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PC WORLD

May 1984
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The Personal Computer Magazine for IBM PCs and Compatibles

IBM PC to Go!

IBM's $2795 Portable PC Stuns the Compatibles Market

PC WORLD

Volume 2, Number 5

PC Portability

• **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.

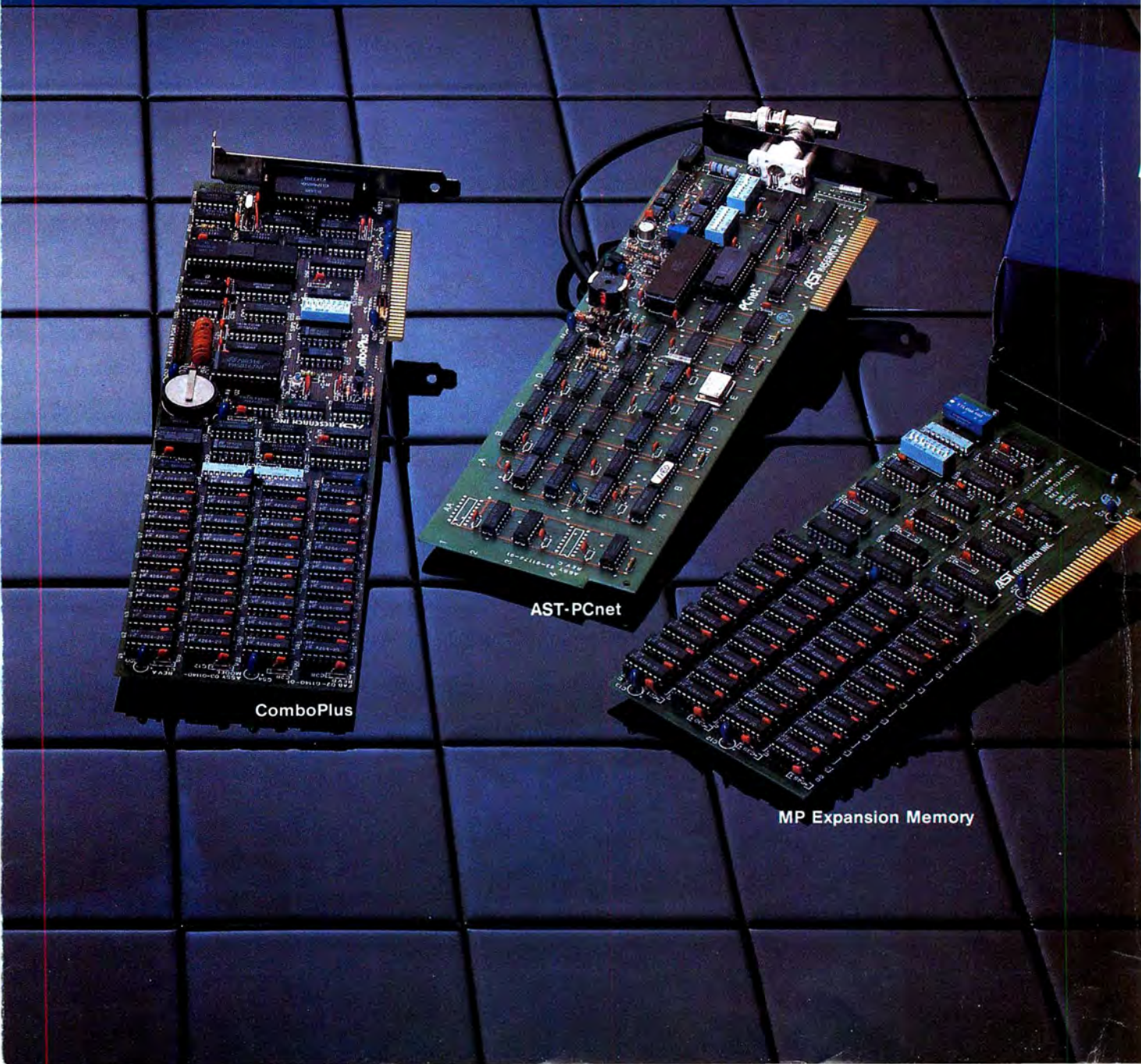
• **Game Adapter** — The game adapter port allows you to connect an IBM-type joystick to your PC so you can play the multitude of arcade-quality games which take full advantage of the PC's graphic capabilities. Or you can use the joystick input for other applications by writing your own programs.

• **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!



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.

AST

Number One Add-On Products for IBM PC

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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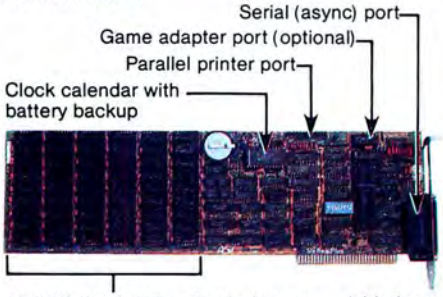
AST Research Micro-to-Mainframe Communications Products:

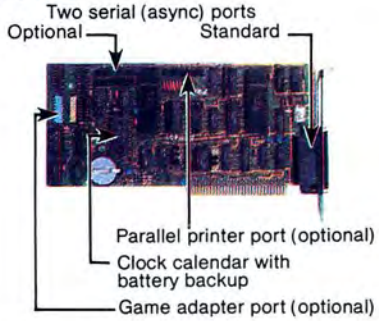
- **AST-SNA** — A family of five products that enable a PC to communicate with a mainframe via the IBM SNA protocol without the use of protocol converters.
- **AST-5251** — An interactive 5251 remote work station emulation package for use with the IBM System 34, 36, or 38.
- **AST-3780** — A hardware/software 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™:

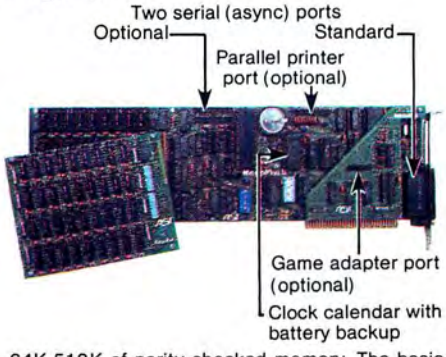


64K-384K of parity checked memory. Added to a PC or XT with a fully populated 256K system board, the SixPakPlus can bring the system memory to 640K, the maximum addressable user memory.

I/O Plus II™:

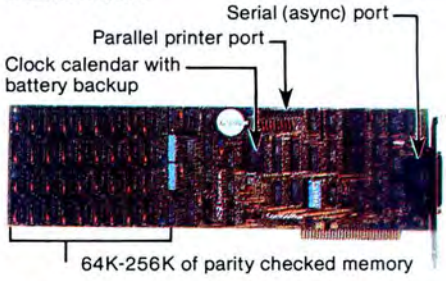


MegaPlus II™:



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™:



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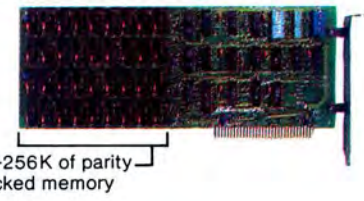

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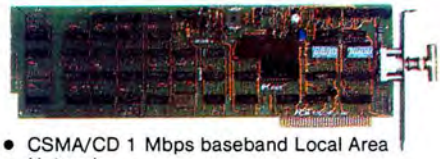

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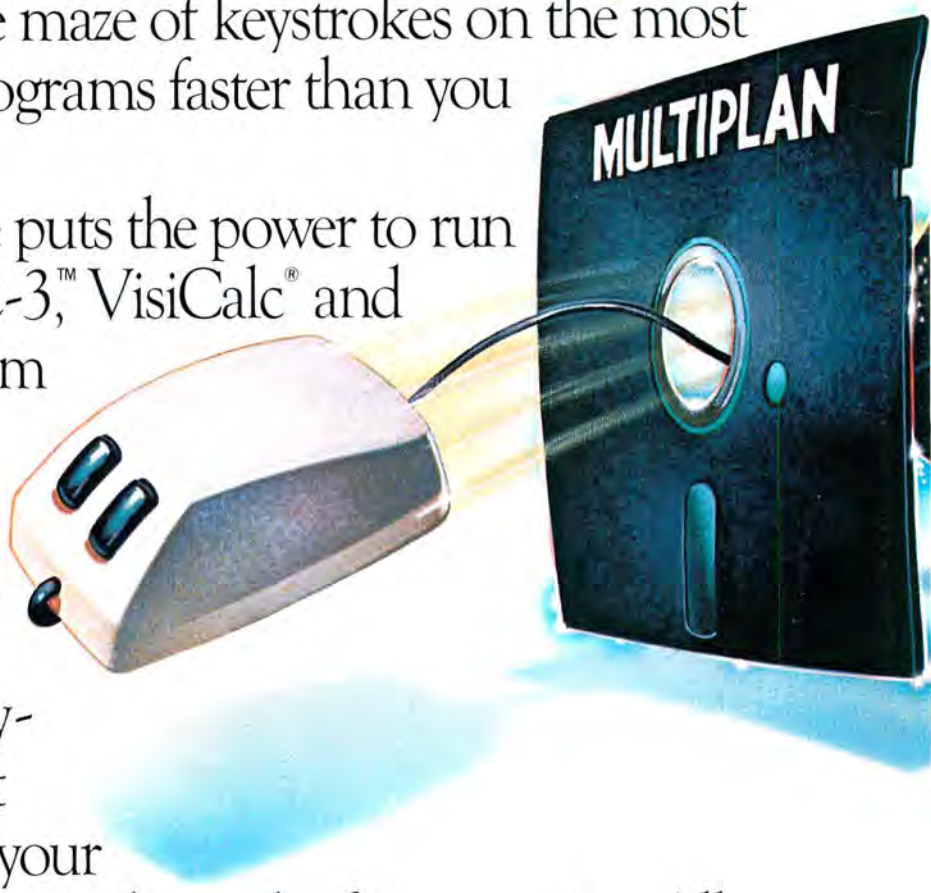

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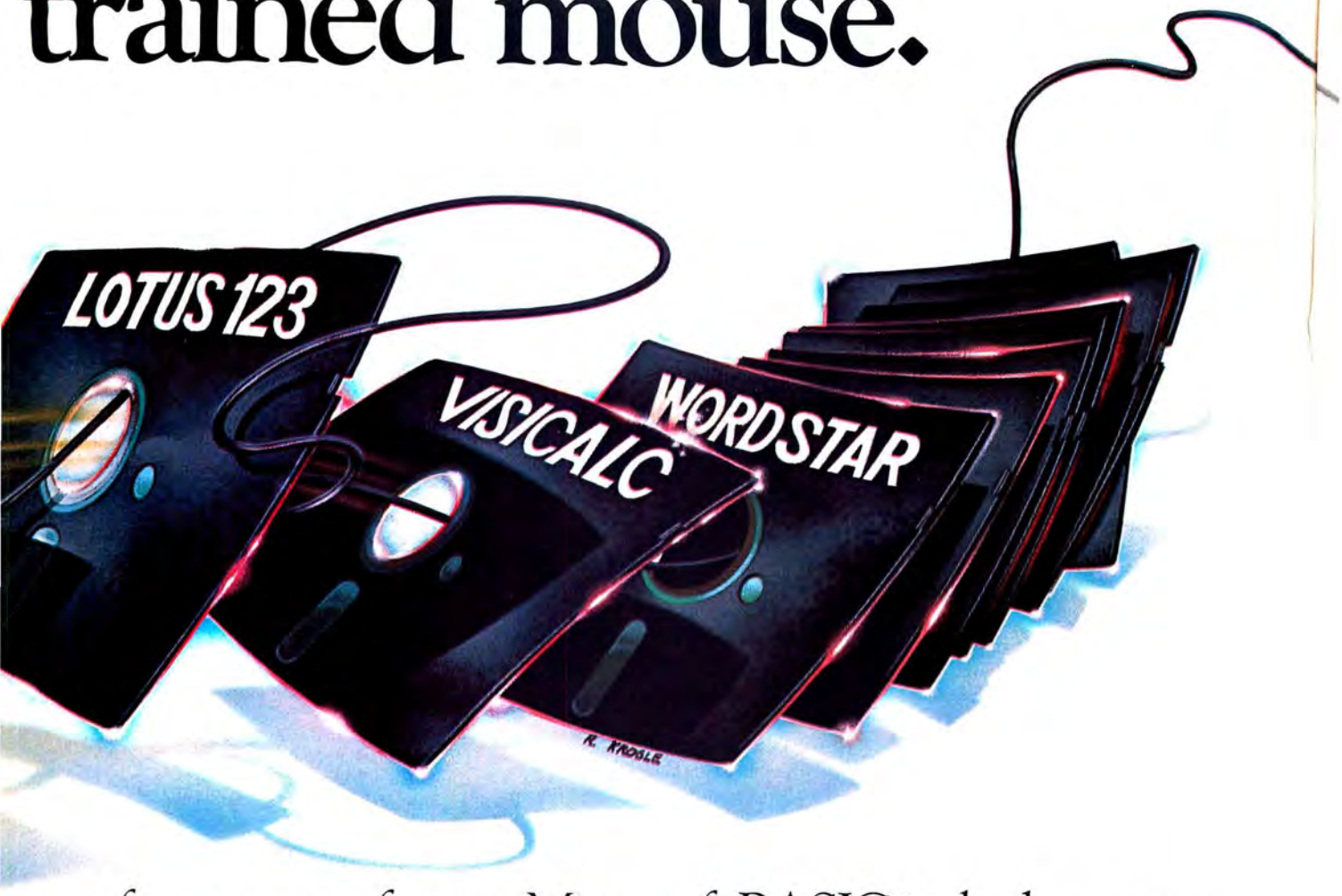

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PC WORLD

The Personal Computer Magazine for IBM PCs and Compatibles

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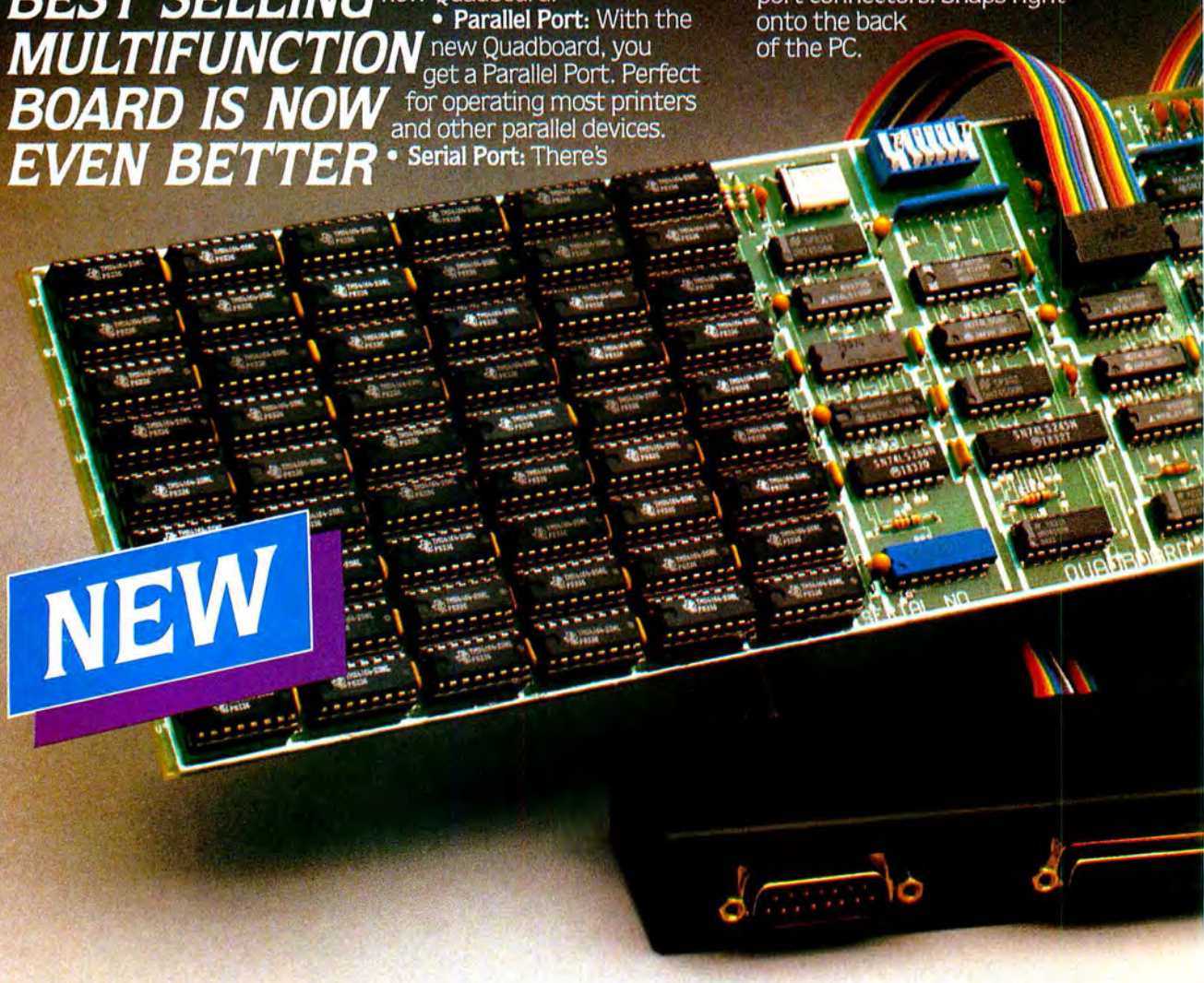
- **Chronograph:** And Quadboard's Chronograph (Real-time clock/calendar) keeps your system's clock up-to-date.
- **Game Port:** The new Quadboard has an IBM compatible Game Port. Plug in a joystick or game paddles, and fire away.
- **I/O Bracket:** Quadboard now comes with a special I/O bracket. Use it to organize your expansion port connectors. Snaps right onto the back of the PC.



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• **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.

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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
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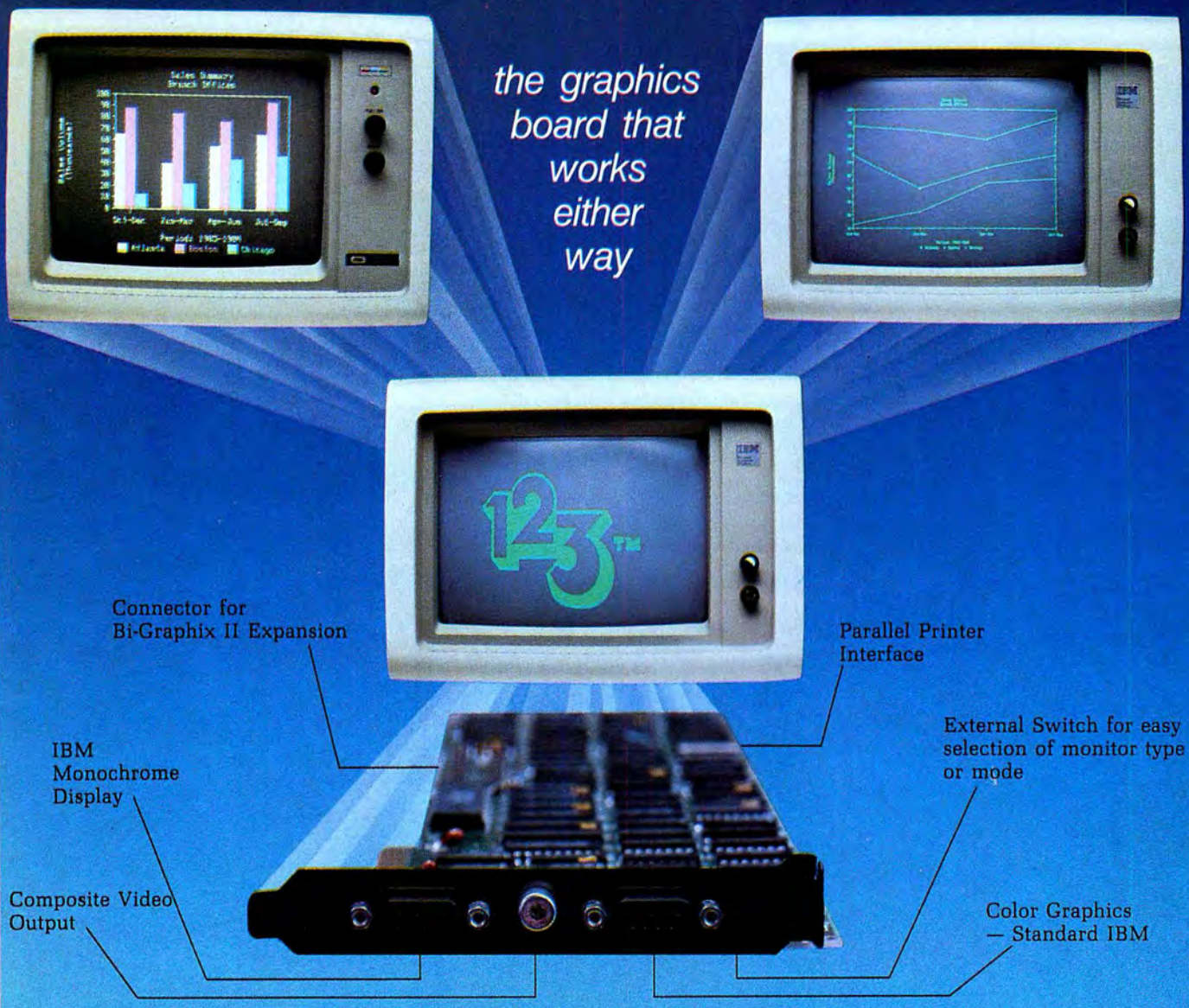
the graphics board that works either way



Bi-Graphix I replaces both the IBM Monochrome Display/Printer Adapter and the Color/Graphics Adapter Card. It will also allow graphics to be displayed on the IBM Monochrome Monitor.

No modification is needed to run standard graphics software on the IBM Monochrome Display.

Monitor and mode selection is done easily by the flip of a single external switch. With two 9 pin output connectors you can have the IBM Monochrome Display and a color monitor connected simultaneously. Switching between the two monitors can be performed through software.

With **Bi-Graphix I** you can run Lotus 1-2-3 with the IBM Monochrome display, and enjoy the benefits of superior text quality and graphics without sacrificing compatibility.

Bi-Graphix II is a piggyback card with 128 k of memory. By installing Bi-Graphix II onto Bi-Graphix I you will be able to reach resolutions of 640 X 400 in 16 colors, using any standard high resolution color monitor. Resolutions of 720 X 700 can be attained on the IBM Monochrome Display.

FEATURES

Bi-Graphix I

- Standard IBM graphics modes
- Standard IBM Monochrome text
- IBM Monochrome Display Graphics
- Upgradeable for higher resolutions

Bi-Graphix II

- 640 X 400 16 colors with Color monitor
- 720 X 700 IBM Monochrome Display
- Software support for higher resolution
- Piggy-Back onto Bi-Graphix I, so no need for an extra slot.

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Subsidiary of Applied Computer Products
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215-934-6990
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PGS is a trademark of Princeton Graphics System. Bi-Graphix I and Bi-Graphix II are trademarks of PC components.

David Bunnell

256K and Rising

One of the strengths of the IBM Personal Computer is its ability to assume a multitude of different forms. Not only does it have a software library that is beginning to rival the Library of Congress, but it has inspired an endless stream of hardware options and expansions.

Despite the variety of PC systems, our most recent reader survey showed that a "typical" system is emerging among PC users. A third of *PC World*'s readers use an IBM PC with two disk drives, a dot matrix printer, and a surprising 256K of memory. In a *PC World* survey taken in July 1983, the typical amount of memory was 128K.

The current survey reveals that 96 percent of *PC World* readers own personal computers, 12 percent own an IBM PC XT, and 18 percent own an IBM PC-compatible computer. Slightly more than 25 percent of our readers own letter quality printers, while 45 percent have color monitors and 44 percent own modems. A hard disk is used by 26 percent of our readers.

These statistics are surprising when you consider that the average reader has owned a PC for less than

one year. More surprising is the level of sophistication among *PC World* readers, even among the 50 percent who classify themselves as beginners. Over half of the "beginners" have accomplished at least six tasks with their PCs: they have used a word processor for correspondence and memos, used a word processor to produce long documents, used an electronic spreadsheet, entered data into a data base, created a data base, and written a simple BASIC program.

Among the readers who call themselves "advanced," more than half have accomplished the tasks just mentioned plus the following: they have produced a report from a data base, transferred files between programs, changed the default format of a word processor, and created an electronic spreadsheet application.

There are some other interesting differences between *PC World* readers who classify themselves as beginners and those who call themselves advanced. The median age of the beginner group is 44 while that of the advanced group is 41. The proportion of women in the beginner group is 14 percent, yet in the advanced group it is only 4 percent. While 62 percent of the beginners are in business management or the professions, only 46 percent of the advanced users do that kind of work. Our readers report that 44 percent of advanced users are in technical professions, compared to 24 percent of the beginners.

As the personal computer market grows, we expect to see the beginners outnumber the advanced group. In anticipation of the needs of new readers, we have created a new section for *PC World* called "Getting Started." This section will enable us

Circle 685 on reader service card

David Bunnell

to give more information to computing newcomers while we maintain the same level of sophistication you've come to expect throughout the rest of the magazine.

We are very pleased that 93 percent of you consider us a quality publication and that 84 percent find *PC World* "very useful." To maintain this high level of reader satisfaction, we

The fact that many beginners sit down in front of 256K the first time they plug in their PCs shows the growing power and complexity of software.

want to provide beginners with both an entry point to personal computing and a pathway to becoming advanced users.

When *PC World* first hit the newsstands over a year ago, PCs with 256K of RAM were still fairly rare and indicated a technically advanced user. That this configuration is now the standard and that many beginners sit down in front of 256K the first time they plug in their PCs show the growing power and complexity of software over the last year. Perhaps next year I'll write a column called "512K and Rising."

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"Thanks"

Paul Schmitt

"Thanks, Alpha, for giving us Data Base Manager II. We find it indispensable for jobs like report writing, form letters, list maintenance and account management. Nothing else we've seen even comes close." Paul Schmitt, Vice President, Wells Fargo Bank.

And our thanks to people like Paul Schmitt for making Data Base Manager II – The Integrator™ one of the hottest-selling and highest-rated data base programs in the world.

And for the best possible reasons. It's fast. It's flexible. It's packed with power and exceptional performance. Plus, only DBM II integrates directly with nearly all other popular software. Instantly, accurately, **without ever reformatting data.**

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More important, DBM II works directly with people like Bernie Campbell. People who demand superior performance, but refuse to write complex programs.

"We're thoroughly satisfied with DBM II. It's proven to be an excellent file manager, and people here love to use it." Mike D'Ippolito, Programmer Analyst, Columbus Mutual Life.

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THE BEST HARDWARE FOR THE BEST PRICE.

Features	Tele-PC	IBM PC	Tele-XT	IBM XT
Monitor	YES	OPTIONAL	YES	OPTIONAL
Screen Size	14"	12"	14"	12"
Tilt Screen	YES	NO	YES	NO
Quiet Operation	YES (NO FAN)	NO	YES	NO
Memory	128K	128K OPTION	256K	256K OPTION
Graphics Display (640 x 200 resolution)	YES	OPTIONAL	YES	OPTIONAL
Printer Port	YES	OPTIONAL	YES	OPTIONAL
Communication Port	YES	OPTIONAL	YES	YES
MS™-DOS/BASIC®	YES	OPTIONAL	YES	OPTIONAL
System Expansion Slot	YES	YES	YES	YES
RGB and Video Port	YES	OPTIONAL	YES	OPTIONAL
Typical System Price	**$2995**	**$3843**	**$4995**	**$5754**

compatibles. the best software.

and has the standard—not optional—features you need to take full advantage of every job your software can do.

Study the chart at the left. It proves that TeleVideo—not IBM—offers the best hardware for the best price.

Note that TeleVideo's ergonomic superiority over IBM extends from fully sculpted keys and a comfortable palm rest to a 14-inch, no glare screen that tilts at a touch.

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What is perhaps most impressive about the TeleVideo IBM PC Compatible can be found deep within its circuitry. We use the same 8088 central processing unit that runs an IBM PC. But we also employ new VLSI (Very Large Scale Integration) microchips that are designed and built exclusively for TeleVideo. These interface more efficiently with the powerful 8088 and yield numerous benefits.

For example, our tiny custom chips do the work of many of the larger, more expensive circuit boards in an IBM PC. So we can offer a computer system that comes in one attractive, integrated case, is ready to run and occupies less desk space. A computer that edges out IBM's added-cost component system for reliability, ease of service and purchase simplicity.

Fewer circuit boards to cool also allowed us to eliminate the noisy, irritating fan IBM and most other PCs force you to put up with. And TeleVideo compatibles accept any IBM hardware options without modification.

THE BEST PORTABLE FOR THE BEST PRICE.

Features	TPC II	COMPAQ
High Capacity Storage	YES	NO
2nd Disk Drive	YES	OPTIONAL
Quiet Operation (No Fan)	YES	NO
Ergonomic Display	YES	NO
Communication Port	YES	OPTIONAL
International Power Supply	YES	NO
MS™-DOS 2.11	YES	NO
Graphics Display	YES	YES
Typical System Price	**$2995**	**$3710**

THE BEST LINE.

But the Tele-PC is only one element of the TeleVideo IBM PC Compatible line.

The TeleVideo XT is the best hardware for users of popular IBM XT software who would appreciate an extra 10 megabytes of storage capacity along with the advantages listed on the preceding chart.

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The TeleVideo IBM PC Compatible line is made by the world leader in multi-user computer systems and the number one independent manufacturer of terminals.

Our compatibles are available at participating ComputerLand and Entré (call 800-HI-ENTRE) dealers or you may call 800-538-8725 for the dealer nearest you. In California, call 408-745-7760.

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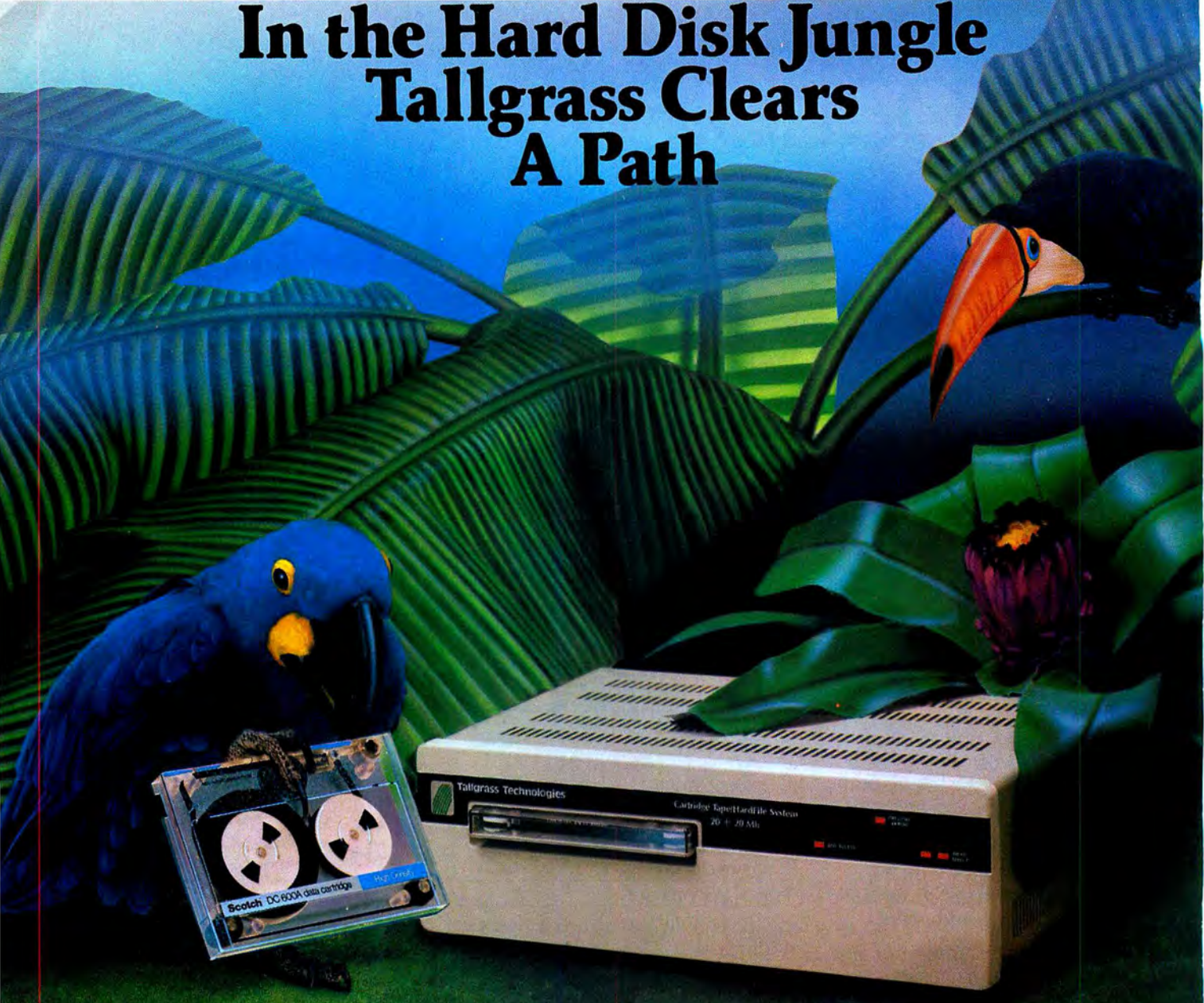
In the Hard Disk Jungle Tallgrass Clears A Path



In today's hard disk jungle, Tallgrass clears a path by offering high performance, integrated mass storage solutions for the IBM® PC/XT, the T.I. Professional and related computers.

TALLGRASS INNOVATIVE FEATURES

MASS STORAGE SYSTEMS with formatted HardFile™ capacities of 6, 12, 20, 35 and 70 Mb, all with built-in tape backup.

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NETWORK READY and fully compatible with networks such as PCnet® and EtherShare.™

HIGH RELIABILITY with dual directory and read-after-write verify options. A dedicated landing zone, where the read/write heads reside when the disk is idle, provides data protection during powerdowns and transportation.

Follow the Tallgrass path to your local computer dealer and watch your personal computer transform into a powerful data processing system.

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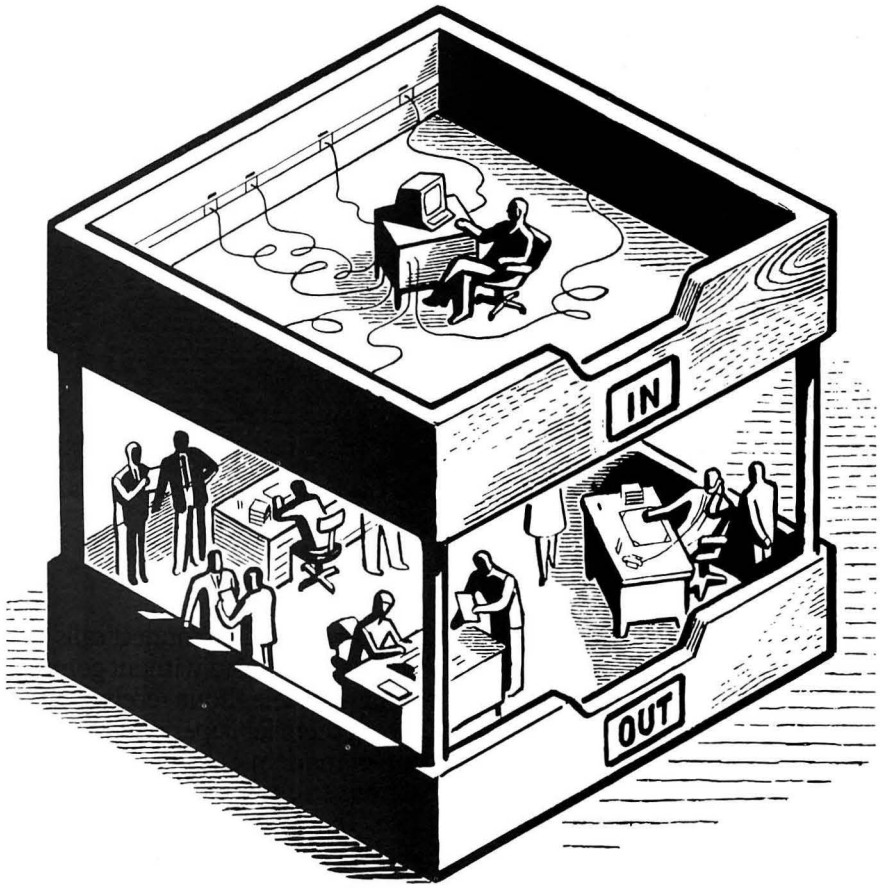
The Knowledge Workers



With the rapid proliferation of microcomputers the sheer momentum of technology will force a revolution in the office and society of the 1990s. Virtually every manager and secretary will have a terminal. This will induce a radical change in the flow of information and the staffing of positions. Shared data bases, shared files, and common electronic mail systems will largely replace traditional telephone conversations, meetings, and written messages.

Clerical workers will be displaced as such routine work as filing, mail sorting, mail delivery, and photocopying are handled electronically by computer systems that perform these tasks at the push of a button or the sound of a voice. Out of the labor force will come a new group of paraprofessionals—the knowledge workers—who will assume semi-management positions in the office, using computers to monitor and control a variety of processing chores that are currently performed manually. The line between management and clerical workers may well blur. Managers and executives will use teleconferencing to replace expensive and time-consuming travel. Computerized decision support systems will increasingly assist executives in handling budget preparation, performing sophisticated modeling tasks, and maintaining their calendars. A variety of communications tools will give the knowledge workers access to a vast number of internal and external data bases.

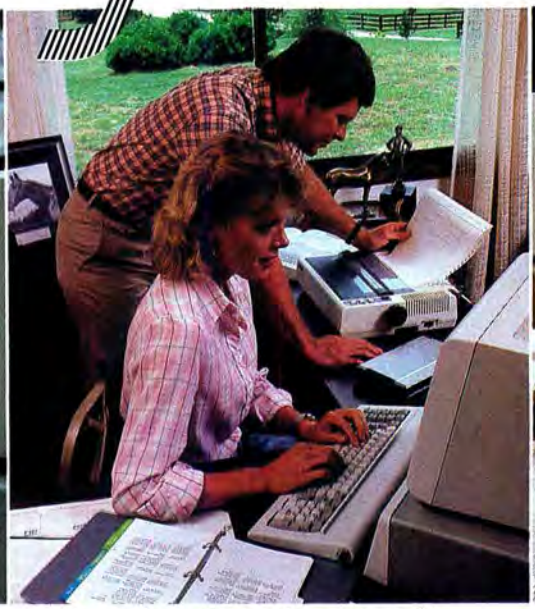
The new era of electronic mail and videotex services will provide graphs, charts, and photographic images concurrently with text messages, and documents will be annotated with voice comments that refer to the text. An integrated message facility (IMF) will provide a single interface for controlling a complex web of message facilities. For example, a window in the user's work station will provide a complete status report on telephone calls (incoming, camp-on, queuing, etc.), a secretarial intercom, operator messages, and text/graphics and voice messages.

A major accessory in the office of the nineties will be information storage and retrieval facilities using optical disc technology. Optical discs can store both analog and digital data of virtually every kind on a single me-

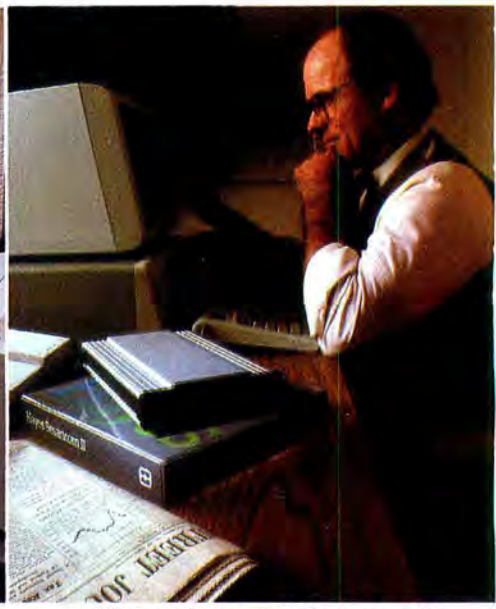
Your computer's telephone.

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?

It's possible. All you need is a modem, to connect your computer to others. Down the hall. Or thousands of miles away.

Hayes Smartmodem. Think of it as your computer's telephone. Hayes Smartmodem 300,™ and the faster Smartmodem 1200,™ allow you to communicate over ordinary phone lines.

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.

Choose your speed; choose your price. The lower-priced Smartmodem 300 is ideal for local data swaps and communicates at 300 bps. For longer distance and larger volumes, Smartmodem 1200 operates at baud rates of 300 or 1200, with a built-in selector that automatically detects transmission speeds.

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®

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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.

Backed by the experience and reputation of Hayes. A solid leader in the microcomputer industry, Hayes provides excellent documentation for all products. A limited two-year warranty on all hardware. And full support from us to your dealer.

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dium. Standard computer data, voice, music, photographs, color graphics, and motion picture and video footage can all be stored on the optical disc. A 12-inch optical disc can compress the equivalent of a sheet of standard typewriter paper (54,000 square millimeters) onto .5 millimeter of disc surface and can store up to 10^{10} bits—a number equal to the number of seconds in 317 years. Optical scan time between an optical disc and a computer is much faster than current mechanical disk drives can provide.

In the nineties, flat-panel display technology will allow managers to have truly portable computers that will be linked to their offices by radio or telecommunications. This technology not only makes the computers mobile—it makes their users mobile as well. By the end of the century the automated office may be staffed by technicians, and most of the staff may work at home. The societal changes this could bring about are heady indeed. If a worker could be employed by a firm in Canada and live in Hawaii or Mexico or anywhere a data link could be established, the impact on our way of life would be greater than that produced by the industrial revolution.

The disbanding of the office combined with the availability of interactive videotex on home computers and interactive videodisc home entertainment systems may completely change current living patterns. The seclusion of individuals that may be caused by computerization is contrary to human nature and could cause long-term problems in society. The traditional center of the marketplace will be missing, and there may be little practical need to deal directly with other people on a daily basis.

In addition, public opinion will be a factor in the future of computing. If the sophisticated computerized systems on which we have become dependent should fail due to power blackouts or brownouts, either by accident or by deliberate sabotage, a reaction against computer technology could occur. As we rush headlong into automation, computer backlash is more likely to increase than abate. Public acceptance of computers will hinge on the extent to which we solve the problems of the quality of life that are associated with computers.

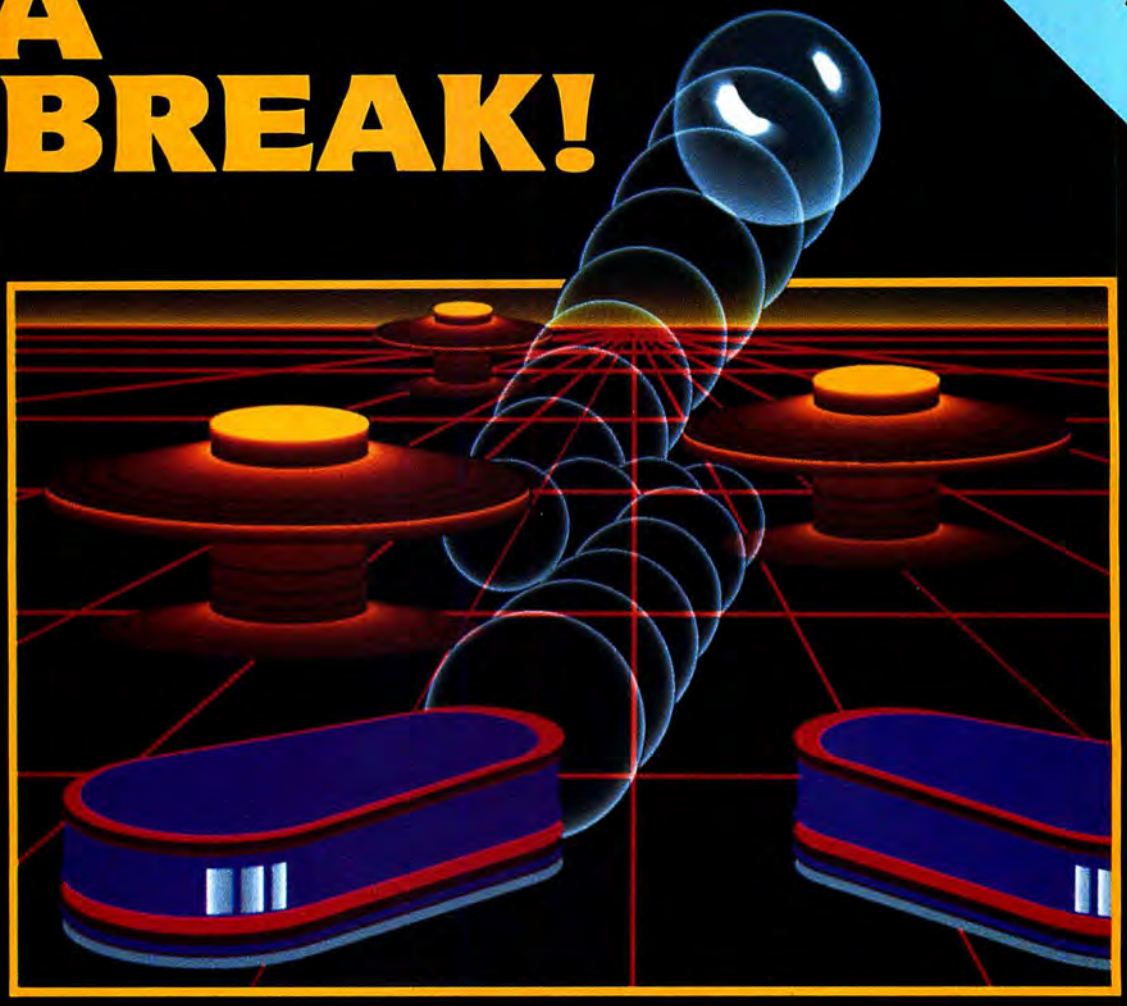
The optimists believe that the automation of the office will result in greater freedom and individuality and a more humane and personalized society. In their view, increased productivity from computer-assisted manufacturing techniques and robotics can only improve our standard of living and increase leisure time. The pessimists conclude that computer technology will dominate our lives and sweep us along in a tide over which we shall have little control. According to their scenario, people will become the harassed and exposed victims of a depersonalized and dehumanized process that places greater value on efficiency than on more noble qualities of life. There is also a fear that computer monitoring of individuals will cause an increasing threat to privacy.

For good or ill, the automated economy will integrate itself into society. Its productivity capabilities and its momentum are too great to be held back. It will be the same story as in the past: your children will be better off than you are, and their children will be better off than they are. The only question is how you define "better."

Major B. L. Olmstead is a pilot in the Canadian Forces and the automated data processing coordinator at the Canadian Forces Base Esquimalt in Victoria, British Columbia.

TAKE A BREAK!

For IBM-PC and IBM-XT



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The new COMPAQ PLUS offers an integrated ten-megabyte fixed disk drive in a portable.

Plus a bigger payload

How much is ten megabytes?

Enough to tackle jobs that can't be conveniently handled on most personal computers.

A mailing list of 100,000 names and addresses.

Information that would fill your company's ledgers can be stored on the fixed disk drive of the COMPAQ PLUS.

Inventory records on a quarter million items.

The entire San Francisco phone book, with room left for Peoria.

Your most used programs can be permanently kept on the fixed disk drive of the COMPAQ PLUS, ready to call up and run.

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Your inventory control program and your inventory records can go with you to the factory. Your building specs and your project management programs can go with you to the construction site.

The high-capacity portable multiplies the productivity of every program it runs.

Plus more programs

The COMPAQ PLUS runs all the popular programs written for the IBM® Personal Computer XT, available in computer stores all over the country. And they run with no modification whatsoever.

You're buying a computer to solve problems. Why not have more problem-solving programs to choose from?

Plus a traveler's toughness

A true portable has got to be tough. The COMPAQ PLUS is.

Its fixed disk drive is designed specifically to travel. Rough roads and hard landings don't bother it because a specially designed shock isolation system protects the disk from jolts and vibration.

All the working components are surrounded by a unique aluminum frame with cross-members that strengthen it side-to-side, front-to-back, and top-to-bottom.

Does a portable personal computer really have to be this tough? Take a look at your briefcase and then decide.

Plus a lot more

The COMPAQ PLUS comes with a 360K byte diskette drive for entering new programs and copying data files.

The COMPAQ PLUS also works with optional printers, plotters, and communications devices designed for IBM's personal computer family.

It has two IBM-compatible slots for adding optional expansion boards. With companion programs, they'll let you network with other personal computers, communicate with your headquarters computer files or add memory capacity if your needs grow.

When you see all that COMPAQ PLUS has to offer, you'll be pleasantly surprised by the price. The fact is, it costs hundreds less than comparably equipped desktop personal computers.

See the first high-performance portable personal computer. The COMPAQ PLUS—performance, programs, productivity. Plus problem-solving power.

The problem-solving power of a high-performance desktop personal computer can now go where you need it.

For the name of the Authorized Dealer nearest you, call 1-800-231-0900.

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The COMPAQ Portable, the industry standard in portable personal computers. ▼

The new COMPAQ PLUS, the first high-performance portable personal computer. ▼

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1000 FLOPPY DISKS

VS. THE BANK.™

Savings you can take to the bank: 200 MB only $2,195. CORVUS is proud to introduce the BANK.

It's the most dramatic breakthrough in low cost, high capacity mass memory systems since CORVUS introduced the Winchester disk for microcomputers in 1979.

The BANK's removable tape cartridges hold up to 200 megabytes of information. That's equal to 1000 double density floppies or 10 times the capacity of the largest hard disks commonly available for microcomputers. You can use the BANK to complement a Winchester disk. It has 19 times the capacity.

And the BANK's cartridges are removable for unlimited capacity and storage.

On-line archival back-up you can bank on. You can use the BANK as a random access archival device. If your Winchester disk fails, you can restore selected volumes without having to restore the entire contents of the hard disk.

The BANK is the perfect solution to your back-up storage problems as a shared storage device on OMNINET™—the leading Local Area Network for microcomputers.

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CORVUS

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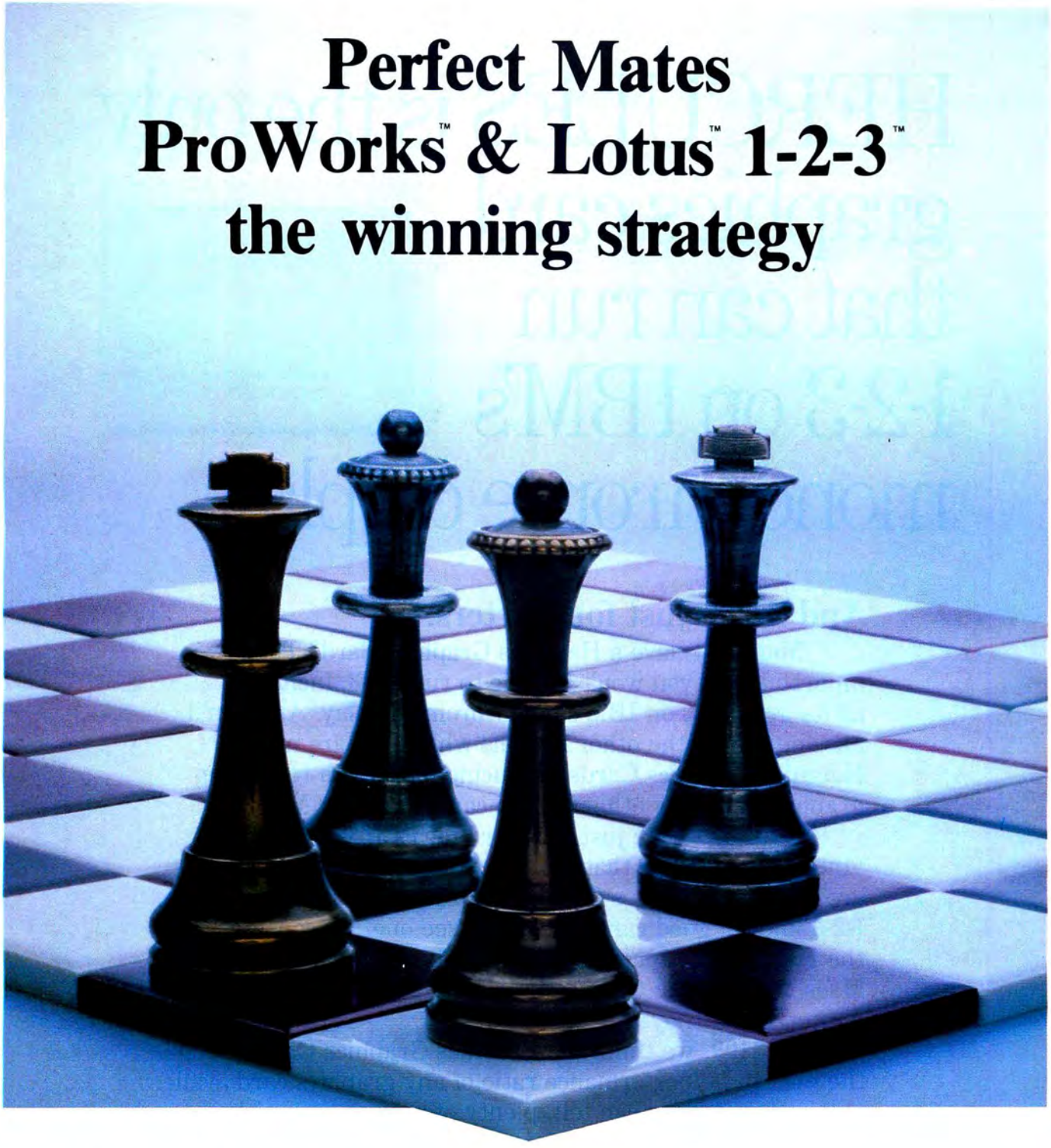
Perfect Mates
ProWorks™ & Lotus™ 1-2-3™
the winning strategy



ProWorks™ means new solutions to old problems. ProWorks and Lotus' 1-2-3™ combine for the winning strategy—a strategy that marries the raw power of 1-2-3 with the consistency, speed, and flexibility of ProWorks. They're the perfect mates, saving you valuable time that can be focused on analyses and solutions—today, not next week. Instead of spending time setting up and building models, use the strategy that wins—ProWorks, business and personal applications for today's professional.

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Letters

Mis-Leading

Robert Luhn's article, "The Compatibles Line Up" [*PCW,* Vol. 2, No. 4], is grossly in error regarding the Leading Edge Personal Computer. He erroneously asserts that the LE PC is only 66% compatible with the IBM PC and that it will not run the MicroSoft *Flight Simulator,* the IBM *Advanced Diagnostics,* or the GW BASIC graphic samples. In the same article, Mr. Luhn gives a glowing review of the Sperry PC and calls it 99.44% compatible with IBM. Strange isn't it when one considers that the machines are identical except for monitor and keyboard? Both the Leading Edge PC and the Sperry PC are (as is common industry knowledge) manufactured in Japan by the Mitsubishi Electric Company. Both systems have the same system unit components, both run the same BIOS, and both run the same version of MS-DOS provided by the same source. You are wrong, Mr. Luhn; both the Leading Edge Personal Computer and the Sperry PC are at least 99.44% IBM compatible.

In addition, Mr. Luhn states that the LE keyboard is "light and flimsy" and "difficult to use." The Leading Edge keyboard weighs exactly the same amount as the Sperry keyboard, and about the same amount as the IBM. The Leading Edge keyboard is in fact one of the best technologies in the industry, is very easy to use, and has a mean time between failures of 10,000,000 depressions per key—much more than the IBM technology. Why the Leading Edge keyboard can even be washed out when it is dirty or survive a coffee spill with no damage. Try that with an IBM keyboard.

Geoffrey S. Burr
Vice President, Marketing,
Leading Edge
Canton, Massachusetts

The Leading Edge PC tested at COMDEX did fail to run the programs you mentioned. Only after the publication of our article were we informed that the Leading Edge PCs at COMDEX were equipped with "prerelease" BIOS ROMs.

PC World *was aware that the Leading Edge PC and the Sperry PC are both manufactured by Mitsubishi. However, the results obtained at COMDEX indicated that the Sperry PC was indeed more compatible. (The article did state that "changes affecting compatibility can be made literally days before a machine's official release.")*

Whenever possible at COMDEX, we talked with OEM technical personnel and tested machines in their presence. In the case of Leading Edge, booth personnel were unavailable during the test; when we finally spoke to someone, he was unable to supply us with technical information. Every compatible manufacturer, including Leading Edge, was contacted following COMDEX to verify details relating to the review.

The issue of compatibility remains. Since the appearance of the review, Leading Edge has claimed that its machine is as compatible as the Sperry PC. A released version of the Leading Edge PC is currently being reviewed by PC World. *The results—whether they support our original test or refute it— will stand.—Robert Luhn*

Programmer Proselyte

APL has changed my life!

Last year I bought the IBM APL package, and since then my life has not been the same. I have been forced to abandon my comfortable prejudices; things that appeared de rigueur under the cloud of those deceptions are now seen to be doing things the hard way.

Learning and using APL has forced me to reflect on the useless and foolish battles that plague our lives, often standing in the path towards pleasant and productive work. As a young radio amateur in the twenties, I was a fanatical member of a self-defined group of snobs who asserted that anything other than CW transmissions (and that only done with a hand key) was unworthy of the traditions of Marconi and Phillips of the S. S. Titanic.

Grudgingly, after a second-class telegrapher's ticket and with considerable guilt, I made an emotional compromise to use a Vibroplex. And how we fought the efforts to outlaw the spark gap. Until you have heard the mournful yet pleasant sound of the spark-gap wireless, you cannot understand how sad we were when finally Sir John Fleming and Lee De Forest put the spark gap into the museums.

A more alert person would then have seen the handwriting on the wall. But I went through the same futility of choosing sides and doing battle in the controversy between the

Letters

AMers and something Edwin Armstrong was trying to rock the boat with called FM.

Perhaps our enslavement arises because we want so desperately to be part of an elite cohort. The fetters are made insidious by the deceptions we create with our arbitrary definitions of group membership. My computer experience dates from the time of Whirlwind and has successively gone through any number of illusory allegiances to various sides of technical and philosophical issues.

Early on, I eagerly joined the ranks of digital computerists versus analog computerists. We often taunted the guys using analog computers with the assertion that they were constantly "resetting zero." Later, I believed that for a programmer to forsake machine language programming for the use of higher-level languages was somehow to be unfaithful to Von Neumann. The theme was the same for the battles between the compiled versus the interpreted language adherents, the "top-downers" versus the "bottom-uppers"; no one knows how I struggled with the admonition always to finish the flow diagrams before a single line of code could be written.

APL has changed all of that. The scales have fallen from my eyes. What a delight to live in a world where there is no top and no bottom, where computer programming is no longer a ritual.

If now, for instance, I wish to solve a problem in functions of the complex variable or Schrödinger's equations, I sit at the console, forget all of the inhibiting biases, whip out a ten-liner, and voilà, life is beautiful. To everyone who has been deceived by the hype of the software and book peddlers who claim that no serious programming can be done with APL, the message is clear: Arise, you have nothing to lose but your chains.

Thank you Ken Iverson; thank you IBM; thank you Madrid Scientific Center (whoever you are). The program with the "funny little symbols" has finally set me free.

George O. Wright
Washington, D.C.

Copyright Update

I have just purchased the January 1984 issue of *PC World* [Vol. 2, No. 1] and would offer the following comments on Jordan Breslow's *REMark*. Mr. Breslow poses the question, "Is a program eligible for copyright if it is integrated with a physical object such as a ROM chip or disk?" This question has been answered numerous times, most recently in *Apple Computer, Inc. v. Franklin Computer Corp.* The programs there in question were embedded in ROM chips. This case has been discussed by numerous authorities, including my partner, Neil Boorstyn, the author of the book *Copyright Law* and chairman of the California State Bar Copyright Committee of the Patent, Trademark, and Copyright section. Mr. Boorstyn has cited the *Apple v. Franklin* case as being the death knell to the "screwball defenses" against copyright infringement suits.

Mr. Breslow's suggestion that a program could be sold and still retain its trade secret status is particularly scary. While limited distribution of computer software would permit one to retain a trade secret status in that program by contract, a widespread distribution such as is common with microcomputer software would almost without fail result in loss of trade secret status. It is my opinion that the "wrapper licenses" that are now very common are not enforceable.

Hugh D. Finley
Attorney
San Francisco, California

At the time the January issue went to press, the media had reported the possibility of further appeals in the Apple v. Franklin *case. Those appeals were never pursued, however, so as you say, the ROM chip question is probably settled.*

Regarding your second point, Mr. Breslow meant to suggest that one could sell a program and still retain rights over such things as in-house programming languages or other programming methods used in the creation of that program. We apologize for any ambiguity.—Ed.

Further FORTRAN Notes

As a FORTRAN user, I greatly appreciated the article "But Is It Really FORTRAN?" in the February issue [*PCW,* Vol. 2, No. 2]. But let me add more.

For many reasons, I had to rely on FORTRAN compilers for the IBM PC in order to carry out an extremely ambitious project: construction of what is probably the first large-scale vehicle-scheduling system ever pre-

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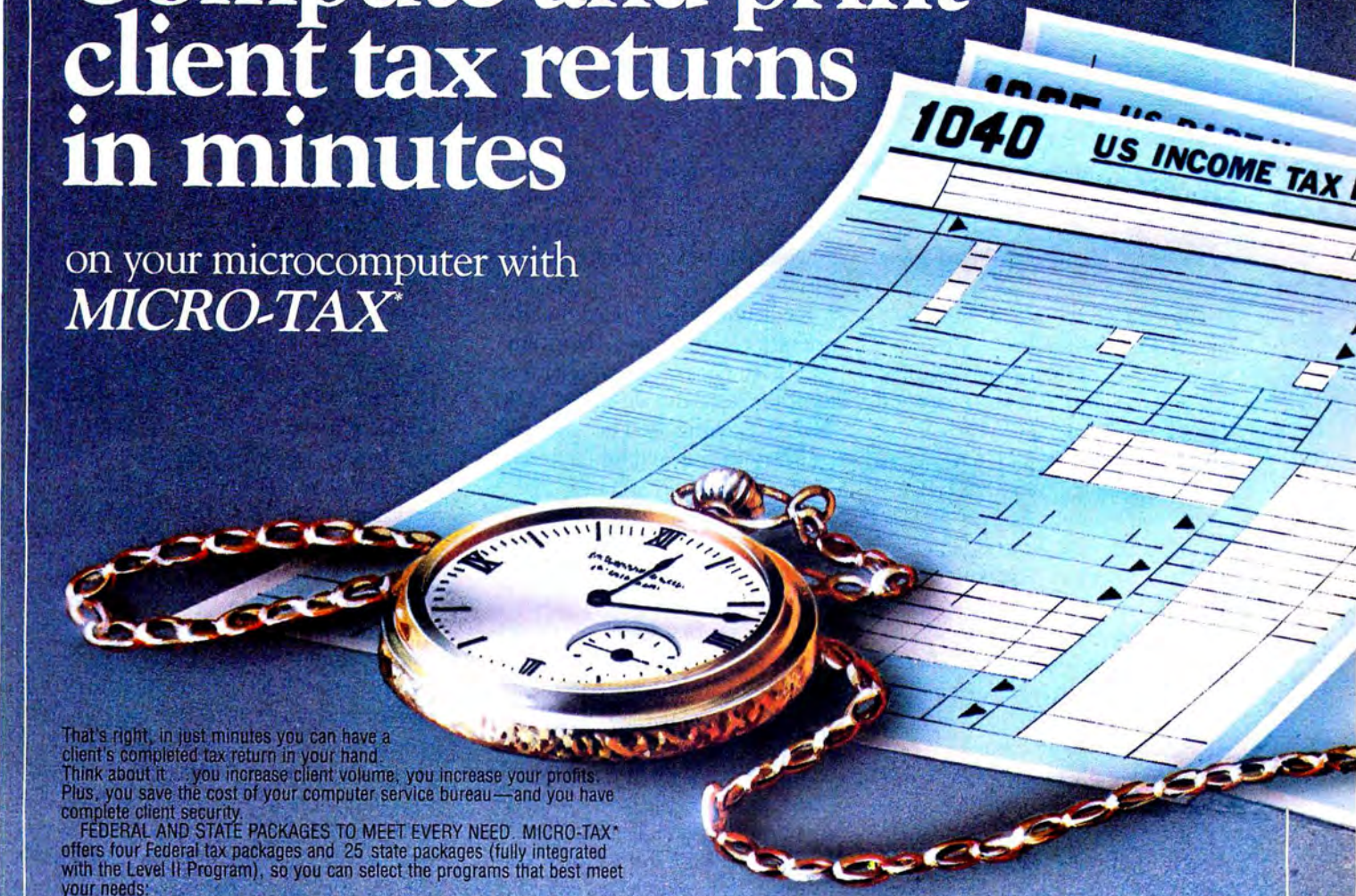

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pared for microcomputers. This system constructs and then solves a zero-one matrix of up to 99 rows and up to 3000 columns, within the 64K data space allowed. This was no blackboard exercise, and the compilers had to work.

I used two of the three compilers evaluated in your article: IBM FORTRAN and SSS FORTRAN. Of the latter, SuperSoft FORTRAN, the article only says tactfully that it has some "glaring limitations."

Let me tell you about one "limitation" not mentioned by your authors. I hope I never have to use software with less adequate documentation. Authors of the compiler are alleged to be college professors. Seemingly, they believe in the sink-or-swim method of graduate school education: grudgingly begin an explanation with one sentence and leave the rest as an exercise for the student.

Maybe this is a rigorous test for Ph.D. candidates, but it doesn't work for the commercial software marketplace. I found the SSS FORTRAN user's manual to be useless, and whatever I got to work was achieved by a great trial-and-error effort on my part.

The irony is that the compiled code, if you can puzzle out how to do it, is excellent!

By comparison, documentation for IBM FORTRAN is superb. You may have trouble compiling programs of over 600 source lines because of space limitations on 320K disks, but if you have access to the IBM PC XT with its hard disk, these problems vanish. The only real limitation I have seen in IBM FORTRAN is its inexplicable lack of double-precision variables.

Incidentally, I compiled my proprietary combinatorial algorithm with both packages, and it runs almost twice as fast with IBM FORTRAN as with SSS. This is a result contrary to your published findings.

Murray Spitzer
Bethesda, Maryland

Testimonial

I must admit that I was a little nervous when I placed my order. How could it do all it claimed in the ad for only $50? But I decided it was worth the risk and bought it.

Turbo Pascal by Borland International has to be the best $50 I ever spent on software. It makes teaching Pascal a pleasure instead of a pain. Everything they advertise about it is true. It really does take up only 33K on the disk. (No disk swapping!) It really does come with its own editor. It really is standard Pascal, so I can use it for teaching.

Having the compiler and the editor resident in memory together is what makes Turbo Pascal interactive. Did you forget a semicolon? No sweat. The compiler throws you back into the editor right at the syntax error. No more time-consuming loading and reloading the editor and compiler. Students can concentrate on the language and not the details of the compiling process. Their time spent on the computer is more productive.

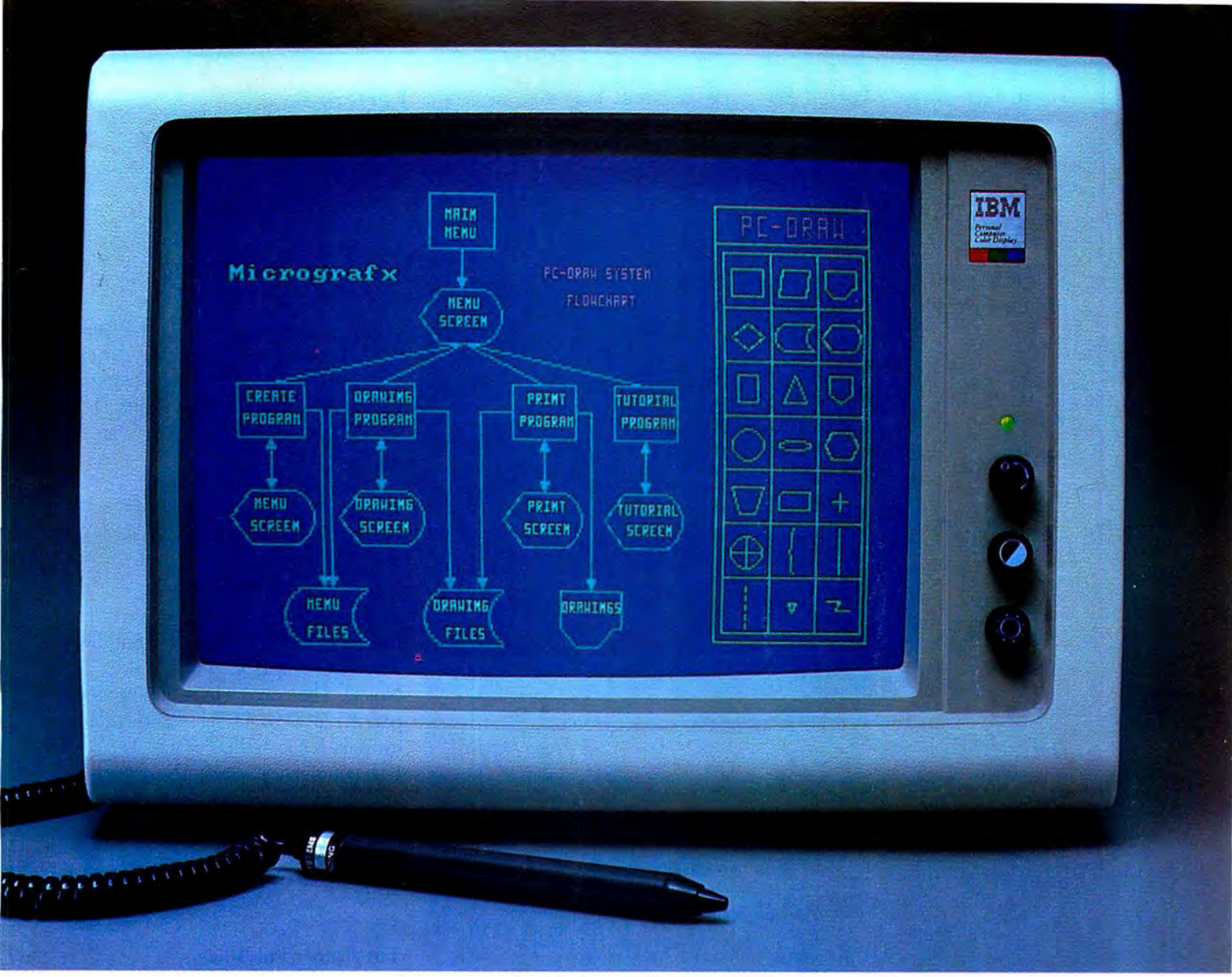
Besides all that, Turbo Pascal compiles to very compact code. The same program compiled by Turbo Pascal and IBM Pascal, respectively, yielded a 9K COM file and a 25K EXE file. I don't know how Borland did it, but I'm glad they did.

Gary Rittenbach
Auburn, Washington

Helping Hands

I have an inexpensive solution to the problem of not being able to hit more than one key at a time, an ability necessary when using the <Shift>, <Alt>, or <Ctrl> keys. My father noticed at Radio Shack a small jig designed for holding light items while soldering them or some such activity. The "Helping Hands" (catalogue number 64-2093A) has an alligator clip located at each end of a sliding crossbar, which is attached to a support base. All the joints have swiveling clamps that allow great freedom of movement and can be tightened into any position desired. If you slide the crossbar all the way to one side of the base, the jig is able to sit to the side of the keyboard and reach the aforementioned keys.

Because the keys are located practically equidistant from the base of the jig, I am able to pivot the arm and use the alligator clip as an extra finger to hold down whichever key I want without having to do any major repositioning. The only problem comes when trying to anchor the jig relative to the keyboard. My brother made a wooden tray that holds the keyboard in place and has the jig clamped next to it. The jig could alternatively be attached directly to the board.



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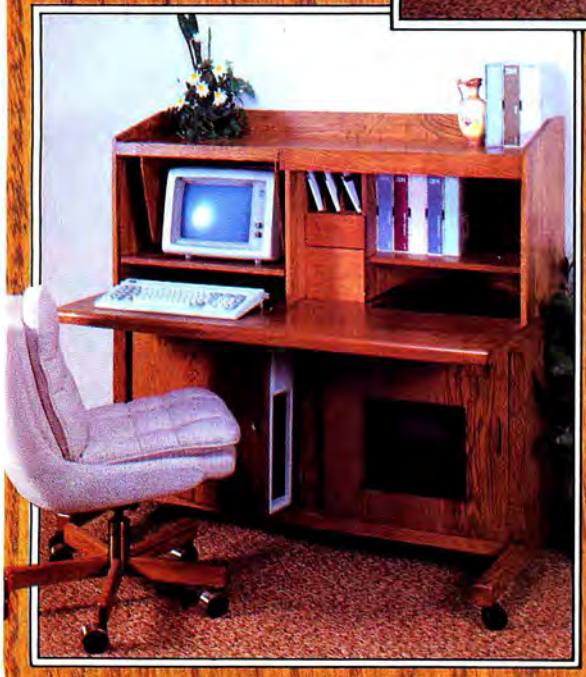

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Letters

I have been tempted to buy RoseSoft's *ProKey*, which would solve this problem through key redefinition (and do many other things). But at $7.95, the Helping Hands is an attractive alternative.

Robert A. Hurlbert
Houston, Texas

Power Control Parts

There are two errors in my parts list for the PC Power Control ["Build a PC Power Control," *PCW*, Vol. 2, No. 1]. The correct part number for part K1 is 275-243. The correct name for part K2 is "DPDT Relay, 125V 10A contacts, 12V coil." Sorry for any inconvenience this may have caused.

Jack Powers
San Jose, California

The Proper Publisher

I'd like to make a correction to the article "Bird of a Feather," reviewing the Eagle PC [*PCW*, Vol. 1, No. 8].

The article's table of compatible software listed the publisher of TCS Accounting Software as Rocky Mountain. Rocky Mountain Software Systems is just one of over 1000 TCS dealers nationwide. The TCS *Total Accounting System* is published by TCS Software, Inc., located in Houston, Texas.

