1
9020 PRINT "Input file name "; : IF SAV THEN PRINT "for saving": PRINT SPC(3);
9030 PRINT "of download characters"
9040 PRINT "Default file ";FILE$; : INPUT " ";FILEX$
9050 IF FILEX$="" THEN 9060
                 ELSE Y=CSRLIN : LOCATE Y-1,1 : FILE$=FILEX$
                 : PRINT "New default file name : ";FILE$; SPC(15) : PRINT
9060 IF SAV THEN RFLAG=0 : OPEN FILE$ FOR APPEND AS #1 : CLOSE #1
9070 OPEN FILE$ FOR INPUT AS #1
9080 RETURN
9090 '
9100 REM--Subroutine to pause until user hits key
9110 PRINT : PRINT "press any key to continue";: A$=INPUT$(1)
9120 RETURN
9130 '
9200 REM--Subroutine to input download character from file
9210 INPUT#1, CHARA,CHARA,ATTRA
9220 FOR J = 1 TO 11
9230   INPUT#1, DOTA(J)
9240 NEXT J
9250 INPUT#1, NN$
9260 RETURN
9270 '
9300 REM--Subroutine to send download character to FX printer
9310 LPRINT CHR$(27);"&";CHR$(0);       'Set FX to accept character definition
9320 LPRINT CHR$(CHARA);CHR$(CHARA);CHR$(ATTRA);
9330 FOR J = 1 TO 11
9340   LPRINT CHR$(DOTA(J));
9350 NEXT J
9360 LPRINT
9370 RETURN
```

```
TITLE  'DOWNLOAD - CHARACTER GENERATION FOR THE EPSON FX  10/83'

;*****************************************************************
;       Character generation of Epson FX characters to produce
;       Diablo scientific compatible characters using a
;       download definition
;
;             By   J. G. Vaughan     University of Mississippi

;             Copyright by  J. G. Vaughan, 1983

;       Requires "MASM" macro assembler
;
;*****************************************************************


;***********************
;
;  Define a temporary stack.  Required for initialization
;  of program only.
;
;***********************

STACK SEGMENT PARA STACK
     DB   8  DUP('STACK   ')
STACK ENDS


BYTABLE SEGMENT PARA

INITSTR DB      27      ; Initialization of EPSON FX with "ESC @"
        DB     "@"      ;
        DB      7       ; BEEP the printer to indicate start of download
        DB      27      ; Define EPSON FX DOWNLOAD character generation
        DB      "&"     ; Sequence of ESC, "&", 0 with n-m
        DB      0       ;
        DB      32      ; n  is position of first character
        DB      127     ; m  is position of last character defined

;************************
;
; Define characters...12 bytes per character
;
;              as print attribute and 11 columns of print dot location
;              to form the complete character definition

;************************

        .RADIX 16       ; All values are in hexadecimal


BITVAL    DB   08BH,000,000,000,000,000,000,000,000,000,000,000   ; 32
          DB   08BH,000,010,000,03E,000,020,000,03E,000,020,000   ; 33
          DB   08BH,000,000,000,030,048,030,048,030,000,000,000   ; 34
```

Listing 2: DOWNLOAD.ASM

```
DB    08BH,000,000,000,010,000,06C,082,000,082,000,000   ; 35
DB    08BH,000,000,082,000,082,06C,000,010,000,000,000   ; 36
DB    08BH,000,022,000,022,000,0FA,000,022,000,022,000   ; 37
DB    08BH,000,000,000,000,000,07F,080,040,080,000,000   ; 38
DB    08BH,000,010,000,010,044,010,044,010,000,010,000   ; 39
DB    08BH,000,000,080,000,040,03F,000,000,000,000,000   ; 40
DB    08BH,000,000,000,004,000,078,000,080,000,000,000   ; 41
DB    08BH,000,000,000,000,000,03F,040,000,080,000,000   ; 42
DB    08BH,000,000,001,002,001,0FE,000,000,000,000,000   ; 43
DB    08BH,000,000,000,000,000,060,080,040,080,000,000   ; 44
DB    08BH,000,003,000,003,000,003,000,003,000,003,000   ; 45
DB    08BH,000,040,080,000,080,040,020,000,020,040,000   ; 46
DB    08BH,000,000,000,020,000,01E,000,001,000,000,000   ; 47
DB    08BH,000,000,000,070,088,000,088,070,000,000,000   ; 48
DB    08BH,000,000,000,048,000,0F8,000,008,000,000,000   ; 49
DB    08BH,000,000,000,048,090,008,0A0,048,000,000,000   ; 50
DB    08BH,000,000,000,090,008,080,028,0D0,000,000,000   ; 51
DB    08BH,000,000,000,020,040,0A0,000,0F8,000,020,000   ; 52
DB    08BH,000,000,000,0E8,000,0A8,000,0A8,010,000,000   ; 53
DB    08BH,000,000,000,000,030,048,020,088,010,000,000   ; 54
DB    08BH,000,000,000,088,010,0A0,040,080,000,000,000   ; 55
DB    08BH,000,000,000,050,0A8,000,0A8,050,000,000,000   ; 56
DB    08BH,000,000,000,040,0A0,008,0B0,040,000,000,000   ; 57
DB    08BH,000,020,000,040,000,080,000,040,000,020,000   ; 58
DB    08BH,000,040,0A0,040,000,000,000,040,0A0,040,000   ; 59
DB    08BH,000,042,000,07E,000,040,000,07E,000,042,000   ; 60
DB    08BH,000,003,004,009,010,021,000,003,000,000,000   ; 61
DB    08BH,000,010,028,010,080,07F,080,010,028,010,000   ; 62
DB    08BH,000,002,001,000,001,07E,080,000,080,040,000   ; 63
DB    08BH,000,000,000,000,000,0FF,000,000,000,000,000   ; 64
DB    08BH,000,040,030,048,004,042,004,048,030,040,000   ; 65
DB    08BH,000,018,000,024,000,018,000,024,000,018,000   ; 66
DB    08BH,000,0E0,010,00A,080,07E,080,00A,010,0E0,000   ; 67
DB    08BH,000,000,010,028,082,07C,082,028,010,000,000   ; 68
DB    08BH,000,010,028,054,000,010,000,010,000,010,000   ; 69
DB    08BH,000,010,000,028,000,044,000,082,000,000,000   ; 70
DB    08BH,000,003,004,019,060,080,060,019,004,003,000   ; 71
DB    08BH,000,000,060,080,07E,080,000,0FE,000,080,000   ; 72
DB    08BH,000,000,020,040,000,0FE,000,040,020,000,000   ; 73
DB    08BH,000,000,000,082,000,044,000,028,000,010,000   ; 74
DB    08BH,000,000,050,0AA,000,0AA,000,0AA,014,000,000   ; 75
DB    08BH,000,002,038,046,080,000,080,046,038,002,000   ; 76
DB    08BH,000,000,004,048,092,000,092,044,038,000,000   ; 77
DB    08BH,000,018,004,000,004,038,040,000,040,030,000   ; 78
DB    08BH,000,000,004,002,000,07F,000,002,004,000,000   ; 79
DB    08BH,000,000,000,032,048,084,048,032,004,000,000   ; 80
DB    08BH,000,080,000,0FF,000,080,000,080,000,0C0,000   ; 81
DB    08BH,000,038,044,092,000,092,000,092,044,038,000   ; 82
DB    08BH,000,082,000,0C6,028,092,000,082,000,0C6,000   ; 83
DB    08BH,000,010,000,010,000,010,000,054,028,010,000   ; 84
DB    08BH,000,044,082,038,082,010,082,038,082,044,000   ; 85
DB    08BH,000,018,024,000,024,018,000,024,000,024,000   ; 86
DB    08BH,000,00C,010,024,040,084,040,024,010,00C,000   ; 87
DB    08BH,000,000,02A,000,02A,000,02A,000,02A,000,000   ; 88
```

(continues)

```
        DB    08BH,000,040,000,082,040,03E,040,082,000,040,000    ; 89
        DB    08BH,000,024,040,004,040,024,010,004,010,024,000    ; 90
        DB    08BH,000,008,004,002,004,008,010,020,040,080,000    ; 91
        DB    08BH,000,000,028,000,028,000,028,000,028,000,000    ; 92
        DB    08BH,000,010,000,010,000,07C,000,010,000,010,000    ; 93
        DB    08BH,000,000,000,00DH,000,00E,000,000,000,000,000  ; 94
        DB    08BH,000,001,000,001,000,001,000,001,000,001,000    ; 95
        DB    08BH,000,000,000,000,040,0A0,000,0A0,040,000,000    ; 96
        DB    08BH,000,000,01C,022,000,022,010,00C,010,022,000    ; 97
        DB    08BH,000,000,001,07E,080,012,080,052,02C,000,000    ; 98
        DB    08BH,000,040,030,008,000,0FF,000,008,010,060,000    ; 99
        DB    08BH,000,000,03A,044,008,054,020,044,0B8,000,000    ; 100
        DB    08BH,000,000,014,02A,000,02A,000,022,014,000,000    ; 101
        DB    08BH,000,000,000,000,000,0FC,002,000,001,000,000    ; 102
        DB    08BH,000,041,002,044,028,010,008,004,002,001,000    ; 103
        DB    08BH,000,040,020,01E,020,000,020,010,00F,000,000    ; 104
        DB    08BH,000,000,000,020,000,03E,000,002,000,000,000    ; 105
        DB    08BH,000,000,001,000,002,0FC,000,000,000,000,000    ; 106
        DB    08BH,000,000,07E,000,010,028,040,004,042,000,000    ; 107
        DB    08BH,000,01C,022,000,006,008,006,000,022,01C,000    ; 108
        DB    08BH,000,000,001,03E,000,002,000,002,03C,002,000    ; 109
        DB    08BH,000,000,020,010,00C,002,004,020,018,000,000    ; 110
        DB    08BH,000,000,00C,010,022,000,022,004,038,000,000    ; 111
        DB    08BH,000,001,002,00C,010,022,000,022,000,01C,000    ; 112
        DB    08BH,000,020,000,020,010,00E,010,020,040,000,000    ; 113
        DB    08BH,000,000,000,07C,082,010,082,07C,000,000,000    ; 114
        DB    08BH,000,00C,012,020,002,020,012,02C,000,020,000    ; 115
        DB    08BH,000,010,020,000,022,01C,020,000,020,000,000    ; 116
        DB    08BH,000,000,004,088,034,0C1,014,081,006,000,000    ; 117
        DB    08BH,000,000,000,028,000,010,000,028,000,000,000    ; 118
        DB    08BH,000,000,00C,052,0A2,012,088,044,000,000,000    ; 119
        DB    08BH,000,042,000,064,010,008,014,022,040,002,000    ; 120
        DB    08BH,000,020,018,004,002,000,002,004,038,000,000    ; 121
        DB    08BH,000,000,080,058,005,060,005,042,000,040,000    ; 122
        DB    08BH,000,020,050,088,070,088,050,088,050,020,000    ; 123
        DB    08BH,000,078,084,000,0FC,000,0D4,028,084,078,000    ; 124
        DB    08BH,000,040,038,040,000,078,000,020,000,078,000    ; 125
        DB    08BH,000,000,000,080,040,080,060,000,000,000,000    ; 126
        DB    08BH,000,000,000,000,000,000,000,000,000,000,000    ; 127


BYTABLE ENDS


DOWN SEGMENT PARA

ASSUME  CS:DOWN,DS:BYTABLE,SS:STACK,ES:NOTHING

        ORG     100H
```

Figure 2 *(continued)*

```
START PROC FAR
        PUSH    DS              ; Save address of segment register
        MOV     AX,0
        PUSH    AX              ; Save zero return address
        MOV     AX,BYTABLE
        MOV     DS,AX           ; Data resides in BYTABLE data segment
        MOV     AX,STACK
        MOV     SS,AX           ; Stack segment initialized
        MOV     SI,0            ; Initialize address index to 0
        MOV     CX,8            ; Will loop for the 8 chars of INITSTR
LOOP_INITSTR:
        MOV     DL,INITSTR[SI]  ; Set up DL to contents of INITSTR
        CALL    SEND            ; Call print routine
        INC     SI              ; Update to next address of INITSTR
        LOOP    LOOP_INITSTR    ; Loop until done
        MOV     SI,0            ; Initialize address index to 0
        MOV     CX,96           ; Will loop for 96 chars of BITVAL
LOOP_BITVAL:
        CALL    SEND_TWELVE     ; Print 12 chars in BITVAL
        LOOP    LOOP_BITVAL     ; Loop until done
        MOV     DL,7            ; BEEP the printer to indicate finish
        CALL    SEND

        RET
START ENDP


SEND PROC NEAR
        MOV     AH,05H          ; Set function call for printer output
        INT     21H             ; Print contents of DL
        RET
SEND ENDP


SEND_TWELVE PROC NEAR
        PUSH    CX
        MOV     CX,12           ; Will loop for the 12 columns of BITVAL
LOOP_COLUMNS:
        MOV     DL,BITVAL[SI]   ; Set up DL to contents of BITVAL - column one
        CALL    SEND            ; Call print routine
        INC     SI              ; Move to next column of BITVAL
        LOOP    LOOP_COLUMNS    ; Loop until done
        POP     CX
        RET

SEND_TWELVE ENDP


DOWN ENDS

        END     START
```

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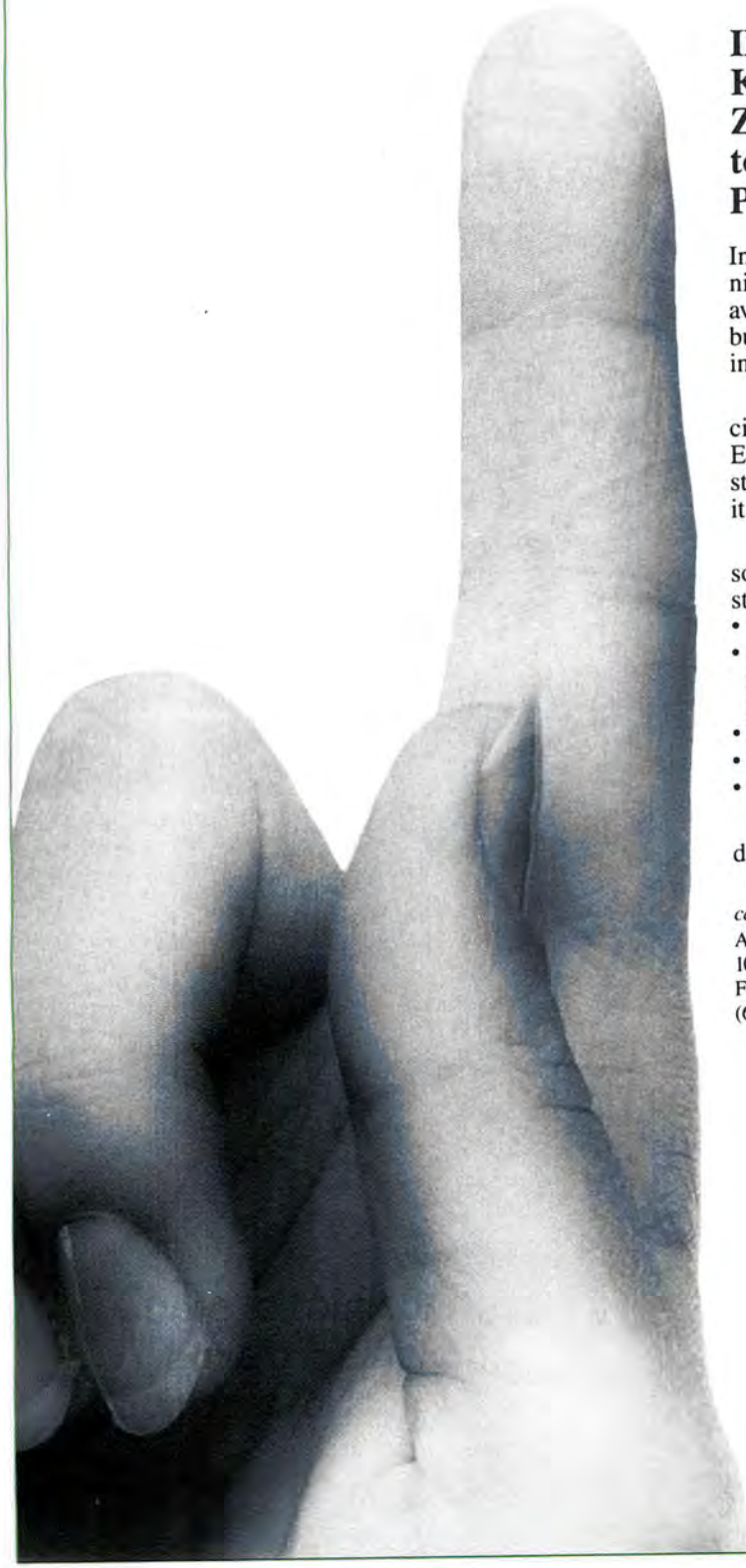

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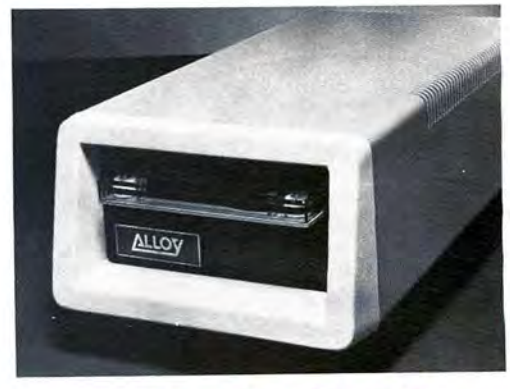

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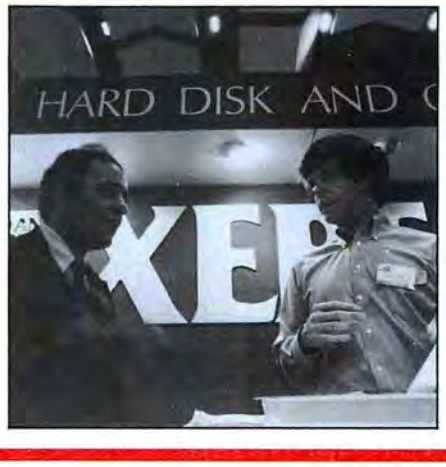

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. Star-Dot-Star

A global exchange of personal computer discoveries

Edited by Art Wilcox and Karl Koessel

Peter Baenziger's article "Pixel to Printer" (*PCW*, Vol. 1, No. 10) provided several BASIC programs that enable various printers to do graphics screen dumps. Star Micronics's Technical Manager Rick Osgood has sent us an addition to these procedures. If you insert a one-line code modification to Listing 4 in Baenziger's article (page 190), the program will work with the Gemini-10X/15X or Delta-10 printers. Replace line 1220 in the listing with the following line:

```
1220 SETCRLF$ = CHR$(27) + "3" + CHR$(16)
```

This month's *.* includes items about using BASIC—recovering deleted BASIC programs, displaying scalar variables and their current values, and checking the cross-references in programs. We also have a routine for setting screen colors from DOS 2.00 and an assembly language subroutine that mimics BASIC's SOUND statement. Our lead item is a tutorial about the erratic bug in the BASIC command VAL.

VAL Tutorial

Here's more information on the strange VAL command. The item "VAL Mischief Again" (*.*, Vol. 1, No. 10) illustrated a connection between PRINTing exponential numbers and testing the VAL of a non-numeric string.

In BASIC if you PRINT a value greater than 9.999999E+16, a subsequent test for the VAL of a non-numeric string equal to zero will fail. The BASIC program in the listing FUNNYVAL.BAS illustrates this point.

What relates the printing of a floating-point number to the testing of the VAL of a string? Here are the facts concerning this problem.

1. The anomaly occurs only if the floating-point number is PRINTed, not merely assigned.

2. If an arithmetic operation is performed using the VAL function, the anomaly disappears; for instance, the test `IF VAL(A$)-0=0` works correctly.

3. The floating-point number must be greater than 9.999999E+16 for the anomaly to appear.

4. If certain other arithmetic operations take place between PRINTing the number and testing the VAL of the string, the anomaly disappears. Otherwise the anomaly remains—even if all the program variables are cleared.

You should note that PRINTing the numeric value and converting the string to a numeric value both involve conversions of binary to ASCII or ASCII to binary. Also, the relationship between points 2 and 4 above indicates that some information is stored somewhere and then modified by certain arithmetic operations. This information affects the testing of VAL but is unaffected by operations on variables not involving arithmetic operations.

Its most probable location is a temporary work space called the floating-point accumulator (FPA) in BASIC's work area. If a number is above a certain minimum level, the binary-to-ASCII conversion (in order to PRINT it) must be done using the 4 bytes of the FPA. To test the VAL of a string, conversion must be made from ASCII to binary, also using the FPA.

The problem is that data is left in the FPA after the binary-to-ASCII conversion for PRINTing. Then, during the VAL calculation, the ASCII-to-binary conversion will stop as soon as the first non-numeric character is detected, leaving the remnants of the initial conversion in the FPA. The last few bytes of the FPA are now garbage.

However, an exponent of zero denotes a zero value, so VAL(A$) does return a zero. But when VAL(A$)=0 is tested, the FPA is not completely empty. Some garbage exists in the last couple of bytes, so the test fails.

This thinking is close to, if not totally, accurate. You can see empirically that clearing the FPA before the test will return VAL(A$)=0 accurately in the example.

The best way to beat the bug is to test for VAL(A$)-0=0. Also, this bug appears to have been fixed in later releases—my XT does not exhibit this behavior.

Gregg Weissman
New York, New York

Un-NEW BASIC

My name is Todd Tokita, and I'm 12 years old. I discovered a way to recover programs in BASIC erased by the NEW statement. For example, if you created a program and didn't SAVE it when you (or someone else) accidentally erased it using the NEW command, the program may be recovered as follows:

```
5 'This program demonstrates the bug in BASIC's VAL statement which was
6 ' mentioned in the DECEMBER issue of this column. As you can see, the
7 ' bug does not occur when J<=9.999999e16 but does occur when J=>1e17.
8 'This bug does not occur on XTs or PCs with the later ROMs.
9 '
10 J=9.999999E+16        'Bug does NOT occur for J<=9.999999e16
20 GOSUB 100              'PRINT J, test VAL(A$), clear FPA, test VAL(A$)
30 J=1E+17               'Bug DOES occur for J=>1e17
40 GOSUB 100              'PRINT J, test VAL(A$), clear FPA, test VAL(A$)
50 END
99 '**********PRINT J, test VAL(A$), clear FPA, test VAL(A$)
100 A$="A$ is not a numeric string"
110 PRINT : PRINT "The numeric value under test is:"J : PRINT
120 GOSUB 200                    'Test VAL(A$)
130 DEF SEG                      'Clear the FPA
140 PRINT "Clearing the floating point accumulator."
150 FOR I=1183 TO 1186 : POKE I,0 : NEXT
160 GOSUB 200                    'Test VAL(A$)
170 RETURN
199 '**********Test VAL(A$)
200 PRINT "The result is...";
210 IF VAL(A$)<>0 THEN PRINT "NOT a good VAL statement"
                  ELSE PRINT "a GOOD VAL statement."
220 RETURN
```

FUNNYVAL.BAS

Type PRINT CHR$(15) and press <Enter>. This statement will print a starlike figure in the first column of the next line. Then move the cursor up to the star, press <Ins>, type 1 PRINT " (which will appear inserted in front of the star), and press <Enter>.

Then LIST your program. The first line should read '1 PRINT "0' followed by a few numbers and part of the original line. Except for the first line, all of your program will probably be recovered.

The only problem with this technique is that you cannot remove the first lines (which are now garbled) without NEWing the program and moving up and pressing <Enter> on each line you want to keep. You must also reenter the original first line. But if your program listing is longer than one screen, you won't be able to recover it—unless you can find another way to do it.

This technique is useful when one of my brothers erases my complicated programs. It may not be the only way to do it, but it always works for me.

Todd Tokita
Sandy, Utah

Editor's note: If your program is longer than one screen, use this technique up to the point when you LIST the recovered program. Then SAVE the program in ASCII, use EDLIN to remove the first two lines, and reenter the original first line.

Variable Checker

Quite often it is necessary to examine the current values of variables while you are trying to debug a BASIC program. The listing VARCHKR.BAS is a BASIC subroutine that displays the

```
64000 P.%=PEEK(858)-6:Q.%=PEEK(859)
64010 A.%=PEEK(856)+256*PEEK(857)
64020 T.%=PEEK(A.%):E.%=PEEK(A.%+3):L.%=T.%+E.%+3
64030 N.$=CHR$(PEEK(A.%+1)):IF PEEK(A.%+2)>0 THEN N.$=N.$+CHR$(PEEK(A.%+2))
64040 IF E.%>0 THEN FOR K.%=1 TO E.%:N.$=N.$+CHR$(PEEK(A.%+3+K.%)MOD 128):NEXT
64050 IF T.%=3 THEN 64120
64060 V.$="":FOR K.%=1 TO T.%:V.$=CHR$(PEEK(A.%+L.%-K.%+1))+V.$:NEXT
64070 ON T.%/2 GOTO 64080,64090,64180,64100
64080 V.!=CVI(V.$):T.$="%":GOTO 64110
64090 V.!=CVS(V.$):T.$="!":GOTO 64110
64100 V.!=CVD(V.$):T.$="#"
64110 PRINT N.$;T.$;"=";V.!:GOTO 64150
64120 B.!=PEEK(A.%+L.%-1)+256*PEEK(A.%+L.%)
64130 T.$="":FOR K.%=1 TO PEEK(A.%+L.%-2):T.$=T.$+CHR$(PEEK(B.!+K.%-1)):NEXT
64140 PRINT N.$"$=";CHR$(34);T.$;CHR$(34)
64150 IF A.%+L.%<P.%+256*Q.%-1 THEN A.%=A.%+L.%+1:N.$="":GOTO 64020
64160 V.$=INPUT$(1)
64170 POKE 859,Q.%:POKE 858,P.%:RETURN
64180 PRINT "error in dump routine"
```

VARCHKR.BAS

scalar variables from a BASIC program. It was developed as a general debugging aid for use on any program in place of inserting the ad hoc PRINT statements usually used to help find errors. When called, the subroutine will list all the scalar (not dimensioned) variables and their current values. Variable type symbols (%, !, #, $) are included in the listing regardless of how the variable names appear in the main program so that no confusion exists between variables of different types with the same letter names.

The line numbers are purposely high so as not to interfere with the line numbers in your program. Also, all the subroutine's variable names contain a period (.), minimizing the chances of duplicating a variable name in your program. The subroutine's variables will not be listed. If your program uses any of this subroutine's variable names, change those names in your program to keep the subroutine from changing a program variable when it is called.

After the subroutine has been entered and SAVEd (with the ASCII option) as VARCHKR, use it as follows. With your BASIC program loaded in memory, issue the command `MERGE B:VARCHKR` (assuming you have the subroutine on the disk in drive B) and insert `GOSUB 60000` in your program wherever you want a dump.

J. C. Ratliff
Sterling, Virginia

Cross-Reference Checker

An easy way to check all the cross-references in a BASIC program is to renumber an imaginary line beyond the end of the program. For example, if your line numbers end at 4000, type the following in direct mode:

```
RENUM 9999,9999
```

BASIC checks all the line number references and issues any error messages without renumbering your program. If the only reply is 'Ok', then all your GOTOs and GOSUBs refer to existing line numbers.

Carl Wagner
Rochester, Minnesota

DOS 2.00 COLOR

BASIC provides a COLOR statement, but DOS 2.00 does not. However, the DOS 2.00 command PROMPT may be used to implement ANSI.SYS escape sequences. This is possible because the PROMPT command uses $e to represent the ESCape code 27, which cannot be entered from the keyboard.

```
goto %1
:normal
 prompt $e[0m
 goto exit
:bright
 prompt $e[1m
 goto exit
:reverse
 prompt $e[7m
 goto exit
:black
 prompt $e[30m
 goto exit
:red
 prompt $e[31m
 goto exit
:green
 prompt $e[32m
 goto exit
:yellow
 prompt $e[33m
 goto exit
:blue
 prompt $e[34m
 goto exit
:magenta
 prompt $e[35m
 goto exit
:cyan
 prompt $e[36m
 goto exit
:white
 prompt $e[37m
 goto exit
:bblack
 prompt $e[40m
 goto exit
:bred
 prompt $e[41m
 goto exit
:bgreen
 prompt $e[42m
 goto exit
:byellow
 prompt $e[43m
 goto exit
:bblue
 prompt $e[44m
 goto exit
:bmagenta
 prompt $e[45m
 goto exit
:bcyan
 prompt $e[46m
 goto exit
:bwhite
 prompt $e[47m
 goto exit
:exit
 shift
 if not .==.%1 goto %1
 prompt
 echo off
 cls
 goto done
:help
 .ANSI.SYS and CONFIG.SYS (containing
 . the line DEVICE=ANSI.SYS) must be
 . accessable when the PC is booted.
 .Type COLOR and then your choice of
 . character, intensity, and/or back-
 . ground color(s) selected from the
 . following list of parameters:
 .For color displays:
 .      black           bblack
 .      red             bred
 .      green           bgreen
 .      yellow          byellow
 .      blue            bblue
 .      magenta         bmagenta
 .      cyan            bcyan
 .      white           bwhite
 .For color and monochrome displays:
 .      normal
 .      bright
 .      reverse
:done
```

COLOR.BAT

Using EDLIN, or your favorite editor, copy and save the batch file in the listing COLOR.BAT.

In addition to preparing the batch file, you need a configuration file on your DOS disk. Create a file named CONFIG.SYS containing the line

```
DEVICE = ANSI.SYS
```

If you already have a CONFIG.SYS file, just add the above line to it. You will also need the file ANSI.SYS, from your DOS 2.00 disk, on this disk. Now reset your PC (<Ctrl>-<Alt>-<Del>) to install the ANSI.SYS driver.

COLOR.BAT can now be used to set screen colors. The command COLOR GREEN, for example, sets the display's characters to green, and the command COLOR BBLUE turns the background blue, keeping the current foreground (character) color. Notice that the letter *B*, indicating background, is prefixed to the name of the color.

You can use more than one parameter in the same command, for example, COLOR GREEN BBLUE; however, if the foreground and background colors are the same, the characters will be invisible. Because all the background colors provided by COLOR.BAT are low intensity, you can restore visible characters by entering the command COLOR BRIGHT. (Work carefully, because what you type is invisible at this point.) This command sets the current foreground color to high intensity.

To change characters from low intensity blue to high intensity green, use the command COLOR BRIGHT GREEN. When changing characters from high to low intensity, you must include the name of the color after the parameter NORMAL (for example, COLOR NORMAL CYAN) since the command COLOR NORMAL (without specifying a color), merely returns the display to its usual appearance.

COLOR.BAT also works with the monochrome monitor, providing normal, bright (high intensity), and inverse video characters. COLOR.BAT can easily be modified to include blinking or underlining on the monochrome monitor. A table of the SGR (Set Graphics Rendition) escape code sequences can be found in the DOS 2.00 manual, page 13-8.

I also combined PROMPT and other escape codes to develop some batch files that defined strings for key combinations such as <Alt>-<F1> or <Ctrl>-<F10>, giving me a poor man's version of *ProKey*. The following pair of commands can be placed in a batch file, which then assigns the string DIR B: (with no carriage return) to <Alt>-B.

```
prompt $e[0;48;"DIR B:"p
prompt
```

Note that there is no semicolon after the second set of quotation marks, despite the SGR syntax shown in the documentation. If the semicolon is included before the final *p*, unexpected results may occur.

The documentation states that ASCII and extended ASCII codes can be found in the Technical Reference manual. If you don't have a manual, they are also documented in Appendix G of the BASIC manual.

Unfortunately, many programs have their own keyboard and screen display routines, and the ANSI.SYS driver is locked out while these programs are active. Hopefully, they restore the previous state upon termination. BASICA and *Peachtext* are two programs that behave this way.

John Bagwell, Jr.
Torrance, California

Cassette Port Control Compiled

I read with interest Michael Covington's "The Cassette Port Lives!" (*PCW*, Vol. 1, No. 10). I too have used the humble cassette interface to trigger external alarms.

However, the BASIC MOTOR statement is not supported by the BASIC Compiler. A little research in the Technical Reference manual (pages 1-9 and 1-25) reveals that the cassette motor relay is controlled by bit 3 of I/O port 61H. Setting this bit

```
100 PRINT "MOTORing along at ";TIME$
110 '
120 OUT &H61,INP(&H61) AND 247  '-close relay contacts
130 '
140   SOUND 32767,(18.2*5)      '-start 5-second delay
150   SOUND 32767,1             '-suspend execution
160   SOUND 32767,0             '-clear timer
170 '
180 OUT &H61,INP(&H61) OR 8     '-open relay contacts
190 '
200 PRINT "MOTORing ended at ";TIME$
```

MOTOR.BAS

to 1 opens the relay, turning the MOTOR off, while setting the bit to 0 closes the relay, turning the MOTOR on.

The BASIC program in the listing MOTOR.BAS demonstrates this technique and works with any version of BASIC. Lines 120 and 180 are equivalent to MOTOR 1 and MOTOR 0 respectively. SOUND command "stacking" is utilized to suspend program execution for a specified amount of time.

Joseph E. Doran, Jr.
Carlisle, Massachusetts

Assembly Language SOUND

The IBM Technical Reference manual (page 2-22) states that the internal speaker can be driven by changing bits in an output port. It also implies that the speaker frequency can be controlled by programming the 8253-5 timer on the system board. Anyone who has tried to generate music outside of BASIC has probably noticed that IBM did not document how to program the 8253-5 timer. The listing SOUND.ASM is an assembly language subroutine that can be called from a higher level language program to generate different tones and durations with the speaker. The program emulates the SOUND statement in BASIC. The parameters passed are for frequency and duration. The listing PASSOUND, a small Pascal program, demonstrates how to call this subroutine.

You will notice in the assembly program that the value B6H is output to port 43H. This code tells the 8253-5 that you wish to load counter 2 with a 2-byte value. It also tells the 8253-5 that it is to treat this number as a binary value rather than a BCD (binary coded decimal) and is to produce an output square wave equal to the 1.19 MHz input clock wave divided by the counter value. The subroutine uses counter 0, which is counting at a rate of approximately 18.2 clock ticks per second, to calibrate the duration of the generated tone. Note that calling this subroutine with a frequency less than 19 hertz will produce a divide overflow error. The 8253-5 timer chip contains three programmable counters; each can be programmed and run independently in one of six modes. For more information on the operation of the 8253-5, see page 1-310 of the Peripheral Design Handbook published by Intel.

Colin Hulme
Scottsdale, Arizona

```
audios  segment 'code'

ASSUME  CS:audios

PUBLIC sound
;
;*****************************************************************************
;
;    Pascal invocation of this subroutine:
;
;            sound(frequency,duration);
;
;    Where duration is the number of clock tics (18.2 / second) that the
;     note should be played.
;
;    Frequency and duration should be declared as word or integer variables.
;
;*****************************************************************************

sound proc far                          ;generator tone for duration

        push    bp                      ;save current base pointer
        mov     bp,sp                   ;load stack pointer to reference parameters
        mov     al,0b6h
        out     43h,al                  ;initialize 8253 control register
        mov     dx,18
        mov     ax,10352                ;dx;ax contains 1.19e6 (base clock rate)
        div     word ptr[bp+8]          ;ax contains 1.19e6 / frequency
        out     42h,al                  ;load counter 2 least significant byte
        mov     al,ah
        out     42h,al                  ;load counter 2 most significant byte
        mov     ah,0                    ;read counter 0 value
        int     1ah
        add     dx,[bp+6]               ;add delay count to low order word
        mov     si,dx                   ;save new value
        in      al,61h                  ;check speaker control value
        mov     bl,al                   ;save value for future use
        or      al,3                    ;set speaker on bits
        out     61h,al                  ;turn on the speaker
aud_delay:
        int     1ah                     ;check counter 0 value
        cmp     dx,si                   ;has delay time elapsed?
        jnz     aud_delay               ;if not wait till it has
        mov     al,bl                   ;restore original speaker control value
        out     61h,al                  ;turn speaker off
        pop     bp                      ;restore original base pointer
        ret     4                       ;return to calling program

sound ednp

audios ends
```

SOUND.ASM

```
program beep(input,output):

var     frequency,delay : word;

    procedure sound(frequency,delay : word); external;

begin
    repeat
        write('Enter frequency:  ');
        readln(frequency);
        write('Enter delay:  ');
        readln(delay);
        writeln;
        sound(frequency,delay);
    until frequency = 65535;
end.
```

PASSOUND

Screen Respite

The Dynalogic Hyperion, a portable PC compatible machine, has a very nice feature to avoid burning characters into the phosphor and to help extend the life of its built-in screen. If 5 minutes elapse without a keystroke, the screen goes blank. Pressing any key immediately restores the screen to its previous state.

I decided to emulate this useful feature on my COMPAQ, and I came up with a short assembly language routine to do so. The listing called BLANKMKR.BAS is a BASIC program that produces a file called BLANK.COM. Once this file has been produced, simply type BLANK to install the routine. I find it convenient to include BLANK in my AUTOEXEC.BAT file.

The routine is called 20 times per second by the BIOS interrupt 1CH. It then checks to see if 5 minutes have elapsed since the last key was pressed. If so, the screen is flipped to page 7. Because this page is rarely used, this procedure should produce a blank screen. When the next keystroke is detected, the previously active display page is selected, thus restoring the screen.

Because BASIC handles keyboard input in a unique way, this program will have no effect while BASIC or BASIC programs are running. It does work well while DOS or programs written in compiled languages (except BASIC) are running.

Christopher Wiley
Prescott, Arizona

Drive Door Parts

Those who have had the door fall off their IBM PC (Tandon) floppy disk drive will quickly learn three things:

○They are not alone. This is an all-too-common problem with these drives.

○For all practical purposes, replacement door assemblies don't exist.

○A glue repair job on the broken door is a difficult and temporary solution at best.

While browsing through the local computer store, I noticed a remarkable similarity between the door on an Apple disk drive and my broken Tandon door. The store had replacement Apple doors in stock at $4.90 each.

Indeed, the Apple and Tandon doors are so similar that they are indistinguishable when mounted, and the Apple door works well with one simple modification. A thin shim must be added between the door hinge piece and the cone lever arm to which it is mounted. I used a small piece of flat aluminum, about 1/32 inch thick, and trimmed it to fit with a pair of scissors. This thickness is critical. You may need to do some experimenting. If the shim is too thin, the cone lever arm is not lowered far enough to clamp the disk securely to the spindle; if too thick, the arm is not raised enough to allow free insertion and removal of disks.

Hopefully, Tandon will eventually realize that replacement doors are needed. Until they do, the Apple door is a good, readily available alternative.

Ed Crabbe
Peoria, Arizona

Editor's note: We had a hinge on a drive A door crack after eight months of use. All of a sudden the PC would not read from drive A, offering the 'drive not ready' message even

```
100 DEFINT A-Z
110 DIM BYTES(153)
120 SUM=0
130 FOR I=1 TO 153
140   READ BYTES(I)
150   SUM=SUM+BYTES(I)
160 NEXT
170 IF SUM <>12626 THEN PRINT"CHECKSUM ERROR, CHECK THE DATA":END
180 '
190 OPEN "BLANK.COM" FOR OUTPUT AS #1
200 FOR I=1 TO 153
210   PRINT #1,CHR$(BYTES(I));
220 NEXT
230 CLOSE
240 SYSTEM
250 END
999 '
1000 DATA &HEB, &H6E, &H00, &H00, &HC6, &H06, &H02, &H01, &H01, &HCD
1010 DATA &H50, &HCF, &H00, &H00, &H9C, &H50, &H80, &H3E, &H02, &H01
1020 DATA &H01, &H75, &H0E, &HC6, &H06, &H02, &H01, &H00, &HE8, &H33
1030 DATA &H00, &HC7, &H06, &H0C, &H01, &H00, &H00, &H80, &H3E, &H03
1040 DATA &H01, &H01, &H74, &H0F, &HFF, &H06, &H0C, &H01, &H81, &H3E
1050 DATA &H0C, &H01, &HF4, &H01, &H75, &H03, &HE8, &H03, &H00, &H58
1060 DATA &H9D, &HCF, &H50, &HC6, &H06, &H03, &H01, &H01, &HB4, &H05
1070 DATA &HB0, &H07, &HCD, &H10, &HC7, &H06, &H0C, &H01, &H00, &H00
1080 DATA &H58, &HC3, &H50, &H80, &H3E, &H03, &H01, &H01, &H74, &H08
1090 DATA &HB4, &H0F, &HCD, &H10, &H88, &H3E, &H0D, &H01, &HC6, &H06
1100 DATA &H03, &H01, &H00, &HB4, &H05, &HA0, &H0D, &H01, &HCD, &H10
1110 DATA &H58, &HC3, &HB8, &H00, &HF0, &H8E, &HD8, &HBA, &H87, &HE9
1120 DATA &HB4, &H25, &HB0, &H50, &HCD, &H21, &H8C, &HC8, &H8E, &HD8
1130 DATA &HBA, &H0E, &H01, &HB4, &H25, &HB0, &H1C, &HCD, &H21, &HBA
1140 DATA &H04, &H01, &HB4, &H25, &HB0, &H09, &HCD, &H21, &HBA, &H70
1150 DATA &H01, &HCD, &H27, &H00, &H00, &H00, &H00, &H00, &H00, &H00
```

BLANKMKR.BAS

though the door was shut. It took quite a while to find that a crack in the hinge was preventing proper disk clamping and that the disk was not spinning.

Jerry Pournelle has more words on drive doors in the January 1983 issue of BYTE. *Besides expressing his observations of Tandon, he informs us that Tandon disk drive replacement parts can now be obtained from Workman & Associates, 112 Marion Ave., Pasadena, CA 91106, 213/796-4401.*

PC-Talk III and Microcom Marriage

I have written a few BASIC lines, shown in the listing PCS-TALK.PAT, that can be merged with the communications program *PC-Talk III* allow-

```
425 CLOSE#1:OPEN COMM$ AS #1
430 ROW=1:COL=1:GOSUB 2820:LOCATE 1,1,1:PRINT GO$:GOSUB 821

821 '
822 '-Initialize MICROCOM PCS modem
823 '
824 PRINT #1,"4";
825 PAUSE%=1     ' PAUSE 1 SECOND
826 SEC%=VAL(RIGHT$(TIME$,2)) :ENOUGH%=(SEC%+PAUSE%) MOD 60
827 WHILE SEC%<>ENOUGH%  :SEC%=VAL(RIGHT$(TIME$,2))  :WEND
828 PRINT #1,"5";
829 RETURN