Linda L. Duttenhaver
Marketing Manager, TCS Software
Houston, Texas

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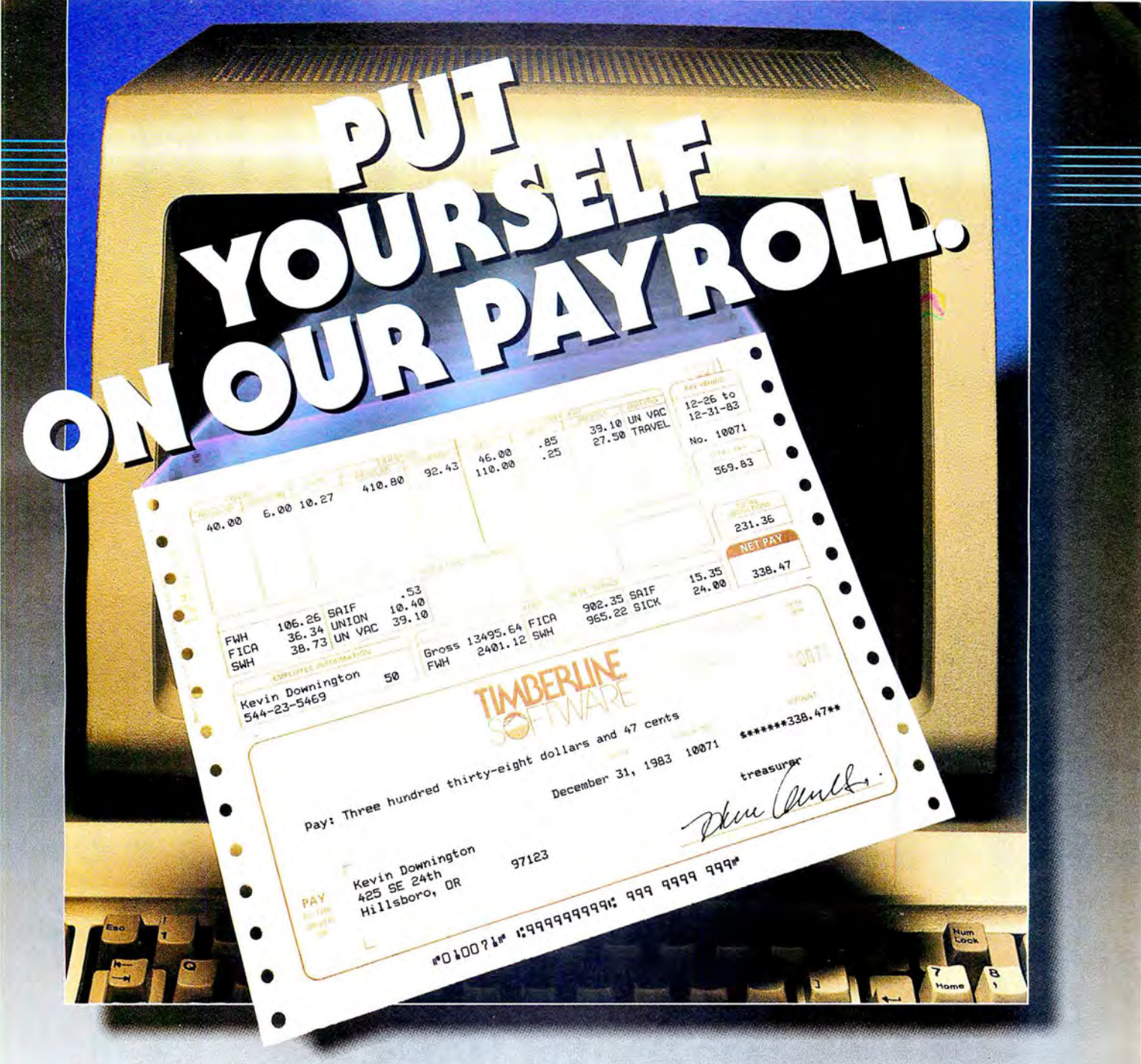

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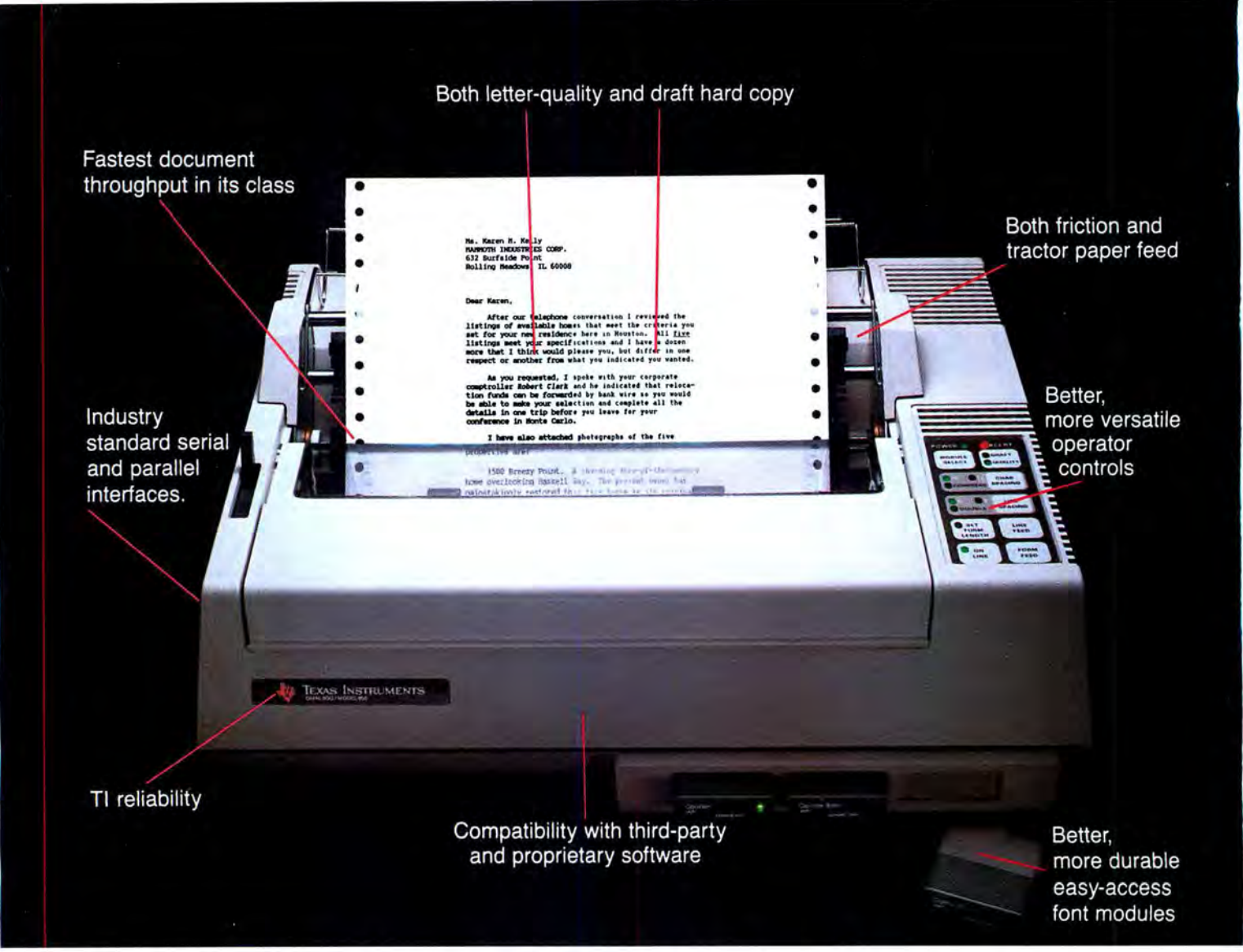

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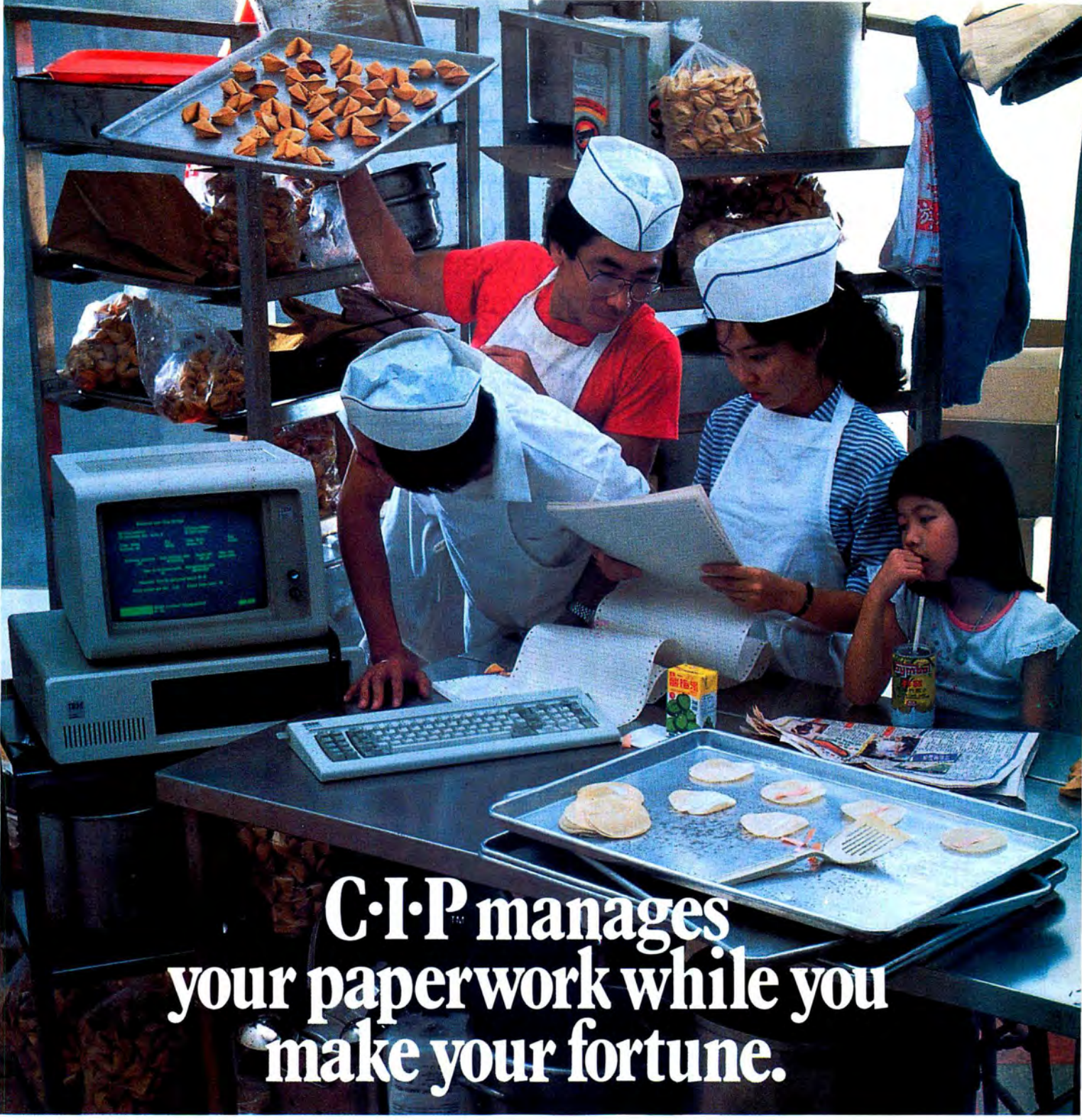

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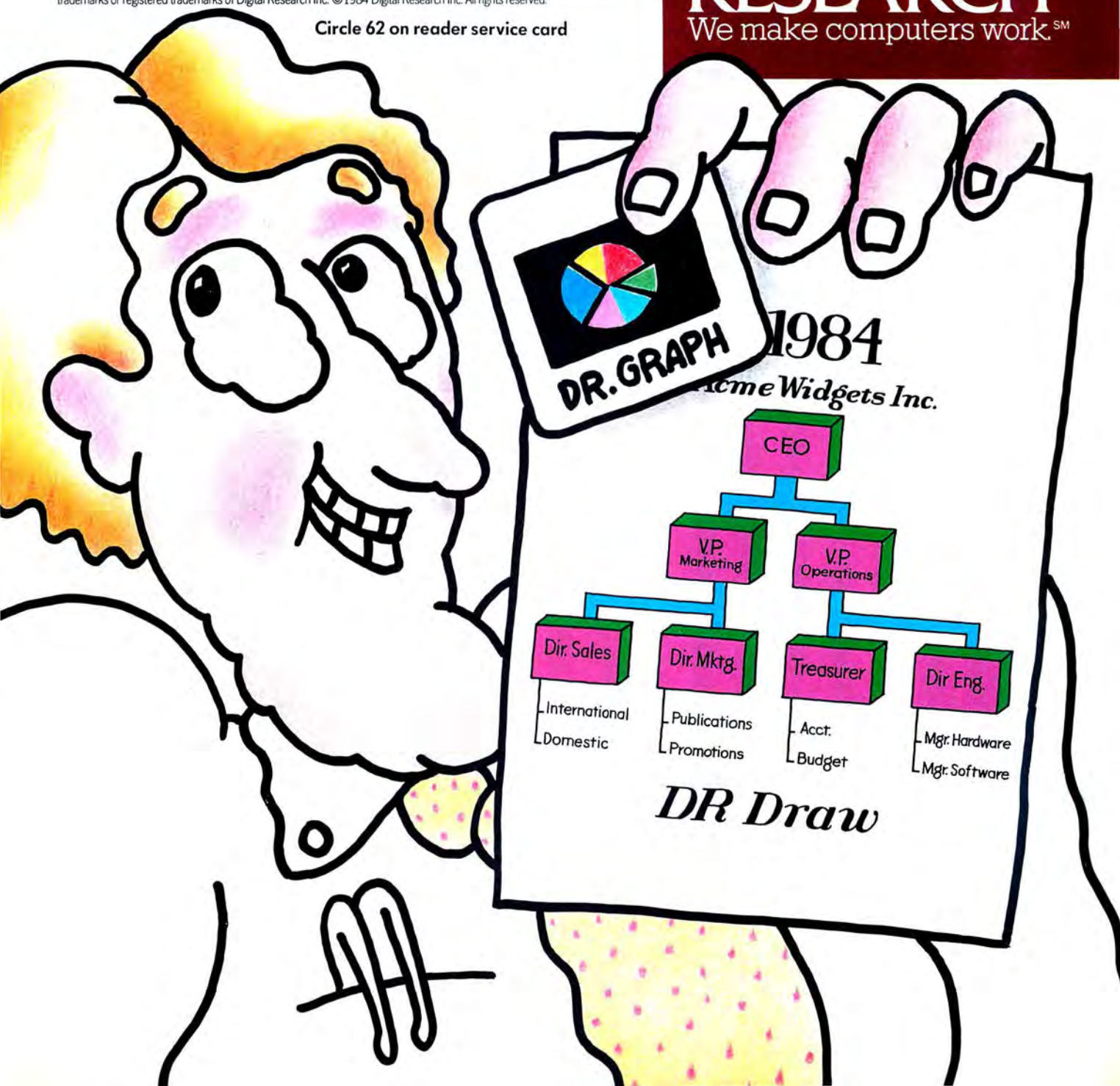

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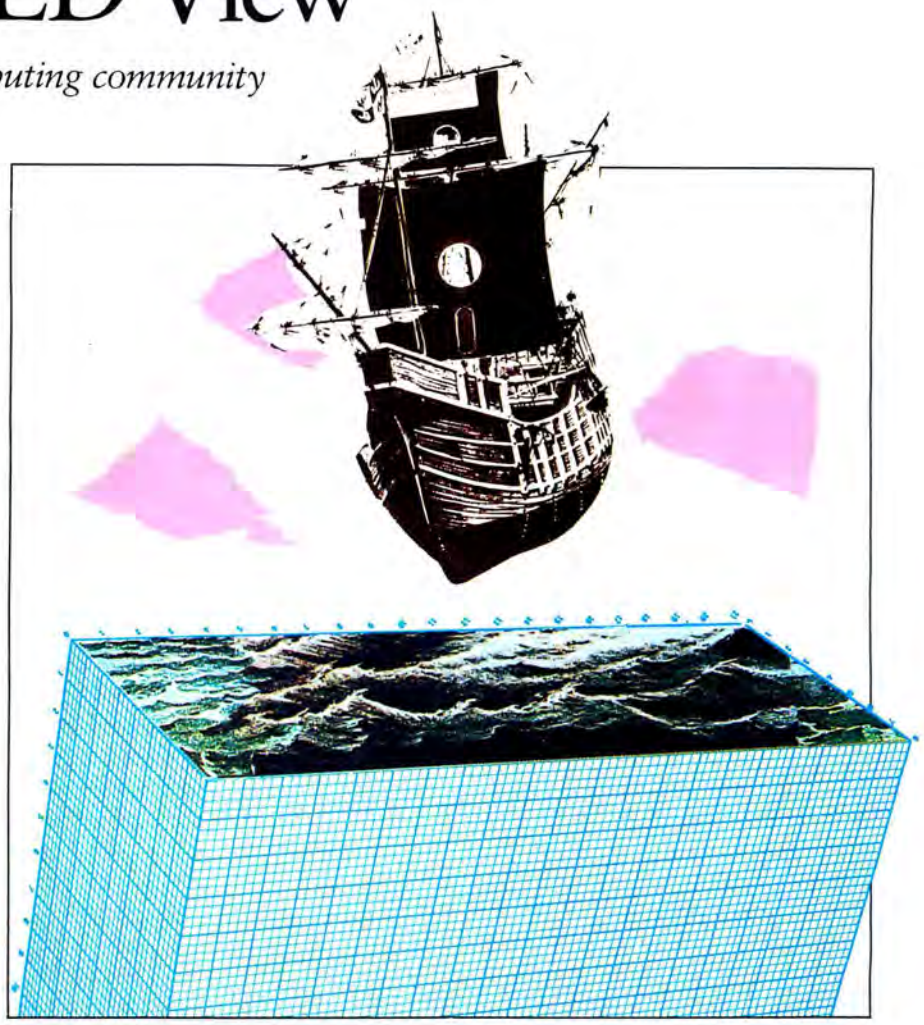
PC WORLD View

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've reserved the "Grapevine" section of this column for industry reports that are still at the speculative stage.



Grapevine

Operating System Trio

According to industry sources, IBM will launch three new operating systems, reportedly code-named the Nina, the Pinta, and the Santa Maria. The new software products are reputed to link PCs with IBM mainframe computers, providing environments that permit the use of other operating systems, including PC-DOS, within the framework of the new operating systems.

The first of the new products, the Nina, is said to be scheduled for release with another code-named system from IBM—the Popcorn, a multiuser computer. Industry analysts speculate that the Nina may be an enhanced version of the operating system introduced last fall with the 3270-PC.

The three new operating systems are reported to be part of IBM's strategy to compete with AT&T's new presence in the computer marketplace. The same competitive drive may be the reason behind IBM's January announcement of a version of UNIX for the PC, called PC/IX. PC/IX was prepared for IBM by Interactive Systems of Santa Monica, California. Observers see the move to UNIX as an attempt by IBM to keep AT&T's version of UNIX from becoming an accepted standard. (AT&T is the original developer and the owner of UNIX; other companies must purchase a license from AT&T to distribute one of the several versions of the operating system.) A number of firms have licensed UNIX and market their own versions of it, including Microsoft (whose version is called XENIX) and Quantum Software (whose version is called QNX).

Whether or not the Nina, the Pinta, and the Santa Maria resemble UNIX, IBM clearly seems to be broadening the PC's horizons.

Return to Sender

Investors in the stock of Verbatim, a Sunnyvale, California, manufacturer of floppy disks, were recently startled to learn that one of the company's largest customers had returned some $2 to $3 million worth of disks. Industry sources report that the Verbatim customer in question was IBM and that the disks were rejected because Verbatim had changed the design of the disk jacket so that its corners were more pointed than on the disks previously supplied by the manufacturer.

It seems that the new disk jacket does not fit properly in disk drives manufactured by Control Data Corporation (CDC)—and use of the disks could even damage the drive's internal mechanism. CDC supplies approximately 30 percent of the floppy disk drives used in the PC and the XT, and IBM can't risk damaging its hardware by using the new Verbatim disks. So IBM returned the disks—without penalty because Verbatim had not notified IBM of the change in design before manufacturing and shipping the disks.

This problem, plus a lower overall demand for the company's products, resulted in a 25 percent decline in Verbatim's net income for the last quarter of 1983. Many stockholders reacted to the decline by selling their stock; on the day Verbatim announced lower earnings and the disks' return, Verbatim's stock lost 19 percent of its value, dropping from $17 to $13.75 per share.

More Scottish PCs?

SCI Systems, headquartered in Huntsville, Alabama, recently announced that it will build a new manufacturing plant in Irvine, Scotland. SCI holds contracts totaling several billion dollars for producing a variety of electronic gear, including a substantial portion of the motherboards for the IBM PC. An SCI spokesperson would not say what products will be made in the new plant, but IBM may well be planning to supplement work done at its own facility in Greenock, Scotland, by having its new neighbor help manufacture PC components for the European market.

Stocks on Disk

Value Line, the New York publisher of the widely respected *Value Line Investment Survey* newsletter, has implemented a useful service for PC users. Called *Value Screen,* the service supplies a disk containing current information about some 1650 common stocks, arranged according to 32 variables that an investor can specify in a stock search. A $495 yearly subscription brings a new disk with updated information each month.

The usefulness of *Value Screen* is its flexibility. An investor can specify up to 9 criteria (from among the 32 variables) and retrieve the names of stocks that meet all of those criteria. For example, if an investor wants to purchase stocks with a low price/earnings ratio and a promising growth potential, he or she can specify those criteria and locate the stocks that meet them.

An investor can glean additional information about each listed stock by subscribing to the *Value Line Investment Survey.* More information about *Value Screen* is available by calling Value Line at 212/687-3965.

Brokers Sell PCs

For people who need both financial information and a computer with which to manipulate that information, two major financial service firms are now selling their own enhanced versions of the PC and XT. The stock brokerage firm of E. F. Hutton offers the PC or XT along with its Huttonline, an on-line information service. Dun and Bradstreet, which gathers and dispenses financial data, has formed a new subsidiary, Dunsplus, to sell the PC XT to businesses along with a software package including a spreadsheet, a word processor, an electronic mail service, and access to specialized on-line data bases.

Big Blue's News

PCs Proliferate

Even though IBM has introduced the PCjr and Apple has brought out the Macintosh, the demand for PCs and PC compatibles does not seem to have abated. In fact, one spokesperson at IBM's PC headquarters in Boca Raton, Florida, recently volunteered a rather amazing statistic. He noted that IBM manufactured as many PCs (including XTs) in November and December of 1983 as it did in all of 1981 and 1982.

Although he would not cite specific numbers, industry estimates suggest that at least 200,000 PCs were manufactured by the end of 1982, which would mean that IBM was making 100,000 PCs per month at the end of last year. That's more than 3000 per day, or about 138 machines per hour if the plants are operating round the clock. No wonder they farmed out the PCjr to Teledyne!

Selling Two by Two

In an unusual marketing move, IBM has joined forces with software publisher Comshare of Ann Arbor, Michigan, to sell software for the PC and for IBM mainframe computers. The two companies have signed a "complementary marketing agreement," under which salespeople from both companies will recommend the other's products.

The Comshare product is *System W*, a decision-support software package for mainframe computers that can be linked to the PC. The software costs between $75,000 and $100,000, depending on the mainframe system's configuration. The price includes one mainframe copy and two PC copies of the software. Additional copies of the PC version can be purchased for $900 each.

The advantage of such micro-mainframe connections is that they allow users to retrieve information from their companies' mainframe data bases and then manipulate and analyze it on the PC.

Typewriter Gets Disk Drive

Office automation buffs are fond of predicting that computers will replace typewriters in most offices in the near future. But if the newest IBM typewriter is any indication, it may soon be difficult even to distinguish between a typewriter and a computer. Among the new products IBM announced recently are two enhanced versions of its electronic typewriters, the 85 and the 95, both of which have limited internal memory capacity. The real news, however, is that IBM now offers a disk drive that can be attached to those typewriters for off-line storage of data.

These fancy typewriters have successfully imitated computers in another way as well—price. The 85 and the 95 cost $1950 and $2395, respectively, and the disk drive costs $1330, so a typewriter-disk system costs about the same as a PC with two disk drives and 64K of memory.

Government Gets Wide Angle

California Computer Systems (CCS) recently agreed to supply $2.5 million worth of its SuperVision boards to Automated Business Systems & Services, a Maryland firm that will use the boards in systems it prepares for the federal government. SuperVision enlarges the capacity of the screen on the PC, XT, and many PC compatibles, allowing the screen to display 132 columns and 44 rows of data. The SuperVision board is also capable of displaying 720-by-348, dot-addressable graphics.

One obvious use of the board is with electronic spreadsheets, which makes us wonder if CCS's systems are all going to the IRS. When the auditors catch up with the hackers, there could be big trouble. Then again, maybe it means we'll all be able to hand in our tax returns on disk one of these years.

Downward Compatibility

In an effort to bolster the reputation of its beleaguered Adam home computer, Coleco Industries has announced that it will offer an attachment that allows Adam to run some of the software designed for the IBM PC. Few details are available about this Adam enhancement as yet; Coleco spokespeople could not give the price of the device, nor would they name any specific PC programs that it would run. They did, however, promise this new product by the end of the year.

Loose Lips

People in the computer industry say some provocative and illuminating things. We'll print a selection of these statements each month and welcome contributions to this gallery of gab.

"If you really want your people to innovate, buy a science fiction book, take the cover off, and tell them it's history." *Nolan Bushnell, founder of Atari and Chuck E. Cheese's Pizza Time Theatre, on how to spark creativity in organizations.*

"IBM needs to support UNIX because it doesn't want independent software firms to control its destiny." *Industry analyst Robert Fertig, on IBM's offering a version of UNIX for the PC and XT.*

"The government is discovering that it doesn't even have to collect the data anymore—there are no laws limiting it from using private information. That means we'll have to rely on private organizations to protect our privacy rights, and if the price is right, they'll give up any information." *Robert Ellis Smith, publisher of* Privacy Journal, *on the proliferation of computer files about citizens.*

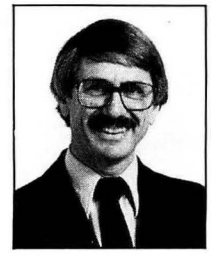
"In the past, the leading hardware vendors included IBM, DEC, and HP. In the future, that select group will be joined by AT&T, which is the only company with enough clout to challenge IBM in the Fortune 1000 environment." *Industry analyst Eileen Skrabutenas, on Ma Bell's move into the computer market.*

"A lot of new companies that announced products at COMDEX will not get off the ground. If they don't have $15 or $20 million in the bank, how are they going to get chips?" *Dan Carter, president of compatible maker Corona Data Systems, on the competition for components as well as customers.*

Back to BASIC

The inventors of the BASIC language, John Kemeny and Thomas Kurtz, have begun work on a new version of the language. To be called True Basic, the PC version of the new language will be released in September. Kemeny and Kurtz, who have formed True Basic, Inc., in Hanover, New Hampshire, promise that True Basic will be a more powerful language than BASIC and will incorporate interactive graphics, a window manager, formatting tools, and a high-level debugger. The enhancements mean that the new language will require at least 128K of RAM.

John Kemeny



Thomas Kurtz

Another of the authors' objectives in writing True Basic is to provide an interface and command structure for the language that is the same regardless of the computer on which the language is used. This would be a distinct improvement over BASIC, which currently requires numerous versions for use on different computers.

Chameleon Disks

First it was disks that came in colors, now it's disks that change colors. Omni Resources, of Millbury, Massachusetts, offers a line of floppy disks containing sensors to detect temperature and humidity levels that might cause damage to data. The sensor on each disk changes from blue to red to indicate the danger zone—a temperature of 120 degrees Fahrenheit or humidity above 80 percent. This is a technological development that workers can applaud—when your disk sensor turns red, you'll know it's too hot and sticky for people to work, too.

Mystery Responses

In January's *PC World View* we reported the mystery of a program that would load on PCs that have certain ROM chips and not load on PCs that have other ROM chips. We've received a variety of explanations for the problem. We've also received a few calls about other programs that behave differently in PCs with ROM chips that have different dates. Here are some of the clues and proposed solutions.

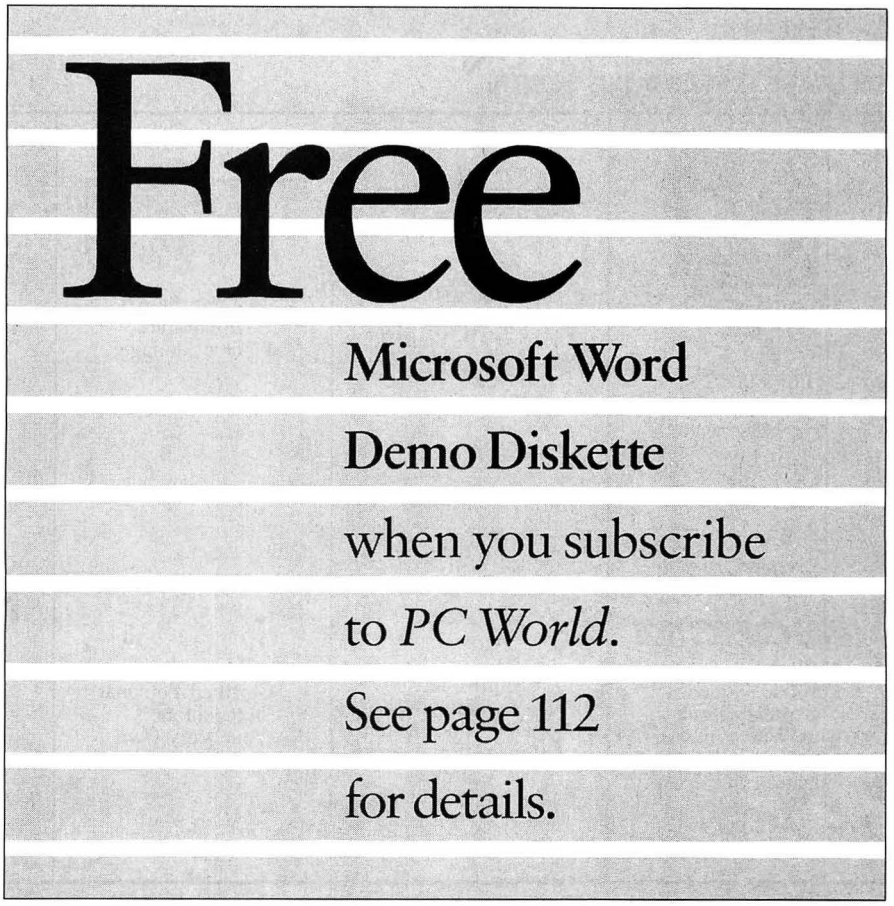
Bud Thurber of Fort Wayne, Indiana, reports that he had a similar problem when writing a program he plans to market commercially. His explanation: "The ROM dated 10/19/81 does not handle alternate text screens properly. When in 80-by-25 text mode, either color or mono, the default screen (screen 0) works fine. If we switch to screen 1, 2, or 3, however, certain combinations of writing to the screen will create gibberish or a blank screen. Since my software is absolutely dependent on alternate screens, I simply changed the method of writing to the screen."

Thurber also suggests trying the uncooperative program with both DOS 2.00 and 1.10 to see if changing versions of the operating system solves the problem.

Bob Pirko of New York City suggests that available RAM may be the reason a program would load on some computers and not on others. He points out that "when the creator of a program states that it will run in 128K, he either means that it uses less than 104K (if it is to run under DOS 2.00) or that it uses less than 116K (if it can only run under DOS 1.00 or 1.10)." Pirko adds that running CHKDSK will verify the total RAM in a system and the amount of that memory available for program use.

Edward Fischer of New York City posits another solution: "I have found that a few programs behave differently on PCs with 64K system boards and 256K system boards. This could account for the problem."

PC World View welcomes contributions from readers, and we'll pay up to $50 for the items we use. Please include your name, address, and phone number with your contributions. Send them to PC World View, PC World, *555 De Haro St., San Francisco, CA 94107.*



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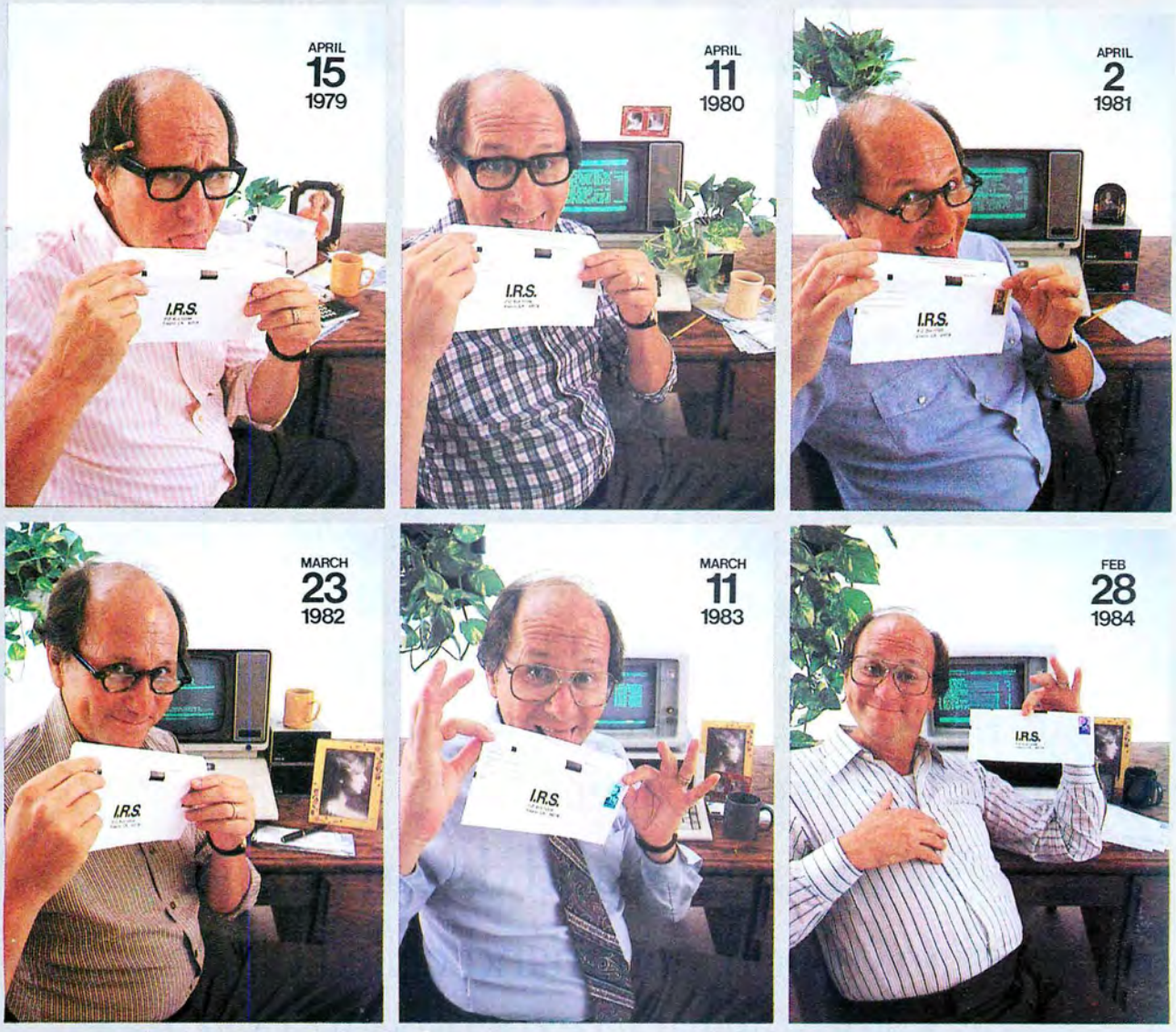

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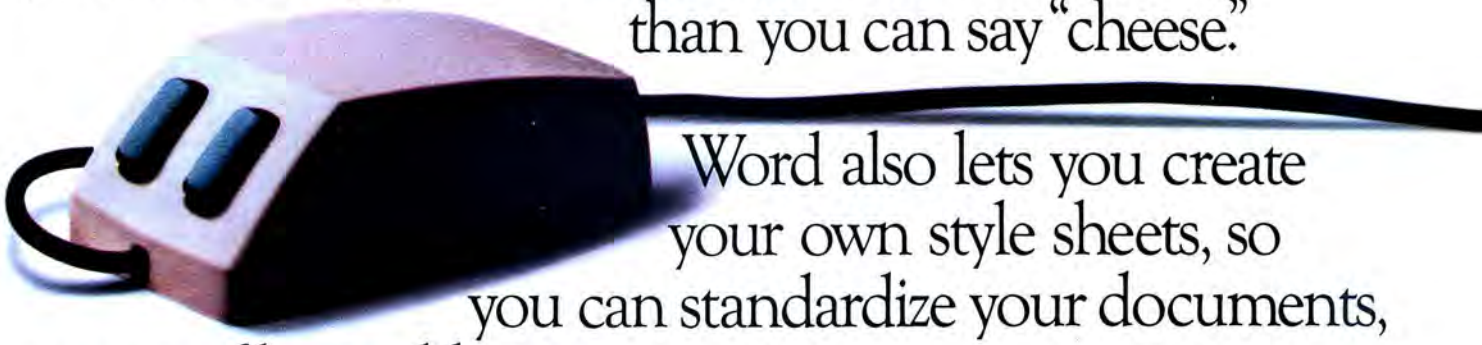

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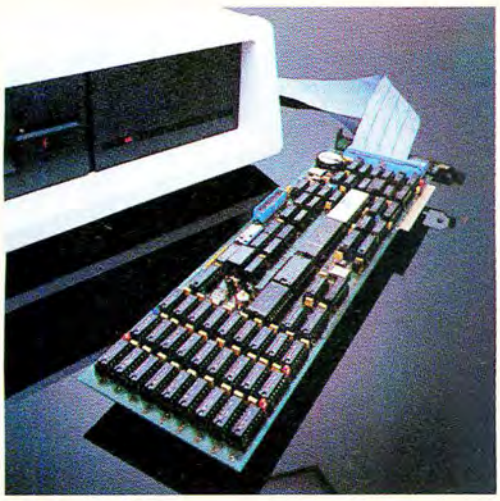

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Cooking Up a Batch File

David Arnold and Seth Novogrodsky

A batch file for the PC is like a recipe. In a few simple steps, you can whip up a file of DOS commands that automatically execute in a sequence you specify. Instead of typing the same group of commands every time you want to perform an operation, you need only type the name of a batch file. Quick, easy, and error free—if you use the right ingredients.

Any DOS command can be used in a batch file as long as the command is available on the disk from which the batch file is run. Batch files that call up only internal commands (such as COPY, DIR, and DEL) can be run from any disk, but batch files that include external commands (such as CHKDSK, FORMAT, and DISKCOPY) must be run from the DOS disk or a disk onto which the command files have been copied. A batch file contains one or more DOS instructions and always has the file name extension .BAT. To execute the commands contained in a batch file, type in the batch file name without the extension. You can create a batch file using the COPY CON: command (which is shorthand for "copy from the console," or keyboard, to the specified file) or a text editor such as EDLIN. This article assumes that you are using DOS 2.00 or 2.10 and not an earlier version. The ECHO and IF commands will not work properly with the earlier versions.

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Getting Started

AUTOEXEC.BAT is a special batch file that, if present, executes automatically when you turn on the system or reboot by pressing <Ctrl>-<Alt>-<Del>. It is just like any other batch file, however, in that it may be executed from DOS at any time by typing AUTOEXEC. Many software packages include AUTOEXEC.BAT files to assist you in running an application.

Stopping a Batch File

Occasionally, you may want to halt the execution of an AUTOEXEC.BAT file or some other batch file. As with most DOS operations, you can usually stop the execution of a batch file by pressing <Ctrl>-<Break>. This aborts the current operation, and the message 'Terminate batch job (Y/N)?_' is displayed. You must decide whether to abort the batch instructions entirely or continue with the remaining operations.

> Experimenting with batch files is the best way to discover how you can take advantage of them.

To prepare for the following batch file experiments, first boot up the DOS disk in drive A: and copy all the BASIC programs onto a disk formatted with the /s option in drive B: by typing COPY *.BAS B: <Enter> at the A> prompt. Then copy CHKDSK.COM to drive B: by typing COPY CHKDSK.COM B: <Enter>, and go to drive B: by typing B:<Enter>. As with all DOS commands, you may type the commands in either uppercase or lowercase, or both.

Experimenting with batch files is the best way to discover how you can take advantage of them. For example, you might want to make copies of all the BASIC programs on a given disk. Such a precaution might prove useful in the event that a program is inadvertently erased or the disk develops a defective sector. You can type COPY *.BAS *.BA2 <Enter> to do this, but rather than typing in this rather cumbersome command each time you want to make copies of your BASIC programs, you can type it in only once and then use a batch file. At the B> prompt or A> prompt type the following (notice that <Enter> is pressed at the end of every line):

```
COPY CON: DUPLIC.BAT <Enter>
COPY *.BAS *.BA2 <F6> <Enter>
```

To create a batch file in this way begin with the COPY CON: command. The batch file ends with <F6> <Enter> or <Ctrl>-Z <Enter>. COPY CON: tells DOS that the following keyboard (console) data should be copied into the file on the right (DUPLIC.BAT). The function key <F6> (or ^Z, as it appears on the screen) tells DOS that you are finished typing in the batch file.

To execute the batch file, type DUPLIC <Enter>. Note that the entire command appears on the screen as if you had typed in each character yourself. By displaying a directory of drive B: (DIR B: <Enter>), you can see that your batch file has made a copy of all the BASIC files and has given them new extensions (.BA2).

Batch files are useful for combining several commands into one. The next batch file displays a wide directory (DIR /W) and a disk status report (CHKDSK) with a single command. Type

```
COPY CON: DIRCHK.BAT <Enter>
DIR /W <Enter>
CHKDSK <F6> <Enter>
```

To execute this batch file, just type DIRCHK <Enter>. The result should look similar to Figure 1.

An AUTOEXEC.BAT file can be used to automatically initiate the use of a program whenever the computer is turned on or rebooted. For example, to create a batch file that will prompt you for the date and time and also load *WordStar* automatically, type

```
COPY CON: AUTOEXEC.BAT <Enter>
DATE <Enter>
TIME <Enter>
WS <F6> <Enter>
```

Replaceable Parameters

Many DOS commands are used with mandatory or optional parameters. The parameters are generally used to indicate disk drive designators or the names of files. Because the parameters will probably be different each time a batch file is executed, you will need to specify dummy parameters to represent the actual values. When the batch file is executed, the values will be placed where the dummy parameters are specified.

Dummy parameters are indicated by the percent sign preceding any single-digit number (%0, %1, %2, and so on up to %9). The %0 symbol denotes the name of the batch file itself, %1 is the first parameter, %2 the second parameter, and so forth.

```
B>dir/w

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

COMMAND  COM   ART        BAS   SAMPLES    BAS   MORTGAGE   BAS   COLORBAR   BAS
MUSIC    BAS   DONKEY     BAS   CIRCLE     BAS   PIECHART   BAS   SPACE      BAS
BALL     BAS   COMM       BAS   CA1        BAS   DUPLIC     BAT   ART        BA2
SAMPLES  BA2   MORTGAGE   BA2   COLORBAR   BA2   MUSIC      BA2   DONKEY     BA2
CIRCLE   BA2   PIECHART   BA2   SPACE      BA2   BALL       BA2   COMM       BA2
CA1      BA2   DIRCHK     BAT   CHKDSK     COM
     28 File(s)     226304 bytes free

B>chkdsk

   362496 bytes total disk space
    22528 bytes in 2 hidden files
   113664 bytes in 28 user files
   226304 bytes available on disk

   262144 bytes total memory
   237568 bytes free

B>
```

Figure 1: DIRCHK batch file display

Replaceable parameters make batch commands more flexible. For example, in the DIRCHK.BAT file above, there is no way to designate a disk drive or a specific file. You can accomplish this with replaceable parameters. Type

```
COPY CON: DIRCHK2.BAT <Enter>
DIR %1 /W <Enter>
CHKDSK %1 <F6> <Enter>
```

By adding replaceable parameters, you can execute the DIRCHK2 command in a number of ways. Typing `DIRCHK2 A: <Enter>` asks for a directory and a CHKDSK (check disk) of drive A:. Typing `DIRCHK2 *.COM <Enter>` asks for a directory of all files having the .COM extension on drive B: (the default drive) and a CHKDSK of the specified files on drive B: (see Figure 2). By using replaceable parameters and asking for different variables during the execution of a batch file, you can achieve countless variations.

Subcommands

Four subcommands (ECHO, REM, PAUSE, and IF) provide a way for the computer to communicate with you during batch file execution. By making liberal use of these subcommands, you can become more aware of what the computer is doing while a batch file is executing.

```
B>dirchk2 *.com

B>dir *.com /w

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

COMMAND  COM      CHKDSK     COM
     2 File(s)     224256 bytes free

B>chkdsk *.com

   362496 bytes total disk space
    22528 bytes in 2 hidden files
   115712 bytes in 30 user files
   224256 bytes available on disk

   262144 bytes total memory
   237568 bytes free

All specified file(s) are contiguous.

B>
```

Figure 2: DIRCHK2.BAT using replaceable parameters

ECHO. You may want to suspend the automatic display of DOS commands as they are executed so that the screen will not be cluttered. The ECHO subcommand can stop and start the automatic display of DOS commands as they are being executed from a batch file. This subcommand can also be used to display messages while a batch file is in the process of executing.

To disable the automatic display of commands, place an ECHO OFF command at the beginning of the batch file. Note that the ECHO OFF command is displayed as it is executed, although the commands following it are not. You can determine whether ECHO is on or off at any time from DOS simply by typing ECHO <Enter> from the DOS prompt (generally A> or B>). Normally ECHO is on.

The ECHO subcommand can stop and start the automatic display of DOS commands.

You may want to display a message during the execution of a batch file. To do this, put an ECHO command in the batch file followed by the message (on the same line). For example, type

```
COPY CON: DIRCHK3.BAT <Enter>
ECHO OFF <Enter>
ECHO      * DIRECTORY & STATUS REPORT * <Enter>
DIR %1 /W <Enter>
CHKDSK %1 <Enter>
ECHO ON <F6> <Enter>
```

As usual, you can run the batch file by typing DIRCHK3, and you can indicate the appropriate disk drive as an optional replaceable parameter, as in DIRCHK3 A:. Always have an ECHO ON command at the end of a batch file that contains an ECHO OFF command.

REM. You may want to include remarks in a batch file. Although you can display comments with the ECHO subcommand, you may want to include general comments about the purpose of the batch file by using the REM subcommand (REM stands for "remark"). The REM subcommand consists of REM followed by a space and a comment (on the same line). Remarks can be up to 123 characters long. Unless the ECHO feature is turned off, the remarks (along with REM) will be displayed on the screen while the batch file is being executed. For example, type

```
COPY CON: REMARK.BAT <Enter>
REM This is a sample batch file that demonstrates the REM <Enter>
REM command. These REMarks will be displayed when <Enter>
REM this batch file is executed. <Enter>
ECHO OFF <Enter>
REM This remark will not be displayed. <Enter>
ECHO ON <F6> <Enter>
```

Now type REMARK to run the batch file. The ECHO OFF command stops the display of DOS commands so that only the first three remarks are shown.

PAUSE. The PAUSE subcommand halts the execution of a batch file and displays the message 'Strike a key when ready....'. At this point, you must press any key to resume execution of the batch file. The PAUSE subcommand can be used to provide another variation of the DIRCHK batch file. To try this out, create a batch file by typing the following:

```
COPY CON: DIRCHK4.BAT <Enter>
ECHO OFF <Enter>
ECHO      * DIRECTORY & STATUS REPORT * <Enter>
DIR %1 /W <Enter>
ECHO      * Status report coming up * <Enter>
PAUSE <Enter>
CHKDSK %1 <Enter>
ECHO ON <F6> <Enter>
```

IF. Occasionally, you might want to have a batch file perform certain operations only if specified conditions are met. Conditional execution of DOS commands in a batch file is accomplished by using the IF subcommand. You may want to have a batch file that performs different functions depending on the value of a replaceable parameter.

The following batch file displays the directory entry of a file specified by the first parameter (%1) no matter what second parameter is specified. And if an optional second parameter (%2) has the value of *T*, the contents of the designated file (%1) will also be displayed on screen. Type

```
COPY CON: DIRTYP.BAT <Enter>
DIR %1 <Enter>
IF %2 = = T TYPE %1 <F6> <Enter>
```

In this example, if you wish to have the computer type the contents of the file in addition to displaying the directory, you must enter a second parameter of *T*. If you do

not specify a second parameter and merely type DIRTYP <Enter>, an innocuous syntax error message will be displayed. To display the directory entry (the file name) and the contents of COMM.BAS, type DIRTYP COMM.BAS T <Enter>.

Just as a baker must determine whether all the ingredients are available before starting to make a cake, you may need to determine whether a file exists before performing certain DOS operations. The computer can execute a particular command in a batch IF command on the condition that a specified file exists. For example, you can create a batch file that will display a directory of a specified file. Type

```
COPY CON: CHKFILE.BAT <Enter>
ECHO OFF <Enter>
ECHO This file helps prevent duplication of file names. <Enter>
IF EXIST %1 DIR %1 <F6> <Enter>
```

You can test this batch file by typing CHKFILE COMM.BAS <Enter>. Now try executing the command with a file not on the disk. For example, type CHKFILE NEWNAME <Enter>.

You can negate the condition in an IF command by typing NOT immediately after IF. You might want to replace the last line in the CHKFILE.BAT file with

```
IF NOT EXIST %1 ECHO File %1 does not exist
```

This command will check the disk's contents to see if the named file exists. If the file doesn't exist, a message on the screen will say so.

Because any DOS command can be executed in a batch file, you can have your computer perform a series of complex operations while you sit back and watch. You can easily create recipes that have DOS commands as the ingredients. You needn't be an experienced programmer to start cooking up batch files, just as you needn't be a master chef to make dinner. Bon appetit!

David Arnold is a professor of sociology at Sonoma State University in Rohnert Park, California. He teaches a course on computers and society and has written a book about the IBM PCjr published by Holt, Rinehart and Winston. Seth Novogrodsky is a Contributing Editor to PC World Books.

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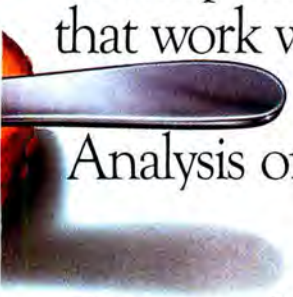

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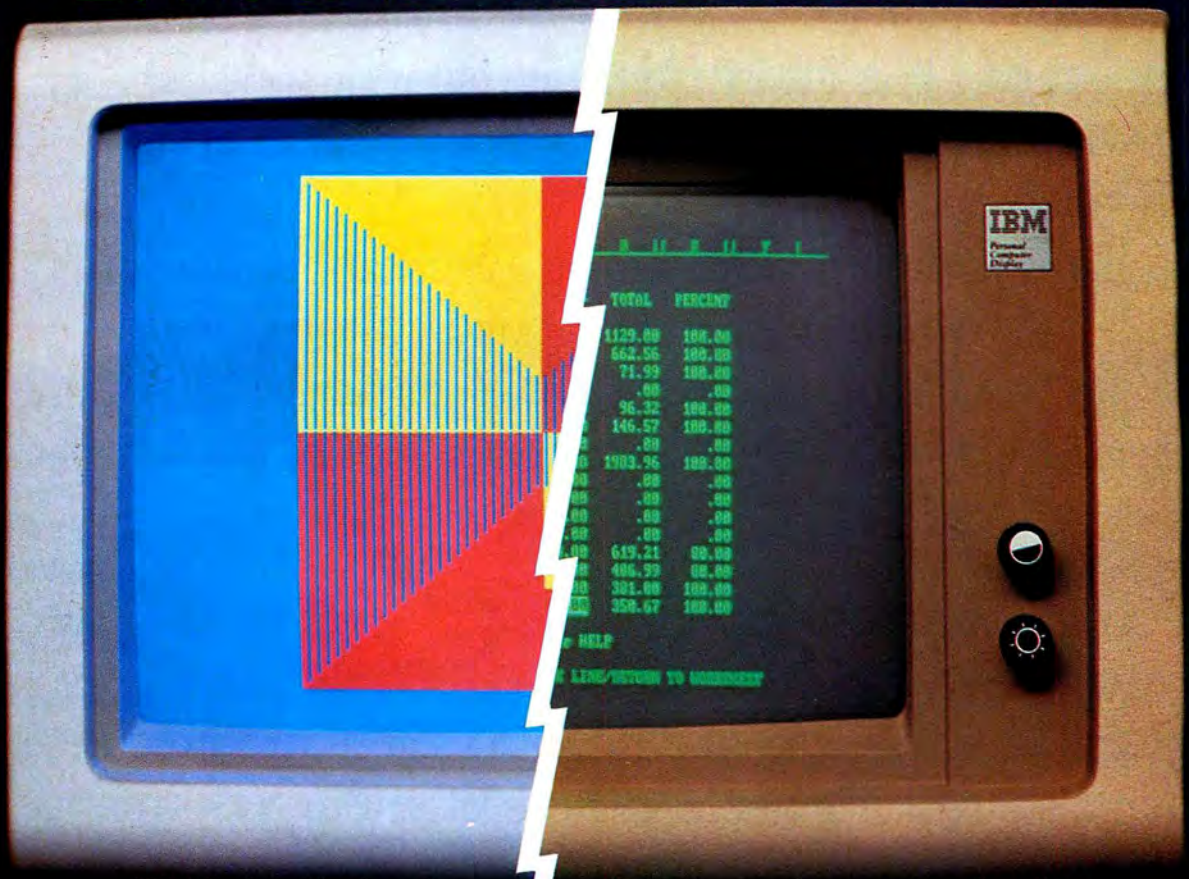

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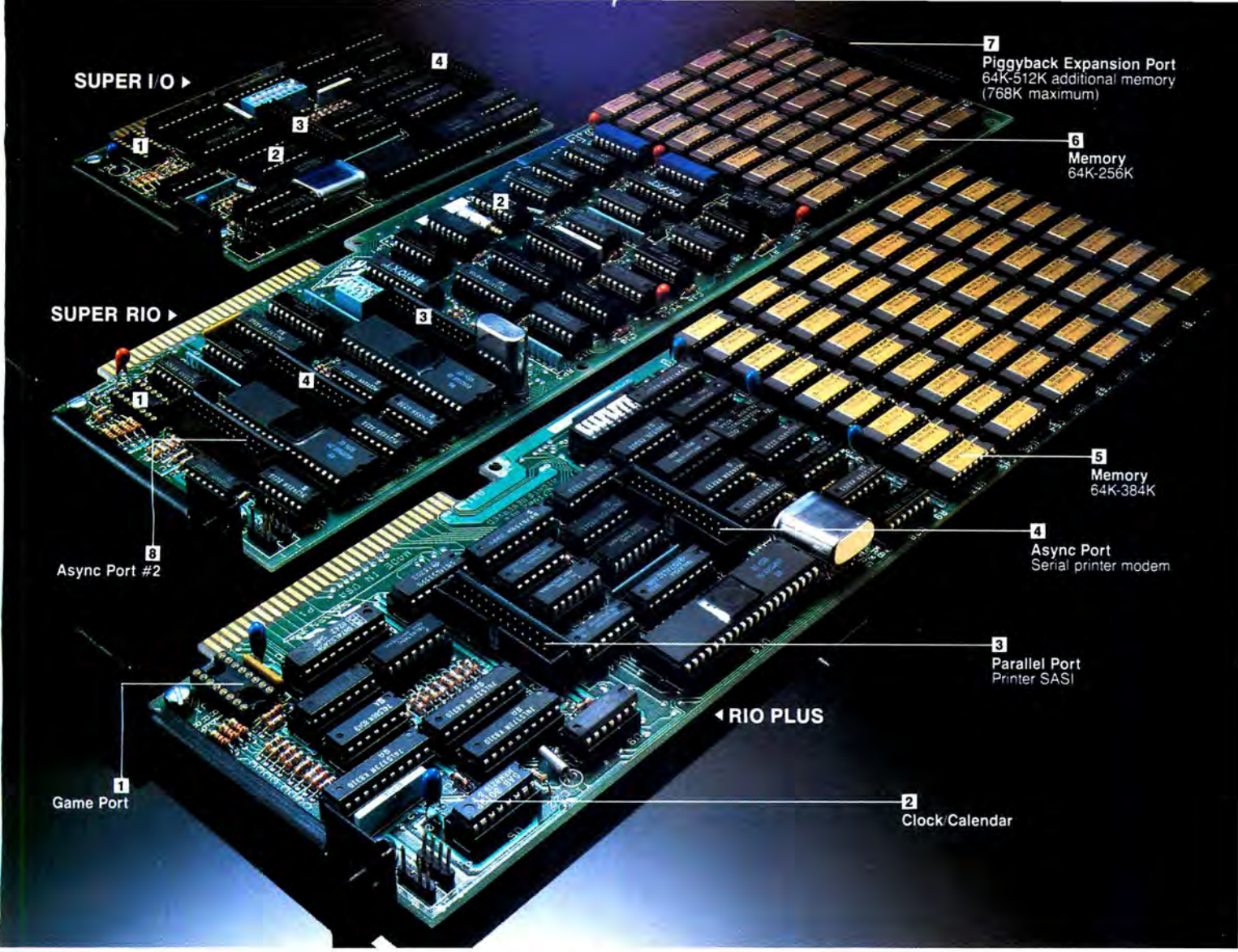

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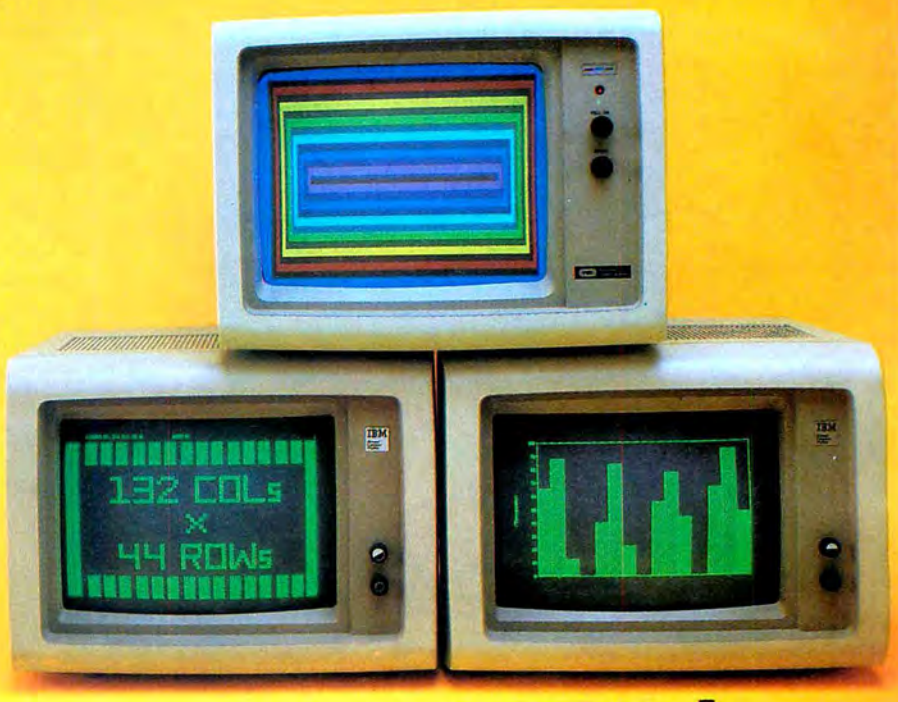

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Ashton-Tate's new tutorial lets you bypass the manual for a painless launch into dBASE II.

Steven D. Ryals

dBASE II, a data base management system, has been one of the best-sellers in the microcomputer marketplace since its introduction over three years ago. While it has been touted as the standard against which competing systems are judged, one consistent criticism has been that it is difficult to learn. Several books, including *dBASE II User's Guide* by Adam B. Green (Prentice-Hall, Engelwood Cliffs, New Jersey, 1983) and *Everyman's Data Base Primer* by Robert Byers (Reston Publishing, Inc., Reston, Virginia, 1982), have become almost required reading to help users decipher the documentation supplied with *dBASE II*.

Ashton-Tate has solved this problem with a new on-disk tutorial. It provides the same information presented in the first section of the *dBASE II* manual, but it does so in more interesting and comprehensible terms. The tutorial is included free of charge with *dBASE II 2.4* or with updates purchased since September 6, 1983. Registered *dBASE II* owners who bought updates before that date can order the tutorial for a fee.

Getting Started

This tutorial greatly simplifies much of the initial learning process that is necessary for you to become familiar with the major commands and capabilities of the program. The tutorial's

goal is to take new computer operators and turn them into competent data base manipulators in only a few hours.

A frequent problem with tutorials is that in practice a beginner often

The tutorial greatly simplifies much of the initial learning process.

gets lost. This tutorial requires little if any knowledge of computers in order to start. The tutorial's error-handling function works well, providing clear messages about how to correct any problems.

The tutorial comes with three disks. The first disk includes the introduction and Lesson 1, the second disk has Lessons 2 through 7, and a third disk contains Lessons 8 through 10. The instructions printed on the inside of the disk folders are divided into three sections: one details how to install the disks, the second provides a list of the on-line lessons, and the third describes how to start the lessons.

I found only two minor problems with the instructions. The installation section includes a note stating that if your disk is labeled "pre-installed," you can simply start the lessons. The disks I received did not state anywhere that they were pre-installed. When I attempted to follow the installation instructions, however, I found that no install program was on the disks—the disks were pre-installed after all.

Another inconsistency occurs in the section "Starting the Lessons." It explains how to respond to the date prompt that appears on screen. As it happens, the date prompt does not appear. The copyright message is immediately followed by the normal *dBASE II* dot prompt, which indicates that the program is ready for instructions.

You can start the lessons with one simple command provided in the instructions. The next step is to type in your name. You must do this every time you start a lesson, even if you are moving from one lesson to the

Getting Started

I - Introduction, definitions of basic computer terms (reference not interactive)
1 - Create files, generate Reports, and correct syntax errors
2 - Add, change, and delete data in files, and record positioning
3 - Selecting sub-sets of data on files, and computations
4 - Record keys, indexing, random processing, and Boolean operators
5 - File and system utilities, and intro to command procedures
6 - Sorting, updating, and use of memory
7 - Relational data base construction
8 - Other forms of accepting and displaying data, dBASE II functions, and SET options
9 - Building custom reports and screens
10 - Command procedures (programming features in dBASE II)

Figure 1: Lessons menu

next at one sitting. The other question that has to be answered before you begin each lesson is whether or not the printer is hooked up and turned on. If the answer is yes, the tutorial proceeds to print out the entire lesson. This provides a complete record of the lesson for future reference, but be sure you have plenty of paper. The introduction and lessons use up 55 pages. After these preliminary steps are taken care of, the lessons menu appears on the screen (see Figure 1).

The Lessons

The introduction explains the terms and concepts needed to begin the lessons. It introduces general computer terms and defines some of the disk operating system (DOS) commands such as COPY, ERASE, and DIR. Terms specific to data base management like file, record, field, and data are also covered. The introduction shows an example of a data base and discusses the concept of a relational data base.

The first four lessons will make most beginners comfortable with *dBASE II*. These lessons teach the commands required to create data base files, edit data in the files, perform computations on the data, and generate reports based on the files. The remaining six lessons delve into some of the more complex features of *dBASE II*. Each lesson presents information in a logical and easy-to-follow format.

The lessons are interactive, meaning the tutorial asks questions and acts on your responses. By the end of the tutorial, the beginner will glimpse the full power of *dBASE II*. Complex programming is appropriately beyond the scope of this tutorial. It provides a superior introduction to the rigors of *dBASE II* data handling, however, and will therefore make learning this complex piece of software a much easier task for many people. ●

Steven D. Ryals is a dBASE II *consultant and writer living in Oakland, California. He specializes in developing business applications for microcomputers.*

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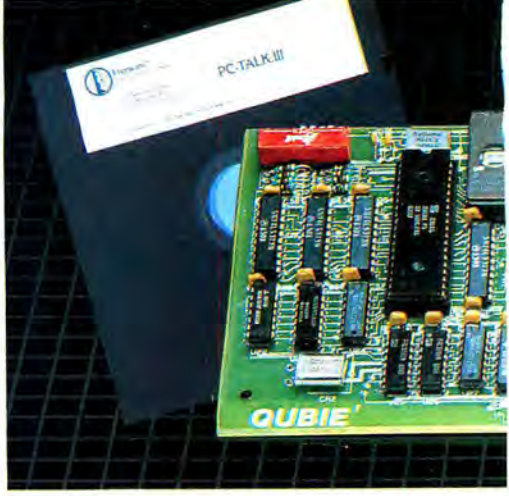
dBASE II On-Disk Tutorial
Ashton-Tate
10150 W. Jefferson Blvd.
Culver City, CA 90230
213/204-5570
List price: free with dBASE II 2.4 *or with updates purchased after September 6, 1983; $35 with prior update*
Requirements: 128K, one disk drive

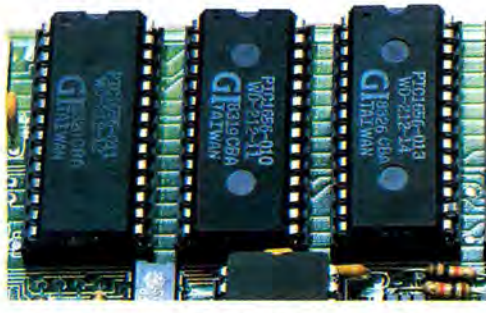


Flip the pages. You see PC modem cards with fewer features advertised for as much as $599. Up until now that's how much it cost to make a modem capable of transmitting at 120 characters per second (1200 baud). It doesn't take a computer to figure out the savings in phone line charges when you communicate 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.

SEE HOW THEY WORK

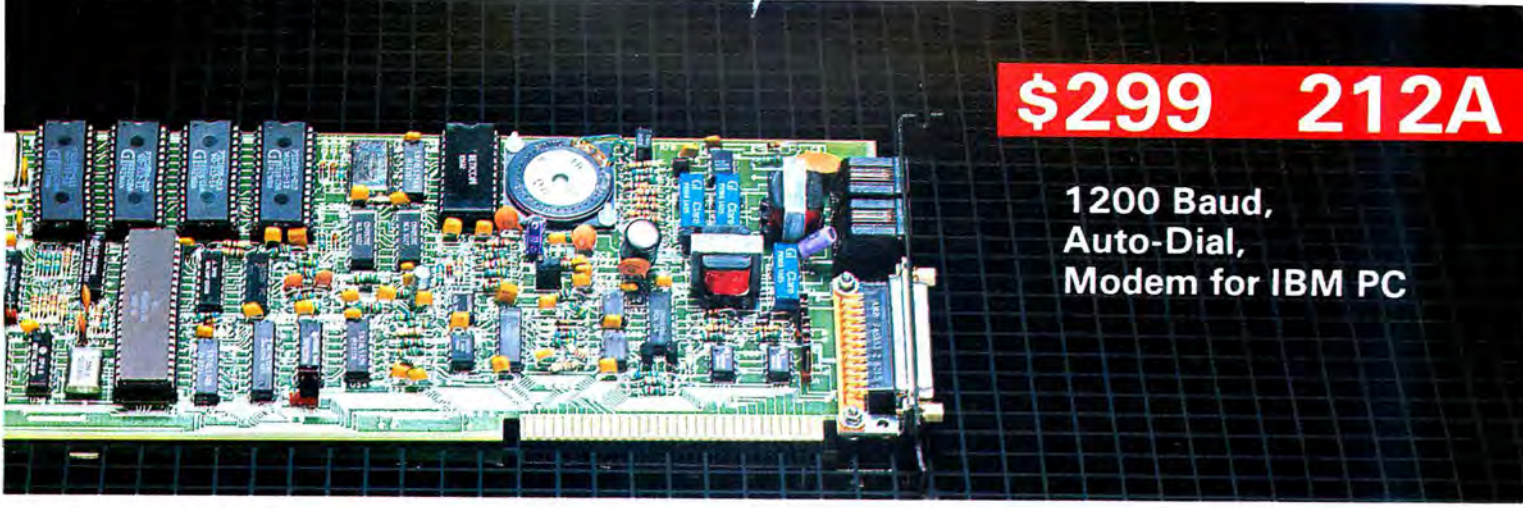
You can image how precise the components have to be to convert tones over a phone line into 120 characters every second. Precision equates to cost. With the advent of the mass market in personal computers the economies of scale drove the costs of manufacture down, but did not effect the precision required. The technology used is called "analog filtering". It is the process of sending (modulating) and receiving (demodulating) tones with perfect pitch. A lot of adjusting, noise suppression, and a little magic is required. Real expensive. Some use lots of chips and filters (known as discrete components). The latest rage is LSI (Large Scale Integration) technology. Which is the same old analog stuff condensed onto fewer chips.

ADVANTAGE #1
Digital Signal processing



A NEW IDEA

We took a different approach. Through the use of four microprocessors the tones are chopped up digitally and measured millions of times per second, eliminating the need for analog circuity. Two microprocessors do the modulating, two the demodulating. The chips are programmed to emulate the 103 (30 characters per second) or 212 (120 characters per second) standards and determine the correct speed automatically. It's a proven technology that provides outstanding performance. Best of all, it's inexpensive and reliable.



$299 212A

1200 Baud, Auto-Dial, Modem for IBM PC

PC 212A/1200:

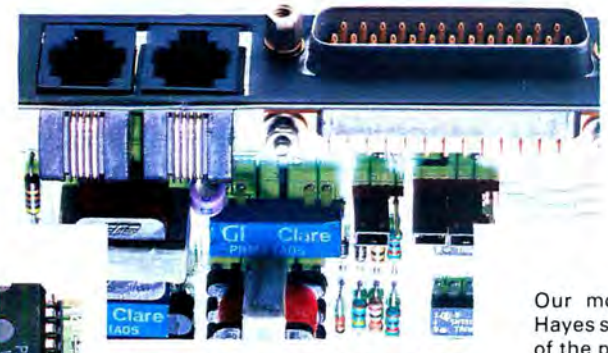
A GENUINE BREAKTHROUGH

NO CORNERS CUT

We included every feature you would want in a modem card. It's FCC registered for direct connection to your modular phone jack with the cord which is included. There is a separate modular jack for your telephone or you can listen through the onboard speaker. The auto-dialer works on rotary lines, tone lines, or a combination of both, and will pause for use with Sprint or MCI. It will work in originate or auto-answer modes. A separate microprocessor, a Z8, controls all the functions.

ADVANTAGE #2

Optional external serial port connector



AN ASYCHRONOUS ADVANTAGE

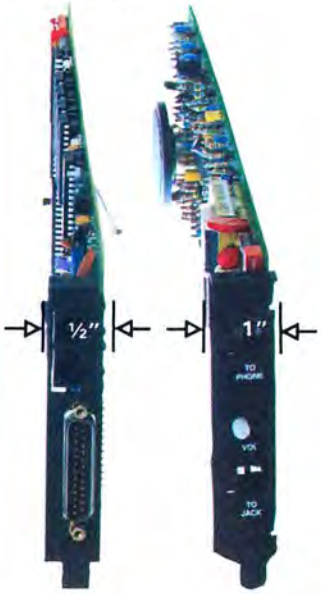
The modem board is addressed in the software as COM1 or COM2 and we have a handy little option you ought to consider. If you would like to use the asynchronous communications port when your modem is not in use, we will add a connector and the necessary circuitry for just $20. This saves you the hundred bucks or so you would spend for another async card and saves a valuable slot. It can be configured as COM1 or COM2 and works just like IBM's does.

THIN IS IN

It plugs into your IBM PC or XT and occupies any one slot since it is just 1/2 of an inch thick. This is made possible by using a special speaker which is just 1/8" tall. Competing brands either use a convential cone type speaker, or they just skip the speaker altogether. Some modems also have large transformers which allow rob valuable space.

ADVANTAGE #3

Just one slot in PC or XT



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Our modem is 100% compatible with the Hayes software commands so you can use any of the popular communications packages like IBM's Asynchronous Communications Support, CrossTalk, Transend, or PC Modem. We go one better than the competition. We **include** PC-TALK III. PC WORLD magazine referred to it as "the benchmark that other PC communications packages are measured against." It stores phone numbers, handles setting the modems characteristics, saves to disk files, transmits from disk files, even binary files. You can program up to forty keys to have things like passwords and log-on information be entered when you hit them. And to make sure data is sent and received accurately, the XMODEM protocol detects errors caused by poor line quality and automatically retransmits the data.

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BY PHONE: Call us and one of our sales staff can answer any questions you have and take your order. Have your Visa or Mastercard number handy when you call.

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VISA & MASTERCARD

$299 includes: PC 212A/1200 auto-dial modem card, PC-TALK III software, cord to connect to modular phone jack, and manual. 1 year limited warranty.