5095 PRINT GO$:GOSUB 821:GOSUB 2800:GOTO 515

5290 COLOR FG,BG,BG:PRINT GO$:GOSUB 821:GOSUB 2800:GOTO 515

6260 CLS:LOCATE 1,1,1:GOSUB 821:PRINT "===DIALING ";N$
```

PCS-TALK.PAT

ing the use of the Microcom PCS 2000 modem.

The modem initialization string for the PCS is 45, but simply using this string in the program default menu will not work because the initialization sequence for the PCS requires a 4, a pause, and then a 5. A subroutine to perform this sequence is shown in lines 821 to 829. It sends a 4 to the communications port, pauses for 1 second, and then sends a 5. Use of the modem initialization string from the default parameter list is eliminated.

You'll need to initialize the PCS modem at the start of the program (line 430) when you specify new communications parameters (line 5095), change program defaults (line 5290), or dial a number from the *PC-Talk* dialing directory (line 6250). This modification works with either the interpreted or compiled versions of *PC-Talk*.

The 1-second delay in lines 825 through 827 is taken from a contribution to this column by Graham Pearson, "Making 'Em Pause" (*PCW*, Vol. 2, No. 1). This forces the delay interval to be the same whether Interpreted or Compiled BASIC is used.

Of course, typing 45 to manually initialize the PCS each time the communications file is reopened is perfectly functional, but these modifications simplify interaction with this fine modem.

Robert D. Thomsen
Springfield, Oregon

---

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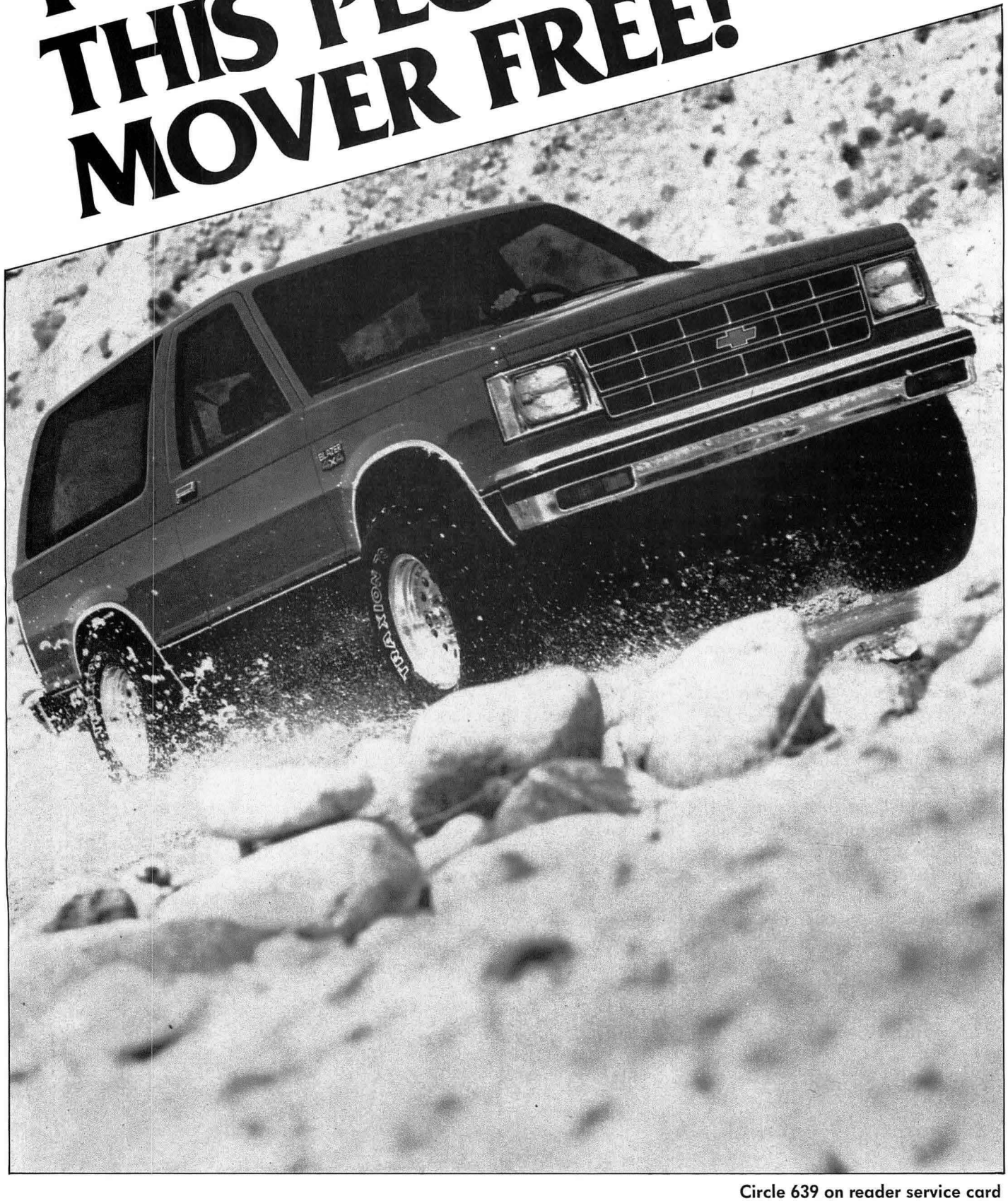

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IN A FIT OF PIQUE HE SPILLS VINTAGE WINE (H) INTO WATER-WHEEL (I) WHICH TURNS PULLEY THAT CAUSES GLOVE (J) TO GRASP SPREADSHEET AND MOVE IT TO TAPING AREA.

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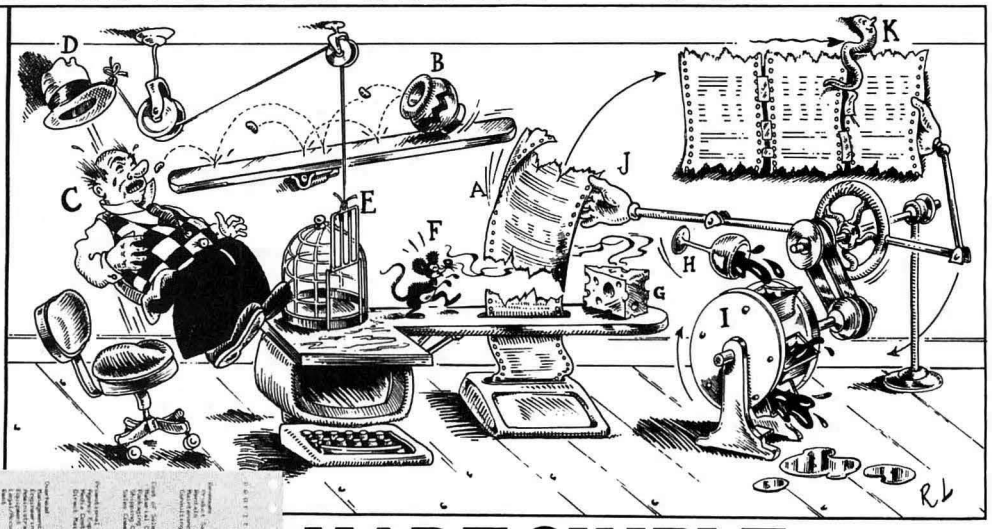

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1984 World Class PC Contest

Win a super PC system worth thousands of dollars

The 1984 World Class PC will have additional hardware and software and will be more valuable than the 1983 winning system pictured above.

PC WORLD

PC World is proud to announce the second annual World Class PC contest. The 1983 contest received a great response from readers, who voted for their favorite IBM PC compatible products in 14 hardware and software categories. The winning products plus an IBM PC constituted the $14,000 World Class PC system. One lucky person, Allan Klein of Union, New Jersey, won the entire system in a drawing last summer.

PC World asks readers to help design this year's World Class PC by voting for PC compatible products in the categories listed on the contest entry form. Choose one product in each of the categories you are familiar with that you would recommend to a friend for outstanding performance and value. *PC World* will announce the 1984 World Class PC system in the November issue.

The best news about this year's contest is that the rewards are even greater than they were last year. New categories of software and hardware have been added to the 1984 system, so the total estimated value of the winning system will be close to $22,000.

Another bonus for voting in this year's contest is the chance to win second prize—an IBM PC compatible computer worth approximately $2500. *PC World* will hold a drawing for the winners of the first and second prizes at the October 1984 IBM PC Faire.

Several of the software categories are defined here to help readers place their votes. The other categories are self-explanatory.

Accounting
Order processing, inventory, accounts receivable and payable, check writing, payroll, general ledger, management reports.

Business management
Project and appointment scheduling, statistical analysis, decision analysis, personnel records, sales prospect management.

Education
Classroom subjects, training on applications software such as word processing.

Financial applications
Investment analysis; portfolio management; stock information retrieval; financial calculation, planning, and reporting.

Operating environments
Window-oriented software systems designed to integrate any number of applications programs.

Personal management
Household record keeping, personal finances, personal data management.

Spreadsheets
Includes programs that integrate other functions, such as graphics or word processing.

Remember to vote for products that you would recommend to a friend, which means performance and value are equally important considerations. After all, you may win the system you help to create.

Contest Rules:

Only one entry form per person is allowed. Entries must be written or printed by hand on the entry form that is printed in the magazine or on a reasonable facsimile of that entry form. You must include your name, address, and phone number along with your vote for IBM PC compatible products. Entries must be received no later than June 1, 1984. Employees of PC World Communications, Inc., and CW Communications, Inc., are not eligible to enter the contest. One last note: please do not staple the form. Instead, place a small piece of tape over the long edge of the card. Thank you and good luck!

1984 World Class PC Entry Form

Name _____

Address _____

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Dear Reader:

Use this entry form to vote for IBM PC compatible products that **you are familiar with and would recommend to a friend for performance and value.** Choose one product per category, although it is not necessary to vote for all categories. Only commercially available, off-the-shelf products are eligible. Please print your entries and submit by June 1, 1984.

Hardware

	Manufacturer	Product	Model
Compatible Computer (second prize)			
Color Graphics Board			
Color Monitor			
Combination Board			
Disk Drives			
Hard Disk Storage (10M to 12M)			
Input Device (mouse, light pen, digitizer, touch pad, etc.)			
Modem			
Plotter			
Printer—dot matrix			
Printer—letter quality			
Protocol Converter			

Software

	Manufacturer	Product
Accounting		
Business Management		
Communications		
Data Base—index file		
Data Base—major		
Disk Emulator		
Education		
Financial Applications		
Games		
Graphics		
Language		
Operating Environment		
Operating System		
Personal Management		
Spreadsheet		
Terminal Emulator		
Utilities		
Word Processing		

(continues)

1984 World Class PC Entry Form

Market Research Questions

1. Age ☐ 18–25 ☐ 26–34 ☐ 35–44 ☐ 45–54 ☐ 55+
2. Occupation _____
   Industry _____
3. Household income
   ☐ Under 15,000 ☐ 15,000–25,000 ☐ 26,000–35,000 ☐ 66,000+
   ☐ 36,000–45,000 ☐ 46,000–55,000 ☐ 56,000–65,000
4. Computer owner? ☐ Yes ☐ No
5. Type of computer _____
6. Do you plan to make a computer-related purchase in the next 12 months? _____
   If so, what? _____
   Amount you will spend? _____
7. For what applications do you use your computer?
   ☐ Accounting ☐ Data Base ☐ Financial Planning ☐ Graphics ☐ Word Processing
   ☐ Communications ☐ Education ☐ Games ☐ Spreadsheet

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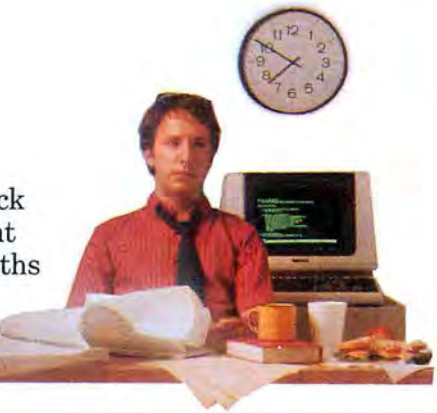

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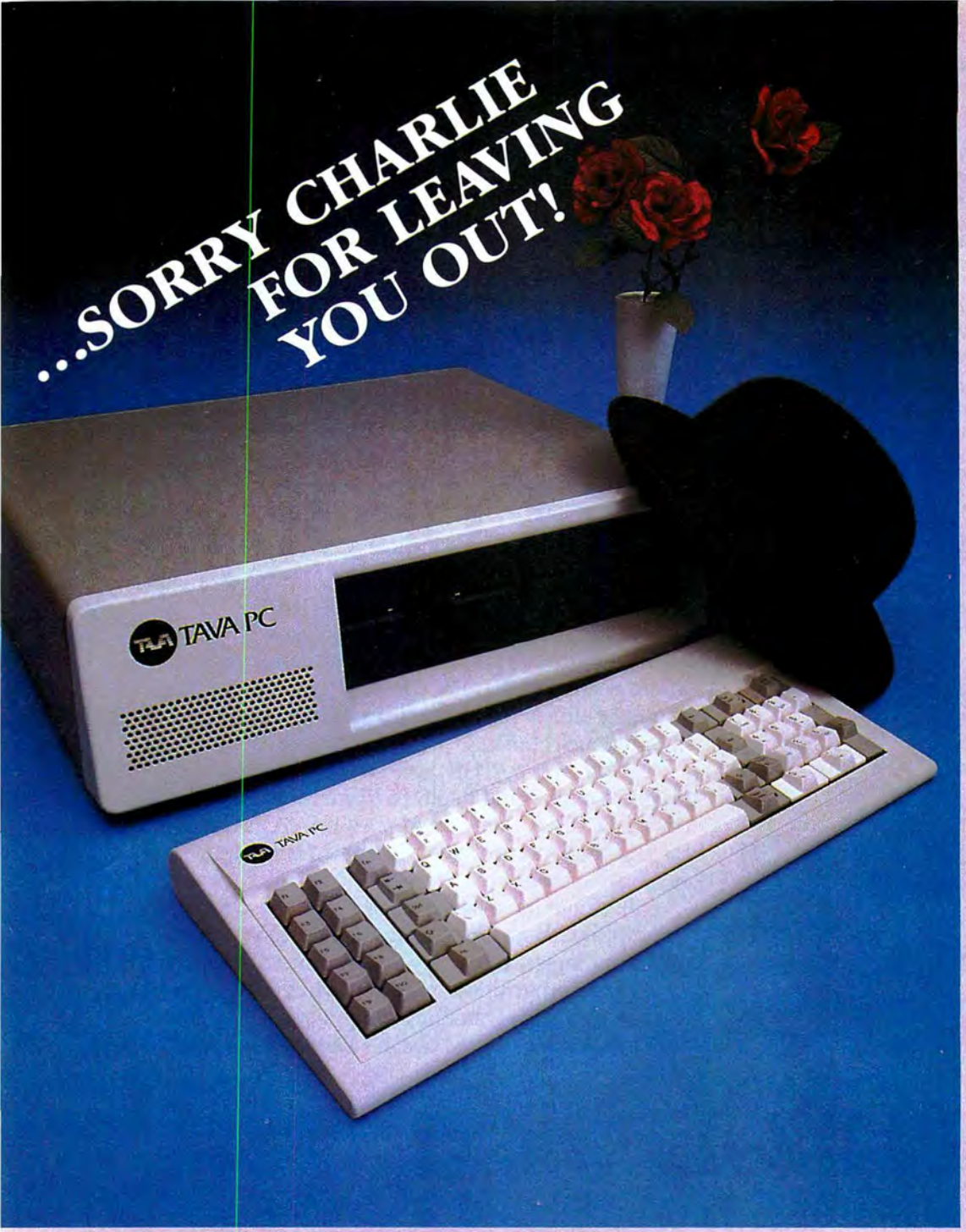

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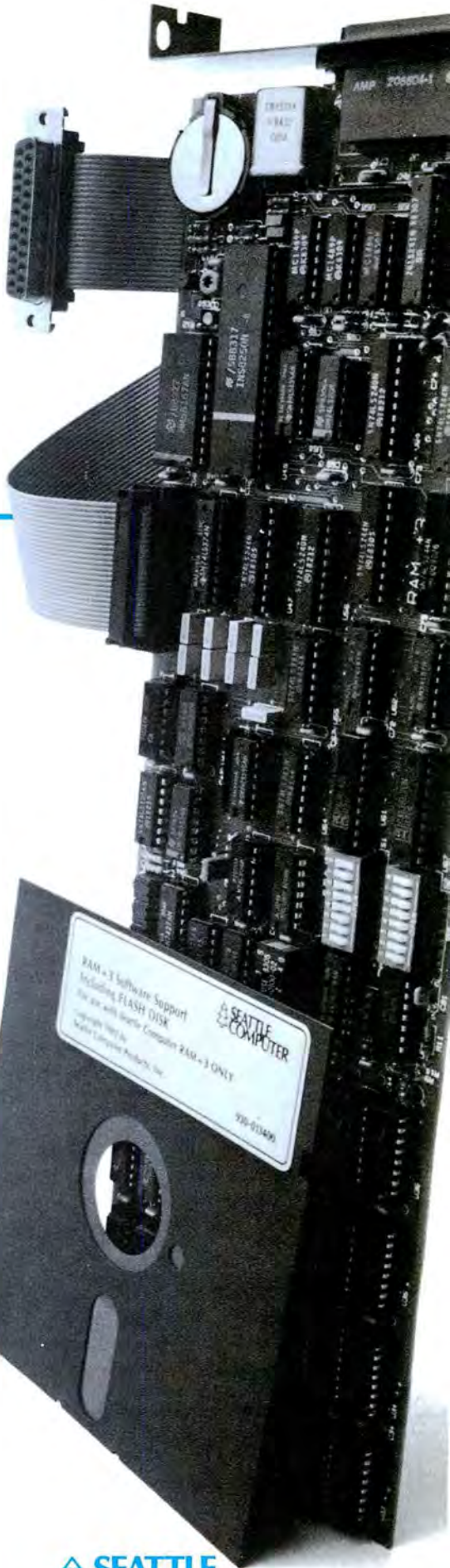

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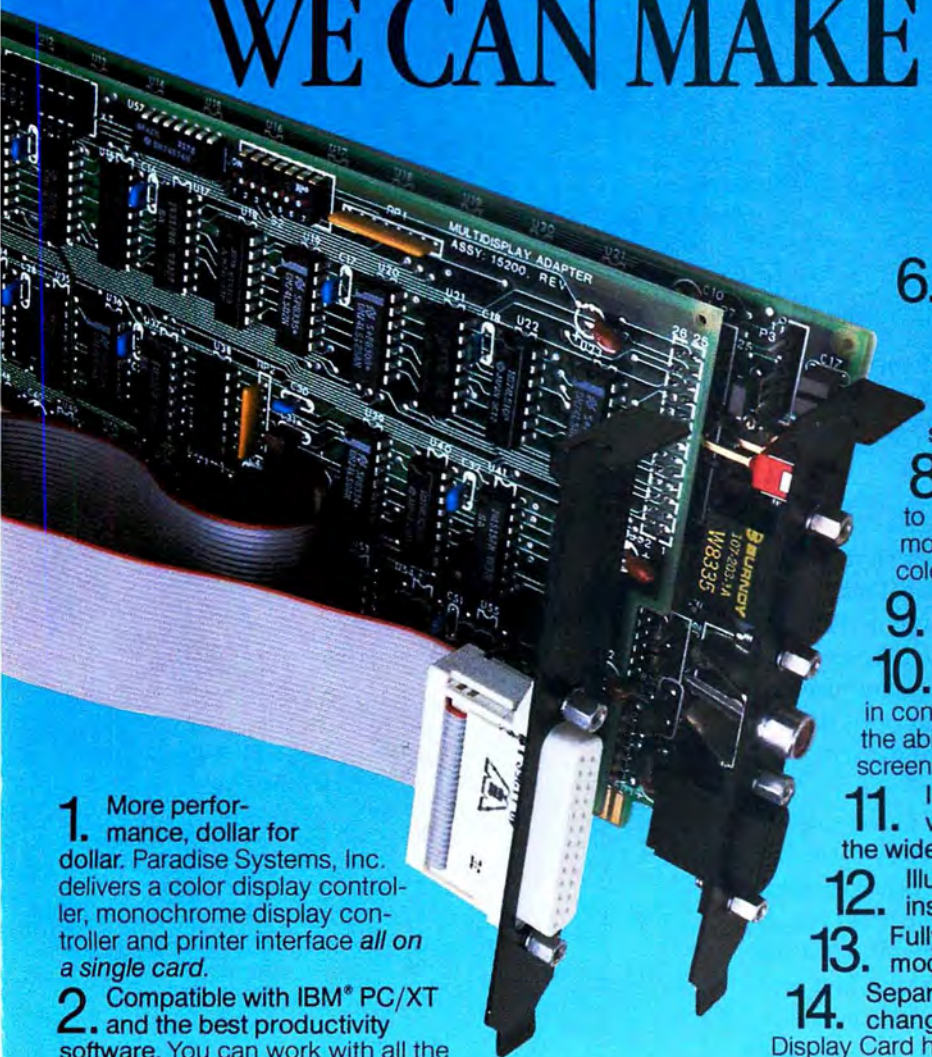

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Perils of Software Publishing

Jonathan Littman

Dreams of riches have led many a programmer to start a software company, but in this increasingly competitive field you will need more than optimism to get you through.

ThinkTank, the idea-organizing program recently made available for the IBM PC (see "ThinkTank," *PCW*, Vol. 2, No. 2), has been glowingly reviewed in the *New York Times*, *InfoWorld*, and *Science Digest*. You might imagine that this publicity would mean instant success. Actually, it was only the ante. The good reviews interested the dealers, which in turn interested the venture capitalists. Then the game began.

One lawyer described the obstacles facing software companies in terms of video games. At every corner there are dangers to elude or enemies to defeat. Employees often run off with ideas or even entire programs. It's difficult getting dealers to sell your programs. It's a challenge finding venture capital, and even if your first program's a success, competition, mismanagement, and software piracy can send you back to the unemployment office. Starting a software company is no longer an enterprise to be taken lightly.

Today, consumers demand sophisticated "user interfaces," readable documentation, and product support. In the early hobbyist period of personal computers those features, if available at all, were mere window dressing.

Now they are often the whole store. From the venture capitalist's point of view, documentation is often more important than the program itself. Documentation sells programs to dealers and the public. Without it a program might as well exist in a vacuum.

Go West, Young Programmer

Behind every product there is an idea. For Dave Winer, the creator of *ThinkTank*, the idea came from his girlfriend. In 1979 he was working on a Pascal program editor at the University of Wisconsin. One afternoon he described to his girlfriend how the program worked. She didn't seem particularly impressed but idly suggested, "Why don't you do that for ordinary people?" Winer saw her point. He had developed a tool for organizing and manipulating computer code, but that was only one application. Why not use a similar method to organize words and ideas?

Winer was so intrigued by the thought that he bought a microcomputer and spent the next nine months in seclusion, programming. By the end of this gestation period he had created the prototype for *ThinkTank*. When he heard that Apple had recently adopted Pascal as its development language, Winer packed up and moved to California, convinced that Apple would want his outlining program in addition to a relational data base program he had developed. As it turned out, Apple only wanted the data base. Winer refused to separate his two products, and the deal fell through. Says Winer, "I was naive, but perhaps they were too. After all, they had turned down *VisiCalc*." *VisiCalc* had just been released by Personal Software (soon to become VisiCorp) and was the talk of Silicon Valley.

In need of a job, Winer decided to give Personal Software a call. He hoped that a company with software as innovative as *VisiCalc* might take a chance on his outlining program. He was right. "They just happened to be looking for an outline editor," says Winer, "and I happened to be probably the only person in the world who had one." Winer made a deal with Personal Software, and they started working on version two of *ThinkTank*. It was to be called *VisiText*.

The honeymoon didn't last long. "I think VisiCorp and I both went through growing pains," says Winer. "The industry lacked definition. The original *ThinkTank* was slated to be out in four months. Even the simplest program requires at least a year of development." Winer feels that the whole industry was confused about the design process in 1980 and 1981. "It's an inverse ratio: the simpler the product, the more difficult it is to create. People didn't realize this. They believed you could simply execute the specifications." Winer calls these programs "mathematical proofs." They don't bomb out, but they fail to serve any useful purpose. Winer suggests that software development is not suited to rigid planning. "When you develop software, you get intuition as you go along."

In October of 1981 Winer left VisiCorp with his program intact. One of his fellow programmers at VisiCorp, John Llewellyn, also left and became Winer's partner in a company called Living VideoText. They continued working on *ThinkTank* even though it was basically finished. Llewellyn calls this period an extended editing process. "The program went through several philosophies," says Llewellyn. "We kept questioning how it would be used and by whom. The past versions of *ThinkTank* show little resemblance to the IBM PC version. At one time we thought *ThinkTank* should be primarily a word processor; at another time, a data base. Later we thought it might be a note-taking program and finally even an interface for an operating system."

Llewellyn doesn't feel that this degree of flexibility in thinking would be possible at a large company. "A programmer has a tendency to feel that a program is never finished. At a company you have someone telling you when it is finished," he says. After 2½ years of working on *ThinkTank* Winer could no longer afford to pay Llewellyn. He had been paying Llewellyn's salary with money from the sale of his VisiCorp stock. When the funds ran out and *ThinkTank* was not yet making money, Llewellyn took his programming skills elsewhere but remained a stockholder in Living VideoText.

Ironically, Winer's lack of funds may have been an advantage. The manual for the Apple version of *ThinkTank* was begun in August of 1982, well before the program was finished. Development delays allowed the manual writer, John Zussman, to give feedback on how various design features influenced the manual. Says Winer, "John was actually helping to design *ThinkTank*."

Going to Market

By October of 1982 the Apple version of the program and manual were finished. The easy part was done. Now Winer had to figure out how to sell *ThinkTank*. He hired some salespeople and sent them to dealers around the Bay Area, but nobody would carry the program. "Maybe it was because so many other people were doing the same thing," says Winer of his initial failure. "Dealers are so inundated with software, they almost have to be forced to take on a new program. We had the additional problem of having a unique product. It wasn't a

word processor or a data base. Dealers need signposts to categorize programs." Finally, Winer could no longer afford the salespeople. He gave up. Three years after its conception not a single copy of *ThinkTank* had been sold.

Without money there was only one hope—free advertising. Winer sent review copies to every influential person he could think of who might write about *ThinkTank*. One of the first and most important reviews appeared in the *New York Times*, written by Erik Sandberg-Diment. Says Winer, "That review gave us instant credibility."

Despite the prestige of appearing in the *New York Times*, Winer felt that the review in *InfoWorld* was more important. Although *InfoWorld* has a much smaller circulation, it had a more immediate effect on sales. More computer dealers read *InfoWorld* than the *New York Times*. "The review in *InfoWorld* started a chain for us. There are so many trade magazines around that the competition for stories is intense. When one magazine gets ahold of what they think is a hot product, everybody else wants a look."

> 'Dealers are so inundated with software, they almost have to be forced to take on a new program.'

By April, sales began to trickle in on the Apple version of *ThinkTank*. Winer was finally able to live on the program's earnings. For several months he had been supporting himself and the company by doing contract work in game design, sometimes earning as much as $1250 a day. This unique skill enabled him to carry the company by working as little as one day a week.

Meanwhile Winer had been scouting around for other sources of financing. As early as 1981 he courted venture capitalists, but as Winer says, "At first they saw us as too young. Later, after the reviews, they saw a product but no company." Ironically, it was not until Winer no longer needed venture capital to survive that he finally got it. The infusion of venture capital helped Winer build a company. It enabled him to hire salespeople and a business manager and to launch an advertising campaign. He is currently working on a second product due out this year.

Perfect Software

While Winer's success with Living VideoText is a classic example of a designer who has taken his ideas and built a company around them, there are other ways to start a software company. One is to learn from other companies. Perfect Software provides an example of this more conservative tack. Originally a small software distributor, Perfect Software sold off its New York distributorship in September of 1981 and moved out to Berkeley, California, with a six-person staff. It bought the rights to *Mince* and *Scribble* from Mark of the Unicorn for $10,000 (see "Not-So-Identical Twins," *PCW*, Vol. 2, No. 3). After integrating the two programs and making modifications, the company came out with its first product, *Perfect Writer*, in April of 1982. The product received good reviews, and Perfect Software went on to develop a full product line including *Perfect Speller*, *Perfect Filer*, and *Perfect Calc*. These programs were designed to work together as an integrated package (see "The Almost-Perfect Library," *PCW*, Vol. 2, No. 3).

By October of 1982, NewMarket, a venture capital firm, was interested enough to sink $800,000 into the company. One of the key factors in Perfect Software's success was its ability to persuade computer manufacturers to bundle its software. "We had contracts with Kaypro and several other companies," says Robert Glidden, cochairman of the board. "There was also a solid interest from OEMs [original equipment manufacturers]."

The company exploded from 6 to 60 employees in less than eight months. Glidden talks about the growing pains. "I think the most difficult thing was finding quality people. Another problem is that one department often becomes larger than another. Imbalances develop." In March of 1983 Perfect Software received another $3 million in venture capital from TA Associates, the same firm that financed Digital Research, Televideo, and Tandon. Tandon also made a large, undisclosed investment.

Glidden feels that getting venture capital is simply a matter of proving yourself. "I think a venture capital firm looks for two basic things. Either you have prior experience that particularly relates to your business, or proven, tangible results. Ideas are a dime a dozen. You have to have the ability to put an idea into action."

By starting out as a small distributorship, Perfect Software was able to learn the ropes without getting tangled up in them. But Glidden feels that it was more than just a question of recognizing mistakes. "Everybody saw the mistakes that were being made, but that wasn't what was important. You needed to see or anticipate the trends. For example, it became apparent that well-written documentation would become a desired standard. We made that one of our goals." Glidden also recognized

the importance of capturing international markets. Perfect Software now has offices in France, the United Kingdom, and Australia and has translated *Perfect Writer* into several languages.

Lawyers to the Rescue

If you are considering going into the software business, spending time with a lawyer first may free you of your delusions. There are easier ways to make (or lose) money than starting a software company.

Unfortunately, designers and presidents of software companies usually wait until they are in trouble before they see a lawyer. Attorney Jordan Breslow of Stewart, Stewart and Breslow in Walnut Creek, California, describes a common scenario. "Often there is no conscious thought of structuring a company, just a couple of friends who went to computer school together. Everything has been done on a handshake. Then the company starts becoming successful. Somebody leaves the company, or two out of three people end up doing all the work and want to kick out the third. The problem is that they didn't establish any rules. In the end they may have to dissolve the company and start all over again."

A company facing litigation disputes among its principals is not very attractive to venture capitalists. If legal counsel is garnered early in a software company's life, it can do more than incorporate the company and keep it from stumbling. Lawyers can make a company more attractive to venture capitalists and other sources of financing, and they can even help a product sell. Equally important, they can advise permissible ways of soliciting venture capital under federal and state corporate law.

Lawyers can also help you explore ways of protecting a programming language, software, or a software concept. Among these protective measures are employee and confidentiality contracts, copyrights, licenses, and trade-secret laws.

Partnerships

Another method of organizing and funding a company is to give out general and limited partnerships for research and development (R and D). General partners are just like regular partners in a partnership. If the business goes under, they are personally liable for any losses. General partners are usually responsible for running the company. In contrast, limited partners invest a certain dollar amount, have little say in managing the company, and can lose no more than the amount of their investment.

An advantage to issuing limited partnerships for R and D is that general partners are likely to retain more of the limited partners' initial investment than if the funds came from a bank or a venture capitalist. Bob Dulksy, a New York consultant who does strategic planning for software firms, explains why. "For the small company, R and D funding has a distinct advantage over a bank loan. The bank wants to be paid specific amounts on specific dates. With R and D you only have to give investors a return when the company is successful—when you have a cash flow."

However, R and D financing often appears risky to investors. "The problem is not that companies are researching an unknown product," says Dulksy. "Virtually all products are already in the process of development. The real risk to the investor is that the company doesn't have the knowledge to market the product." Dulksy feels that a homespun version of R and D partnerships may be the best solution for companies too small to attract venture capital. Dulksy calls this method of funding "doctor and dentist money." If enough friends or contacts can be put together, a few hundred thousand dollars can be raised. Then if the company achieves success, it should be easier to acquire more traditional forms of capital.

One of the most common methods of organizing and financing a young company is to set up the company under small business exemption codes. In California you can take advantage of the small offerings exemptions under the California Corporation Code, section 25102, which limits stock ownership to 35 people. There can be no advertisement for the offering and no commission paid to anyone for a sale of the offering. This small organization scheme is usually adequate until a company reaches more than a few million dollars in sales, a level at which corporations often go public. At that point they come under strict regulations and usually must hire specialists who put the books and company in proper order.

In Search of Venture Capital

Few software companies can get very far without outside capital, which is usually venture capital. "Venture capitalists want to see success, some kind of a product," says Breslow. "They are wary of the high failure rate in the software industry." A lawyer can help in the negotiations for venture capital. "Most people are naive as to the amount of control venture capitalists want in a company they invest in. The person who starts a company wants to hold on to his or her baby. A lawyer can help this person reach a compromise."

Why does one software company effortlessly find all the venture capital it needs, while another struggles like a confused knight in search of the Holy Grail? Financial reasons are the deciding factor in many cases, but venture capitalists consider a variety of other factors.

"We are always looking to back outstanding, young, creative individuals," says Jean Deleage of Burr, Egan, Deleage and Company, a venture capital firm. "This is

an industry in which you cannot expect a track record. We are more prone to take a risk on young people and young companies." Deleage also stresses practical abilities and the importance of distribution, marketing, merchandising, and even publishing skills. Yet he considers management skills to be paramount. "They must be able to manage people. To know how to hire, organize, and retain people is critical. Software is not an asset-based industry. If the key people leave, say the chief programmer, your company is in trouble."

Deleage feels that most business plans are too detailed. "You cannot speak seriously about the future in this industry. I prefer an operating plan geared toward 12 months or so."

R and D financing often appears risky to investors.

Deleage does not think that having the most advanced software is necessarily the key to success. But documentation, says Deleage, is essential because it can help dealers use and understand the product.

Perhaps the greatest handicap designers and small software companies face in obtaining financing is the exaggerated importance they give to their programs. When I asked one venture capitalist what he looks for in software, he answered quite frankly, "We look backwards. We look at what the market is demanding. Then we try to determine if the program will fill the need." Innovative programming, elegant screen design, and clear documentation are secondary. The first question for venture capitalists is, "Will it sell?"

Although Deleage's firm has let hundreds of designers and owners of small software companies pass through its doors, it is currently financing only seven software-based companies. One of Deleage's associates, Shirley Cerrudo, explained that the market is not big enough to accommodate everybody's programs and that designers are often unaware of existing competition. "Since it is a cottage industry, you sometimes don't know who your competitors are. People often think their idea is unique, and it isn't. We've heard it somewhere before."

Another common misconception, says Cerrudo, is that it will be easy to get OEMs. "Many assume that if they are making a product that runs on the PC, IBM will come running and want one for every machine. It just doesn't work that way. My guess is that 50 to 100 programs are turned down by OEMs for every one accepted." A small software company that has had some success is often unaware of the high expectations of venture capitalists. Cerrudo thinks a start-up software company should have a growth rate of between 75 and 90 percent based on gross income. "Once it is up and running it should be making 20 percent after taxes. Small software companies often think that 14 to 15 percent is great, and it is, for manufacturing. But in software that simply isn't good enough."

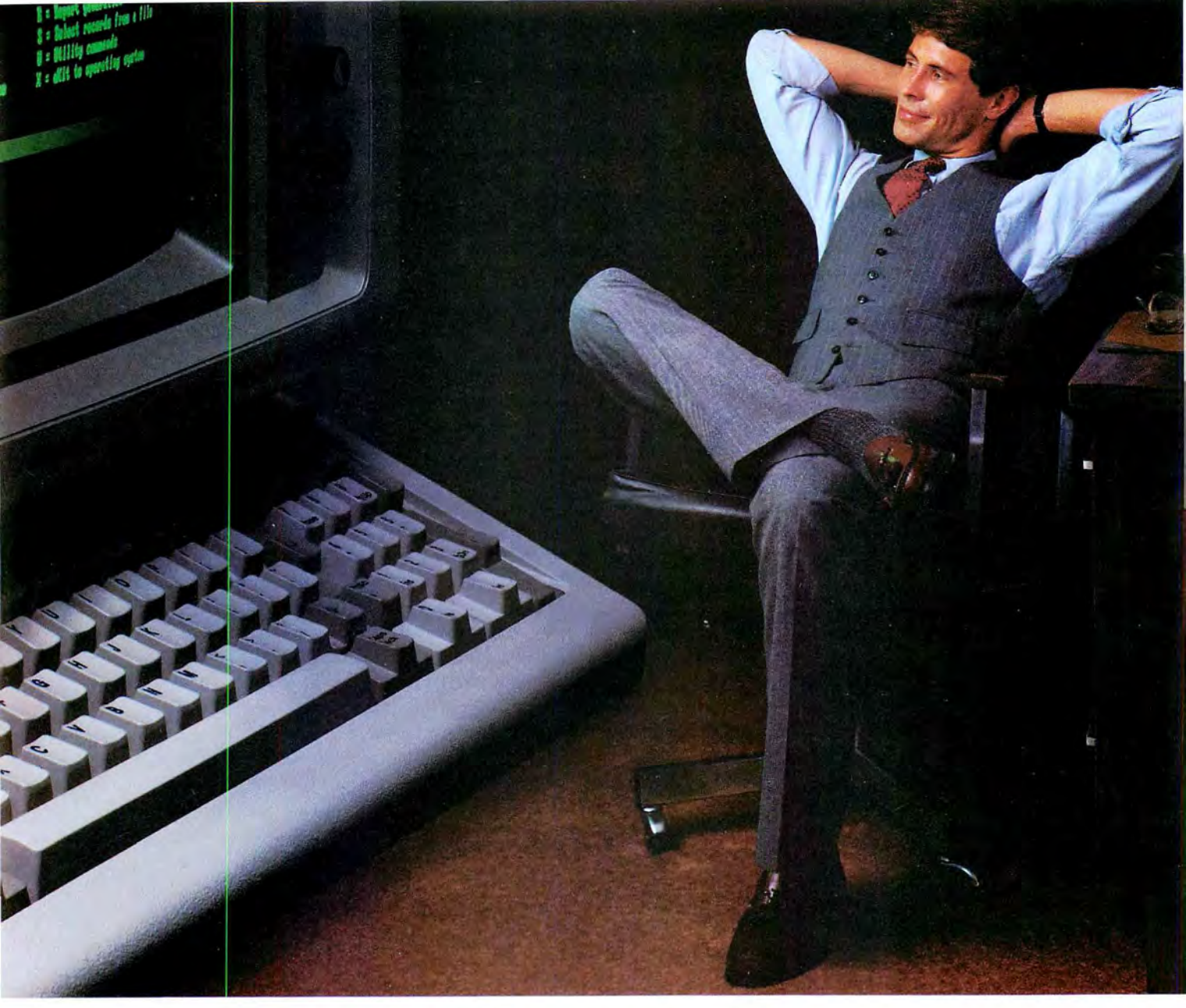
Few software companies get venture capital until they have had a product out for one or two years. Cerrudo says she has met dozens of bright individuals with good products but no business strategy. "They simply haven't given a thought to marketing; they assume it will sell magically, by itself." Cerrudo says that the more sophisticated seekers of venture capital not only have a product that is selling, but they also have planned a follow-up product. "A product's life is not infinite," says Cerrudo.

Tom Hughes of Management and Capital Group in Walnut Creek, California, spoke of the "survival" factor. "Software is a very rapidly paced market with enormous competition. Hardware is approaching the stage where it is a commodity, and software may evolve in the near future to that same stage. If it does, prices will drop drastically." Hughes feels that most software firms must have at least two years of returning a profit to offer a healthy return to investors.

The greatest limiting factor in the growth of software companies may be the type of people who start them. "Typically they don't think big," says Cerrudo. "Maybe they were chief programmers at other companies or they just got out of school. They are often happy with $1 to $3 million in annual sales." Many software companies just don't grow up. Seldom do they move beyond the initial peer group, and they don't have a management organization to maintain or digest growth. There are few large software firms. Only 20 or 30 have over $20 million in annual sales, so there are few models to learn from or imitate.

With the obstacles facing software entrepreneurs it is a wonder that companies get started at all. Most entrepreneurs feel that producing software is their calling. They seldom make money or become famous, and if they do, it is usually after endless hours of staring at computer screens. During a demonstration of the IBM PC version of *ThinkTank*, someone said to Winer, "Gee it must be a lot of fun to start your own software company." Winer laughed and shook his head. "Fun? Sure it's fun if you like losing several years of your life." ●

Jonathan Littman is a freelance writer based in the San Francisco Bay Area.



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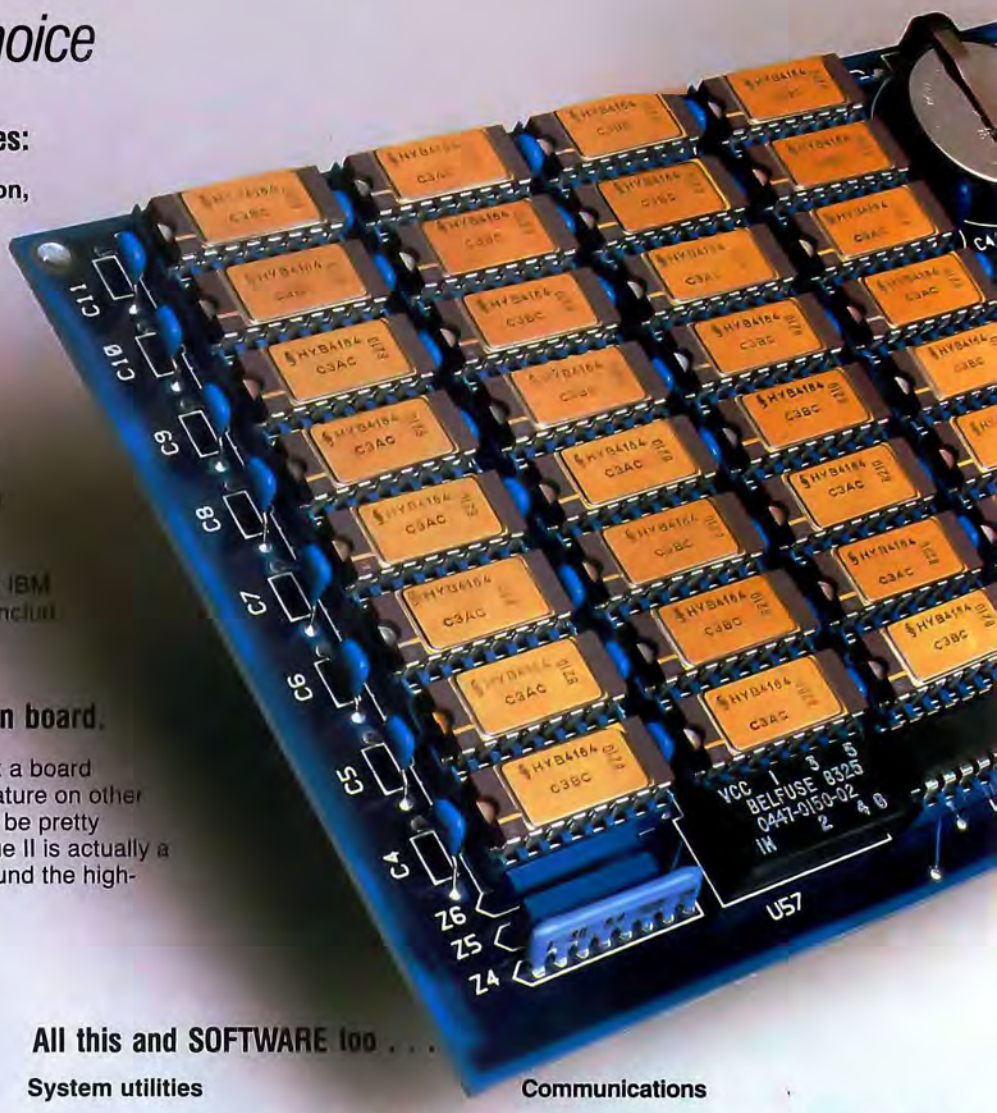

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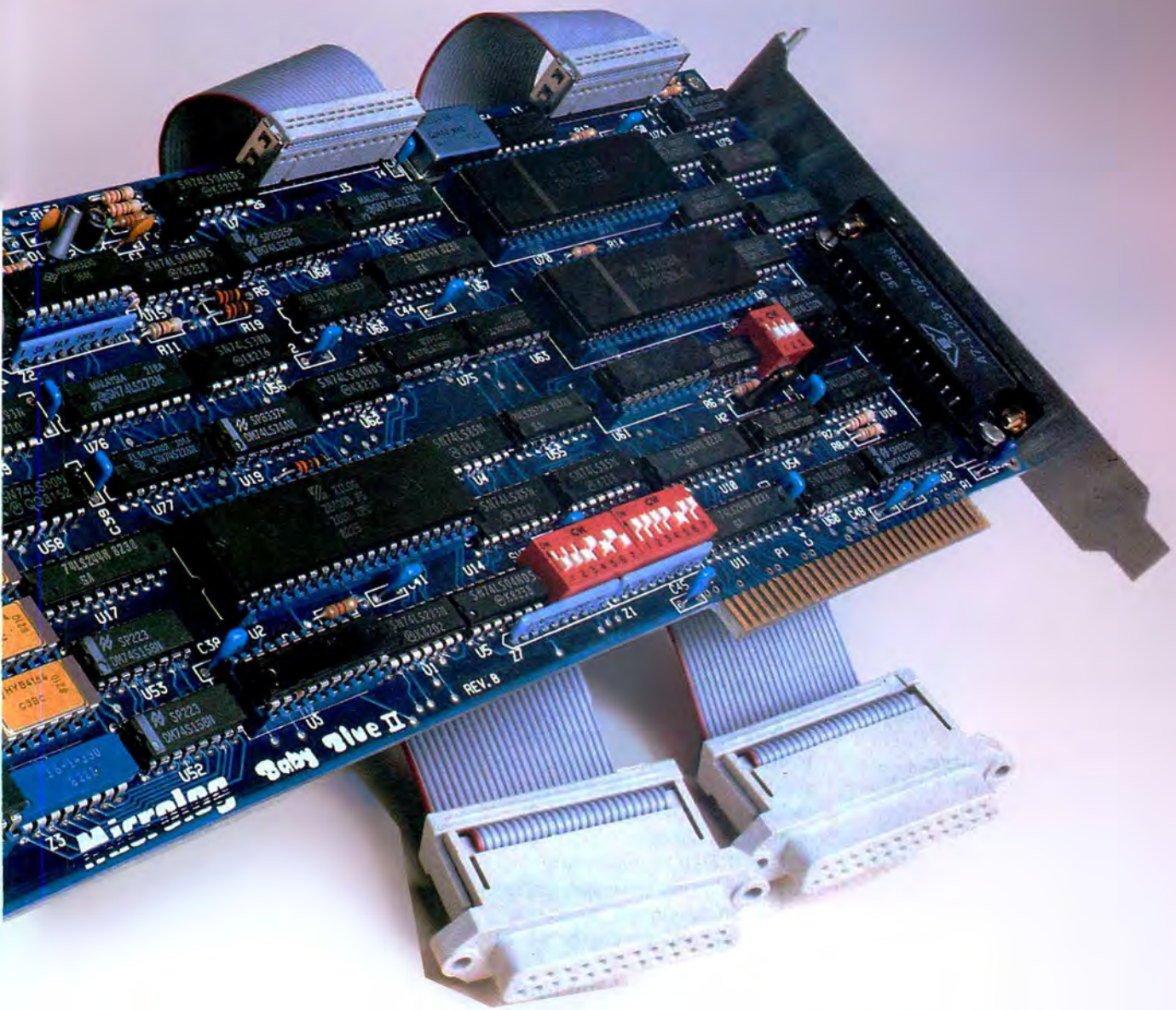

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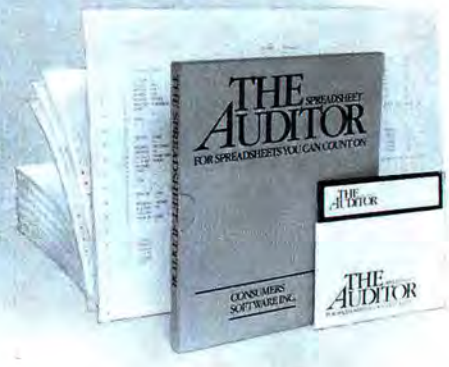

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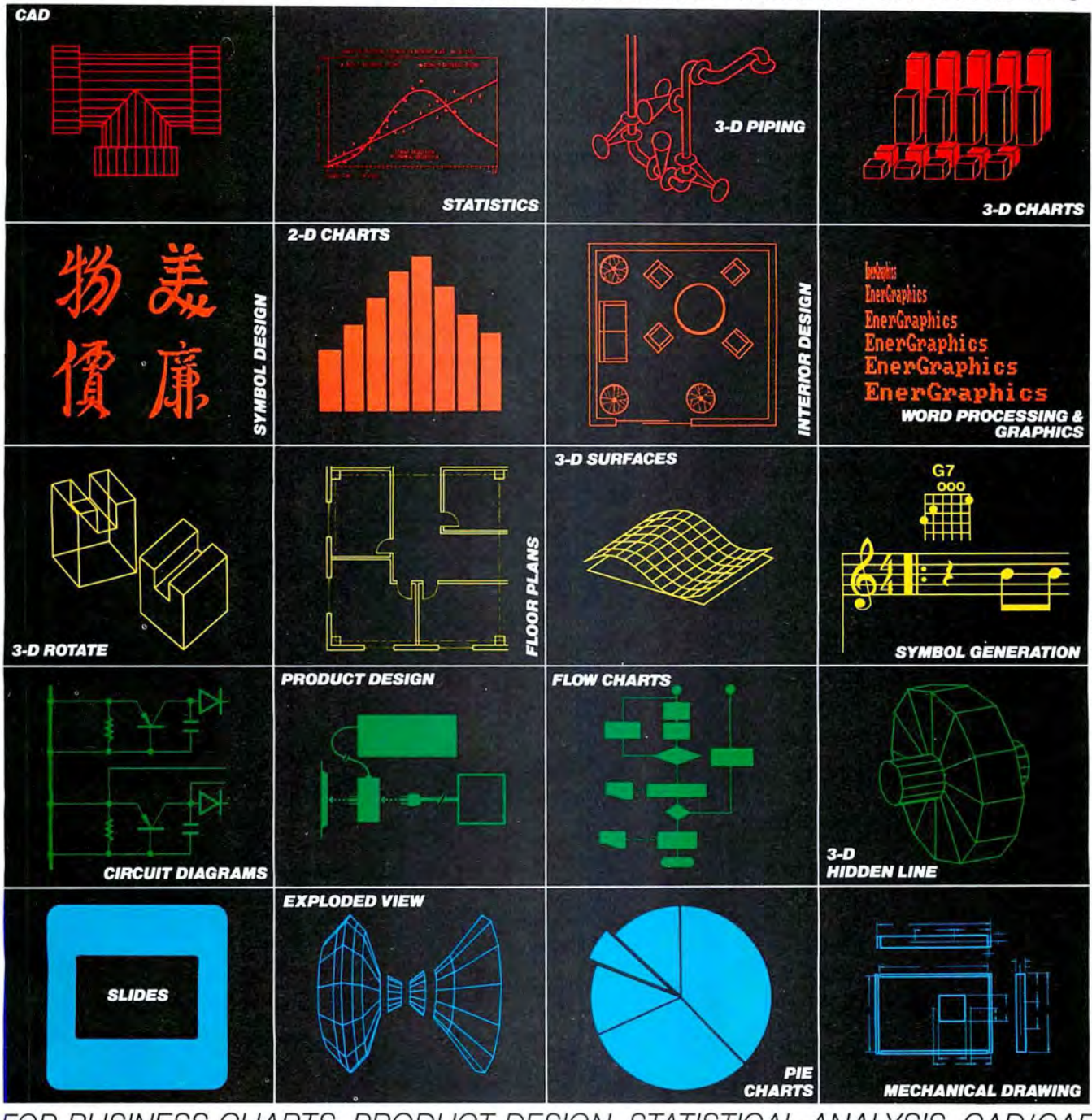

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The PC News

Videotex, teletext, and data bases are competing fiercely for an electronic news market that doesn't exist yet.

Dana Blankenhorn

The daily newspaper has reached your personal computer, whether you want it there or not. While printed newspapers are not necessarily bound for the industrial graveyard, most large dailies now have electronic versions available. The *New York Times*, the *Los Angeles Times*, and the *Wall Street Journal* led the way, and now smaller papers like the *Sacramento Bee* are following.

Three types of computer-driven news are now available to readers: teletext, data base services, and videotex.

Teletext

Teletext services broadcast information over an unused part of a TV picture called the vertical blanking interval (you can see it by turning the horizontal hold knob on your TV set—it's a dark bar running up and down the screen). Unfortunately, teletext is a one-way technology and requires a special terminal. That may be why Time Inc., which had planned to produce a teletext service that would use Mitsubishi terminals, shelved its plans last fall. Keycom, a joint venture among Honeywell, Centel, and Field Enterprises, has introduced a teletext service called Keyfax that is broadcast over the satellite signal of WTBS-TV, Ted Turner's Atlanta-based cable "superstation."

Data Base Services

Data base services, such as The Source, CompuServe, and Dialog, have offered archival searching of daily newspaper indexes for about five years now. One service, Nexis, offers full-text searches of 14 newspapers. Data base services are today's dominant form of computer-delivered news. They are accessible to any personal computer that uses ASCII characters and is equipped with a modem and a password.

Videotex

Videotex is the technology causing the most excitement around newspaper offices these days. Like a data base service, videotex is interactive. Like teletext, it's easy to use. Like TV, it offers both color and graphics, which means you can advertise on it (see "Networking in Color," *PCW,* Vol. 1, No. 1).

Until last year, American videotex development lagged behind foreign videotex networks such as Canada's Telidon, France's Antiope, and Great Britain's Prestel. This slow start was due mostly to the absence of a standard and the need for special terminals. The standards problem has faded with acceptance of the North American Presentation Level Protocol Syntax (NAPLPS, pronounced "naplips") by, among others, Dow Jones, Knight-Ridder, Times-Mirror, and AT&T. The terminal shortage has been addressed by AT&T, whose NAPLPS-standard videotex terminal, Sceptre, costs $900. The unit includes a 1200 bps modem, a cable TV attachment, and a high-resolution monitor capable of displaying up to 256 colors.

Those of you who already own a personal computer may not have to buy a special videotex terminal to use videotex services unless you want the higher-resolution graphics. New software and standards are giving videotex access to a growing number of personal computer owners. Videotex software for the IBM PC can be bought from various sources.

Now that the future of videotex no longer depends on massive sales of specialized terminals, the questions become: what do people want from an electronic newspaper, how much are they willing to pay for it, and how will the newspaper make money? The answers will decide the future of videotex.

Showdown in South Florida

Since the beginning of 1983 South Florida has been the battleground of the first electronic newspaper war. Viewtron, a subsidiary of the Knight-Ridder newspaper chain, and Dow Jones News/Retrieval, affiliated with the *Wall Street Journal,* are the combatants. Although both rivals provide news coverage, their systems are markedly different. Viewtron concentrates on banking, shopping, and education services, while Dow Jones pursues a more conventional, data base approach.

Knight-Ridder, which is said to have invested $16 million in the creation of Viewtron, has a staff of more than 30 people charged with maintaining its data base. The editors' job is to create "frames" of information, each the size of a computer screen, holding whatever they think subscribers might want. Photographs can't be used, but drawings can. One of their most popular screens is a weather map. Managing Editor John Wooley says his editors look for visual impact, working from a screen measuring 200 pixels by 256 pixels, and using up to 256 colors.

The future of videotex no longer depends on massive sales of specialized terminals.

Most of the news on Viewtron comes from wire copy, press releases, and the *Miami Herald,* the local Knight-Ridder newspaper. Still, Wooley adds, "We do our own news gathering to pick up local stories like school honor rolls, crime reports, and sports scores." Much of that information previously went unreported because of the limited size of a conventional paper's "news hole"—the amount of space allotted to content—which is limited by the quantity of advertising the paper can sell. Viewtron's available news hole is virtually unlimited.

Once a Viewtron subscriber buys a Sceptre terminal, the service is relatively inexpensive: $12 per month plus $2 per hour for connect time. That's cheap compared to CompuServe or The Source but much more expensive than a subscription to a newspaper.

Wooley's expectations, therefore, are modest. "I think we kid ourselves if we believe videotex is going to totally replace any medium, including newspapers," he says. To survive, Viewtron plans to hire out its services to banks that want to offer home banking and to sign on advertisers at $1 per screen per day. Wooley hopes that as the audience grows, shopping too will become interactive, making the advertisers' investments more profitable. Soon, Knight-Ridder will decide whether to bring Viewtron into as many as 18 additional markets around the country; this often would be done in partnership with existing daily newspapers.

Dow Jones in Florida

Dow Jones News/Retrieval is an ASCII data base service that can be accessed in most of the nation, but a portion of the service has been converted into NAPLPS code for South Florida subscribers. News/Retrieval Executive Director Richard Levine says that eventually all 22 of the service's data bases will be converted to videotex, because videotex output is more readable and easier to use than output from an on-line data base service.

Levine says Dow Jones is using South Florida as a test case to see what people want from videotex. While Viewtron holds an edge in gathering local news, Dow Jones has much more financial information, along with a 20-volume, on-line encyclopedia. Prices for the competing videotex services are comparable. Dow Jones's basic videotex charge is $12 per month, plus $10 per month for renting the terminal; there is no hourly charge.

Besides experimenting with covering different types of news (including sports and 3000 movie reviews), Dow Jones is trying to see how well it can do without advertising. Levine admits that the service may carry advertisements in the future.

Levine and Wooley disagree about the type of hardware that consumers will use to access videotex services. Wooley thinks that the medium's growth will depend on expensive, specialized terminals like Sceptre. Levine expects PC owners to be videotex's mainstay: "We're going on the assumption that personal computers will become true videotex terminals in the not-too-distant future."

Knight-Ridder and Dow Jones are not alone in opening videotex services. Times-Mirror, owner of the *Los Angeles Times*, is preparing to launch its Videotex America service in Orange County, California. Like Knight-Ridder it will enter into joint ventures with local newspapers for quick national expansion.

Penny Welch of Videotex America says tests show that home banking, home shopping, and electronic mail are among the most popular videotex services. News pages are used mostly to learn about late-breaking stories, in much the same way people turn on all-news radio stations.

Chicago-area videotex fans can soon expect service from Keycom, which opened a teletext service over cable superstation WTBS last fall. The videotex service is called Keyfax Interactive. Keyfax terminals will be made by Synertek, a Honeywell subsidiary, and will cost $650 to $700. But Tom Ray of Keycom says, "We will be accessible by major personal computers as well. We will make interface packages available, both modems and software." Keycom hopes to have 17,000 subscribers by the end of this year.

Plugging In the PC

To get the most out of a videotex service like Viewtron, you need a specialized terminal or a TV set. But if you can put up with low resolution, all you really need is a personal computer, a NAPLPS decoder software package, and a 1200 bps modem. With a color monitor and a color graphics board you can get close to the full effect of videotex.

Several companies have recently come out with software for the videotex connection. Avcor, a Canadian company with joint-venture links to Videotex America, offers videotex terminal software for the IBM PC and the Commodore 64.

> Today's low software prices are already creating a cottage industry in videotex screen creation.