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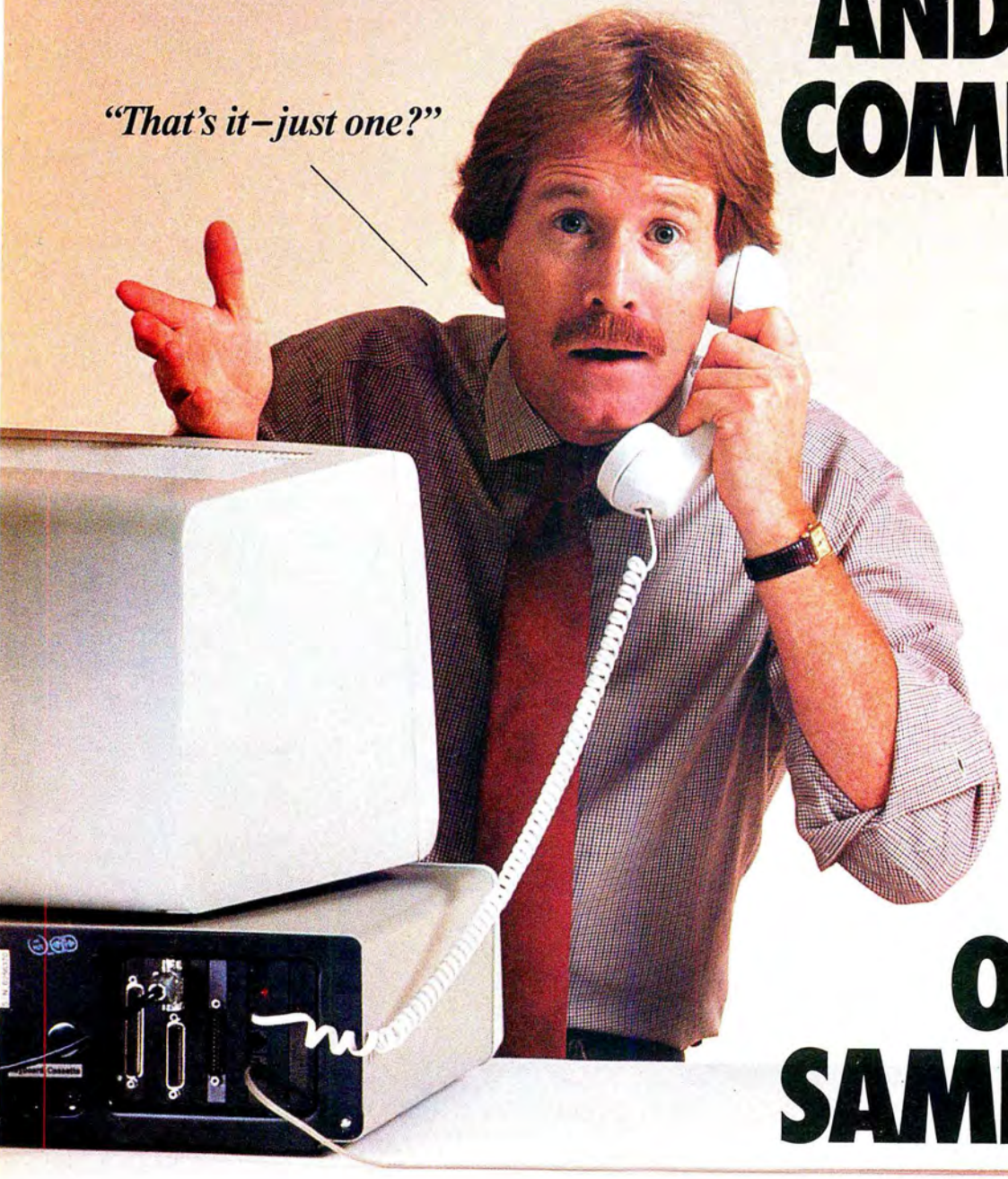

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Only the PC:IntelliModem™ lets you switch repeatedly between voice and data communications.

Any old modem will let computers talk. But to move from talking or listening to sending and receiving data—at the touch of a single button—there's only one modem that's smart enough. The 1200-baud PC:IntelliModem from Bizcomp.

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PC:IntelliCom Software Included
- 99-name on-line telephone directory
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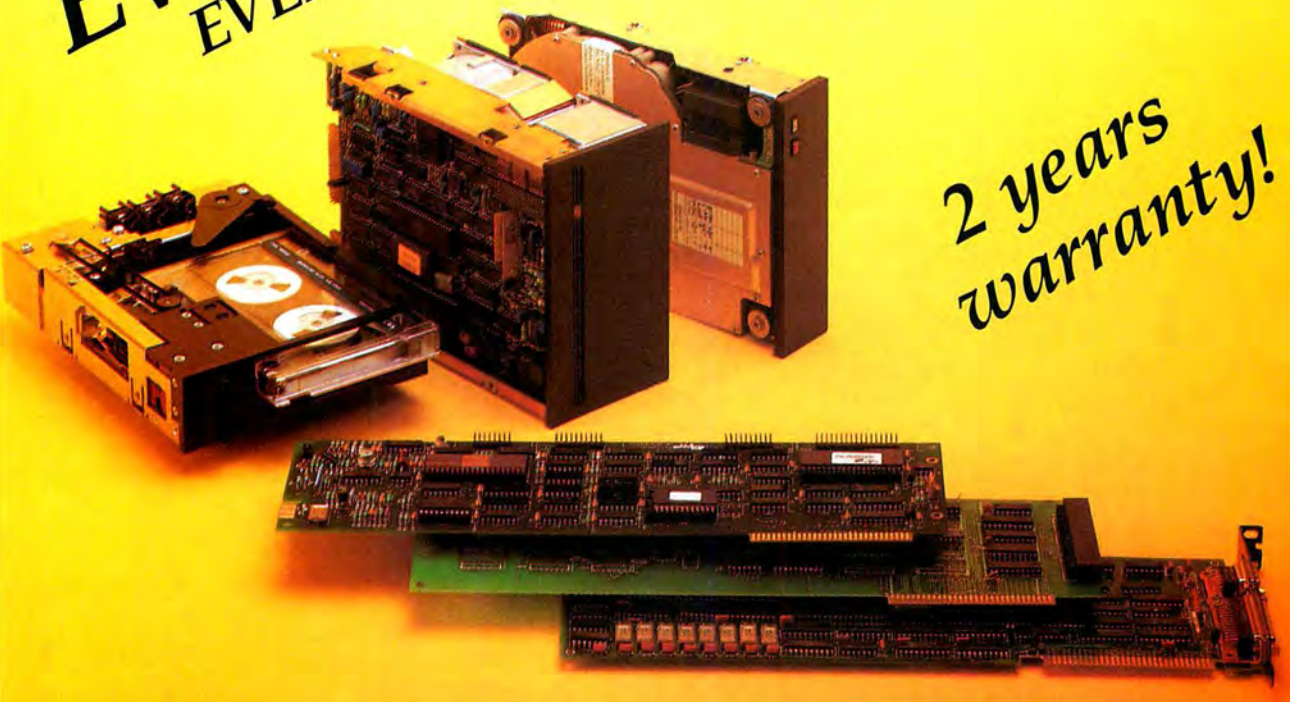

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Circle 699 on reader service card

The Help Screen

PC World offers answers and advice at every level.

Karl Koessel

This month we look at the problem of television reception disrupted by radio frequencies that emanate from the PC. We also discuss increasing the PC's system board memory. And because several readers have reported techniques for reducing the creation of string garbage in BASIC programs, the remainder of the column is devoted to a discourse on BASIC's garbage collection.

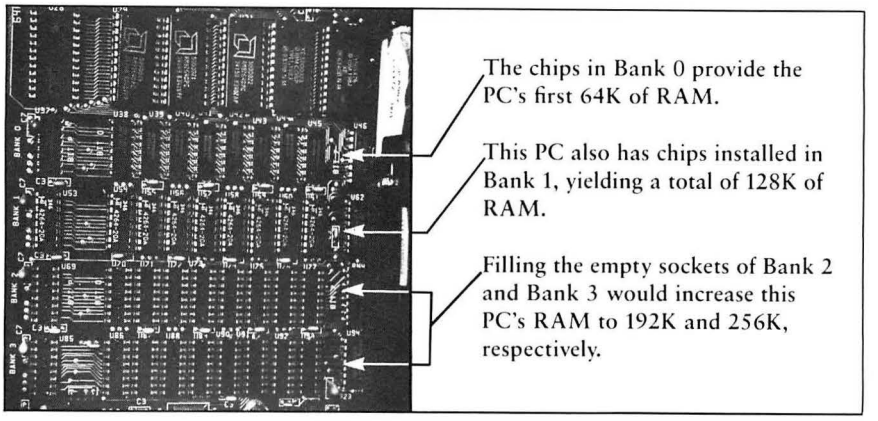

Figure 1: Each bank of nine RAM chips spans the system board horizontally and provides 64K of RAM.

PC vs. TV

Q. I would appreciate your help in solving a very annoying problem I am having with the IBM PC. When the computer is turned on, the TVs in our home have a lot of static and become snowy. This problem is particularly bad on our local Channel 5, and to a lesser degree on Channels 9 and 12.

The computer is on its own electrical circuit, connected directly into the main electrical panel. The PC is separated from the main TV antenna by an outside wall, about 20 to 25 feet away. The TVs on the main coaxial cable are affected most, but the condition also exists on a portable that has its own antenna. Meanwhile, I can't use my computer when my family wants to watch TV. Any suggestions?

Todd Deutsch
Cincinnati, Ohio

A. Computers and other digital devices radiate radio noise, referred to as radio-frequency interference (RFI). The PC, when operated normally with the cover screwed on tight, is a Class B computer. This FCC classification means that the PC's design sufficiently shields the RFI radiating circuitry so that the amount of RFI emitted outside the system is minimal. Obviously, in your case it's still too much.

Your PC is acting as a broadcast antenna, radiating RFI into neighboring TV antennae. Although the walls of your home are virtually transparent to radio waves, increasing the distance between a broadcast antenna and a receiving antenna will decrease the strength of the signal received. Assuming that you are not entertaining the expensive prospect of additional shielding, you have only two alternatives: move the main TV antenna or move the PC.

Expanding System Board Memory

Q. Last year I purchased a PC with 64K bytes of random access memory (RAM) installed. Now I am ready to expand to 96K or 128K, but I don't want to buy an expensive memory expansion board. I have heard that I can buy individual 16K or 64K memory chips to install on the motherboard. Is it possible for me to expand my system in this way? If it is, how does one go about ordering the chips, and approximately how much would this expansion cost?

Chuck LeFebvre
Carterville, Illinois

A. While it certainly is possible to purchase memory chips, whether they can be installed on your PC's motherboard (system board) depends on which model you own. The newer model PC-2, like the PC XT, uses only 64K RAM chips on the system board, whereas the older PC-1 uses only 16K RAM chips. Determining which model you own is as simple as reading the numbers printed on the RAM chips installed in your machine. To correctly order and install the RAM chips, however, you must understand a bit more than the names of RAM chips and where they are in the PC.

System board memory is located in the front-left quarter (next to the speaker, see Figure 1) of all PCs. Note that there are four rows (called banks) of nine chips (or sockets if the chips are absent). All PCs have at

The Help Screen

```
10 DEFINT A-Z : P1=500 : P2=20
20 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
30 DIM X1$(P1) : FOR I = 1 TO P1 : X1$(I) = STRING$(P2,"1") : NEXT
40 PRINT TIME$,FRE(0),TIME$,FRE(""),TIME$
50 DIM X2$(P1) : FOR I = 1 TO P1 : X2$(I) = STRING$(P2,"2") : NEXT
60 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
70 DIM X3$(P1) : FOR I = 1 TO P1 : X3$(I) = STRING$(P2,"3") : NEXT
80 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
90 DIM X4$(P1) : FOR I = 1 TO P1 : X4$(I) = STRING$(P2,"4") : NEXT
100 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
```

Listing 1

```
10 DEFINT A-Z : P1=500 : P2=20
20 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
30 DIM X1$(P1) : FOR I = 1 TO P1 : X1$(I) = STRING$(P2,"1") : NEXT
40 PRINT TIME$,FRE(0),TIME$,FRE(""),TIME$
50 DIM X2$(P1) : FOR I = 1 TO P1 : X1$(I) = STRING$(P2,"2") : NEXT
60 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
70 DIM X3$(P1) : FOR I = 1 TO P1 : X1$(I) = STRING$(P2,"3") : NEXT
80 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
90 DIM X4$(P1) : FOR I = 1 TO P1 : X1$(I) = STRING$(P2,"4") : NEXT
100 PRINT TIME$,FRE(0), TIME$,FRE(""),TIME$
```

Listing 2

least the first bank filled. (Usually, the first bank is soldered directly to the system board.) Memory is added to the system board by filling the next available bank of sockets. Because the PC stores data in 8-bit bytes and keeps a parity check bit for each byte, the entire bank of nine chips (one for each bit, including parity, of each byte) must be filled before the system will recognize an increase in memory size.

If you have a 64K PC-1, all four banks are already filled—you cannot add more chips to the system board. If you have a 64K PC-2 (or a 128K PC XT), only the first bank (and second bank on the PC XT) of memory is installed, and you can add the 64K RAM chips to your system board, increasing the PC's RAM by 64K with each bank filled. (Readers whose PCs have less than 64K of RAM have the earlier model. Those readers can upgrade their systems using the 16K RAM chips, increasing their PCs' RAM by 16K with each bank filled.) A 64K RAM chip used by the PC is called a 4164, a code number that means 64K by 1-bit dynamic random access memory chip. (The 16K RAM chip is called a 4116, meaning 16K by 1-bit dynamic RAM.)

In addition to size and type, the RAM chips used by the PC are also categorized by speed. The speed of a memory chip indicates the time it takes to set a value into the chip. A RAM chip's speed must be at least as

23:14:25	59798	23:14:25	59798	23:14:25
23:14:27	48280	23:14:27	48280	23:14:26
23:14:49	36768	23:14:49	36768	23:16:04
23:16:06	25256	23:16:06	25256	23:18:55
23:18:57	13744	23:18:57	13744	23:23:56

Figure 2: The results from printing Listing 1

23:25:19	59798	23:25:19	59798	23:25:19
23:25:21	48280	23:25:21	48280	23:25:40
23:25:43	36768	23:25:43	46768	23:26:13
23:26:15	35256	23:26:15	45256	23:26:56
23:26:58	33744	23:26:58	43744	23:27:50

Figure 3: The results from printing Listing 2

fast as the computer system. The PC needs RAM chip speeds of at least 250 nanoseconds (ns) or faster (you may use the 200 ns chips). But faster chips are more expensive and do not increase the speed of the system because that is determined by the PC's 8088 central processing unit (CPU) and the operating system.

If you have a 64K PC-2, the chips you need to add memory to the system board are called 4164-250 RAM chips, and they cost about $6 to $7 each. Check the back pages of any computer magazine for advertisements. Chips are also available from the larger distributors such as Hamilton/Avnet. But order more than you think you need. The less you pay, the greater the possibility of receiving a defective chip. Although the distributor will usually replace a bad chip, you will lose time during mailing and installation.

Be very careful when handling RAM chips, because they are sensitive to static charges. Remove synthetic clothing, ground yourself, and avoid touching the chips' pins. Install the chips carefully to avoid damaging the pins, and be sure that the chips are aligned in the proper direction (the notch cut in one end of each chip should face the rear of the PC). Remember to set the system board switches as shown in the *Guide to Operations* to reflect the amount of RAM your system now has.

Add-MEM of Castro Valley, California, has announced a "no slot" memory board, the PCM-KPC, for the PC-1. Available as a kit, preassembled, or installed by their technicians, this printed circuit board replaces the PC-1's 16K RAM chips. Solder a few jumpers from the PCM-KPC to the PC's motherboard, and your PC-1 is transformed into a PC-2.—Ed.

Reducing BASIC Garbage

Several readers have pointed out that the length of time for garbage collection in BASIC is related not to the amount of string garbage (as I had incorrectly stated in *The Help Screen, PCW,* Vol. 2, No. 1), but to the total amount of string space allocated to both currently valid strings and abandoned string garbage. The following excerpts from two letters offer several tips on reducing the creation of string garbage, including techniques that use string variables of constant length:

I've been reading your column for a while now. I've found it well written and generally useful. However, anyone who tries your advice concerning BASIC's garbage collection—"If you do it often, it will happen so fast that you won't notice the lapse"—will be very disappointed.

Let me illustrate, with two variations of a simple BASIC program (Listings 1 and 2). Note that the difference between Listing 1 and Listing 2 is that Listing 2 reassigns the X1$ array. What does it all mean? Compare the output of these two programs (Figures 2 and 3). Why does

```
20 MID$(A$,1) = INKEY$   '<--------------Reuse assigned string space
30 IF A$ = "" THEN 20
40 B$ = B$ + A$          '<--------------Create Garbage !!
```

Listing 3

Listing 2 take up to 5 full minutes to recover 0 bytes of garbage? I haven't traced the code, nor have I tried to chase it down with DEBUG. The obvious conclusion is that garbage collection time is related to two factors: the number of strings and the number of bytes taken up by those strings.

The best strategy is to write code that avoids creating string garbage in the first place. (See Listing 3 for an example of string manipulation that reuses assigned string space, and an example of string manipulation that creates garbage.) Attempt, wherever possible, to structure the strings in your program so that their lengths do not change.

And because BASIC creates garbage even when the new value of a string has the same number of bytes, use the following BASIC statements: SWAP, to swap two strings, particularly when the 'from' string is no longer required; LSET and RSET, to pad strings with spaces without changing lengths or creating garbage; and that champion MID$, to assign new values to strings without altering their lengths. RIGHT$ and LEFT$ have limited meaning because they are subsets of MID$, and they cannot be used on the left side of assignments.

I create a work string with a length of 255. After that, I use MID$ (as the left argument of an assignment statement) to manipulate the work string so that its length never changes. I copy strings into it, work on them, then copy them back out. This work string is my designated garbage.

The most annoying feature about that garbage collection pause is that you can't tell what's going on. <Ctrl>-<Break> doesn't work. For all you know, you have to use <Ctrl>-<Alt>-<Del> or power down/up to get out of your computer's grand mal. What I do is PRINT FRE(0) at a designated location on the screen. I can watch that garbage pile up, and therefore am not alarmed when collection occurs.

Patrick Banchy
New York, New York

In "A Tiger Meets a Dragon" (*BYTE* magazine, December 1983), Dan Rollins offers a solution to the garbage collection problem. When a string variable is assigned a new value by means of a MID$ statement, the characters are replaced at the same location in the string space. Thus, MID$(A$,1) = B$ reuses the space already allocated to A$ and does not create garbage.

David E. Lupo
Moncks Corner, South Carolina

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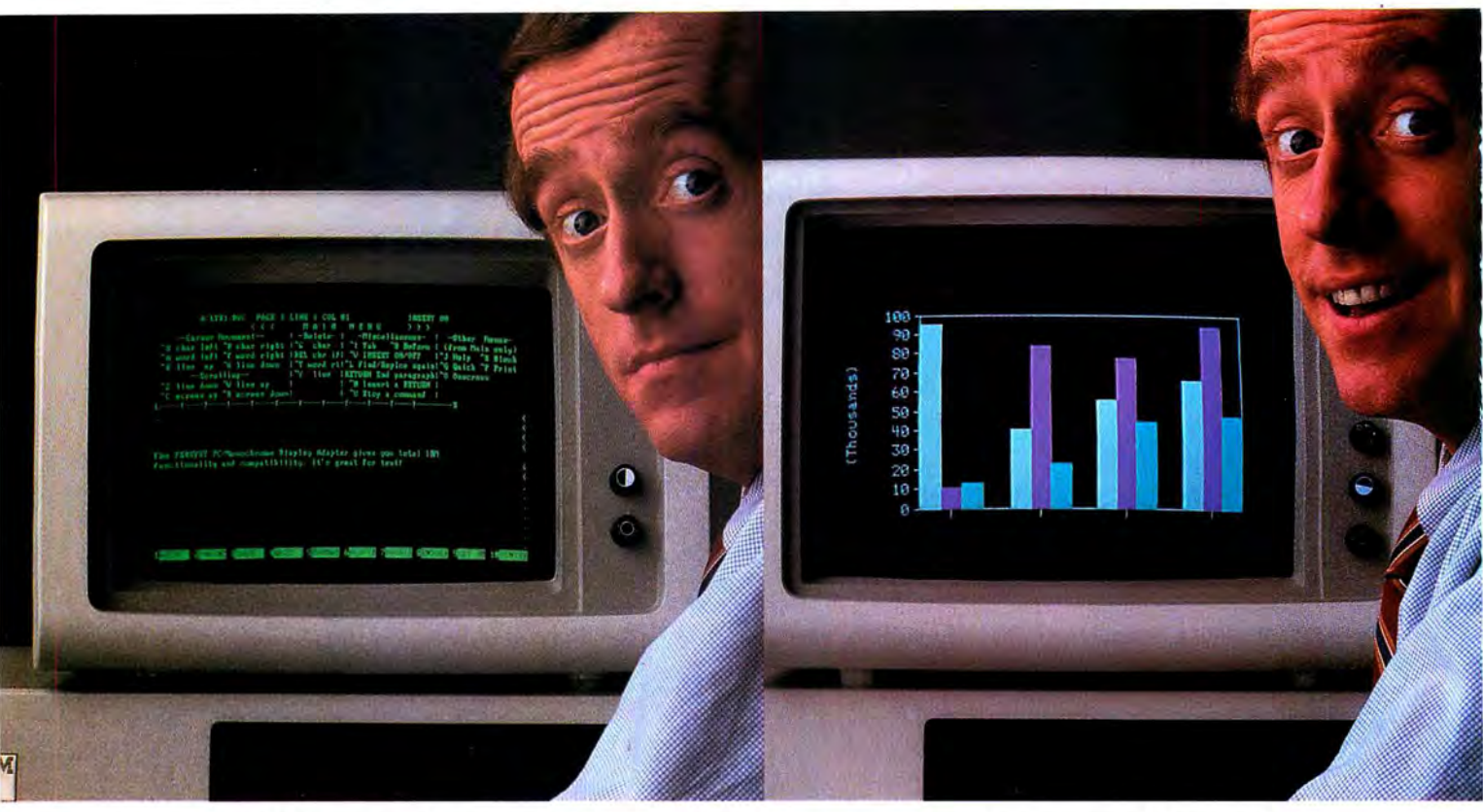

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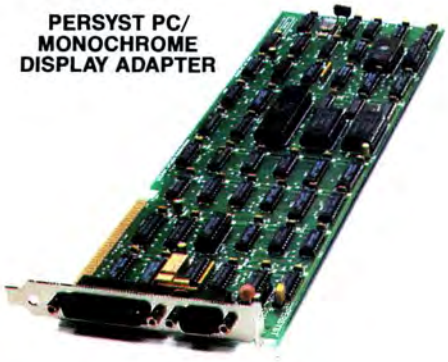

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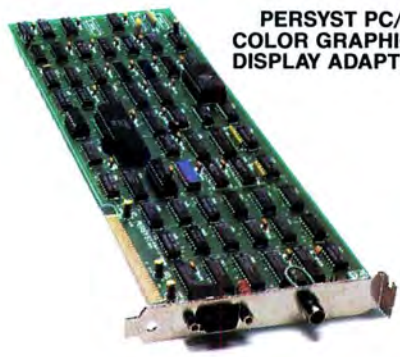

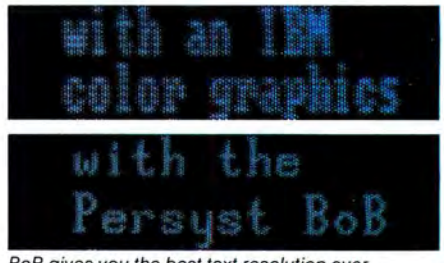

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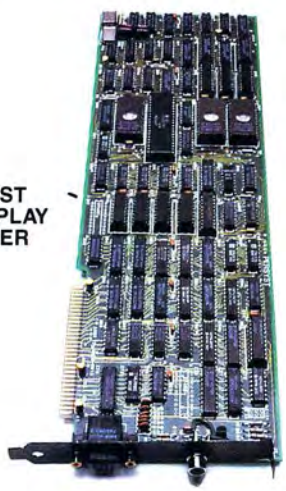

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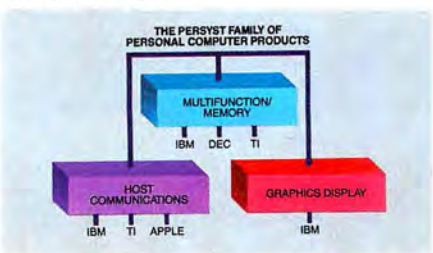

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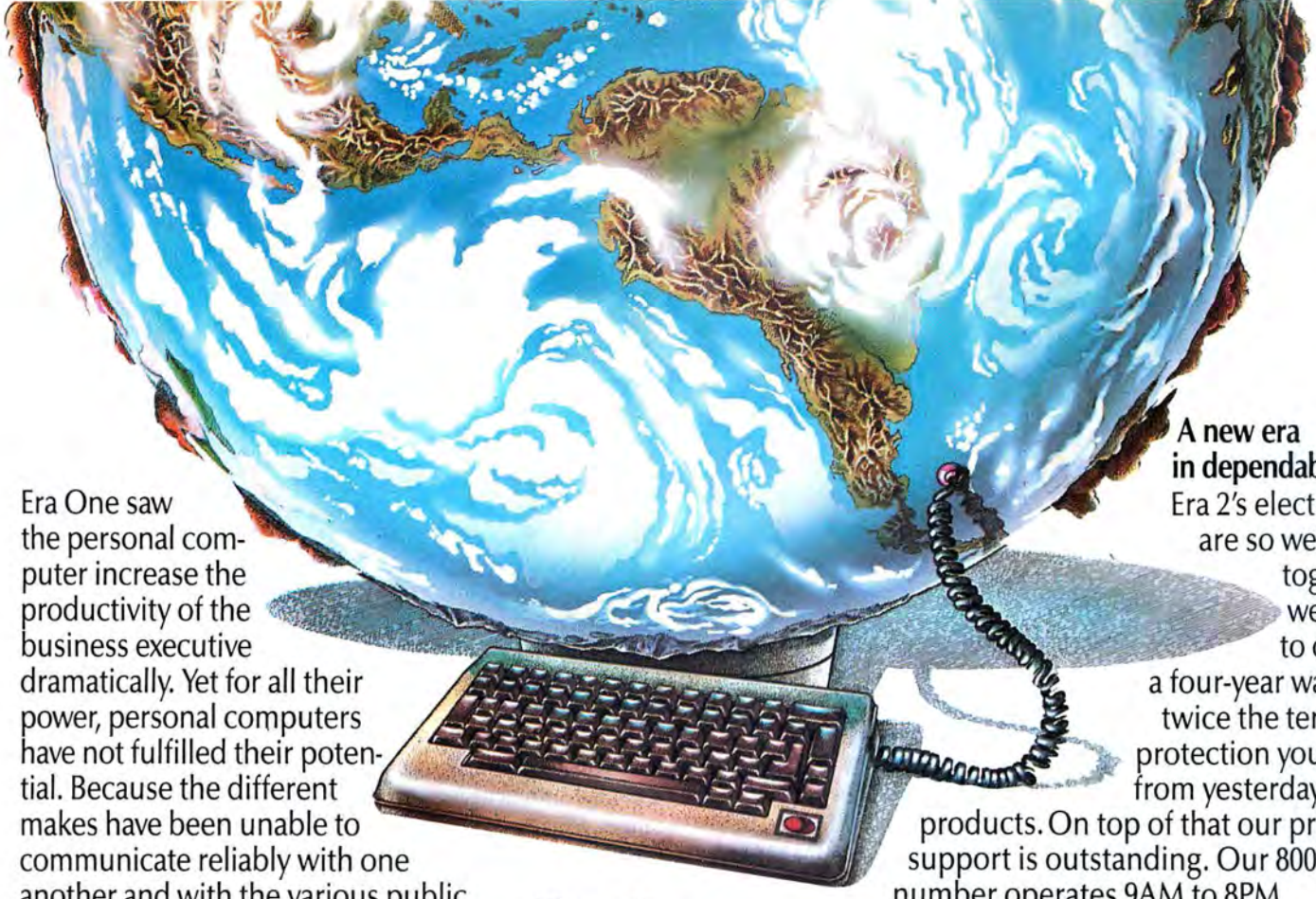

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PC to Go . . .

Harry Miller and Eric Brown

The headlines could have read "IBM Announces a COMPAQ Clone." In the midst of a boom in portable PC-compatible computers, IBM has stepped in with the IBM Portable Personal Computer—the PPC. The PPC is about the same size and weight as the COMPAQ, its greatest portable competitor, and like the COMPAQ features a built-in graphics screen. However, the PPC lacks the COMPAQ's dual screen mode that would allow its screen to emulate the IBM Monochrome Display. Notable features include an amber screen, half-height disk drives, and an XT-size system board that comes with 256K of RAM installed.

In the last six months IBM has deluged the market with a wide range of PC-compatible products. The PC family has quickly grown from the PC and PC XT to include the 3270-PC, XT/370, PCjr, and a local area network (see "Cluster Program"). Amid very little fanfare the family grew even larger with the first showing of the IBM Portable Personal Computer (PPC) February 21st at the Softcon software show held at the Superdome in New Orleans.

Although sketchy news reports had circulated a week before the PPC's release, many Softcon attendees were surprised to stumble upon IBM's first entry into the lucrative portables market. Only a small section of IBM's elaborate show space was devoted to the new PPC, and only a few models were available for demonstration. Still, we managed to borrow a unit for an overnight test.

We had our first chance to evaluate the PPC's portability when we discovered huge crowds in front of the Superdome and not a taxi in sight. There was no choice but to lug the computer for several blocks until we found a cab. And lug is the correct term. Weighing in at 30 pounds and measuring 20 by 17 by 8 inches, the PPC is one of the heaviest portables on the market. Fortunately, IBM includes a canvas carrying bag with the PPC. Although the shoulder strap is thin and not quite up to the task of comfortably handling such a large box, the bag's handle is large and well padded. The PPC itself also has a handle sufficient for carrying the computer short distances. Finally hailing a cab, we were relieved that this first test had ended—the PPC was portable—but just barely.

The PPC uses the same system board as the PC XT, so there is the same tight fit for expansion boards. The system board has eight expansion slots, but the slot on the far right is not supported. The PPC also comes equipped with an IBM Color/Graphics Adapter and a disk drive controller board, each of which takes up a full-length expansion slot. Thus the PPC provides five extra expansion slots, compared with the COMPAQ's three. However, all but one of these slots are by necessity "short slots," since they are located directly behind the disk drive (or drives). Standard, full-length PC adapter boards can only be used in the one long slot.

The short slot problem is only partially amelioriated by the fact that the PPC comes with 256K of random access memory (RAM) and allows memory expansion up to 512K with an IBM memory expansion board. You can configure the PPC to 640K by adding a larger-size expansion board from another manufacturer.

Since the vast majority of expansion boards made for the PC are full size, deciding on the right board for your one precious long slot could be difficult indeed. The lack of either a parallel or serial port (the former is standard on the COMPAQ) for hooking up a modem or a printer is a notable omission. Most likely this was a conscious trade-off on IBM's part to keep the PPC's price below the COMPAQ's. The short slot situation presents a great opportunity for manufacturers of short expansion boards (see "Short Boards for the PPC").

Compatibility

The PPC uses the same proprietary BIOS and BASIC ROM (read only memory) chips as the PC, automatically making it compatible. The COMPAQ and other PC work-alikes must somehow simulate the software contained in those copyrighted ROM chips. According to IBM, the PPC is fully compatible with the PC and PC XT but will not run software, such as *HomeWord*, designed only for the PCjr. A few PC packages that work exclusively under DOS 1.10, such as the BPI accounting packages, also will not run on the PPC.

Faster Phosphors

The Portable Personal Computer uses a built-in, 9-inch amber monitor to display 80 characters by 25 lines of text. The PPC comes with a built-in IBM Color/Graphics Adapter and can therefore display graphics, but like the COMPAQ, in a single color only. Unlike the dual-mode COMPAQ monitor, the PPC's screen cannot emulate the superior resolution of the PC's Monochrome Display. Unfortunately, each character on the PPC's display is broken up into horizontal lines, making each character look like part of the famous IBM logo. Programs that are designed specifically for a monochrome adapter will not run on the PPC.

The PPC's Color/Graphics Adapter can display graphics on an external RGB or composite graphics monitor as well as on the built-in screen. You could install a standard IBM Monochrome Display and Printer Adapter to drive a monochrome monitor, but that would use up the only free full-sized expansion slot. You would also have to get an AC adapter to connect the monochrome monitor's specially cowled AC plug to a standard wall outlet, since the PPC doesn't have the corresponding AC socket.

Amber screens are popular in Europe but are rarely seen with American computers, and the PPC's 9-inch amber display does take a little getting used to. However, it tends to be easier on the eyes than black and white or green displays, particularly if you spend a long time in front of it. Aside from easing the PPC's entry into the ergonomically conscious European market, the amber display helps to offset the limitations of a smaller screen. Because the PPC's amber screen uses a faster phosphor, characters and images linger less on the screen, eliminating the irritating ghosting effect that is common on the COMPAQ.

State of the Art

The PPC's graphics display is approximately equivalent to that of the COMPAQ. Both machines create unappealing or unreadable images when displaying a program designed to take advantage of color in shades of a single color (amber for the PPC, green for the COMPAQ). However, you can inhibit this shading effect with a DOS 2.10 MODE B&W command.

Slimmer Storage

The PPC's 360K, half-height disk drives are the same as those used in the PCjr. They are functionally equivalent to the ones used in the desktop PC, but they take up only half the height. The standard configuration includes only one slim-line disk drive; a second drive is optional and is available for $425.

IBM does not support a hard disk for the PPC at this time, but since the PPC uses the same system board, fan, and power supply as the XT, there is nothing to prevent you from adding a 10- or 20-megabyte, half-height hard disk from another manufacturer instead of adding the second floppy disk drive. In fact, the machine appears designed to accommodate a hard disk. This seems to confirm speculation that IBM will soon release a 20-megabyte, half-height hard disk. The larger power supply and the noisier fan are the same features that COMPAQ incorporated into its original design, anticipating the production of a hard disk machine, the COMPAQ-Plus.

> The PPC uses the same BIOS and BASIC ROM chips as the PC, automatically making it compatible.

To accommodate international distribution, the PPC's universal power supply can use either 120 volts at 60 Hz or the European standard 230 volts at 50 Hz.

And Hold the Applause

Ken Greenberg

IBM's Portable Personal Computer (PPC) has entered the marketplace with something between a bang and a whimper, but PC compatible makers are generally crowing about the legitimacy Big Blue has lent their own portables.

Virtually all the manufacturers contacted by *PC World*—COMPAQ, Eagle, Corona, Columbia, and Kaypro—said that their products are sufficiently distinct from the PPC and are readily available and that the marketplace is diverse enough to enable them to profit from IBM's latest move.

"We seem to benefit every time IBM does something in the marketplace," said Jack White, vice president of sales and marketing for Columbia Data Products. "IBM tends to legitimize whatever they do, so it's only good news when they enter a part of the market we're in." Larry Lotito, marketing vice president for Corona Data Systems, echoed these sentiments. "When IBM announced the XT, they gave credibility to our own hard disk compatible and our sales went up," he said. "I expect something similar to happen with their portable."

IBM's announcement caught no one by surprise. Ron Peterson, product planning vice president for Eagle Computer, considered the introduction "really more a question of when, not if." Sparky Sparks, vice president of sales and service for COMPAQ, said his company foresaw "significant additional competition in our game plan for 1984 and 1985. We've also assumed that the COMPAQ will remain competitive in both function and price."

The compatible makers agree that the PPC is priced competitively and that its standard 256K RAM, expandable to 512K, is a decided plus. But the PPC's poor text resolution (due to its graphics display), uncertain availability, lack of a hard disk drive option, and single half-height floppy disk drive may hamper its success. In addition, most manufacturers don't expect consumers to sit on

their hands while IBM cranks up production. Several suggested that IBM's initial decision to sell directly to corporations rather than through retail outlets will boost sales of portable clones.

Sparks, a one-time IBM sales chief for the PC, said COMPAQ intends to "maintain the same product differentiation" that has made its computer the dominant 16-bit compatible portable on the market. He noted that the COMPAQ's standard printer interface and dual mode display plus the "upgrade capability" of COMPAQ-Plus's hard disk set the company's products apart from the PPC.

Other manufacturers similarly seek to distinguish their products from IBM's latest offering. Like Sparks, Corona's Lotito stressed his portable's "upgrade path"—its capacity for accepting a hard disk. Jack White noted that for its $2995 price, the Columbia VP portable includes two disk drives and 15 software packages. Eagle's Ron Peterson emphasized his firm's commitment to diversification. "Our product strategy is to carry a broad line of products. For that reason, we're not preempted by one product announcement," he said.

Kaypro Corporation spokesperson Margaret Phanes termed the PPC "no threat" to Kaypro's market. "We supply ready-to-use computers, while IBM continues to hide the cost of items that may end up doubling the purchase price," said Phanes, echoing a statement from marketing vice president David Kay. She continued, "We rely on CP/M, so we're not as sensitive to the price wars that occur in the IBM compatible marketplace." Kaypro, which sold more than 100,000 8-bit portables during 1983, plans to release a 16-bit PC XT compatible portable this year.

At least one retailer is convinced that the PPC proves that IBM is now playing catch-up. Brian Leeland, microcomputer hardware product manager for California-based Businessland, noted, "This is the first time IBM has announced a product that follows another product. The PC and PCjr were clearly differentiated and broke some new ground. This breaks very little new ground."

Even so, Leeland feels the PPC will have a salutary effect on the portables market. "It will help some manufacturers and will generally raise the level of competence needed to successfully compete in this market. From now on, the market will be less forgiving," he prophesied.

Don't expect the price of most portables to drop appreciably—at least not until the PPC enters the market in significant numbers. Eagle plans to "reassess its pricing strategy" in light of the PPC's $2795 price tag, although Corona and Columbia intend to hold the line on prices—for now. For COMPAQ, "price takes a back seat to meeting customer needs and providing an adequate supply of machines," according to Sparks. But he hinted that there will be a price reduction for dealers in the near future.

Whatever their price, PC-compatible portables appear to be selling as fast as manufacturers can turn them out. Columbia is shipping 2000 to 3000 units per month, and COMPAQ recorded sales of $52 million during the final quarter of 1983. Corona's sales topped $80 million last year, although the company offered no breakdown on its sales of portables.

Compatible makers are sanguine about IBM's decision to court corporations directly, since this leaves the retail market open to their products. "Dealers are looking to decrease their dependency on IBM," Peterson observed. "They see a strong need to stock Eagles and COMPAQs."

Businessland's Leeland agreed. "The PPC definitely puts the spotlight on the portable arena, but several systems—especially the COMPAQ and the Eagle Spirit XL—compare very well. Buyers are intelligent enough to look twice before making the move to a new product, even IBM's."

Cluster Program

Along with the unveiling of the Portable Personal Computer in late February, IBM announced that a hardware and software scheme for connecting PCs, XTs, PPCs, and PCjrs in a "cluster" would be available in May. The scheme, called the IBM Personal Computer Cluster Program, supports the connection of up to 64 computers in a bus-structured network.

Each computer connected to the network requires a Cluster Program license and a Personal Computer Cluster Adapter. The Cluster Adapter allows each computer to be connected to the main cable of the network and have a unique station address that is set by switches on the Cluster Adapter. (At this point only entry-level PCjrs using an external Cluster Attachment can join the network. In its initial release, the Cluster Attachment cannot accommodate a PCjr with an installed disk drive, internal modem, or parallel printer attachment. IBM is promising that future versions of the Cluster Program will accommodate PCjrs of any configuration.)

The Cluster Program allows computers in the network to send messages or files to each other, and to share expensive resources, such as letter quality printers. One XT or a PC with a hard disk drive Expansion Unit can be designated as a disk server, allowing other computer stations to share its disk space. Thus, some of the computers in the network could be run without any disk drives of their own. Each remote station can have its own private volume on the disk server's hard disk, and all stations can have access to a shared public volume. Both private and public hard disk volumes would appear as additional disk drives to computers on the cluster.

The Personal Computer Cluster Program is essentially a baseband (direct transmission) bus-structured network that transmits data at 375K bits per second over a 75-ohm main coaxial cable. The cable connections use standard BNC connectors. The main coaxial cable can be a maximum of 3280 feet long, and the cables that connect the Cluster Adapter in each remote computer to the main cable have a maximum length of 16 feet. The software transmits data in messages and uses a carrier sense multiple access with collision avoidance (CSMA/CA) scheme to keep the messages straight.

The data transmission speed of the Cluster Program is relatively slow, which leads some industry observers to speculate that this program is not the definitive local area network software expected from IBM.

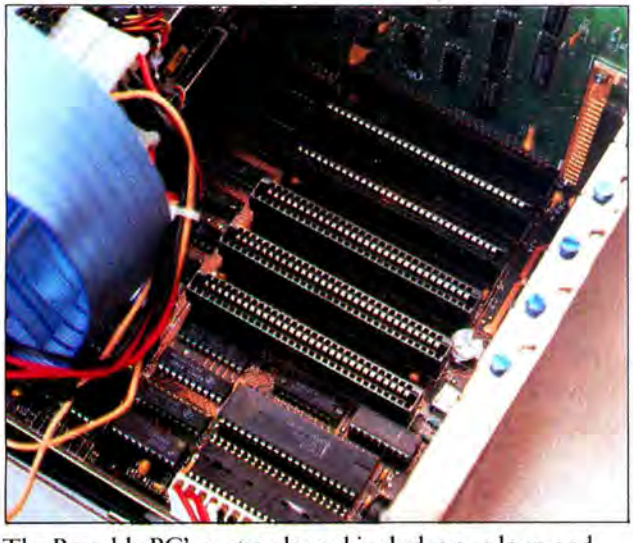
Flip-Top Keyboard

The keyboard layout is identical to that of the PC's bulkier and heavier keyboard and shares the latter's tactile and audible feedback. The PPC keyboard is much lighter than the PC's keyboard, although it is heavier than the COMPAQ's. It is carved out on top where the cord attaches, so there is space for the coiled cord when the keyboard is folded up against the monitor. The cord plugs into a modular phone-type jack a third of the way up on the front of the computer—which gives the face of the PPC the Japanese-car-dashboard look reminiscent of the Osborne 1.

This is not as dramatic a design innovation as it might at first appear. Inside the PPC, a wire from the phone jack winds its way to the back of the computer and connects with a standard keyboard jack. Although we can't think of a practical reason to do so, you could plug your standard PC keyboard into the keyboard jack on the back of the PPC.

Because the PPC cord is not taut and does not spool into the interior of the computer when tension is released, the PPC's cord can stretch further than the COMPAQ's. Although this approach avoids the constant tugging at the retractable keyboard cord that COMPAQ users have to cope with, the PPC cord is a distraction

The lowered door opens to reveal the Portable PC's back plane.



The Portable PC's system board includes one long and four short expansion slots.

that sticks straight up out of the groove in the keyboard. In certain positions, the cord can get in your way as you type. Also, the modular phone plug that pops into the console is not as sturdy as most keyboard attachments and could eventually snap off, disabling the computer.

The best feature of the PPC's keyboard is the way it folds up into the computer. The four spring-loaded pegs (two at the top and two at the bottom) allow you to detach the keyboard at the top and swing it down, leaving the bottom pegs attached. Although the keyboard is only loosely held in this manner, the pegs still help provide stability. This feature solves the "hotel room desk space" dilemma. If you are working on a narrow desk, you won't have to balance the keyboard on your knees or place it on top of the computer.

Durability

IBM's portable seems to have less protection from the rigors of travel than the COMPAQ. The PPC is easier to get into than the COMPAQ: unscrewing six screws on the front frees the bulk of the case from the front bezel and chassis; unscrewing another three allows the removal of the cage that covers the expansion boards. The cage is made of thinner metal than the COMPAQ and feels almost flimsy by comparison. There are no visible shock mounts under the disk drives.

Short Boards and Funny Cords

Just as the XT took a bite out of the expansion hard disk industry, the PPC is clearly aimed at heading off, somewhat belatedly, competition in the PC-compatible portable field, notably from the hugely successful COMPAQ. (See "And Hold the Applause"). The IBM name alone may be enough to cut into COMPAQ's share of the portable market. How big of a cut it makes depends largely on how consumers react to the PPC's amber screen, lack of full-size expansion slots, and less-than-laudable keyboard cable arrangement. It also depends on how many units IBM can deliver to dealers. IBM is already hampered with parts shortages due to the enormous demand for PCs and the introduction of the other members of the PC family.

In many ways the PPC seems like a hodgepodge of parts and features taken from other computers. The system board is the same as that found on the XT, the half-height drives are the same as the PCjr's, and the keyboard is like the PC's. The size, weight, screen area, and graphics capability are obviously an imitation of the COMPAQ. And yet, despite a few shortcomings (short boards and funny cords), the pieces come together well. It's a useful and reliable machine at a reasonable price.

Harry Miller is the Editor of PC World. *Eric Brown is an Assistant Editor of* PC World.

IBM Portable Personal Computer
IBM
Systems Products Division
P.O. Box 2910
Delray Beach, FL 33444
305/998-6048
List price: $2795

Short Boards for the PPC

The following is a list of expansion boards that will fit in the short slots of the PPC.

Multifunction Boards

Clock Plus Printer Port
Prelude Computer Corp.
20380 Town Center Ln. #217
Cupertino, CA 95014
408/257-6033
Features: parallel port, clock/calendar, spooler
List price: $149

Clock Plus Serial Port
Prelude Computer Corp.
20380 Town Center Ln. #217
Cupertino, CA 95014
408/257-6033
Features: serial port, clock/calendar, spooler
List price: $159

Cygnus
Titan Technologies, Inc.
P.O. Box 8050
Ann Arbor, MI 48107
313/662-8542
Features: serial or parallel port, game port, clock/calendar,
List price: parallel port $199, serial port $299

IDEAmini
IDEAssociates
7 Oak Park Dr.
Bedford, MA 01730
617/275-4430
Features: disk emulator, spooler
Options: one or two serial ports, parallel port, clock/calendar
List price: with one option $175

PC Clock I/O P/N 0240
Vista Computer Co., Inc.
1317 E. Edinger
Santa Ana, CA 92705
714/953-0523
Features: serial port, parallel port, clock/calendar, spooler
List price: $139

Persyst Uniport
Personal Systems Technology, Inc.
15801 Rockfield Blvd., Ste. A
Irvine, CA 92714
714/859-8871
Features: parallel port, clock/calendar
List price: $155

PIC-1
Apstek, Inc.
2636 Walnut Hill Ln. #335
Dallas, TX 75229
214/357-5288
Features: parallel port, clock/calendar
List price: $129

Quad I/O
Quadram Corp.
4355 International Blvd.
Norcross, GA 30093
404/923-6666
Features: serial port, parallel port, game port, disk emulator, spooler
List price: $245, with second serial port $285

Super I/O
STB Systems, Inc.
601 N. Glenville #125
Richardson, TX 75081
214/234-8750
Features: serial port, parallel port, game port, clock/calendar, accelerator
List price: $229

Wave
Tecmar
6225 Cochran Rd.
Solon, OH 44139
216/349-0600
Features: up to 256K, disk emulator, spooler
List price: 64K $299, 128K $379, 256K $499

Port Boards

Asynchronous Communications Adapter
IBM
Systems Products Division
P.O. Box 1328
Boca Raton, FL 33432
800/447-4700, 800/447-0890 Alaska and Hawaii, 800/322-4400 Illinois
Features: serial port
List price: $120

Com Card, Dual Com Card
ZenTek Corp.
455 Whitepine Dr.
Salt Lake City, UT 84107
801/263-3925
Features: Com Card, serial port; Dual Com Card, two serial ports
List price: Com Card $65, Dual Com Card $85

Printer Adapter Card
IBM
Systems Products Division
P.O. Box 1328
Boca Raton, FL 33432
800/447-4700, 800/447-0890 Alaska and Hawaii, 800/322-4400 Illinois
Features: parallel port
List price: $150

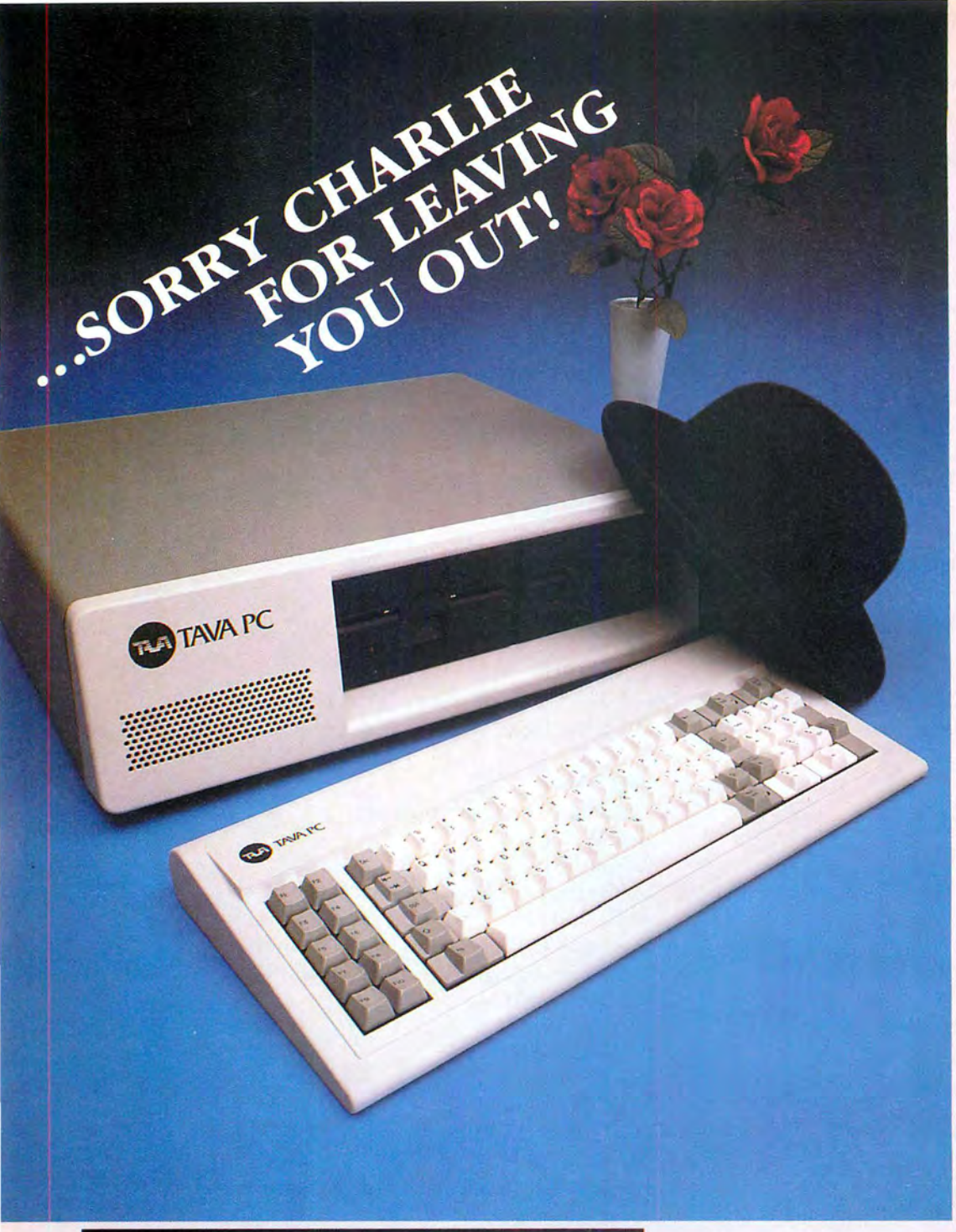
Miscellaneous

Discortex
Discortex Corp.
87 Bethpage Rd.
Hicksville, NY 11801
516/935-5538
Features: color transformer
List price: $295

GPIB-PC
National Instruments
12109 Technology Blvd.
Austin, TX 78727
512/250-9119
Features: IEEE-488 bus for up to 15 devices
List price: $385

INFOMATE 212PC
Cermetek Microelectronics, Inc.
1308 Borregas Ave.
P.O. Box 3565
Sunnyvale, CA 94089
408/734-8150
Features: 1200 bps modem with auto-answer and auto-dialing, and extra serial port
List price: $480

PC Modem Half Card
Ven-Tel, Inc.
2342 Walsh Ave.
Santa Clara, CA 95051
408/727-5721
Features: 1200 bps modem with auto-answer and auto-dialing
List price: $549



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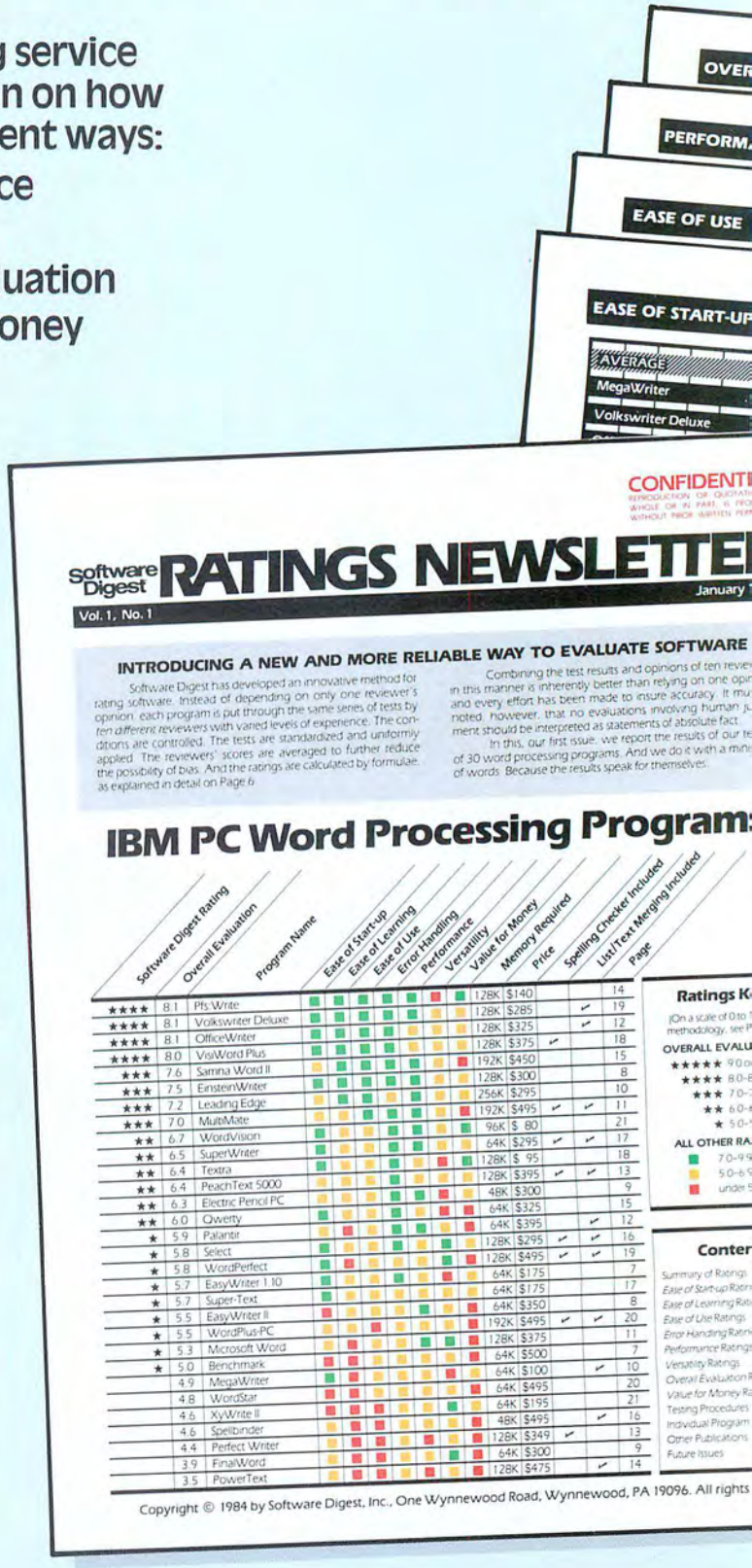

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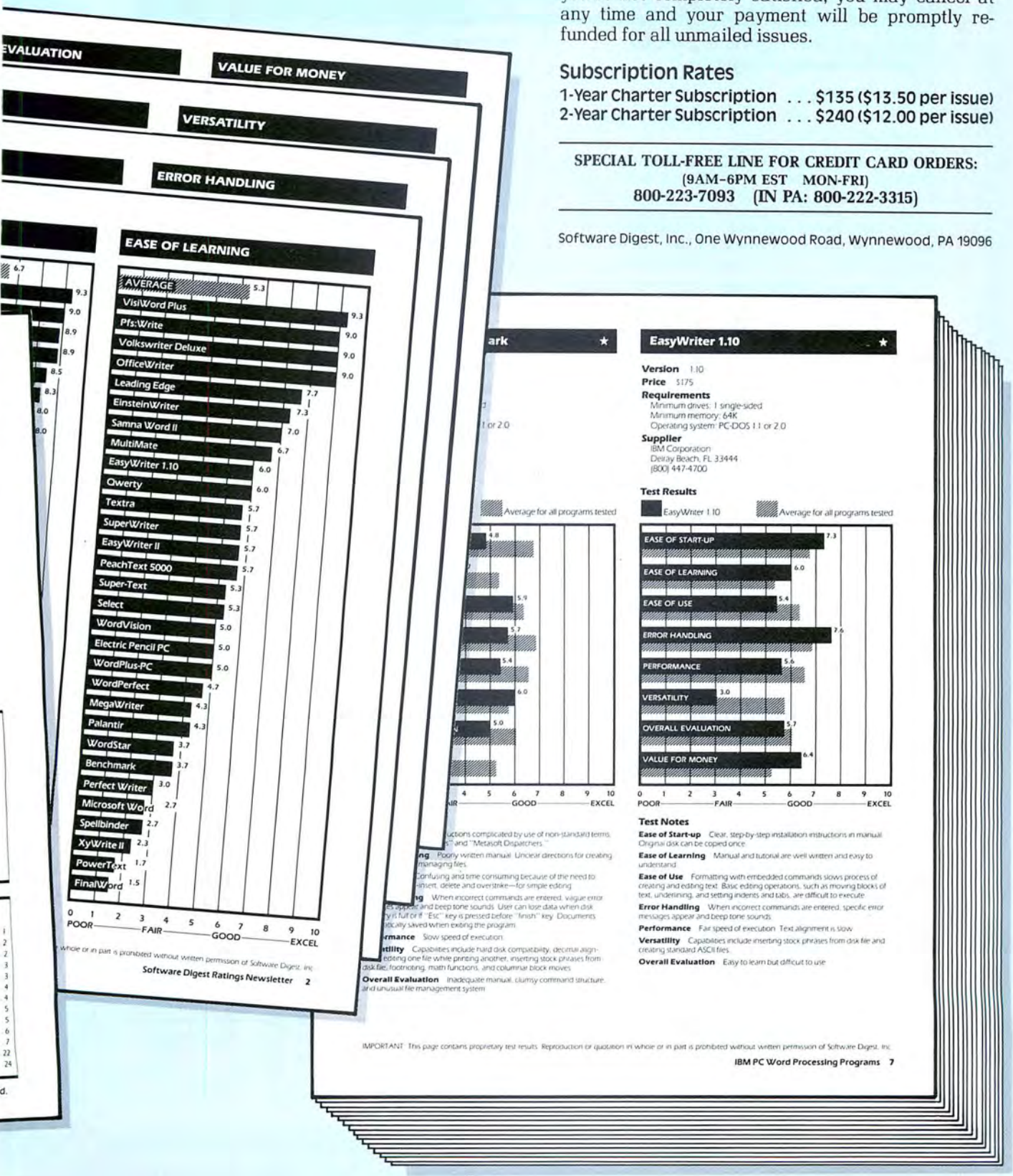

Want to know *how* Software Digest ratings are determined? Please turn the page ►

Here's how Software Digest tested and rated 30 IBM PC word processing programs—a project that took two months and cost over $100,000. This was followed by the testing of data management programs with an even more comprehensive series of tests designed just for that application. Each category of software will be tested with the same methodical thoroughness, consistency and impartiality.

Reproduced from the first issue of the Software Digest RATINGS NEWSLETTER.

THE SOFTWARE DIGEST RATINGS METHODOLOGY

Testing and Rating Procedures for Word Processing Programs

Testing Procedures

Our testing procedures for word processing programs consisted of three phases:

In the first phase (INSTALLATION), the reviewers installed the program following the instructions given by the software supplier. This generally included making one or more backup copies of the master disk, adding the operating system to the program disk, creating a data disk, and selecting the correct type of monitor (color or monochrome) and printer. The installation procedure was timed and comments noted.

During the second phase (THE "2-HOUR TEST"), reviewers were given exactly two hours to learn how to edit a simple letter with the program, plus whatever else could be learned within that period. This was the only phase with a specific time limit. A two-hour limit was chosen because it is about the maximum time a typical user would spend with a program before trying to use it.

In the final phase (EDITING/PRINTING), reviewers were given a prepared disk file containing a standard one-page letter with text to be changed, deleted, moved, copied, centered, underlined, and then printed. As with the installation procedure, editing and printing were timed. Thus, the test was designed to answer the question: "After spending two hours to learn this word processing program, how difficult and time consuming is it to produce a typical business letter?"

At the end of each phase, reviewers reported their observations on a detailed report form. Individual scores were recorded for the ease of performing a typical range of editing functions, as well as ease of installation, ease of learning, ease of use, speed of execution, error messages, error resistance, and overall evaluation.

Rating Procedures

Information provided by the tests was statistically summarized in eight rating categories described below. Each category had a possible score between 0 and 10 (10 being the highest rating).

Ease of Start-up Ease of getting the program "up and running." It included the average time required for installation (inverted and adjusted for upper and lower limits) and the average Ease of Installation score.

Ease of Start-up = ((10 − ((Installation Time − 5) / 45 * 10)) + Ease of Installation) / 2

Ease of Learning The average Ease of Learning score. It was a measure of how simple it was to learn to use the program, as determined by each reviewer.

Ease of Learning = Total Ease of Learning Scores / 10

Ease of Use Statistical mean of the average time required to edit and print the standard letter (inverted and adjusted for upper and lower limits), the average Ease of Use score, and the average Functional score (composed of a series of editing procedure scores).

Ease of Use = ((10 − ((Minutes to Edit − 15) / 105 * 10)) + Functional Score + Ease of Use) / 3

Error Handling A weighted composite of reviewer scores (50%) and our Technical Department's error-testing procedures (50%). Reviewer scores included whether the program "froze" (i.e., refused to respond to further user commands), whether data was lost, and the average scores for Error Messages and Error Resistance. The Technical Department procedures included tests for how the program handled specific situations: disk full, disk directory full, attempting to read a disk with the drive door open, reading and writing to a non-existent drive (e.g., Q:), writing to a write-protected disk, system memory full, printer cable disconnected, and printer turned off. Each program was also checked to see if it prompted users when they attempted to leave the system before saving the current text to disk.

Error Handling = (Freeze + Data Lost + Error Messages + Error Resistance + (4 * Lab Score)) / 8

Performance Statistical mean of the average Execution Speed score and the average letter score (i.e., how well the reviewers were able to correctly edit and print the final copy of the letter).

Performance = (Execution Speed + Letter Score) / 2

Versatility The program's power, above and beyond simple word processing functions, based on a checklist of 20 advanced features. One point was given for each of the 20 features on the following list which the program possessed, and the total was divided by two to place it on a 10-point scale.

Versatility = (Five or more printers specifically supported +
Hard disk compatibility +
User can reassign keys or build macro commands +
Shows preview of printing +
Decimal alignment +
Can edit one file while printing another +
Can insert stock phrases from disk file +
Deletions can be restored +
Creates standard ASCII files +
Split screens or windows +
Multicolumn formatting +
Virtual memory +
Footnoting capability +
Mouse compatible +
Math capability +
Index and/or table of contents creation +
Columnar block moves +
Soft hyphenation +
Text can be more than 80 columns wide +
Print selected page or range of pages) / 2

Overall Evaluation A weighted average of all of the preceding ratings and the average Overall Evaluation score, as follows:

Overall Evaluation = ((2 * Ease of Use) + Ease of Start-up + (2 * Ease of Learning) + Performance + (2 * Error Handling) + Versatility + (2 * Overall Evaluation)) / 11

Value for Money An indication of what to expect for your money. The two variables were the Overall Evaluation rating and the program price. For the purpose of fair comparison, the retail price of each program was adjusted by subtracting $50 for each major accessory program included (such as list/text merge and spelling checker programs). These accessory programs were not tested and, therefore, played no part in the reviewer scores.

Value for Money = (Overall Evaluation + (10 − (Adjusted Price − 50) / 45)) / 2

For more information about The Ratings Newsletter, please refer to the preceding two pages.

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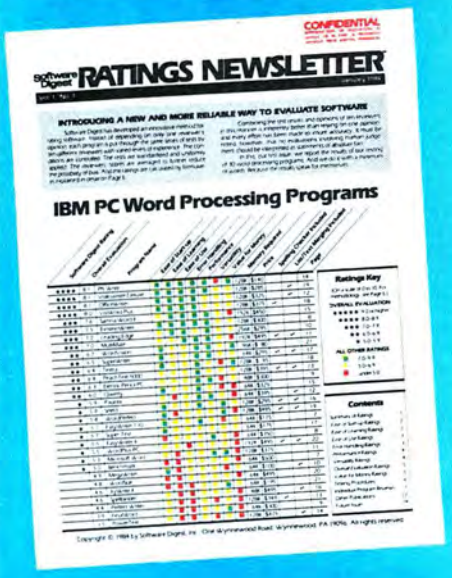
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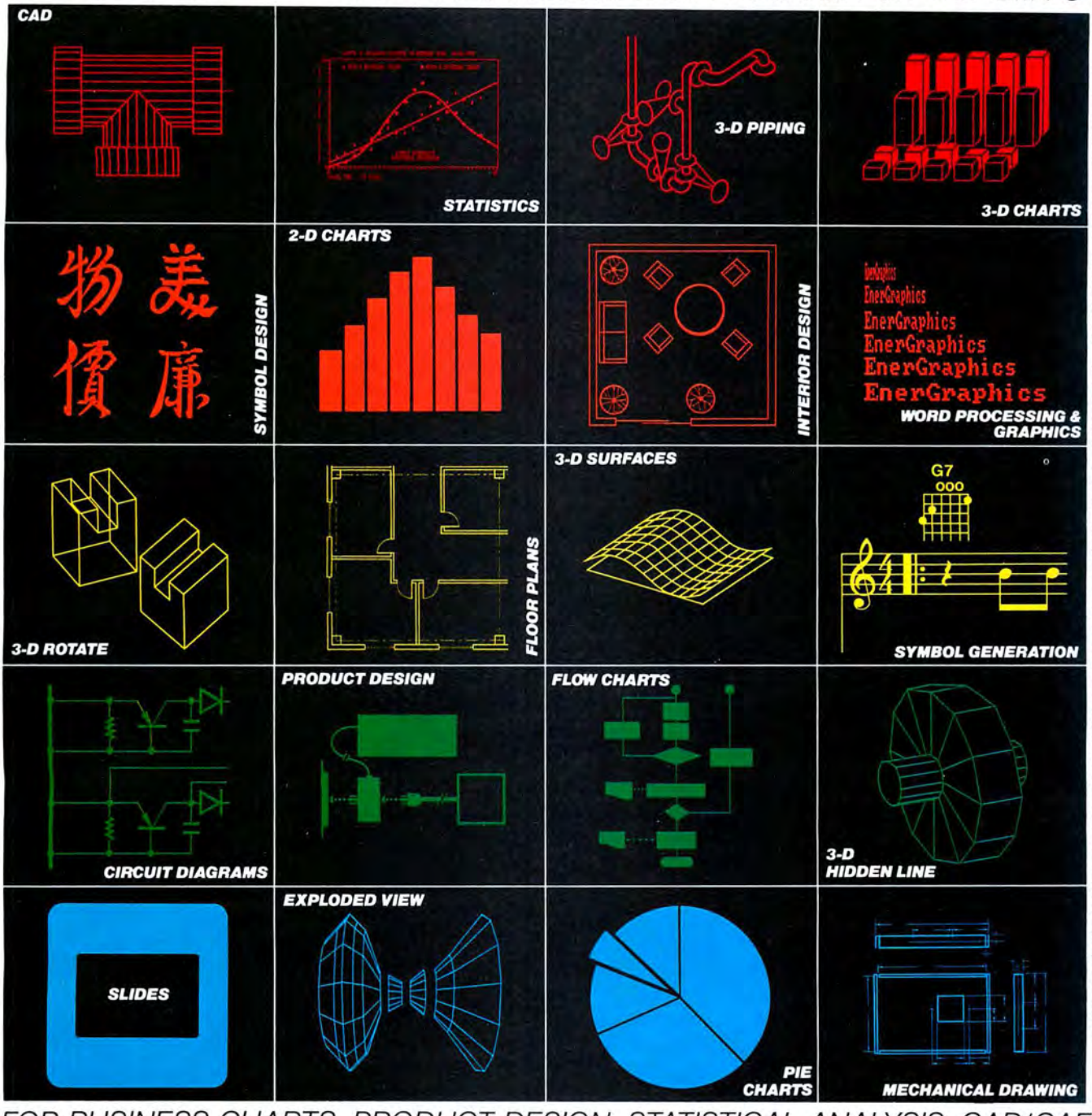

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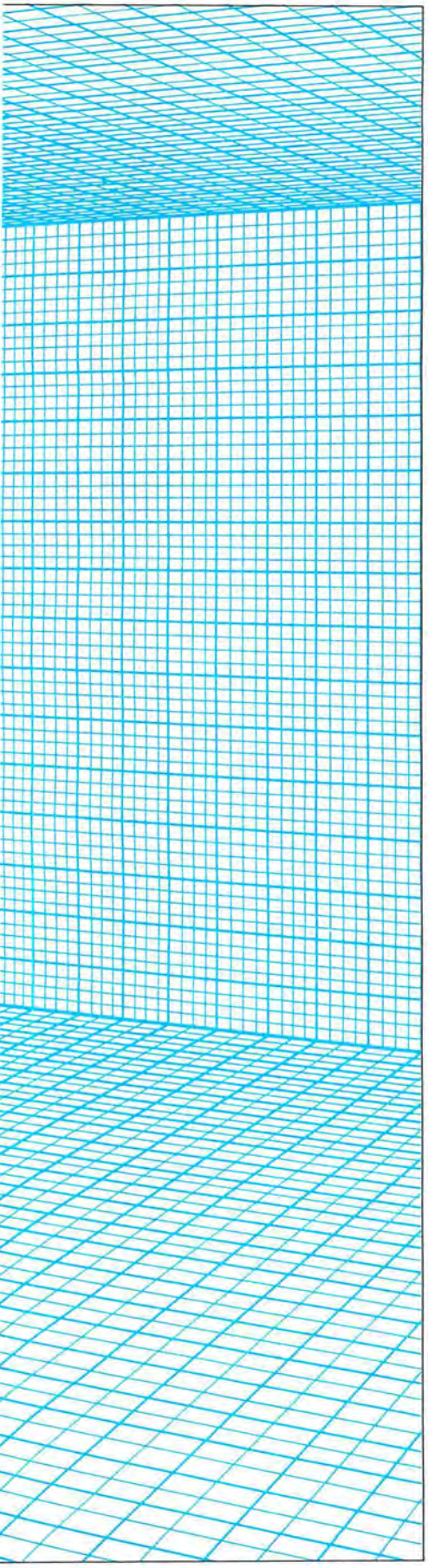


The Microcom Agreement

The Microcom Networking Protocol is emerging as a communications standard that brings mainframe-style data and file transfer to the PC.

Gregory Pearson

Using a PC to communicate with another PC over a telephone line can be an exercise in frustration. Not only must you deal with the limitations and idiosyncracies of your own communications system—PC, modem, and software—you must also worry about those of the receiving system and the telephone line. Does the other PC have enough internal memory to hold the transmitted file (or is its communications software smart enough to send the data to a disk file when the internal memory is full)? Can its modem handle a 1200 bps transmission? Is the noise on the telephone line so great that your file might become garbled and need to be sent over and over again? In such a case, will your communications software tell you what part of the file was mangled? Is the other PC running under a different operating system? Worse yet, is it using different communications software?

PC-to-PC communications are enough of a headache. When an IBM PC tries to talk with a different computer, such as an Apple Lisa or an IBM mainframe, the headache turns into a migraine. The primary concern is that data not become corrupted due to hardware or software incompatibilities. Having the same communications package at both ends of the line does not always ensure uncorrupted communications. Many popular communications packages recognize differences in software but not in hardware. Thus, two different computers using *Smartcom* may be incapable of communicating.

Until recently, data communications for the PC meant using a package that forced the computer to work mostly as a dumb terminal for a remote mini or mainframe computer. Going beyond that simple kind of communication has been possible only with software packages that provide error-correcting file transfer techniques, such as those used in the Xmodem protocol. But the proliferation of protocols, not to mention operating systems and microprocessors, has thus far precluded the adoption of a standard file transfer method.

Enter Microcom

The Microcom Networking Protocol (MNP) is a file transfer technique that not only accounts for hardware and operating system differences but also provides sophisticated error

checking. File exchanges are thus possible between almost any computers using an MNP-based communications package. MNP also supports popular features such as electronic mail, terminal emulation, and access to mainframe editors.

Developed by Microcom of Norwood, Massachusetts, MNP can be licensed by any communications software vendor for a nominal fee. MNP has already been adopted by IBM for its *Personal Communications Manager* software (developed by Microcom) for the PC, XT, and PCjr. Other companies such as Apple, Victor, Tandy, VisiCorp, Lotus Development, and Dow Jones have adopted MNP, along with such telecommunications giants as GTE Telenet, MCI, British Telecom, and Uninet.

Protocols

Among human beings, protocol is the etiquette that acknowledges another person's rank or status. The handshake, the doffed hat, and the placement on a dais are all expressions of protocol—the agreed-upon rules by which we recognize and relate to one another. A communications protocol is similar; it is a set of rules that defines how computers interact. For two computers to transfer files successfully, they must observe the same protocol—the same set of rules. Typically, a protocol specifies when to send a message, how to format the information in the message, and, at the other end, how to acknowledge the receipt of the message.

Simple, physical-level protocols are concerned only with hardware configurations. For example, in a PC-to-PC communication each computer is physically connected to a modem; both sides use modems to convert digital information to analog form (for transmission over a telephone line) and then back to digital. Establishing this basic physical connection between two computers requires that a particular series of steps be followed.

The originating modem takes the telephone "off the hook" electronically and waits for a dial tone. The dial tone tells the modem it can transmit the telephone number representing the receiving modem's electronic address. This number is formatted as a series of pulses and is sent out over the telephone line. The receiving modem senses the incoming number as a relatively high voltage (the kind that would normally cause a phone to ring) and interprets this as a request to establish a connection. It goes off the hook and transmits a "connected" message to the transmitting modem. At that point, as specified in the protocol, hellos are exchanged by both sides—the connection is made.

All of this works because both modems use the same protocol. Today these basic connect protocols are fairly standard, particularly for the low-speed, asynchronous (intermittent operation) Bell 103 and 212A modems that are commonly used on the PC. But as communications becomes more complex and involves dissimilar machines and file formats, protocols must, in turn, become increasingly sophisticated.

Connecting two computers is only a small part of the communications work necessary for accurate data transfer. Telephone lines are often noisy, and errors can crop up in transmitted data. These errors must be detected and corrected. The transmission rate must be paced so that the recipient is not flooded with data. In addition, information about each computer's file system must be swapped and file movement and manipulation must be defined. These

Seven Layers of Protocol

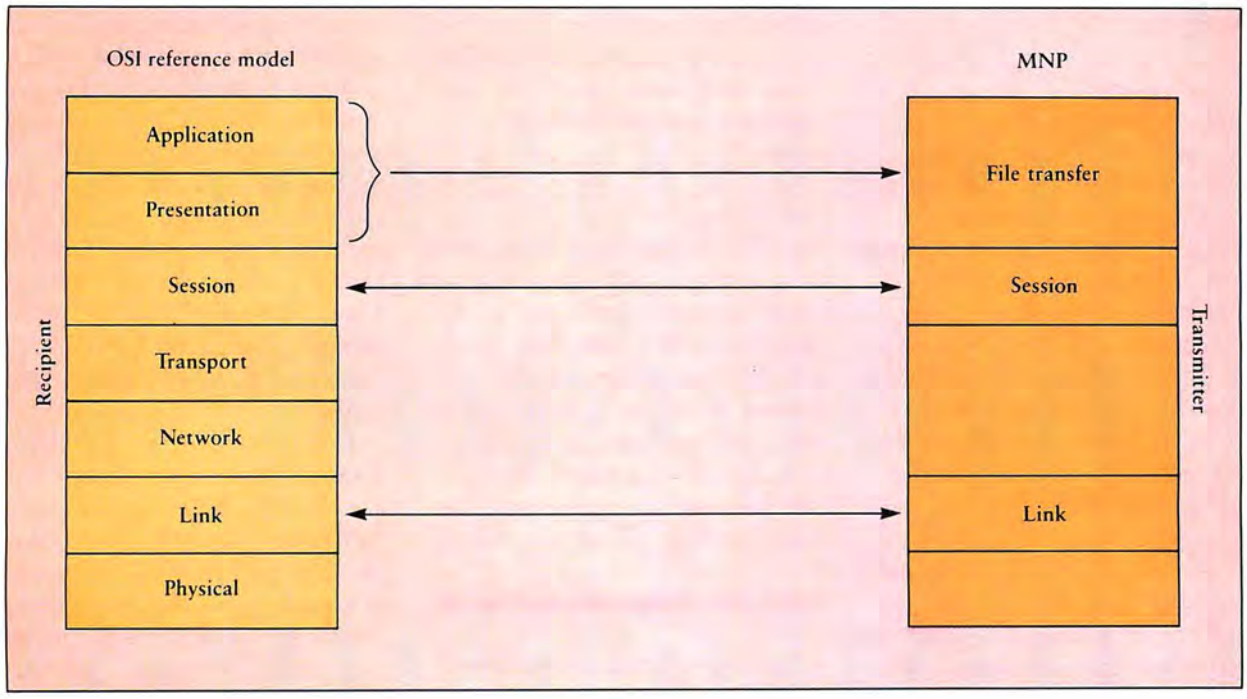
The International Standards Organization Model for Open Systems Interconnection (see figure) is made up of seven layers of protocol. Each layer provides a subset of services to the overall set of functions.

Physical link layer. Controls the electrical and mechanical aspects of establishing, maintaining, and disconnecting the physical medium for transmitting data. This layer includes hardware, such as modems, the RS-232C serial port, and communications lines, as well as systems software to drive the hardware.

Data link layer. Sets up a communications path (or channel) and manages access to and use of that channel. The data link frames the data in the transmitted messages, assures the proper sequence of transmitted information, and checks the integrity of received messages. That is, the data link protocol determines what information must precede (e.g., start bits) or follow (e.g., stop bits) a frame or block of data.

Network control layer. Addresses and routes messages between communicating devices; it controls the flow of messages.

Transport layer. Controls the communications session once the path has been established. The transport layer allows devices to exchange data sequentially and reliably, no matter which systems are communicating or where they are.



Session control layer. Provides the establishment and termination of connections, end-to-end session data unit control, dialogue control, message-unit flow control, signaling nonrecoverable errors, and other services. The session control layer bridges the gap between the services of the transport layer and the logical functions running under the operating system in a communicating node.

Presentation control layer. Translates encoded data that has been transmitted and converts it into display formats that can be used by terminal screens or printers. The presentation layer also provides data compaction or expansion, data encryption and decryption, data structure (for file transfer), and command translation (for virtual terminals). This level puts the data into forms that can be understood and manipulated by the user. It also includes such services as character code translation (e.g., ASCII to EBCDIC) and terminal emulation.

Applications or user layer. Supports user and applications tasks and systems management. Resource sharing, file transfers, remote file access, data base management, and network management are examples of applications provided at this level.

The Microcom Networking Protocol (MNP) is modeled directly after the OSI model. It uses a basic, physical-level connection, although it does nothing to help the physical level along. The services at the link layer are exactly comparable. The network and transport layers exist in MNP but are essentially null. The MNP session layer corresponds directly to the OSI model services. Finally, MNP's file transfer layer encompasses services generally found in the application and presentation layers of the OSI model.

concerns go beyond physical-level protocols into the realm of complex communications protocols. It is this territory that MNP covers.

Protocol Layers

Many mainframe communications packages have been designed in a layered fashion like the Open System Interconnection (OSI) Reference Model developed by the International Standards Organization (see "Seven Layers of Protocol"). The separate functions that comprise communications are divided into seven discrete sections in the OSI model. MNP mirrors this structured, modular approach, although it uses only three layers to OSI's seven.

The OSI approach is not unlike that taken when writing a large and complicated computer program. Relatively simple modules are combined to perform a series of complex functions. Changes in one module may not drastically affect another, as long as certain parts of the module's code remain the same.

In the case of MNP, a similar structure is used. Each layer is relatively isolated and provides a specific service. If something forces a change in a layer (for example, if the MNP is modified for use on a new computer), the change is confined to that layer. The layer's standard interfaces to other layers remain unchanged.

In addition to ensuring machine portability, MNP's structure allows services provided by one layer to support those in the layer above. This accumulation of services is in a sense passed upward, from protocol to protocol, to the applications program. For example, the bottom layer is the physical protocol, which takes care of the electrical connection. That electrical connection service supports the link protocol layer by keeping the messages that flow over that connection straight. With the electrical connection established and the messages straight, the session layer is free to describe the type of information being transmitted or the originator's name and electronic address. The protocols are triggered sequentially from the bottom (physical) to the top (file transfer). In all, MNP defines three unique protocols: the link, the session, and the file protocols.

Link Protocol

The MNP link protocol is responsible for providing reliable, controlled data transmission over a medium (a telephone line) that is inherently noisy and likely to cause errors. Once a physical connection is established between two machines, the link protocol acts as a negotiator, getting both computers to agree on the nature of the link: Should it be half- or full-duplex? (Half-duplex communications allows data to flow in both directions, but in only one direction at a time. Full duplex allows data to flow in both directions simultaneously.) How many data messages can be sent before confirmation is needed? How much data can be contained in a single data message?

> As communications becomes more complex and involves dissimilar machines and file formats, protocols become increasingly sophisticated.

When these values have been determined, the link protocol initiates data transfer, all the while pacing the flow of data and, if necessary, retransmitting data messages that contain errors due to telephone line noise. It is in the detection and correction of these errors that the MNP link protocol distinguishes itself.

Using techniques that are common in mainframe synchronous (continuous) communications, the MNP link protocol allows blocks of data (as opposed to individual bytes) to be sent asynchronously (intermittently) down the line. Data transfer is faster, because the ratio of data to control characters regulating the transfer is higher. Control is possible because of a mainframe-like "framing" technique in which a block of data is capped on both ends with specific codes.

As Figure 1 illustrates, in MNP data transfers, a block of data is prefaced by three bytes that act as a "start flag." The SYN (synchronous idle) byte tells the receiving computer that a message is about to arrive; the combination of DLE (data link escape) and STX (start of text) bytes essentially announces that everything else that follows is part of the message. These three bytes designate the beginning of a frame.

What comes next is a "header," a link protocol message that describes the user data. The link data header contains protocol control data and performs such functions as identifying itself as a link data message and providing a message sequence number to distinguish it from other messages. The next portion of the message is the session protocol header, which provides further information about the transmitted user data. The "stop flag" bytes, DLE and ETX (end of text), signify that the user data has passed and that the next two bytes will be the frame check sequence.

The frame check is performed by cyclic redundancy checking (CRC). All the binary values that represent data are run through a polynomial expression and divided by a constant; this is done on both ends of the communications link. The resulting remainders are compared, and if they match, the data block has been trans-

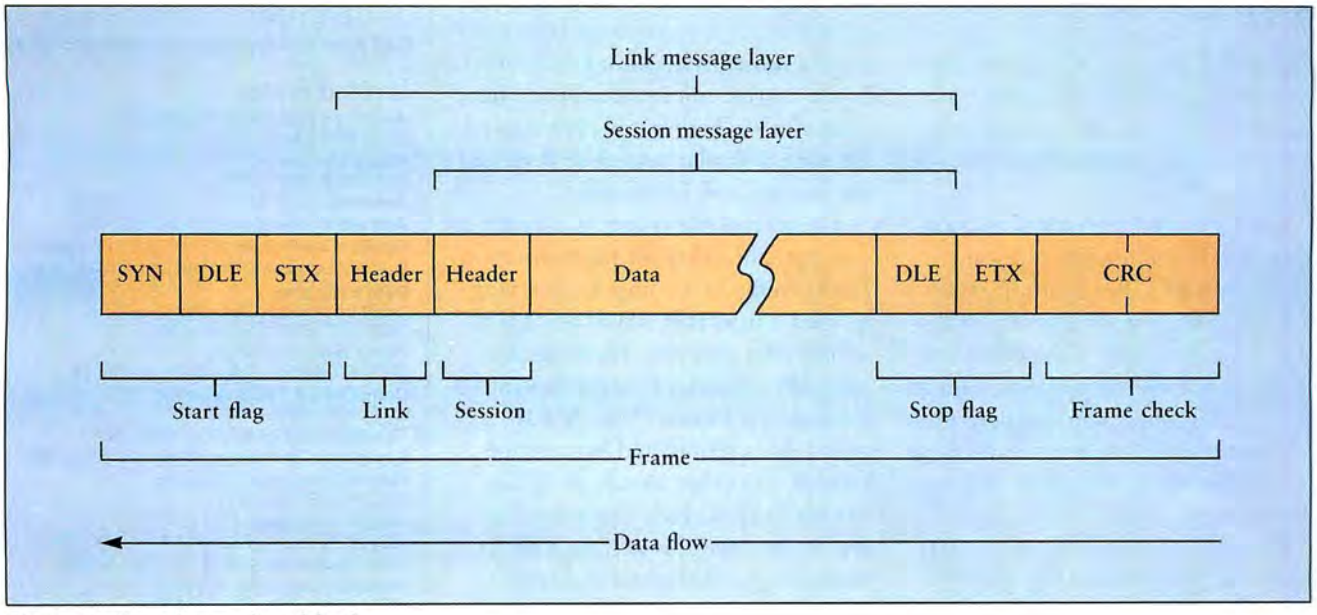


Figure 1: Framing a data block

mitted without error. If the remainders are different, the block is automatically retransmitted.

At the conclusion of the data transfer the link protocol sends the receiving computer a termination message. This message specifies that upon its receipt the connection is to be broken, even if data is lost. This reflects the protocol's independence of the physical connection—a vital consideration since the physical connection on the other end may be quite different. MNP's physical independence ensures that a transmission can be halted for any reason.

Session Protocol

With many communications packages the user must fill in gaps, supplying computers on both ends of a communications link with information. Generally, you must log on, "ring" the other computer, prepare your computer and the other computer for a file transfer, and check that certain files are open and that space on the receiving end is available. Many of these functions are handled automatically under MNP.

When a connection is made using MNP, each side automatically declares pertinent system and file information, including computer type, how files are formatted, what kind of information can be transmitted (e.g., ASCII or binary), and the user's identity (name and electronic address). The session originator can even specify who should be communicating at the other end.

One of the most significant advances contained in the MNP is the automatic negotiation of which level of service can be used between the two communicating devices. While this type of negotiation is common among mainframes, it is new to microcomputer communications.

At the beginning of the connection, MNP assumes that the devices on both sides have only minimal capabilities: slow data transfer, asynchronous communications, and the byte-oriented frame described in Figure 1. But part of the originator's link request message includes an indication of the highest service level of which the originator is capable. The device at the receiving end responds with a message that indicates its highest possible service. The sending computer compares the response with its own capabilities and proceeds, using the highest common denominator service level. When a communication is finished, the session protocols at both ends exchange messages to verify that data sent in each direction has been received and is complete. This graceful termination somewhat softens the link protocol's tendency to abruptly end a conversation.

File Transfer Protocol

The MNP file transfer protocol defines and formats the messages involved in file transfers and manipulations. There are three transfer services available. The first allows you to send and the second to receive a file, while the third permits you to append a file to an existing file at the other end of the communications link. This last function is particularly useful, since you may not always want to create a new file but merely to update one already present. This is

a common practice of business executives who take their computers on the road and who, for example, periodically update their company's order entry file.

The file transfer protocol also enables you to manipulate a distant computer's files. For example, you can delete files, rename them, or display a file directory at the other end of the line. This ability saves a great deal of time, since you can determine whether the file you want is too large for your existing disk space or even if the file exists at all.

A typical MNP file transfer starts when one side sends a "file start" message to the other. The file start message includes the requested file's name, size, and format, along with any password needed for the file's return trip to the requesting computer. Both computers exchange hellos, along with confirmation that a file will be sent by one side and accepted by the other.

When the file is transmitted, it is followed by an end-of-file message. The recipient acknowledges receipt of the data and confirms that it was stored properly. If the file cannot be closed for some reason, this fact is returned instead of an acknowledgement. Both sides would then know that the transfer had failed, even though no data had been lost or corrupted during transmission.

Virtual Filestore

Transferring a file from one computer to another involves more than specifying the format of messages. This is particularly true when different computers (or similar computers running under different operating systems) telecommunicate files. Every computer and operating system formats data in a distinct manner.

MNP overcomes hardware and software incompatibilities by creating "virtual" files that can be understood (and converted) by any computer running a communications package using MNP. While a session is being established, the systems on both sides receive information about each other. Based on that information, each side determines whether it is communicating with a similar system or if virtual file formats will be required.

The virtual file system is actually a conceptual facility for file translation. For example, if a computer is trying to send a printable ASCII text file to a dissimilar machine, the transmitting side translates its data files into a message file format (7-bit ASCII codes, lines terminated by carriage returns—in other words, as "plain vanilla" as possible). The receiving end knows that it is getting a file in this message file format and translates the file into whatever format is required locally. The virtual file system includes all the types of files typically found on personal computers. Thus a PC running under DOS 2.00 could send files to an Apple IIe, which in turn might later send them to a VAX minicomputer using UNIX—provided they all support MNP.

Chances are that more and more software and machines will support MNP as the need for communications protocol standardization becomes more apparent. The increased acceptance of MNP by telecommunications, software, and particularly hardware companies (IBM and Apple among them) indicates that the computer industry is discovering that getting business means getting serious about communications.

Gregory Pearson is the chief network architect for Microcom.

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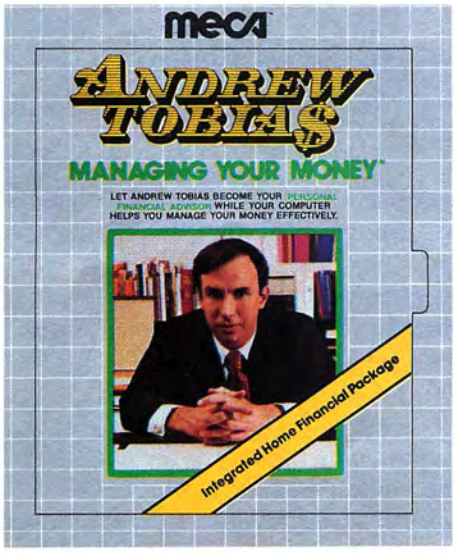

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Getting to know PCjr's infrared keyboard.

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A close look at the home computer's infrared keyboard: gimmick or breakthrough?

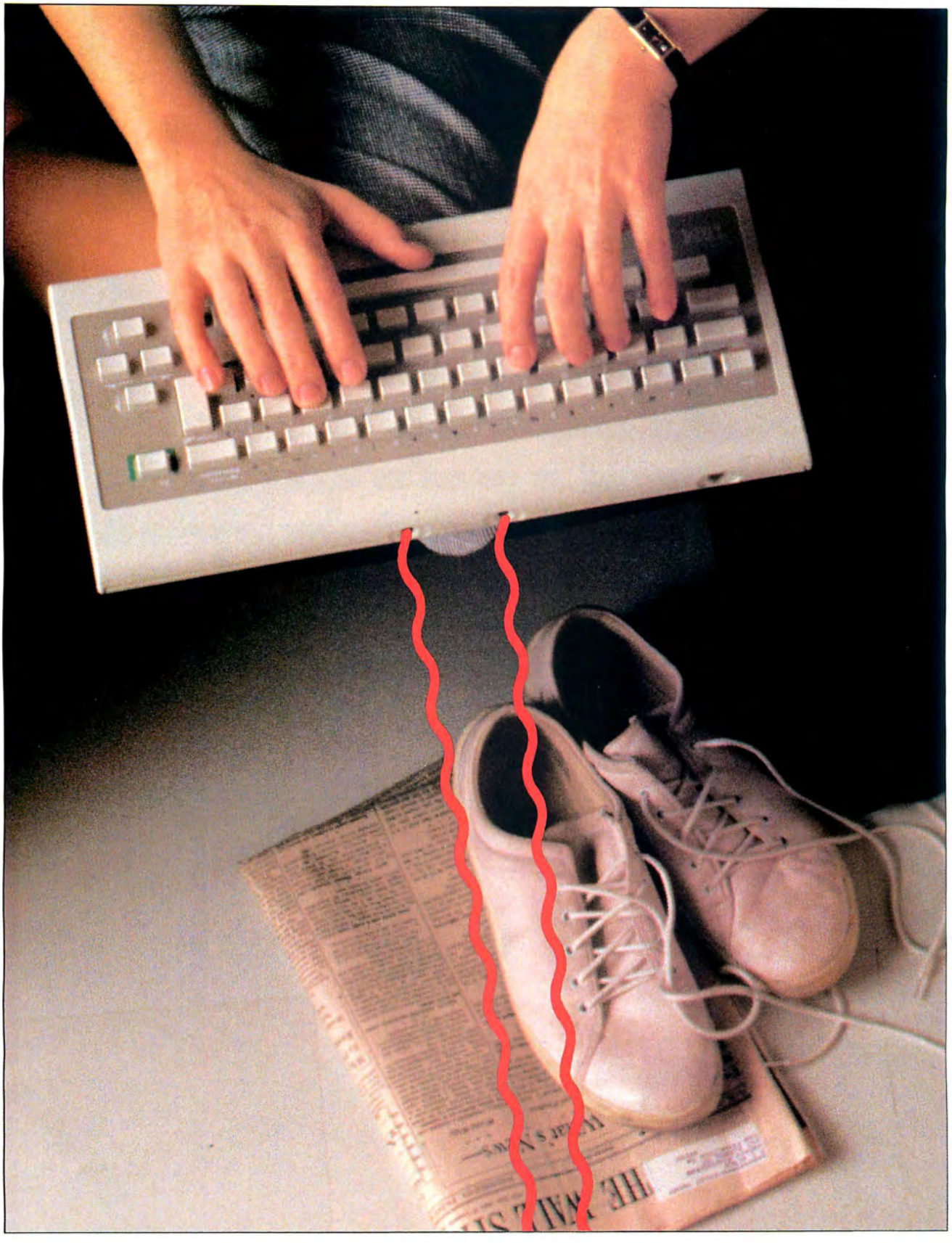
Beam Me Up, PCjr

Katie Seger and Frederic E. Davis

The PCjr keyboard has been the object of much discussion, debate, and more than its share of criticism. Critics have called the infrared keyboard a "gimmick," educators have praised the keyboard's templates, and reviewers have cautioned that the rectangular keys may decrease typing speed. A close look at the keyboard should help you make up your own mind about its merits and faults.

Key Notes

The PCjr keyboard weighs 25 ounces. Two small infrared LEDs (light emitting diodes) and ten chips, including a microprocessor, are inside the keyboard (see Figure 1). The LEDs permit you to operate the computer even when the keyboard is not attached to the system unit. The microprocessor is the 80C48 8-bit chip designed by Intel and built by NEC. The letter *C* in the name of the chip indicates that it is a CMOS (complementary metal oxide semiconductor) chip. CMOS chips use considerably less power and give off less heat than do other chips. Since CMOS chips require only 10 percent of the power of other chips, the PCjr keyboard needs only four penlight batteries to make it run. The 80C48 is the CMOS version of the 8048 microprocessor used in the PC and XT keyboards.



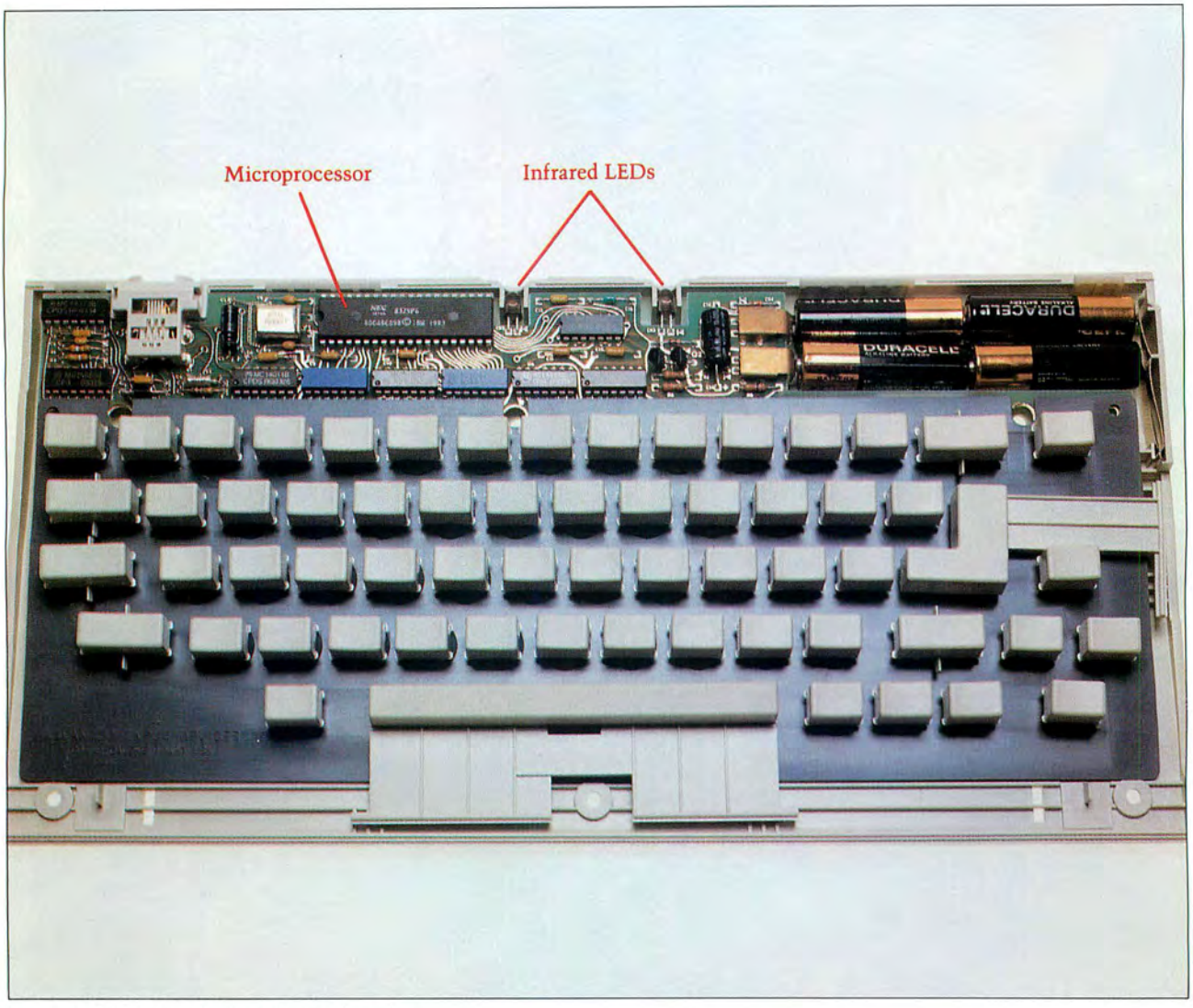


Figure 1: A look inside the PCjr keyboard

PCjr's 62 keys are "full travel" keys, which means that they move up and down and offer typists the same operational feel as do keys on typewriters and office computers, even though PCjr's keys are narrower. Although you will probably never need to take apart the PCjr keyboard, Figure 2 shows what's underneath the keys. The keyboard's internal design may look a bit strange, but the keyboard uses the same design as many other computing devices.

The plastic keys rest on but are not attached to small rubber bumps, or domes. The undersurface of each rubber dome is coated with a carbon compound that conducts electricity. When you press a key, the carbon compound contacts the two wires underneath the dome and closes an electrical circuit. When the circuit closes, the switch underneath the dome registers "on." The 80C48 microprocessor finds out which keys are being depressed by determining which switches are on. The microprocessor generates and sends the corresponding letters, numbers, characters, and codes to the system unit, which sends the information to the screen or the disk. When you stop pressing a key, the switch registers "off," the rubber dome pops back into its normal shape, and the plastic key pushes up with the spring-like action associated with the PC and other office computers.

Many people have been concerned that the keyboard might not send information to the system unit as fast as it is typed. Even in a typing/sending race, however, typists will find that they cannot hit the keys faster than the machine can send. The keyboard transmits the information to the computer's system unit using serial transmission, a method in which 1 bit of data is sent at a time. The PCjr keyboard is capable of sending information to the system unit at a speed of 1200 bits per second. Since only a few bits are needed for each keystroke, the transmission speed is adequate for even the fastest typists.

The Infrared Beam

The keyboard transmits the keystroke information via the LEDs, which operate like a TV remote control unit. These LEDs emit an invisible infrared light beam. To properly transmit the information to the computer with the infrared beam, the keyboard must be pointed in the direction of the system unit. Since very small LEDs are used, the keyboard must be operated within 20 feet of the system unit so that the signal is strong enough to transmit all the keystroke information.

Since the keyboard relies on the same type of infrared technology that television remote control units and other devices use, people have questioned whether the devices might interfere with the operation of the PCjr keyboard. Advanced Input Devices, manufacturer of the PCjr keyboard, has tried to overcome potential problems caused by outside interference. According to Stephen F. Meyer, chairman of the board of Advanced Input Devices, the PCjr keyboard uses a complex code that is designed to be recognized by only the PCjr system unit and not by other infrared devices. The system unit is also able to distinguish this infrared code from other infrared signals. "Most infrared devices should not interfere with PCjr," says Meyer. However, he adds that interference may occur occasionally.

When PCjr has trouble receiving an infrared signal or when it detects infrared interference, the computer emits a high-pitched beeping sound to indicate a problem. Even if this alarm is sounded, the complex encoding scheme makes it unlikely that PCjr will interpret stray infrared signals as keyboard output. Some camera flash units emit infrared light that causes the computer to beep. This stray interference doesn't seem to cause the computer to lose or scramble information.

Some camera flash units emit infrared light that causes the computer to beep.

Four size AA, 1.5-volt batteries can power the keyboard. The batteries must be replaced when they run down. When the keyboard is attached to the system unit via the keyboard cable, power is supplied through the cable, and the batteries are not needed. The keyboard cable also eliminates the problem of infrared interference because signals are carried directly over the cable and do not have to rely on PCjr's infrared beam.

Keyboard Arrangement

The PCjr keyboard has 62 keys arranged in a standard typewriter layout. The rectangular plastic keys, similar to keys found on touch-tone telephones and some calculators, are sometimes referred to as "Chiclet" keys.

The keyboard was designed so that the PCjr-specific keys—<Alt>, <Ctrl>, <Esc>, <Fn>, and the four cursor-control keys—are set apart from the alphabet, numeral, and symbol keys that you find on typewriters. This design makes it easy to find the PCjr-specific keys when you are typing. Another helpful layout feature is the shape of the <Enter> key, which is one of the keys typed most often. It is L-shaped and easy to distinguish from the rectangular keys. This improvement over the PC and XT keyboard layout may increase typing speed.

Overlays may become a standard software package component.

Although the PCjr keyboard does not have specially designated function keys like the PC and XT keyboards, PCjr still has ten function keys. Function keys are specially programmed keys that, when typed, send specified commands to the system unit. A function key may be programmed with a command to clear the screen, for example. The <Fn> key, which is not found on the PC or the XT, controls PCjr's function keys. To activate one of the keyboard's function keys, you press and hold down the <Fn> key and then press one of the number keys in the top row.

Two programs, *Keyboard Adventure* and *Exploring the IBM PCjr*, help new PCjr owners learn about the computer's keyboard. *Keyboard Adventure* is built into PCjr's read-only memory (ROM) and so requires no cartridge or floppy disk to run. This built-in program is an interactive introduction to the keyboard. *Keyboard Adventure* lets you move the cursor and play with the <Fn> key while you acquaint yourself with the keyboard. If you have never operated a computer before, *Keyboard Adventure* is the program you should use first.

Exploring the IBM PCjr is a disk that comes with enhanced PCjr models. The disk includes five sections, the second of which is devoted to learning the PCjr keyboard. The software, which was designed for people who have had some experience operating computers, has more text and less interaction than *Keyboard Adventure* has. After explaining a keyboard concept, *Exploring the IBM PCjr* encourages you to type and experiment with the keyboard on your own.

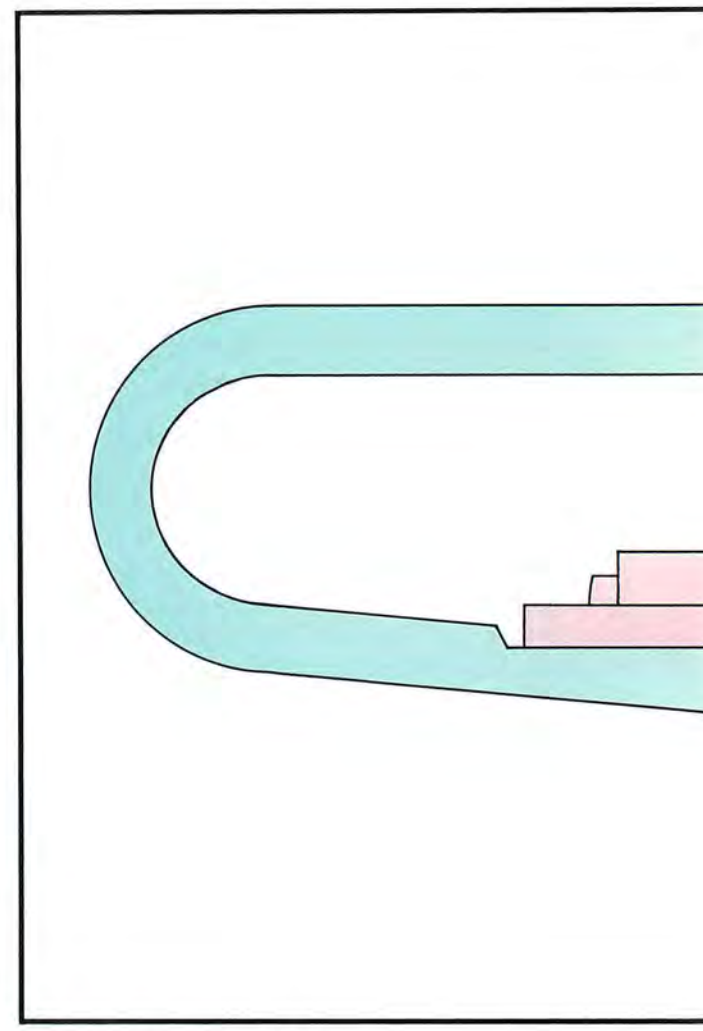
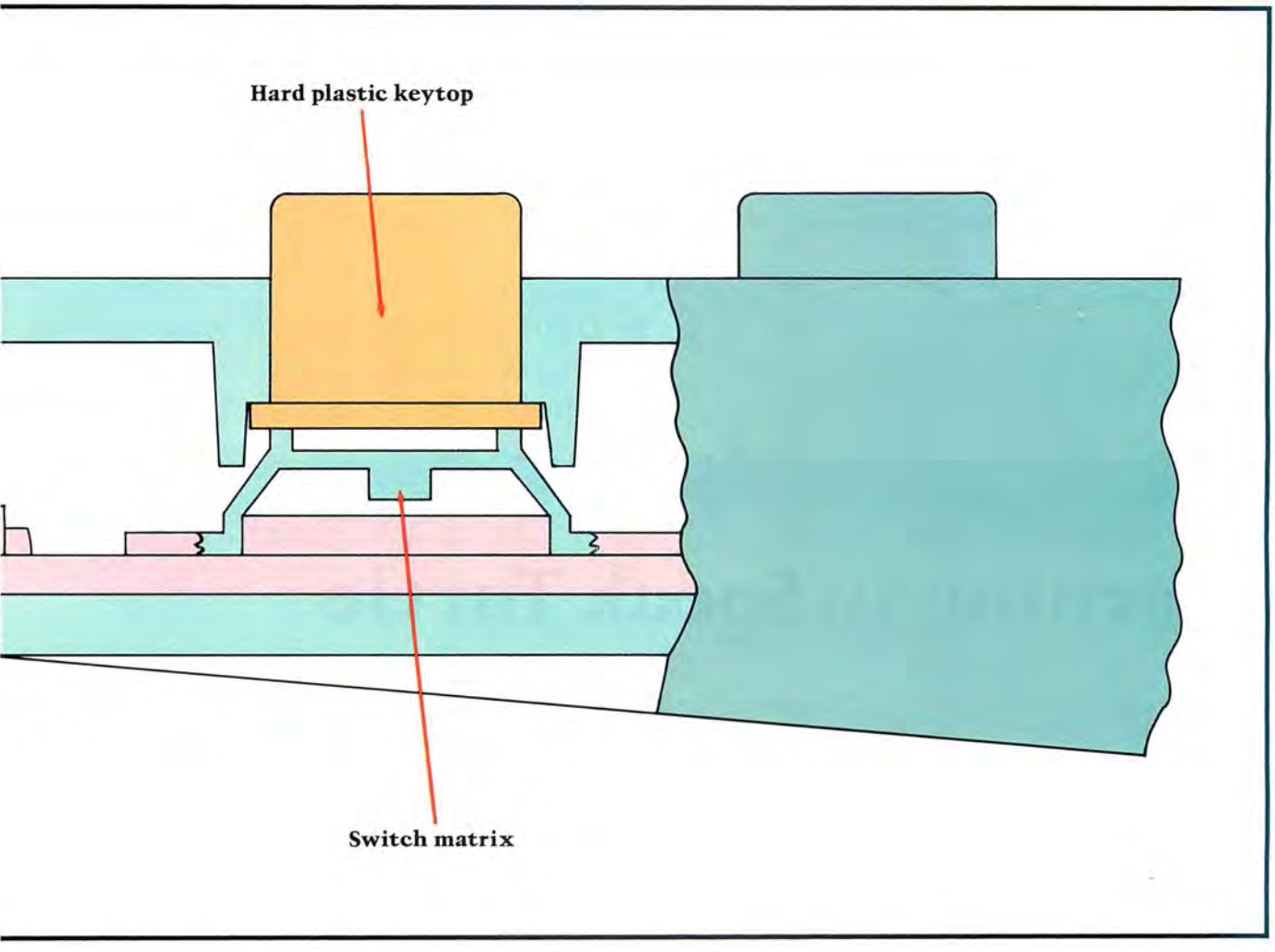


Figure 2: Cross section of a key

Dressing Up Your Keyboard

Unlike the rows of keys on the PC and other office computers, the rows on PCjr have about ½ inch of space between them. Another different feature of the PCjr keyboard is that its keys are not marked with letters, numbers, or symbols. These markings, or legends, some of which are highlighted with color, are printed in the space between the rows.

Because of the space between the keys, overlay templates can be placed on the keyboard to make programs easier to learn and use. The word processing program *Home Word* includes a keyboard overlay. When you look at a PCjr keyboard covered with a *Home Word* template, you notice that <Ctrl> has a



yellow border on three sides. Several letter keys have yellow rectangles underneath them indicating that these keys are used in conjunction with the <Ctrl> key to perform certain commands. The program commands are spelled out in the rectangles. For example, the U key has the word *underline* in the yellow rectangle. When you press <Ctrl> and U together, *Home Word* underlines your text. Likewise, you can print your document by pressing the <Ctrl> key and the P key.

Overlays may become a standard software package component along with floppy disks and documentation manuals. In the future, overlays may even be used with a new PC keyboard produced by Advanced Input Devices. The keyboard, which is similar in design to PCjr's, has 83 keys and connects via a cord to the PC.

When people think about computers, they usually picture the screen, because it is the part of the computer they look at the most. It's ironic that few people think about the keyboard, even though it is the component that lets them control the computer and is the part they touch every time they sit down at the machine. But then, that is the sign of a well-made device—you don't think about it, you just use it.

Katie Seger is an Assistant Editor for PC World Special Editions. Frederic E. Davis is a computer consultant, systems engineer, and the author of Hardware for the IBM PC and XT *to be published in 1984 by PC World Books and Simon and Schuster.*

Try Logo for creating computer games, making lists, drawing shapes, or designing charts.

Learning to Speak Turtle

David Myers

The appeal of Logo is no secret; the language is easy to learn yet sophisticated. You can use it to draw complex pictures or to do practical data processing. The most intriguing feature of Logo, however, is that it is a painless—even fun—way to learn computer logic and programming.

Learning and having fun at the same time are what Logo is all about. A number of elementary and secondary schools now teach Logo as an introductory computer language. In fact, the language was designed by people who were interested in how learning takes place.

Logo was developed in 1968 by Seymour Papert and a group of researchers at a Cambridge, Massachusetts, consulting firm. Papert had worked extensively with Jean Piaget, the Swiss psychologist known for his research on the way children perceive and relate to the adult world. Studying the results of thousands of tests done with young subjects, Piaget found that children learn best by taking an active and even initiatory role in the learning process. Papert used Piaget's finding as the philosophical base for Logo when he realized that computers were ideal tools for creating a stimulating educational environment.

Logo grew from the programming language LISP, an acronym for list processing. LISP is used primarily for artificial intelligence programs, which can make a computer appear almost as intelligent as a human being.

Initially Logo ran only on large, mainframe computers, but with the advent of personal computers and the help of Papert and his researchers, Logo made its way from the laboratory into the home and the classroom.

Turtle Graphics Tutorial

Logo is a two-part computer language. List processing is used for processing words and data. Turtle graphics, probably the best-known Logo feature, is used for drawing images (see Figure 1).

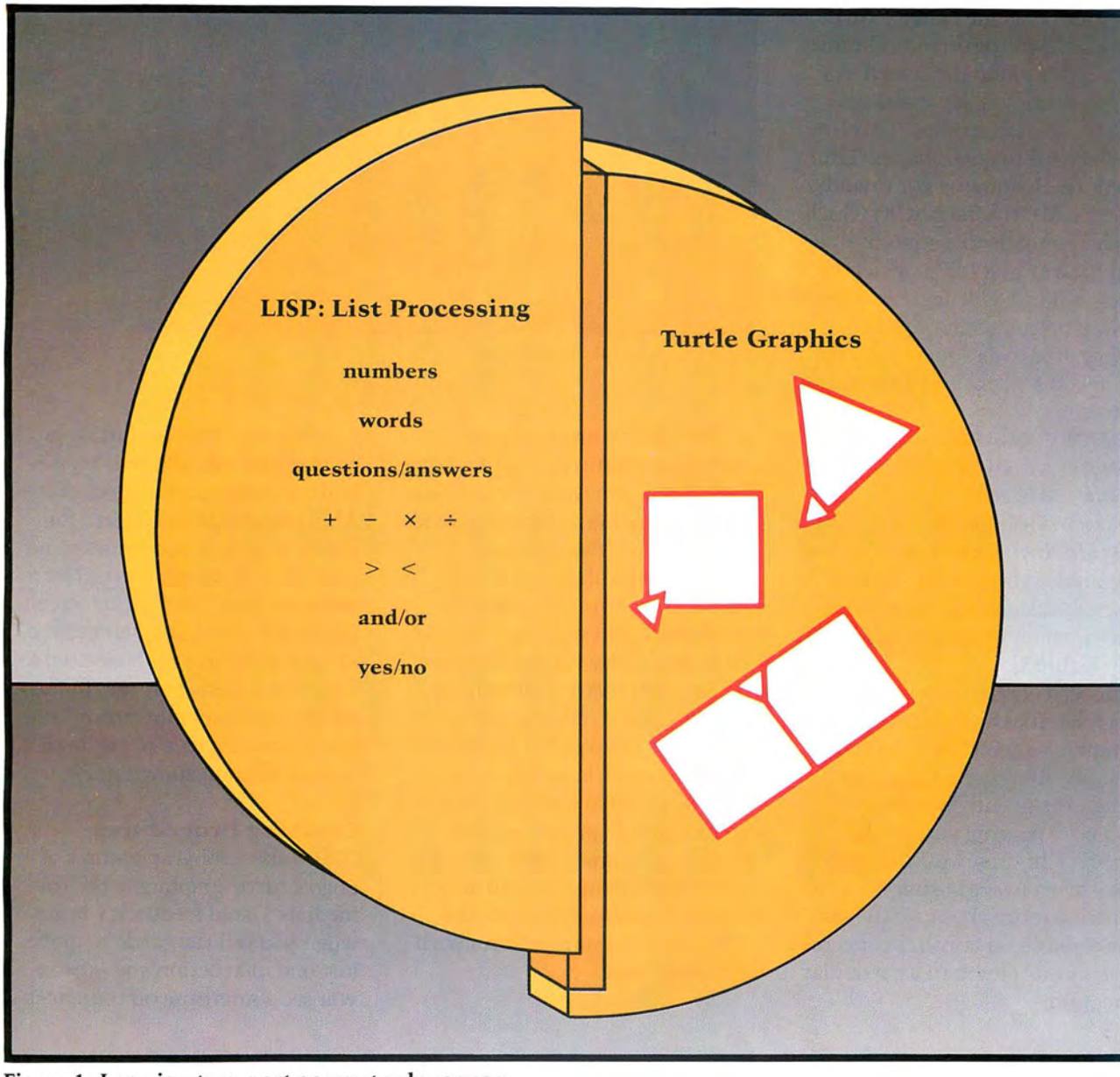


Figure 1: Logo is a two-part computer language.

IBM distributes a version of Logo developed by Logo Computer systems. Other PCjr Logos from Digital Research, Harvard Associates, and Waterloo Microsystems are under development. The following turtle graphics tutorial uses general principles that you should be able to follow no matter which version you have. Most commands work with most versions.

Start Logo by following the directions for your version. The first image that appears on the screen is a small triangle called a turtle. You use Logo commands to move the turtle around the screen. As the turtle moves, it can draw a line of the path it takes. This line can be used to draw shapes. The major turtle-moving commands are FORWARD and BACK, which move the turtle in a straight line, and RIGHT and LEFT, which rotate it a number of degrees around a point on the screen. For instance, to draw a square with 60 points on a side you tell the turtle to move

```
FORWARD 60 RIGHT 90
FORWARD 60 RIGHT 90
FORWARD 60 RIGHT 90
FORWARD 60 RIGHT 90
```

After following these instructions the turtle is back at its starting point, headed in the same direction as when you began to move it (see Figure 2).

Instead of relating a geometric shape to lines and points on the computer screen, the commands describe movements that you would make with your body if you were moving around the screen. Children working with Logo learn to see abstractions in concrete terms, because the language draws on familiar concepts such as movement in a particular direction.

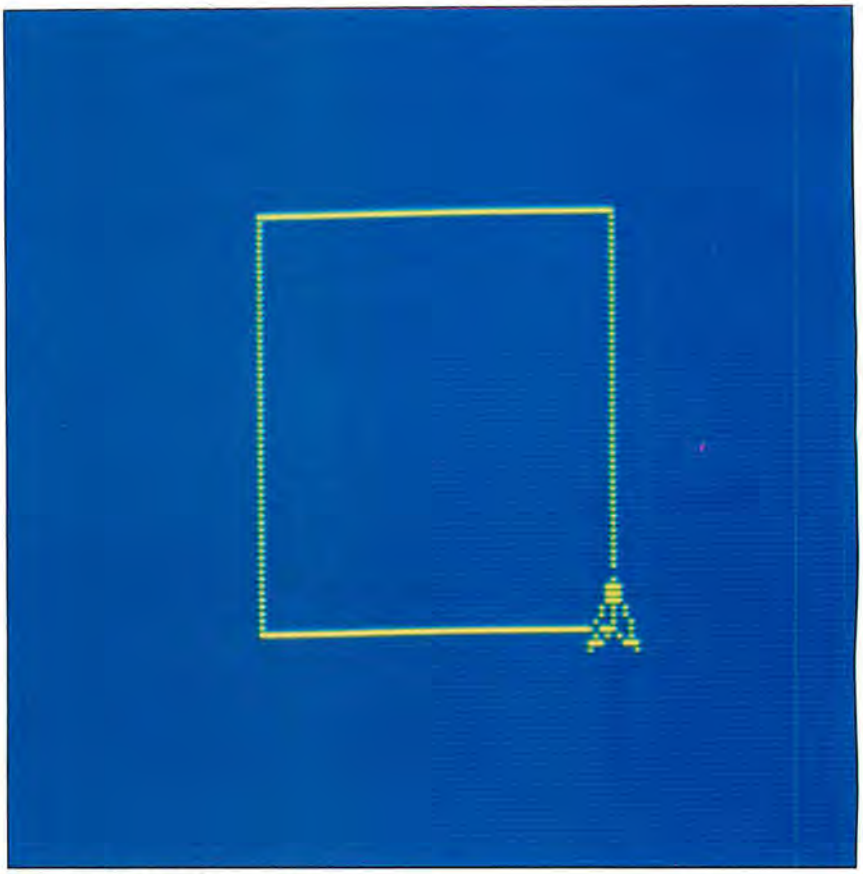


Figure 2: A simple Logo figure

The turtle commands are known as primitive graphics commands since they are the simplest Logo instructions you can give to draw a shape. You can simplify drawing the square by using REPEAT, a primitive controller command. You can make the turtle draw exactly the same square by having it `REPEAT 4 [FORWARD 60 RIGHT 90]`. The 4 tells the turtle to repeat the FORWARD 60 RIGHT 90 movements four times and then stop. If you use Logo on a color monitor, primitive commands can draw lines in any of a number of colors. You can also change background colors and shade parts of your pictures with different hues.

Of course, after becoming proficient with Logo you will be able to draw more than simple squares. The language is well suited for drawing images of a recursive nature, that is, images formed by repeating a figure at various screen positions. Using Logo commands almost as simple as those used to draw the square, you can, for example, rotate a figure around one point on the screen to create the optical illusion shown in Figure 3.

Creating Procedures

One of the strongest features of Logo's turtle graphics is the immediate visual feedback you get when you tell the turtle to move. Just one instruction and—bang—you see something on the screen.

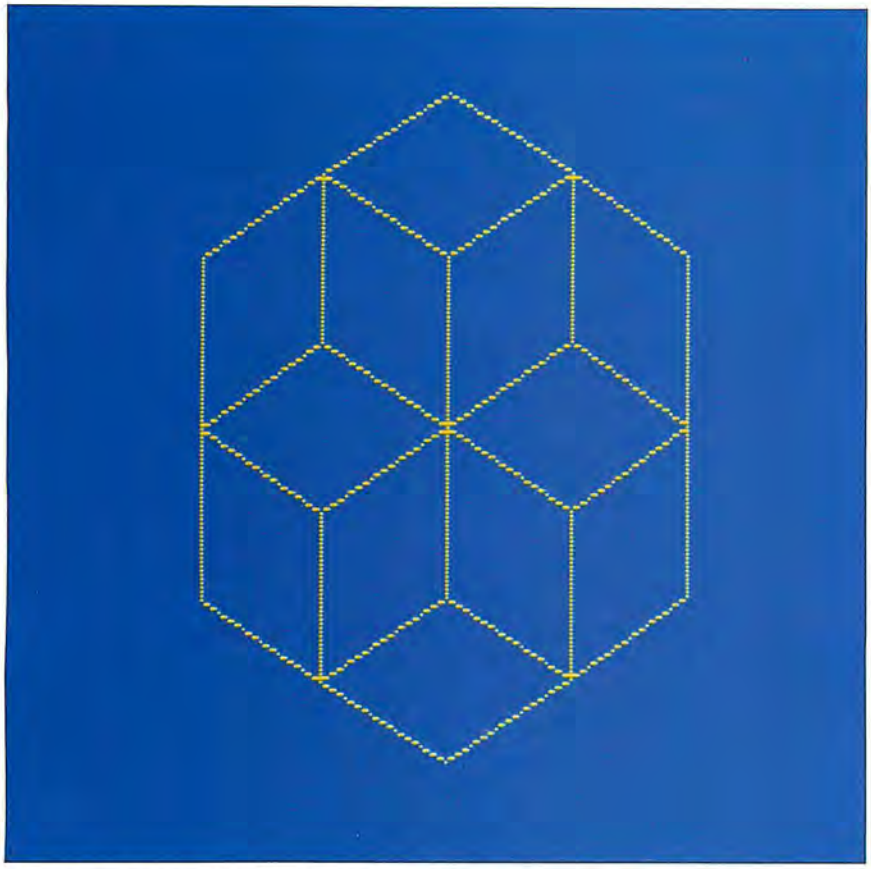


Figure 3: An optical illusion created by rotating a figure (turtle not shown)

But there is more to the instant feedback nature of Logo. Because you watch each step as the turtle draws, you are encouraged to break down each graphic into the smallest tasks possible. Thus, for the square you draw a line (task 1), turn a corner (task 2), draw a line (task 3), and so on. Programmers recognize immediately that this type of structured tasking, or breaking a program down into individual subtasks, is a key concept in effective programming. Logo, then, teaches you to think about problems as a sequence of small, programmable tasks. However, to avoid scaring anybody away, the word *programming* is rarely mentioned in relation to Logo. Instead, a set of tasks is called a procedure.

Procedures, like tasks, can be put together into sequences to get a job done on the screen. To signify that you are defining a Logo procedure, you give the TO command and name the procedure. Logo recognizes that the steps that follow TO make up a procedure. The END command tells Logo that you are finished defining the procedure. To draw a square, you can use a single procedure (note that FD and RT are abbreviations for the FORWARD and RIGHT commands):

```
TO SQUARE
REPEAT 4 [FD 60 RT 90]
END
```

When you want to draw the square again, you simply type SQUARE and press <Enter>. For the optical illusion shown in Figure 3, two procedures are defined; one draws a six-sided figure and the other rotates the figure on the screen. The first procedure, FIG, draws a six-sided figure 40 points on a side:

```
TO FIG
REPEAT 6 [FD 40 RT 60]
END
```

The right turn of 60 (RT 60) is made because a six-sided figure has 60-degree angles.

The second procedure, OPTIC, rotates FIG around a point six times. OPTIC redraws FIG from the same starting point (the vertex), but the turtle points in a different direction for each repetition. The procedure is

```
TO OPTIC
REPEAT 6 [(FIG) RT 60]
END
```

The right turn of 60 (RT 60) is used again because FIG is redrawn, or rotated, around a point six times to create the optical illusion. Once you've created the OPTIC procedure, all you have to do to draw the image is type OPTIC and press <Enter>. Note that the FIG procedure created earlier is used exactly like the primitive commands BACK, FORWARD, and REPEAT; this means that you can build complex procedures made up of other procedures. There is virtually no limit to the complexity of the procedures you can create with Logo.

Suppose you want to draw other shapes using the two procedures. For example, you can draw a five-sided figure, 50 points on a side, that rotates around a point 12

Meet the Drawing Board Doctor

Katie Seger

Will the Mitchell family ever be the same now that Dennis the Menace has a computer? Once Dennis learns about the version of Dr. Logo for PCjr, there will be no stopping him.

It's not surprising that Henry, Alice, and Dennis have been grouped around a computer in several strips; Dennis's real father, cartoonist Hank Ketcham, acquired his first computer last year. "I now understand why there are computer widows," the 64-year-old Ketcham said as he talked about the IBM PC in his life.

Ketcham was given his PC by Digital Research last spring to help him create the character of Dr. Logo for the firm's language software. Dr. Logo, a red-bearded, bespectacled professor, can be seen with Dennis and his parents in Digital Research's magazine advertisements for the new product. The fatherly academic will also be featured in the upcoming book, *Dennis the Menace Meets Dr. Logo*, a 64-page tutorial that will be available in mid-1984 with the PCjr version of Dr. Logo. Ketcham is writer and illustrator for the book, which is designed for both children and adults.

"Since Dennis doesn't know a floppy disk from a Frisbee, he is a perfect Logo student," Ketcham said. The cartoonist thinks that his lack of a computer background was an asset rather than a hindrance for this project because he looked at Logo with beginner's eyes. "It was just me and Dennis learning the language," he said.

Ketcham got the job after he met Gary Kildall, chairman of the board and chief executive officer of Digital Research, at a company software demonstration. "My daughter has a girlfriend whose mother is a programmer at Digital Research," Ketcham explained, "so I knew a little bit about the company. But I was curious to know more." Ketcham and Kildall were surprised to discover that they had both attended the same high school in Seattle. "Of course, it was at different times in the century."

To prepare for writing the primer, Ketcham read about the version of Logo for Apple computers and studied Digital Research's Dr. Logo documentation. Digital Research supplied experts to help whenever Ketcham "hollered loud and clear." The company also had a Logo expert serve as technical editor. Ketcham tried to keep the book free of Computerspeak, a language he says is emerging in other books.

One of Ketcham's favorite Logo features is the turtle graphics. "I spent far too much time designing pictures of Dennis and Dr. Logo on screen when I should have been doing other work," he confessed. Ketcham works on his comic strip and freelance projects in his Carmel, California, studio from 8:30 a.m. to 5 p.m. every weekday.

He has been drawing a daily Dennis cartoon since March 1951. The strip, inspired by Ketcham's then three-year-old son, Dennis, is translated into 14 languages and appears in more than 850 newspapers in 48 countries.

The Seattle native is fond of saying he "graduated from the University of Walt Disney." Ketcham attended the University of Washington in 1938 but left after a year because "I wanted to be part of the parade, not just watch it go by." He headed for Hollywood and got a job at Universal Studios working with animator Walter Lantz on Oswald the Rabbit cartoons. He then joined Walt Disney Productions and worked on Donald Duck cartoons and the feature-length films *Pinocchio* and *Fantasia*.

During World War II, Ketcham, a chief petty officer, served as a photographer specialist for the United States Naval Reserve working on Navy war bond and training films. During this period Ketcham created his first comic strip, *Half Hitch*, for the *Saturday Evening Post*. The strip was discontinued after the war.

Ketcham later settled in Connecticut and began freelancing cartoons and illustrations to advertising agencies and magazines such as the *New Yorker* and *Collier's*. "I was fascinated by the Walt Disney process; I still am. But I had climbed that mountain, and I felt the lure of the freelance world." The freedom allowed him the time to develop the character of Dennis and begin 33 years of daily cartooning.

times (see Figure 4). You could retype each procedure, entering the numbers in the appropriate places, but it is far easier to use Logo's variables technique. To define a Logo variable you assign it a symbol preceded by a colon. The number of sides in FIG is :N (read "dots N"), and the length of each side is :L. Now the procedure is written

```
TO FIG :N :L
REPEAT :N [FD :L RT (360/:N)]
END
```

To see what your new FIG looks like, type FIG 5 50 and press <Enter>. Using the same technique, you can rewrite the second procedure, using :P as the variable for the number of times to rotate FIG around a point. The OPTIC procedure becomes

```
TO OPTIC :P :N :L
REPEAT :P [(FIG :N :L) RT (360/:P)]
END
```

To see the new drawing, type OPTIC 12 5 50 and press <Enter>. If you want to try different number combinations, just type the numbers after typing OPTIC.

List Processing

In other programming languages, procedures like FIG are called subroutines. But in keeping with Logo's folksy style, you'll never find the word *subroutine* in Logo manuals. Procedures are treated as lists of steps for the turtle to carry out.

List processing uses the same methods as turtle graphics to write procedures, but instead of creating and processing pictures, list processing works with data.

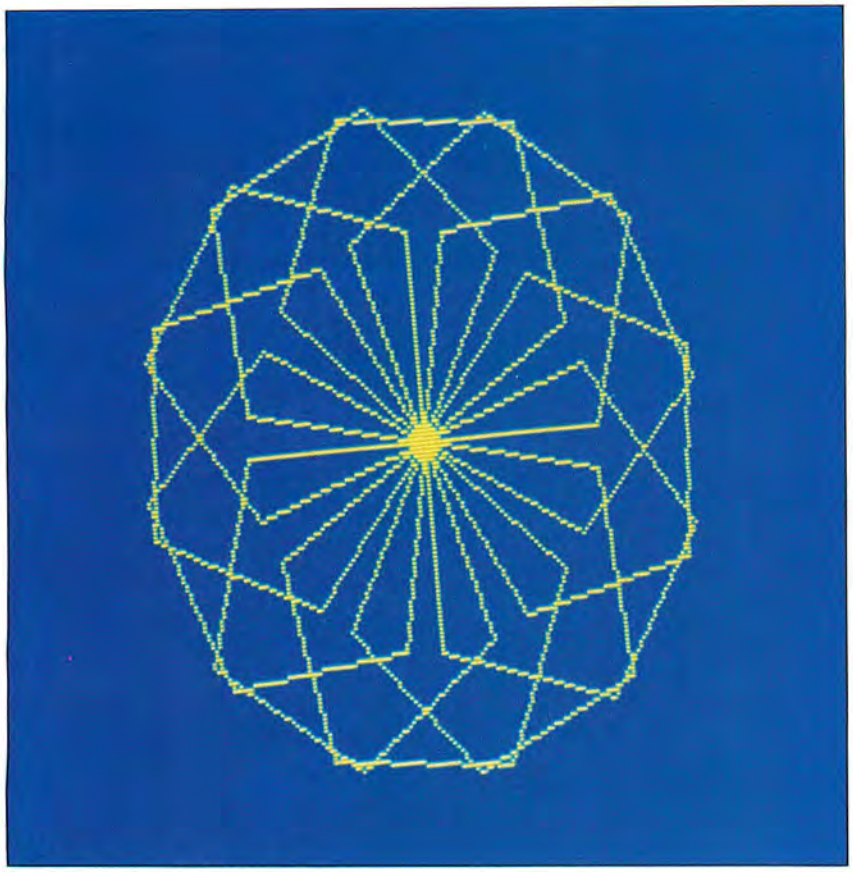


Figure 4: A five-sided figure rotated 12 times

The data can be numbers, words, or other Logo lists. Just as turtle graphics procedures create drawings on the screen, list processing procedures produce results for whatever type of processing you specify. Logo list processing includes standard numerical operations (add, subtract, multiply, divide, sine, and cosine) and editing commands for writing conditional expressions (and, or, if false, if true, greater than, and less than). Other commands include controller commands (like REPEAT), commands for displaying or printing out data, and commands for loading, naming, saving, and erasing files.

List processing can be used for preparing phone and mailing lists, and it works especially well for creating interactive word games. For instance, using the commands PRINT, IF, MAKE, and READLIST, you can make the computer appear to answer questions. The PRINT command tells the computer to display text on the screen; the IF command tells the computer to carry out a step in the procedure if a particular condition is true. The MAKE command puts two input phrases together and makes the second input phrase act as the value of the first. The READLIST command reads the words you type as part of an interactive game.

Here's an example of a list processing program:

```
TO BEST.FRIEND
PRINT [NAME YOUR BEST FRIEND]
PRINT [AND I'LL NAME MINE.]
PRINT [WHO'S YOURS?]
MAKE "BEST.FRIEND READLIST
MAKE "REPLY SENTENCE [I ALSO LIKE]
  :BEST.FRIEND
PRINT :REPLY
IF :BEST.FRIEND = [ME] [STOP]
PRINT [BUT MY BEST FRIEND IS ME!]
END
```

When you type BEST.FRIEND and press <Enter>, the following sequence appears:

'NAME YOUR BEST FRIEND
AND I'LL NAME MINE.
WHO'S YOURS?'

Suppose you type MALCOLM. The computer will respond,

'I ALSO LIKE MALCOLM
BUT MY BEST FRIEND IS ME!'

You can see from this procedure how artificial intelligence got its name. The computer appears to be carrying out a conversation with you as it asks you questions and answers yours.

The beauty of Logo for teaching list processing is that you first develop the necessary programming and analytical skills by working with turtle graphics. The procedure command TO, the controller command REPEAT, and the technique for inserting variables are all part of Logo list processing.

Logo is a language that teaches you computer concepts almost without your knowing it. You learn quickly and easily while you create graphics and useful procedures. Whether you use the

language for learning about computers or for turtle graphics and list processing, Logo is a tool for making computers work for you.

David Myers is a freelance writer trained in computer programming and systems analysis.

Dr. Logo
Digital Research, Inc.
P.O. Box 579
Pacific Grove, CA 93950
800/227-1617 ext. 400,
800/772-3545 ext. 400 in California, 408/649-3896
List price: $129.95
Requirements: 128K, one disk drive

Logo
IBM
Systems Products Division
P.O. Box 1328
Boca Raton, FL 33432
800/447-4700, 800/447-0890 in Alaska and Hawaii, 800/322-4400 in Illinois
List price: $175
Requirements: 128K, one disk drive

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
Waterloo Microsystems Inc.
175 Columbia St. W
Waterloo, Ontario
N2L 3B6 Canada
519/884-3141
List price: $125
Requirements: 128K, one disk drive, color graphics board

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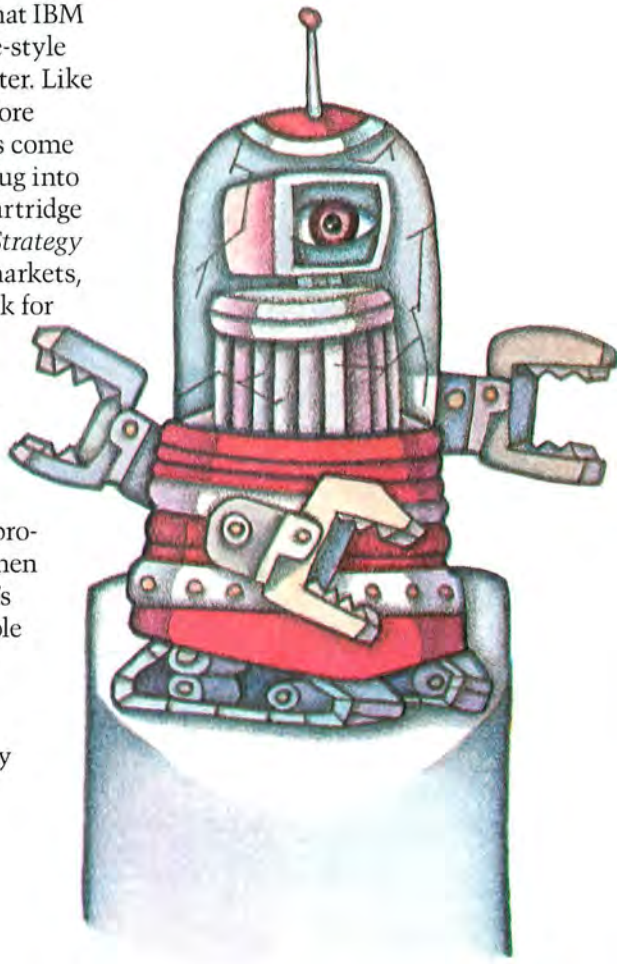
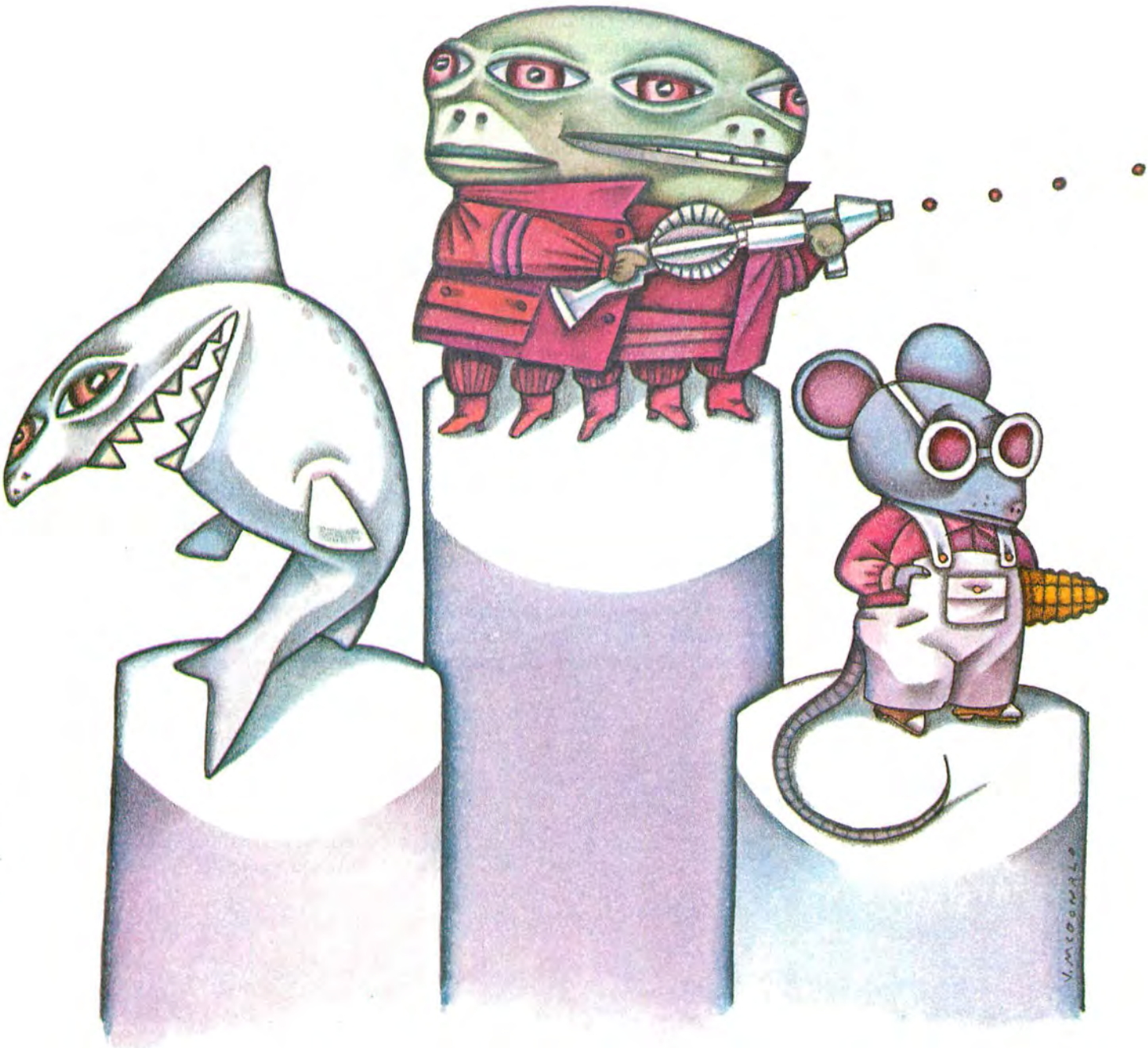
Four new games and a few old favorites to play on PCjr

PCjr's Great Escapes

Keith Richard Cook

If you think that home computing should be fun, and you want to play games with your PCjr, you'll be happy to know that IBM has introduced four arcade-style games for its home computer. Like many Atari and Commodore games, all four PCjr games come on ROM cartridges that plug into either of the computer's cartridge slots. *Casino Games* and *Strategy Games*, which IBM also markets, were written on floppy disk for the PC but will run on PCjr if you first put PCjr's BASIC cartridge in one of the slots. In a few months software manufacturers will undoubtedly offer dozens of programs for PCjr, but until then you can choose from IBM's selection of PCjr-compatible software. The four games aren't exactly dazzling spectacles of video game Sturm und Drang, but they will keep you amused.





Mouser

Mouser is reminiscent of *PacMan* in that your player must move quickly and carefully through a maze, avoiding capture by other maze inhabitants.

Mouser has a unique twist, however. Your player, a little farmer plagued by mice, can change the shape of any of the game's nine mazes by pushing on the interior walls. He changes the maze in order to trap the mice within one square. If he succeeds in trapping all the mice, a lazy cat, who normally just sits in one spot watching the mice run amok, eats the mice for dinner after the farmer moves on to the next maze.

The number of mice varies from maze to maze, but when a male and a female mouse get together, they produce more mice, which means more work for the farmer. The mice move randomly within each maze, and if they touch the farmer, he dies.

Naturally, each maze is more difficult than the last. In some, the farmer must locate a flashlight or risk stumbling about in the dark. A timer counts down 2000 beats (about 3 minutes) each time play begins. If the farmer successfully demouses a maze, the timer resets itself. If the timer runs out, so does your luck. You get four farmers per game, and your goal is to get rid of all the mice in all nine mazes while getting the highest possible score. Hint: lure the mice with cheese.

Crossfire

Crossfire, available on disk for the PC, has been put onto ROM cartridge for PCjr. *Crossfire* is a simple but action-oriented game that should appeal to you if you have an itchy trigger finger. On the screen is a grid composed of 42 blocks. A shooter shares this grid with four species of alien invaders who wander among the blocks. The aliens shoot constantly in an attempt to blast the shooter, who runs through the grid, dodging shots and firing back at the aliens.

When you run low on ammunition, a marker appears somewhere in the grid, and you must run over it to reload your laser. Point markers also pop up from time to time, and if your shooter runs over them, you get 100 points for the first one, 200 for the second, 400 for the third, and 800 for the fourth. You have to dodge alien laser blasts to reach either the ammunition or the point markers, but no one said that ridding your hometown of alien vermin would be easy.

Just staying alive past the first wave of *Crossfire* attackers is difficult. You can move and shoot in four directions, but so can the aliens. They have a PC to help them move, but your left hand must control your shots, and your right hand must control your movements. In addition, you have nine keys to coordinate, which makes for some frustrating and amusing moments until you master the keyboard. You can also play *Crossfire* with a joystick, which is easier than maneuvering with the keyboard.

Your mission is to blast every alien that appears on the screen and score as many points as you can. Hint: develop and use your peripheral vision, or you'll never see half the shots coming.

Scuba Venture

You are swimming as fast as you can through an underground cave, in search of the keys to several treasure chests you know lie within. You are swimming fast because a huge great white shark is nipping at your heels with its fang-laden jaws.

Before you can reach the treasure chest keys, you must dodge seaweed, sea horses, poisonous fish, electric eels, and a ghost diver who keeps getting in your way. If you get as far as the key chamber, you must grab a key by swimming over it, then insert it into a matching treasure chest in the treasure chamber. At no time can you stop or turn back, unless you want to explore the stomach lining of the great white shark.

Scuba Venture offers a choice of eight background colors and keyboard or joystick play. You can play alone or with a friend. One peculiarity of the game is that you and the ghost diver can sometimes swim through the solid

PCjr's Perfect Match

Many software manufacturers are quickly writing software for PCjr in an attempt to grab a slice of what many predict will be a fat and tasty home computing pie. The struggle will be especially intense in the games software category.

Because PCjr is so new, and its development was successfully kept secret, software manufacturers were taken by surprise and now must scramble to write new games for PCjr and to translate their existing games.

In what has to be the lucky break of the year Infocom, producer of several immensely popular prose adventure games, has discovered that all ten of its PC-compatible games run beautifully on PCjr. You don't even need IBM's Cartridge BASIC to enjoy the puzzles and riddles found in the *Zork* trilogy, *Deadline, Starcross, Suspended, Enchanter, Witness, Planetfall,* and their latest release, *Infidel.*

The Infocom games are famous for wit, baffling paradoxes, and puzzling mysteries. What's more, the games run virtually error free. If you're looking for fun and intellectual challenge, Infocom's game lineup is the perfect match for you and PCjr.

rock walls of the underwater cave. Hint: position your diver in the center of the screen and try to keep the ghost diver between you and the shark.

Mine Shaft

In *Mine Shaft,* worker robots dig precious gems from a futuristic underground mine. A cave-in has wreaked havoc among the robots' circuitry, and they are killing every human they find. Piles of gemstones lie amid the rubble, and someone has to go in and retrieve them.

You enter the mine equipped with a mine car to carry the gems and armed only with a laser to blast the killer robots. The action takes place in a *PacMan*-style maze of twists, turns, and numerous dead ends—including your own if your reflexes are slow or your decisions incorrect.

You have to contend with three types of robots. Two kinds can be destroyed, but the third is laser proof and must be avoided. The object is to clear each mine level of robots; you score five points per robot on the first level and an extra five points per robot on each successive level. Gems are worth 100 points. Get the highest score you can, then get out while you still have the hide on your back. Hint: your laser fires only if you are moving in the direction you wish to shoot, so leave yourself room to maneuver when a robot is nearby.

The Fun Begins

These four games are basic arcade entertainment. If you're a card or strategy game enthusiast, you'll want to try the *Casino Games* and *Strategy Games* collections. *Casino Games* includes Blackjack, Five-Card-Draw Poker, and Slot Machine. *Strategy Games* includes Checkers, Elusion, Battleship, and Reversi. These anthologies are also simple fare, but they offer a more cerebral challenge than the arcade games.

And before you can say "PCjr," there will be more PCjr-compatible games to choose from than you can shake a joystick at.

Keith Richard Cook is a San Francisco writer and Contributing Editor to PC World.