Two other companies, Wolfdata of Chelmsford, Massachusetts, and Tayson Information Systems of Calgary, sell NAPLPS decoders for the IBM PC. Wolfdata sells a decoder software package, a decoder to access England's Prestel service, and a program for printing videotex frames. Tayson sells a NAPLPS decoder for the IBM PC that displays up to 16 colors. In the United States Tayson's products are sold through Atlanta-based TVX.

Suzanne Lonergan of Wolfdata says most videotex customers today are banks, insurance companies, and airlines—companies that want to set up their own data bases. Developing a consumer market will require lower hardware prices, Lonergan adds, a process she estimates will take three years. "Once people realize there's something to use a modem for they'll all want to buy one."

"As 1200 bps modem prices fall," says Avcor's Zal Press, vice-president for computer services marketing, "data base operators will be able to reach a broad base quickly without a $900 terminal." Today's low software prices are already creating a cottage industry in videotex screen creation. The creation of videotex frames "is extremely labor intensive," says Press, "requiring artistic decisions and hours in front of a terminal."

Videotex screen-generation software is beginning to appear on the market. TVX has developed videotex page-creation and data base software for the IBM PC. Now that this type of software is available, publishers have a cost-effective way to produce and send videotex (see "Grass Roots Videotex").

Another application for videotex is found at the local area network level. Media Videotex of Vancouver sells a NAPLPS decoder and videotex page-generation software for a UNIX-based network built around the PC XT. The systems can be tailored for stores, hotels, schools, corporations, and other institutions. They can act as stand-alone networks or mainframe spur systems. The standard system (PC XT, eight terminals, and software) provides both local videotex display and the ability to send or receive videotex to or from remote locations. Other options include a laserdisc capable of storing 1.6 gigabytes of both video and videotex information, Sony Profeel terminals for integrating the display of videotex and video, and input devices such as keyboards, keypads, and touch screens. IBM PCs also can be added. Prices for the systems range from $25,000 to $50,000.

Is Videotex Here to Stay?

Like any new medium, videotex is what you make it. No one knew at the dawn of TV that weather forecasters would become stars: it had to be proven in the marketplace. No

one yet knows what people will buy in the way of videotex services. Alan Cole-Ford, editor of the newsletter *Electronic Publisher*, is among those who believe the future of videotex isn't tied to information at all. "Ultimately the factor that is going to make videotex arrive in a serious way is transactional services" (such as home shopping, banking, and airplane reservations). Cole-Ford adds that one of the most popular frames on Viewtron's system during its trial run in Coral Gables enabled viewers to take the Florida state drivers' test. "It's pretty unglamorous stuff, but it's certainly important to the users."

Paul Emard, editor of the *Online Chronicle*, a newsletter available through the Dialog data base service, questions whether a mass market exists for videotex. "The penetration of home computers won't equal that of TV sets over the next five years," he says. Emard also wonders whether the general public is ready to read information from a screen.

Richard Adler of the Institute of the Future in Menlo Park, California, suggests that TV is an improper analogy for videotex. "The reality is that when TV came along the model had been established with radio. The industry was in place to exploit the new medium. With videotex we're in the early days of radio, when no one knew what it was good for." Twenty-four years elapsed between Marconi's invention of the radio in 1896 and the first radio broadcast, in Pittsburgh, Pennsylvania, in 1920.

"The more revolutionary a medium," says Adler, "the longer it takes to see what it's good for. And videotex really is a revolution in the way people acquire and use information."

In the short run, large-scale services like Viewtron and Videotex America may fail, according to Adler, but that doesn't mean the industry is going to die. He predicts the success of transactional services like Chemical Bank's Pronto home banking service, which enables users to obtain

Grass Roots Videotex

Creative Loafing is a free weekly newspaper in Atlanta that local people read to find out where to hear music, see movies, or find homemade ice cream. Publisher Debbie Eason's files are bulging with names, phone numbers, and contacts—all sorts of information she had until recently been unable to publish.

That changed when *Creative Loafing* founded Atlanta's first public videotex system. "We've got three different data banks," Eason says. "We have classified ads, a calendar of events, and a people's yellow pages of phone numbers not in the directory." These numbers include hot lines for victims of rape, AIDS, and even airplane noise.

Last year, before the videotex system was set up, the phone numbers were stuffed into Eason's Rolodex. She had planned to publish them in booklet form until she met Will Macoy at a Christmas party. Macoy was looking for a videotex guinea pig. He had left IBM the month before, filled with ideas for a videotex screen generator and cheap receiving software. Working with two Canadian firms, Microstar of Ottawa and Tayson Information Services (TIS) of Calgary, Macoy found what he was looking for—a way to turn small publishers like Eason into grass roots videotex operators.

The TIS (TVX in the United States) system is composed of two parts. The first, and more revolutionary, is a software program with add-on boards that enable an IBM PC, a PC XT, or a PCjr to generate, store, and send NAPLPS videotex screens with high-resolution graphics. The package includes a system of icons to make screen creation easy.

TIS also sells a $100 decoder program that enables a PC (or any MS-DOS computer with 128K) to interact with NAPLPS videotex. The problem, Macoy says, is that "it's very difficult to sell decoders when people don't know what they're for."

To spread the word about the new technology, Eason plans to have existing *Creative Loafing* advertisers, ranging from restaurants to chiropractors, pay a few dollars extra per week to maintain frames on her system. Meanwhile, she is selling decoder software through the newspaper, which has a weekly circulation of 65,000.

"Even if nobody buys it right off, I can justify the whole expense because, for the first time, we have a computer to do our writing and maintain our records," she says. "I have nothing to lose."

account balances and organize their checkbooks for $12 per month. Pronto hopes to have 50,000 customers in the New York metropolitan area by the end of this year.

Despite all the hoopla over personal computers, most people still don't own one. Not all computers have modems, and not all modem owners know how to search a data base. Despite this, Adler notes, 60 to 100 videotex operations have opened around the country. Most, like Pronto, are specialized.

Despite all the hoopla over personal computers, most people still don't own one.

"Ten years ago I was studying cable TV," Adler says. "That industry spent 25 years in the wilderness before satellite-fed programming services like HBO and WTBS gave people what they wanted. Then the industry exploded."

Adler expects videotex to follow that pattern. "Some basic questions remain to be answered," he concludes. "It will take some thrashing out." If a few big electronic newspapers fold during that time, it will prove only that videotex has left the laboratory and entered the real world.

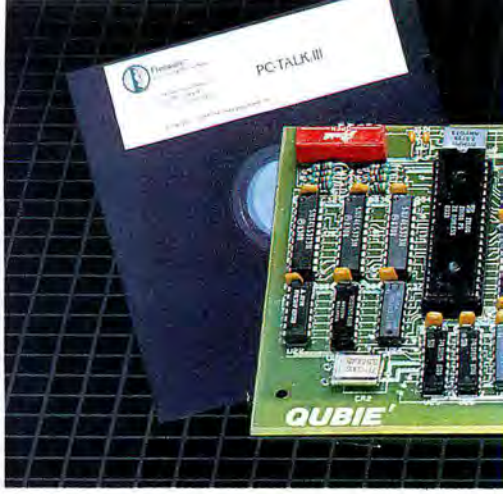
Dana Blankenhorn is an Atlanta-based freelance computer journalist doing business as "Have modem will travel."

TVX Micro Videotex System
TVX Inc.
P.O. Box 888364
Atlanta, GA 30356
404/433-4500
(In Canada, Tayson Information Systems 403/230-5998)
List price: decoder $250, page-creation and data base software $800
Requirements: 128K, one disk drive, color graphics board, color monitor, modem

Wolfdata Videotex Decoder
Wolfdata Inc.
187 Billerica Rd.
Chelmsford, MA 01824
617/250-1500
List price: NAPLPS decoder $250, videotex printing software $225, Prestel decoder $195
Requirements: 128K, one disk drive, Plantronics ColorPlus board, color monitor, modem

Avcor Videotex Decoder
Avcor Ltd.
512 King St. E #303
Toronto, Ontario
M5A 1M1 Canada
416/864-9240
List price: $99.95
Requirements: 64K, one disk drive, color graphics board, color monitor, modem

Media Videotex
1200 Burrard St.
Vancouver, British Columbia
V6Z 2C7 Canada
604/681-6379



Flip the pages. You see PC modem cards with fewer features advertised for as much as $599. Up until now that's how much it cost to make a modem capable of transmitting at 120 characters per second (1200 baud). It doesn't take a computer to figure out the savings in phone line charges when you communicate four times faster than the 30 character per second modems (300 baud). Now you can have the solution to your communication needs at an affordable price.

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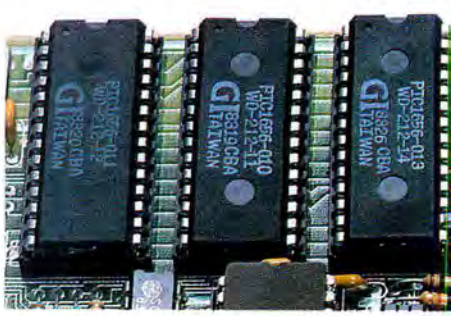

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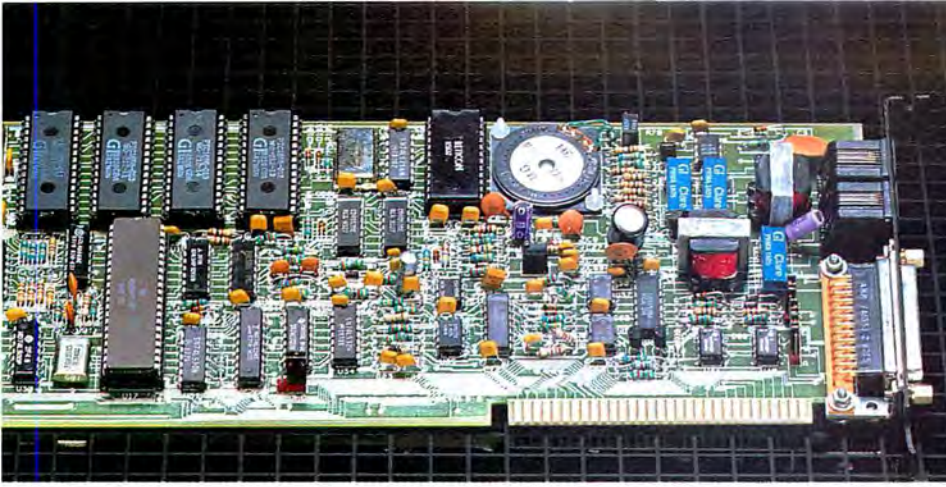

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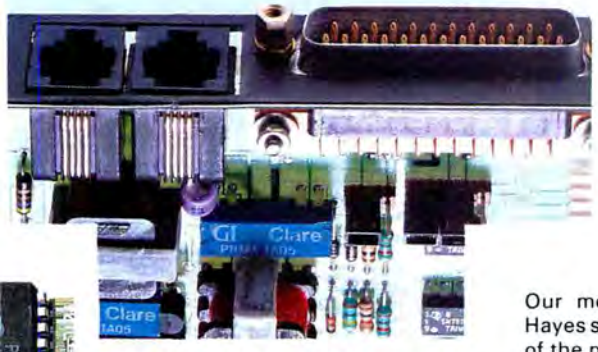

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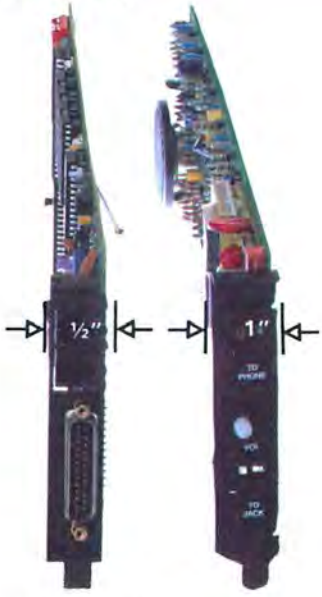

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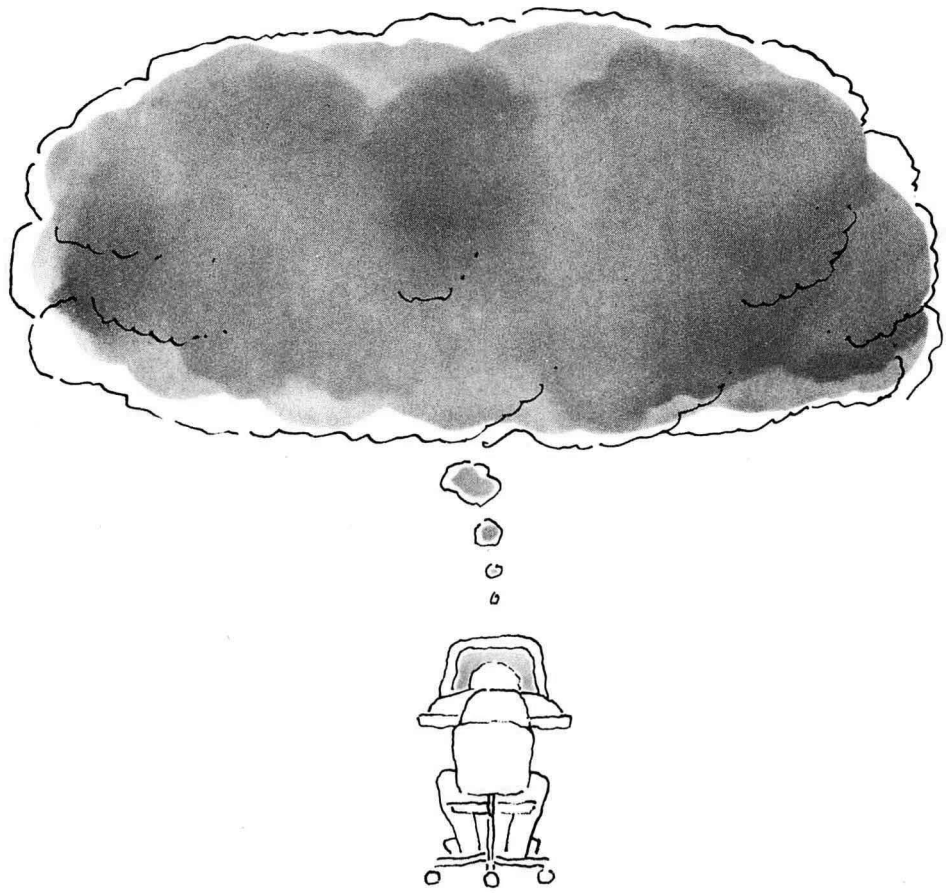

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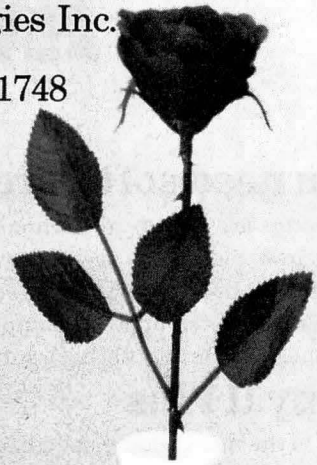

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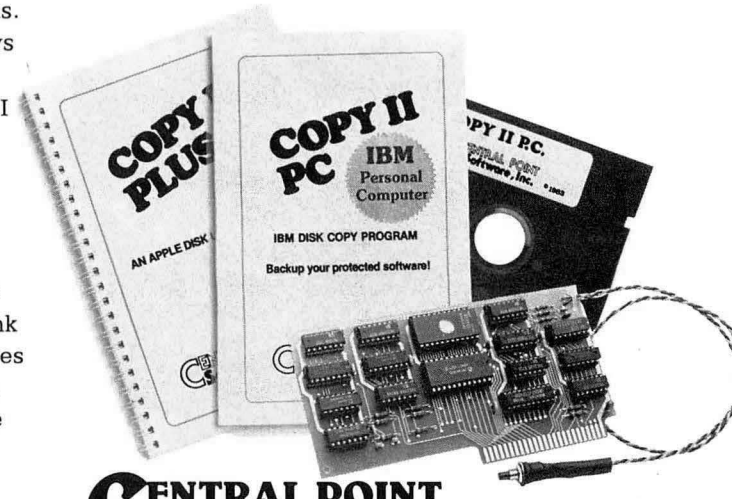

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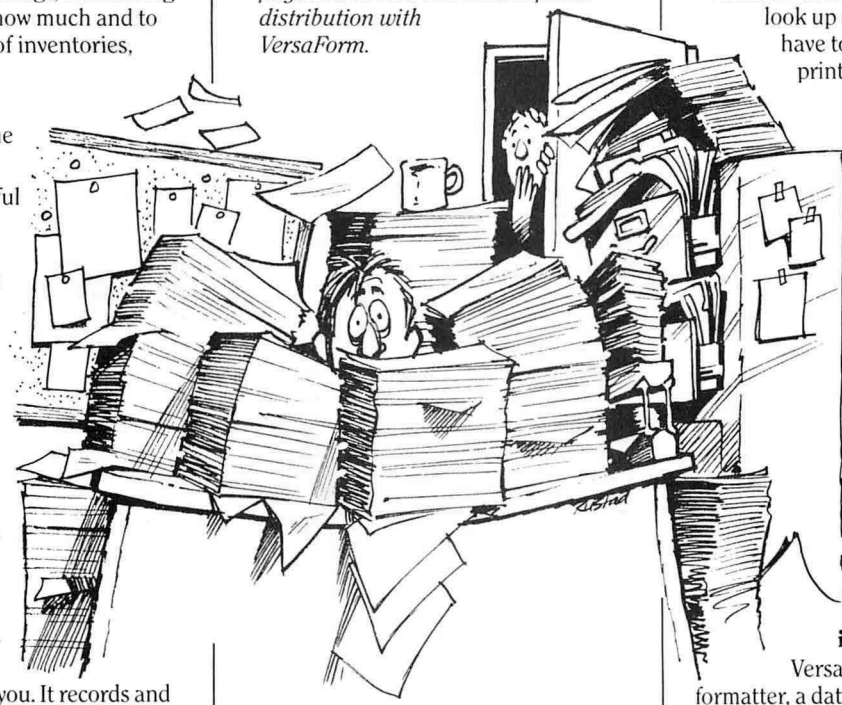

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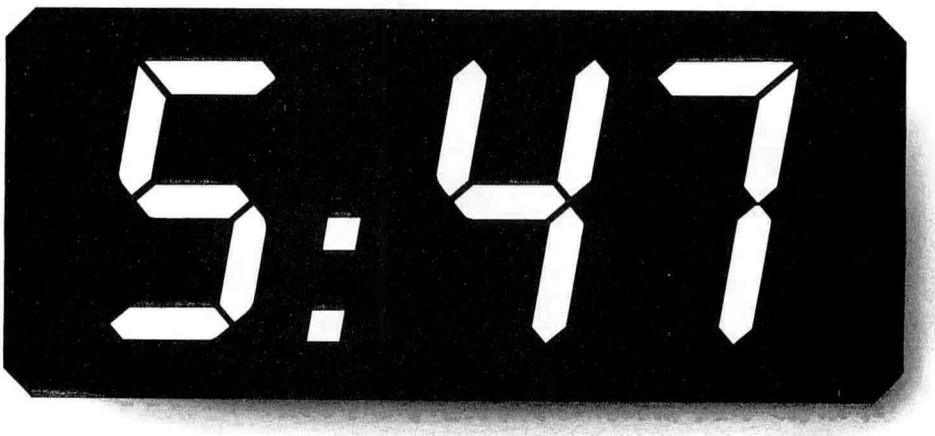

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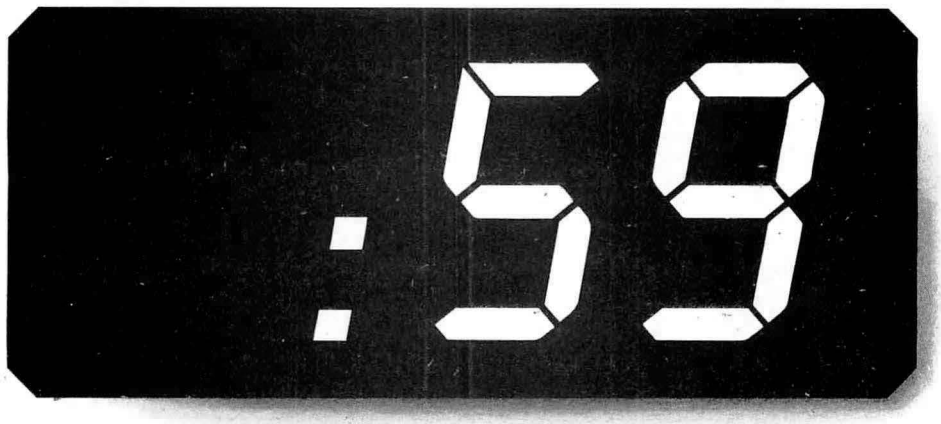

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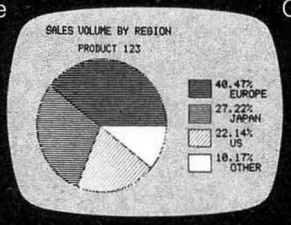

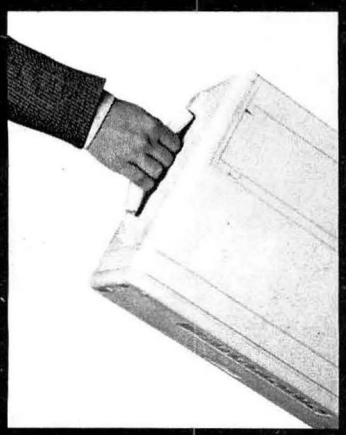

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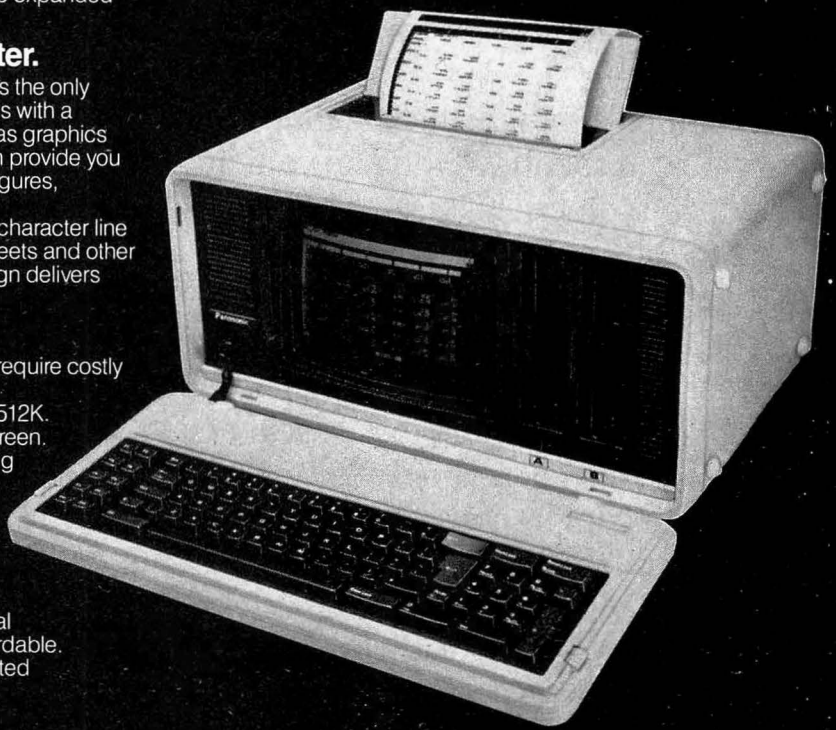

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User Group Dispatch

Practical visions from the Boston Computer Society

Anita Micossi

The year is 1976. The only microcomputer on the market is the Altair kit, available by mail order from MITS in Albuquerque, New Mexico. The Apple I is a breadboard in a San Jose, California, garage. And Jonathan Rotenberg is just a 14-year-old high-school student, albeit an exceptionally bright and mature one. Rotenberg is investigating the possibility of replacing his school's teletype-computer hookup with a microcomputer. During this nine-month project he discovers that the information he needs is not easy to find.

Rotenberg's response to this information vacuum is to create an organization that collects and disseminates information about personal computers and, more importantly, demystifies the computer for novices. He has no patience with the obfuscating jargon of computer experts or the elitism of the high-tech hobby crowd.

1977: The Boston Computer Society has its first meeting at the Commonwealth School in Boston. Two people show up, including someone who just happens to be working late.

1978: The BCS sponsors its first computer exposition, "Home/Business Computers '78." There are 48 exhibitors and 1000 visitors, and the group's membership grows from 70 to 225 in one day.

As of November 1983 the BCS has a membership of about 10,000 people across the United States and in 27 foreign countries.

In addition to its monthly meeting, which is used as a forum for the introduction of new products, the BCS has 15 user groups—one for each major personal computer. There are 15 special interest groups on subjects ranging from entrepreneurial opportunities to home applications, robotics, and social issues. And the BCS also sponsors small Saturday clinics for beginners, with consultants on hand to supervise and answer questions.

If a group doesn't exist with the information or theme you're interested in, you're encouraged to create it. For example, at the last IBM PC user group gathering (which drew about 400 members), 14-year-old Julie Lehrman posted a sign in the hope of attracting other youthful users.

Like most BCS members, Julie Lehrman is not interested in computer technology for its own sake, but rather in its application. She knows that the knowledge is "out there." It's simply a matter of going out and getting it. The BCS provides resources, communication links, and a staging ground. The rest is up to its members.

Volunteer Labor

Personal initiative is the key to getting the most out of the BCS. Except for three full-time paid employees at its Boston headquarters, volunteers conduct all activities. The roster of volunteers includes industry luminaries like Mitch Kapor of Lotus, Daniel Bricklin, author of *VisiCalc,* and Stewart Alsop II, editor of *InfoWorld.* Rotenberg, now a senior at Brown University and an occasional $1500-a-day consultant, still puts in 30 to 40 hours a week for the BCS.

A new member stood up at a recent IBM PC user group meeting and started to complain about the lack of hardware resources at the BCS. "Why," he wanted to know, "can't we have machines available for training sessions or for testing new software?" Group Coordinator Mike Rohrbach smiled benignly and replied that manufacturers are more than willing to supply demos. It is simply a matter of finding somebody to be in charge of the equipment and space. "How would you like to volunteer?" he asked.

A Wealth of Resources

The BCS maintains a reference library with books, back issues of most trade magazines, and a resource file. The larger user groups such as IBM PC, TRS, and Apple also have their own software libraries. The IBM library, for example, has 22 disks of public-domain software. Each program has been reviewed and abstracted and is available to members for $3 to $6 per disk.

The BCS publishes *Computer Update,* a full-color bimonthly magazine with a circulation of over 10,000. The various subgroups publish newsletters that include minutes of meetings, announcements of upcoming meetings, software reviews, technical articles, lists of new public-domain software, and new product information.

The BCS has an electronic bulletin board where members can leave messages, place ads, and exchange information.

Advanced users contribute their expertise to a phone service. Members with urgent problems can call the central office to be directed to another member who can help them.

In addition to all these resources, the BCS sponsors forums and trade shows in the Boston area. The Future of Personal Computers forum has

brought together industry leaders on several occasions. Applefest—an exposition solely for Apple software and accessories—drew 23,000 people in 1982.

The most remarkable thing about the BCS is that an atmosphere of cooperation and exchange prevails despite the members' diverse interests and backgrounds. The meeting halls are crowded with high-tech veterans cheek-to-jowl with bewildered novices. The BCS has been described as a school, a club, and a professional organization all rolled into one.

Of all the ways a beginner can learn about computers—including dealer training programs, university extension courses, self-taught tutorials, professional publications, and computer books—only the user group provides an ongoing dialogue among peers in a supportive social setting. Even the novice is quickly caught up in the freewheeling question-and-answer sessions that are part of each meeting.

At the IBM PC meeting a dozen or so special interest subgroups gathered an hour before the general assembly. On the main floor and in the balcony of the large hall, small groups clustered under various signs—Pascal, Telecommunications, DOS/BASIC, and so forth—like caucuses at a political convention.

At the Word Processing gathering a businesswoman asked about different word processing programs. One suggested brand was immediately debunked by a user who'd been burned. A swift debate ensued; the pros and cons were argued while the businesswoman took copious notes. A man who seemed to know a lot about printers had a question about the best furniture to use with his equipment. Another man, who admitted his lack of knowledge about all technical matters but was a skilled carpenter, offered the specs for a sturdy, low-cost, do-it-yourself work station.

Knowledge from Neophytes

Even advanced users learn from this kind of informal exchange. I asked several individuals with broad microcomputer experience if the elementary question-and-answer sessions weren't a bore. One of them confessed sheepishly, "Even a pro in this business misses some fundamental procedures or principles along the way. Training is often erratic and piecemeal, so I learn things from the naive questioners." Another veteran appreciates the explanations of new products: "I can get a quick overview and find out what I need to know without having to read the entire manual."

On the other side, some of the experts enjoy sharing their knowledge gratis. Avram Tetewsky, coordinator of the Otrona group, writes articles and condensed versions of user manuals for beginners in the organization. When I asked him why, he answered, "I think that I would like to teach." As if this weren't motive enough, he added, "I help others and receive help. We spread it around."

For the dedicated hobbyist the BCS functions as a club of like-minded enthusiasts. Exchange is still the name of the game, although it is carried out on a much more sophisticated level. In the Otrona group, which draws hard-core computer jocks, members typically divide the labor on some agreed-upon problem: writing a utility program, finding the bugs in a compiler, or emulating a Tektronics terminal.

"One of the advantages of the BCS is that you can form a high-power tech group if you want to," explains Tetewsky. "We run ours on the same principle as the beginner groups. It's just a matter of levels, like high school versus college."

Business Contacts

For computer professionals who want to adapt their expertise to computer technology or who wish to become part of the business boom surrounding computers, professional contacts are a prime reason for joining the BCS.

According to Mike Rohrbach, "Eighty percent of the members of the IBM PC group are already involved with computers in some kind of vendor or consulting capacity. They are looking for ways to escape the corporate umbrella and strike out on their own." The user group provides an excellent stepping-stone into the computer marketplace.

First Micro Group, a Boston training and consulting firm, has its roots in the BCS. Tod Riedel was active in the Business Group and Claude Comeau was a volunteer consultant at the Saturday clinics.

They met through a friend at a BCS meeting, swapped tales, and discovered their mutual interest in bridging the gap between the business community and the microcomputer industry. The result of this shared vision is First Micro Group, which functions as an external management information system for small businesses making the transition from the traditional to the electronic office.

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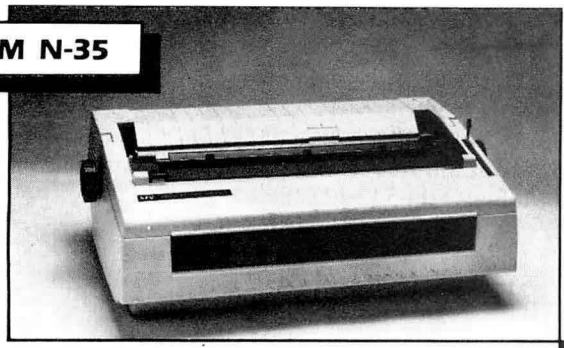