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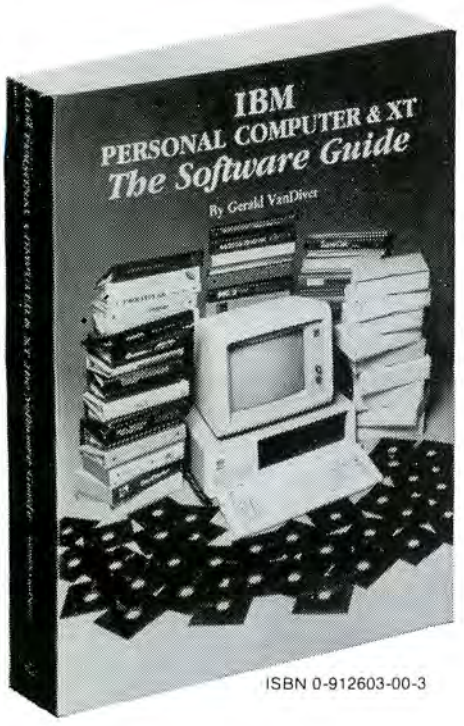

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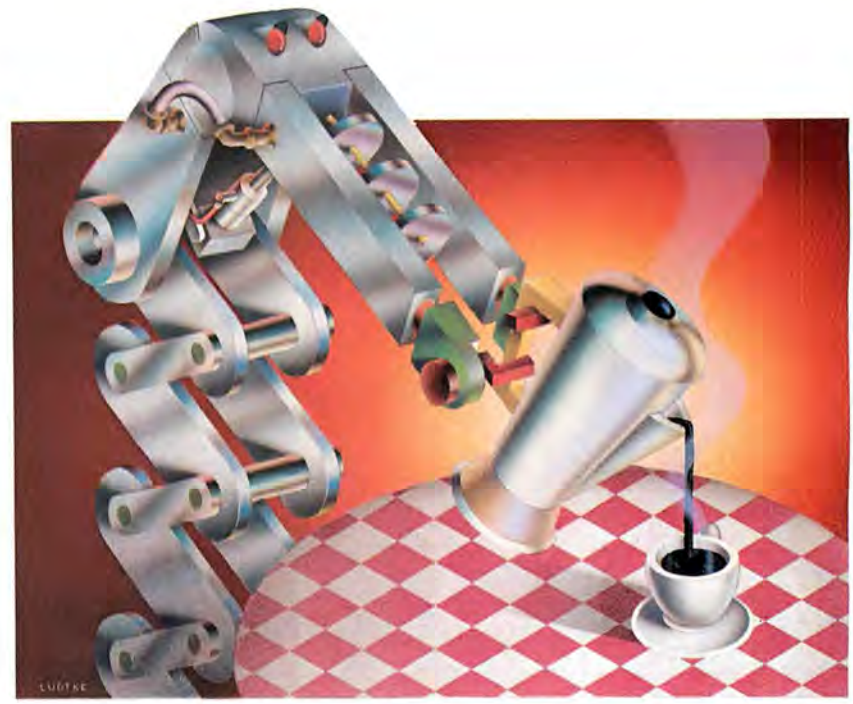

Katie Seger

Megabytes *reports about people, products, and developments in the computer world. We give you up-to-date information on events and trends, and occasionally we speculate about the rapidly expanding world of PCjr.*

Working Arm in Arm

The team working on robotics projects at the Palo Alto Veterans Administration Medical Center thinks that its new robots will improve the lives of severely disabled people throughout the United States and the world. The Rehabilitation Research and Development Center at the V.A. center in California is working currently on a Robotic Aid Project (RAP) that will permit disabled people to give verbal orders to a robotic arm. Normally used in industrial applications, the arm can pick up a phone receiver or take a casserole from an oven upon receiving step-by-step instructions from its master.

The test arm has six joints and a two-fingered hand equipped with optical sensors for measuring distances to objects. The arm extends 24 inches with approximately the same movement flexibility as a human arm. The arm is attached via cable to a microcomputer unit equipped with voice-recognition and speech-synthesis capabilities; the entire system relies on 12 microprocessors. The robotic arm allows human and machine to work together to perform everyday tasks.

Approximately 100 patients and researchers worked with the arm in 1983. Off-site testing in nursing and private homes is being conducted this year. Plans are being made to mount the arm on a wheeled platform to give it more mobility. Researchers believe that the arm, which now costs approximately $70,000, will cost no more than a luxury car in a few years.

L Stands for ???

One of the best features of PCjr is the clear labeling of the connectors, or sockets, on the computer's back panel. Each connector is marked with a letter that helps people identify which equipment to plug into the socket. C marks the socket for a cassette tape recorder, for example, and K marks

the keyboard cord socket. The L socket has been a bit of a mystery, however, since IBM has not yet announced what peripheral will use that connector. IBM spokespersons have avoided answering questions about the connector by saying that the L stands for later.

An industry source says that the L connector on PCjr's back panel stands for local area network. A local area network joins computers in a specific location, usually an office but sometimes an area as large as several buildings. Networked computers share programs, storage, and peripherals such as printers.

PCjr could be hooked up to a local area network through its L connector, but it is more likely that the computer's parallel port will be used for a network link. The parallel port has more pins, or prongs, than the L connector and therefore permits a faster exchange of data through the network. More information about IBM's PCjr network plans will have to wait until later.

Reprogrammable Cartridges

Romox Inc., of Campbell, California, may be changing the way computer games and applications programs are distributed. Romox sells blank cartridges (list price: $19.95) that can be programmed and reprogrammed with games or applications software for personal computers like Atari, Texas Instruments, and Commodore.

The programs are put on the cartridges at the company's terminals, which are set up in retail stores such as K-Mart, Long's Drugs, 7-Eleven, and retail computer stores. If customers grow tired of the software, they bring back the cartridge, and a salesperson erases the program using an ultraviolet light and replaces it with another game or application.

The cost of the Romox software is low—$9.95 is the average price. Approximately 300 stores throughout California have the Romox terminals, and several PCjr programs are scheduled to be included in the company's software titles.

A test conducted in the last quarter of 1983 showed that the Romox distribution service was a success with both customers and retailers, a Romox spokesperson says. The system appears to be a good way to match production and inventory to trends and tastes in software buying.

Convenience $tores

The Southland Corporation, owner of the 7-Eleven store chain, and First Texas Savings Association have agreed to place automatic teller machines (ATMs) in 7-Eleven stores across Texas. Fifty of the 1000 planned ATMs will be operational by June 1, a Southland spokesperson says. The ATMs will accept IMPACT, Pulse, Texas Money Make, and Teller 24 customers' cards as well as some VISA, MasterCard, and American Express cards. Between 5 and 6 million cardholders in Texas are eligible to use the machines.

Two hundred 7-Eleven stores in Pennsylvania, New Jersey, and Delaware have had ATMs since October 1983. Southland's spokesperson says that the company eventually plans to have teller machines in all its 7300 convenience stores nationwide. So the next time you need quick cash, maybe you'll be able to order a Slurpee, too.

Watch Out

The Japanese watch company, Hattori Seiko, is marketing the first wristwatch computer. The computer watch, which has been sold in Japan since January, will be available in the United States later in 1984.

According to reports, the computer components include a 2-ounce watch that serves as both a conventional digital wristwatch and the computer display, a system unit about the size of a desk calculator that can be used to write and edit memos, and a small printer. The system will sell for approximately $230.

Computer Literature

"Surveys have shown that the person who spends money on video equipment is also likely to spend it on computer equipment," says an associate editor for *Video Review*, a four-year-old magazine for home video enthusiasts. For that reason, *Video Review* began including computer game reviews in September 1982 and expanded the section last summer to include reviews of applications programs. As a matter of fact, *Video Review*'s January issue included one of the first reviews of *Home Word* for PCjr; the reviewer gave it a three-star (good) rating. Besides the software reviews, each issue of the magazine now includes at least one feature article on computers. The computer/video marriage isn't so surprising, considering that PCjr's parallel port can be used to connect a laser videodisc player.

BASIC Stars

User groups are common in the personal computer world. Group members, who get together to share information about software or particular computers, usually live in the same geographic location. But Eric Burgess, author of *Celestial BASIC: Astronomy on Your Computer*, has readers from around the world who write to him to share their new discoveries, so he has started an international user group.

Celestial BASIC, now in its fourth printing, contains programs for charting the positions of the planets, determining the dates of lunar eclipses, mapping the night sky, and following other astronomical phenomena. Although Burgess wrote the programs for Apple II computers, he designed them so that "they are amenable to translation" for other computers. Burgess never expected his book to generate the response that it has. "Many people made excellent modifications to the programs so they could run them on other computers. I felt I should share that information," he says.

Burgess gets at least 20 letters and 10 to 15 phone calls each month from readers who have suggestions for adapting the programs for other machines or who want to share some sky-charting information. The user group (with the assistance of the U.S. Postal

Service) is the way Burgess shares the information his readers send him. The author hopes that a few PCjr hints will eventually come his way. You can write to Eric Burgess, c/o Sybex, 2344 Sixth St., Berkeley, CA 94710.

Study Incentive

Krell Software, producer of the *College Board SAT Preparation Series*, is sponsoring "The Great American SAT Contest." The software firm will give away $50,000 in computer hardware and software to students who score highest and improve most in their Standard Achievement Test scores after using the company's software at home or in school. To qualify for the improvement score category, students must take the SAT twice.

First, second, and 15 runner-up prizes will be awarded in both contest categories. In addition to receiving his or her own prize, each of the 34 prizewinners may designate a school to which Krell will donate $1000 worth of software. The contest ends August 31. For more information write to Krell Software, 1320 Stony Brook Rd., Stony Brook, NY 11790.

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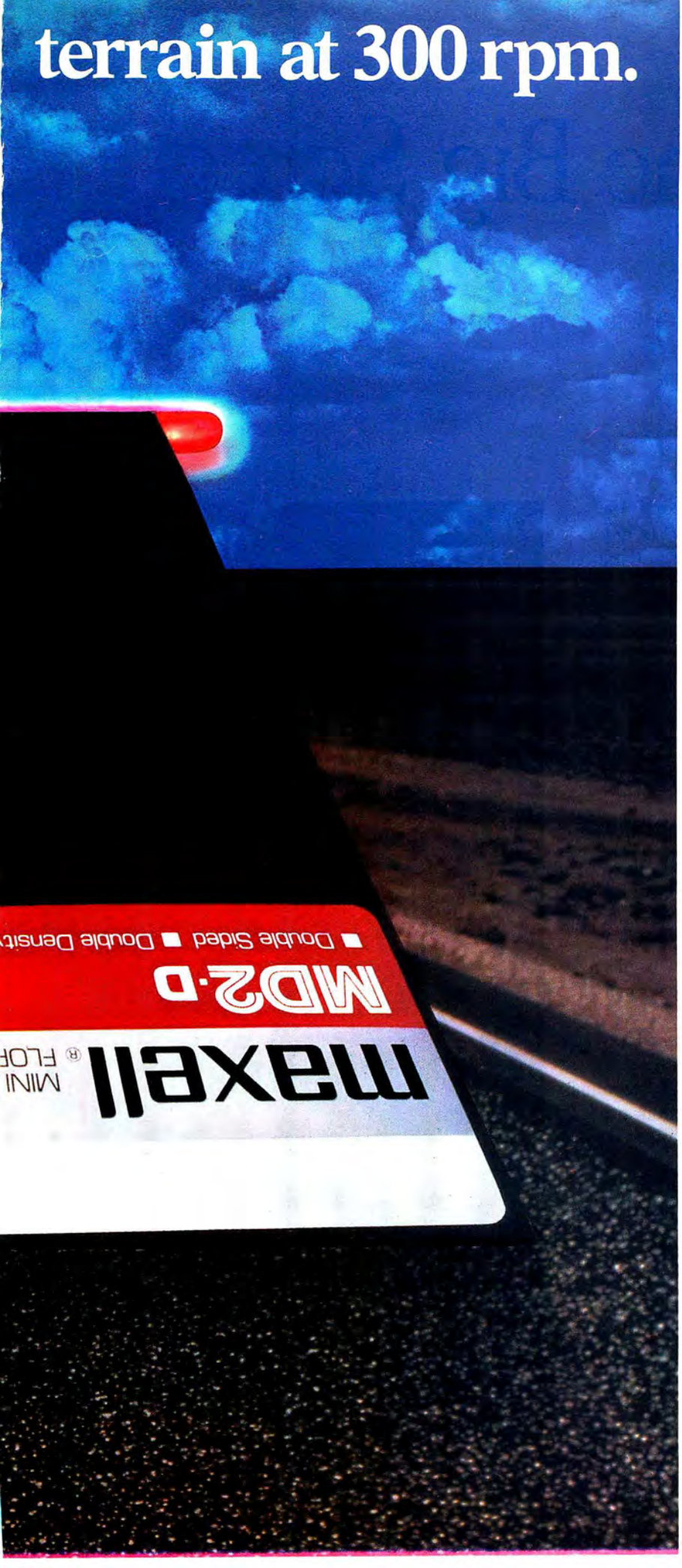

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Up on the Big Screen

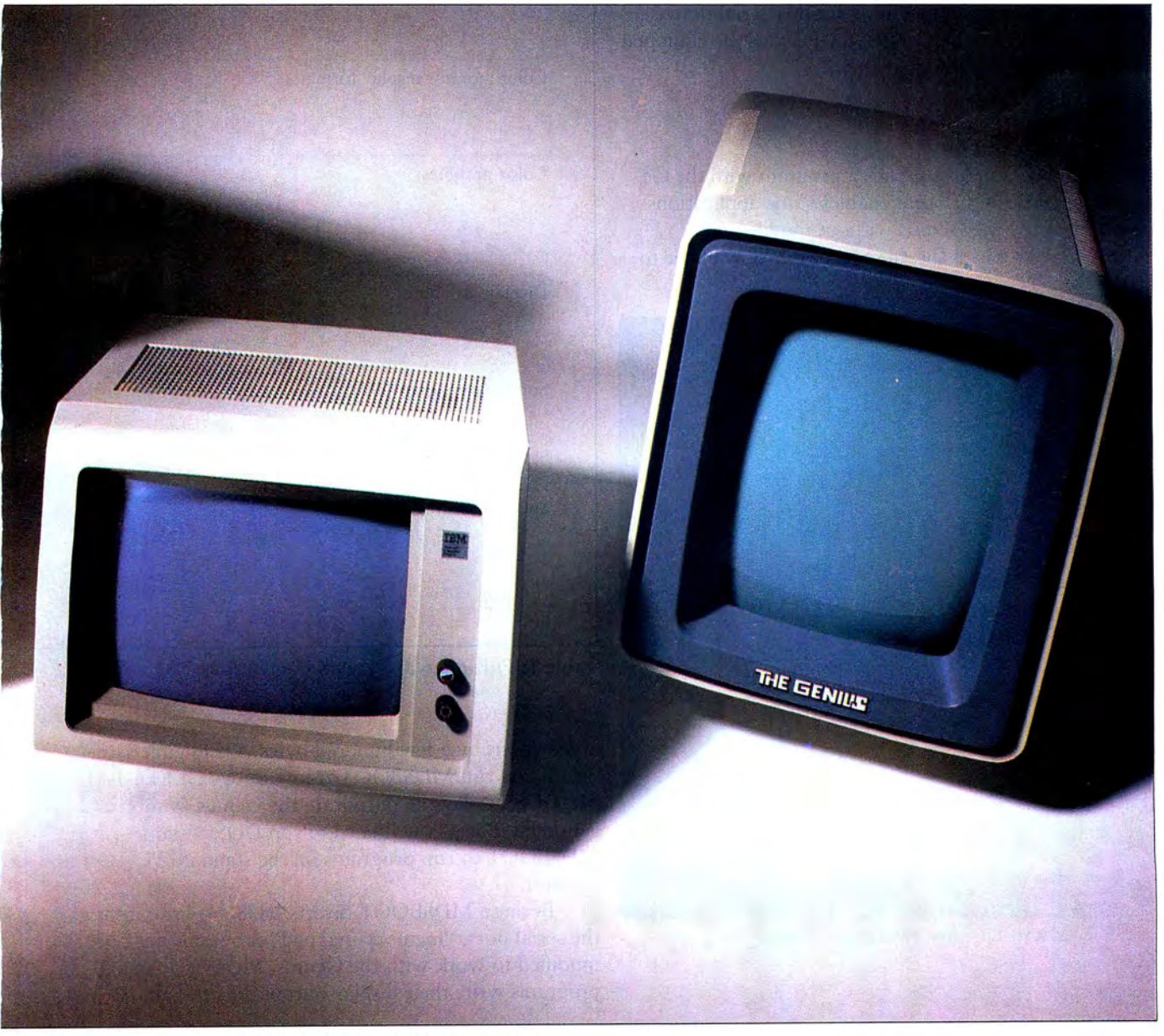
Jonathan Sachs

Are you tired of endlessly scrolling through text? Are your spreadsheets too big to fit on the screen? Is 80 by 25 cramping your style? There are alternatives. Large-screen monitors and extended display adapter boards let you see more data at once.

For a while your computer seemed like an infinitely powerful tool—a magic window into the world of words and numbers. Then you started bumping into its limitations, like the small size of the screen. Most PC users print out their work on 8½- by 11-inch paper, but the standard PC monitor can display only half as much. When you want to lay out a page of text or review a wide spreadsheet or chart on the screen, you can see only part of the picture at one time; to see the rest, you have to scroll or move the cursor and wait for the other part of the image to fall into place. If you're working on a difficult passage and want to review a page or so at a time, the PC's 80-character by 25-line display begins to seem less like a magic window and more like a small peephole.

Until recently, to display a full page you had to shell out $10,000 or more for a dedicated word processing machine. Now large and extended displays are becoming available for the PC (see Table 1). Two of the four products reviewed, Micro Display Systems's Genius and Quadram's Quadscreen, are large-screen monitors. The other two, California Computer Systems's SuperVision and Tecmar's Graphics Master, are graphics boards that reduce character size and line height to make your current monitor display more text. Each of these extended display methods was tested with four applications: the *WordStar* word processing program, BASICA (the Advanced BASIC programming language), PC-FORTH (another language), and Lotus Development's *1-2-3*, an integrated spreadsheet program.

The IBM Monochrome Display flanked by Quadram's



Quadscreen (left) and Micro Display's Genius (right).

The Genius

Micro Display Systems's Genius is a full-page display monitor that plugs into an RS-232C serial interface port such as the one provided by the IBM Asynchronous Communications Adapter. It presents an 80 by 57 (80-character by 57-line) display on an 8½- by 11-inch screen (see Figure 1). You can buy the Genius with a green, white, or amber display. It may be used with any computer and program that can direct the video display output to an RS-232C interface.

Installation

"Installing" the Genius means plugging it into a serial port and setting some switches inside the Genius to the appropriate data rate of 9600 bits per second (bps). If you have to operate a modem or another serial device while you are using the Genius, the PC must be equipped with a second serial interface board.

Software Compatibility

Micro Display Systems supplies a program with the Genius called MDSBOOT that enables some applications programs to use the Genius without modification. MDSBOOT decreases the amount of RAM available to applications by a few hundred bytes, a negligible sacrifice. If you run MDSBOOT from an AUTOEXEC.BAT file, DOS displays its output on the Genius as soon as it is booted. But you will need to run DOS without MDSBOOT to run programs on the standard PC monitor.

Because MDSBOOT diverts DOS display output to the serial port, "memory-mapped" programs must be modified to work with the Genius. Memory-mapped programs write their display output directly into the part

Figure 1: Micro Display Systems's Genius

Manufacturer & device
Description
List price
Need special software to run in 25x80 mode?
RAM needed for special software
Monochrome display formats
Monochrome graphics
Color monitor display formats
Color graphics
Display attributes
Software compatibility
Special features

Table 1: Full-page display characteristics

California Computer Systems SuperVision	Micro Display Systems Genius (RS-232C version)	Quadram Quadscreen	Tecmar Graphics Master
Adapter board	Display unit with RS-232C interface	Display unit and adapter board	Adapter board
$799	$1995	$1995	$695
No	Only one mode, 80x57; needs special software	Yes	No
About 24K	About 0.5K	About 24K	About 58K
80x25, 80x44, 132x44	80x57	80x25, 120x42, 132x46, 160x64; other modes may be defined by modifying software	40x25, 80x25, 40x43, 80x43, 40x50, 80x50, 40x86, 80x86
720x348; requires optional daughter board	None	968x512	18 modes up to 720x704; some can display shades of gray
80x25, 132x30; B&W display only; composite monitors only	N/A	N/A	40x14, 80x14, 40x25, 80x25, 40x28, 80x28, 40x50, 80x50
All standard IBM modes; B&W display only; on composite monitors only	N/A	N/A	22 modes up to 720x400; some can display up to 16 colors; special software supports drawing commands
All standard IBM attributes	Inverse video; blinking	None; inverse video could be simulated by changing character set	All standard IBM attributes
Complete in 80x25 mode; most software requires modification to run in other modes	Most software requires modification to use device	Most software requires modification to use device	Complete in 80x25 mode; most software requires modification to run in other modes
Support for either monochrome or composite monitor	Green, white, or amber display; compatible with any computer having RS-232C interface	17" screen; user-definable character sets; smooth scroll; split screen gives two "pages" side by side	Full emulation of IBM Monochrome Display Adapter or Color/Graphics Adapter; extra colors and/or resolution

of RAM that the display adapter board sends to the screen. Since this technique bypasses DOS, MDSBOOT is unable to catch the output and redirect it to the serial port.

Micro Display Systems provides detailed instructions for modifying *WordStar 3.24* or *3.3* to run with the Genius. For each version, the instructions require entering about a dozen lines of changes using the DEBUG program.

Due to limitations in *WordStar,* no more than 53 lines of text can be displayed on the Genius. Because *WordStar*'s standard page format holds 55 lines, the Genius misses true "full-page" capability with *WordStar* by a hair.

The Genius cannot display bright or dim characters. *WordStar*'s menus and status lines are displayed in blinking inverse video—a distracting effect. You can disable the blinking, however, by writing a program that sends a four-character sequence (27 73 0 5) to the screen.

Review

None of the other programs used for evaluation work with the Genius. PC-FORTH and *1-2-3* simply ignore the Genius and use the standard monitor (if that monitor is still attached). BASICA displays its output on the Genius's screen, but responds to any input—even an empty line—with the message 'Syntax error'.

Micro Display Systems provides modification instructions for several standard software products, but the list does not include many of the PC's most popular applications programs. The only well-known spreadsheet for which modification instructions are supplied is a CP/M-86 version of *SuperCalc*. You will have to keep a

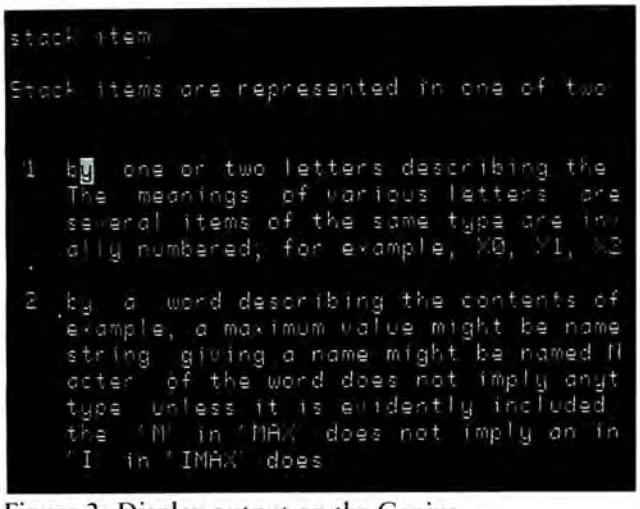


Figure 2: Display output on the Genius

standard monitor and adapter board to use with programs that can't be displayed on the Genius. Micro Display Systems reports that it is working on adaptations for more software, so this problem should diminish with time.

The Genius can display all the characters shown on the PC keyboard but cannot display most of the other characters in the PC's 255-element character set. Applications that depend on the PC's full character set will not perform well on the Genius.

Performance

The Genius produces an exceptionally clear image—a more legible display than the other three products are capable of producing (see Figure 2). The Genius exhibits a certain amount of flicker, but after awhile the flicker is surprisingly easy to ignore. Its cursor is an easy-to-see inverse-video rectangle.

The Genius's Achilles' heel is its serial interface, which results in slow screen refresh. At the PC's maximum data rate of 9600 bps, it takes 4½ seconds to fill the screen with 53 full-length lines.

Documentation

The documentation writers made an effort to describe the Genius's installation and use in nontechnical terms. It is the only one of the four manuals reviewed that includes instructions for adapting some common applications programs to work with the device.

Unfortunately, errors in the manual impair its usefulness. For example, the *WordStar* installation instructions omit DEBUG's w (write) instruction. This omission causes the changed copy to be discarded without being first saved to disk.

The Genius is a unique, well-engineered product, but its adaptation to the PC is technically inadequate. Its serial interface makes it difficult to use with many common applications programs. The shortcomings in the software and the documentation make it difficult to use without assistance from a programmer. If Micro Display Systems develops better documentation and a memory-mapped PC adapter board, the Genius will be dynamite.

The Quadscreen

Quadram's Quadscreen consists of a large-screen monitor and a special adapter board. It offers four display formats; 80 by 25, 120 by 42, 132 by 46, and 160 by 64. All four formats support the PC's full 255-element ASCII character set. The display unit has a 17-inch (diagonal) screen—over 60 percent larger than the IBM Monochrome Display. The Quadscreen is a dot-addressable graphics monitor, and its characters are generated by software. With software provided by Quadram, you can define and use your own character sets.

Installation

The Quadscreen is easy to install: you just plug in the adapter board and hook up the monitor. The accompanying software package includes a program that you must run when you boot up. This program adds software to the copy of DOS that is in RAM, decreasing the RAM available for applications programs by about 24K. Quadram provides a program similar to DOS's MODE command that assigns display modes.

Software Compatibility

The Quadscreen is a memory-mapped device, but it uses a different type of memory mapping than the PC. On the PC's standard monitor, each byte of display memory represents a character. On the Quadscreen, each bit of display memory represents a dot (pixel) on the screen, much as it does on the IBM Color/Graphics Adapter in graphics mode. Display-oriented programs that use the PC's standard memory mapping must be modified to work with the Quadscreen.

Because *WordStar 3.24* and earlier versions do not use memory mapping, they can run without modification. A 2-byte patch makes those versions of *WordStar* display up to 53 lines of text at a width of up to 160 characters (see "Patching WordStar for Large Screen Displays"). A separate copy of *WordStar* must be used for each display mode. Because *WordStar 3.3* is memory mapped, it does not work with the Quadscreen. Presumably, it could be patched to work with the Quadscreen, but patching instructions are not supplied.

PC-FORTH behaves normally on the Quadscreen, although in the extended modes it uses only the upper left part of the screen. *1-2-3* does not work with the

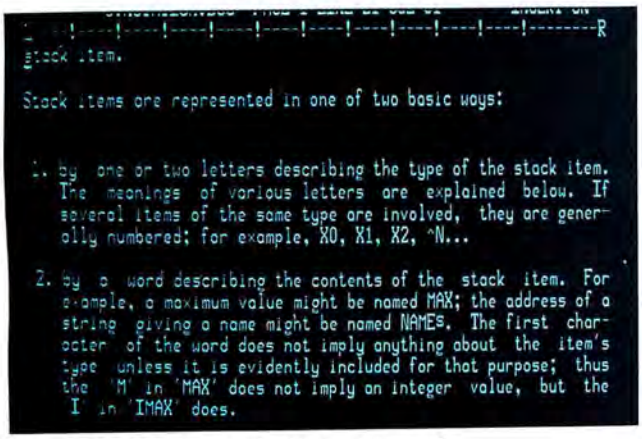


Figure 3: Quadscreen's 80 by 25 mode

Quadscreen at all. Quadram supplies patches that make BASICA fully compatible with the Quadscreen. The patches are applied automatically by a program in the Quadscreen's software called QSINIT. The patched version of BASICA is stored under the name BASICQ. It provides full-screen display for all Quadscreen display modes and offers access to all Quadscreen graphics capabilities.

Quadram claims that any program that runs on a standard display with BASICA will run on the Quadscreen with BASICQ. That is not quite true; BASICQ's COLOR statement won't accept some of the parameters accepted by BASICA. However, the incompatibilities are minor in view of the Quadscreen's vastly enhanced graphics potential.

Performance

The Quadscreen's 80 by 25 display mode produces giant characters (about 5/16-inch high)—a valuable feature for people who have impaired vision (see Figure 3). The 120 by 42 mode produces characters of standard size, similar to those on the IBM monochrome monitor but not quite as sharp (see Figure 4). The 132 by 46 mode produces characters that are slightly smaller, but still quite legible. The 160 by 64 mode produces rather cramped characters that are about as sharp as those of an 80 by 25 display on a good color monitor (see Figure 5).

The Quadscreen has one major shortcoming: it is slow. With text in 80 by 25 mode, filling the screen takes about 6 seconds—and even longer in modes that display more characters. The slow screen refresh is the result of the Quadscreen's redefinable character set, which is achieved by generating each displayed character with software rather than hardware.

When you select the smooth-scrolling option, the lines move smoothly instead of jumping, which makes the display easy to read. Unfortunately, it also slows down an already slow device, and display-oriented applications require special programming to take advantage of it.

Another unique feature is the split screen, which makes the Quadscreen display two half-width "pages" side by side. Text appears at the bottom of the right page. It scrolls up the right page, then moves to the bottom of the left page and scrolls up again. The split-screen

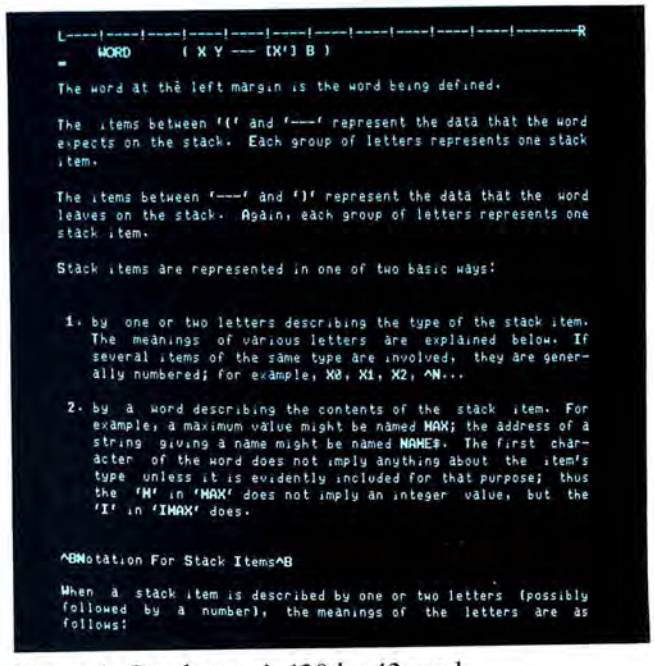


Figure 4: Quadscreen's 120 by 42 mode

feature could be used to show whole pages of text in two documents at once, but it is not currently supported by standard DOS software packages.

The Quadscreen has a "noisier" image than the other products tested—"snow" flickers over the text on the screen. Although the problem is not bad enough to impair legibility, it could increase the strain of using the monitor for extended periods.

The Quadscreen's white phosphor tube was more of a strain on the eyes than the green tubes of the Genius or the IBM Monochrome Display. On the other hand, white phosphor "ghosts" much less than green phosphor does. Overall, the Quadscreen's image quality is adequate.

A more serious shortcoming is the Quadscreen's inability to display bright, dim, or inverse video characters, as the IBM Monochrome Display can. In *WordStar*, for example, blocks of text marked for copying are not distinguished from the rest of the text. Patching *WordStar* to display the markers '<B>' at the beginning and '<K>' at the end of a block helps, but the block is still not as visible as on a standard monitor.

For all its electronic sophistication, the Quadscreen's mechanical design is rather poor. The unit has a flat bottom that is placed on a small plastic stand with a

Figure 5: Quadscreen's 160 by 64 mode

flat top—not the most secure seat for a large, expensive piece of hardware. All Quadscreen controls—even image brightness—are located inside the chassis. Since no instructions are provided for locating these controls, routine adjustments become a job for a technician.

The unit's data cable is so short that the monitor can only be put on top of the PC's system unit. Quadram explains that it had to make the cable short to get the device its class B certification (approval for residential use) from the FCC.

The Character Set

The Quadscreen's software package includes a version of the PC's 255-element character set for each of the standard display modes. It also allows you to create your own character sets. Each mode uses a different font size: a 12 by 20 matrix for 80 by 25 mode, 8 by 12 for 120 by 42 mode, 7 by 11 for 132 by 46 mode, and 6 by 8 for 160 by 64 mode. In comparison, IBM's Monochrome Display Adapter uses a 9 by 14 font, and its Color/Graphics Adapter uses an 8 by 8 font.

> Quadram provides a font-editing program that displays an entire character set.

The characters in the larger display modes are inevitably not as well formed as those in smaller modes, because the character box must be smaller. Quadram did a poor job of defining some of the character sets. In the 7 by 11 set, every character seems to be designed in a different style. The 8 by 12 set is almost as bad.

You can redefine the character sets yourself, but it requires a lot of work. Quadram provides a font-editing program that displays an entire character set. The program can move one character at a time to an editing window. In the editing window, the cursor control keys move a dot cursor around the character; the function keys turn the dot either into a "paintbrush" that leaves a trail of lighted dots behind it or into an "eraser" that leaves a trail of unlighted dots (see Figure 6). The editing program can be learned in a few minutes; the elementary editing commands make it easy, but tedious, to use.

Documentation

The Quadscreen manual's instructions for installing the adapter board and connecting the monitor are detailed but unsurprising. If you've ever installed an adapter board, you may safely skip them. The manual does a poor job of explaining how to install the Quadscreen software, obfuscating a process that is essentially simple. The manual tells you to install the software by using the QSINIT installation program. The program works fine if you have a floppy disk system, but if you have a hard disk system, the manual's instructions—and QSINIT's prompts—don't apply. Hard disk software installation is possible using QSINIT with the DOS COPY command, but first you must understand how Quadscreen's programs relate to DOS—information about which files you should copy is lacking. Except for this oversight, the manual adequately explains the use of the device and its software. Although the manual is not well organized, the software is so easy to use that it doesn't much matter.

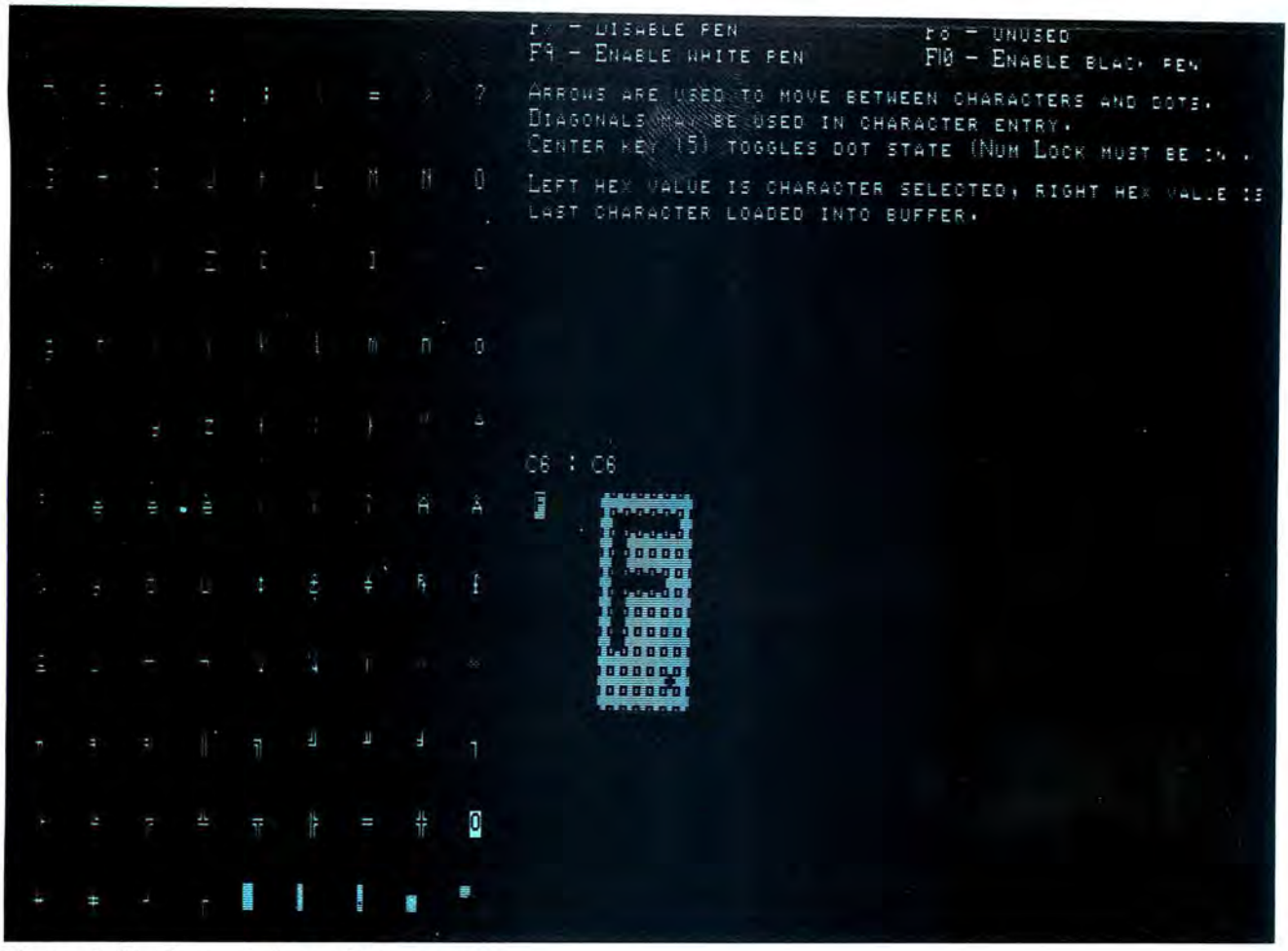


Figure 6: Quadscreen's font-editing program

SuperVision

California Computer Systems's SuperVision is an adapter board that replaces IBM's Monochrome Display Adapter. Like the IBM board, it contains a parallel interface for connecting a printer. But unlike the IBM board, SuperVision offers two extended display modes that display 80 by 44 and 132 by 44 images. The more expensive graphics version of SuperVision can present 720- by 348-bit graphics on a monochrome display. If you don't buy the graphics version, you can upgrade later with a daughter board that plugs into the adapter board instead of using an extra slot.

SuperVision cannot operate an RGB (red-green-blue) monitor such as IBM's color monitor, but it can operate a composite video monitor as well as a monochrome monitor. With a composite monitor it can produce an 80 by 25 or 132 by 30 display and any of IBM's standard graphics displays. On a composite monitor, SuperVision can display only black-and-white images and does not support the use of a light pen.

Installation

Installing SuperVision is easy: just plug it into the system board in place of the IBM Monochrome Display Adapter. For normal operation there is no need to change the factory DIP switch settings.

SuperVision comes with a disk that includes utilities for using the board's extended features. One program, SV, must be run before the extended display modes can be used. SV adds software to the DOS that is in RAM, decreasing the RAM available for applications programs by about 24K. Other utilities must be run to switch between display modes.

Software Compatibility

In SuperVision's extended modes, most display-oriented applications programs must be modified if they are to use the entire screen; some must be modified to operate at all. *WordStar* can be easily modified by using DOS's DEBUG command to change 2 bytes that determine how many lines and columns are displayed. A separate version of *WordStar* must be prepared for each display format.

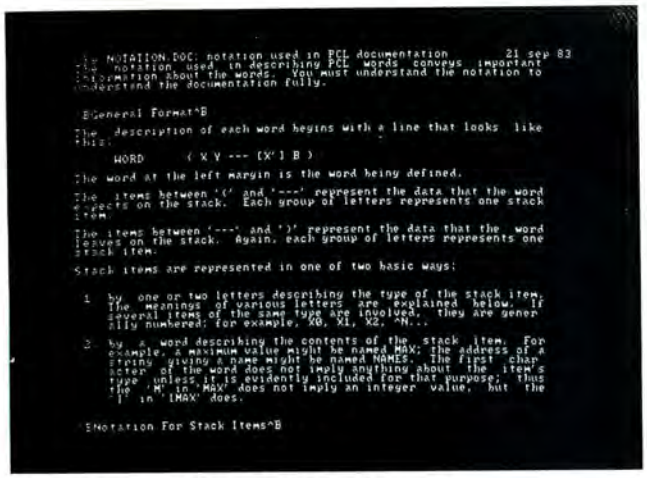


Figure 7: SuperVision's 80 by 44 mode

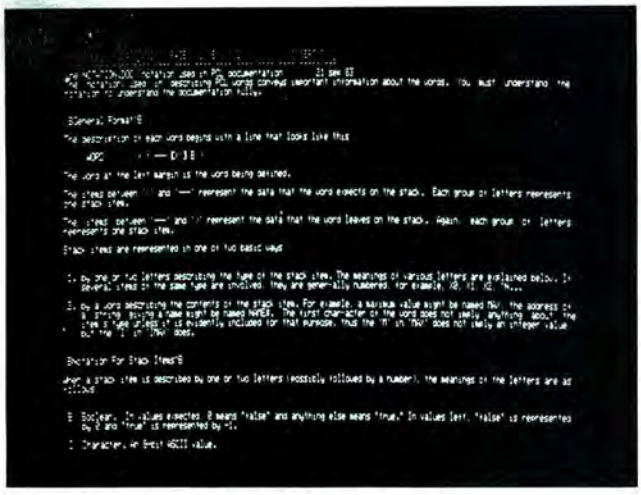


Figure 8: SuperVision's 132 by 44 mode

In the extended modes, BASICA uses only the upper left part of the monitor. The cursor appears as a blinking, underscored, umlauted *u*, and a blinking umlauted *u* is left at the end of each line when you press <Enter>.

PC-FORTH's screen output becomes invisible in the extended modes, but PC-FORTH's built-in program editor works properly in those modes. *1-2-3* ignores the extended mode altogether, forcing the display back to the standard 80 by 25 mode.

Performance

In 80 by 25 mode, SuperVision's display is identical to that of the IBM Monochrome Display Adapter. In the other modes, the characters are smaller and more difficult to read than those of the IBM display. In 80 by 44 mode, each character is as wide as a normal character but only 60 percent as high (see Figure 7). The smaller size does not reduce the legibility of the individual characters, but it does produce an odd illusion: two empty lines on the screen look like one, and three or four look like two.

In 132 by 44 mode the ratio of character width to height is almost identical to that in 80 by 25 mode, so line spacing appears proportional. However, the characters are small and difficult to read (see Figure 8). Most users will find the 132 by 44 mode potentially valuable for preparing wide tables with a word processing or spreadsheet program, but it is not suitable for extended use.

Documentation

SuperVision's manual assumes too much technical knowledge, and it lacks instructions for modifying a software package to enable users to take advantage of the extended display modes. The manual is poorly organized and contains some errors. For example, the software installation instructions show a COPY command that is invalid.

California Computer Systems's personnel promise that a better manual is in the works. The new manual will include instructions for modifying standard software packages to work with SuperVision's extended display modes. In the meantime, they offer telephone assistance to users who are not prepared to figure out software patches on their own.

The Graphics Master

Tecmar's Graphics Master is similar to California Computer Systems's SuperVision. It is an adapter board used in place of IBM's Monochrome Display Adapter. It supports eight display modes on the monochrome display, ranging from 40 by 25 to 80 by 86, including an 80 by 25 mode that allows the board to fully emulate the IBM Monochrome Display Adapter.

The Graphics Master does not have a parallel interface as the IBM Monochrome Display Adapter does. On the other hand, it can perform all the functions of IBM's Color/Graphics Adapter and more: it provides a 16-color display with 320 by 200 resolution on composite monitors and 640 by 400 resolution on RGB monitors. It also displays graphics on the monochrome display with resolutions of up to 720 by 704.

Installation

The Graphics Master is more difficult to install than the other devices tested: you have to set six jumpers on the board. The installation instructions are accurate and detailed, but they assume extensive knowledge of the PC's hardware and software.

Patching WordStar for Large Screen Displays

Before *WordStar* can take advantage of a large display, you must tell it the number of lines and columns the display can show. All standard versions of *WordStar* assume a display that is 25 lines long and 80 characters wide. Changing *WordStar*'s display dimensions is not difficult, but the procedure is not described in MicroPro's documentation.

To change *WordStar*'s display dimensions, run the DOS utility DEBUG, and follow the directions given in the example or one of the variations. Note that these changes are not sufficient to make memory-mapped versions of *WordStar* (such as version 3.3) run with the Genius or the Quadscreen.

```
1. A>debug ws.com <Enter>
2. -e248 <Enter>
3. 0931:0248   19.2B <Space> 50.84 <Enter>
4. -rcx <Enter>
5. CX 5380
6. :5380 <Enter>
7. -rbx <Enter>
8. BX 0000
9. :5380 <Enter>
10. -n wslsm.com <Enter>
11. -w <Enter>
12. Writing 5380 bytes
13. -q <Enter>
```

The following describes the functions and variables of the preceding patch:

Line 2. The e command allows you to display and change the contents of the *WordStar* program file. This command begins displaying and changing the file at location 248H.

Line 3. The first four digits (0931 in the example) will vary on PCs that are configured differently. The value of location 248H is the number of display lines in hexadecimal notation. In an unmodified version of *WordStar,* it should be 19H (decimal 25). Change it to the number of lines to be displayed in your large display by typing the number in hexadecimal. Press <Space> to make DEBUG display the value at the next location (249H), which contains the number of columns *WordStar* will display. In an unmodified version of *WordStar,* this should be 50H (decimal 80). Change it to the number of columns (in hexadecimal) on your large display. If you can't find a decimal-to-hexadecimal conversion chart, use the BASIC command PRINT HEX$(*decimal value*) for single-byte values.

If DEBUG does not display the values 19H and 50H at locations 248H and 249H, do not try to finish the modification procedure. Seek the help of a technically informed person who is familiar with *WordStar.*

Line 6. When DEBUG prompts you with the colon, enter the number that it displayed on the preceding line. This may not be 5380.

Line 9. When DEBUG prompts you with the colon, enter the same number that you entered at line 6. Do not enter the 0000 that DEBUG displayed on the preceding line.

Line 10. Use the n command to specify the file name under which you want to save the modified version of *WordStar.* You may use any name having the extension .COM.

Lines 11 through 13. Use the w command to write the modified version of *WordStar* to the disk file you have named. Use the q command to end DEBUG and return control to DOS.

Try out the modified version of *WordStar.* If it works, you can delete or rename the original version, then rename the modified version to WS.COM (the original version's former name). Until you perform this renaming step, you will not be able to use the R option to run another program from *WordStar*'s main menu.

Unlike the other products tested, the Graphics Master lacks programs for shifting the board to its extended character display modes. A device driver called a General Terminal Emulator (GTE), which provides a powerful set of tools for operations such as drawing lines and circles, is included, but it works only in the graphics modes.

The GTE manual indicates that the GTE can be used to shift the Graphics Master from one mode to another. In fact the GTE ignored all the character mode commands except the one that shifts the display into 80 by 25 mode, which was effective for bringing the adapter out of one of its graphics modes. In any case, GTE slows down the PC's character display speed by a factor of about eight. Thus GTE is useless for text-oriented applications.

Review

The other way to shift the Graphics Master to one of its extended display modes involves writing new values to 16 "mode registers," which regulate the operation of the display controller chip. The manual contains several examples of BASIC programs that perform this function, but the examples don't work. A call to Tecmar revealed that the BASIC programs will never work—the BASIC interpreter interferes with the values set in the mode registers. A program that sets the mode must be written in another language.

Thus the Graphics Master offered me my first opportunity to write a complete program in 8086 assembly language. When the program was completed and debugged, it still didn't work. Another call to Tecmar revealed

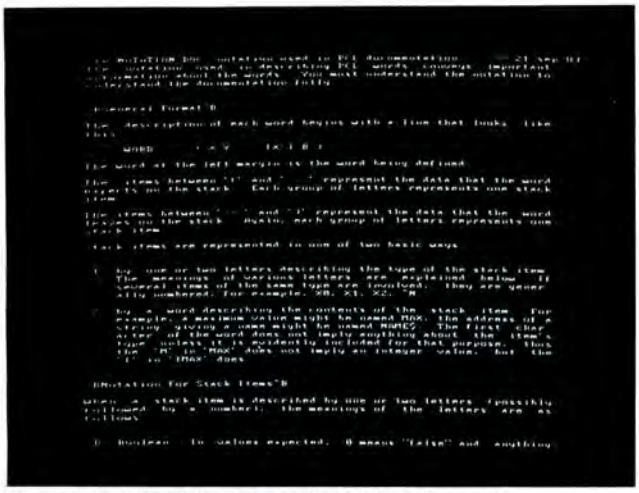


Figure 9: Graphics Master's 80 by 50 mode

that the manual gave incorrect values for some of the mode registers. Tecmar's technical support group dictated the correct values over the phone and sent me an updated copy of the manual.

When the mode-changing program was equipped with the correct mode register values, it successfully switched the Graphics Master between 80 by 25 and 80 by 50 modes. However, the 80 by 43 and 80 by 86 modes produced unsatisfactory results, described later under "Performance."

Software Compatibility

DOS normally scrolls a 25-line display, and with the Graphics Master's homemade mode-changing program, it continues to do so. DOS leaves garbage in the bottom half of the 80 by 50 mode display. Tecmar was unable to say how to correct this problem.

WordStar requires a 1-byte patch for compatibility, to tell it how many lines the Graphics Master is displaying. When *WordStar* returns control to DOS, the PC seems to "forget" where its display memory is. Although commands are executed normally, *WordStar*'s last display remains frozen on the screen until a MODE MONO command is run. Tecmar personnel blamed this problem on *WordStar* and were unable to provide a solution.

BASICA and PC-FORTH both work perfectly in 80 by 25 mode. In 80 by 50 mode they work, but they use only the upper half of the display. *1-2-3* works perfectly in 80 by 25 mode, but in 80 by 50 mode it forces the display back to 80 by 25.

Performance

Once properly installed, the Graphics Master functions as a PC-compatible display adapter. It needs no software support to operate in one of the standard display modes (which one depends on how the jumpers are set).

In 80 by 50 mode, the Graphics Master produces a display with characters of normal width but only half the normal height (see Figure 9), which was difficult to read. The Monochrome Display seems to reach its limit of legibility somewhere between 44 and 50 lines.

The other two modes tested, 80 by 43 and 80 by 86, displayed only the upper one-half to two-thirds of each character. Tecmar suggested several sets of display register values, but none of them resolved this problem. This problem might also affect some of the other modes not tested, such as the extended display modes on a color monitor.

Documentation

Tecmar provides two manuals with the Graphics Master: one for the board itself and one for the GTE. The Graphics Master's documentation is worse than that of any of the other three products reviewed. The manuals are targeted for a user who thoroughly understands the interrelationships among DOS, the PC, and a variety of monitors. The manuals are detailed but poorly organized; related bits of important information are scattered and information is often difficult to find. The manuals' worst vice is inaccuracy so pervasive that it seriously impairs their usefulness.

Conclusions

Because the Genius offers the sharpest image of the devices tested, it is the best for word processing when display speed is not important. The Genius's serial interface slows the display down considerably and prevents most display-oriented programs from operating it without modification. On the other hand, the serial interface makes the Genius compatible with almost every small computer available.

The Quadscreen offers the largest display, both in inches (17 inches diagonally) and characters (up to 10,240 per screen). Its bit-mapped design gives it the unique ability to display user-defined character sets but also causes speed and compatibility problems much like those of the Genius. The Quadscreen is a powerful graphics display, but it is not very good for character-oriented uses.

> The Graphics Master performs all the functions of IBM's Color/Graphics Adapter and more.

For most word processing and spreadsheet applications, SuperVision is clearly the best of the four products reviewed. Its speed and PC compatibility are better than the Genius's and the Quadscreen's, and its 132 by 44 mode and well-designed software give it an edge over the Graphics Master.

The Graphics Master combines full PC compatibility with more extensive graphics features than those of SuperVision or the IBM Color/Graphics Adapter. Unfortunately, the Graphics Master has poor documentation and little software support for character applications. These faults make it appropriate only for programmers who are willing to invest the time it takes to make it work.

All four products reviewed have at least some compatibility problems with a large portion of the software available for the PC. However, if you are willing to make phone calls and find or develop software patches, these extended display products can turn your PC into a magic window.

Jonathan Sachs is an independent consultant living in the San Francisco Bay Area. He the author of Your IBM PC Made Easy *(Osborne/McGraw-Hill, 1983).*

The Genius
Micro Display Systems
P.O. Box 455
Hastings, MN 55033
612/437-2233
List price: $1995
Requirements: Serial port

The Quadscreen
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Norcross, GA 30093
404/923-6666
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408/734-5811
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Requirements: Monochrome or composite monitor

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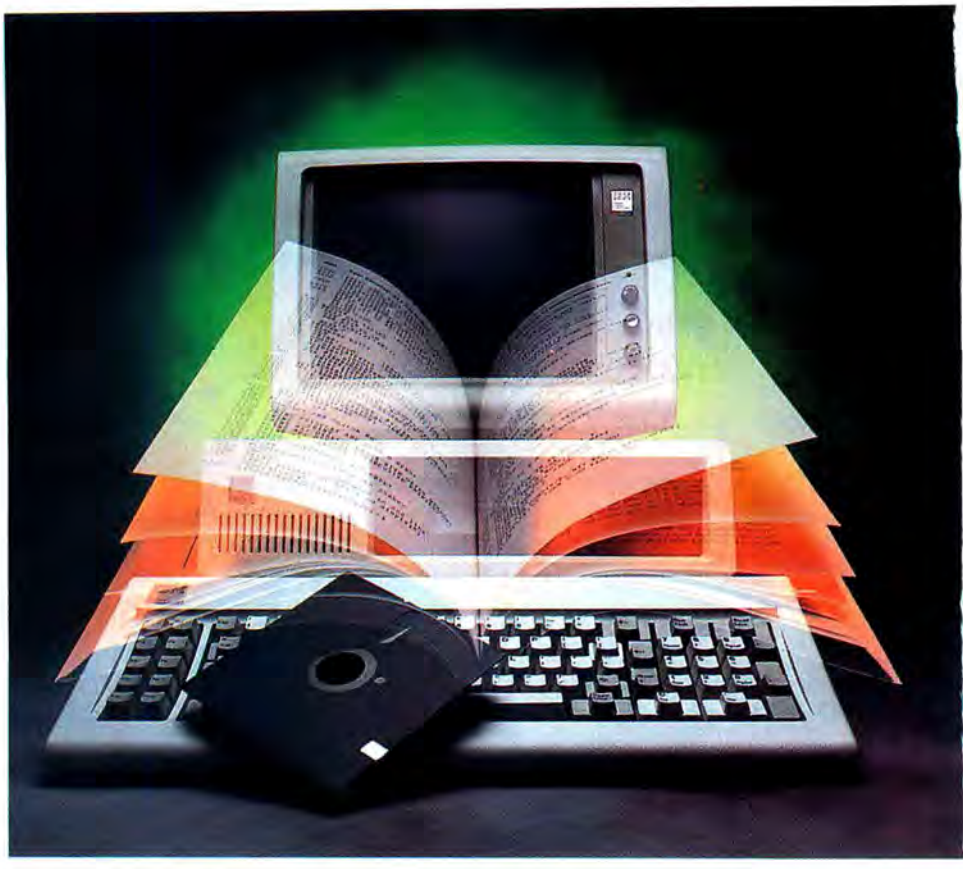

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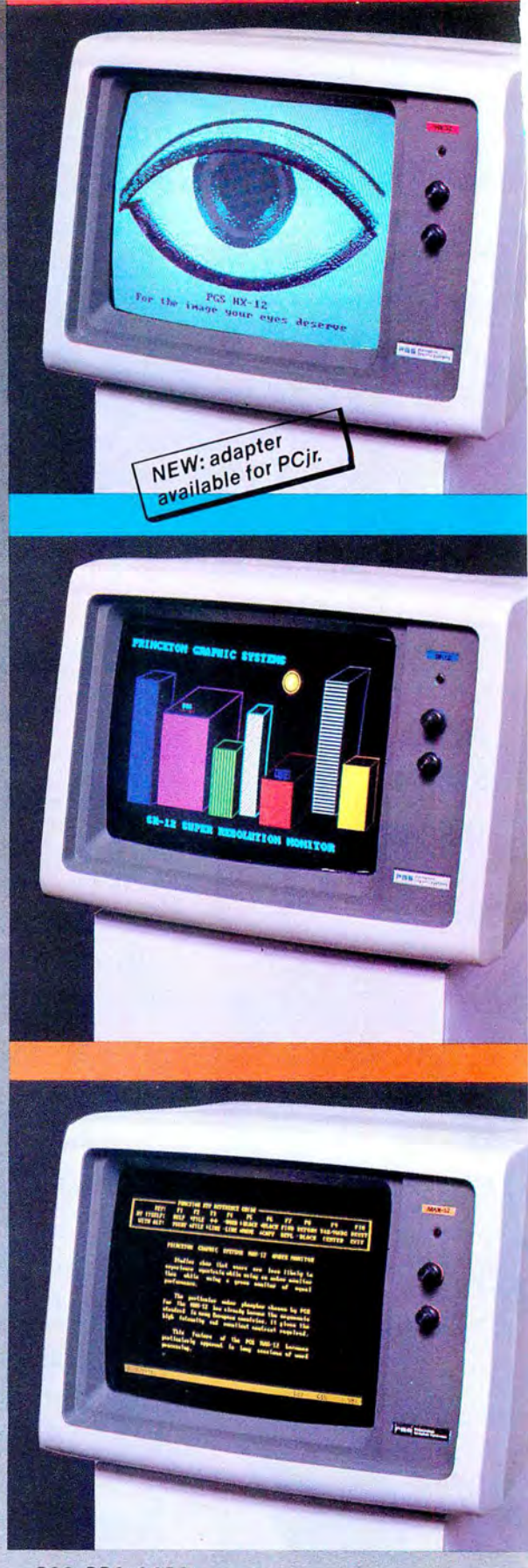

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Legal Troubles

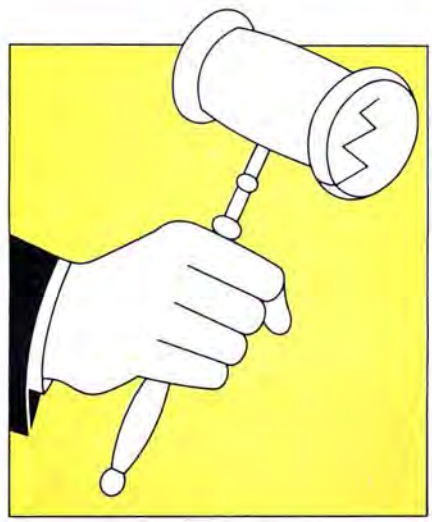
One of the first do-it-yourself legal packages gets off to a shaky start.

Jordan Breslow

Should a consumer buy a program that merely duplicates a function that can be done manually, such as bookkeeping or editing a document? The answer is no—unless the program is faster, cheaper, or more efficient. The *Personal Lawyer* from Lassen Software is none of these.

The four separate packages that make up the *Personal Lawyer—Wills, Power of Attorney, Residential Real Estate Lease,* and *Promissory Notes*—are aimed at the user who needs standard legal documents common to personal and small business transactions. Although the *Personal Lawyer* packages allow you to add a personal touch to prefabricated legal forms, the cost and the risks involved in using the programs outweigh that minor advantage.

The equivalent forms can be purchased from a stationery store for about $1. In addition, preprinted forms for wills, such as California's Statutory Will, can be obtained from the Bar Association and will produce the same or superior legal results. Each *Personal Lawyer* program comes with a user manual that briefly discusses the purpose of the document generated by the program and explains the questions asked by the program. However, local Bar Association forms are not only cheaper, but they have the distinct advantage of being drafted specifically for the residents of a particular state. *Personal Lawyer* programs are designed for use throughout the United States (except Louisiana for the *Wills* program), but they include language that, though not fatal to a document's validity, is inappropriate or misleading in some states. At the same time, legal options that may be beneficial in some states are not included.



In short, the *Personal Lawyer* programs do not offer any real advantage over stationery store or Bar Association forms. But how do they compare with using an attorney? Depending on your attitude toward lawyers, it may be more fun to deal with a computer. But a competent attorney can offer advice, explain the law's salient points, and assist you in choosing the legal document most appropriate to your individual needs. In law, one size does not fit all.

Using Personal Lawyer

The *Personal Lawyer* programs are relatively easy to use: a question is asked, and your response determines the next question. Simple disk formatting instructions are included in each user manual along with limited legal information, a list of the questions asked by the program with some explanatory comments, and the text of a sample document. Printing a document involves specifying the printer type (parallel or serial) and the printing speed in characters per second. Difficulties in using the programs usually relate to design inconsistencies.

The format for entering dates is not explained in the manual or in the program, and you must discover it by trial and error. The <CursorUp>

key is used in the *Personal Lawyer* programs to display the previous screen. But if you hit that key at the first question in *Wills*, the program must be reloaded, a process that can take as long as 3 minutes. The <CursorDown> key generally repeats the answer given to a question the last time that question was answered, but this is not true in every program. Those flaws, while not catastrophic, are irritating.

A Will That Won't

Because *Personal Lawyer* programs use a limited question-and-answer approach for gathering information and cannot offer advice, the question of the appropriateness of the documents they generate must be raised. The problem is most acute in the *Wills* program. There are many kinds of wills, some with trusts and others without; there are even alternatives to wills. Which choice is best? Is estate tax planning necessary? Neither the program nor the 73-page *Wills* user manual answers those questions.

At least in California, the document produced by the *Wills* program is substantially less thorough than a statutory will. For example, a statutory will can be used to establish a trust for the benefit of your children; *Wills* cannot. Keep in mind, too, that a simple will generated by the program may not be the best choice even for those with modest assets and could cost tens of thousands of dollars in estate taxes and probate fees that otherwise might have been avoided.

After answering the first few questions, you may be advised to hire an attorney instead of using *Wills*. That piece of advice costs you the price of the program—$79.95—money that could be better spent on a lawyer. Indeed, the user manual candidly states that the program "cannot replace the educated judgment of an attorney who specializes in estate planning."

In some instances the program gives what amounts to bad advice. A will usually includes a few specific gifts of property, such as a ring or a gift to charity, and leaves the rest, or "residue," of the property to the chosen beneficiaries. But in most states property held in joint tenancy cannot be controlled by a will; it is automatically "inherited" by the surviving joint owner. The explanation in *Wills* of that critical fact is highly misleading, since it implies that joint tenancy property can be left to a person of the user's choice by including it in the "residue clause." It cannot.

Unbending Will

Wills asks a number of questions about the user's family, the gifts to be made, the funeral arrangements, the appointment of a guardian for minor children, the choice of an executor, and so on. The keyed-in answers are plugged into the text of an existing will, and the result is printed, but it cannot be saved to disk and thus altered. The problem is that the program makes a number of significant decisions that the user has no opportunity to make or change.

Wills automatically waives the requirement of a bond for the executor. (The bond is like an insurance policy that protects the estate.) That decision should be made only after considering the skills and judgment of the particular executor and the consequences to the estate if the executor mismanages its assets. *Wills* also automatically authorizes the executor to sell the user's business. A business owner might prefer that a business

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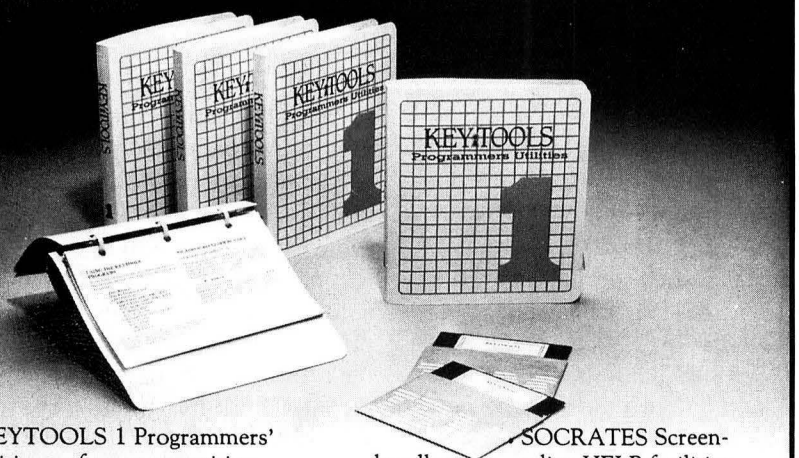

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remain in the family. The choice of what portion of the estate pays estate taxes is also made by the program and cannot be altered.

Power of Attorney

A power of attorney allows you (the "principal") to authorize someone else (the "attorney-in-fact") to handle your financial and legal affairs. A general power gives very broad authority, while a special power limits the authority to specific transactions. The *Power of Attorney* program generates a general-power or special-power form. The program is slightly more flexible than *Wills*. The resulting form can be saved to disk and changed later with a word processor, but it is generally advisable to consult a lawyer before modifying a power of attorney document.

A number of questions must be considered. Which form should the user choose—general or special? Which special power (there are many) is appropriate for the user's intended purpose? How can the power of attorney be modified so that it is valid only if the user becomes mentally incompetent? What legal alternatives are there to a power of attorney (such as a conservatorship or a living trust), and which is best? What is done with the form once it is signed? Those important questions are not addressed in the program or the user manual.

The *Power of Attorney* program also fails to take advantage of legal benefits available in some states. Normally, a power of attorney lapses when the principal becomes mentally incompetent. Thus the document is useless when it is most needed. California and other states have a valuable "durable power of attorney" system that permits the attorney-in-fact to continue to act on the principal's behalf. In order to produce a form that is valid in all 50 states, the *Personal Lawyer* program had to sacrifice that flexibility.

The Least Lease

The *Residential Real Estate Lease* program is an adequate alternative to hiring a lawyer as long as the user understands the legal ramifications of the lease's provisions. The *Personal Lawyer* user manual will not help. At one point the program asks if the lease should allow the landlord to cancel the lease if the tenant files for bankruptcy. The program doesn't state—and the landlord should know—that this provision is invalid under federal bankruptcy law. The program also asks if the lease should require the landlord to maintain the premises in a fit condition for residential use. A landlord might answer no and feel relieved of that responsibility. In most states a lawyer must explain that the landlord is responsible for the habitability of the property regardless of what the lease says and that in some cases a tenant can withhold rent if the property is not habitable.

A Note on Notes

In everyday parlance a promissory note is an IOU, a promise to pay a specified sum at a specified time. If you want to lend a few dollars to a friend or a relative and put it in writing, the *Promissory Notes* program is probably adequate. When larger amounts are involved, *Promissory Notes* may leave you in a precarious position.

The program queries if the note will be secured by collateral, such as a deed of trust or a mortgage. Securing a note, however, is a complex legal process. The user manual advises you to consult an attorney on the matter; unfortunately, this information doesn't reach you until you have paid for the program. In a few instances the text of a note does not reflect the responses entered in the program. One question asks when interest will begin to accrue on the

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note, allowing the lender to specify a no-interest grace period. But the resulting note states that interest accrues from the date of the note.

A Note on Use

Your love of computers or your loathing of lawyers may be the reason you use these programs. My concern is that some people may be lulled into a false sense of security because a sophisticated computer appears to be offering legal advice and making complex decisions based on the user's input. It is doing neither. If you feel compelled to use the *Personal Lawyer* programs, remember that there are some possible dangers. Do not use a program if you do not understand the user manual or the legal document it prints out. Keep in mind, too, that a program will not reflect changes in the law. Unless you know what you're doing, avoid modifying a program's prefabricated text. Finally, do not produce legal documents for your friends—malpractice insurance isn't available to nonlawyers.

Jordan Breslow is a partner in the Walnut Creek, California, law firm of Stewart, Stewart and Breslow, which emphasizes computer and artistic practices law.

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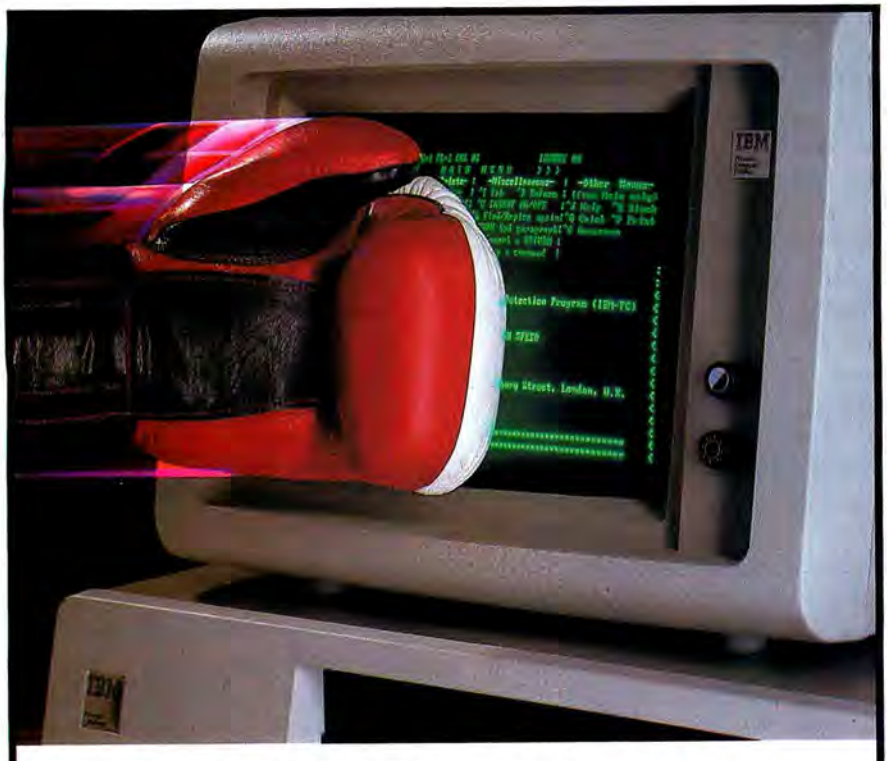

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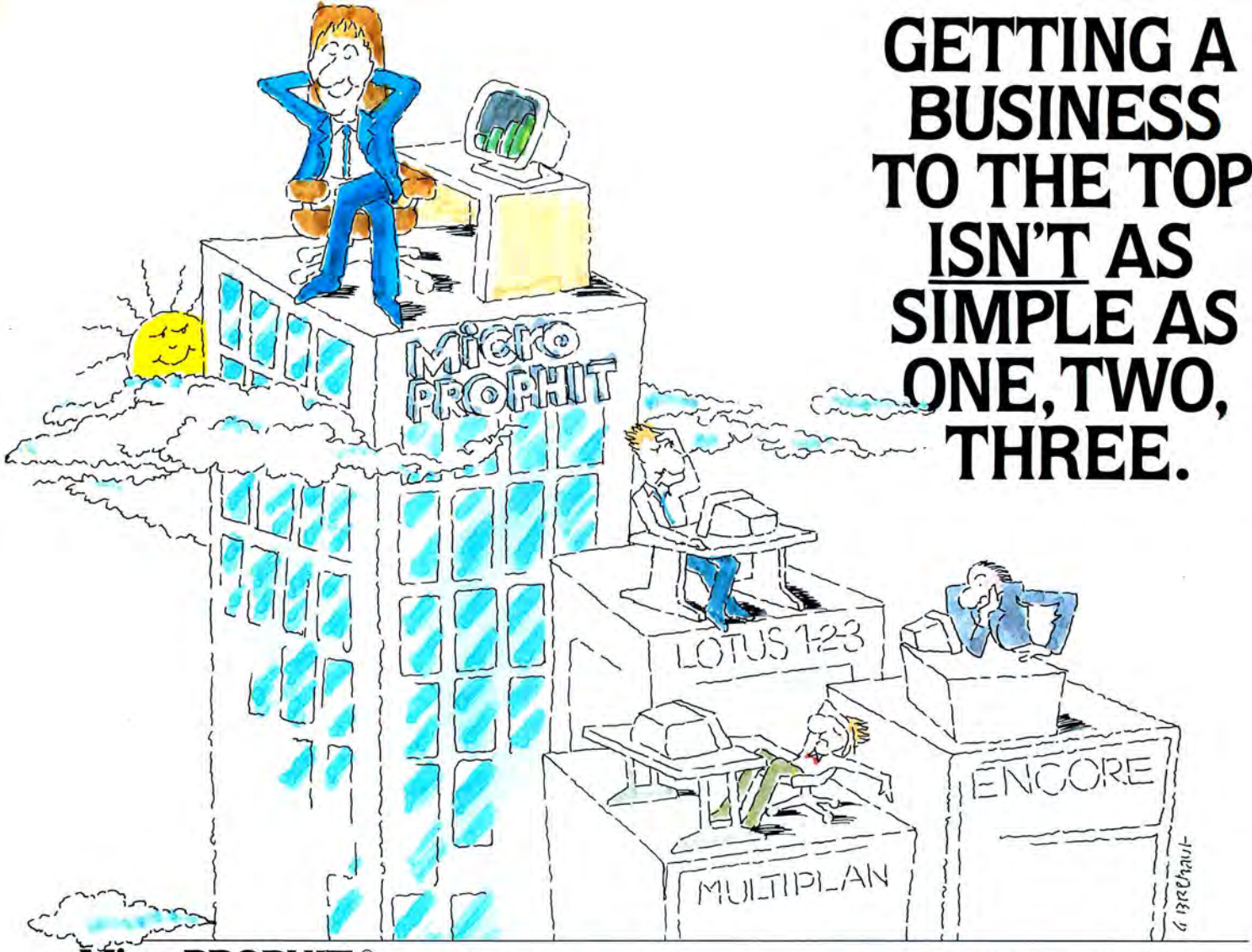

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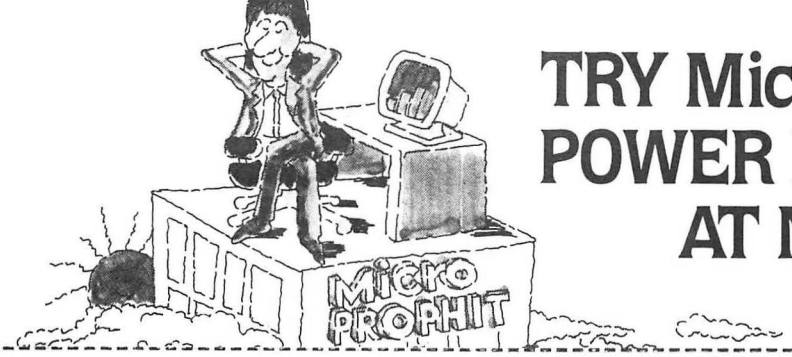

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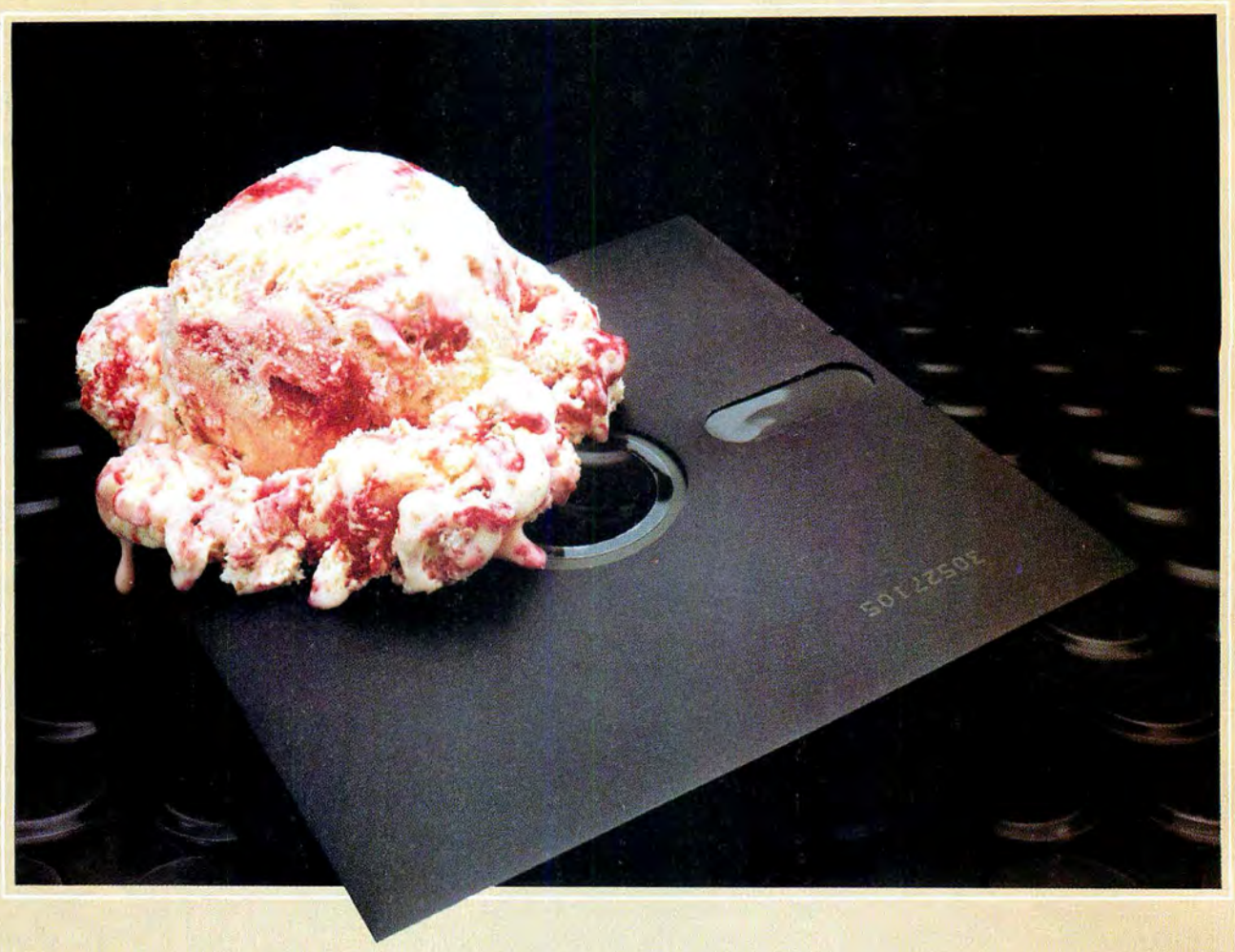

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Michael Ham

The IBM PC has predictably attracted the attention of FORTH developers. You can now choose from FORTH packages specifically designed to take advantage of the PC's special features, such as the following FORTHs from four vendors: FORTH-Level 2 (Version 1.5) from FORTH Technology; PC/FORTH (Version 1.26) from Laboratory Microsystems, Inc.; MMSFORTH (Version 2.2) from Miller Microcomputer Services; and FORTH-32 (Version 2.0) from Quest Research, Inc.

What is FORTH?

FORTH is a programming language invented in the early 1970s by Charles Moore and subsequently refined by him and other users. Based on a philosophy of simplicity, FORTH is finding increasing favor as a developmental tool (see "Go FORTH," *PCW*, Vol. 1, No. 5).

FORTH is a structured, interactive, extendable, high-level programming language. It is its own operating system and compiler, and it also includes an assembler in which the programmer can code low-level, high-speed routines. Except for a core of low-level commands, FORTH is written in FORTH, and you write a program by continuing to extend the language and by extending the compiler.

Note that FORTH is compiled yet interactive: each new (and typically brief) FORTH command is compiled when it is defined. The new command is added to the language (either temporarily for a given application or permanently) and can be used in subsequent definitions that create other new commands.

> FORTH programmers reap the productivity benefits of interactive development without giving up the speed and compactness of a compiled language.

The programmer thus reaps the productivity benefits of interactive development without giving up the speed and compactness of a compiled language. Moreover, since the newly created commands are invoked by programmer-assigned names, the resulting programs can be made easy to read and maintain.

FORTH Disk Formats

Although some packages can read and write disks in PC-DOS format, the usual FORTH practice is to read and write disks in 1-kilobyte blocks, displayed on the screen as 16 lines of 64 characters each. A single-sided disk typically holds 160 such blocks, a double-sided disk 320. (MMSFORTH uses special techniques to read and write disks in a variety of formats, including one that puts 400 1K blocks on each double-sided disk and another that reads and writes disks for MMSFORTH TRS-80 installations.)

The blocks can be read at random: typing 123 BLOCK will bring block number 123 into one of the block buffers in memory (if it is not already there) and leave on the stack the memory address of the first character of the block. This technique makes it easy to write FORTH commands that use the disk as virtual memory, paging (or swapping) blocks into and out of memory as needed.

The blocks store programs as well as data, and the programs typically are stored as source code, just as you wrote it. The command 123 LOAD will cause the contents of block number 123 to appear just as if they were being entered at the keyboard; the FORTH commands in the block will be executed as they are encountered. Since the compiler directives are

commands, the source code can be kept in the block and compiled as it is loaded. And the block can include a command to load additional blocks, so that a single LOAD command can compile a program that stretches over many blocks.

Having ready access to the source code is helpful as you develop a program. You can easily call up the block using the full-screen editor (an amenity offered by all the packages), make any changes you want, and reload the block at once to test your changes.

One advantage of the FORTH packages is that each is to some extent an open book, with most of the blocks containing source code that you can inspect and even modify. FORTH-Level 2 includes exceptionally clear comments that help you modify many of the commands to suit your preferences. (Associated with each block of FORTH-Level 2 source code is another block, the "shadow block," invoked by the command Q; the shadow block contains detailed instructions and comments about the source code in its associated source block.)

However, if you have developed a program package to sell, trade, or give away, you may want to release only the object code—in fact, your licensing agreement may require it.

FORTH programs can be put on a disk in compiled form with all command names deleted, retaining only that part of the FORTH nucleus needed to run the programs. Since this format consists mainly of addresses, it is secure from decompilation. An important consideration in comparing FORTHs is the degree to which each allows users to package programs for sale or trade.

Assembler

Each FORTH package includes an assembler. Assembly language definitions run faster than high-level definitions, and for applications in which speed is essential you may wish to use assembly language for particular commands.

Under the 90/10 rule of thumb, 90 percent of program execution is concentrated in 10 percent of the code. FORTH programmers can write programs in high-level FORTH and then redefine time-consuming routines in low-level assembly language. The FORTH assembler allows assembly routines to be named and invoked by name, just as they are in high-level FORTH, and many high-level control structures are also available at the assembler level.

A single LOAD command can compile a program that stretches over many blocks.

An example of the power of assembled routines can be seen in a demonstration of the quicksort algorithm included with MMSFORTH. The first version is written entirely in high-level FORTH, while in the second the word *partition* is written using the assembler. The demonstration generates 1800 random characters, loads the screen with them, and does the sort (moving the characters on the screen so you can watch the sort as it proceeds). The first quicksort demonstration takes 7.8 seconds, and the second only 3.7 seconds.

83 Standards

The FORTH 83 Standards, which supersede the 79 Standards, had just been approved and adopted at this writing. Agreeing on the importance of recognized standards, the developers of each package reviewed here plan to modify their FORTHs to comply with the 83 Standards. Each package, of course, will implement the standards in its own way, and all packages will include capabilities and features that go beyond the standards.

In the packages reviewed, the observance of the 79 Standards is uneven. PC/FORTH is not a 79 Standards system, but a refinement and an extension of an earlier, public-domain FORTH. MMSFORTH conforms to the 79 Standards except that short command names are used in place of the 31-character names the standard requires. (The short name consists of a number that represents the length of the name, the first 3 characters of the name, and a hash code derived from the rest of the name.)

Many programmers prefer the short name because it uses less memory. FORTH-Level 2 also uses a short name form (without the hash code) unless the programmer specifies that the full name (up to 31 characters) is to be used for a given definition.

FORTH-32 and FORTH-Level 2 observe the 79 Standards, although both have implemented nonstandard options, which in some cases are automatically taken unless you specify otherwise. But you can change some of those options. For example, FORTH-Level 2 includes instructions on how to set the short-name length; you can leave it at 3 or set it to any length up to 31.

FORTH-Level 2

FORTH Technology is the consumer-products distributor for FORTH, Inc., the developer of FORTH-Level 2. FORTH, Inc. is the oldest FORTH-based company, founded in 1973 by Charles Moore and Elizabeth Rather. Although Moore is no longer with the company, FORTH-Level 2 reflects his emphasis on economy and simplicity of design.

FORTH, Inc. has until recently aimed its products at professional programmers and engineers, who use them primarily for real-time applications in science and engineering. FORTH, Inc.'s typical product is a multiuser system used in an industrial environment; FORTH-Level 2 is their first product aimed at the consumer market.

Of the four packages reviewed, FORTH-Level 2 clearly has the best documentation. Although all the vendors recommend the book *Starting FORTH*, by Leo Brodie (Prentice-Hall, Englewood Cliffs, New Jersey, 1981), FORTH Technology is the only one to include the book with their package. This may be because the book is in effect a FORTH, Inc. manual, since that company directed its writing and holds its copyright.

The FORTH-Level 2 manual is clear and well written. It is bound in a small three-ring binder that will fit on most bookshelves. Labeled index tabs divide the sections, which are organized with explanatory subheadings. The appendices include both the FORTH glossary (which is too brief) and a listing of the source code blocks, with their corresponding shadow blocks on facing pages. The comments in the blocks are helpful, and the FORTH code is easy to follow. The manual has both an index and a detailed table of contents.

The command LOCATE supplements the documentation. If you enter LOCATE EXAMPLE the block in which the command EXAMPLE is defined will be listed and the line on which the definition starts will be highlighted. (This works only if EXAMPLE is in the dictionary, but not in the precompiled nucleus.)

FORTH-Level 2 has excellent sound support with two demonstration programs: one defines the musical scale in FORTH commands and then plays several familiar melodies, and the other translates text into International Morse code, sounding the code at the speed you designate. The command BELL sounds a tone briefly, as does BASIC's BEEP. The FORTH commands that perform these functions are clearly defined and well named, and users can readily adapt them to their own programs.

FORTH-Level 2 supports color but only medium-resolution graphics. The 40-column display mode is not supported.

Function keys are handled in an elegantly simple manner: pressing the function key <F3> is equivalent to entering the FORTH command F3. If you have defined F3, the command is executed. If you have not defined such a command, FORTH-Level 2 responds 'F3 ?'. (It is easy to create "empty" definitions, like ": F3 ;" which do nothing except avoid the error message.) Similar commands are entered for <Ctrl>-<F*n*>, <Alt>-<F*n*>, and <Shift>-<F*n*>.

The function keys can issue commands in this way because FORTH-Level 2 does its own keyboard code translation. This means that you don't have access to the normal key input codes; for example, the 8 key in the numeric keypad is always 8 while you are in FORTH (although it functions as the <CursorUp> key in the editor). The <NumLock> key acts as another <Backspace> key. For most uses, this arrangement will work.

FORTH-Level 2 programs are limited to 64K, which perhaps reflects Moore's opinions that 8K is enough for most applications, complex work may require 32K, and 64K is essentially infinite. Certainly FORTH produces compact code; for large applications FORTH code can take up less room than assembled code. It is difficult to imagine applications that would require more than 64K of program space. FORTH-Level 2 does include commands that allow programs to access memory beyond 64K for data storage, though program instructions cannot reside there. The FORTH I/O techniques allow the disks to be used as adjuncts to main memory for arrays and data storage. Thus FORTH-Level 2's memory size of 64K (like that of PC/FORTH and MMSFORTH) will seldom seem limiting.

Although FORTH-Level 2 uses disks in the traditional FORTH format of 1K blocks, it also includes special commands to read and write files in PC-DOS format for DOS 1.00 and 1.10. (Commands for DOS 2.00 were under development at this writing.)

FORTH-Level 2 is its own operating system. When it runs, PC-DOS is not resident in the computer; FORTH-Level 2 is completely independent of PC-DOS. Indeed, the package cannot reside on a PC-DOS-formatted floppy or hard disk. Currently FORTH-Level 2 supports only the Davong hard disk. Generalized hard-disk support (including support for the PC XT) is under development.

Multitasking capabilities are part of the package. The print routine is already a separate task, so the PC can print while accepting keyed input for another job.

Two editors are included with FORTH-Level 2: a simple line editor (described in *Starting FORTH*) and a screen editor. The line editor is loaded with FORTH; it doesn't take up much memory and is useful in making small changes. The screen editor can be loaded separately, or you can make it a part of the FORTH loaded on start-up by following the instructions given in the editor's help screen. (One tenet of FORTH philosophy, observed in all four packages, is not to load extensions until you have to, and then to flush them out of memory as soon as they are no longer needed. This approach stems from FORTH's zealous conservation of memory resources.)

For large applications FORTH code can take up less room than assembled code.

The screen editor I tested had a few bugs (I was working with a beta-test version), and the screen display did not box the text, so it was difficult to determine exactly where the end of the line fell. The line editor,

however, underscores the line being edited on a monochrome monitor (or inverts the colors on a color monitor) so you can see clearly how much room is left on the line.

FORTH-Level 2 includes a package-builder utility, which creates a disk with a binary image of your compiled program (not the source code). This offers a reasonable level of program security as well as making the program load more quickly. If the application package you develop allows no access to the underlying FORTH, including error messages, you can build a package for sale or trade without owing royalties or fees to FORTH, Inc. The policy states that you must submit the package to FORTH, Inc. so they can verify that it follows this restriction. If your package does allow access to the underlying FORTH, you must agree with FORTH, Inc. on licensing and royalties before releasing the package.

The strength of FORTH-Level 2 is its clean, elegant, and simple design. Users can easily understand how it works and can modify the package to suit most situations.

Problems

FORTH-Level 2 has some hair-trigger responses. If you initialize a disk, for example, the program doesn't ask you to confirm the command: it instantly begins to initialize the disk in drive B. But the commands are so clearly written and well documented that you can easily add a question and a pause to the INITIALIZE command.

Other weaknesses are evident. The program lacks a keyboard input buffer, so any keystrokes entered while FORTH is loading blocks or computing are lost. It is often frustrating to wait for the cursor to reappear, even when the wait is only 3 or 4 seconds. (All the other FORTHs include a buffer to capture and save keyed data until FORTH is ready for it.)

The memory-mapped display is fast, but FORTH-Level 2's implementation requires a program to determine whether the screen has room for output. Sending large amounts of output to the screen without appropriate carriage returns will result in data being lost beyond the screen's boundaries. Although there is some wraparound, from top to bottom and right to left, the screen does not automatically scroll upward. And data doesn't always make it through the wraparoud; if the output is a long sequence of numbers, part of the sequence will never appear on the screen. FORTH-Level 2's screen output routines should behave better than they do; it can be argued that programs that dump more than a screenful of data to the screen are not well designed.

PC/FORTH

Laboratory Microsystems, creator of PC/FORTH, produces custom software for the industrial market; 90 percent of their products are for use by researchers and electrical engineers—the primary PC/FORTH market. Laboratory Microsystems has been working on FORTH-related products since 1980, and PC/FORTH was first released in March 1982.

The program's documentation is adequate at best. Sometimes information is presented out of sequence, so if you are stumped at any point, keep reading—the missing links may appear later. The manual comes in a 10-by 12-inch three-ring binder that is too tall for most bookshelves. (It will soon be produced in a smaller size, however.) Neither dividers nor an index is provided.

The documentation is aimed at the technically knowledgeable reader and makes few allowances for the novice. If you are comfortable with the hardware innards of your PC and have

Timing Tests

Each of the packages reviewed in "Four FORTHs" was timed using the PC's internal clock (the results are shown in Table 1). The empty loop, add, subtract, multiply, and divide tests were 30,000 iterations of a loop doing the indicated operation.

The read test simply read 100 consecutive blocks of 1K characters each from the disk, and the read/write test did the same, writing each block back to the disk as soon as it had been read. (Although these blocks were accessed sequentially, FORTH provides direct access to any block.)

The test PRIMES measured the time required to compute and display all prime numbers less than 1000. The test was named PRIMES for each FORTH package, though both FORTH-Level 2 and MMSFORTH use only the first 3 characters of a name. Listed below the execution time in Table 1 is the number of bytes that a particular package's compiled version of PRIMES occupies in its FORTH dictionary. When the command definition straddled a 64K boundary in PC/FORTH+, it required 138 bytes. The FORTH and the BASIC versions of PRIMES are displayed in Listings 1 and 2.

In FORTH, the word DO gets two numbers from the stack and uses them as the start and finish values for its loop. The current index value is then placed on the RETURN stack (FORTH's other stack). The FORTH word *I* copies the current index value from the RETURN stack. This

will always be the index value of the loop the program is currently within. The FORTH word *J* does the same thing as the word *I*, except that *J* obtains the current index value of the DO...LOOP that is nested around the currently executing DO...LOOP and places that value onto the stack.

In the FORTH version of PRIMES, each iteration of the outer DO...LOOP (from 1 to 1000) places a 1 on the stack and then proceeds with the inner DO ...LOOP. The inner loop checks whether any of its indices (from 2 to 500) will divide the current outer loop index. If so, the 1 on the stack is dropped and replaced by a 0. When the inner loop is finished the program's last IF...THEN tests the value on the stack. A value of 1 indicates that the current index value of the current loop (the outer loop) is prime, and the FORTH word . displays the index value on the screen.

The BASIC version of PRIMES was written to match the functions of the FORTH routine. The function of FORTH's DO...LOOP cycle is mimicked in BASIC by the FOR ...NEXT loop. For each iteration of the outer FOR...NEXT loop (from 1 to 1000), the BASIC version of PRIMES checks whether any of the inner FOR...NEXT loop indices (from 2 to 500) will divide the current outer loop index. If none will, the outer loop index is prime (or 1) and is displayed.

```
( A program to find and print all primes < 1001 )

: START    0 0 0 SET-TIME ;

: PRIMES   CR START
           1001 1 DO     1
                         501 2 DO    J I >
                                     J I MOD 0=
                                     AND   IF DROP  0 LEAVE THEN
                                     J I = IF LEAVE THEN
                               LOOP
                         IF I . CR THEN
                   LOOP
            TIME ;
```

Listing 1: PRIMES, FORTH version

```
10 REM  A PROGRAM TO FIND AND PRINT ALL PRIMES < 1001
20 DEFINT A-Z
30 TIME$="00:00:00"
40 FOR J=1 TO 1000
50    K=1
60    FOR I=2 TO 500
70       IF J>I AND J MOD I=0 THEN K=0:I=500
80       IF J=I THEN I=500
90    NEXT I
100   IF K THEN PRINT J
110 NEXT J
120 PRINT TIME$
```

Listing 2: PRIMES.BAS, BASIC version

	FORTH-Level 2	PC/FORTH	PC/FORTH+	MMSFORTH 2.2	FORTH-32 WORD mode	FORTH-32 LONG mode	BASIC
Empty	1.0	1.0	1.9	1.0	1.5	2.0	37
Add	2.3	2.2	3.8	2.2	3.9	4.8	114
Subtract	2.3	2.2	3.8	2.2	3.9	4.8	115
Multiply	3.1	3.0	18.5	3.0	5.0	10.1	111
Divide	3.4	3.3	18.5	3.3	5.1	30.5	109
Read/Write	37.2	39.8	40.4	47.8	23.2	23.3	120
Read	14.8	19.9	20.0	8.0	20.2	20.3	40
PRIMES	26.1	25.2	91.9	26.9	61.6	122.8	551
(Bytes)	(88)	(101)	(98)	(91)	(191)	(103)	—

All values are time in seconds except the last line, which is the number of bytes occupied by PRIMES.

Table 1: Timing test results and size of PRIMES

done some assembly language programming on the 8088 or 8086 processor, the technical information will be useful rather than intimidating. But you will find it hard to locate information in the poorly organized manual.

PC/FORTH includes the command BEEP, which produces a sound, and one of the demonstration programs plays a bugle call. Color graphics are supported with a few commands to place dots and generate lines, but for serious work you will need the color graphics extension package ($100). Forty-column display is supported.

PC/FORTH uses the function keys (for example, in the screen editor) but provides no easy way for you to assign functions to them; it has nothing like FORTH-Level 2's F*n* commands.

Like FORTH-32, PC/FORTH operates under PC-DOS. The FORTH program is a command file, and the blocks that FORTH uses reside in another PC-DOS file with the extension .SCR (for screen, a synonym for block). When you are in PC/FORTH, you can read and write these blocks just as in a normal FORTH, but you can't know exactly how much room you have (since the disk may contain other files). Thus when you attempt to write a block, you may get a 'no more room on disk' message.

In traditional FORTH this problem does not arise since each block is in a fixed location on the disk and you know exactly how many blocks you have. With PC/FORTH you have the advantage of being able to maintain separate files for different collections of blocks. This enables you to put different applications or programs on the same disk. But from within PC/FORTH you never know whether you have a little or a lot of room left.

PC/FORTH programs, like those of FORTH-Level 2, are limited to 64K (but to have that much room you must have more than 64K installed, since PC-DOS occupies some of the available memory). PC/FORTH includes instructions to access memory beyond 64K for data storage, arrays, and the like.

Laboratory Microsystems also sells PC/FORTH+, which uses an expanded instruction format to enable programs to occupy memory beyond the 64K limit. When you buy PC/FORTH+ you also get PC/FORTH; and if you have bought PC/FORTH, you receive a $100 credit toward the purchase of PC/FORTH+.

The expanded instruction format means that the normal FORTH cells, which are 16 bits wide (and handle addresses up to 64K), become 32 bits wide to accommodate larger addresses. This provides a greater range for "single-precision" integer arithmetic but means that internal operations are slowed because all instructions that formerly brought in 2 bytes now must bring in 4. The timing test results (Table 1) show the reduction in processing speed.

Before opting for the greater address space be sure you need it. FORTH programs are extremely compact, and you can write your programs so that only a portion of a program is in memory at any one time.

PC/FORTH and PC/FORTH+ are essentially the same program, except for the difference in the addressing techniques and changes in the dictionary structure to accommodate the longer addresses. Neither program has any compatibility problems with PC-DOS. PC/FORTH files can be on a floppy or hard disk with PC-DOS files and can be operated under DOS 1.00, 1.10, or 2.00. The FORTH programs can also read normal PC-DOS files through a special set of commands included with each package.

Multitasking capabilities are included, and an example in the manual shows how to display a clock running in background mode on the screen.

The screen editor provided with PC/FORTH is one of the best. It clearly has been polished through use in a production environment and is both powerful and friendly. At any time you can get a complete list of available commands by pressing a function key. The list of commands is extensive but useful. For example, <F1> date-stamps a block; normally the first line of the block is reserved for identifying information, such as the title, the programmer, and the date. Since these are not to be executed as commands, they must be enclosed in parentheses. <F1> encloses the first line in parentheses, puts the current date (from the system clock) at the right-hand end of the line, and positions the cursor one space past the opening parenthesis so you can enter the title information. A clever feature, and practical as well.

Unlike the FORTH-Level 2 screen editor, the PC/FORTH editor surrounds text with a box, so you can see exactly how much room is left on each line. You load the editor separately and it remains in memory. It is precompiled (so you can't make changes in it) and loads quickly.

The screen display is better behaved than that of FORTH-Level 2. There is no strange wraparound from the top; when output reaches the bottom right corner, any further output is thrown away (unless, of course, your command includes appropriate carriage returns to force the screen to scroll). Discarding output was a design decision made to avoid the overhead of building scrolling routines into various primitive commands, but the result is not totally satisfactory. Both MMSFORTH and FORTH-32 scroll the screen upward once it is filled, discarding no data.

PC/FORTH charges no royalties or licensing fee when the purchaser creates and sells applications programs that contain PC/FORTH as part of

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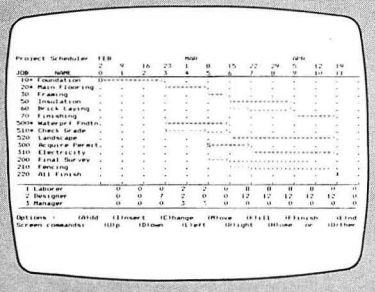

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Review

the run-time module if FORTH is "sealed off" from the end user. This is done by making the package self-booting and by controlling the abort routines through a procedure described in the manual. Thus, PC/FORTH is exceptionally friendly to the software developer.

Note, however, that this capability does not give you a compiled version of your program; the disks you distribute will contain screen files with your source code in them, to be compiled as the blocks are loaded. Thus you have minimal security. A better approach would be to distribute only precompiled FORTH, which is not only more secure but loads faster.

The strengths of PC/FORTH are its speed, its friendly relationship with the PC-DOS operating system, and the range of add-on packages available. As previously noted, PC/FORTH does not observe the 79 Standards, but the next release (Version 2.0) will adhere to the 83 Standards.

One problem I encountered was the amount of discipline needed in signing off. When you are done using PC/FORTH, you must execute the command BYE to exit to DOS, and you must have the same disk that you started with in the drive. Otherwise the original disk may be left in an indeterminate and unusable state, and if the contents of any updated disk buffers intended for the original are written back to the disk currently in the drive, information on this disk will be lost.

MMSFORTH

Miller Microcomputer Services (MMS) has been in business since 1977, and the first version of MMSFORTH (for the TRS-80 Model 1) was available in 1979. The PC version, expanded with special capabilities for the PC, first came out in July 1982. MMS focuses equally on developing custom software and selling, supporting, and refining MMSFORTH and related software packages.

MMSFORTH's documentation reflects its history. The manual obviously is a quick rewrite of the TRS-80 manual, with instructions for the TRS-80 and the IBM PC intermixed. It seems to have been not so much written as accumulated, with information inserted from time to time wherever it seemed to fit. The explanations often show haste or weariness; some amount to "Here's a list of the commands; look them up in the glossary."

You don't get the key parts of the manual (including the glossary) when you buy the software. They are mailed to you only after MMS receives your license agreement. The sign-on screen and the manual itself bristle with warnings not to make any unauthorized copies. (None of the packages I discuss is copy-protected.)

The manual lacks dividers and an index and in general is not up to the standards set by the software. It is bound in a full-sized three-ring binder too tall for most bookshelves.

The manual includes a tutorial examination of three sample programs, although one is explained only for the TRS-80. IBM users are referred to an unspecified block on the disk.

The source code on the screen is compact, much of it in assembler. A lot of tricky programming is evident, and a novice would be well advised not to tinker with the definitions until he or she can understand them (and thus is no longer a novice).

MMS offers telephone support and also publishes a newsletter about fixes, interesting applications, and MMS products. The schedule is bimonthly, but gaps between issues are often much longer.

Sound is barely implemented. The dictionary includes no sound-generating words, but some of the demonstration programs produce sound, and you can analyze their formulations as a start for your own definitions. (The collection of demon-

stration programs in MMSFORTH is excellent. The programs are intrinsically interesting; they include games, a small word processor, a checkbook balancer, and the sorting demonstration.)

MMSFORTH provides a 40-column display mode, color, and low-resolution (80 by 50) graphics. Medium- and high-resolution graphics are part of the separately-sold utilities package, which also includes high-level support for the 8087 chip. (The 8087 support that comes with MMSFORTH is for the assembler level only.)

You can assign any string you want to each function key. This method is not as simple to use as FORTH-Level 2's, but it seems more powerful since the data stored for a function key can be either treated as a string of keystrokes in the input stream or executed as commands. PC/FORTH's F1 date-stamp function is easily duplicated using the MMSFORTH function-key capabilities.

The memory-mapped display is fast and the screen is well behaved. No data is lost beyond the screen boundaries or discarded at the foot of the screen; data will scroll past the top of the screen, but you can use <Ctrl>-<NumLock> to pause screen output.

MMSFORTH programs must reside within the 64K limit, but "long-address" words are provided that enable you to access the full range of memory for data storage. In addition, the package includes an emulated disk (a portion of memory that acts as a very fast disk drive) and a print spooler. Other than the print spooler, no multitasking function is provided.

Although MMSFORTH does not read or write PC-DOS files and is incompatible with PC-DOS disk formats, it includes a technique (which I did not test) for partitioning a hard disk so that PC-DOS uses a part of the disk space with the DOS format, and MMSFORTH uses the remainder, formatted into traditional

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Review

1K blocks. Support for the PC XT hard disk is provided, and support for other hard disks (including the Davong and the Corvus) is available as an option.

Using MMSFORTH you can adjust the rate at which keys repeat when they are held down. They go like lightning at the initial setting. This feature is a delight—you will be surprised how much faster editing goes when the cursor flies across the screen as you hold down the arrow keys. You quickly become used to this convenience and will be frustrated by the sluggish cursors in other editors and programs.

The editor display is clear and the text is boxed. A "pad" line is displayed beneath the text box; any lines you drop are moved there, and you can reinsert them at the line the cursor is on. If the pad is blank, you can use it to insert blank lines. It is a toss-up between this screen editor and PC/FORTH's; both are fast and convenient.

MMS allows no copies of its standard package to be sold, lent, or traded. If you write a program, only you and others who have MMSFORTH can use it. But MMS makes a package-builder utility, which strips out the part of the FORTH nucleus necessary for your application and creates a bootable disk with your precompiled program resident on it. With this package you can distribute your applications programs with no licensing restrictions, royalties, or fees as long as FORTH itself is inaccessible to the user. The package-builder utility costs $5000 (reduced to $500 if you agree to make no more than 50 copies).

The strengths of MMSFORTH are its speed and capability. The vocabulary is rich with many additional words to handle strings, arrays, and special features of the IBM PC. The additional disk capacity is useful, and the editor is a pleasure.

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MMSFORTH includes good demonstration programs and useful options, and the additional utility package is reasonably priced at $40.

MMSFORTH's weaknesses are poor documentation and the lack of an inexpensive channel to make your programs available to others. The weak documentation is a particularly serious flaw because the source code, written for speed rather than instruction, is difficult to read and understand.

FORTH-32

Quest Research, in business since July 1982, released FORTH-32 in March 1983. Version 1 was supplanted by Version 2 in July 1983. The professional staff of Quest Research previously did defense work on the United States ballistic missile system; future projects include a comprehensive office automation system.

FORTH-32 is the youngest of the packages being reviewed, but in some ways it is the most ambitious. Quest Research's staff has a background in minicomputers and has tried to bring minicomputer power to FORTH-32. Its programs are not limited to 64K; as in PC/FORTH, they may occupy all the PC's memory space. ("32" refers to the 32-bit-wide address structures used to make such programs possible.) The package supports light pens, joysticks, and disks in three formats: regular PC-DOS format, FORTH blocks kept in PC-DOS files (like PC/FORTH), and the traditional FORTH format (like FORTH-Level 2 and MMSFORTH). FORTH-32 also provides a 16-bit instruction set, which can be used for programs that reside within 64K, and includes a helpful and sophisticated debugging aid.

The documentation is well packaged; it comes in a short, three-ring, boxed binder. The contents are less pleasing, however, for they include a formidable amount of technical detail presented in rigorous, uncompromising fashion. The author clearly wants the reader to understand precisely how FORTH-32 works, and you need the information to exercise some of the package's options. The writing has no fat and no slack, just hard-driving technical detail. One longs for a bit of white space or a touch of humor.

The manual's organization is logical to a fault; readers are expected to study 118 pages of detailed technical description before learning how to boot up the disk and get into FORTH. It makes sense to want readers to be fully informed before they try to use the system, but Quest Research should realize how eager most users are to fire up their new systems and see what they can do.

The glossary is in the middle of the book, followed by chapters on the editor, the graphics, the decompiler, the debugger, and the assembler. An index is included, but there are no dividers. Overall, I rate the documentation as accurate and complete, but not user-friendly.

Sound; color; and low-, medium-, and high-resolution graphics are supported. The sound command lets you specify both frequency and duration. In addition, FORTH-32 supports 40-column display.

No special routines exist to handle the function keys or make it easy to assign functions to them, but it is simple to assign a special routine to <Ctrl>-C. This seems to be a step backward.

The screen discipline is good, like that of MMSFORTH; output wraps around by itself and scrolls up. Pressing <Ctrl>-<NumLock> pauses the display before it scrolls past the top of the screen.

The FORTH-32 programs can occupy all the PC's memory space, but this requires complex maneuvers. FORTH-32 has two operating modes, LONG (32-bit) and WORD (16-bit). You use the command %LONG to enter the LONG mode and %WORD to enter the WORD mode. Separate commands can be created for each mode, but under significant restrictions; a WORD command cannot be created unless there is already a LONG command with the same name, and the WORD command must be created immediately after its LONG twin.

The problem with this approach is its overhead. One overhead cost is the significant increase in time required to perform many operations (see Table 1). Other costs are paid by the programmer, who must type in a LONG definition for every WORD definition created. (The WORD mode version of the timing test PRIMES is almost twice the size of the LONG mode version.)

The programmer can include the mode-change command %WORD inside a LONG command, and the LONG (32-bit) command will then execute in WORD (16-bit) mode. The programmer gets the speed benefits of the WORD mode without having to type in a separate WORD command. Overall, however, PC/FORTH+'s approach is much easier on the programmer.

FORTH-32's prompt differs from the traditional FORTH response of "ok" at the end of a line, followed by the cursor returning to the beginning of a new line for a command. FORTH-32's prompt is L> (or W>, depending on which mode you're in) at the beginning of the line, and the command is entered immediately after the prompt with no intervening space.

The FORTH commands (called *words* in the FORTH community) are called *verbs* in FORTH-32, since *word* has been used by the WORD mode. *Verb* is more descriptive than *word,* but takes some getting used to.

As mentioned earlier, FORTH-32 works with disks in all formats. Since it operates under PC-DOS (as a command file), it fits comfortably into the normal PC-DOS environment.

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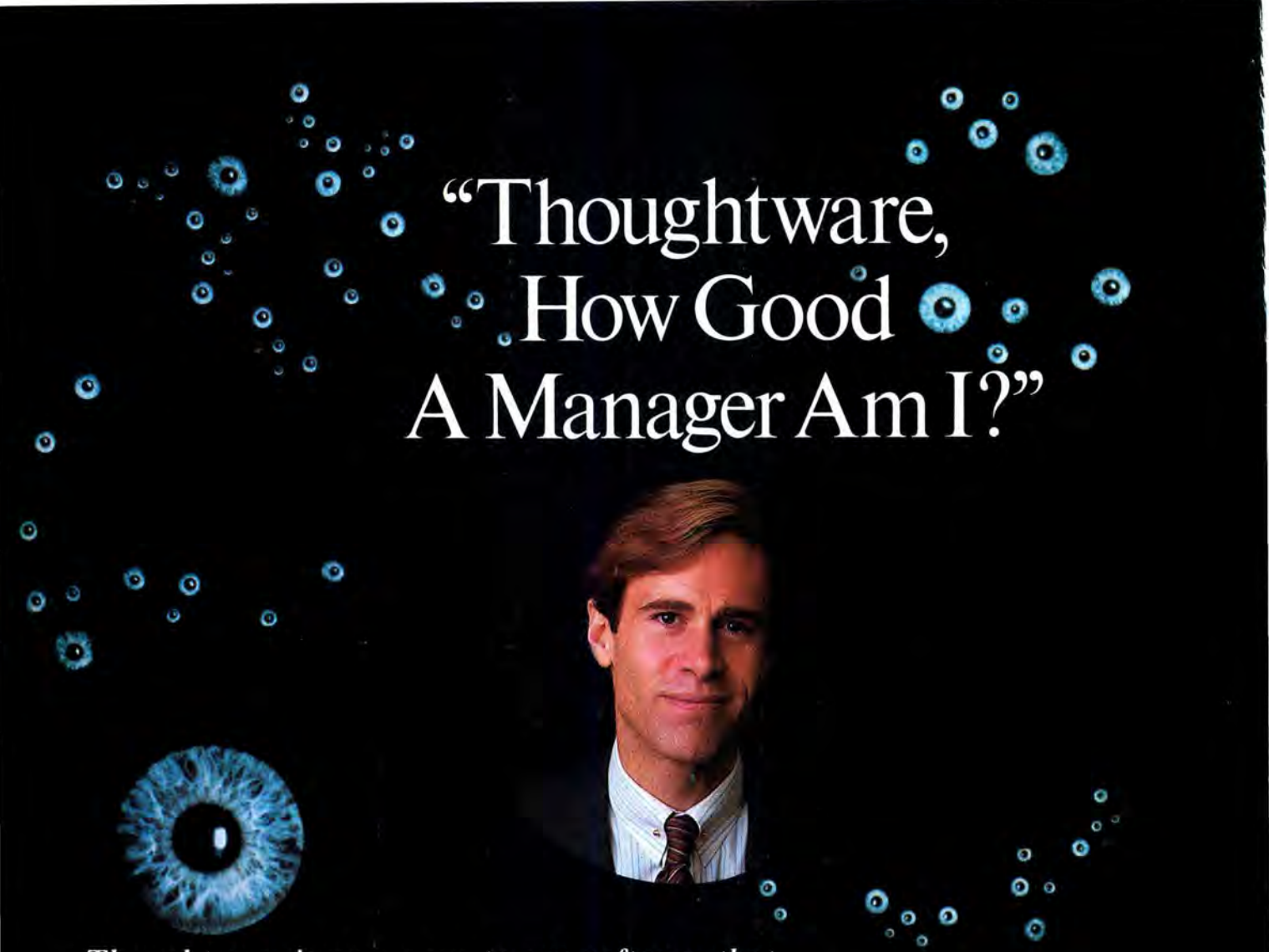

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Review

The package does not automatically add blocks as needed to a PC-DOS screen file, unlike PC/FORTH. FORTH-32 requires you to use the command ADD-SCREEN. Before I could do the read/write benchmark, I used a loop to add 100 screens. It took 125.7 seconds.

No initialization of FORTH-32 is required beyond making a backup copy and putting the DOS system on the disk. (The vendor said that the copy-protection of Version 1.0 caused so many problems that it was abandoned, so Version 2.0 is not copy-protected.) However, you can change some of the boot-up literals and default values by using an installation program that enables you to enter new hexadecimal values for some of the literals. Entries are edited for validity.

FORTH-32 includes Extender, a program that will copy to disk a file containing the current memory image of FORTH-32, including any commands you have compiled into memory during the session. You can also include any utility package, such as the editor. When you execute Extender, you give the name (with the extension .EXE) of the file to be created. This file can then be executed, and will consist of FORTH-32 plus your modifications or additions. Because Extender copies a memory image, the additions to FORTH-32, which are already compiled, load faster than if they had to be compiled from source code.

The vendor points out that this speed can be useful in developing a large project: when you have completed a substantial part of the work, use Extender to create PROJECT.EXE. Then your new commands will already be resident in FORTH (in the file PROJECT.EXE), available for use in defining the remaining commands for the project. (However, the Extender should not be used as a substitute for the package-builder utility.)

The screen editor is useful but cumbersome. Loading the color version takes more than 40 seconds, but you can use Extender to make the editor resident in a copy of FORTH-32. The editor boxes text and provides a pad line, though the display is crude compared to that of MMSFORTH. The display is constructed using only printable characters so that you can make a printout of the edit display.

Text crowded off the end of the line by insertions will return when you make deletions if the cursor has not left the line. This is particularly helpful because the editor operates in the insert mode at all times—it has no replace mode. The <Ins> and <Del> keys insert and delete lines, not characters, so you may have to modify habits you picked up from other programs.

To page up or down, you use <Shift>-<F1> and <Shift>-<F2> instead of <PgUp> and <PgDn>, which merely move the cursor to the beginning or end of the text on the screen. <PgUp> and <PgDn> are used to go to adjacent screens in the editors of the other vendors; some of the editors use <PgUp> to go to a screen with the next higher number (the next screen on the disk) while others use <PgUp> to go to the screen with the next lower number (the preceding screen).

A separate package-builder utility is available for $50. If you wish to distribute any packages you make, you must pay a one-time fee of $500. No additional royalties or other payments are required. The package builder was being revised while I wrote this review and was not tested.

FORTH-32's strengths are its rich variety of options and extensions and the fact that programs you write can inhabit all available memory. Its weaknesses are the price one pays for such capabilities: a marked increase in the complexity of FORTH's structure, a more cumbersome set of procedures for programmers to follow,

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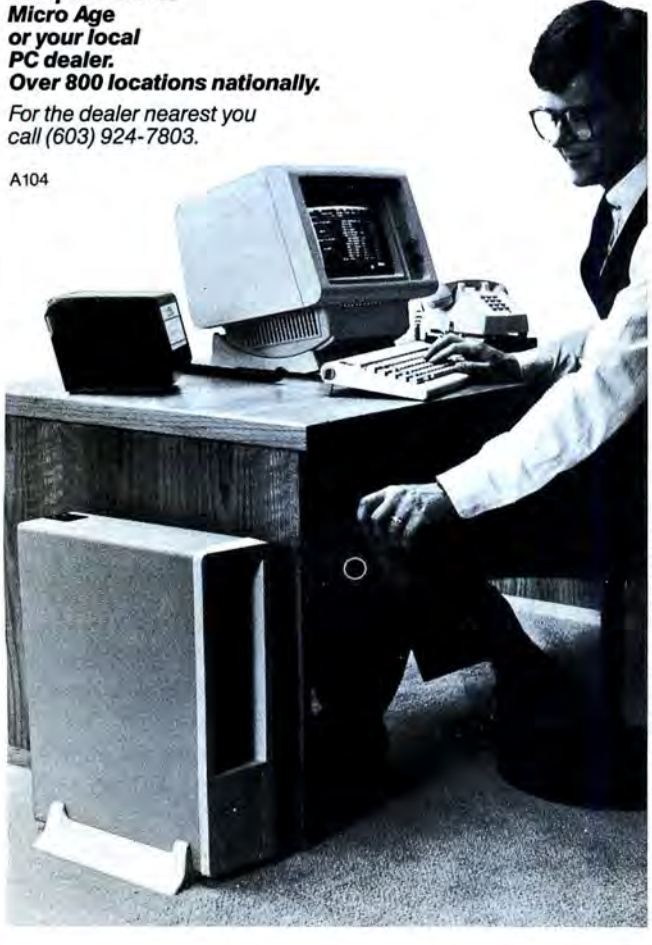

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and slower execution times. In addition, the newness of the package means MMS has had less time to polish rough edges (although Version 2 is a significant improvement over Version 1, and the vendor is continuing to add to and improve the package). The relentlessly technical manual will be rough going for novices.

Making a Choice

Which package should you buy? The answer depends on your skill level and objectives. For novices, I think FORTH-Level 2 is the best choice. Its documentation offers the most help, and its FORTH code is the most accessible. Moreover, its package-builder utility is included with the package and enables you to share your programs. As you can see from Table 1, FORTH-Level 2 is both fast and compact.

If you are an old hand at computing, comfortable with assembly language but new to FORTH, consider your objectives. You might want to try FORTH-Level 2 for the reasons previously given. If PC-DOS compatibility is important to you, the choice is between PC/FORTH (or PC/FORTH+) and FORTH-32. FORTH-32 comes with more features but is slower and harder to use. PC/FORTH costs less, but you have to buy extensions to reach the full range of options.

If you know you have to go beyond 64K of program size, only FORTH-32 and PC/FORTH+ offer you a way to do it without overlays. PC/FORTH+ is the more expensive, but it's easier to use.

If you already know FORTH, you can work with any of the packages, but you will probably find MMSFORTH a comfortable and powerful vehicle. The inadequate documentation should not be a great hindrance since you already know

FORTH, and you will like the editor and the large collection of predefined commands.

On the other hand, if your plans include developing software packages for resale you must consider the $5000 cost of the MMSFORTH package-builder utility. FORTH-Level 2 includes the utility, FORTH-32's utility costs $550, and PC/FORTH lets you distribute closed versions at no additional cost (although the PC/FORTH programs remain as source code on the distribution disks instead of being in compiled form). You pay no royalties or fees in using any of the package-builder programs if the end user has no access to the underlying FORTH. If your packages will be stand-alone, self-booting applications, FORTH-Level 2 seems the most appealing because it includes a package-builder utility and can access PC-DOS files.

As you think about the four packages, don't forget FORTH's extendability. You can (and will) add power to whatever package you get as you define new commands that bring to the language the capabilities you need. The package you buy is only the starting point, a kit from which you will make the language that you ultimately will use.

Finally, note that all the packages reviewed here are continually being refined and enhanced. By now some of the problems and weaknesses I've discussed may have been overcome, so I suggest that you check with vendors to determine the current statuses of their FORTHs before making your purchase.

Michael Ham is an experienced systems designer currently developing microcomputer applications for support services for education.

FORTH-Level 2
FORTH Technology
432 15th St.
Santa Monica, CA 90402
213/372-8493

List price: $149, 8087 support $129
Requirements: 32K, one disk drive

PC/FORTH, PC/FORTH+
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4147 Beethoven St.
Los Angeles, CA 90066
213/306-7412
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MMSFORTH
Miller Microcomputer Services
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Natick, MA 01760
617/653-6136
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FORTH-32
Quest Research, Inc.
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800/558-8088, 205/533-9405
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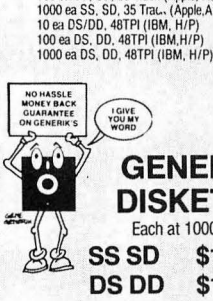

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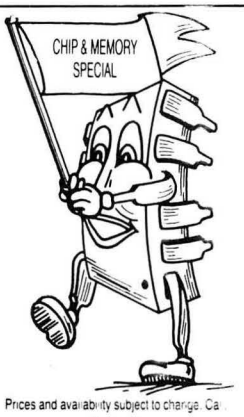

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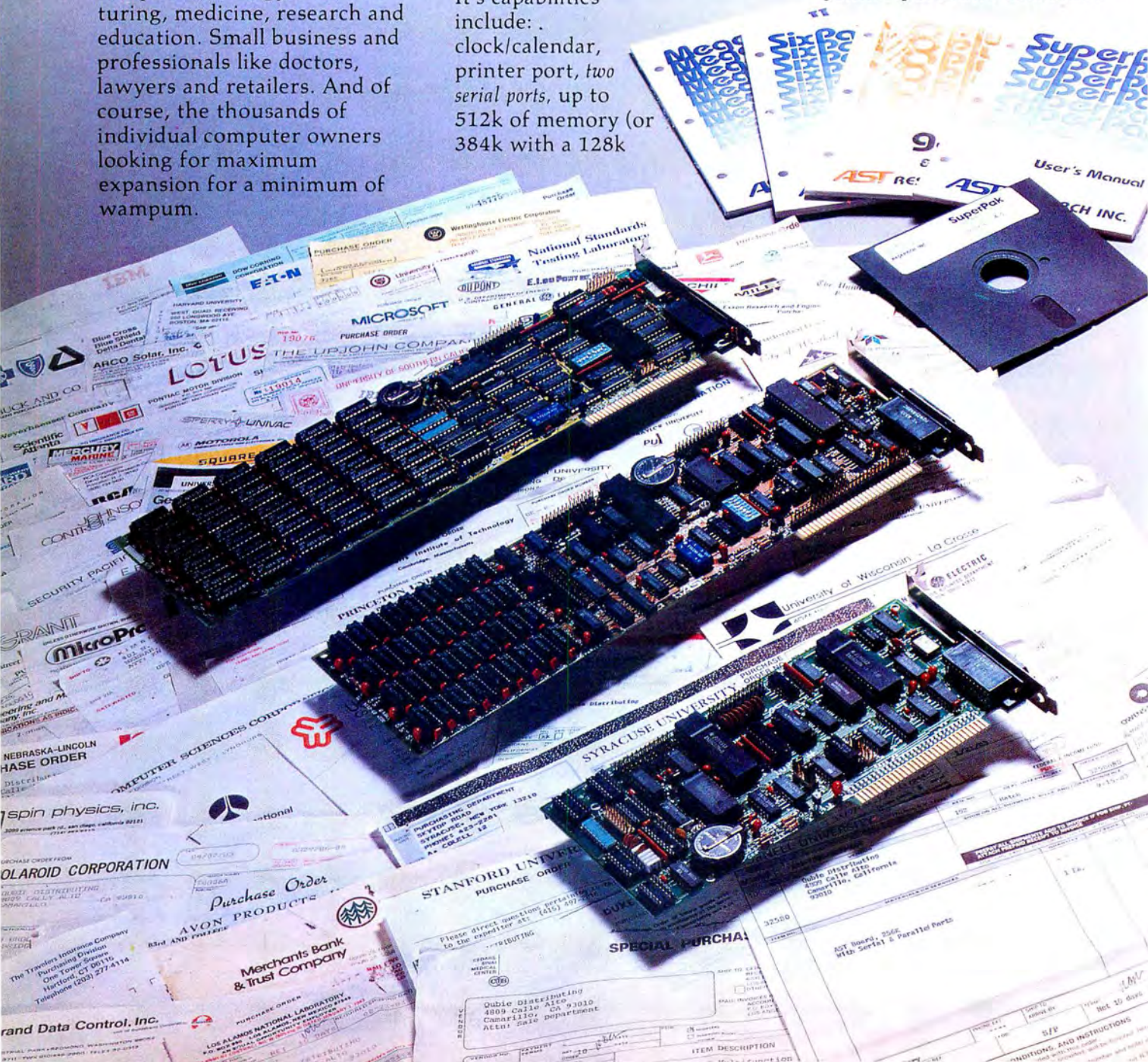

band their PC's & XT's

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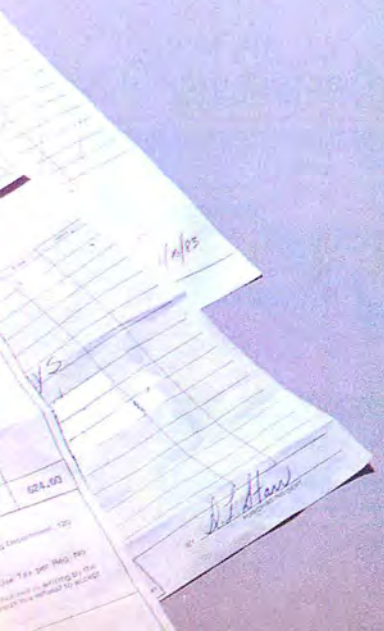

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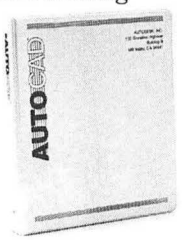

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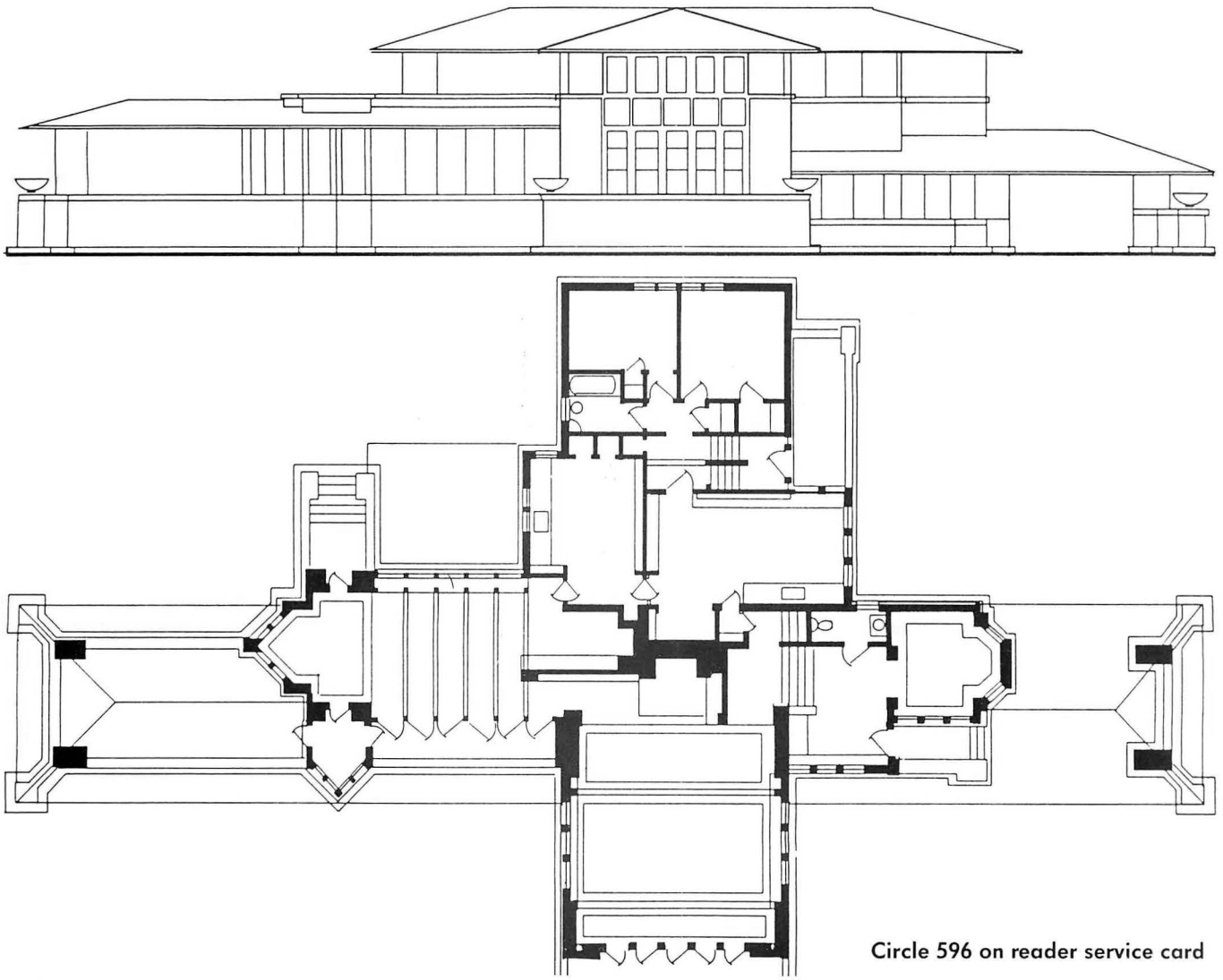

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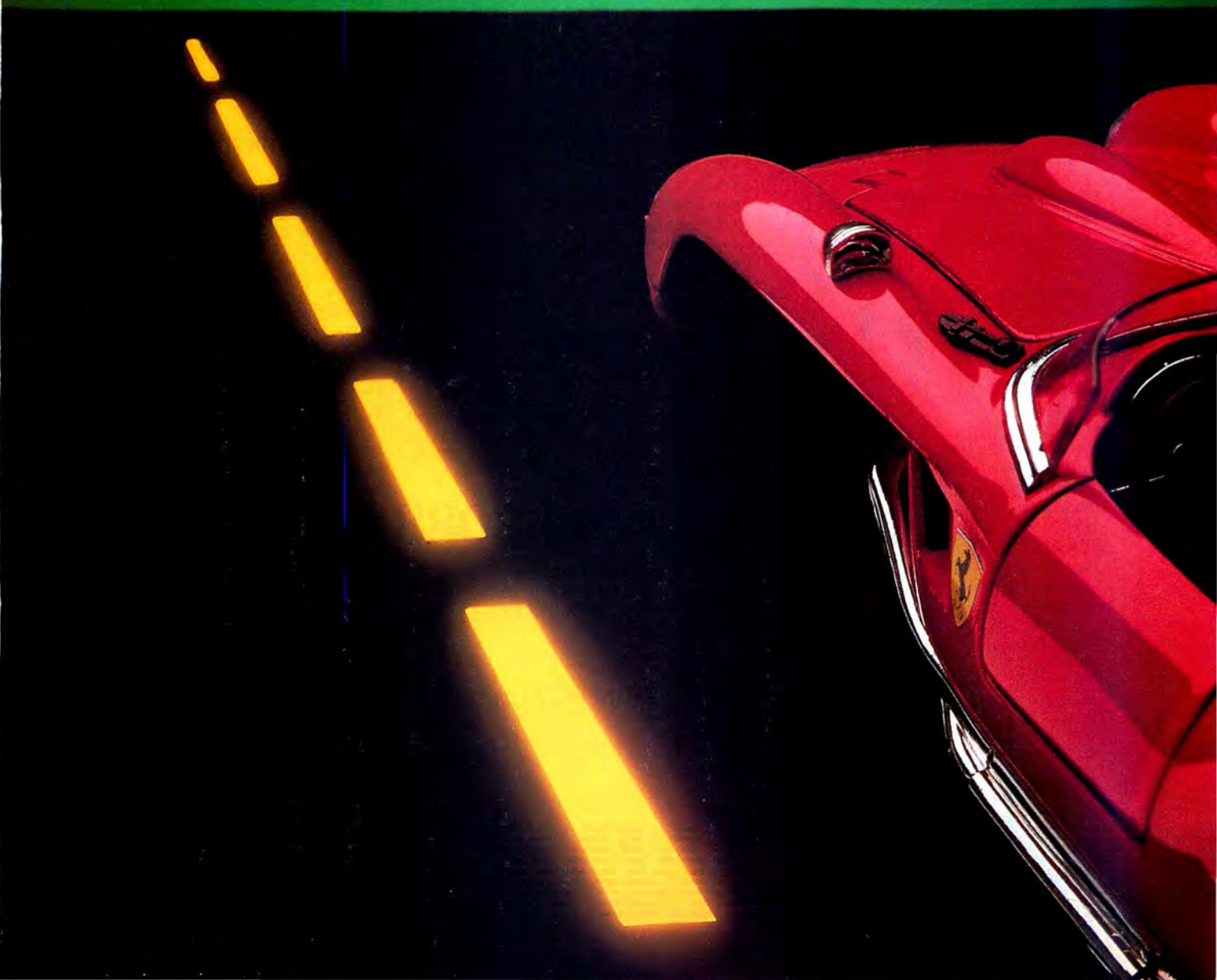

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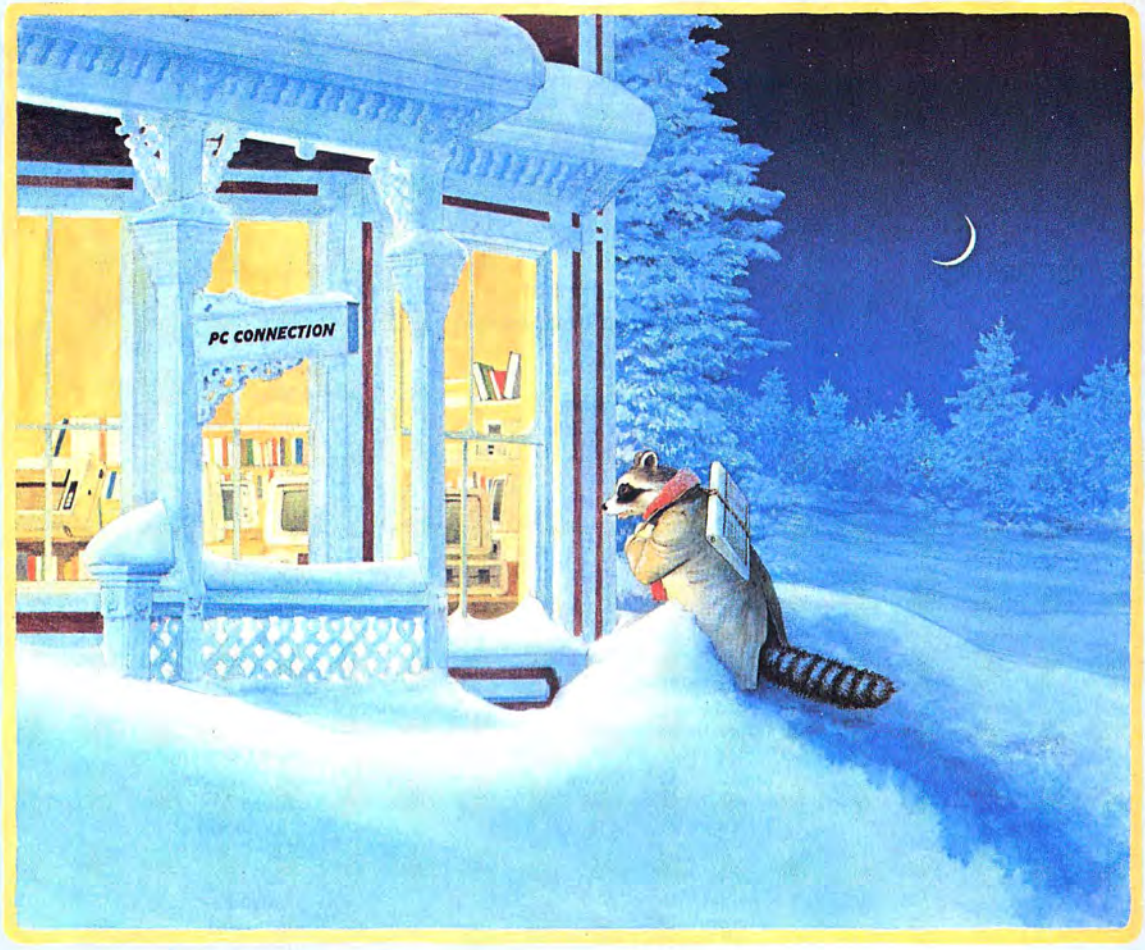

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The dBASE . report

David Jenkins

The real power and usefulness of data management software is not that it can store data, but that it organizes data into a form that is easy to analyze. dBASE II*'s REPORT FORM command brings sophisticated control of the program's output reports within reach of the data management novice.*

Data management programs are intimidating, and while *dBASE II* is friendlier than some (particularly as a data retrieval device), the thought of printing out a formatted report is enough to make even a fairly experienced user feel a little faint. If you own and use *dBASE II,* chances are you have used only the LIST command to generate reports. Although the LIST command enables you to display the contents of a file on the screen or print them on paper, it is not very discriminating. The REPORT FORM command, on the other hand, is sufficiently sophisticated to produce complex, formatted reports—and is still well within the capabilities of the *dBASE II* novice.

> The LIST command supplies instant information.

The LIST command allows you to extract specific records or fields from a file. For example, you can type `for lastname = "Smith"` to obtain only the records that include the last name Smith, or you can type `list firstname,lastname for lastname = "Sm"` to select the records that include last names beginning with Sm. The LIST command supplies instant information, but the resulting reports will not be formatted and cannot include headings, page numbers, totaled columns of numbers, and other desirable features. You might look at a LIST report several days later and be unable to recall when it was produced or what the data refers to.

If you know the LIST command and are familiar with the use of field names in a file, you should be able to apply many of the REPORT FORM features to your data files. The REPORT FORM command can automatically create formatted reports for a number of situations. You can also save a format that you create with the REPORT FORM command and use it as a template for other data files—a time-saver once you've found a format you like.

A Simple Report

To practice with the REPORT FORM generator, you will need a copy of *dBASE II* and a sample data file. If you are a novice, you might want to recreate the Reptdemo data file as shown in Figure 1. After entering *dBASE II* from DOS, type `create reptdemo <Enter>`. (When using *dBASE II,* notice that it automatically inserts a space after the prompt. In copying the figure, do not insert an additional space.) *dBASE II*'s queries (capitalized in the figures) ask you to specify all the fields you want to include in the file. Pressing <Enter> after an empty field (in this case 008) will immediately display the first record form. Key in the data following 00001 in Figure 1 using the APPEND command. You can later add records of your own using APPEND.

To produce a simple formatted report using a few basic features such as page headings and column definitions, enter the responses for the Vanilla report shown in Figure 2. With the Reptdemo data file in use, you initiate

```
. CREATE reptdemo
ENTER RECORD STRUCTURE AS FOLLOWS:
 FIELD   NAME,TYPE,WIDTH,DECIMAL PLACES
 001     firstname,c,15
 002     lastname,c,20
 003     address,c,20
 004     city,c,20
 005     state,c,2
 006     zip,c,5
 007     age,n,5,2
 008

 INPUT DATA NOW? y

 00001  Rachel            Jenkins-Stevens     1609 Bancroft Way    Berkeley
        CA 94703   6.50
 00002  Sally Elizabeth   Jenkins-Stevens     1609 Bancroft Way    Berkeley
        CA 94703   1.50
 00003  Alice             Springs             1024 Fifth Street    Syracuse
        NY 01234  30.00
 00004  Elizabeth         Finkelstein         4096 1st Ave.        New York
        NY 01234  37.00
```

Figure 1: Creating the sample data file

the REPORT FORM command by typing REPORT FORM vanilla. *dBASE II* will look to the disk, find that there is no report named Vanilla, and ask a series of formatting questions. In this example, no changes have been made to the default options, which set the left margin of the report at column 8, the number of lines per page at 57, and the page width at 80 characters.

After specifying the page heading and answering a few more questions, you come to the column definitions. Each column is defined by its width (the number of one-character-wide columns across the page), the contents of the field, and the column heading. *dBASE II* automatically assembles the report when no further columns are defined. This report format is now saved in a file called vanilla.frm. If you want to display a report with this format, type

```
use reptdemo <Enter>
report form vanilla <Enter>
```

```
. USE reptdemo
. REPORT FORM vanilla
ENTER OPTIONS, M = LEFT MARGIN, L = LINES/PAGE, W = PAGE WIDTH
PAGE HEADING? (Y/N) y
ENTER PAGE HEADING: report demo, simple test
DOUBLE SPACE REPORT? (Y/N) n
ARE TOTALS REQUIRED? (Y/N) n
COL    WIDTH,CONTENTS
001    15,firstname
ENTER HEADING: first name
002    20,lastname
ENTER HEADING: last name
003    5,age
ENTER HEADING: age
004


        PAGE NO. 00001
        01/01/80

                                        report demo, simple test

          first name      last name          age

        Rachel            Jenkins-Stevens   6.50
        Sally Elizabeth   Jenkins-Stevens   1.50
        Alice             Springs          30.00
        Elizabeth         Finkelstein      37.00
```

Figure 2: dBASE II queries and Vanilla report

Printing a Report

To print a report, you can either add TO PRINT to the REPORT FORM command line or use <Ctrl>-<PrtSc>. With the former, you would type report form vanilla to print. (When TO PRINT is used, it is always the last clause of a REPORT FORM command.) For example, if you introduced an additional clause or command, such as FOR, you would type report form vanilla for age<20 to print.

You can also print out a report by typing report form vanilla <Ctrl>-<PrtSc> <Enter>. <Ctrl>-<PrtSc> acts as a printer toggle, turning the printer on if it is off, and vice versa. You can use this feature to get a printout as you define a report's format. (You will get *dBASE II*'s queries as well as your responses. Subsequent printouts of the report's format will provide you with only your responses—not *dBASE II*'s queries.) Such a printout is helpful if you later need to revise the report.

Formatting

Using the REPORT FORM command's features, you can generate another kind of report from the Reptdemo file. You can format a page and its headings, and put a number of items in a column. Figure 3 illustrates the REPORT FORM command's queries, the entered responses, and the resulting report.

Set the left margin at 0 (instead of the default 8), the lines per page at 60, and the page width at 70 columns. You can print a two-line page heading by separating the first line ('report demo') and the second line ('formatting capabilities') by a semicolon, which tells *dBASE II* to start a new line. Unless another position is specified, *dBASE II* will center page and column headings over the data. You can move column headings flush left or flush right by using the respective angle bracket when you type the column heading. For example, in Figure 3 the < places the 'address' column heading at the left side of the column. Lining up a column heading with the data, particularly when there are large and small fields in a column, improves the look of a report.

```
. USE reptdemo
. REPORT FORM format
ENTER OPTIONS, M=LEFT MARGIN, L=LINES/PAGE, W=PAGE WIDTH m=0,l=60,w=70
PAGE HEADING? (Y/N) y
ENTER PAGE HEADING: report demo; formatting capabilities
DOUBLE SPACE REPORT? (Y/N) y
ARE TOTALS REQUIRED? (Y/N) n
COL    WIDTH,CONTENTS
001    20,lastname+firstname
ENTER HEADING: <name;----
002    20,address+trim(city)+"   "+state+"   "+zip
ENTER HEADING: <address;-------
003    10,age
ENTER HEADING: >age;yrs
004    10,int (age*365)
ENTER HEADING:>age;in days
005


PAGE NO. 00001
01/01/80

                    report demo
                formatting capabilities

name                address                  age        age
----                -------                  yrs      in days

Jenkins-Stevens     1609 Bancroft Way       6.50        2372
Rachel              Berkeley CA 94703

Jenkins-Stevens     1609 Bancroft Way       1.50         547
Sally Elizabeth     Berkeley CA 94703

Springs             1024 Fifth Street      30.00       10950
Alice               Syracuse NY 01234

Finkelstein         4096 1st Ave.          37.00       13505
Elizabeth           New York NY 01234
```

Figure 3: Print formatting with the REPORT FORM command

Other column formatting features are available with the REPORT FORM command. You can underline a column heading by creating a two-line heading, with the second line defined as hyphens. Note too that column 001 prints out two fields from the file. The plus sign is the equivalent of "then print"; it tells *dBASE II* to print the last name and then the first name. Because the column width is set at 20 (the width of each single field), *dBASE II* will wrap the text around to the next line, and the first name will appear directly under the last name. This feature is useful when you want several data fields to line up, or when you have one long field that must be divided in two.

In the second column (address), more complicated *dBASE II* features are used. Although the city field was earlier defined as 20 characters long, not all entries will be this large. The trim function removes blanks to the right of the entry. The city field is thus printed next to the state and zip code field. You can also type the expression in the following form: address + city + state + " " + zip. The four fields would then occupy three lines, with the address, city, and state/zip each taking one line.

Notice that a space surrounded by double quotes separates the city, state, and zip code fields. The quotes

```
. USE reptdemo
. index on state to state
00004 RECORDS INDEXED
. set index to state
. report form totaling
ENTER OPTIONS, M=LEFT MARGIN, L=LINES/PAGE, W=PAGE WIDTH
PAGE HEADING? (Y/N) y
ENTER PAGE HEADING: report demo;subtotaling
DOUBLE SPACE REPORT? (Y/N) n
ARE TOTALS REQUIRED? (Y/N) y
SUBTOTALS IN REPORT? (Y/N) y
ENTER SUBTOTALS FIELD: state
SUMMARY REPORT ONLY? (Y/N) n
EJECT PAGE AFTER SUBTOTALS? (Y/N) n
ENTER SUBTOTAL HEADING: report for state =
COL    WIDTH,CONTENTS
001    20,lastname
ENTER HEADING: last name
002    20,firstname
ENTER HEADING: first name
003    10,age
ENTER HEADING: >age
ARE TOTALS REQUIRED? (Y/N) y
004    10,int (age*365)
ENTER HEADING: >age (days)
ARE TOTALS REQUIRED? (Y/N) y
005

        PAGE NO. 00001
        01/01/80

                                  report demo
                                  subtotaling

        last name        first name                  age        age (days)

        * report for state =CA
        Jenkins-Stevens  Rachel                     6.50          2372
        Jenkins-Stevens  Sally Elizabeth            1.50           547
        ** SUBTOTAL **
                                                    8.00          2919

        * report for state =NY
        Springs          Alice                      30.00         10950
        Finkelstein      Elizabeth                  37.00         13505
        ** SUBTOTAL **
                                                   67.00         24455

        ** TOTAL **                                75.00         27374
```

Figure 4: Totaling and subtotaling in a report

identify a literal; that is, something that will be printed or displayed exactly as it is typed. In this case, since a space is between the quotes, *dBASE II* places a space between fields. Without it, the printed result would be 'BerkeleyCA94703'.

The column width need not match the data field size. For example, the age column is 10 characters wide, even though an age field never exceeds five characters. Using the appropriate column width, you will avoid having to abbreviate or hyphenate a heading. A computation is also included in the example shown in Figure 3, where the age in years is multiplied by 365 and converted into

> Subtotaling is useful only when data is organized in some order.

an integer. Data that makes up the fourth column, age in days, is a result of the computation performed on the number in column three—a demonstration that the *dBASE II* report generator lets you manipulate the printed output, but leaves the contents of a file unchanged. You cannot change the data in your file during a report.

Totals

Subtotaling and totaling allow you to add any numeric expressions in a column. *dBASE II* will calculate the total amount for that column, adding only those records that are selected. The total is printed at the end of the report.

Subtotaling is useful only when data is organized in some order. In Figure 4 the four records are indexed by state. To produce subtotals, you must specify a subtotal field (ENTER SUBTOTALS FIELD: state), which acts as a control break. When there are no more CA records, the command that adds up the accumulated numbers is triggered, and the California subtotals are printed. The new value in the subtotal field (NY) starts the process all over again. If you had answered yes to 'SUMMARY REPORT ONLY?', the report would include only the subtotal headings and the subtotals. For large files that are properly indexed, summary reports can be a quick way to distill information.

Variations on a Theme

The REPORT FORM command creates a template rather than an absolute definition of a report. Although *dBASE II* anticipates and provides most of the formatting features that a user might need, other formatting features can be specified each time a report is printed. Some of these formatting features are:

Temporary report headings. When you have a file that undergoes constant revision, you may want to change the report's heading to reflect each version. Typing `set heading to This is Draft 3` will print 'This is Draft 3' on the report until you change the heading with another SET HEADING TO command or exit *dBASE II*.

Date. Typing `SET DATE TO 01/02/83` will print the date below the page number on all reports.

Record selection. You can decide which records to print by specifying the report name (such as Vanilla or Format) and the indexed field after the REPORT FORM command. For example, typing `report form vanilla for state = "CA"` will select only those records containing CA in the state field.