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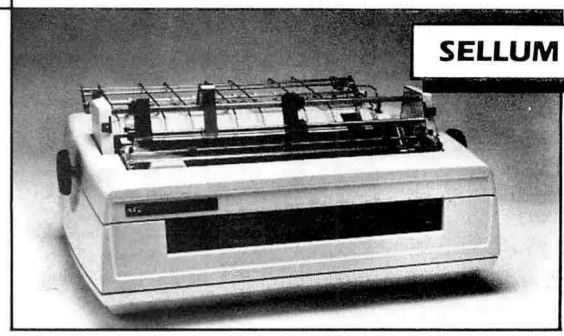

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The BCS is the largest of the more than 2000 user groups in this country, but it is extraordinary for reasons other than its scope. Ask any of its directors about the future and they speak of plans for a national organization, an educational center and museum, a product testing and rating service, and maybe even a Washington lobby to act as a consumer advocate on technological issues.

Such change and growth are the philosophical cornerstones of the BCS, which began with a mission to make personal computers as familiar to the consumer as the TV or the telephone.

Jonathan Rotenberg sees the computer as a storehouse of potential. Knowledge is the key to unlocking that potential. The Boston Computer Society holds the key in its collective hands.

Anita Micossi is a Boston-based writer and sociologist.

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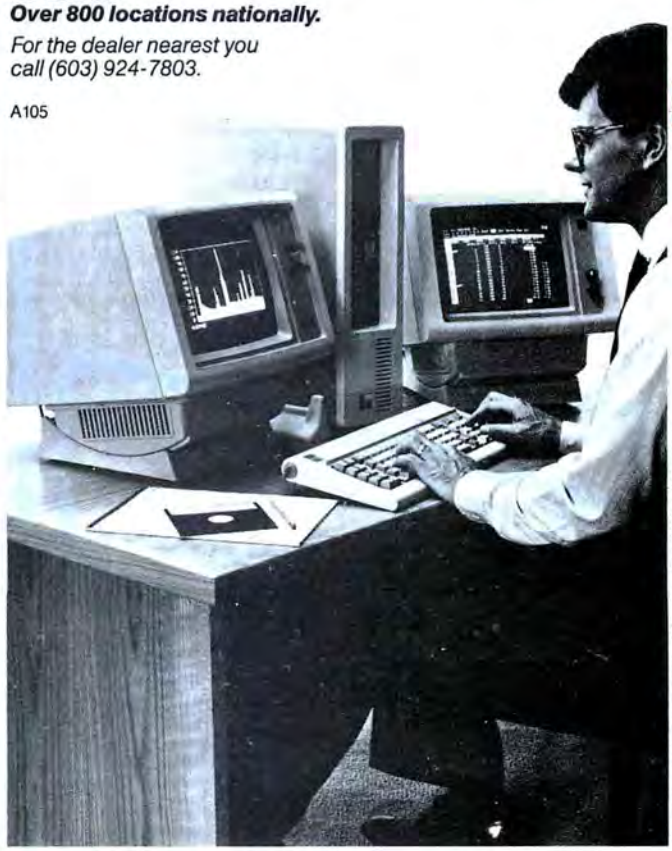

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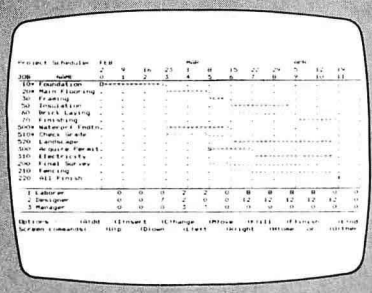

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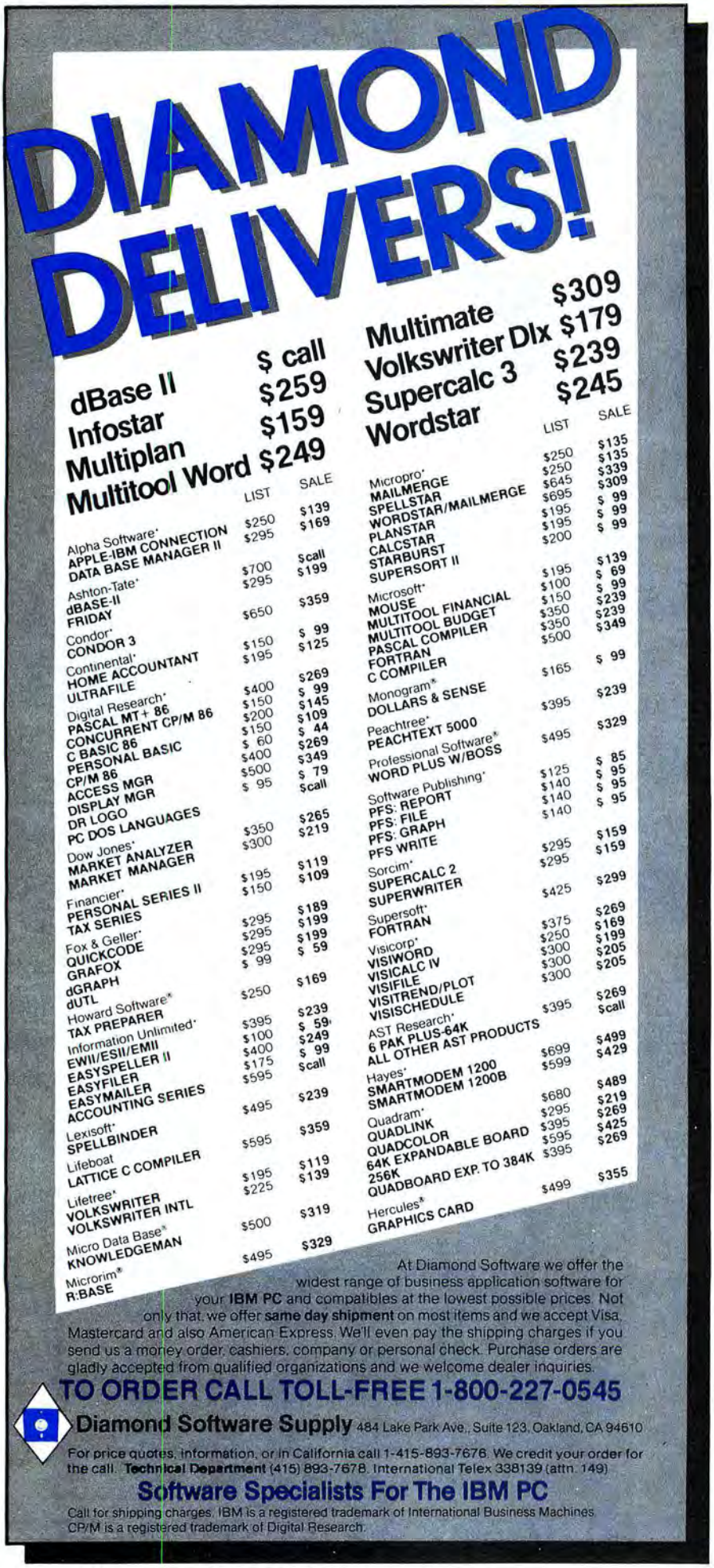

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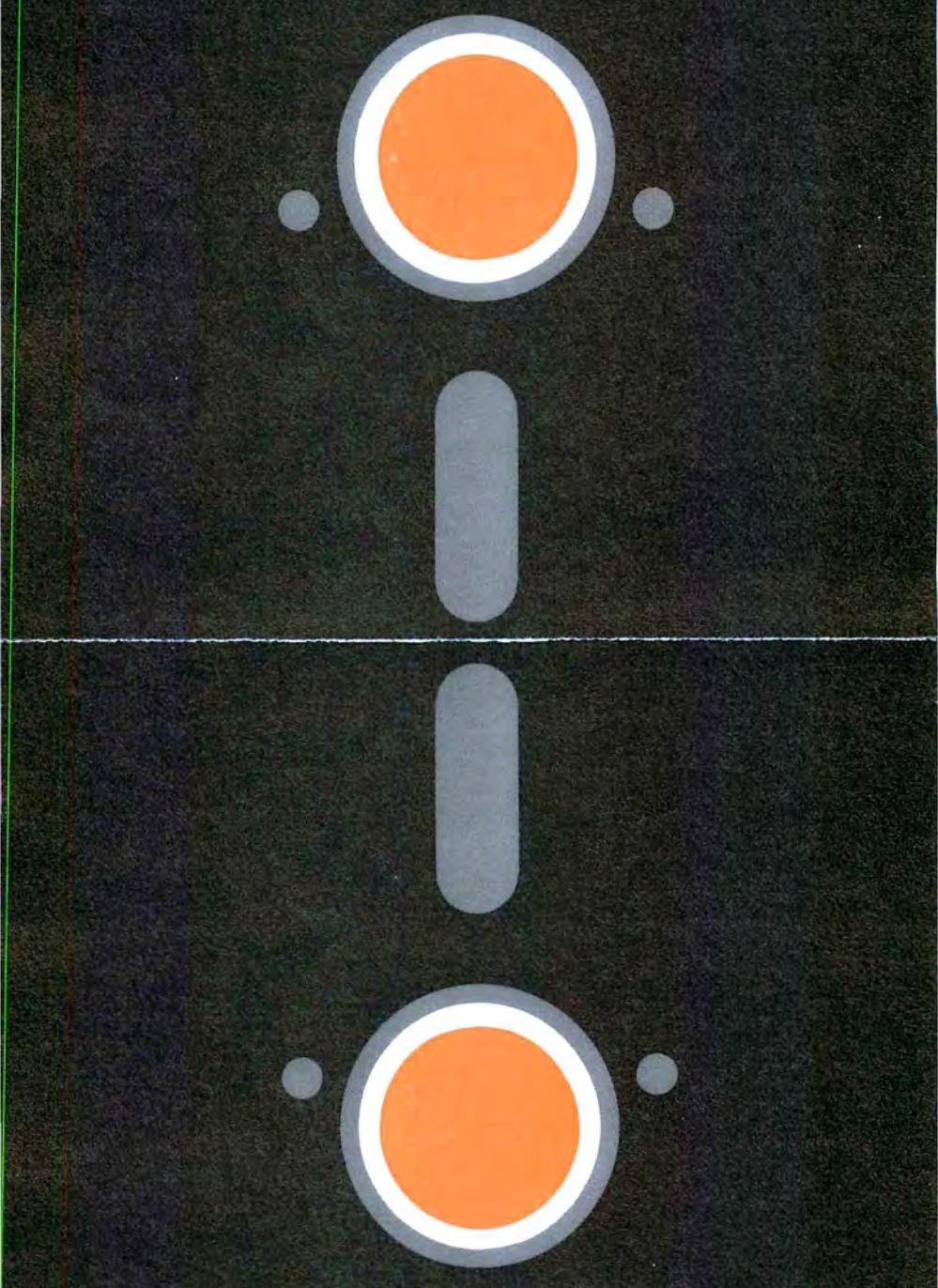

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World Events

A calendar of regional, national, and international events

Edited by Eric Brown

World Events lists computer-related conferences, conventions, workshops, camps, symposiums, trade fairs, and shows. If you know of an upcoming event, we'd like to hear about it.

March 14 to May 10
Chips and Changes
Exploratorium
San Francisco
An exhibition of computer chip technology focusing on the social impact of microelectronics. The exhibition will also show at eight museums around the country.
Exploratorium
3601 Lyon St.
San Francisco, CA 94123
415/563-7337

March 19-22
1984 Federal Office Systems Expo
Washington Convention Center
Washington, D.C.
An exposition and conference focusing on both government and commercial office systems integration. This year's theme is "Office Systems Integration—Today's Realities, Tomorrow's Prospects."
National Trade Productions, Inc.
9418 Annapolis Rd.
Lanham, MD 20706
800/638-8510, 301/459-8383

March 23-25
Ninth West Coast Computer Faire
Brooks Hall, Civic Auditorium, and Trade Show Center
San Francisco
A computer exposition focusing on microcomputer software, hardware, and peripherals for home and business use.
Computer Faire, Inc.
570 Price Ave.
Redwood City, CA 94063
415/364-4294

March 27-29
Seventh Annual Southwest Computer Conference
Myriad Convention Center
Oklahoma City
A business and industry exhibition and conference for management and technical personnel. More than 10,000 attendees are expected to visit 250 booths. The show features 50 seminar presentations.
E. Z. Million
SWCC
P.O. Box 950
Norman, OK 73070
405/329-3660

March 29-30
Personal Computers in the Clinical Laboratory
Duke University Medical Center
Durham, North Carolina
A conference on using personal computers in the clinical laboratory.
Medical Technology Program
Duke Medical Center
P.O. Box 2929
Durham, NC 27710
919/684-6015

April 19
California Computer Show
Hyatt Hotel
Palo Alto, California
A display by 65 exhibitors of the latest advances in the computer industry for OEMs and sophisticated users.
Norm DeNardi Enterprises
289 S. San Antonio Rd. #204
Los Altos, CA 94022
415/941-8440

April 26-29
Third Annual New York Computer Show
Nassau Coliseum
Long Island, New York
A general computer show featuring hardware and software.
Northeast Expositions
822 Boylston St.
Chestnut Hill, MA 02167
800/343-2222, 617/739-2000

May 3-6
The Mid-West Apple/IBM PC Expo
Rosemont Exposition Center
Chicago
A trade and end-user exhibition featuring IBM PC and Apple computers and compatibles (formerly Applefest and PC'83).
Northeast Expositions
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May 6-9
Comunicaciones Expo '84
Curtis Dixon Hall
Tampa, Florida
An exhibition and conference on telecommunications and data communications, with a focus on the Latin American and Caribbean marketplace. Conference topics include local area networks, management and computers, rural telecommunications, and mobile communications.
LATCOM, Inc.
Mitch Hall Associates
P.O. Box 860
Westwood, MA 02090
617/329-8090

May 10-12
Softwest '84
Regency Hotel and Conference Center
Denver
An exposition, a conference, and educational seminars on IBM PCs and Apple computers. The exposition will include software, peripherals, and compatibles.
The Colorado Conference Group
3312 Cripple Creek, Ste. C
Boulder, CO 80303
303/499-1034

May 22-25
COMDEX/Spring
World Congress Center and Apparel Mart
Atlanta
A computer trade show with emphasis on small computers, peripherals, and software.
The Interface Group
300 First Ave.
Needham, MA 02194
617/449-6600

May 22-26
MicroExpo '84
Palais des Congres (C.I.P.)
Paris
Europe's oldest and largest microcomputer show, now in its ninth year. Floor space has been doubled since last year, and over 35,000 attendees are expected.
Diane Brock
Sybex
2344 Sixth St.
Berkeley, CA 94710
415/848-8233
Telex: 336311

(continues)

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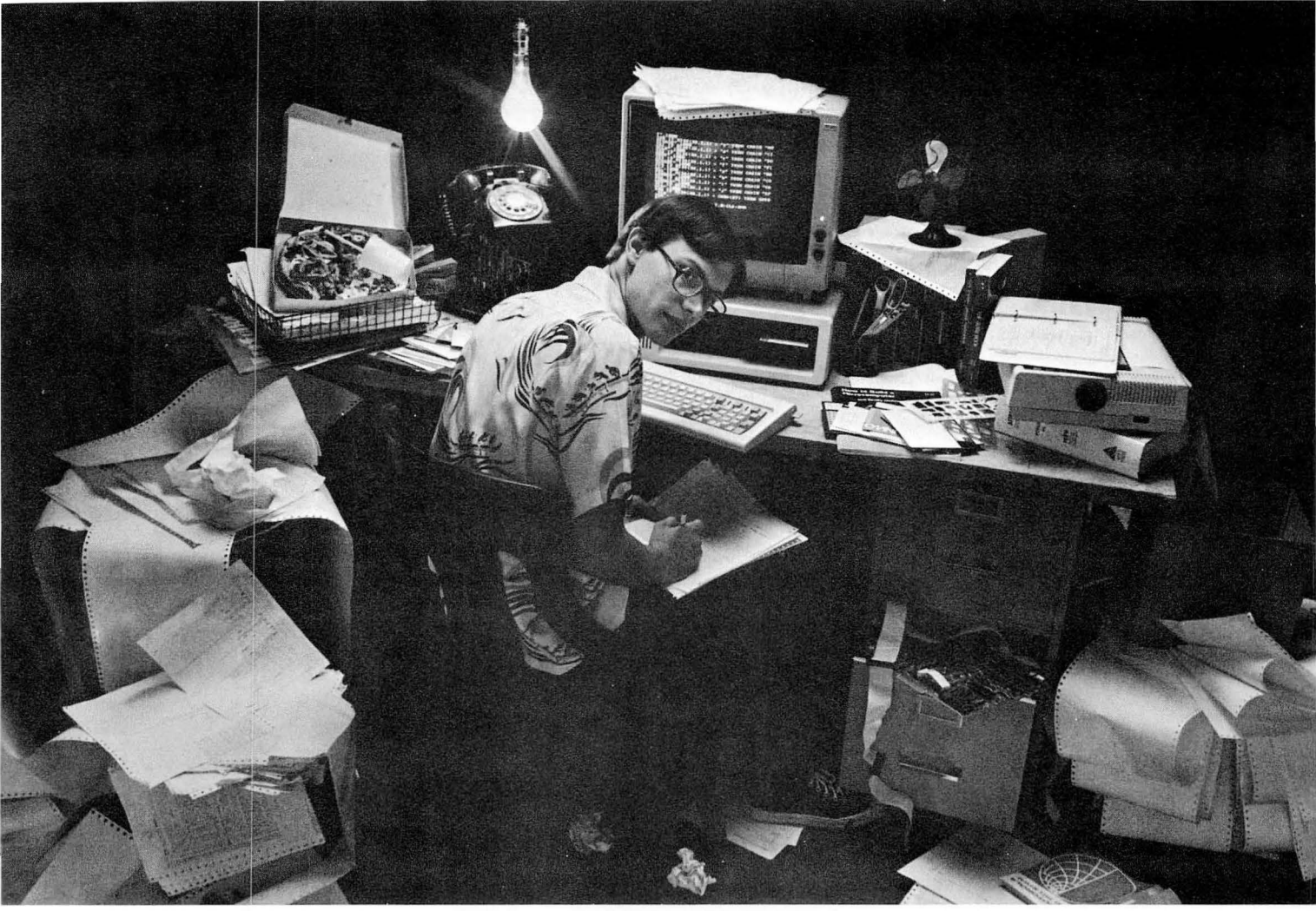

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An international conference on the FORTH programming language that is aimed at both experienced users and novices.
Institute for Applied FORTH Research, Inc.
70 Elmwood Ave.
Rochester, NY 14611
716/235-0168

June 13-15
IBM World Expo
McCormick Place West
Chicago
An exposition and conferences on IBM PC hardware, software, and compatibles.
IBM PC World Exposition
Mitch Hall Associates
P.O. Box 860
Westwood, MA 02090
617/329-7466

June 13-15
NECC '84
Dayton Convention Center
Dayton, Ohio
The National Educational Computing Conference. Panels, tutorials, demonstrations, and exhibits on the use of computers in education.
Computer Science Department
University of Dayton
Dayton, OH 45469
513/229-3831

(continues)

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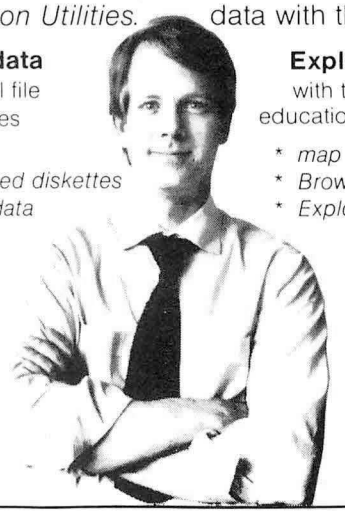

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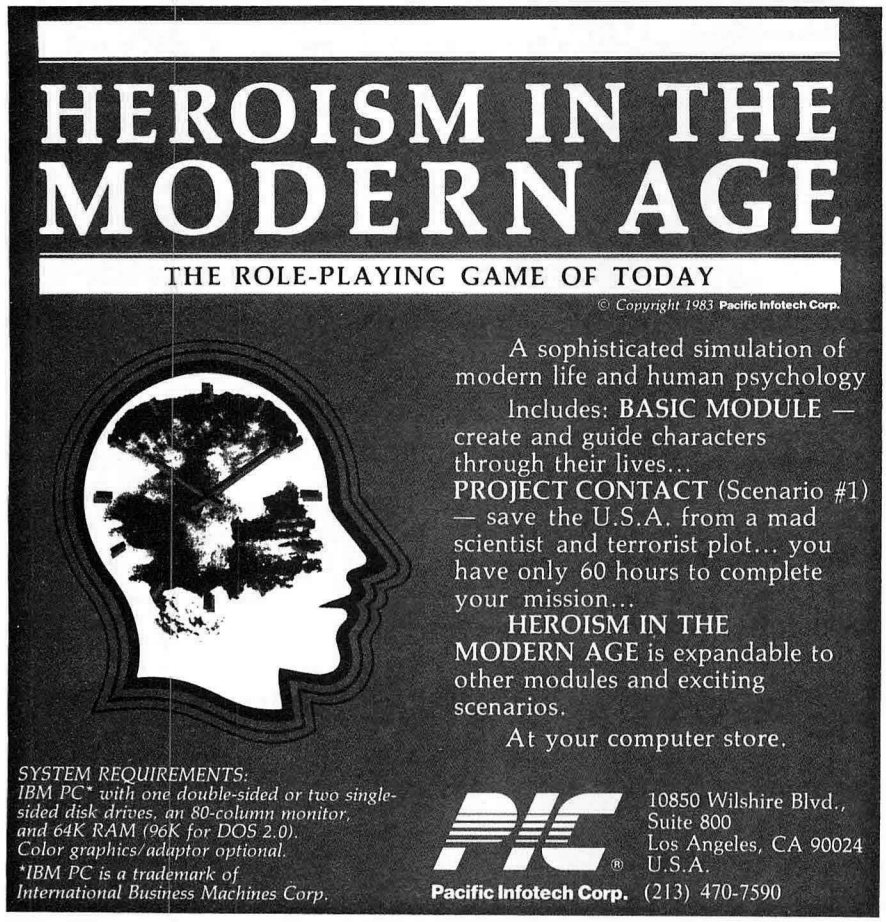

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June 14-17
International Computer Show
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A computer show featuring personal computers for business and home use.
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June 26-28
PCExpo
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A trade show dedicated to the IBM PC and compatibles. Exhibitors are manufacturers, original software producers, and principal service vendors. Attendees include third-party resellers, consultants, dealers, corporate volume buyers, and MIS and EDP managers. Daily seminars will be offered.
PCExpo
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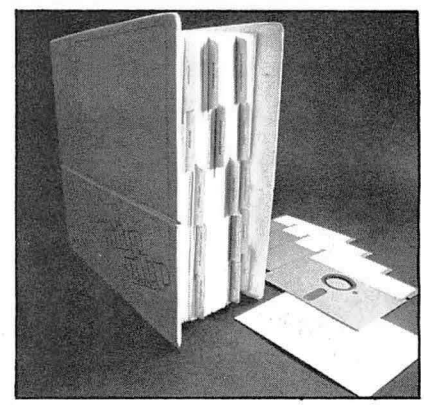

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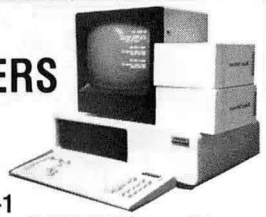

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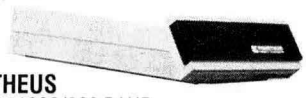

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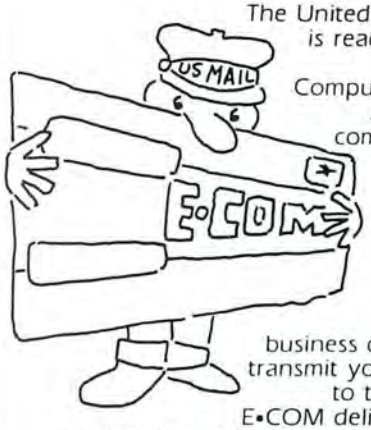

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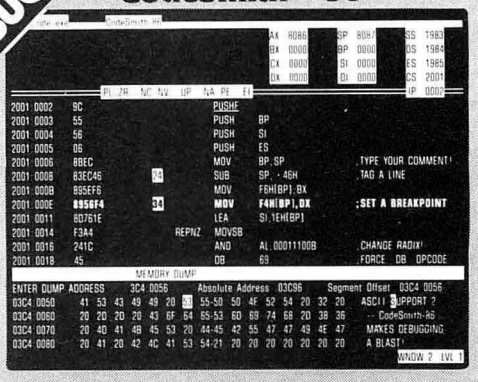

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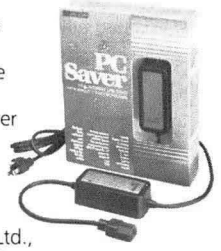

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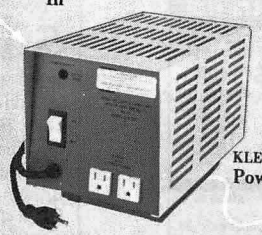

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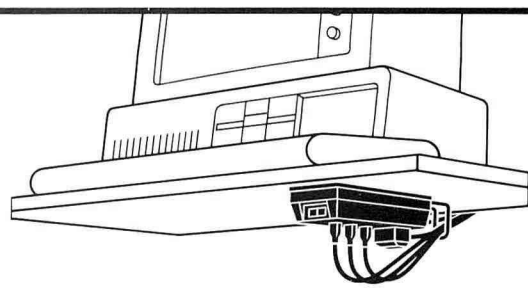

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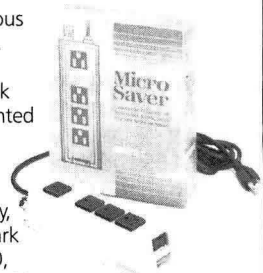

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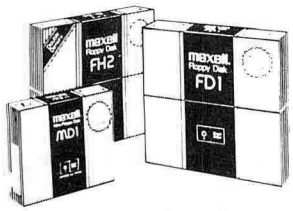

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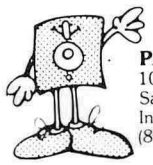

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PCOX is a high-performance IBM 3278/79 emulator for the IBM & compatible PCs. PCOX consists of a DMA-attached board & emulation software with an optional file-transfer facility. The file-transfer option operates with both TSO & CMS. Emulates mods 2, 3 & 4 of the 3278 & mods 2A & 3A of the 3279. *CXI, Inc., 3606 W. Bayshore Rd., Palo Alto, CA 94303, 415/424-0700*

Computer Repair

CRC—Computer Repair
IBM PC & XT service. Prompt professional repairs on IBM & non-IBM devices. Large spares inventory reduces delay to a minimum. Trained certified technicians provide the professional user with the professional service he deserves. Nationwide through local franchises. *Computer Repair Corp., 1111 W. El Camino Real #133, Sunnyvale, CA 94087, 408/720-0994*

IBM Circuit Board
Repairs for PC, XT. An Alternate source of professional circuit board and subassembly repair available through PC dealers. Lower prices and faster turnaround, utilizing Automatic Test Equipment (ATE), typically 5

days in-house. From keyboards to power supplies. Have your dealer contact: *Unitrace Inc., 3350 Scott Blvd. #20, Santa Clara, CA 95051, 408/727-7573*

Consultants

California

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Advance Info Systems

A micro is still a computer! Let me help you save your time & money. Services offered include user needs analysis, hardware & software selection & personalized training. Ask me about dBASE II, spreadsheet programs, networking, telecommunications, etc. IBM PC system integration is my specialty. *Advance Info Systems, 2818 Clay St., San Francisco, CA 94115, 415/922-6539*

Accounting on Your PC

Let our CPAs help you select & set up the best accounting system for your needs. We use a proven approach that has helped many businesses computerize successfully. We have evaluated & used all of the major accounting packages (over 24) & know which are good. We sell no hardware or software. *Knight & Company, CPAs, 6644 Heartwood Dr., Oakland, CA 94611, 415/339-9036*

New Jersey

Computer Systems Labs

IBM PC communications specialists. Professional systems staff highly experienced with software/hardware selection, training and applications. Developer of PCTIE, async communications software for IBM & non-IBM systems. Custom software for all PC/Host networks. Call or write for brochure. *Howard Dean, Software Systems, 808 Shrewsbury Ave., Tinton Falls, NJ 07724, 201/842-5800*

Tennessee

Add-On Board Design

Engineering firm specializing in microcomputer hardware & software development. We will design products (add-on boards, peripherals, etc.) for the IBM PC, PCjr, or other microcomputers. We have extensive experience in industrial controls, data acquisition, & speech synthesis applications. *Arnet Systems, Inc., 1717 West End Ave., Nashville, TN 37203, 615/329-0728*

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AST/Maynard/Quadram

AST MegaPlus (SC, 64K) $269. AST SixPack (SPC, 64K) $269. AST I/O Plus (SC) $114. Extra Parallel, 2nd serial or game, $35. MAYNARD Disk Controller $162. With PP add $43, SP add $63. QUADRAM Quadboard $269. Set of nine 64K, 200ns chips $55. Hayes Smartmodem 1200B, $435. *VLM Computer Electronics, 10 Park Pl., Morristown, NJ 07960, 201/267-3268*

No Slot Memory Upgrade

Let us install up to 256K RAM on your EXISTING SYSTEM BOARD using NO SLOTS. We improve your IBM PC so it can address the 64K RAM chips. 256K-$335 (expandable & warranteed). DO-IT-YOURSELF KITS, PC-KPC-$69.95. With assembled no slot PC Board, $99.95. 64K-RAMS ($5.85 ea). *Add-MEM, 22151 Redwood Rd., Castro Valley, CA 94546, 415/886-5443*

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Big Blue CP/M-80 Plus

Big Blue runs CP/M-80 programs on PC, COMPAQ or Columbia without CP/M. This single slot card includes Z80B, 64K RAM, parallel & serial ports, serial cable, real time clock & hard disk interface. Programs provided for emulation, communication & reading most CP/M formats. Just $595. *QuCes, Inc., 3 QuCes Dr., Metuchen, NJ 08840, 201/548-2135, Telex-299410*

LNW Busboard
Add up to 8 functions of your choice & only use one slot in your PC or XT. Busboard can hold 512K and either coprocessor or function modules. It comes complete w/memory management software allowing up to 812K w/ print spooler & RAM drive. *Inflo Inc., 244 Mill Rd., Yaphank, NY 11980, 516/924-9229 (voice line), 516/924-8115 (300/1200 baud 24 hr modem line)*

Multiplexer
EIGHT TERMINALS can be connected to an IBM PC using the PC MUX. One printed circuit board mounts inside the PC. An external interconnect module with eight RS-232 connectors interface directly with terminals or other serial devices. $395. *Solana Electronics, 742K Genevieve, Solana Beach, CA 92075, 619/481-6384*

2 in 1 Dual Video Board
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Disk Drives

Hard Disk III
Leading Edge® hard disk III is a 5¼" Winchester disk subsystem. Features (Z80A) microprocessor, which provides 18 high-level commands. TRS-80 model III & I & IBM PC compatibility. Provides power for 2 Winchester disk drives. Full sector buffer 256-512 bytes. *Leading Edge Products, 225 Turnpike St., Canton, MA 02021, 800/343-6833, 617/828-8150*

Thinline Drives
With Inflo's drive system the PC can hold up to 4 floppy drives or 2 floppy drives and a hard disk inside your PC. Drives are available with storage from 320K to 1600K. *Inflo Inc., 244 Mill Rd., Yaphank, NY 11980, 516/924-9229 (voice line), 516/924-8115 (300/1200 24 hr modem line)*

Disk Drives for PC

TM55-2,	DS,	40T:	$229
TM100-1,	SS,	40T:	$175
TM100-2,	DS,	40T:	$229
TM101-4,	DS,	40T:	$315
CDC 9409,	DS,	40T:	$239

MAYNARD complete internal 10M Winchester hard drive system. From $969. Visa/MC/checks. *VLM Computer Electronics, 10 Park Pl., Morristown, NJ 07960, 201/267-3268*

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Angel Workstation
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PC Mouse
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Modems

XCOM Modem
Internally mounted modem board for IBM PC and XT. Full featured 103/212A compatible asynchronous modem comes with CROSSTALK-XVI & telephone cable. Features: auto-dial/auto-answer, auto speed select (300/1200 bps), ringback busy & dialtone detect & 2 yr. warranty. DLR pkg. avail. (Visa/MC) Price $449. *XCOM, 3213 Ramos Circle, Sacramento, CA 95827, 916/366-7071*

Printers

Starwriter F-10
This 40 CPS daisy wheel includes low profile design, industry standard ribbons and print wheels, standard centronics parallel or RS-232C, and extensive built-in word processing functions. The Starwriter F-10 printer is supported by a full year warranty and national authorized Leading Edge service centers. *Leading Edge Products, 225 Turnpike St., Canton, MA 02021, 800/343-6833, 617/828-8150*

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WE KEEP BOTH! We stock most wanted printers at BELOW MARKET PRICES. If we foresee a delay in your shipment, we will contact you immediately for your instructions—CANCEL or WHATEVER. Your cashier's check or credit card will only be deposited at time of shipment. Allow us to serve your printer needs. *Printers & Promises, 800/824-3011*

Printmaster F-10
The 55 CPS model with all the same features as Starwriter F-10 plus faster print speed & carriage return time, accept data transmission up to 600 baud, dual-color ribbons, & original plus 4 copies. The Printmaster F-10 is supported by a 1 year warranty and nationally authorized Leading Edge service centers. *Leading Edge Products, 225 Turnpike St., Canton, MA 02021, 800/343-6833, 617/828-8150*

Prowriter
Offers a printing speed of 120 CPS, bidirectional printing, 8 character sizes, and 5 alphabets. Prowriter's NX9 matrix produces correspondence quality print and high resolution graphics. The Prowriter 85 IOA provides a 10" carriage. Prowriter 1550 provides a 15" carriage. *Leading Edge Products, 225 Turnpike St., Canton, MA 02021, 800/343-6833, 617/828-8150*

NEC Spinwriter Catalog
FREE CATALOG! Includes pictures, product descriptions & prices of all letter quality printers featuring the IBM PC compatibles. The 3550 & the 2050 catalog also illustrates all character sets (with alternate sets) available for the Spinwriter & identifies interchangeable Thimbles. Write or call: *WPPS Inc., One Industrial Way, Eatontown, NJ 07724, 201/389-1600*

Storage Devices

QCS HarDrives
QCS offers external Winchester Subsystems with capacities of 10 to 83M for the IBM PC, COMPAQ, Columbia and TI Professional. Backup to floppy or optional 5M removable cartridge drive with state-of-the-art utilities. Fast, Reliable, Expandable. From $2499. *QuCes, Inc., 3 QuCes Dr., Metuchen, NJ 08840, 201/548-2135, Telex 299410*

Winchester Controller
Hard disk drive controller for IBM PC, Plugs into any of 5 I/O slots. Programmable disk parameter enables the use of any 5.25" hard disk drive model with ST-506 interface. MS-DOS 2.0 driver included $485. For Apple II: controller + host adaptor + DOS 3.3 driver $485. Dealer inquiries invited for DTC Products. *Storage System Engineering Service, 5834 Southview Dr., San Jose, CA 95138, 408/980-7343*

Diskit 10+10R Subsystem
Combination 10M fixed Winchester plus 10M. Removable Cartridge for fast disk-to-disk backups. Compatible with MS-DOS backup & restore utilities with variable directory configura-

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Mailing Lists

Over 528,000 micro owners select by brand: 160M Apple, 95M IBM, 153M TRS-80, others. 4200 Computer Stores w/6 different selection options. 2,618 clubs & user groups. 10,500 computer advertisers. Lists by software brand, printer model, schools, publications, newsletters. Over 50 different micro lists, + direct response card decks. Free catalog. *Irv Brechner, Targeted Marketing Inc., Box 453, Livingston, NJ 07039, 201/731-4382*

Publications

Advertising Tracking

Analysis of ad space, expenditures and market share in over 50 computer publications. Used by ad managers, publishers, space reps, media buyers. Call for complimentary newsletter. *Adscope, A Service of Adtrak, Inc., P.O. Box 226, Goldendale, WA 98620, 509/773-3703*

dBASE II Applications

This is a comprehensive programming guide to dBASE II. Instructions for beginners & advanced programmers. Add-ons such as dgraph, dutil, reviewed in detail. Over 200 pgs. Contains complete Accounting System w/Payroll, Accounts Payable and General Ledger. Order 24 hours. Visa/MC welcome. $39.95 *Automate Computer Software, P.O. Box 290336, San Antonio, TX 78280, 512/692-2437*

Hardware Source Guide

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Online Business Info

150 business newsletters online, full-text, including 40 for the computer professional. Every word indexed in current/back issues. Issues online before print editions. Equiv. print value: $30,000/year. Low-cost service includes NewsFlash, unique electronic clipping service, plus UPI and PR Newswire. *NewsNet, 945 Haverford Rd., Bryn Mawr, PA 19010, 800/345-1301, 215/527-8030*

Computer "Yellow Pages"

A single source arranged like the "yellow pages" providing phone numbers & addresses of over 3300 companies affiliated with the computer industry nationwide. Arranged by product/service categories including hardware, software, consultants, retailers, distributors, furniture & supplies. Price $14.95. Free listings available. *CIM-G, 9371 Kramer Ave., Unit 1, Westminster, CA 92683, 714/892-4468, ext. 7*

Sales/Marketing

Software Authors