Order. You can print the records in a file in a different order but use the same report format by setting the index to one of the originally defined fields. To display the same information in two different orders, type

```
use reptdemo
set heading to This Report Is in Order Records Were Entered
report form format
index on lastname to last
set index to last
set heading to This Report Is in Alphabetical Order by Last Names
report form format
```

Moving formats. One report format can serve several data files, as long as all the file structures include the same field names. You could load a different file with USE, then call in a previously used report format.

Passing files. A *dBASE II* report can be converted into a standard ASCII file and later incorporated into a word processing document. You would type

```
use reptdemo
set alternate to vanilla
set alternate on
report form vanilla
set alternate off
```

This command sequence will send a copy of the Vanilla report to a file named vanilla.txt, which can then be edited by a word processing program.

Hands On

Changing a Report

Until you have more experience with *dBASE II*, you should create a new report format when you need one instead of changing an established one. Once a report format is defined, it is difficult to modify, since you must change the report definitions. Unfortunately, a format file does not store *dBASE II*'s queries but only your responses. Editing a format file (.frm) can be a "gruesome experience" in the words of one *dBASE II* programmer. If you wish to create a report using the name of an existing report, the first report must be deleted. For example, type `delete file vanilla.frm`.

Beyond the Report Generator

Interest in *dBASE II*'s report capabilities seems to be growing. SoftwareBanc has published a book called *Report Writing in dBASE II*. Ashton-Tate, the creator of *dBASE II*, is also issuing the *Advanced Programmer's Guide to dBASE II*, which devotes one section to report writing. The book includes a command file listing of FORMGEN, which simulates the REPORT FORM function with a *dBASE II* command file. FORMGEN could save a considerable amount of time when you need customized reports. And saving time is what data management is all about.

David Jenkins is a computer consultant based in Berkeley, California, who specializes in dBASE II *applications. He currently directs several programming projects for* PC World *and is writing a series of* dBASE II *utility packages for future publication.*

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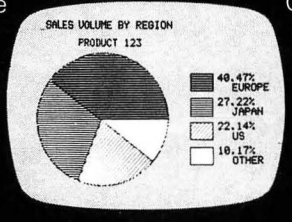

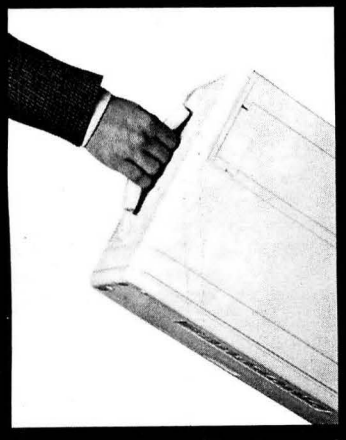

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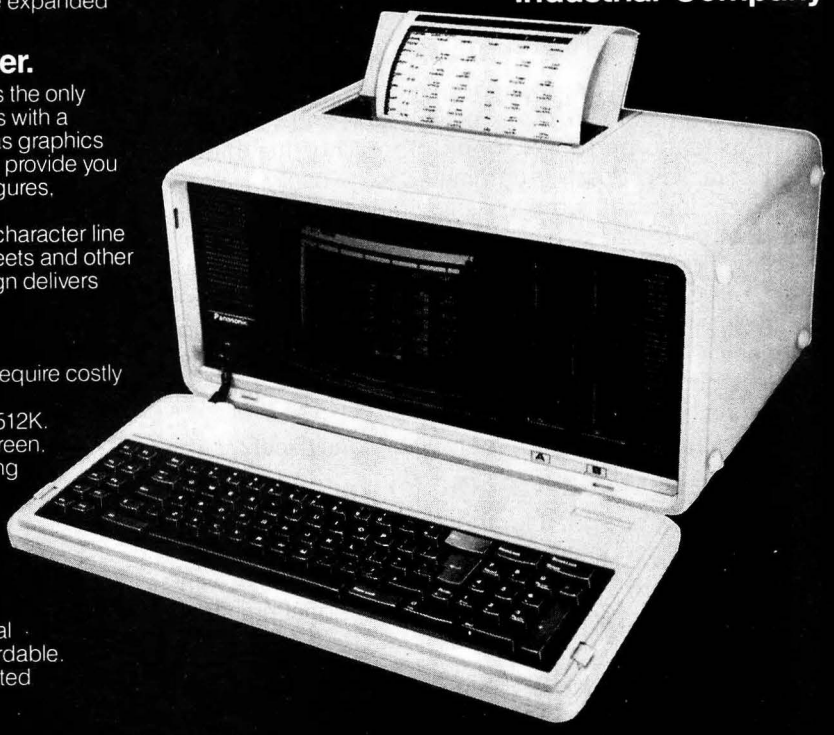

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Understanding Operating Systems

The operating system is the PC's traffic cop; it coordinates input and output from the computer, the applications program, and you.

D. M. Tucker

When you bought your PC, you probably laid down an extra $60 for something called PC-DOS, simply because the salesperson said you had to have it. PC-DOS, the IBM disk operating system, came as two disks nestled with a manual in a loose-leaf binder. The idea of the operating system seemed abstract, but the operating system is in fact essential to the operation of the PC. Without an operating system, you would be forced to communicate with a computer at a primitive level, using a myriad of zeros and ones instead of words like COPY or FORMAT.

Without PC-DOS (or another PC operating system), you couldn't read programs or data from a disk, set the time and date on your computer, or use an applications program such as *1-2-3* or *WordStar*. PC-DOS completes a three-tiered hierarchy of programming and circuitry that defines exactly what a PC is.

Hard, Soft, and Firm Ware

While the concept of hardware is easily grasped (the things you touch, hold, and sometimes drop), the notions of software and firmware are more intangible. A functioning PC is composed of all three. (See Figure 1.)

Hardware provides the basic computing power and memory plus the input/ouput (I/O) devices that allow you and the machine to communicate. Hardware can move a character from one location in memory to another, transmit a single character to the printer, compare two bytes and report on the result, test the result, transfer execution to another location in main storage, and carry out several other elementary tasks. In general, the hardware deals with one or two bytes of data at a time, performs rudimentary input and output, and only understands data represented by zeros and ones.

Software consists of sequences of related instructions (called programs) that are executed by a processor to accomplish a specific task, such as printing a file or adding a column of numbers. Programs are stored externally on tape or, more commonly, on a floppy or hard disk and are read into the computer's internal memory for execution. Most popular soft-

ware, such as *dBASE II* or *WordStar*, is sold on a floppy disk and is designed to perform useful work on information that you supply.

Before any other software can work on a PC, one special piece of software—the operating system—must be read into the computer's internal memory. Like other software, the operating system comes on a disk and consists of programs that are executed by the computer. But the operating system's fundamental purpose is not to work on data but to interact directly with the hardware and the software. The operating system remains in memory throughout the computer's operation, acting as an interface between the user or the applications program and the hardware.

An operating system presents a "pretty" face to the user or applications program while it performs the complex dirty work at the hardware level. For example, the operating system may check a hardware status indicator (a location in memory that stores a value representing an event, such as the end of a print run) to determine if the printer is ready to print another file. It may look at a register in the processor to find the addresses of data or call in routines stored in firmware at the request of an applications program. This ability to directly access the hardware to request specific services or components makes the user's life easier and drastically reduces the number of steps a programmer must take when writing a program.

Firmware, as the name suggests, exhibits characteristics of both hardware and software. It is software that is permanently stored in a piece of hardware, usually a ROM (read-only memory) chip. Programs in ROM are immediately accessible whenever you turn a computer on.

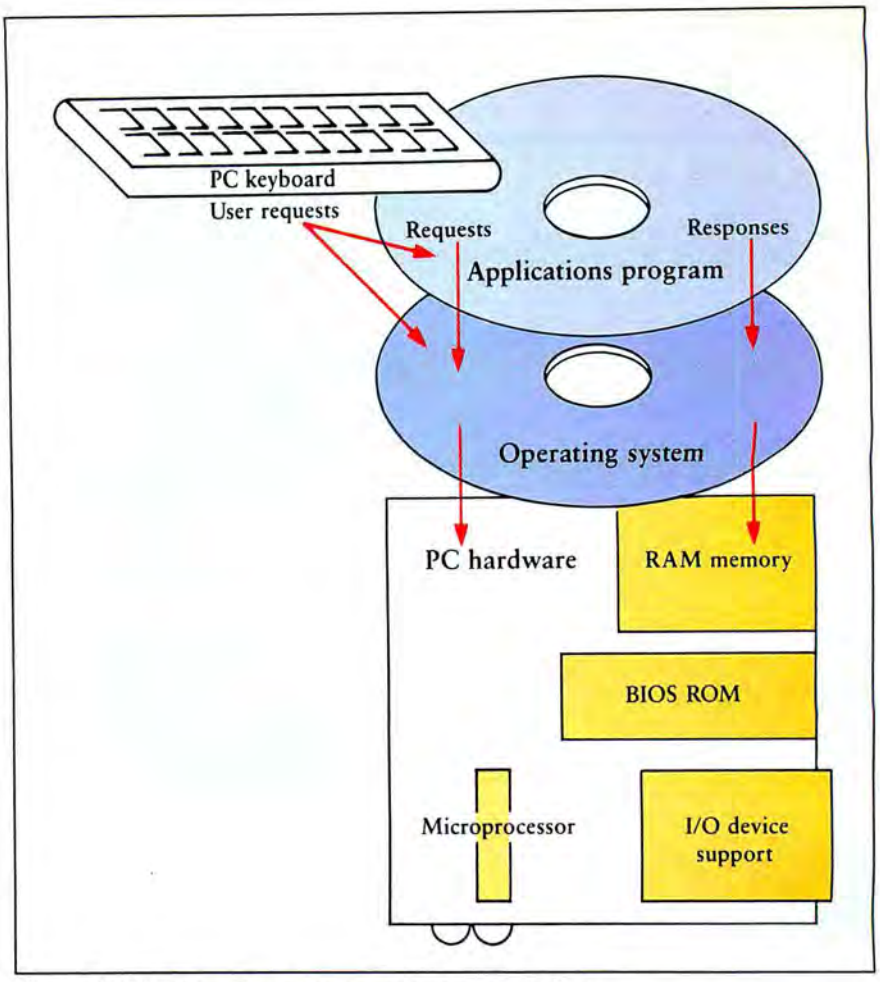

Figure 1: The operating system acts as an interface between the hardware and the software.

In the case of the PC, two pieces of firmware, the BASIC ROM and the BIOS ROM, are included with the machine. The BASIC ROM contains a kernel of the BASIC language that can be used for programming and is the foundation upon which disk BASIC and BASICA programs are built. The BIOS ROM is a kernel of the operating system. It contains programs that perform rudimentary I/O operations for a number of devices, provides date and time services, and performs some hardware diagnostics. One of the BIOS ROM's key routines is the bootstrap loader, which is responsible for loading DOS into memory when the PC is turned on.

Once the computer is up and running, a single instruction from the operating system (often to fulfill a request made by an applications program) can transfer execution of a task to a program in firmware. For example, after a word processor has formatted a line for printing, it might ask the operating system to transmit the line to the printer. The operating system invokes the printer I/O routine stored in the firmware, and the routine takes over, transmitting one character at a time to the printer until the entire line is printed. The operating system will ensure that the

I/O operation is successfully completed and then return control to the word processing program.

The Evolution of Operating Systems

Early computers were large, crude devices that required thousands of vacuum tubes and miles of wiring to multiply two numbers in a few thousandths of a second. I/O operations were largely performed by operators physically flipping switches and patching various units of the computer together. The first operating systems to appear on the scene handled very simple I/O. As these I/O routines were used more and more by programmers, they were standardized and finally packaged as IOCSs—Input/Output Control Systems. Though fairly primitive by today's standards, IOCSs revolutionized the way programmers wrote programs, and their acceptance paved the way for further standardization of I/O operations. When manipulation of the hardware was simplified and standardized, more sophisticated and error-free programming was the result.

IOCSs and other precursors to operating systems were ultimately expanded to include commonly used and increasingly complex routines that provided time-keeping, data-editing, file-organizing, and mathematical functions. By the early 1960s, computers were being delivered with software that effectively insulated programmers from the tedium of I/O programming, program loading, error detection and recovery, and file management. With the advent of direct access, disk-storage devices in the early 1960s, still more comprehensive software was required to relieve the programmer of complex disk I/O operations.

A significant step in the development of operating systems was taken in 1964 when IBM announced Operating System/360 (OS/360) for its family of System/360 compatible computers. For the first time, comprehensive system software (an operating system) was designed and developed simultaneously with the hardware. It was a risky and expensive investment that sorely taxed the financial and engineering resources of even a giant like IBM. (The project cost an estimated $5 billion and was known at IBM as "you bet your company.")

After 20 years of rapid growth in computer power, OS/360 is still one of the most comprehensive mainframe operating systems available. Today OS/360 (now known as OS/MVS) is considered the grandfather of operating systems, exceeding all others in everything from development costs to unwieldiness.

Much as the miniaturization of mainframe components allowed the development of the personal computer, the creation and development of mainframe operating systems likewise benefited personal computer operating systems. While PC-DOS performs only a subset of the many functions provided by its mainframe cousins, its objectives are essentially the same.

An operating system's primary objective is to standardize the way a computer's resources are made available to both a user and an applications program. By making commonly used functions easily accessible, the power of the computer is maximized. The major functions and actions performed by an operating system fall into the following major classifications: command and program execution, input/output control, disk storage management, concurrency, and applications interface.

Command and Program Execution

The part of the operating system you first encounter is the command and program execution processor. In PC-DOS the command processor is visible as the familiar A> prompt, which asks "What do you want to do next?" Entering a command or program name after the prompt initiates a search by the operating system through disk and memory for the proper program to execute. Control is then passed to the program; the operating system waits until it is called on again by the program or the user.

Embedded in this procedure is the necessary logic to recognize which names entered by the user are operating system commands and which are applications program names. The procedure also determines if a program is in memory and can thus be immediately executed or if the program must be read into memory from disk. The operating system also takes any parameters following a command or program name and passes them along to the appropriate command or program. For example, when a file is copied from one disk to another, the source and target file names are passed to the operating system's copy program, which then opens the file being copied and creates a new file on the receiving disk.

In PC-DOS the command processor is visible as the familiar A> prompt.

The command and program execution function of the operating system also manages the computer's internal memory. Before a program or command can be executed, its location must be known. The operating system in effect draws a map of the memory in order to pinpoint where the operating system resides, where

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the disk directory is stored, and where space can be allocated for an applications program.

Input/Output Control

One of the greatest savings an operating system provides is the handling of a computer's input and output, particularly disk I/O. The programming required to transfer data between internal memory and external hardware such as the printer, monitor, and disk is extremely tedious and time-consuming. The operating system provides a well-defined set of rules for programmers to follow when they need to obtain I/O services for a program they have written. This eases software development and greatly reduces the attention a programmer or user must pay to the minutiae of I/O operations.

One important aspect of the I/O function is error recovery. Most hardware devices can detect unusual conditions; a printer "knows" when it's out of paper just as a disk drive recognizes the absence of a disk. When an unusual condition arises, a question is posed by the device to the operating system. Part of the operating system's I/O control involves discovering the device's status and attempting recovery—usually by repeating a specified number of times the operation that produced the unexpected reaction. If the recovery attempts fail to overcome the problem, the operating system may inform you about the problem (for example, by an error message that reads 'Not ready error reading drive B') and ask if you want to abort, retry, or ignore the condition.

Disk Storage Management

Another complex job performed by the operating system is storing data on disk. The operating system defines how a disk is formatted, how data

and program files are written to disk, and how free space is accounted for. Unfortunately, every operating system approaches these functions differently; thus disks formatted by one operating system may not work under another.

Disks fresh out of the box are usually not formatted: they must be formatted, before they are used, by a utility program supplied with the operating system. (PC-DOS provides the FORMAT command for this purpose.) The formatting program puts blank records on the disk, creating slots that can be filled by data or programs. The formatting program then creates two tables in memory: a free-space table that contains information about available disk space and a disk directory that holds the names and locations of all the files on the disk. The two tables are stored on the disk once they have exchanged information and updated each other.

To create a new file, a user or an applications program must ask the operating system to allocate space for the file on the disk. The first free space is found using the free-space table, and a file is opened under the name specified by the program or the user. The operating system then updates the disk directory and permits records to enter the new file. When records in an existing file must be read (such as for display or transmission to another file), the operating system finds the file by searching through the disk directory. Records are then read from the file and supplied to the program or user that requested them.

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operating system deletes the file's entry in the disk directory by changing the first character in the file name so that the file name is no longer valid. The space the deleted file occupies is listed in the free-space table, making it available to new files.

The operating system is conservative when it manages disk space. It always records a requested change on disk before it makes the change. The disk record provides some measure of security if you need to recover a "deleted" record or file or if the computer is accidentally turned off.

Concurrency

Most computers do one thing at a time: a user loads and manipulates a spreadsheet; later a text file is edited. Each action must be performed separately. The limiting factor is not only the hardware (in this case, the processor) but also the operating system. The PC's 8088 microprocessor completes a task in nanoseconds but spends most of its existence waiting—waiting for a user to key in commands or for a disk to start spinning or for a monitor to display data.

Advanced operating systems use the processor during these normally unproductive periods to work concurrently on more than one task. One of the simplest concurrent techniques is called spooling—transferring data from one I/O device to another (usually from disk to printer) during the intermittent waiting periods that inevitably occur. The operating system directs the processor to execute a second program (the spool program) concurrently with another program, such as a word processor (see Figure 2). The two programs do not execute simultaneously, but the processor is switching back and forth

from one to the other so quickly that both appear to be going on at the same time.

Spooling (simultaneous peripheral output on line) is a limited example of concurrency. It is often used to establish the sequence for printing several files while the computer uses another program. PC-DOS 2.00, which is basically a single-task operating system, will support only this kind of concurrency, but more advanced operating systems, such as Concurrent CP/M-86 from Digital Research, allow up to four different programs to be active at once. Concurrent CP/M-86 determines which program uses the processor at any instant and prevents any program from interfering with another. Thus a user can transmit a file to another computer, format and print a document, and enter data in a spreadsheet at the same time.

Applications Interface

In the last three years, IBM has changed PC-DOS three times. Yet an applications program designed in 1981 to run under PC-DOS 1.00 will very likely work with PC-DOS 2.10. The secret lies in the operating system's standard software interface, which gives a program access to the operating system's many functions through a specific set of procedures. The operating system also has a defined set of responses it makes when a program requests a service. This two-way communication between an applications program and the operating system enables commercial software to be developed and, if need be, changed relatively rapidly.

The success of the IBM PC has spurred the development of thousands of commercial programs.

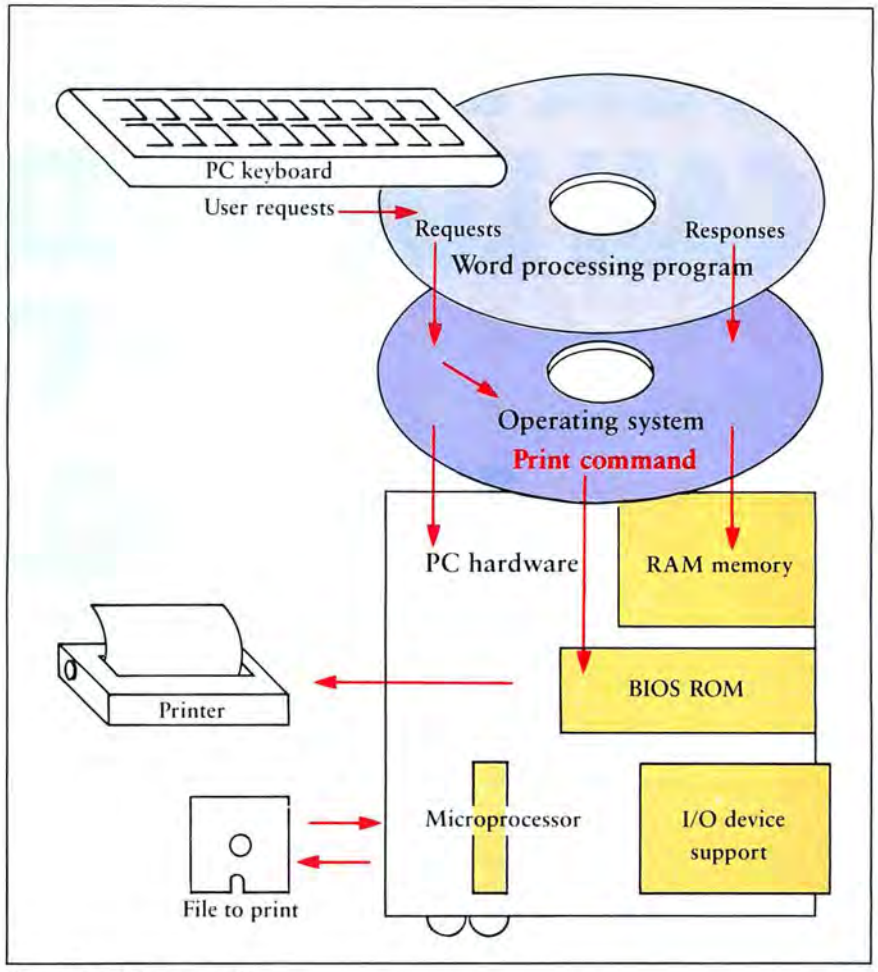

Figure 2: Print spooling

Within this avalanche are hundreds of word processing, data base, and spreadsheet programs—each taking a different programming approach. Such a diversity of programming styles would lead to chaos if it were not for the existence of PC-DOS, whose acceptance reaps indirect but tangible benefits for the user. A program has to play by the operating system's rules if it wants to run on the PC—and sell.

D. M. Tucker was a systems engineer with IBM for 17 years. He is currently an independent consultant working in San Francisco.

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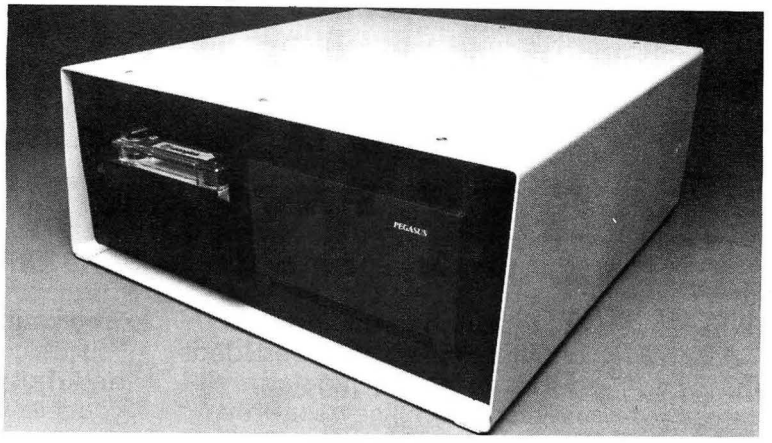

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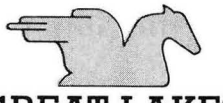

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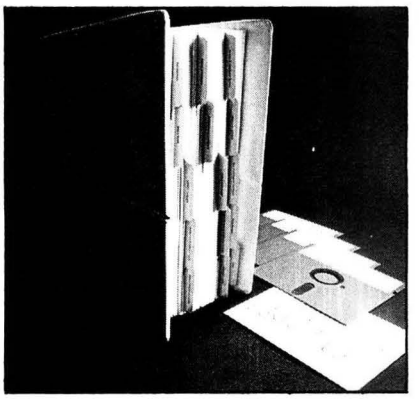

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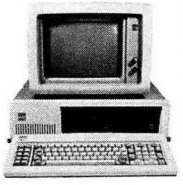

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Steven D. Ryals

Many people are aware that *WordStar,* the word processing program from MicroPro International, is the best-selling program of its kind. It was the first word processing program widely available for microcomputers, and as such it remains the program against which all others are judged.

Complaints about the complexity of *WordStar* have been widespread over the years. The most common complaint is that a user must learn a large set of commands in order to use the program's full capacity. While that charge has merit, the flip side is that *WordStar*'s many commands make it a versatile tool, capable of a wide variety of word processing tasks.

WordStar has several groups of commands, the least understood of which may be the dot commands. These commands, along with the print control commands, are designed to let the user print *WordStar* files in almost any format imaginable. Dot commands control headings and footings, page breaks, margins, character pitch, lines per inch, page numbering, and a host of other print characteristics.

The format files described in this article are examples of templates to print addresses on envelopes and to print on letterheads. These format files can be given the file extension .fmt as a reminder to the user that they aren't text files. Once a document file is opened, you can use the ^KR command to read the .fmt file into the top of the document file to provide the document's print format.

WordStar has several groups of commands, the least understood of which may be the dot commands.

Printing Envelopes

Listing 1 shows the dot commands used for a typical envelope printing format. We can name the file env.fmt. *WordStar* does not print anything to the right of two periods in the first two columns, so the first statement is simply a comment, the equivalent of a BASIC REM(ark) statement. When *WordStar* sees a single period (dot) at the beginning of a line, it takes appropriate action based on what follows the period. Most dot commands should be placed at the beginning of a file. There are exceptions, of course, such as the command to force a page break (.PA), which must appear at the spot where the page break is to occur, or commands to change the format in the middle of the text.

The envelope formatting example starts with the margin commands. The .MT (margin top) command is used to set the top margin. The default is 2 lines; a change to an 8-line top margin is required for an envelope. The bottom margin is set with the .MB (margin bottom) command. The default for the bottom margin is 8 lines from the bottom. Setting the bottom margin at 13, in this context, allows a maximum of 5 lines to be printed on one envelope. This limit can be changed to reflect special addressing requirements.

The .PO (page offset) command sets the column at which printing begins. The default is column 8. On an envelope, the address should be printed further to the right, so the page offset is set at column 50. This is for a #10 (business size) envelope. Other settings can be substituted to accommodate shorter envelopes.

```
..print an address on an envelope
.MT8
.MB13
.PO50
.OP
```

Listing 1: env.fmt

```
..letterhead template
.MT4
.MB13
.PN1
.OP


June 1, 1984
.HM1
.HE June 1, 1984  -  <<addressee name here>>  -  page #
```

Listing 2: lh.fmt

Finally, the .OP (omit page numbers) command tells *WordStar* not to print page numbers until a .PN reinstates page numbering. *WordStar* will place page numbers on all documents unless it is told otherwise.

When you read the format file into the envelope file, the address should be directly under the group of dot commands. *WordStar* will dutifully send to the printer any blank lines it finds between a dot command and the text, thereby throwing off the position of the address as set up by the dot commands.

Letterhead and Text

Listing 2 is a typical letterhead template file, which we'll call lh.fmt. This template is used to print a date on letterhead paper and to print the date, the addressee's name, and a page number as the heading on any subsequent pages of the letter.

Most of the commands used here will be familiar from the discussion of the envelope template. As with the envelope template, the first thing to do is set up the top and bottom margins with the .MT and .MB commands. Once that is done, you may want to change the indentation from the left edge (page offset) with the .PO command to match your preprinted letterhead. The command .PN1 specifies that the page numbers (which will be in the heading) start with 1 for the current page (even though a page number will not be printed on the first page). The command .OP tells *WordStar* to omit the page number at the bottom of each page.

Following the .PO command are several returns and the date (which you must update). *WordStar* reads this information as text; it will skip as many lines as there are returns, to accommodate the printing on the letterhead, and then print the date.

The heading line is set with the .HE (heading) command followed by the text of the heading. The .HE command prints one specified line of text at the top of every page until the .HE command is used again, either with or without text. The .HM command sets the number of lines between the heading and the body of the text. The default setting is 2 lines. The heading line shown in the template includes the date, the name of the addressee, and the current page number. (The symbol # in the .HE command indicates where the page number will appear. It works in conjunction with the .PN command to specify the correct page number for each page.)

These two template files can be combined in a simple letter writing system. To use the system described here, you must keep a list of names and addresses in a file in the following format:

NAME
STREET ADDRESS
SUITE OR BOX NUMBER
CITY, STATE ZIP

You could then start a letter by using the following procedure:

1. Open the name and address file and use the find command (^QF) to search for the address you need.

2. Mark the name and address as a block and write it (using the ^KW command) to a temporary file.

3. Open a document file and read in (using the ^KR command) the envelope template (env.fmt). Move the cursor to the bottom of the text and read in the temporary file that holds the desired name and address.

4. Mark the name and address as a block. Move the cursor to the bottom of the text, and read in the letterhead template (lh.fmt).

5. Move the cursor to the bottom of the text again and copy the name and address that is still marked as a block.

6. Move the cursor to the end of the addressee's full name and mark the end of the block there. Copy it to

the area marked "*addressee name here*" in the .HE command line.

7. Now move the cursor to the end of the addressee's first name and mark the end of the block there.

8. Skip two lines after the address. Type Dear and press ^KC to copy the first name to the salutation line. Finish the salutation with a comma or a colon, and you're ready to start typing the text of the letter.

You have created a single file that contains the formatted address for the envelope and for the letterhead,

> These two template files can be combined in a simple letter writing system.

as well as the body of the letter. Since you're using letterhead, this example assumes that you will tell the printer to pause between pages so that you can insert envelopes, letterhead, and plain bond paper, as needed. If you use a keyboard macro program such as *ProKey*, the whole process could be automated even further.

With some experimentation, you can use *WordStar*'s power to create all sorts of useful template files, which can be saved and used whenever they are needed. Once these templates are fine-tuned, perfect formats can be expected every time.

Steven D. Ryals is a writer, WordStar *instructor, and* dBASE II *consultant living in Oakland, California.*

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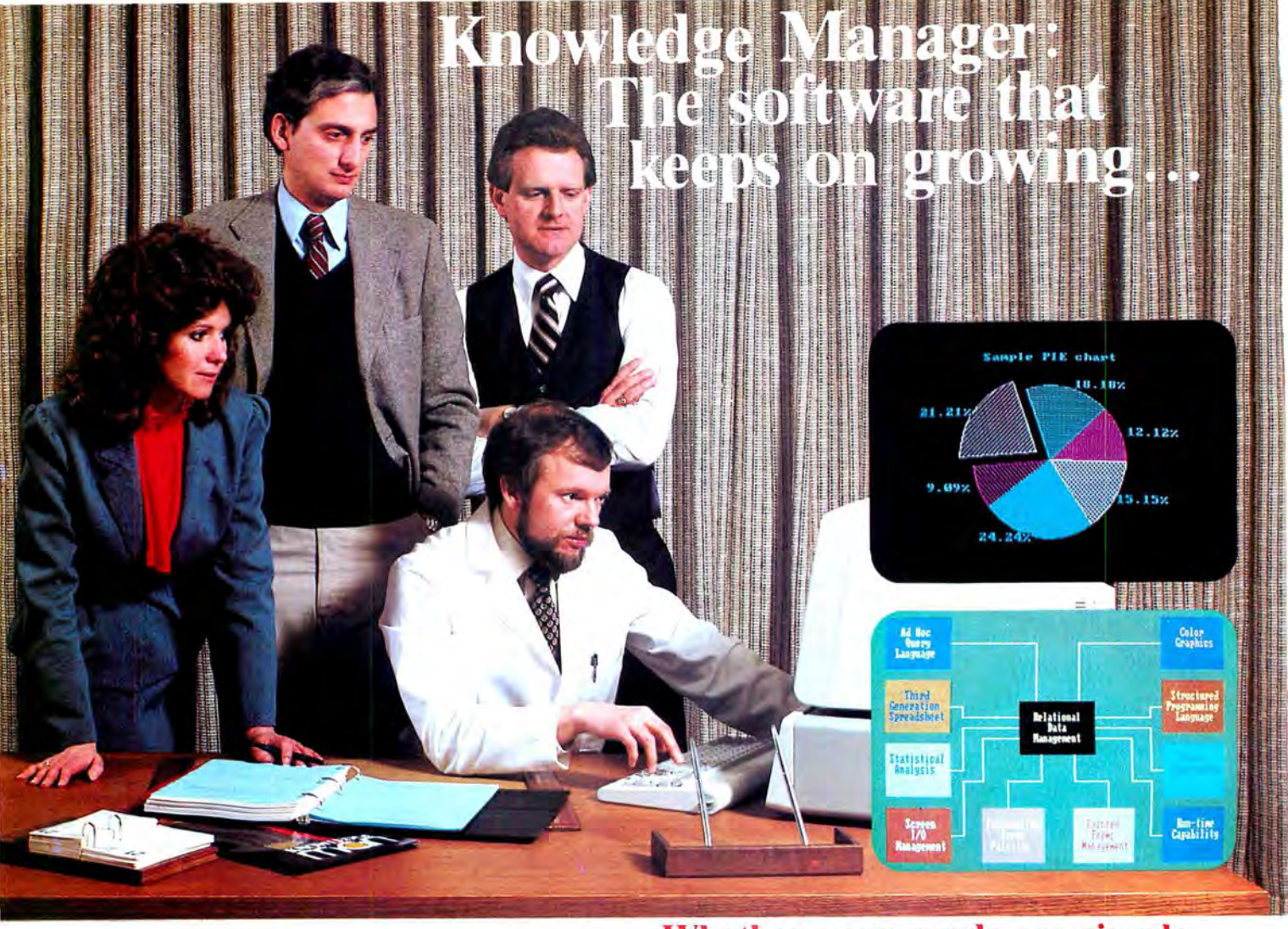

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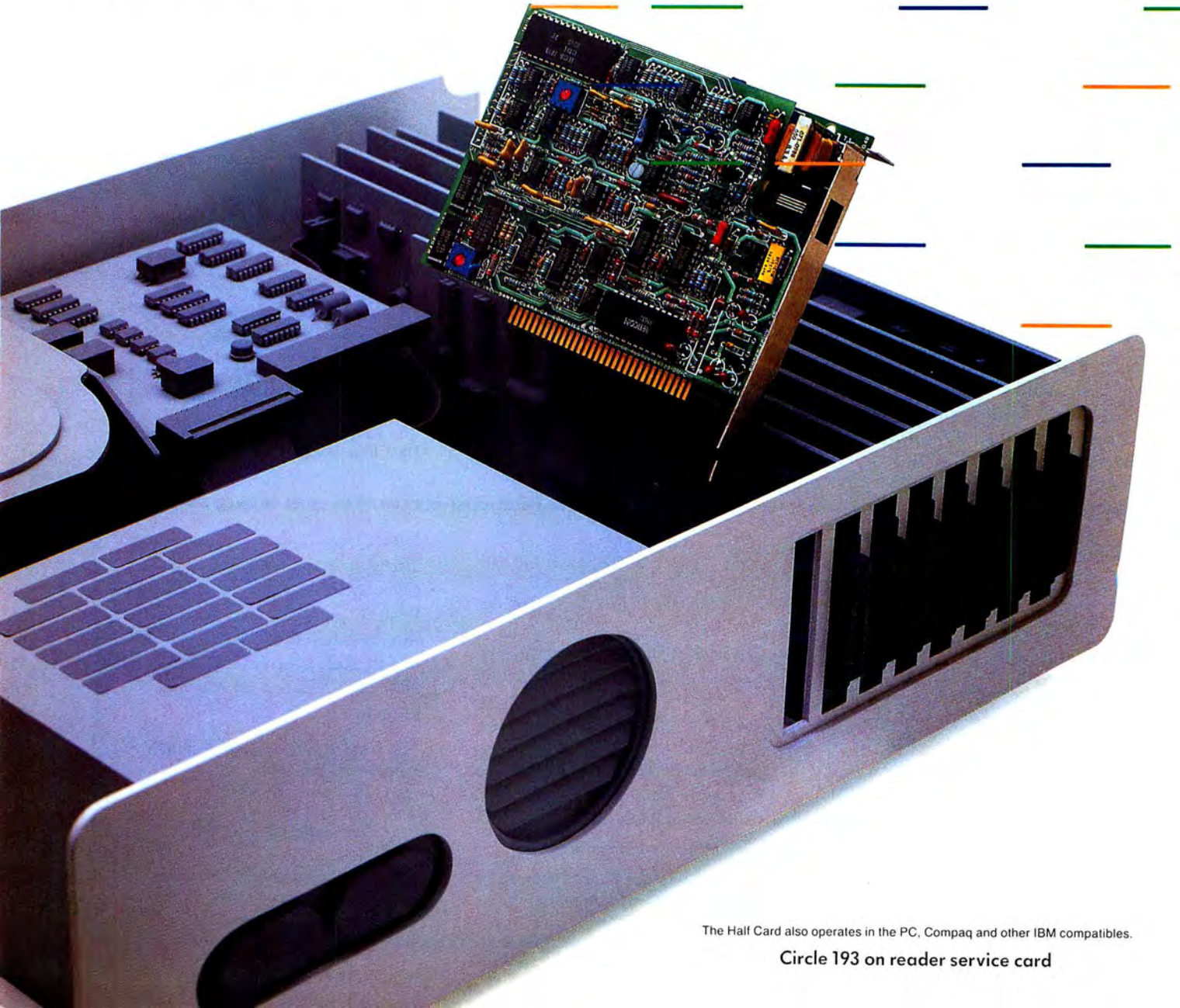

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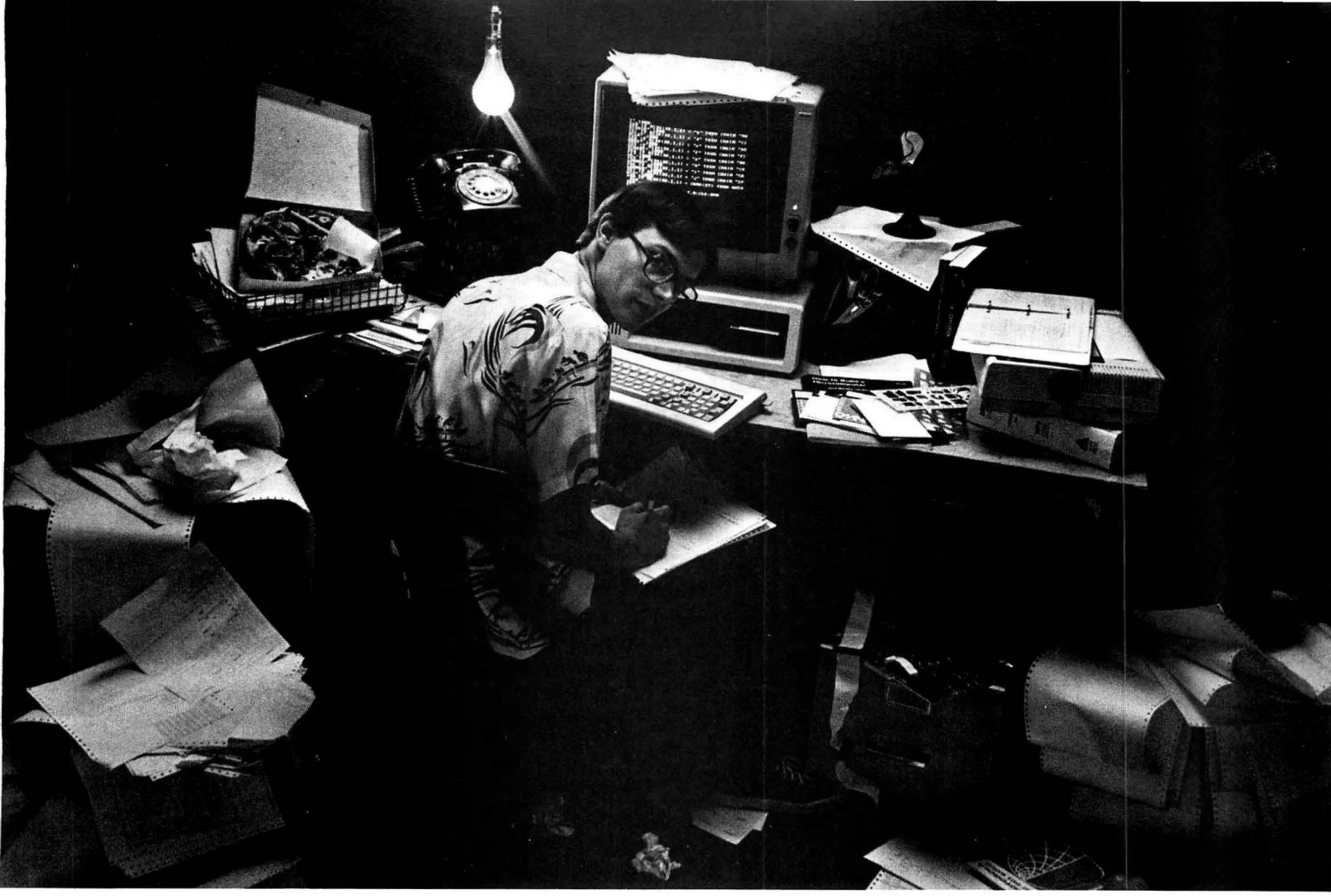

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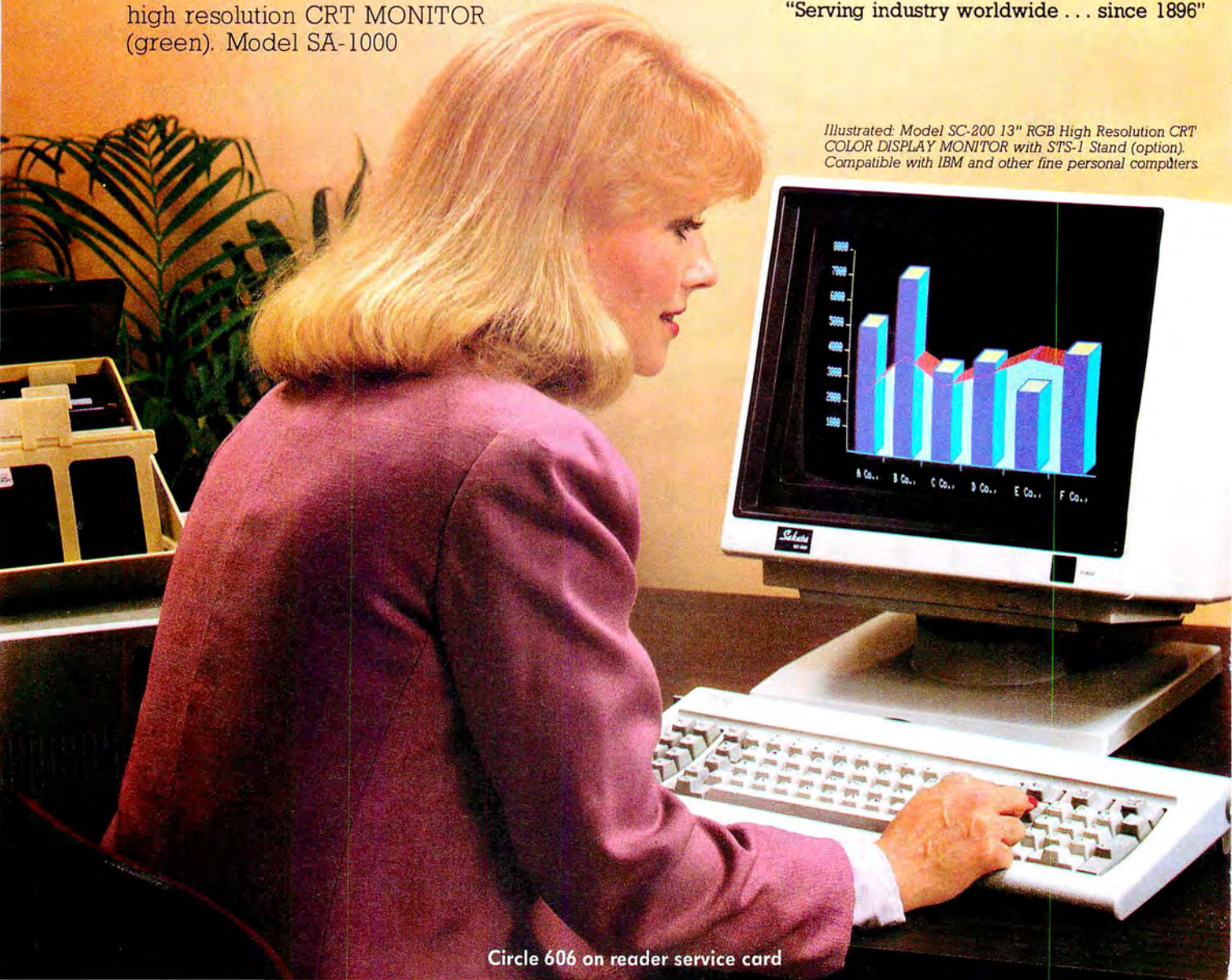

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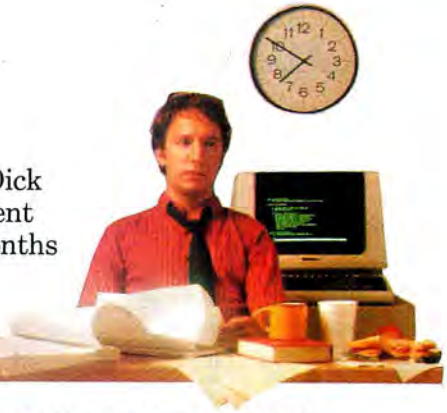

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. Star-Dot-Star

A global exchange of personal computer discoveries

Edited by Karl Koessel and Art Wilcox

This month's discoveries include a program that lists referenced line numbers of a BASIC program, and batch files that facilitate hard disk backups. We also discuss the memory requirements of differently sized *1-2-3* worksheets. This month we lead with ERRLEV, a variation of QUERY (see "Batch," *.*, *PCW*, Vol. 2, No. 3), which permits the user to direct the flow of batch file processing.

The last line in our Editors' note to "Fast Boot" (see *.*, *PCW*, Vol. 2, No. 1) was wrong to suggest placing MORERAM in an AUTOEXEC.BAT file. As many of our readers pointed out, doing so causes an endless loop (which can be stopped with <Ctrl>-<Break>), because MORERAM's last instruction reboots the system.

Don't forget, when you submit your tips on disk, you save us several keystrokes and also get a free disk in return.

More Interactive Batch

The ERRORLEVEL condition parameter within batch files is very useful for conditional execution of commands. For example, when DOS executes the command

IF ERRORLEVEL 5 ECHO HI THERE

'HI THERE' will be displayed if the latest exit code from a program is equal to or greater than 5. The problem is that most programs do not set this code, rendering this condition parameter useless. See pages 6-41 and D-48 of the DOS 2.00 manual.

I have written a short assembly language program (see ERRLEV.ASM) and converted it to the command file ERRLEV.COM, which may also be created by the BASIC program ERRLEV.BAS (see listing by that name). This command file (hereafter referred to as ERRLEV) displays a message, requests a single character of input, and then sets the exit code equal to the ASCII value of the character. All lowercase letters are converted to uppercase. A simple example of ERRLEV used in a batch file is shown in SAMPLE1.BAT.

> The ERRORLEVEL condition parameter within batch files is very useful for conditional execution of commands.

In SAMPLE1.BAT, execution will branch to the label ':NEXT' if you type an uppercase or lowercase *Y* in response to the message 'Do you want to continue? (Y/N)' displayed by ERRLEV. If you type an uppercase or lowercase *N*, execution will branch to the label ':EXIT'. Note also that because the IF ERRORLEVEL conditional command performs a greater than or equal to test, you must test for the largest ASCII value first.

As an example of how I use ERRLEV, I have included a batch file (see ASSEMBLE.BAT) that edits, assembles, links, and creates a .COM file. Note that all files needed are in drive C:.

Gerald A. Crichton
La Canada, California

Editors' note: In SAMPLE1.BAT, any character whose ASCII value is between Y *(89) and* a *(97) or greater than* y *(121), such as* Z*, will also cause execution to branch to the label ':NEXT'. And any character between* Y *and* N *(uppercase or lowercase) will cause execution to branch to the label ':EXIT'.*

To avoid the inadvertent branch caused by accidentally entering such characters, the batch file should check for the next higher ASCII value before checking each value intended to cause a batch file branch. Also, after checking for the last valid expected response, you should include a branch that returns to the latest use of ERRLEV (you may need to add a label) to avoid unintentionally falling through to the next batch file command if an ASCII value less than the smallest valid value is entered. Adding these checks to SAMPLE1.BAT produces the batch file shown in SAMPLE2.BAT.

FORMAT Bell

I have a habit of formatting all disks immediately after opening a new box. This takes some time, and meanwhile you can do something else. But because the FORMAT program prompts are visual, you have to keep checking the screen. I patched FORMAT.COM so it beeps when it prompts for a volume label and also when it prompts to quit or to format

```
TITLE ERRLEV - Sets the ERRORLEVEL to the ASCII code of key entered
              ;Letters a through z converted to uppercase
parmarea        EQU     80H     ;unformatted parameter area in Prefix
cr              EQU     13      ;Carriage return char
lf              EQU     10      ;line feed

cseg    SEGMENT PARA PUBLIC 'CODE'
        ORG     100h
start   PROC    FAR
        ASSUME CS:cseg,DS:cseg,SS:cseg,ES:NOTHING

        PUSH    DS              ;Set return segment addr to stack
        XOR     AX,AX           ;Clear a reg
        PUSH    AX              ;Put zero return addr to stack
        MOV     SI,parmarea     ;Offset in Prefix
        CLD
        XOR     CX,CX
        MOV     CL,[SI]         ;Number of chars in parameter list
        INC     SI              ;Ptr to first char
        MOV     DI,OFFSET msg   ;copy parameter into msg
        REP     MOVSB
        MOV     DS,OFFSET msg   ;Point to message to print
        MOV     AH,9            ;Function selected = console output
        INT     21h             ;Invoke DOS to display message
        MOV     AX,0C01h        ;Clear keyboard & wait for key
        INT     21h             ;keyboard I/O
        PUSH    AX              ;save ASCII code for terminate
        MOV     DL,cr           ;send carriage return
        MOV     AH,2
        INT     21h
        MOV     DL,lf           ;send line feed
        MOV     AH,2
        INT     21h
        POP     AX              ;char code is in AL
        CMP     AL,'z'          ;test if char is lowercase
        JA      ok              ;no
        CMP     AL,'a'
        JB      ok              ;no
        AND     AL,0DFh         ;yes...convert to uppercase
ok:     MOV     AH,4Ch          ;Terminate & set ERROR LEVEL
        INT     21h             ;call function
start   ENDP

msg     DB      80 DUP("$")     ;msg with automatic $ terminator
cseg    ENDS
        END     start
```

ERRLEV.ASM

```
10 '            Program that generates ERRLEV.COM
20 '            By Gerald Crichton, La Canada, CA
30 '
100 CLS: KEY OFF: ON ERROR GOTO 110: GOTO 120
110 PRINT "ERROR: check data": KEY ON: CLOSE: END
120 PRINT "Place disk in Drive A for ERRLEV.COM"
130 PRINT "---then hit <Enter>": DUMMY$=INPUT$(1)
140 PRINT: PRINT "Reading DATA statements..."
150 RESTORE: READ TOTAL, CHECK#
160 FOR I=1 TO TOTAL: READ BYTE: SUM#=SUM#+BYTE: NEXT I
170 IF CHECK# <> SUM# THEN 110
180 PRINT "Writing A:ERRLEV.COM file..."
190 RESTORE: READ TOTAL, CHECK#
200 OPEN "R", #1, "A:ERRLEV.COM",1
210 FIELD #1,1 AS N$
220 FOR I=1 TO TOTAL: READ BYTE: LSET N$=CHR$(BYTE): PUT #1: NEXT I
230 CLOSE: PRINT "ERRLEV.COM created"
240 KEY ON: END
250 DATA 138, 8759
260 DATA 30, 51, 192, 80, 190, 128, 0, 252, 51, 201, 138, 12, 70, 191, 58, 1
270 DATA 243, 164, 186, 58, 1, 180, 9, 205, 33, 184, 1, 12, 205, 33, 80, 178
280 DATA 13, 180, 2, 205, 33, 178, 10, 180, 2, 205, 33, 88, 60, 122, 119, 6
290 DATA 60, 97, 114, 2, 36, 223, 180, 76, 205, 33, 36, 36, 36, 36, 36, 36
300 DATA 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36
310 DATA 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36
320 DATA 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36
330 DATA 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36
340 DATA 36, 36, 36, 36, 36, 36, 36, 36, 36, 36, 36
```

ERRLEV.BAS

```
echo off
IF EXIST c:%1.asm GOTO edit
ECHO This is a new element, do you want to continue?
c:ERRLEV Enter E(edit) X(exit):
IF ERRORLEVEL 88 GOTO exit
:edit
c:edlin c:%1.asm
copy c:%1.asm b:
c:masm c:%1,c:;
c:ERRLEV Enter R(re edit) X(exit) L(link)
IF ERRORLEVEL 88 GOTO exit
IF ERRORLEVEL 82 GOTO edit
c:link c:%1,c:;
c:exe2bin c:%1 b:%1.com
:exit
```

ASSEMBLE.BAT

```
ERRLEV Do you want to continue?(y/n)
IF ERRORLEVEL 89 GOTO NEXT
IF ERRORLEVEL 78 GOTO EXIT
:NEXT
:EXIT
```

SAMPLE1.BAT

```
:CONT
ERRLEV Do you want to continue?(y/n)
IF ERRORLEVEL 90 GOTO CONT
IF ERRORLEVEL 89 GOTO NEXT
IF ERRORLEVEL 79 GOTO CONT
IF ERRORLEVEL 78 GOTO EXIT
GOTO CONT
:NEXT
:EXIT
```

SAMPLE2.BAT

```
A>DEBUG FORMAT.COM
-E CBE
0905:0CBE 28.59 59.2F
0905:0CC0 2F.4E 4E.20 29.07
-E E67
0905:0E67 20.07
-W
Writing 1780 bytes
-Q
A>
```

Display of putting a bell in FORMAT.COM

another disk. The patch involves nothing more than putting the BEL character (ASCII value 07) in the prompting text.

For the DOS 2.00 FORMAT.COM (stamped 3-08-83, 12:00 p), type in the following, making sure to include the spaces:

```
DEBUG FORMAT.COM<Enter>
E CBE<Enter>
59 2F 4E 20 07<Enter>
E E67<Enter>
07<Enter>
W<Enter>
Q<Enter>
```

What you see on the screen should duplicate what is shown in "Display of putting a bell in FORMAT.COM," except that the segment prefix '0905:' will vary, depending on the amount of installed memory.

From now on the FORMAT program will beep when it prompts you for a volume label and when it asks if you want another disk formatted.

Pieter J. Huizinga
Wouwsestraatweg, Netherlands

Hard Disk Backup

Because backing up a hard disk is somewhat of a nuisance, many users don't back up regularly. I have written a batch file (see FBACKUP.BAT) that not only streamlines the actual backup process but also makes it easy to back up a selected subset of your directories. In addition, output from the program is redirected to a log file on disk, which comes in handy when it comes time to restore a file. (I have included line numbers in the listing for reference purposes only; they are not allowed in a batch file and must be omitted when you create the batch file.)

To invoke the file, type FBACKUP followed by either the date (as shown in line 3), or the name of an individual directory followed by ONE (as shown in line 5). Line 6 is necessary only if you set up a separate directory for the backup program and log files. If you would rather use the root directory, delete line 6. Lines 8 and 9 check to see if you are backing up only one directory. If so, control passes to the appropriate label (:back_up, line 18). The *x*'s in lines 8 and 9 circumvent the syntax error message that results from testing the value of a nonexistent batch argument. When you are backing up all directories, you submit only one argument, the date, so the "second" argument, which is nonexistent, must be tested in this way.

If the ONE argument is missing, the program assumes that all the directories are to be backed up. Line 10 then checks to see if there is already a log file on disk in the format

```
1. echo off
2. rem to back up all directories:
3. rem      FBACKUP mmddyy
4. rem to back up one directory:
5. rem      FBACKUP dirname ONE
6. cd \backup
7. echo full backup for %1
8. if x%2==xone goto back_one
9. if x%2==xONE goto back_one
10. if exist fb%1.log goto xist_all
11. :res_all
12. echo on
13. backup c:\ a:>>fb%1.log
14. for %%f in (backup pctalk graphics jeff) do backup c:\%%f a:/s/a>>fb%1.log
15. for %%f in (lotus123 par rbase sim xtalk) do backup c:\%%f a:/s/a>>fb%1.log
16. echo off
17. goto end
18. :back_one
19. if exist %1.log goto xist_one
20. :res_one
21. echo on
22. backup c:\%1 a:/s>>%1.log
23. echo off
24. goto end
25. :xist_one
26. echo %1.log already exists. press ctrl-break to end backup procedure.
27. pause
28. goto res_one
29. :xist_all
30. echo fb%1.log already exists. press ctrl-break to end backup procedure.
31. pause
32. goto res_all
33. :end
```

FBACKUP.BAT

'FB*mmddyy*.LOG'. If so, you can choose between aborting the batch processing or overwriting the log file (lines 29 through 32).

If you opt to proceed, the root directory is backed up (line 13), followed by all directories listed as arguments to the FOR loops in lines 14 and 15, with terminal output directed to the log file. (Theoretically, only one FOR loop is necessary, as the DOS 2.00 manual mentions no limitation on the number of arguments allowed, but I have had the processing blow up with more than eight arguments per FOR loop.) Any directories that are not to be backed up should be left out of the argument lists. Similarly, when a new directory is added to the disk, its name should be added to one of the argument lists. After the FOR loops are executed, batch processing ends.

If the ONE argument is present, control is passed to line 18, where a check is made for the existence of a log file in the format '*dirname*.LOG',

```
3. rem       IBACKUP mmddyy

5. rem       IBACKUP dirname ONE

7. echo incremental backup for %1

10. if exist ib%1.log goto xist_all

13. backup c:\ a:/m>>ib%1.log
14. for %%f in (backup pctalk graphics jeff) do backup c:\%%f a:/m/s/a>>ib%1.log
15. for %%f in (lotus123 par rbase sim xtalk) do backup c:\%%f a:/m/s/a>>ib%1.log

22. backup c:\%1 a:/m/s>>%1.log
```

Changes to create IBACKUP.BAT

such as GRAPHICS.LOG. Note that this batch file, when invoked for single-directory backup, works properly only for directory names of eight characters or less. If the log file exists, you are offered the options outlined above. Line 22 performs the actual backup of the directory.

Another version of this batch file, IBACKUP.BAT, performs incremental backup using the /M option (see the DOS 2.00 manual, page 6-25). The differences between FBACKUP.BAT and IBACKUP.BAT are the remarks in lines 3 and 5, the message printed in line 7, the name of the log file created when you are backing up more than one directory that starts with IB instead of FB (in line 10 and lines 13 through 15), and the inclusion of the /M parameter on the backup commands in lines 13 through 15 and line 22. The differences are shown in "Changes to create IBACKUP.BAT."

These batch files have made managing my archival storage more efficient. Perhaps they will be of use to you, too.

Jeff Blaze
Campbell, California

1-2-3 Overhead

If you run very large worksheets and get a message that your memory is full, there may be a way to make more memory available without breaking the worksheet into smaller chunks or, more radically, adding another bank of 64K chips. The memory may have filled up due to the way *1-2-3* stores cell address information.

1-2-3 has an overhead factor that I call "displacement cost." In addition to the bytes used to hold the data entered into the worksheet, *1-2-3* reserves 4 bytes to use as a pointer for each cell (except A1) within the rectangle of cells bounded by the highest-numbered row and rightmost column in which data has been entered. Expressed algebraically, the displacement cost is $d = 4(rc - 1)$ where d equals the displacement cost in bytes, r the highest row number, and c the rightmost column (A = 1, B = 2, etc.).

For example, if the worksheet has data that extends to row 10 and column N, the displacement cost is the same as if the data were only in cell N10. Enter some number into cell N10 and press <Home>. Then if you press the <End> <Home> key sequence, the cursor will move to the farthest used cell, N10. In this situation, the cost works out to be 4 bytes × ((14 × 10) − 1), which equals 556 bytes.

Now enter a number into cell Z26, which makes the displacement cost 4 bytes × ((26 × 26) − 1), which equals 2700 bytes. Erase the number, and press <Home>. If you press the <End> <Home> key sequence, the cursor moves to the empty cell Z26 rather than the farthest cell with data, N10. Thus 2144 bytes of mem-

```
1 '*********************************************
2 '*                                           *
3 '*  BASIC CROSS-REFERENCE PROGRAM            *
4 '*  DEC 1983 . . . DONALD G. JOHNSTON        *
5 '*  SCANNING AS USED IN SQUISH FROM PC WORLD  *
6 '*  QUICKSORT WRITTEN BY JOHN W. ROSS        *
7 '*                                           *
8 '*********************************************
100 '
110  'INITIALIZE.  DETERMINE FILE AND OPEN IT.
120  '
130 SD=0:XR$="":T=0:T1=0:T2=0:V$="":X=0:ZC=0:DIM LO(50),HI(50),REF(1000),LN(1000
):SCREEN 0,0,0:WIDTH 80:COLOR 11,0:KEY OFF:CLS:LINE INPUT "Enter the name of the
 program to be cross-referenced: ";XR$:IF 0=INSTR(XR$,".") THEN XR$=XR$+".BAS"
140 PRINT:PRINT"Opening ";XR$:ON ERROR GOTO 1000:OPEN XR$ FOR INPUT AS #1:PRINT:
PRINT"Scanning ";XR$;" now ..... Line # = ":PRINT:PRINT"# of references = 0"
200 '
210 'SCAN LINES OF CODE FOR CROSS-REFERENCES.
220 '
230 IF EOF(1) THEN CLOSE #1:GOTO 430
240 LINE INPUT #1,A$:IF ASC(A$)>58 THEN COLOR 12,0:PRINT:PRINT"**** '";XR$;"' is
 not an ASCII file ****":PRINT:COLOR 11,0:END
250 HH=INSTR(A$," "):LN=VAL(LEFT$(A$,HH)):LOCATE 5,29+LEN(XR$):PRINT LN:G1=1:G2=
1:G3=1:G4=1:G5=1:G6=1:G7=1
260 D=4:T=INSTR(G1,A$,"THEN"):IF T THEN G1=T+D:GOTO 340
270 T=INSTR(G2,A$,"GOTO"):IF T THEN G2=T+D:GOTO 340
280 T=INSTR(G3,A$,"ELSE"):IF T THEN G3=T+D:GOTO 340
290 T=INSTR(G4,A$,"GOSUB"):IF T THEN D=5:G4=T+D:GOTO 340
300 T=INSTR(G5,A$,"RESUME"):IF T THEN D=6:G5=T+D:GOTO 340
310 T=INSTR(G6,A$,"RUN"):IF T THEN D=3:G6=T+D:GOTO 340
320 T=INSTR(G7,A$,"RESTORE"):IF T THEN D=7:G7=T+D:GOTO 340
330 GOTO 230
340 A=VAL(MID$(A$,T+D)):IF A THEN R=R+1:REF(R)=A:LN(R)=LN:LOCATE 7,18:PRINT R
350 IF A>0 THEN T=T+D:D=1:T1=INSTR(T,A$,","):T2=INSTR(T,A$,":"):IF T1>0 AND (T2=
0 OR T1<T2) THEN T=T1:GOTO 340
360 GOTO 260
400 '
410 ' USE QUICKSORT TO ORDER THE REFERENCED LINES
420 '
430 CLOSE:LOCATE 9,1:PRINT"Sorting the cross-references... (Depth of sort shown
below.":LO(1)=1:HI(1)=R:II=1
440 IF II<=0 THEN 630
450 IF LO(II)>=HI(II) THEN II=II-1:PRINT II;:GOTO 440
460 I=LO(II)-1:J=HI(II):IL=J
470 IF I>=J THEN 520
```

(continues)

XREF.BAS

```
480 I=I+1:IF REF(I)<REF(IL) OR (REF(I)=REF(IL) AND LN(I)<LN(IL)) THEN 480
490 J=J-1:IF J>I THEN IF REF(J)>REF(IL) OR (REF(J)=REF(IL) AND LN(J)>LN(IL)) THE
N 490
500 IF I<J THEN SWAP REF(I),REF(J):SWAP LN(I),LN(J)
510 GOTO 470
520 J=HI(II):SWAP REF(I),REF(J):SWAP LN(I),LN(J):IF I-LO(II)<HI(II)-1 THEN LO(II
+1)=LO(II):HI(II+1)=I-1:LO(II)=I+1:GOTO 540
530 LO(II+1)=I+1:HI(II+1)=HI(II):HI(II)=I-1
540 II=II+1:PRINT II;:GOTO 440
600 '
610 'FORMAT THE OUTPUT LISTING
620 '
630 PRINT:PRINT"Ready to output the results now!"
640 PRINT"Do you want it to the screen (s) or printer (p)?":A$="":WHILE A$="":A$
=INKEY$:WEND:IF A$="s" OR A$="S" THEN CLS:A$="scrn:" ELSE IF A$="p" OR A$="P" TH
EN A$="lpt1:"ELSE PRINT:PRINT"s or p Please!":PRINT:GOTO 640
650 OPEN A$ FOR OUTPUT AS #1:PRINT #1,"Cross-references of line numbers for ";XR
$:PRINT #1,STRING$(37+LEN(XR$),"-"):PRINT #1," "
660 PRINT #1,"Reference:","Line numbers":PRINT #1,STRING$(30,"-"):PRINT #1,REF (
1);":",LN(1);:FOR I=2 TO R:IF REF(I)=REF(I-1) THEN GOSUB 680 ELSE PRINT #1," ":P
RINT #1,STRING$(30,"-"):PRINT #1,REF(I);":",LN(I);
670 NEXT:PRINT #1," ":END
680 IF A$="scrn:" THEN AX=POS(0) ELSE IF A$="lpt1:" THEN AX=LPOS(1) ELSE END
690 IF AX>73 THEN PRINT #1,"":PRINT #1,"",LN(I);ELSE PRINT #1,LN(I);
700 RETURN
1000 IF ERR=53 THEN RUN ELSE ON ERROR GOTO 0
```

XREF.BAS (continued)

```
Enter the name of the program to be cross-referenced: XREF

Opening XREF.BAS

Scanning XREF.BAS now ..... Line # = 1000

# of references = 22

Sorting the cross-references... (Depth of sort shown below.)
 2  3  4  3  4  5  6  7  8  9  10  11  10  9  8  7  6  5  4  3  2  3  4  3  4
 5  4  3  2  1  0
Ready to output the results now!
Do you want it to the screen (s) or printer (p)?
```

Screen 1, XREF.BAS

```
Cross-references of line numbers for XREF.BAS
---------------------------------------------

Reference :   Line numbers
------------------------------
 230 :        330
------------------------------
 260 :        360
------------------------------
 340 :        260  270  280  290  300  310  320  350
------------------------------
 430 :        230
------------------------------
 440 :        450  540
------------------------------
 470 :        510
------------------------------
 480 :        480
------------------------------
 490 :        490
------------------------------
 520 :        470
------------------------------
 540 :        520
------------------------------
 630 :        440
------------------------------
 640 :        640
------------------------------
 680 :        660
------------------------------
 1000 :       140
```

Screen 2, XREF.BAS

ory are wasted. Used as pointers to empty cells beyond the rectangle bounded by the farthest used cell, these bytes are unavailable to hold data.

This situation arises when data is entered into some far cell within the worksheet and is then erased. Even if the */Range Erase, /Worksheet Delete Row,* or */Worksheet Delete Column* commands are used, *1-2-3* will not give back the displacement cost. It gets saved with the worksheet and eats up memory when it is loaded again. This can be a nuisance if the worksheet is very large. In one case I experienced, the amount of wasted memory was almost 10K—enough to bring a macro to a screeching halt.

The extra memory can be recovered with the following three steps:

1. */File Retrieve* the original file.
2. */File Xtract Formulas.* Limit the range to extract to the active data rows and columns. Don't use the <End> <Home> key sequence to find the end of this range.
3. */File Retrieve* the extracted worksheet file. This can be resaved to the original file.

If you execute a */Worksheet Status* on both the original and the extracted versions, you may be amazed at how much memory was taken up by wasted space.

Eric Weiss
Akron, Ohio

BASIC Cross-Reference

After seeing the *Program Squisher* in "BBS of the Month" (*BBS Watch, PCW,* Vol. 1, No. 10), I realized that within that program was a cross-reference program just dying to get out. The program XREF.BAS (see listing by that name) is the result of a few nights of work after this revelation. "Screen 1, XREF.BAS" and "Screen 2, XREF.BAS" show the program's output when it is run on itself.

The program assumes that you want to cross-reference a BASIC file and will append .BAS if it doesn't detect a period in the file name. (If the file doesn't have an extension, enter the file name followed immediately by a period, and .BAS will not be appended.)

The program keeps a running commentary (on screen) of the line number being scanned and the number of references found. The screen displays the number of references found and shows the current depth of

the sort to give you an idea of how long the sort will take and how far the program is into the sort.

I substituted the Quicksort program for the simple bubble sort because it is only an "order n" sorting algorithm (bubble sorts are "order n-squared"). Sorting a large program with the bubble sort took about 35 minutes. With Quicksort it took about 1.5 minutes. And if you can use the BASIC Compiler, it can do the sort in less than a minute.

As you can see in "Screen 1, XREF.BAS," the output, "Screen 2, XREF.BAS," can go to either the screen or the printer. In either case, the output will wrap if it extends to column 80.

XREF.BAS was "squished" to save space and increase speed, so type it in very carefully, exactly as shown.