Software Marketing Services will help you market your software. If you have a product ready to go, or if you're working on one, we will provide you with the services needed to bring your product successfully to market. We have contacts: OEMs, publishers, distributors & others interested in your software. For details: *Software Marketing Services, P.O. Box QQ, New York, NY 10113*

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DISPLAY WR.	CPT 8000
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APPLE II	TELEVIDEO
MORROW	ALTOS
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XEROX 820	DEC VT180
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Disk to disk and disk to tape conversion also available. *Pivar Computing Services, Inc., 47 W. Dundee Rd., Wheeling, IL 60090, 312/459-6010*

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Orange Co., CA Bureau

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Accounting

Accountants Software

Finally! A software source for the practicing accountant with programs designed especially for the professional practitioner. Depreciation, After-The-Fact Payroll, Form #1099 Generator, Account Analysis & Client Information System are just a few of many. Call or send for our complete catalog. *Omni Software Systems, Inc., 146 N. Broad St., Griffith, IN 46319, 219/924-3522*

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Agricultural

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Record Mgmt. System

Fully integrated ranch mgmt. record keeping system including Payables, G/L, C/A, and Payroll. Easy data entry, editing, and retrieval. Complete Cost Accounting and Payroll Reports, including W-2's and Quarterlies. Available for CP/M, PC-DOS or MS-DOS. Price: $2995. Demo available. *Frontier Computer Corp., 2630 W. Durham Ferry Rd., Tracy, CA 95376, 209/836-2098*

Business Applications

Professional Time Acct.

Time Accountant is an essential timekeeping and management tool for professionals. Functions include billing preview, invoicing and reporting by individual, client, project and activity. Includes pocket calendar-time sheets, telephone support. Requires 128K RAM, two 320K drives. $395. *Time Accountant, 1230 University Dr., Menlo Park, CA 94025, 415/328-7877*

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Linear Programming

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User-friendly Lotus. "Branching tree" File-Link menu sys: enter filenames on easy-edit Menu Boards for instant access. New-file format w/handy commands & room to add yours. Write your own HELP panel, notes, instructions. Sample files show how program works. Organizer $89. Extra File-Link disks 3/$39. Demo: $29. Visa/MC. *The Whiterock Alternative, 8255 15th NE, Seattle, WA 98115*

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A time management system that displays activities in block calendar; prints calendar for selected range of activities, times, personnel or locations; prints calendar extracts in tabular lists; merges separately maintained calendars. Much more. PC-DOS/MS-DOS versions 128K, any printer. $300. *International Software Solutions, 3355 Lenox Rd. #750, Atlanta, GA 30326, 404/233-1519*

Communications

VT52/100/102 Emulator

PC100 turns your IBM PC (or compatible PC) into a DEC VT100/52 terminal. PC102 adds VT102/printer support and file transfer to PC100. PC102SV even supports 132 columns. We guarantee compatibility with all VT52/100 applications including EDT, KED, WORD11, and vi. Call or write for free brochure. From $89. *General Micro Systems, 7525 Mitchell Rd. #101, Minneapolis, MN 55344, 612/937-9194*

Monitor Transactions

MORT measures actual total response time at IBM 3278 terminal. Monitoring intelligence at terminal site thru locally executed scripts. Processor performance not impacted, giving objective measurements. Executes on IBM PC, connects to host as 3278, works with all 3278 applications. $2,495. *Automation Design Inc., 350 N. Clark #650, Chicago, IL 60610, 312/670-2660*

Compilers

Aztec C86

Aztec C86 is the choice of professional programmers worldwide. Aztec C is the most complete implementation of Unix V7C available for micros. The compiler also includes assembler, linker, debugging aids, library utility & overlay support. For a product review see the August 1983 issue of *Byte*. $249. *Manx Software Systems, P.O. Box 55, Shrewsbury, NJ 07701, 201/780-4004*

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Working in support of the c-system's full C Compiler, the c-window provides source statement execution and breakpoints; variables may be displayed/altered using C expressions; displays source code as program is tested. A must for all C programmers. 128K, two floppy drives required. C Compiler $195, c-window $195. *c-systems, P.O. Box 3253, Fullerton, CA 92634, 714/637-5362*

C86-C for Professionals

"C" brings great power, control and conciseness to programming. C86 brings FULL UNIX syntax (portability), source to a rich library (gives you control), no royalties, PC-DOS & CP/M-86 support, and overlays. Hot-line support is solid. $395. Call your Dealer or CI. *Computer Innovations, Inc., 980 Shrewsbury Ave. #530, Tinton Falls, NJ 07724, 201/542-5920*

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Stop locking up your disks! The most secure cryptographic system known, the RSA public-key system, is now available for the IBM PC. Crypt Master encrypts confidential disk files for the ultimate in data security. Ensure the privacy of your electronic mail. (See display ad this issue.) *Digital Signature, 5453 S. Woodlawn, Chicago, IL 60615, 312/324-6533*

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Safeguard sensitive data with this fast, easy-to-use encryption tool. Proprietary info, diary entries—any file can be made undecipherable to anyone but you. No encryption method is foolproof, but this one will protect your data from all but the most sophisticated snoops. Req. 64K, DOS. $30. *Evviva Software, 765 San Antonio Rd. #3, Palo Alto, CA 94303, 415/494-9344*

Culinary Arts

"Compu-Chef"

A complete Culinary Guide for the IBM PC. Create a personal Recipe Library, Directory of Foods, perform Food Cost & Portion Comparisons. COMPU-CHEF has over 90 Continental Recipes, Culinary terms, a Calorie guide, Herbs & Spices, & more. Home & restaurant use. Req. 128K, DOS, double-sided dd. Special intro., $24.95. Distributors invited. *DeAmicis Software Development, 4193 Galbar St., Oceanside, CA 92056, 619/758-4766*

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Development

Program Dev. Tool (PDT)

A single add-in board to IBM PC together with a software diskette provides complete real-time debugging & performance analysis. Major features include Debugger, Real-Time Trace, Hardware

Breakpoints, Performance Analysis & others. Demo diskette available for $20 plus tax. For more info contact: *Answer Software Corp., 20863 Stevens Creek Blvd., B2-C, Cupertino, CA 95014, 408/253-7515*

Edit

KEDIT
KEDIT is an XEDIT-like full screen editor for the PC. Split-screen editing of multiple files, targets, ARBCHAR, SCHANGE, GETFILE, SORT, wordwrap, paragraph reformatting, block operations, key redefinition. Requires 80 column display, 128K (160K with DOS 2.00). $85 ($95 after April 1st) plus $3 shipping. Demo version $10. *Mansfield Software Group, Box 532, Storrs, CT 06268, 203/429-8402*

Educational

Professor DOS
Interactive, self-paced tutorial program designed to teach new PC users important PC concepts, including DOS. Simulates DOS operations, allowing you to freely experiment. Uses graphic images, sound, animation and color to help you learn smarter, faster, easier. Available at fine dealers. $59.95. *Individual Software, Inc., 1163-1 Chess Dr., Foster City, CA 94404, 415/341-6116*

PC/Pilot
Language for education and training. By MicroPi, the source of PILOT on the other major personal computers. Meets Common PILOT standard. Extensions for color, graphics, user fonts, windows, files and video disk/tape control. Includes EZ editor. Lic: $100 single, $550 multiple. *Washington Computer Services, 3028 Silvern Lane, Bellingham, WA 98226, 206/734-8248*

The Instructor
A self-paced tutorial program that teaches first-time users how to interact with the PC. Designed to be the first serious software run by new users of all ages. Uses graphics, sound and color to create friendly interaction. See your local retailer. $44.95. *Individual Software, Inc., 1163-1 Chess Dr., Foster City, CA 94404, 415/341-6116*

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Type Hebrew with your IBM PC or XT. Makes Hebrew school homework more fun. Satisfaction guaranteed or your money back. Makes a great gift! Requires color/graphics adapter. (For optional hard-copy, included screendump requires Epson printer.) Call, ask for Gary Rosen. To order send $29.95: *Gamma Productions, 817 10th St. #102, Santa Monica, CA 90403, 213/451-9507*

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Creative graphics combined with unique interactive lessons on DOS commands and concepts, keyboard operations, and EDLIN, make this training the most effective, enjoyable way to learn IBM PC and XT operations. Teaches DOS 1.1 and 2.0. Requires 64K, DOS, monochrome or color display, 1 diskette drive. $94.95. *Individual Software, Inc., 1163-1 Chess Dr., Foster City, CA 94404, 415/341-6116*

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Quick, versatile, interactive structural programs - beams, columns & frames of any material efficiently analyzed & designed. Extremely friendly input/output with COLOR graphics options. Specify PC configuration and send $25 for demonstration disk to: *c^2b^2 - software design, 763 27th Ave., San Francisco, CA 94121, 415/751-1337*

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Superior copy protection at an affordable price. Protects against all available copy programs including the new interactive ones. Supports up to 32 programs per diskette. Any .COM or .EXE file can be protected including programs that chain or overlay. 2 drives, 64K, price $399. *Soft-Design, 6 Blodgett Rd., Lexington, MA 02173, 617/861-0902*

Disk Mechanic
The ULTIMATE Floppy Disk Backup & Repair Utility. Can back up ALL software protected disks written on the IBM PC. Works manually or automatically. Restores deleted files. Files or sectors can be searched, examined & changed. Checks disk drive speed. Requires IBM PC, DOS 1.10/2.00, 128K mem. & 2 floppy drives. $73 Ppd. USA. For info/MC/Visa: *MLI Microsystems, P.O. Box 825, Dept. PCWD, Framingham, MA 01701, 617/926-2055*

Scrolling Memory
Tired of losing lines that scroll off the top of the screen? Now you can scroll them back down into view! ScrollMate adds up to 14 screens of scrolling memory to DOS. ScrollMate works with DOS (not BASIC) commands & programs that write sequentially to the screen. $69.95. Free brochure. *Inner Loop Software, 5456 McConnell Ave. #120, Los Angeles, CA 90066, 213/822-2800*

Word Processing

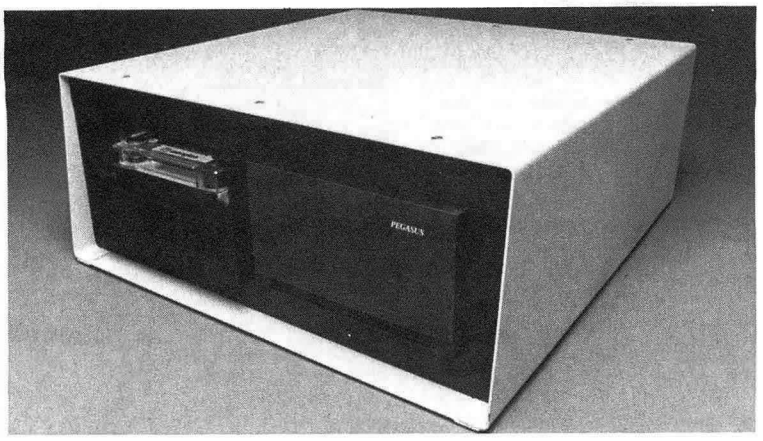
Fontastic™
If you want to SHOUT on paper, here is THE ANSWER! A word processing text customizer. Print your text in many provided font styles or easily create your own! Add special emphasis like italics, bold and underlined, and much more. Requires IBM PC, DOS, 128K, WP or Editor, and dot matrix printer. $125. *IHS Systems, 4718 Meridian Ave. #211, San Jose, CA 95118, 408/265-5503*

Pelada-Science-Foreign
TEXT ENGINEER and LINGUIST are word processors with special symbols & character fonts. You can design characters, even whole alphabets. Italics, European characters, super/subscripts, math, chemistry & more. Text is displayed EXACTLY as printed. Instant, simple editing operations. $150 to $400. *Pelada Informatica Inc., 562 Johnson St., Kingston, Ontario K7L-2A1 Canada, 613/549-1747, Source STP892*

PC-Write™
Features: wordwrap, search/replace, justify, block move/copy/delete, headers/footers, etc. Help screen, quick ref card, 100 page manual. Split screen edits two files at once. Disk w/software & manual $10; registration w/support, source, commissions $75. Visa/MC. Shareware: copy and share with others. *Quicksoft, 219 First N. #224, Seattle, WA 98109, 206/282-0452*

Typesetting

Cimarron
Top quality typesetting. Fast service. Save up to 40%. Send your disks or telecommunicate. Compugraphic typesetting equipment. Best for text jobs like newsletters, directories, catalogs, books, resumes. *Cimarron Graphics, P.O. Box 12593, Dallas, TX 75225, 214/691-5092 (Hostcomm), CompuServe EMAIL 70130,161*



$1495 for a complete 10 megabyte hard disk system is a good deal — but not if you need 23 megabytes of storage!

That's why our 23 megabyte hard disk system is priced at only $2249. And for another $895, you'll get 23 megabytes of tape backup security.

The Pegasus 10 and 23 come complete with all the software and hardware you need to start operations.

If you've outgrown the storage capabilities of your IBM PC or compatible computer but haven't grown into the giant pricetags on 10- or 23-megabyte hard disk systems, you're in for a surprise.

The price on these complete systems featuring the latest components just reached an all time low!

And you get everything you need to start working on your hard disk system:

- Top quality formatted fixed hard disk (ST506 compatible)
- Top quality controller card
- Software that runs on DOS 1.1 and 2.0, CP/M 86
- Host adapter
- Integral power supply
- Cables
- External custom chassis with additional space for either our tape backup, another hard disk, or floppy disk drive.
- 90 day warranty

What's the catch?

There is none. It's a simple matter of economics. Pegasus saw the growing need for mass storage, made a commitment to fill this need, purchased thousands of the finest quality hard disks, and is now passing the good deal along to you.

The only thing you may be missing in buying the Pegasus instead of the IBM XT expansion chassis is something you may not need in the first place: eight expansion slots, a communications card, three little initials, and an extra $1,000 to $2,000 out of your pocket.

But don't I need a tape backup for all that storage?

We recommend it! That's why we're offering you the same great deal on a ¼" cartridge tape backup. We've watched other companies offer 10 and 20 megabytes of storage and forget about the backup altogether. Our tape backup, which carries a 90 day warranty, retails for just $895 — a small price for over 23 megabytes of formatted storage and lots of peace of mind.

Where can I buy a Pegasus hard disk system?

Pegasus systems are available only through dealers. So contact the dealer in your area who sells IBM PC or compatible computers. If he doesn't have Pegasus, chances are he'll carry it soon. Just ask him to call us. We will ship him your Pegasus unit immediately.

Does Pegasus have larger storage systems?

Absolutely. 65 and 140 megabyte systems will soon be available from Pegasus. And the best part is that they, too, are breaking new ground when it comes to pricing. If you've outgrown 10, or even 23 megabytes of storage, ask about the larger capacity units. All with the same top quality hardware and software and full 90 day warranty.

PEGASUS

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Hoffman Estates, IL 60195 • (312) 843-1090

Dealer inquiries invited.

Circle 392 on reader service card

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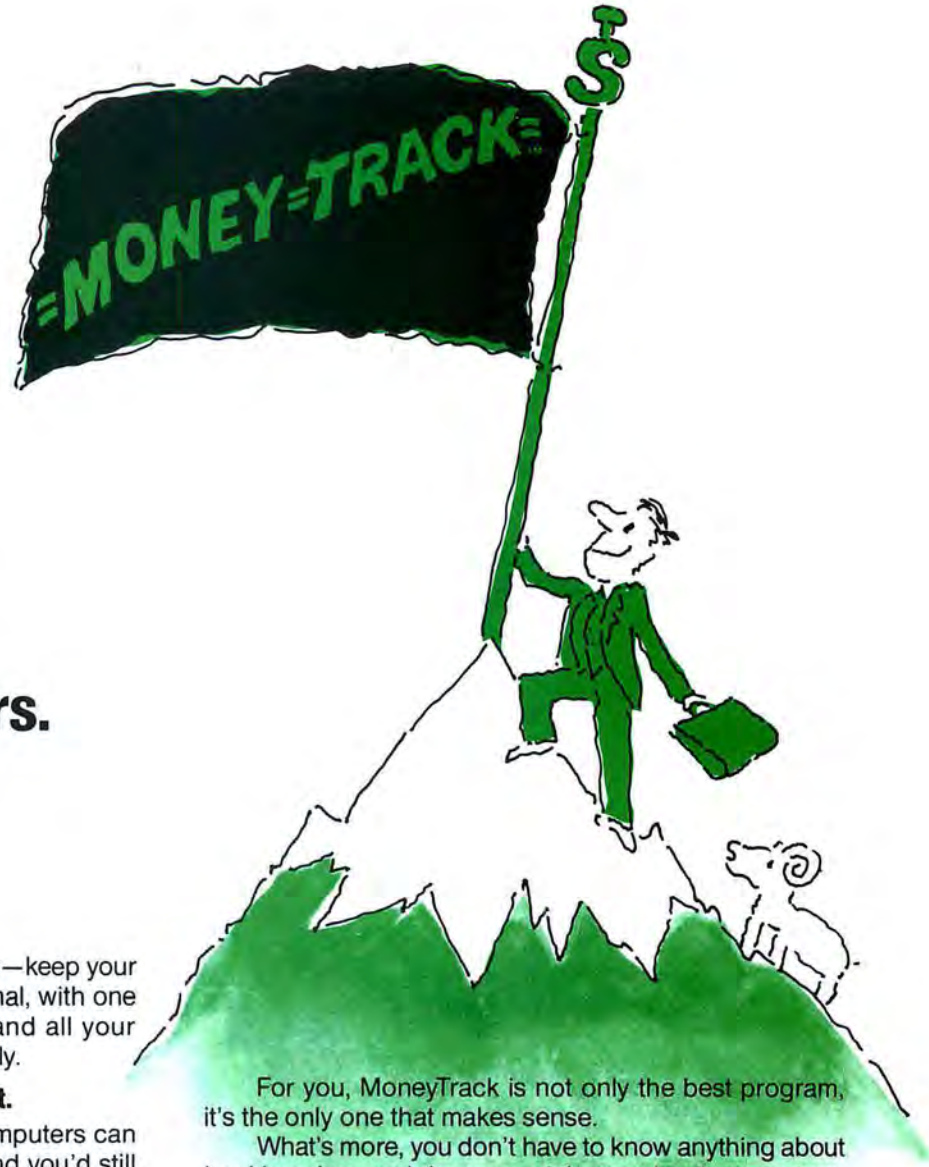

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Even then you wouldn't enjoy MoneyTrack's greatest benefits. Because having everything in one program gives you unmatched flexibility.

For instance, only MoneyTrack lets you do a cross-analysis of both business and personal income and expense. You can track tax-sensitive accounts—like interest income/expense and capital gain/loss—across every one of your ventures.

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It's specifically designed for those with multiple sources of income, varied interests. The entrepreneur, investor, business manager, general partner, developer; those with a small business, farm, retail store, professional practice.

For you, MoneyTrack is not only the best program, it's the only one that makes sense.

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MoneyTrack is under $350. And to know what it's worth, you must see how much it does for you.

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Pacific Data Systems, Inc., 6090 Sepulveda Blvd., Culver City, CA 90230. (213) 559-8713.

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Just Announced

The wide world of PC products

Edited by Art Wilcox

In the fast-paced personal computer marketplace *Just Announced* acts as an alert service to keep you abreast of the latest developments in IBM PC and compatible technology. Information for this department is provided by manufacturers; these write-ups are not reviews. Many of these descriptions will be followed up by reviews in future issues.

Hardware

Boards

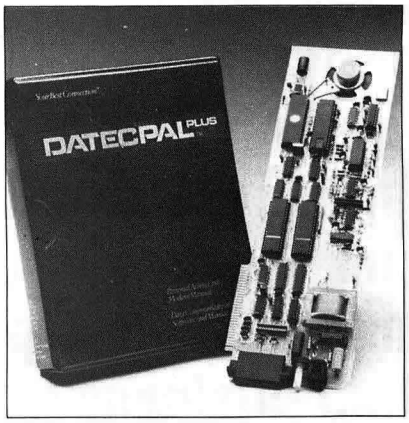
Time Spectrum SB384
A multifunction board that offers up to 384K of additional RAM and communications functions for the IBM PC or the PC XT. It uses one expansion slot. The module includes socketed RAM, a calendar/clock with battery backup, one asynchronous communications port, and a parallel printer port. The SB384 has parity checking and switch-selectable memory size and allows up to three I/O ports to be connected through a single PC slot. The board comes with Persyst disk emulation and print spooler software. List price: 64K $395, 384K $895. Persyst Products, 15801 Rockfield Blvd., Ste. A, Irvine, CA 92714, 714/859-8871.

Multigraph
A graphics board that provides switch-selectable monochrome and color, 32K on-board memory, flicker-free scrolling, and 32-bit internal architecture. Multigraph offers monochrome graphics capability with 720 horizontal by 350 vertical resolution (upgradable to 720 by 700), *1-2-3* compatibility, and optional 132-column width. Multigraph's color graphics are IBM PC hardware compatible and can be upgraded to 640 by 200 or 640 by 400 resolution with 16 colors. Options include smooth scrolling, a parallel port interface, and 128K on-board memory. List price: $499, parallel printer port $65, smooth scrolling $60. Profit Systems, Inc., P.O. Box 1039, Berkley, MI 48072, 313/559-0444.

STB Graphix Plus
A board that provides color and monochrome graphics, a parallel printer port, and a light pen interface. It occupies one expansion slot. The Graphix Plus drives RGB color, composite black and white, or IBM's monochrome monitors with the same resolution and colors as the IBM Color/Graphics Adapter—640 by 200 monochrome or 320 by 200 color graphics. It also provides *1-2-3* and *Flight Simulator* compatibility, and flicker-free scrolling. Disk emulation and print spooling software are included; a clock/calendar is optional. List price: $495. STB Systems, Incorporated, 601 N. Glenville Ave. #125, Richardson, TX 75081, 214/234-8750.

Monitors

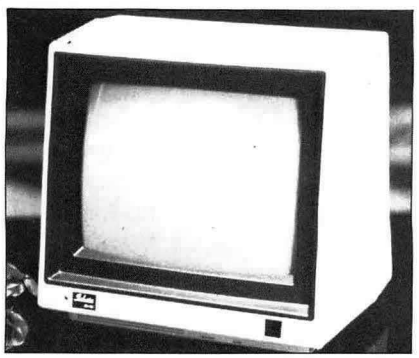
Sakata Color Monitors
Three low-cost, 13-inch color monitors for the IBM PC that offer varied resolutions and controls. The SC-100 composite color monitor offers 8 colors, 1000 characters, and 280 by 300 resolution. It includes sound, contrast, vertical hold, color, tint, and brightness controls. The SC-200 RGB high-resolution monitor provides 16 colors, 2000 characters, a .39mm dot pitch, and 640 by 240 resolution. It includes front and back external controls. The SC-300 RGB high-resolution monitor provides 16 colors, 2000 characters, external controls, a .31mm dot pitch, and 720 by 240 resolution. A tilt-and-swivel monitor stand is optional. List price: SC-100 $329, SC-200 $649, SC-300 $899, stand $49. Sakata U.S.A. Corporation, 651 Bonnie Ln., Elk Grove Village, IL 60007, 312/593-3211.



PAL Plus modem board, Datec

Modems

Datec PAL Plus
A modem board that offers auto-originate and auto-answer modes at speeds of up to 1200 bps for the IBM PC and COMPAQ computers. It uses one expansion slot. The PAL Plus supports touch and rotary pulse tones and full-duplex operation, and includes an extra RS-232C serial port. The modem board has a built-in speaker with volume control, uses the Hayes Smartcom command set, and comes with the *Crosstalk XVI* communications software. List price: $599. Datec, Incorporated, 200 Eastowne Dr. #116, Chapel Hill, NC 27514, 800/334-7722.



SC-100 color monitor, Sakata

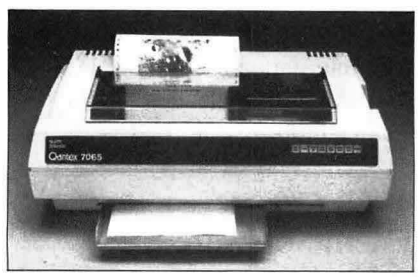
PC Modem Half Card
An auto-dial, auto-answer modem board that fits into the small expansion slot of the IBM PC XT. The PC Modem Half Card transfers data at 300 or 1200 bps and includes the *Crosstalk XVI* communications program. The board supports the Hayes Smartmodem command set and includes instructions and a telephone cable. List price: $549. Ven-Tel, Inc., 2342 Walsh Ave., Santa Clara, CA 95051, 408/727-5721.

Network Devices

10-NET
A local area network that enables up to 32 IBM PCs to share hardware and software resources. It requires 64K, one disk drive, and one expansion slot. 10-NET provides users with record and file locking, password protection, and print spooling. With this network, PCs can be both file servers and work stations; they can access one or more machines while performing tasks requested by another network user. 10-NET also features electronic mail, a Chat mode for PC-to-PC conversations, a Calendar mode for appointment management, and a Who command for displaying a list of current network users. The package includes software, a network board, documentation, and wiring. List price: $595. Fox Research, Inc., 7005 Corporate Way, Dayton, OH 45459, 513/433-2238.

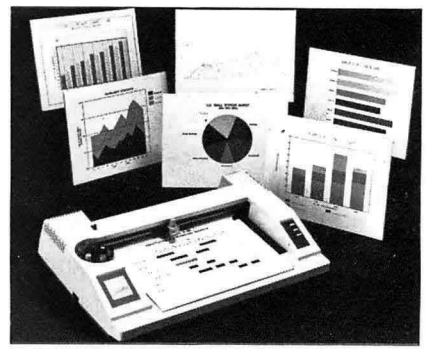
Printers

Qantex Model 7065
A multimode dot matrix printer that is compatible with Epson/IBM printer escape codes and that prints at speeds of up to 300 cps. It has



Model 7065 multimode printer, Qantex

both RS-232C serial and parallel ports and features proportional spacing, right justification, auto-underline, overprint, and boldface functions. The Model 7065 operates at 300 cps in draft mode, 250 cps in compose mode, 125 cps in near letter-quality mode, and 65 cps in letter-quality mode. The printer can store up to three fonts on line without users having to change print wheels, and it performs a self-diagnostic test before operation begins. List price: $1995. North Atlantic Industries, Inc., Qantex Division, 60 Plant Ave., Hauppauge, NY 11788, 516/582-6060.

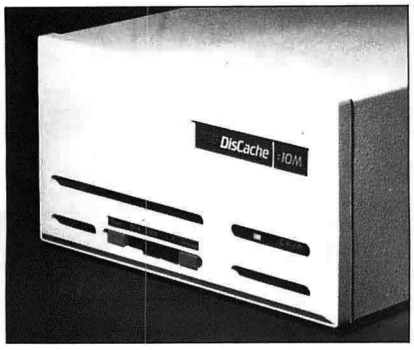


Sweet-P Model 600 plotter, Enter Computer

Sweet-P Model 600
A personal plotter that draws charts, graphs, and illustrations in six colors at a speed of 14 inches per second. The Sweet-P provides both parallel and RS-232C serial ports, 19 English and foreign language character sets, and a 2K buffer memory. It uses either standard paper or transparent projection film in 8½- by 11- or 11- by 17-inch sizes. The plotter uses Enter Computer's SPGL graphics language or emulates the Hewlett-Packard Graphics Language used with HP7400 plotters. List price: $1095. Enter Computer, Inc., 6867 Nancy Ridge Dr., San Diego, CA 92121, 619/450-0601.

Storage Devices

DisCache
A hard disk subsystem that includes a 10-megabyte, 5¼-inch hard disk, a RAM cache of up to 256K, 1 megabyte of print spooling, and an incremental backup system. A special algorithm enables DisCache to keep frequently used program sectors automatically in its RAM cache for immediate access, providing users with 100-millisecond access times. The caching algorithm provides anticipa-



DisCache hard disk subsystem, Eicon Research

tory buffering: 16K of data automatically stored next to the requested disk data is loaded into the RAM cache and thus is immediately available if needed.

DisCache's archival system enables users to back up only those sectors of the hard disk that have been edited or updated, thus eliminating the need to back up the entire disk. CacheNet, DisCache's local area network, allows up to 21 computers to be connected to the hard disk with up to six different operating systems running concurrently. It provides file server functions, including file sharing and record locking. List price: $3000. Eicon Research, Inc., P.O. Box 60456, Palo Alto, CA 94306, 415/326-2164.

Miscellaneous

Speak Easy
A digitized voice-management system that enables the IBM PC to speak and perform telephone functions automatically. It requires 256K and two disk drives. Consisting of a printed circuit board and software, Speak Easy features ring detection, auto-dial and auto-answer, touch-tone recognition, and message reception and transmission. These features allow Speak Easy to answer calls in the user's prerecorded voice and replay selected messages to callers who identify themselves using touch-tone codes. Speak Easy can call one or more programmed phone numbers and deliver a prerecorded message. The program stores incoming calls on disk; users can review them later over a remote telephone or by programming Speak Easy to call a number and deliver the messages. List price: $795. CMC International, Inc., CMC International Building, 1720 130th Ave. NE, Bellevue, WA 98005, 206/885-1600.

System Software

Operating Systems

WindowMaster
A windowing program that runs multiple applications simultaneously in user-defined windows. It requires 128K and two disk drives. *WindowMaster* permits both PC-DOS and CP/M-86 programs to run concurrently in windows that users can expand, shrink, or move using the cursor keys. Users can scroll data horizontally, vertically, or diagonally; transfer data between windows; create graphs from window data; and assign repetitive tasks using a Script function. *WindowMaster* will run any Structured Systems Group software as well as other vendors' software such as *1-2-3* and *WordStar.* The program provides users with status information on programs currently running and the amount of memory being used. List price: $295; with five bundled applications (word processing, spreadsheet, report generation, mass mailing system, and sorting program) $495. Structured Systems Group, Inc., 5204 Claremont Ave., Oakland, CA 94618, 415/547-1567.

DesQ
A multiple-window operating environment that integrates applications from different vendors without modification. It requires 320K and a hard disk drive. *DesQ*'s environment allows users to view up to nine windows at once and transfer data and text among the windows using the keyboard or a mouse. *DesQ* can be customized to do specific tasks with a single keystroke using its Learn facility. List price: $399. Quarterdeck Office Systems, 1918 Main St. #240, Santa Monica, CA 90405, 213/392-9851.

Jane
An operating environment that offers multiple windows, a mouse device, and an interface that uses pictures to represent system commands. It requires 64K and one disk drive. Designed for novices, *Jane* allows users to display simultaneously up to four applications in up to four windows and transfer text or numbers among those applications. The package comes with word processing, spreadsheet, and list management programs. List price: $295. Arktronics, P.O. Box 4190, Ann Arbor, MI 48106, 313/769-7253.

PICK PC-XT
An implementation of the PICK operating system for the IBM PC XT. It offers complete applications software compatibility with all PICK-equipped computer systems and requires 256K. Designed for business users, the *PICK PC-XT* includes a virtual memory manager that supports up to 640K; full data base management with on-line or batch inquiry and report generation; an English-like inquiry language; and a BASIC compiler that supports extended PICK/BASIC. The system supports up to three terminals and a print spooler and has communications facilities for trading file level information between PICK and PC-DOS based systems. List price: $495. PICK Systems, 17911 D Skypark Circle, Irvine, CA 92714, 714/261-7425.

Utilities

Letterform 1000
A computer desk letter reference designed for both beginning writers and experts. It requires 64K and one double-sided disk drive. Letters can be personalized and edited on screen using different word processors and then printed. *Letterform 1000*'s sample letters cover accounting and collection, sales, legal, shipping, personal, educational, charitable, and general business topics. The manual covers reference information on headings, titles, forms of address, government abbreviations, Roman numerals, the metric system, punctuation, and computer terms. List price: $95 including manual. PBL Corporation, P.O. Box 559, Wayzata, MN 55391, 612/473-8998.

Applications Software

Accounting and Inventory

Books!
An automated general ledger system that includes an on-screen tutorial and a sample chart of accounts. It requires 128K and two disk drives. *Books!* allows users to add to the chart of accounts in the middle of a journal entry, enter 512-character journal entry descriptions and 30-character account names, and use the entry descriptions as account names. After users enter transactions, they can check balances, print a record of entries, store the journal in entry order, and post to the ledger while maintaining an audit trail. The program also features user-defined prompts for journal cross-referencing, previous year comparisons, four levels of account detail, and four optional modules: budgeting, recurring entries, invoice printing, and check writing. List price: core program $345, optional modules $75 to $150 each, complete system $750. Systems Plus Inc., 1120 San Antonio Rd., Palo Alto, CA 94303, 415/969-7047.

Communications

Perfect Link
A program that transfers binary or ASCII files between the IBM PC and information services, mainframes, and microcomputers. It requires 128K, one disk drive, and an RS-232C serial port. *Perfect Link* provides one-key automatic dialing and logon, 20 programmable keys, and predefined macros for many information services, including The Source and Knowledge Index. With *Perfect Link* users can strip control characters such as linefeeds from incoming transmissions, manipulate files while on line, transmit a true break signal, and estimate file transmission times. The program emulates various terminals including the Televideo 920, the DEC VT-52, and the IBM 3101. List price: $149. Perfect Software, Inc., 702 Harrison St., Berkeley, CA 94710, 415/527-2626.

Data Management

10-BASE
A relational data base management package based on the Sequel (SQL) DBMS language that originally ran on IBM mainframes. It requires 192K, one disk drive, and DOS 2.00. *10-BASE* allows users to create, edit, delete, query, manipulate, display, and print all or part of data files using one-key English commands and to access up to 16 files simultaneously. The program features B-tree file indexing, logical views, and a user-definable help facility. The number of records per data base and fields per record in *10-BASE* is limited only by availability of storage space. Designed to work with Fox's 10-NET local area network, *10-BASE* will accept files from other programs such as *1-2-3*, *WordStar*, and *MailMerge*. List price: $495. Fox Research, Inc., 7005 Corporate Way, Dayton, OH 45459, 513/433-2238.

Educational

Thoughtware
A series of interactive management-training courses on disk that are designed to improve management performance and competence. The package requires 128K, two disk

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NEC SPIN 3550	1850	PRISM 132	CALL
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PEARLSOFT	199	LOTUS 1-2-3	CALL

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per file and 99 fields per record. *CalcIT*, a 3-dimensional spreadsheet program, enables users to design models of up to 255 pages with 255 rows and columns and to perform linear regression graphing, loan computations, and amortization schedules. *LinkIT*, an asynchronous communications package, provides a full-screen editor, split-screen and unattended operations, and concurrent editing and printing of files. *EditIT*, a full-screen editor, offers multiple-file editing in user-defined windows, color and mouse support, and macro commands. *WritIT* is a private-label version of *MultiMate*.

The other programs are *StatIT*, a package of statistical routines; *PassIT*, a file transfer program that works with IRMA or Forte 3270 emulator boards; *ShowIT*, a business graphics program; *SortIT*, a sort/merge utility; and *SendIT*, a program that helps prepare slide shows and present them in multiple locations simultaneously. List price: $125 to $500 each. IT Software, P.O. Box 2392, Princeton, NJ 08540, 609/799-2600.

Job and Industry Specific

MEDACS

A medical accounting system that can be customized for any type of medical care provider. It can handle records for up to 100 doctors on its data base and requires 256K and a 10-megabyte hard disk. *MEDACS* performs most medical accounting functions such as patient and third-party insurance billing (processing up to 9999 procedure and diagnostic codes), account aging, and credit status and accounts receivable from third-party providers. It offers financial and medical patient analysis and generates printed reports that include patient names, account numbers, and outstanding balance information. *MEDACS* comes in single- and multiuser formats. The single-user package handles records for up to 10 doctors, and the multiuser package can do up to 100. List price: single-user package $5000, multiuser package $7000; both prices include training and installation consulting. Advanced Computer Systems, 3131 S. Dixie Dr., Dayton, OH 45439, 513/294-0586.

EASEL

Editor and Animation System with Extendable Library (*EASEL*) is a professional graphics software package for commercial, educational, and fine arts applications. It requires 265K, two disk drives, and an RS-232C serial port. Designed for novices, all graphic input on *EASEL* is done with a digitizing pen and a tablet through menus of available commands. The package contains a set of computer pens and brushes, including a multicolored airbrush, a mask brush that draws over unprotected colors only, a brush that draws in four-way symmetry, and user-created brushes. Menu commands allow rotating, reflecting, moving, copying, and rescaling images; remapping colors; and loading selected colors from a saved image. List price: software only $1250, Kit-2 including digitizer tablet with electronic pen, frame buffer, Scion PC

640 graphics board, high-resolution (640 by 482) RGB monitor, and *EASEL* software $6000. Time Arts Inc., 4425 Cavedale Rd., Glen Ellen, CA 95442, 707/996-4856.

Personal Management

Net Worth
A menu-driven program that helps users monitor investment portfolios. It requires 64K and two disk drives. *Net Worth* provides users with cash equivalent summaries of assets and liabilities, annual portfolio income figures, year-to-date capital gain and loss summaries, latest closing prices on owned securities, and automatic weekly updates of stock trading ranges and closing prices. Other features include a reward-to-risk computation of factors affecting market trades, automatic transfer via modem of Dow Jones News/Retrieval information, graphic screen displays, and report generation. List price: $295. Bullish Investment Software, P.O. Box 853, Mansfield, TX 76063, 817/473-9249.

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Speed Reading

An interactive program that teaches users the theory, basics, and skills of speed reading in eight half-hour sessions. It requires 96K and two disk drives. *Speed Reading* enables users to learn at their own pace; they can repeat difficult lessons or skip easy ones. The course scrolls reading selections at predefinable speeds, automatically computes reading rates throughout the lessons, and automatically speeds up selections during lessons to promote faster reading. List price: $125. Bureau of Business Practice, 24 Rope Ferry Rd., Waterford, CT 06386, 203/442-4365.

Computer Preparation for the SAT

An integrated, interactive learning system that helps students raise their SAT test scores. It requires 64K and one disk drive. *Computer Preparation* diagnoses strengths and weaknesses, specifies appropriate drills and exercise reviews, and automatically keeps scores. By simulating exam procedures and providing explanations of test-taking strategies, the program helps users build confidence and reduce anxiety. *Computer Preparation* includes a 470-page textbook, *How to Prepare for the SAT,* and a user manual. List price: $79.95. Harcourt Brace Jovanovich, Computer SAT IBM, 1250 Sixth Ave., San Diego, CA 92101, 800/543-1918, 619/699-6335 in California.

Entertainment

MysTrix

A crime-solving mystery game that requires 64K and one double-sided disk drive. Provided with clues and a crime lab, players apprehend and question witnesses, arrest suspects, and use deductive reasoning to solve various crimes. *MysTrix* has six skill levels and records highest scores. List price: $34.95. Insoft, Inc., 7933 S.W. Cirrus Dr., Beaverton, OR 97005, 503/641-5223.

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A tax planner for 1983 and 1984 designed for individuals and professional tax preparers. It requires 64K and one disk drive. *Professional Tax/Forecaster* enables users to do "what if" analysis regarding various tax factors such as IRAs, Keoghs, charitable

contributions, long-term stock sales, and business deductions. The program provides automatic calculations for Schedules A and D, mathematic totaling functions, and printouts of each tax situation. List price: $99.95. Micromatic Programming Company, Cedar Corners Station, P.O. Box 16735, Stamford, CT 06905, 203/968-0933.

Tax Strategist

A program that evaluates tax reduction strategies and computes federal income tax liability for up to ten years. It requires 128K and two double-sided disks. *Tax Strategist* automatically calculates the amount of tax shelter needed to reach a desired tax-reduction goal. The program calculates taxes using tax tables, income averaging, and alternative minimum taxes over a ten-year period, applies ten tax alternatives, and then selects the most advantageous method for each year. *Tax Strategist* provides printed reports and can integrate data from XQ Software's *Investment Strategist*. List price: $395. XQ Software, Inc., 4357 Park Dr., Norcross, GA 30093, 404/923-2880.

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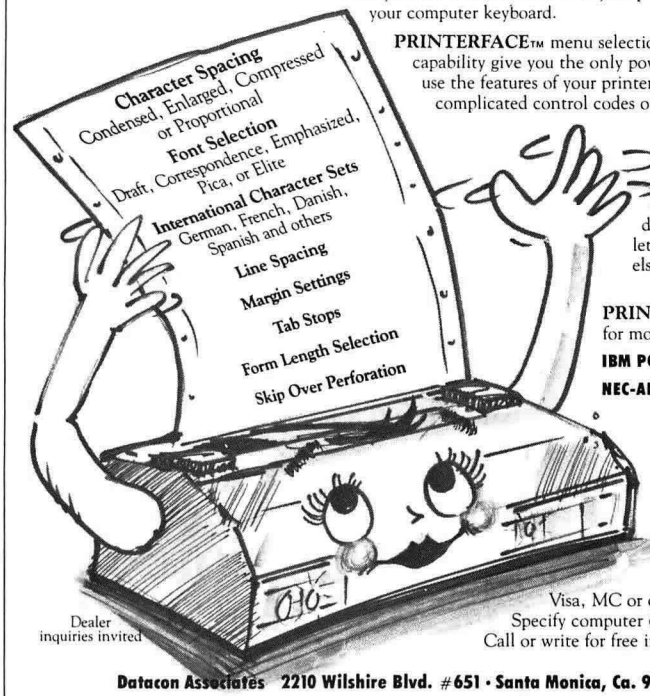

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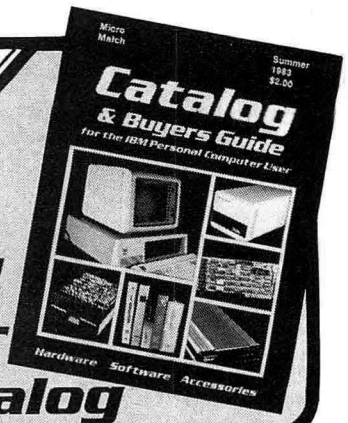

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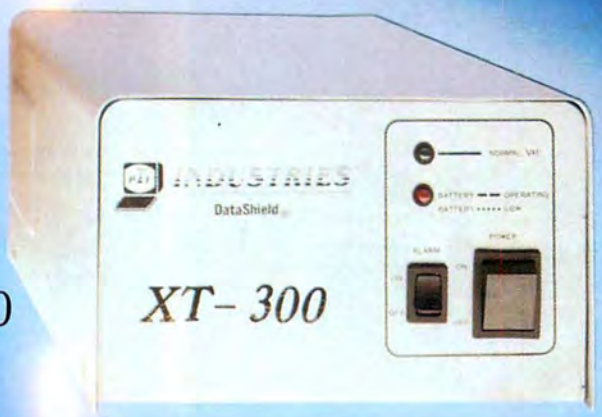

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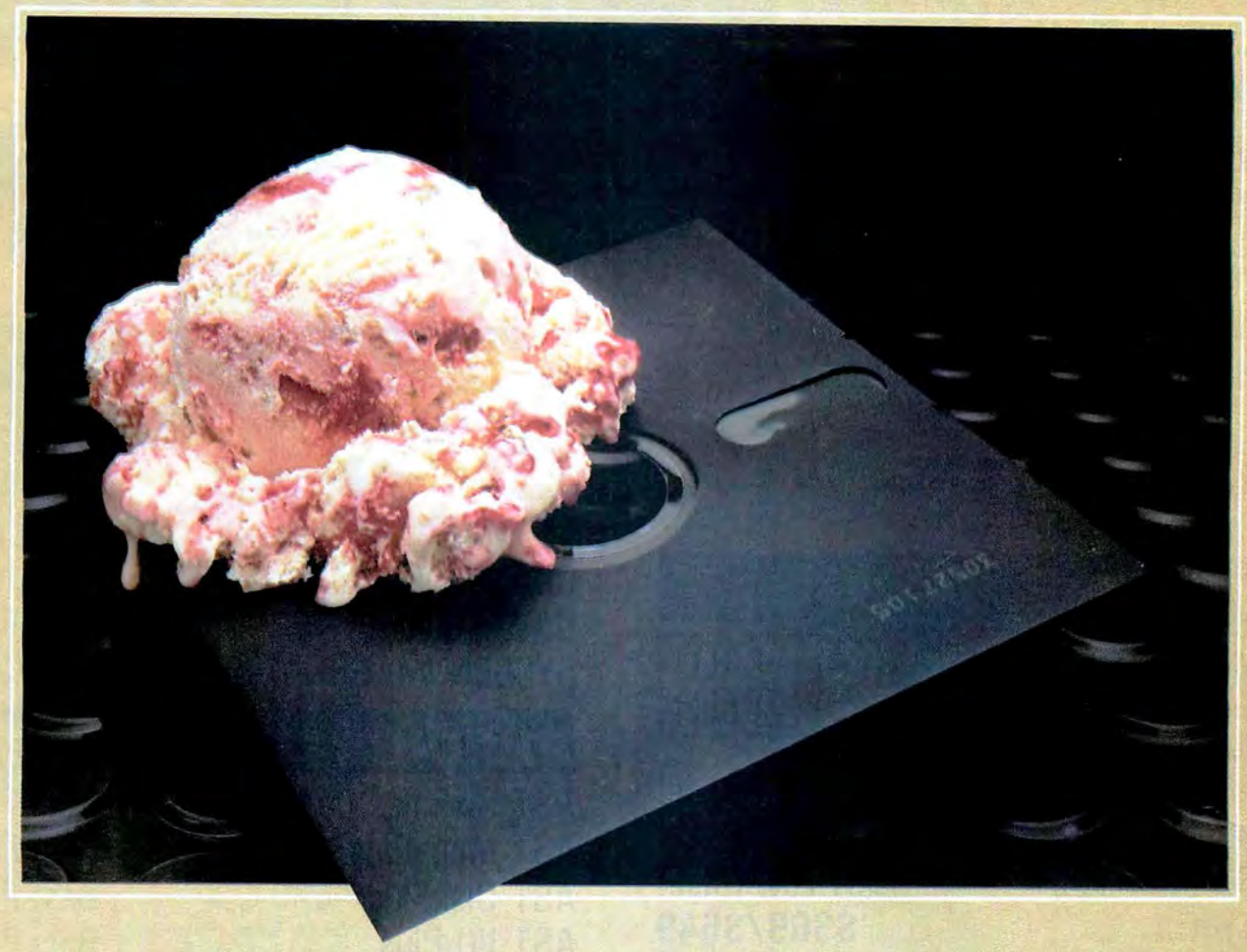

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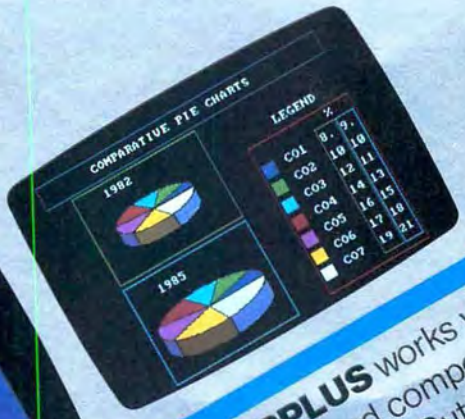

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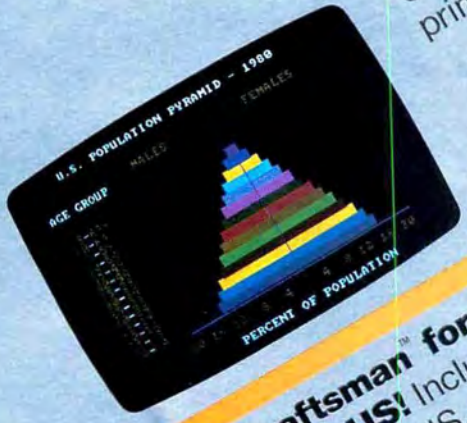

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