Donald G. Johnston
Moose Jaw, Saskatchewan, Canada

---

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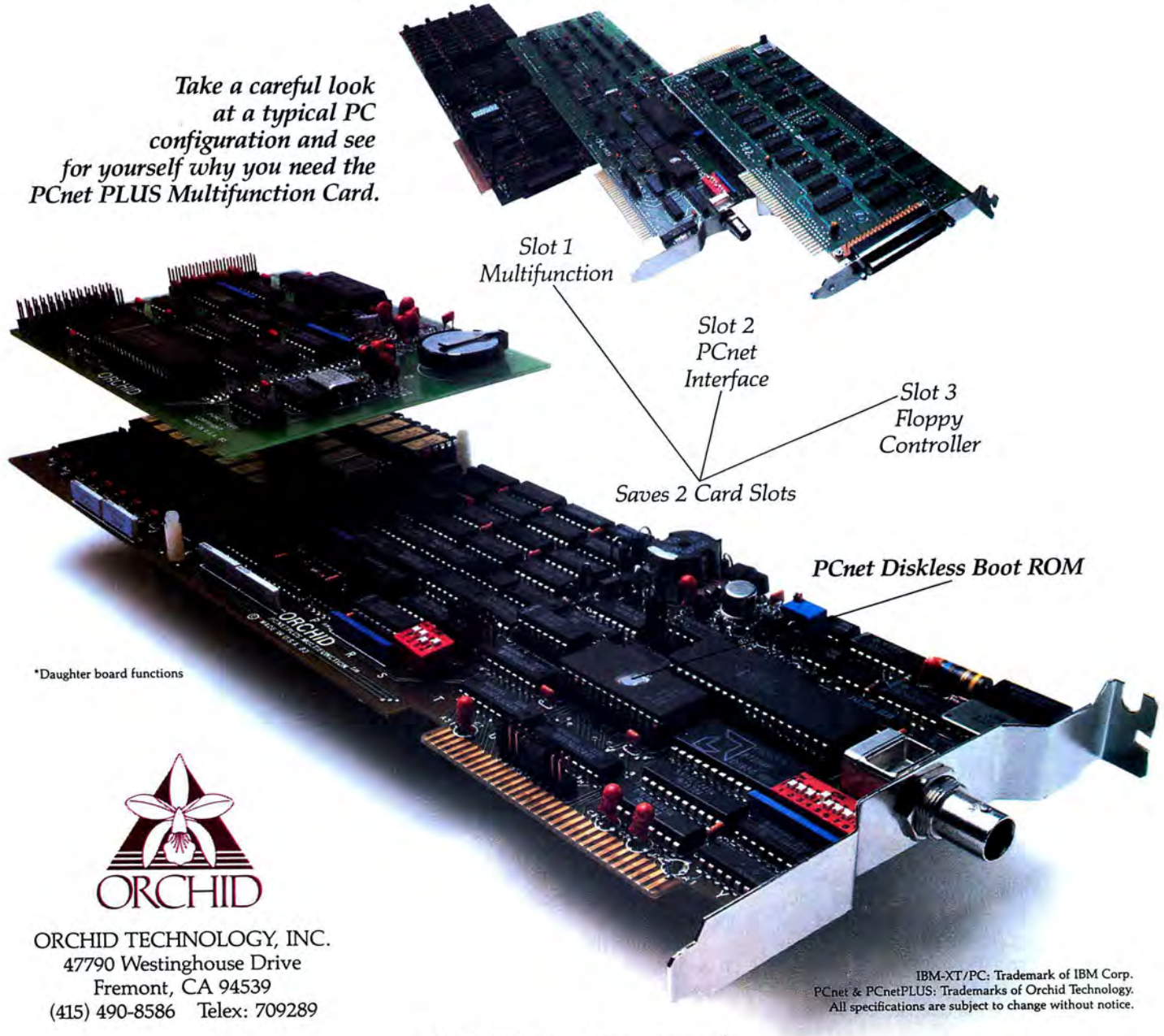

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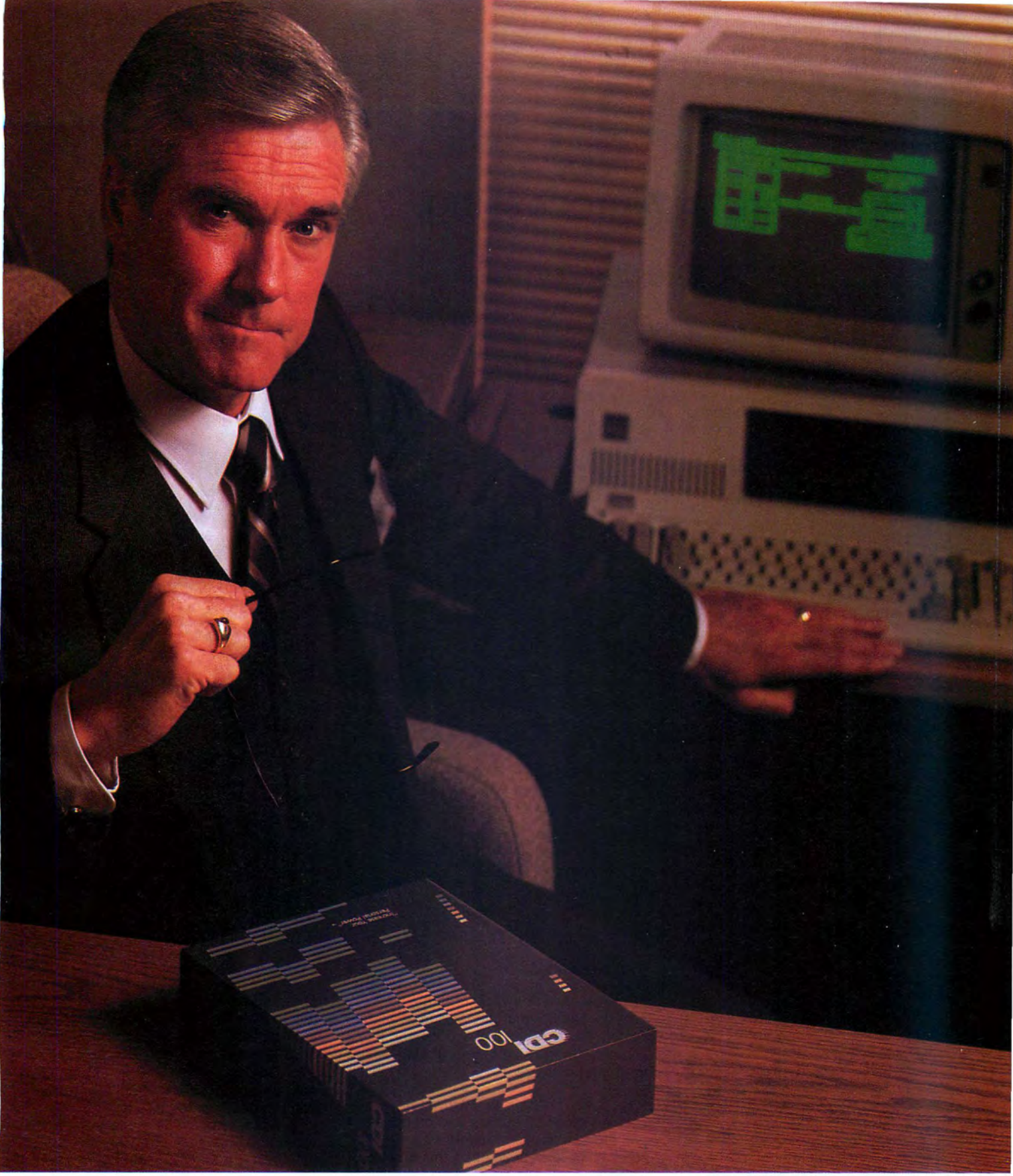

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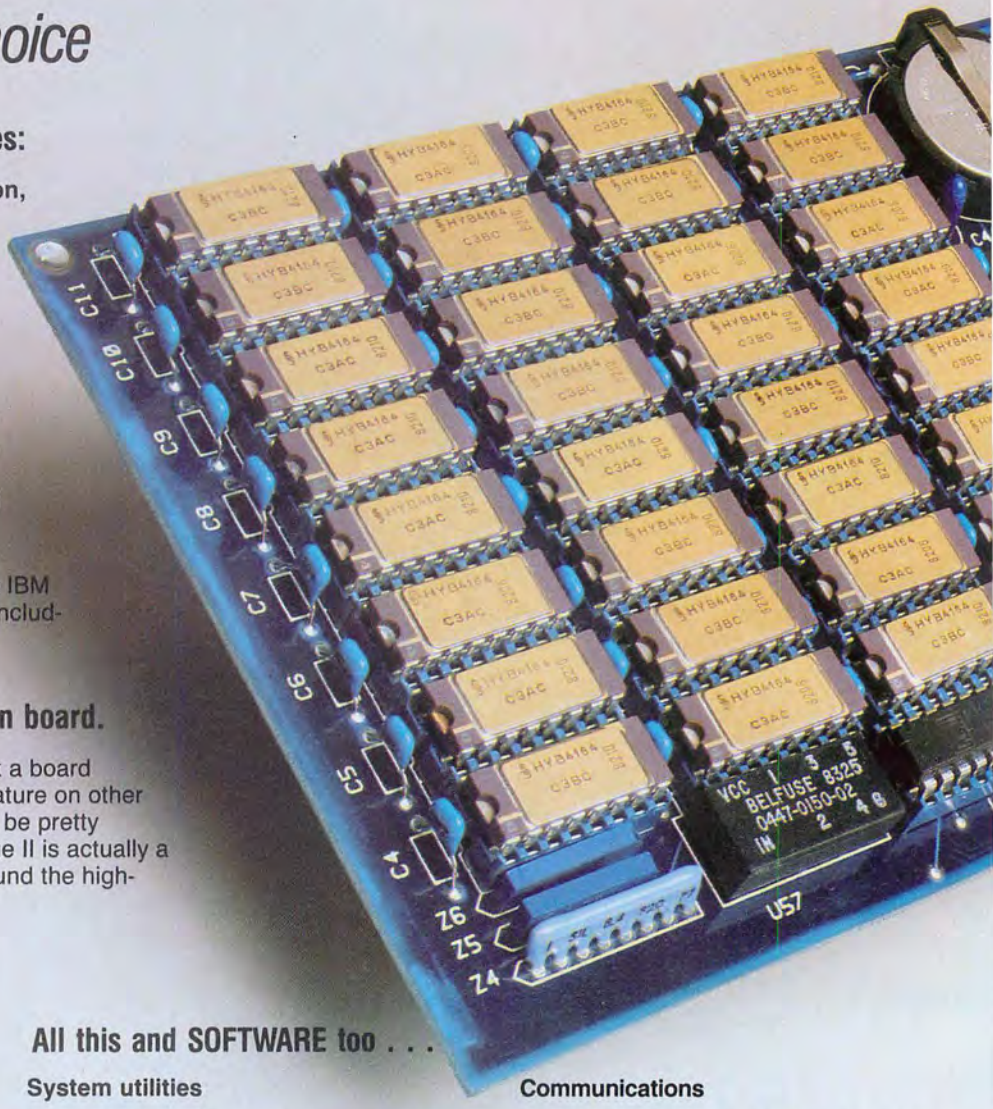

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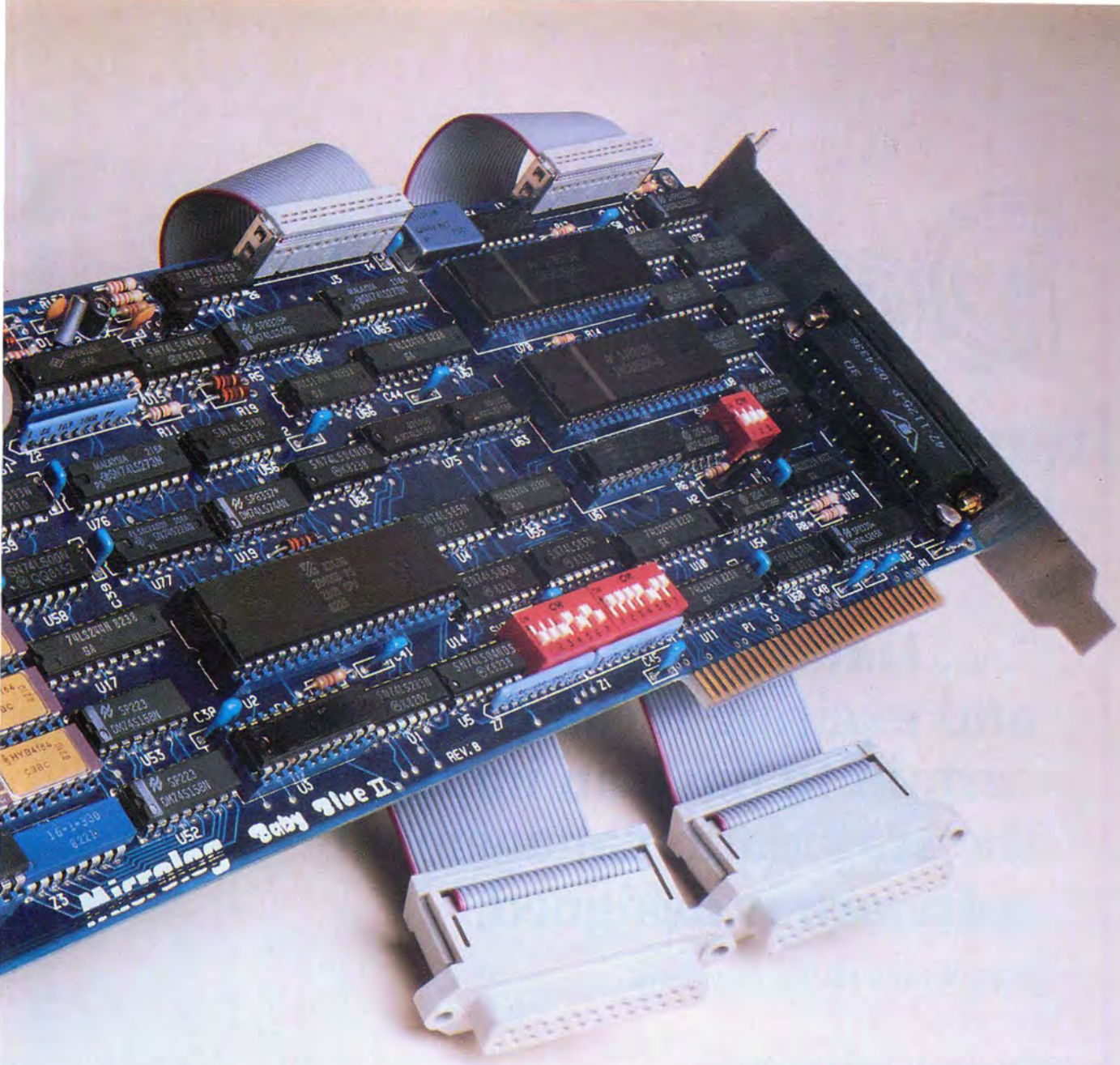

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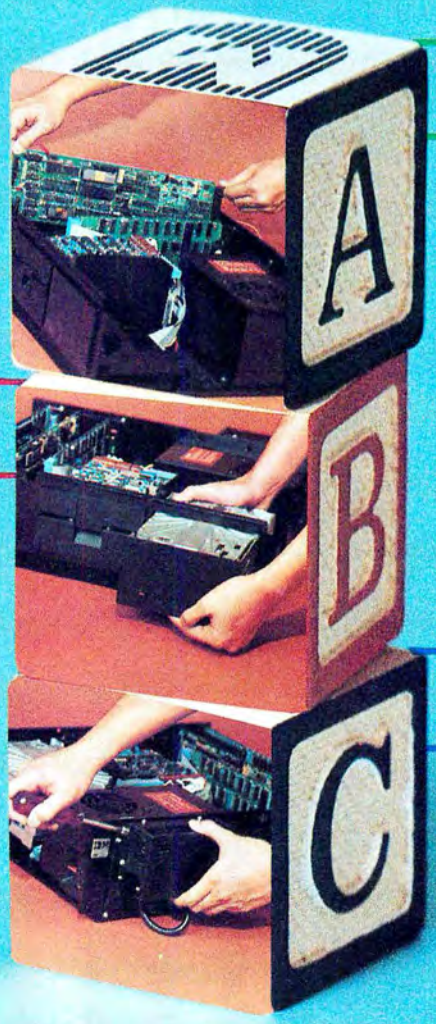

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becomes...
and my **PRINTER**
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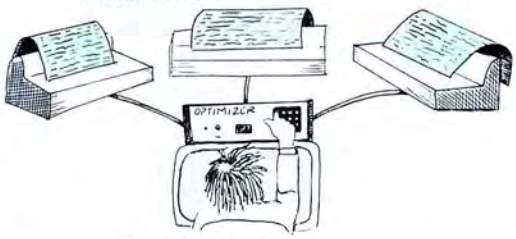

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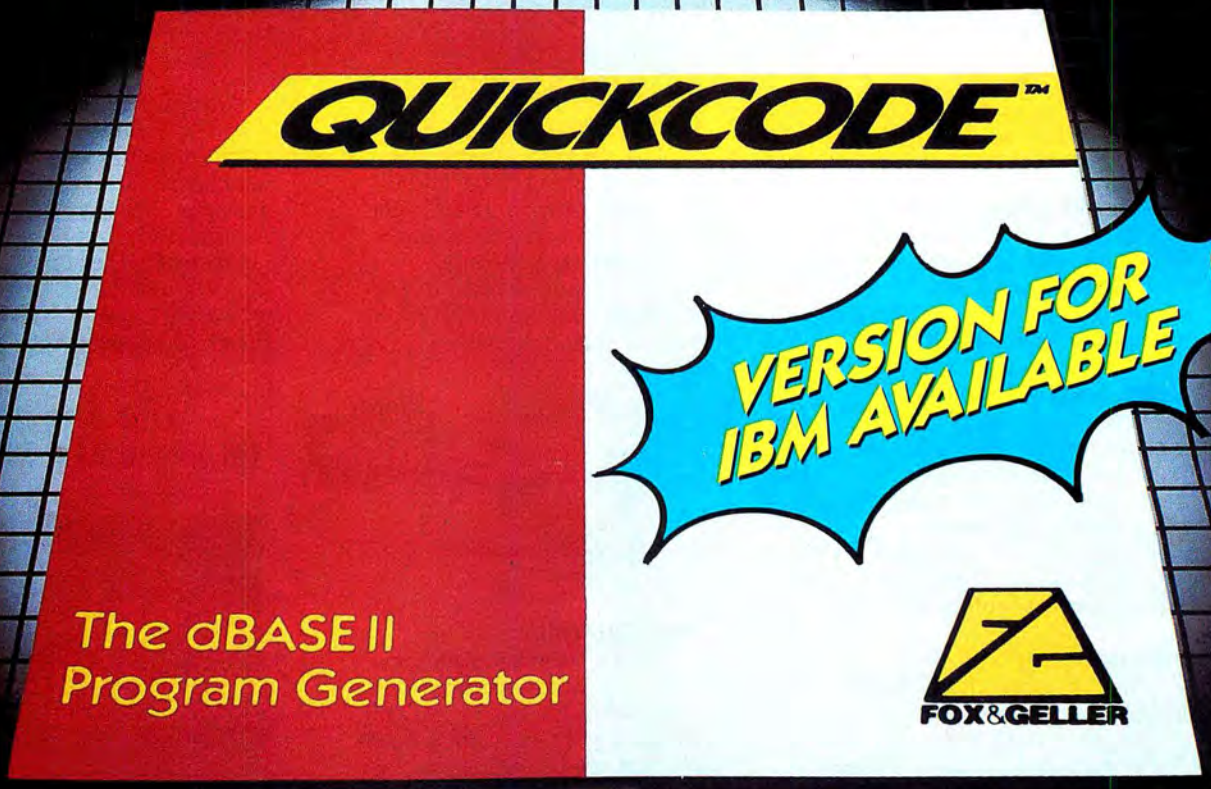

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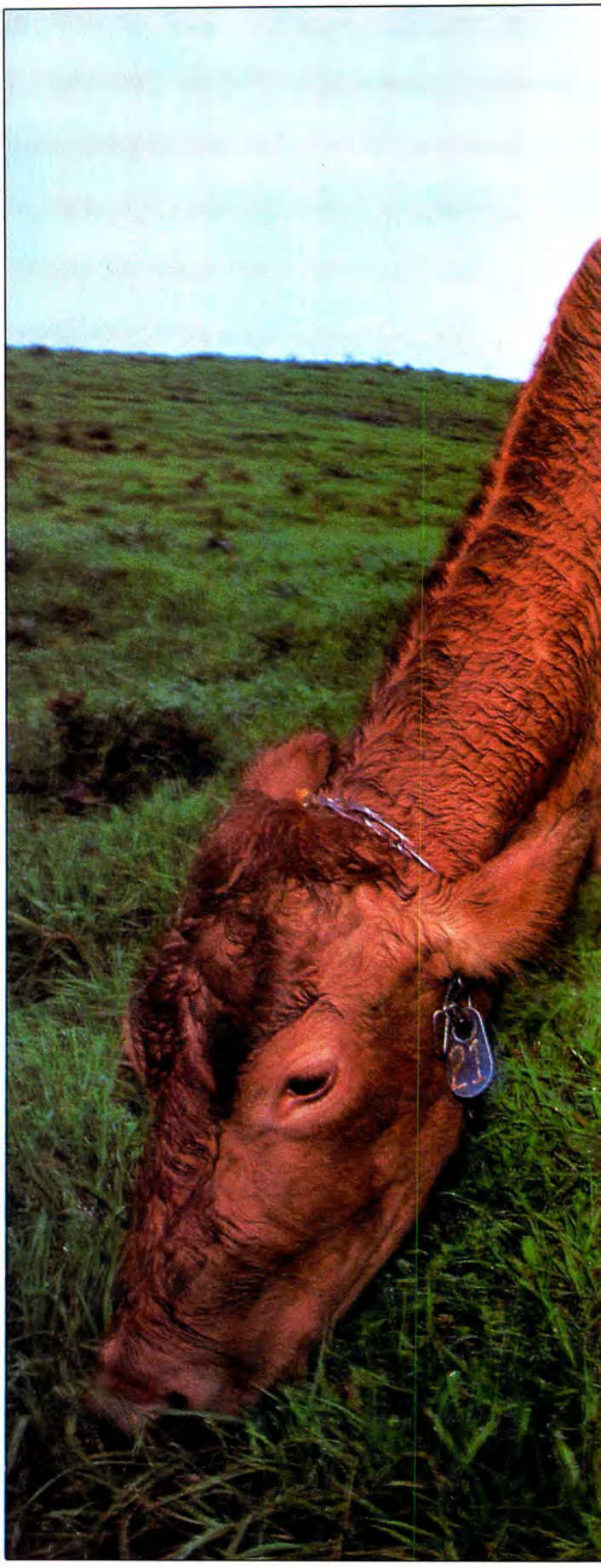


Eric Brown and John Faulkner

The cattle business has changed considerably since the great cattle drives and range wars of the 19th century. Although most cattle ranchers are still rugged individualists and most cowboys still ride horses, the cattle operation of the 1980s is a complex business. Today's cattle producer often needs to know pharmacology, mechanics, genetics, and financial forecasting. As competition increases and cattle operations become more involved, many ranchers and feedlot owners have turned to the computer for help. The IBM PC and XT are already at the forefront of this latest revolution in the cattle business.

"These days the best crossbreed is a cow and an oil well," joked Ron Baker to a sympathetic audience of ranchers and feedlot owners at CompuCattle Roundup II. The pressures of a fiercely competitive market were evident at the MGM Grand in Las Vegas, as ranchers came to see the most useful tool for livestock production since the barbed-wire fence. As the cattle business becomes more complex, many ranchers are finding that a computer is necessary to stay competitive.

Beef is big business in America. In almost half the states, the cattle industry ranks first as a source of farm income. The United States holds 5.5 percent of the world's human population and 10 percent of the world's cattle population (115 million head). Yet this country produces 24 percent of the world's beef and consumes 26 percent of it.

Community

Despite the enormity of the cattle business, it is one of the last livestock industries to become computerized. In large part, cattle producers are reacting to stiff competition from livestock operations that raise animals that have shorter biological cycles. The automated poultry and swine industries have taken a larger chunk out of the consumer's meat dollar.

Meanwhile, beef producers have run into increased competition from abroad and from dairy producers at home. New dairy legislation is causing dairy producers to slaughter more of their cattle for beef, thus lowering prices. Add unpredictable weather, a cholesterol scare, and a trend toward convenience foods, and it is no surprise that many cattle producers are having a hard time breaking even.

With all the bad news facing beef producers, the computer can make the difference for a business in which the profit margin is constantly shrinking. Ranchers and feedlot owners can increase their control over variables such as feed and overhead, and they can predict market activity with greater accuracy and determine the critical break-even price of any steer or heifer.

Computers are a hot topic in the cattle industry these days. They are frequently mentioned in cattle magazines such as *CALF News* and the *Western Livestock Journal.* At CompuCattle Roundup II ranchers and feedlot owners gathered to hear computer and cattle experts, discuss problems, and sample a growing body of cattle-raising software. The most prevalent computers at the exhibition were the IBM PC and XT. (See "Cattle Software for the PC.")

The Feedlot Revolution

The move toward computers is a natural extension of a trend toward centralization of beef production. Most beef cattle spend only the first third of their lives grazing on the range. They are then sold to or boarded at feedlots, where they are fattened quickly on a grain diet. Range-fed cattle take about three years to reach a suitable weight for slaughter, whereas grain-fed cattle usually take less than two years to reach finish weight. Feedlots have shortened the biological cycle of cattle and have increased profits. Further savings are realized through the consolidation of resources. Over 75 percent of all American beef cattle are now grain fed, as opposed to 35 percent in 1947.

The feedlot revolution started in the '30s and boomed in the early '60s, when hybrid grains and new technology provided an abundance of inexpensive grain. Because running a feedlot is more complex than running cattle on the range, large feedlots were the first cattle operations to invest in computers.

Livestock Man of the Year

We pulled the rented black T-Bird up in a cloud of dust and grain at the Hartman-Williams feedlot in Calexico, California. Not far away were the mountains of Mexico, overlooking the Imperial Valley. To the right was the grain mill and to the left the silos. A railroad spur ran directly into the feedlot, terminating at a mountain of grain. In the distance lay acres of steers in open pens.

We walked into the prefab headquarters and found programmer Andy Connelly fussing over the $17,000 IBM System/34 5340. The computer was connected to four terminals and a remote modem hookup to a commodities and seed company.

After showing us the computer, Connelly introduced us to Manager Thomas Remington, who was recently named "Livestock Man of the Year" by the California Chamber of Commerce for his pioneering work with computers. Remington gave us a brief rundown on the feedlot and then offered to give us a tour. We jumped into his pickup and took the high road on the lip of the American Canal overlooking the feedlots. Below us were 22,000 head of every breed imaginable slowly turning into steak. Most of Remington's cattle are bought outright by order buyers in Texas, but he also boards cattle from an average of 65 owners.

An old cowhand rode by on a horse and waved. "He's been with us since the beginning," said Remington. The lot was founded in 1931 as the first commercial feedlot in the Imperial Valley. After World War II, the valley feedlots boomed with the help of inexpensive feed and contract labor. Although dry weather keeps away mud and disease, the excessive summer heat is a problem. Each pen at the Hartman-Williams feedlot is carefully designed to provide 30 square feet of shade per head.

We pulled over to a semicircular chute on the edge of the lot where three cowboys were processing new bulls that had just arrived from Texas. They injected the cattle with antibiotics to reduce the effects of stress from being cramped up in a

boxcar. They used an electric prod to guide the cattle through the main chute into a squeeze chute. There they roped one leg, branded each bull on the flank, and castrated him. The final task was to dehorn the cattle with clippers. The enraged steers were then prodded out into the lot.

Besides destroying sex drive, castration changes hormonal growth patterns. A bull develops large, tough shoulders and lean flanks, but a steer grows more like a cow, providing tender flank meat. Growth hormones are sometimes injected to achieve the desired effect.

Sixteen years ago the feedlot invested in an IBM 1130 with software written in FORTRAN. A few years ago, Remington bought the System/34 and hired Connelly as a temporary full-time programmer.

"The way my imagination works, I could keep Andy busy for the next 20 years handling new applications," said Remington. Remington comes up with new spreadsheet calculations all the time, especially to compute how a particular owner's cattle perform. Primarily, this calculation includes transit time, cost/weight-gain ratio, and numbers of "deads" and "bullers" (steers having hormonal imbalances that cause them to mount everything in sight).

Daily information taken from an on-line commodities service helps Remington follow the market trends for feed prices. By combining this information with guidelines set down by a nutritionist and plugging the data into the System/34, Remington figures the least-cost ration. Using the computer has lowered feed costs by $1.50 a ton of feed.

Packer buyers frequently visit from the meat packing houses to examine Remington's finished cattle. The buyer can usually predict a steer's grade from these investigations, but the final designation is given at the slaughterhouse by the USDA inspector, who checks the carcass by cutting along the twelfth rib. This cut seems arbitrary to Remington, because not all steers have their best cuts at the twelfth rib.

The current trend in the supermarkets is that consumers are buying beef with less fat content. This trend can save the feedlot money. It actually takes more feed to produce fat than to produce lean beef. Fat contains more than twice the stored energy of an equal weight of muscle tissue. With the System/34, Remington can determine when the daily weight increase has leveled off, an indication that cattle are putting on excess fat. The cattle are then placed on reduced rations and prepared for market.

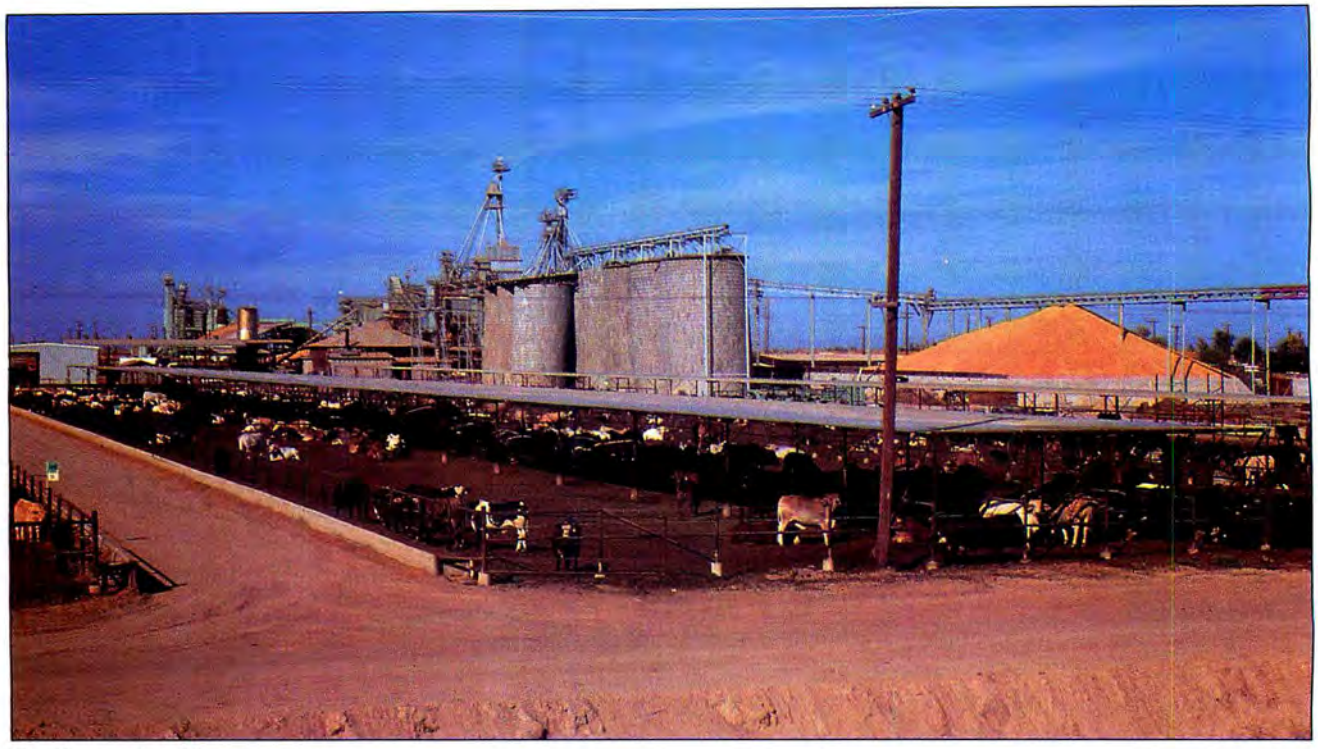
The taste for leaner beef also affects Remington's choice of cattle. Almost all of the cattle delivered to Hartman-Williams are part Brahman, a breed that tends to be lean.

Remington said that it's impossible to say how much money the computer has saved him overall. We asked him if he really needs that much computing power to run the feedlot. "Probably not," he said, "but I bought for the future and plan to expand. I had to make sure that it wasn't just a toy. I'm convinced it's not. We can't effectively manage without a computer anymore. There's no way we could produce our weekly report by hand."

Remington lead us to the mill and demonstrated how the feed was mixed. It was hot and there was a fine grain dust in the air that made our eyes sting.

They give the cattle a variety of feed: wheat, barley, milo, cottonseed hulls, wheat straw, and bermuda straw. In the mill the grain is flattened and rolled so it can be fully digested by the steers. A computerized control board (not connected to the System/34) controls mill operations such as adding the micronutrients in exact doses.

After we finished the tour of the mill, Remington gave us directions: "Take 98 west. I don't think you'll see any highway patrol out there. I usually take my pickup as fast as it can go." Remington winked and walked away.



Feedlot and mill operation

A computer can simplify calculations on feed, cattle movements, payroll and accounting, invoicing, and least-cost feed blending. From those calculations, market projections and analyzable historical records can be created. Feedlot managers can keep track of virtually all overhead down to the last bushel of corn or gram of micronutrients. They can now compute the exact break-even price on any given steer the same day that grain prices change.

Linear programming enables the cattle producer to input a change in any given part of a sophisticated formula and see how it will affect the other variables in that formula. Linear programming deals mostly with non-negative numbers and uses a series of variable additions to achieve a fixed solution. Simultaneous linear equations represent the conditions of a problem, and the linear function expresses the objectives.

Ranching with a PC

The consensus at CompuCattle Roundup II was that any operation larger than 5000 head needs a computer to stay competitive. Although ranches that graze cattle usually have fewer variables to keep track of than feedlots, those smaller operations can also benefit from computers. Microcomputers such as the PC can help ranchers speed up accounting and monitor labor and equipment costs.

With the help of an IBM PC, Don Sokol, an ex-lawyer who also used to grow grapes in Napa Valley, California, is now raising 1000 head of cattle south of Elko, Nevada. Sokol uses *EasyWriter 1.10* for word processing and *SuperCalc 2* to run spreadsheets on his cattle. For Sokol, moving from grapes to cattle was a matter of pride and boredom. "I like to grow things that move. Looking at grapes all day was boring," he says with a wry smile. "At least cattle move around a little." Sokol turned to ranching for its independent lifestyle, and according to Sokol, the PC has made him even more independent.

Sokol says that ear tag identification helps him monitor his cattle with the PC. If ranchers want to use federal land for grazing, they are required by the government to have every steer or heifer wear an identification ear tag. Although many ranchers grumble about this in-

Cattle Software for the PC

The following companies sell cattle-related software for the IBM PC and XT:

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303/352-4332

Computerized Service & Design
P.O. Box 106
St. Onge, SD 57779
605/578-3386

Hi-Plains Systems, Inc.
P.O. Box 8152
Amarillo, TX 79109
806/358-7101

Red Wing Business Systems
610 Main St.
P.O. Box 19
Red Wing, MN 55066-0019
612/388-1106

trusion of government bureaucracy, those who own computers see ear tags as a blessing in disguise. The ear tag gives the PC an easily identifiable number to sink its microchips into. Ranchers can track the progress of individual cattle and compile exact head counts by variables such as sex and breed.

Owning a computer can give ranchers an edge when applying for loans. Not only does a computer spreadsheet provide accurate and detailed information on an operation's finances, but bankers are generally impressed by a rancher who has invested in the future by buying a computer. However, the banker should be provided with only information pertinent to the loan. A rancher who has just mastered a computer often gets carried away with the amount of information that can be generated. Not every spreadsheet calculation need be presented to the outside world. Data overkill not only leads to confusion but can also attract unwanted questions.

Even if a rancher doesn't buy a computer, he or she must be able to understand the computerized bill sent by the feedlot owner. If all the cattle owned by a rancher are boarded at a computerized feedlot, the rancher may not need a computer. The itemized invoice that the feedlot sends may include all the needed information.

"If an operation works, a rancher may not need a computer," says Ronald Baker, owner of C & B Livestock Company, a combination feedlot, cow/calf, and breeding operation in Hermiston, Oregon. Baker was one of the cattle industry's computing pioneers. He bought his first computer 14 years ago and now owns an IBM System/36.

"These are hard times for cattlemen," says Baker, "and computer information can often be discouraging because it tells the truth. But if we're going to survive against the other livestock people, we have to change."

Computers are fast becoming an essential tool in the breeding business. The genetic breakthroughs made by the dairy industry are now moving to beef. Baker says that the computer has been instrumental in helping him breed his renowned line of prize bulls. Computers can compile breeding histories, create national sire summaries, and help narrow buying decisions. However, breeding is still an art dependent on instinct and experience. A computer cannot detect subtle qualities.

Baker warns ranchers not to get carried away with the novelty of a new computer and forget about the ranch. "Don't spend all your time on the terminal. You lose track of the business. Try to get everybody to input on the computer—from the cowboy to the specialists."

Baker suggests that before buying a computer a rancher should buy a good set of scales, get the books in order, and set up an efficient data collection procedure.

Community

Implementing these new procedures involves telling skeptical cowhands to change their ways. Working for computerized ranches or feedlots, cowhands have to turn in detailed reports for every movement made during the day. Although employees don't always like it, ranchers and feedlot owners agree that discipline in data collection must be enforced if computerized operations are to be effective.

Some employees are afraid that the computer will replace them. But according to Baker and other owners, introducing a computer often adds jobs. Sometimes more cowhands are needed to keep the data collection up to par, and operations with larger computer systems require programmers and system operators.

> 'We're talking about a business that's gone from tractors to telecommunications in the span of a rancher's lifetime.'

The PC on the Feedlot

Although some feedlots demand the computing power of larger computers, many are small enough to be handled with microcomputers. Andy Wearin manages a 10,000-head feedlot in Alliance, Nebraska, with an IBM PC XT running general ledger and feedlot management programs. Wearin bought the computer to free up time he used to spend in the office. "The old manual system worked very well, but I don't like being tied down," he says. So far, the rigors of setting up the system have actually added to Wearin's office hours, but he's confident that the system will eventually give him more free time, even if he has to hire a system operator.

Chuck and Shari Flaming use an IBM PC to run the family-owned Sadler Cattle Company, a 4000-head feedlot in Paxton, Nebraska. The PC's primary function is monitoring daily feed consumption. "When a pen starts to finish, their consumption will drop," says Chuck. "The PC lets us know on a daily basis when we should look for a buyer." Spreadsheets listing ration consumption and feeding schedules help buyers estimate what grade a particular pen will attain.

It took six months to get the system on line. Although adapting the Flamings' existing data collection and bookkeeping system took time, the greatest delays came from the lack of hardware support and service on the high plains of Nebraska.

"Some people get into the dealer business without knowing much about computers," says Chuck. At least the Flamings' software was well supported. Representatives of Computerized Service & Design visited often and spent several days customizing *The Heritage Feedyard System* software to the Flamings' operation. "A computer is just like any other piece of equipment," says Chuck. "When you buy a tractor, you get one from a company that gives the best service."

Computerized Service & Design combines some rare traits in the cattle software business—experience in both computers and livestock. Founders Terry Smith and Mark Hotchkiss grew up on neighboring ranches in South Dakota. Hotchkiss went to work for a feedlot as a cowboy, but was soon moved to the front office where they had just bought an IBM System/36. Smith would come over after hours, and together they taught themselves how to program.

Hotchkiss and Smith wrote two software packages for the IBM PC XT: a feedlot management program (*The Heritage Feedyard System*) and a livestock sales program for cattle auctions. The auction program sorts sales information during an auction and quickly prepares itemized bills of sale. The next step is connecting the XT to several terminals in a local area network and gathering weight data directly from a scale through a serial port connection.

Smith, Hotchkiss, and other representatives spend much of their time on the road selling and customizing software. "The ranchers are very hard to convince," says Smith. "But if you can hook them with that first microcomputer, then you've got them. That's why we're starting our system on an XT. It can handle a small- to medium-sized feedlot or cow/calf operation as good as a mini can."

Joe Shell runs Agri Systems, Inc., an agricultural software company in Edmond, Oklahoma. Shell originally ran a mainframe time-sharing operation out of Kansas City, but he had problems with flexibility and phone costs. Now he travels around selling customized

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software and recommending hardware to ranchers and feedlot owners—but not without some resistance. "A lot of ranchers ask me, 'What the hell do I need a computer for? My wife has been running the books perfectly for 20 years, and no computer's going to tell me how to raise cattle.' Sometimes, they are perfectly right."

One of Shell's customers is Dr. Dallas Horton, a veterinarian and the owner of a commercial/experimental feedlot in Wellington, Colorado. Shell wrote the custom software for Horton's Digital Equipment Corporation (DEC) 11/23.

> Computers can compile breeding histories, create national sire summaries, and help narrow buying decisions.

Horton's feedlot weighs cattle every 28 days on a squeeze chute scale. The weight scale and the feed mixer are hard-wired to the DEC through serial port connections. The DEC 11/23's multitasking system also collects data from three terminals and a telecommunications hookup to a remote feedlot. Horton carries around a Texas Instruments Silent 700 portable terminal for computing least-cost rations. The Silent 700 can also exchange data with the DEC.

Data from these seven input sources is edited and sent to the spreadsheet. Because applications change as an operation grows, Horton recommends that ranchers and feedlot owners buy software that has modifiable source code or that they get customized programming support.

Horton admits that computers are not his strong suit: "I thought RAM was a sheep and hardware was when a cow had a wire in its belly." But at the same time, he realizes that he has to understand computers if he wants to remain competitive. "We're talking about a business that's gone from tractors to telecommunications in the span of a rancher's lifetime."

What computers can't do for you, according to Horton, is make it rain, tell you when to sell, increase the price of fat cattle, improve the asset-to-debt ratio, save labor costs, or decrease the cost of corn. "Don't depend entirely on your computer," says Horton. "Some guy with a third-grade education who knows cattle may come up with better answers. Knowledge is what counts."

Putting on the Pounds

The feed conversion rate of a steer is a key indicator of profits. Computing the cost of feeding cattle versus the daily weight gain reveals valuable information on cattle performance by owner, breed, sex, and any other variable you want to delineate. Calculating each steer's growth ratio without a computer would be an overwhelming task.

Before computers, cattle were weighed on a central scale, and feedlot managers estimated cost/weight gain per lot. An individual steer's conversion ratio was unknown. When it came time to bill the rancher, average weights favored lightweight cattle. Ranchers who boarded lightweight cattle received the same feed bill as those who brought cattle in with heavier starting weights, even though the feedlot was spending more on the lightweight cattle to bring them to a finish weight.

Now, most feedlots weigh cattle on a strict schedule and measure the amount of feed and medicine consumed by each steer. By comparing records, the computer can determine which cattle have poor conversion rates and note discrepancies in feeding schedules. Both the feedlot manager and the cattle owner can now see how cattle of different breeds and origins perform.

Agricultural Networks

The price of feed is perhaps the single greatest concern to beef producers. Some feedlot operations have resorted to feeding cattle cardboard, newsprint, and orange peels to cut the high cost of feed. A computer can help reduce feed costs by calculating the least-cost ration. The trick is to feed the cattle the right mix for health and rapid growth at the lowest possible cost.

Although the computer is an essential tool in computing the least-cost ration, some variables don't fit into the mathematical formula. Palatability is one such variable. "The computer can tell you what the least-cost ration should be, but it can't tell you whether the cattle will eat it," says Thomas Remington, manager of the Hartman-Williams feedlot in Calexico, California. (See "Livestock Man of the Year.") Many feedlots have on-site

or consultant nutritionists, but the final decision comes from the feedlot manager. Many decisions made by cattle producers must be based on experience.

Current grain and transportation costs are key variables in determining the least-cost ration. Commodities must be checked daily. Using computers and modems, cattle producers can log on to agricultural on-line data base networks such as Agnet, Agristar, and Pro Farmer. These networks provide up-to-date prices and analysis. Market information can be further manipulated with market forecasting software.

Using a spreadsheet, an owner can see exactly what each steer costs per day.

Spreadsheet to Invoice

The end product of all these computations is the spreadsheet. Data from various sources can be reduced to one spreadsheet that can be updated frequently. Spreadsheet data can be manipulated into current and year to date, nonfeed cost versus feed cost, and any other breakdown that is useful to the feedlot manager.

Horton recommends keeping only two spreadsheets, so you can quickly answer questions from clients and eliminate time spent on the phone. One daily operation sheet should emphasize cattle information for employees, and the other should show financial information for investors, bankers, and management.

Using a spreadsheet, the owner can see exactly what each steer costs per day. If cattle from a particular owner have a high dead rate or a poor conversion rate, the feedlot owner may determine that continuing to feed them is not profitable. Unsatisfactory cattle are often pulled and shipped out as "railers" before they reach finish weight.

Converting spreadsheets into invoices is a simple matter. Itemized bills and profit and loss statements can quickly be printed out for each investor. "We finish our feeding reports on noon Monday," says Remington, "and by Tuesday night the invoices are in the mail."

Most feedlot managers agree that limiting the information shown on an invoice is a good idea. Owners need to know how their cattle are performing, but superfluous information only leads to confusion. "If you give the owners too much information, they start asking too many questions," says Remington.

Diving into a Food Hole

Despite the current problems of cattle producers, the outlook for the beef business looks good. Although consumption has dipped slightly in the United States, the world as a whole is eating more beef. This is especially true in developing countries, where beef is a status symbol for the upper and middle classes. In Japan, where a steak was once a luxury, the demand for beef is skyrocketing.

However, the long-term future of beef consumption may be questionable. Grain-fed beef cattle are the worst protein converters among livestock. Sixteen pounds of grain must go into a steer for every pound of meat produced, compared with 6 pounds of grain for swine and 3 for poultry. Ironically, cattle were never meant to eat grain. Unlike swine and poultry, cattle are ruminants that have four stomachs—natural protein factories that can convert grasses into amino acids. Although feeding cattle grain puts on the pounds quickly, most of the protein content is lost in heat and bodily waste.

Although some claim that the food conversion rate for grain-fed cattle is criminal in the face of world starvation, cattle producers argue that the feedlot method is the most efficient means of raising beef given the current availability of relatively cheap grain. But how long will that condition last? Over the last 20 years, farmers have been subsidized to grow as much grain as possible, and almost half of the grain in America is used in beef production. Yet this cheap grain can be produced only by taxing underground aquifers, eroding the soil, and importing increasingly scarce petroleum products for use in fertilizers. A future change in any of these areas could severely disrupt beef production.

Yet beef continues to be a desirable commodity. As the industry expands, speed and efficiency will become critical. As long as the demand for beef exists, computers will be there to help reduce costs. The ranchers and feedlot owners who have invested in PCs are pioneers in an ever-changing cattle business.

Eric Brown is an Assistant Editor for PC World. *His ancestors were cowboys on the plains of Kansas and Nebraska. John Faulkner is a freelance writer and photographer who grew up on a farm in Michigan.*

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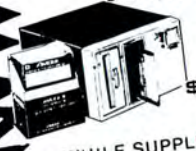

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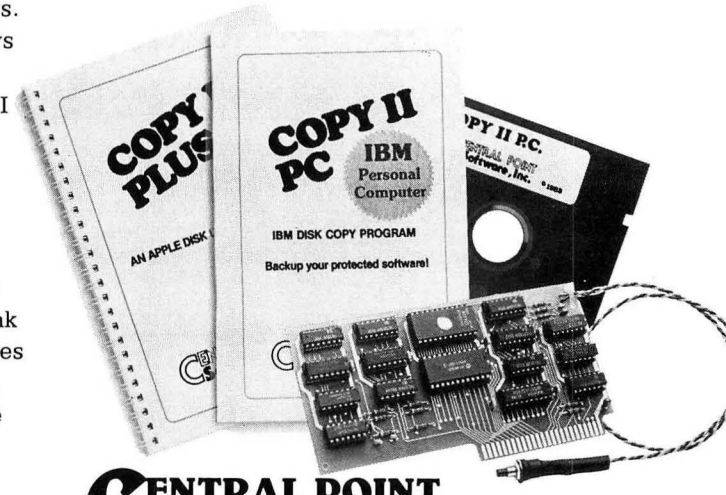

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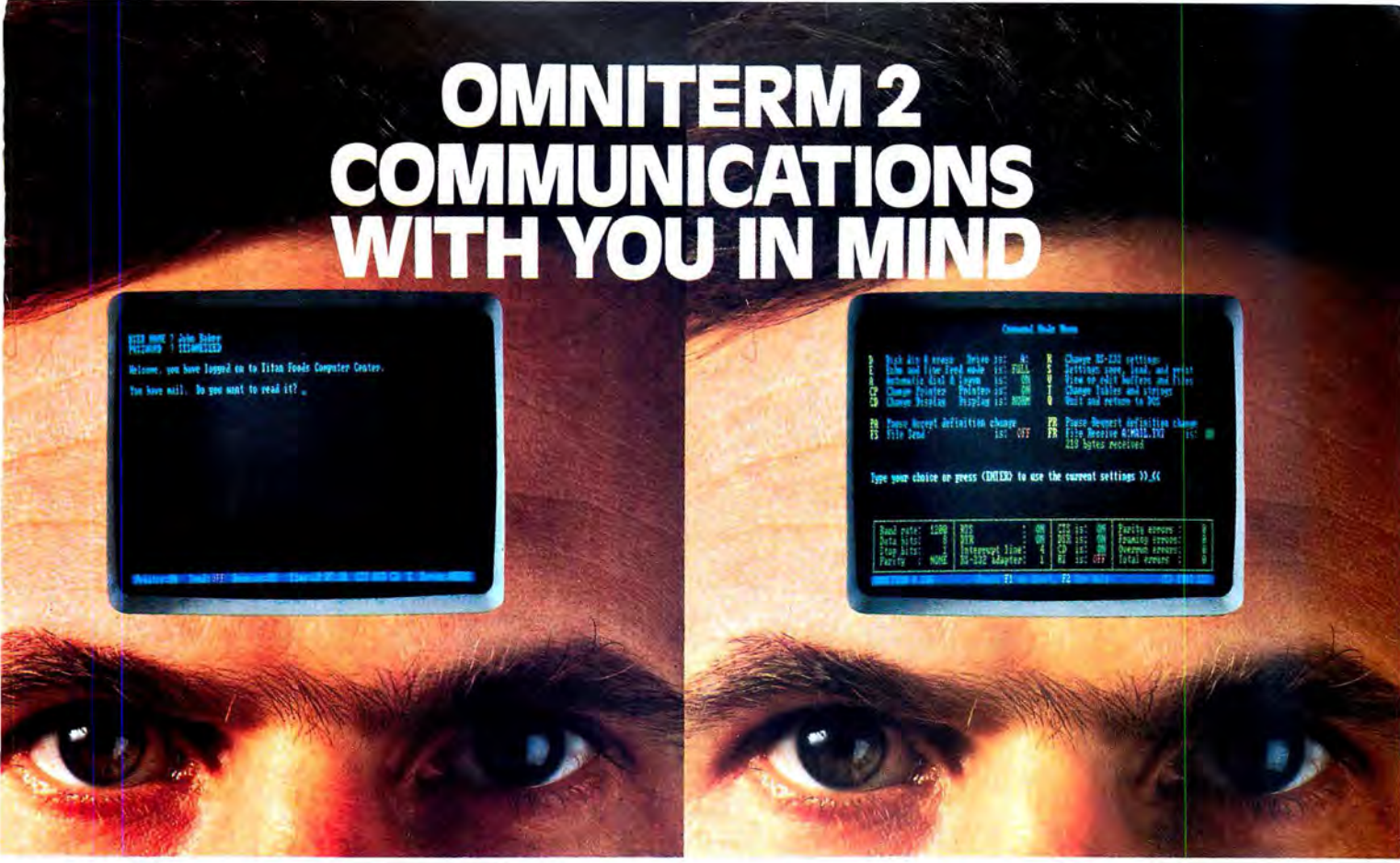

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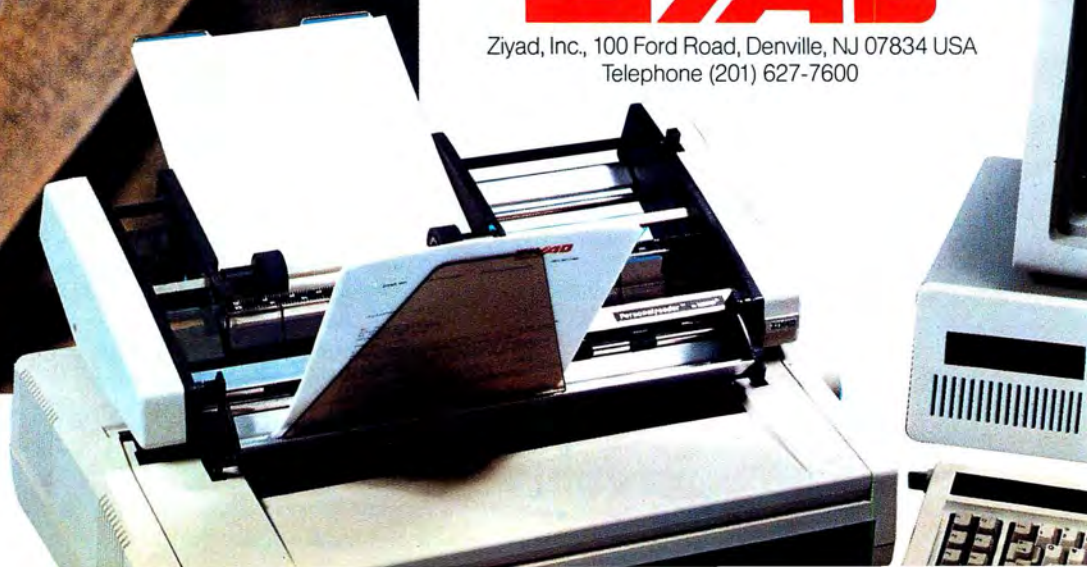

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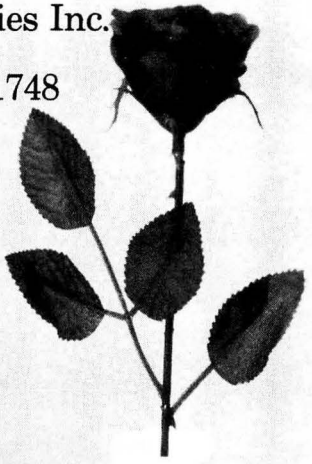

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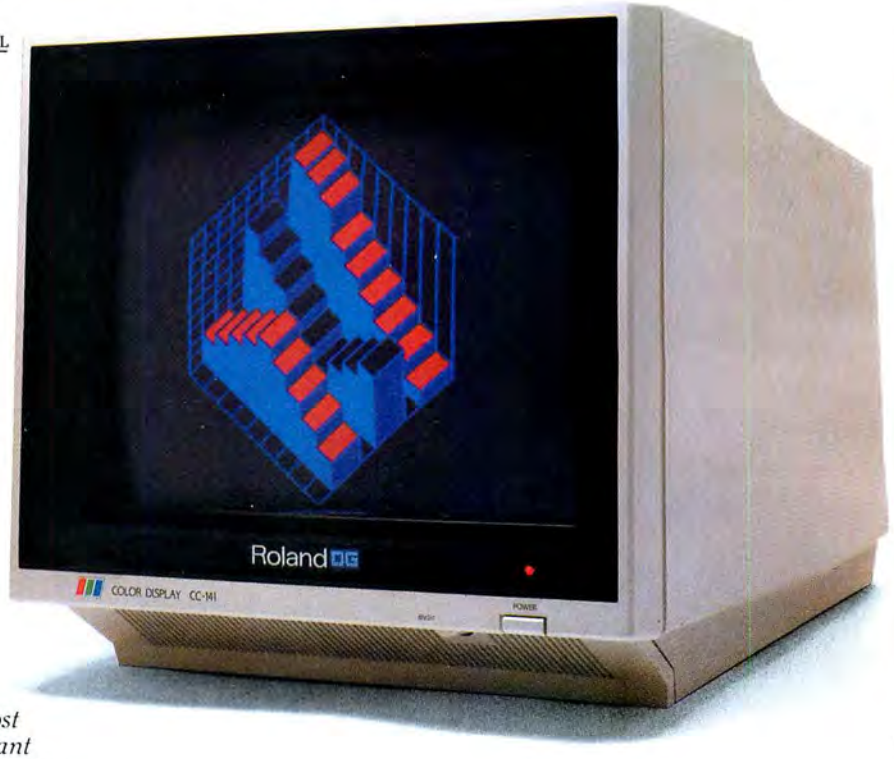

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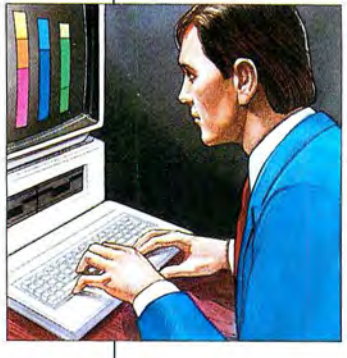

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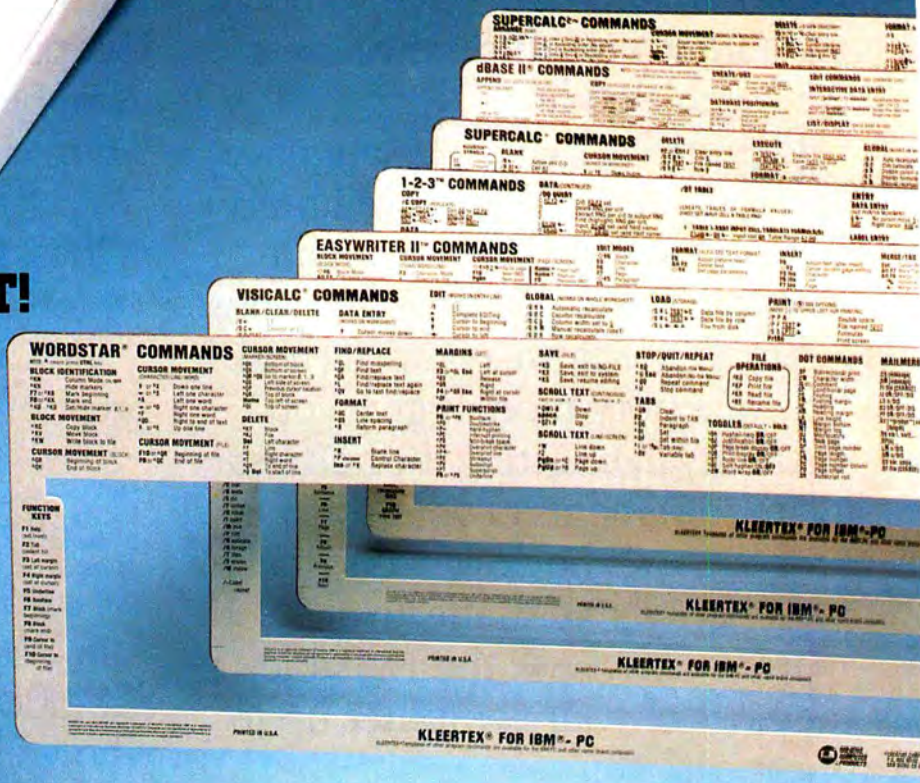

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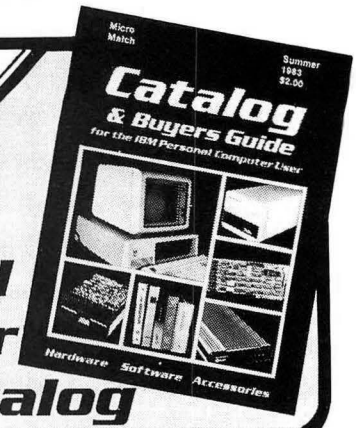

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7 p.m. to 9 a.m. weekdays, 24 hrs weekends; download & upload; messages; 300/1200
RBBS-PC

312/882-4227, 312/882-4228
Chicago, Illinois
SYSOP: Gene Plantz
24 hrs, download & upload, messages, 300/450/1200, registration required
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414/964-5160
Milwaukee, Wisconsin
SYSOP: Bob Mahoney
24 hrs, Xmodem, download & upload, messages, 300/450/1200

416/499-7023
Toronto, Ontario
SYSOP: Doug Peel
24 hrs, Xmodem, download & upload, messages, 300/450/1200
(Passwd = IBMPC)
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714/842-6348
Orange County, California
SYSOP: Larry Dighera
24 hrs, download & upload, messages, 300/1200
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3. *Which drugs have been successfully used to treat osteoporosis?*
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5. *What is the current and projected market for frozen orange juice?*
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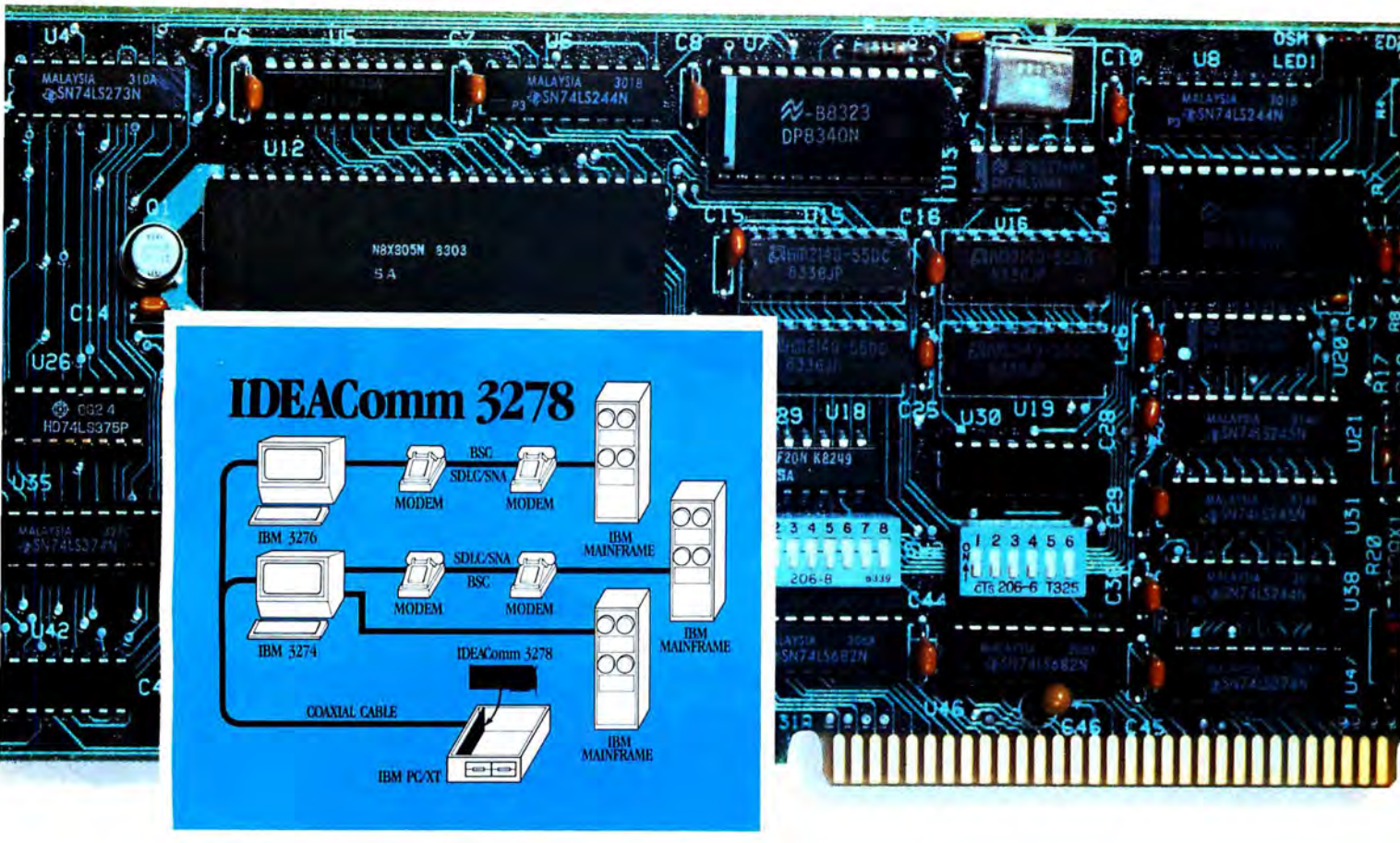

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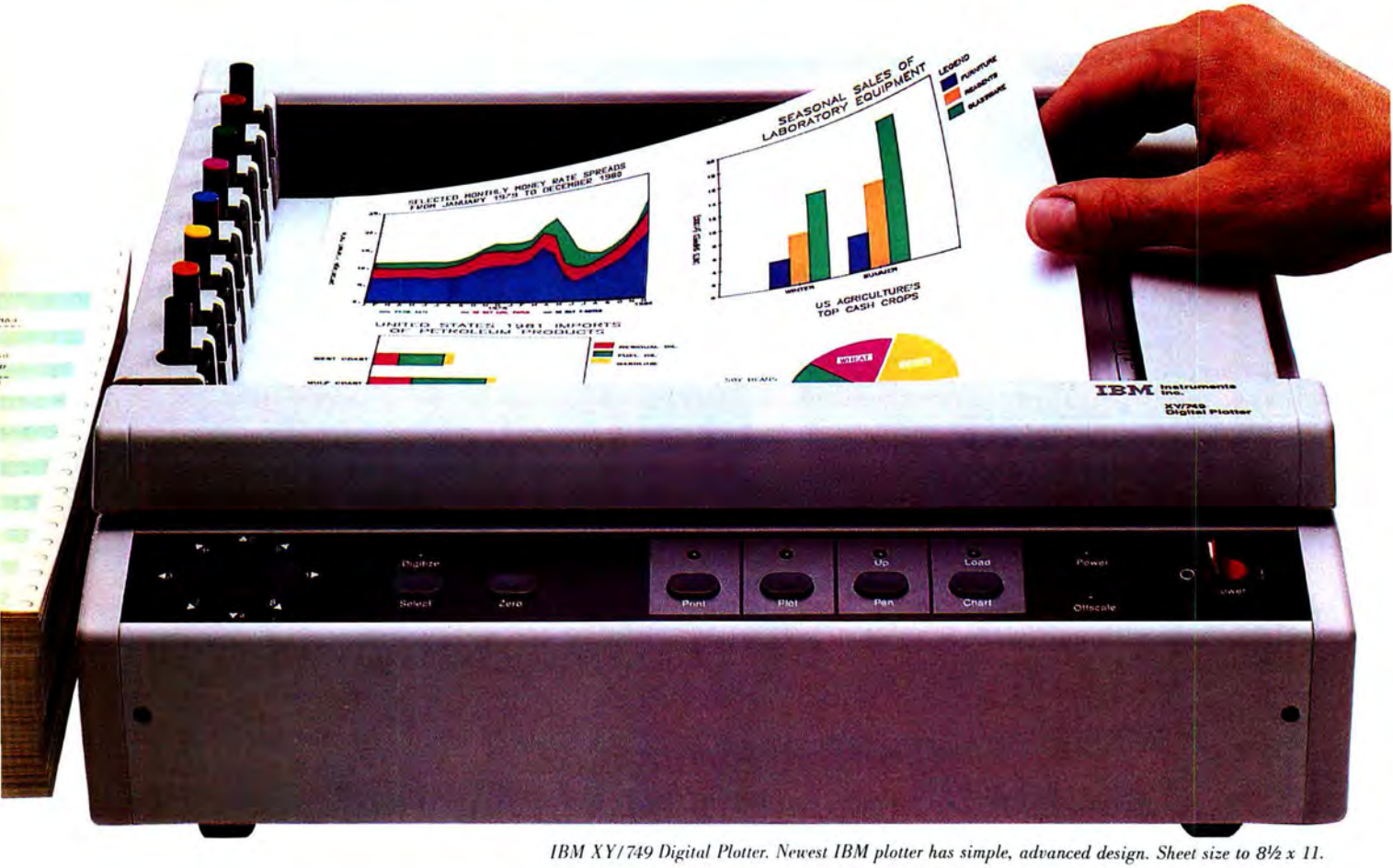

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IN A FIT OF PIQUE HE SPILLS VINTAGE WINE (H) INTO WATER-WHEEL (I) WHICH TURNS PULLEY THAT CAUSES GLOVE (J) TO GRASP SPREADSHEET AND MOVE IT TO TAPING AREA.

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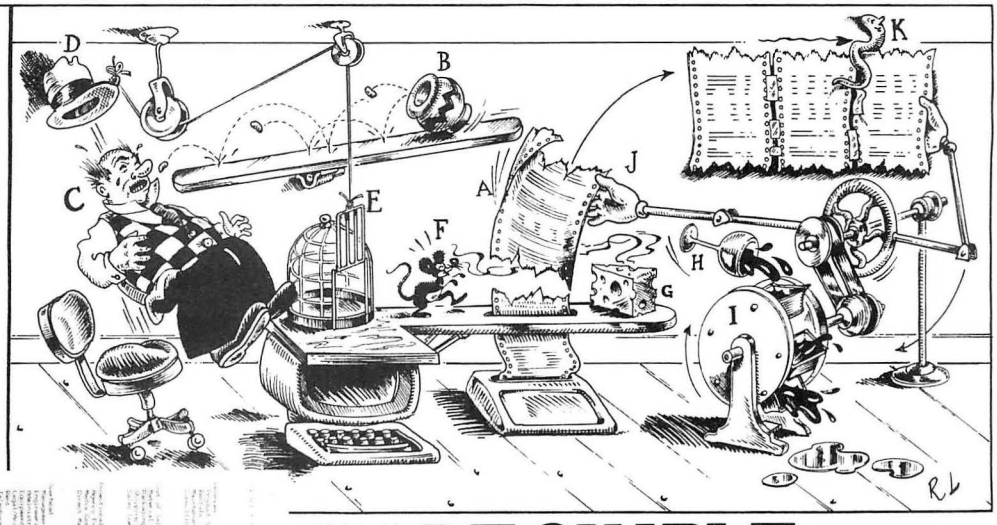

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World Events

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.

April 10-12
Fifth National Online Meeting
Sheraton Centre Hotel
New York
A national meeting for information professionals, including product review sessions and 130 exhibits. Papers will be presented on the design and use of full-text data bases, current communications and data base software, and various downloading methods.
Learned Information, Inc.
143 Old Marlton Pike
Medford, NJ 08055
609/654-6266

April 12-14
Carolina Computer Show
Charlotte Civic Center
Charlotte, North Carolina
A general computer show exhibiting hardware, software, and accessories for professionals and business managers.
Jay Sheppard
L&J Associates, Inc.
P.O. Box 53729
Fayetteville, NC 28305
919/323-4713

April 14-15
Ninth Annual Trenton Computer Festival
Trenton State College
Trenton, New Jersey
One of the original personal computer shows. The festival includes 70 exhibits, 45 talks and tutorials, 12 user group meetings, a computer graphics theater, a computer games contest, and an outdoor flea market.
Marilyn Hughes
Trenton State College
Hillwood Lakes CN 550
Trenton, NJ 08625
609/771-2487

April 26-28
Great Southern Computer Show/ Columbia
Carolina Coliseum
Columbia, South Carolina
A show combining exhibits, workshops, and seminars pertaining to a wide range of computer hardware, software, and peripherals.
Great Southern Computer Show
P.O. Box 655
Jacksonville, FL 32201
904/356-1044

April 26-29
Third Annual New York Computer Show
Nassau Coliseum
Long Island, New York
A general computer show featuring computer hardware and software.
Northeast Expositions
822 Boylston St.
Chestnut Hill, MA 02167
800/343-2222, 617/739-2000

May 3-6
The Personal Computer Userfest/ Chicago
O'Hare Exposition Center
Rosemont, Illinois
A trade and end-user exhibition featuring IBM PC and Apple computers and compatibles (formerly Applefest and PC'83).
Northeast Expositions
822 Boylston St.
Chestnut Hill, MA 02167
800/343-2222, 617/739-2000

May 6-9
Comunicaciones Expo '84
Curtis Dixon Hall
Tampa, Florida
An exhibition and conference on telecommunications and data communications focusing 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
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NEC SPIN 3530	1549	EPSON FX100	CALL
NEC SPIN 3550	1850	PRISM 132	CALL
C. ITOH F10 (PAR)	1149	C. ITOH PROWR 1	375
BROTHER HR 1	749	C. ITOH PROWR 2	675

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AMDEK Color II	469	ZENITH ZVM-121	100

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HAYES SMART 1200B	445	SSM TRANSMDM 1200	525

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World Events

An exposition, a conference, and educational seminars on the IBM PC and Apple computers. The exposition will display 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 an 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
The ninth annual MicroExpo is Europe's oldest and largest microcomputer show. 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

June 5-9
Rochester FORTH Applications Conference
University of Rochester
Rochester, New York
An international conference on the FORTH programming language for both experienced users and novices.
Institute for Applied FORTH Research, Inc.
70 Elmwood Ave.
Rochester, NY 14611
716/235-0168

June 11-13
The Fourth World Computing Services Industry Congress
Keio Plaza Hotel
Tokyo
An international congress drawing participants from 50 nations. The forum includes lectures by experts on world computing services and 19 concurrent working sessions including reports, panel discussions, and lectures.
ADAPSO
1300 N. 17th St. #300
Arlington, VA 22209
703/522-5055

June 13-15
PC World Exposition
McCormick Place West
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An exposition and conferences on IBM PC hardware, software, and compatibles.
Mitch Hall Associates
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NECC '84
Dayton Convention Center
Dayton, Ohio
The National Educational Computing Conference. Panels, tutorials, demonstrations, and exhibits on the use of computers in education.
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June 14-17
International Computer Show
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June 21-23
Great Southern Computer Show/ Jacksonville
Veterans Memorial Coliseum
Jacksonville, Florida
An exhibition, workshops, and seminars pertaining to computer hardware, software, and peripherals.
Great Southern Computer Show
P.O. Box 655
Jacksonville, FL 32201
904/356-1044

June 26-28
PCExpo
New York Coliseum
New York
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. Exposition and daily seminars.
PCExpo
333 Sylvan Ave.
Englewood Cliffs, NJ 07632
201/569-8542

July 9-12
National Computer Conference (NCC '84)
Las Vegas Convention Center
Las Vegas
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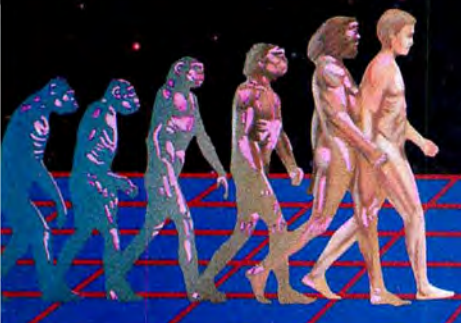

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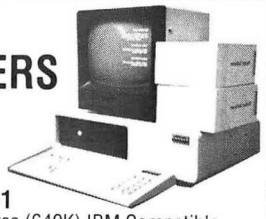

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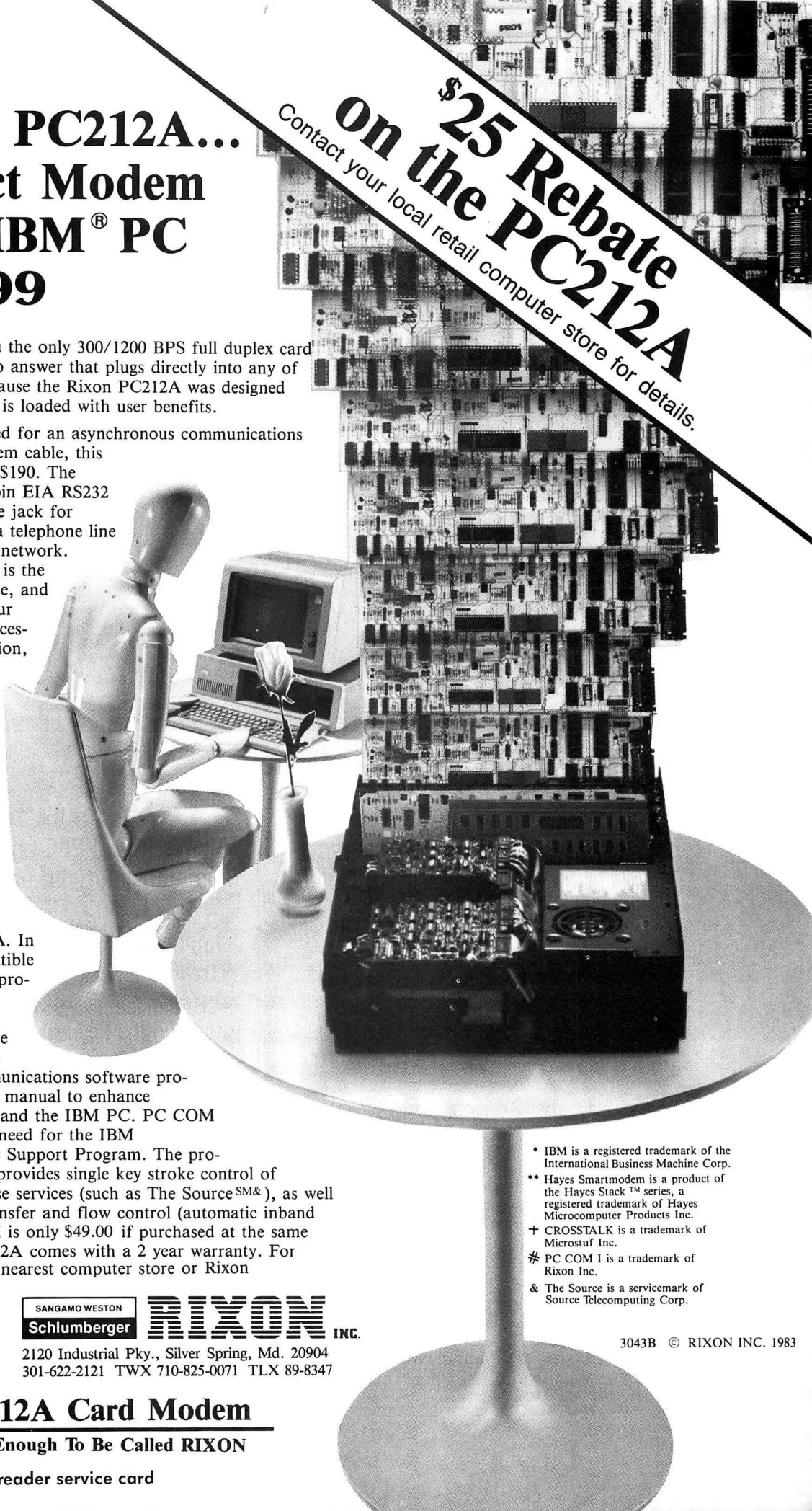

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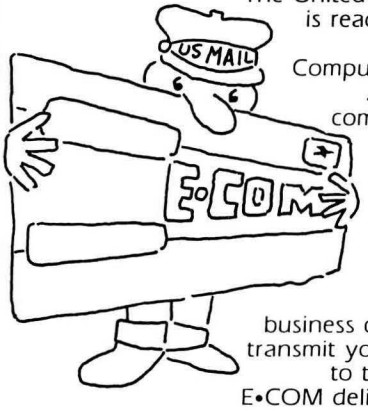

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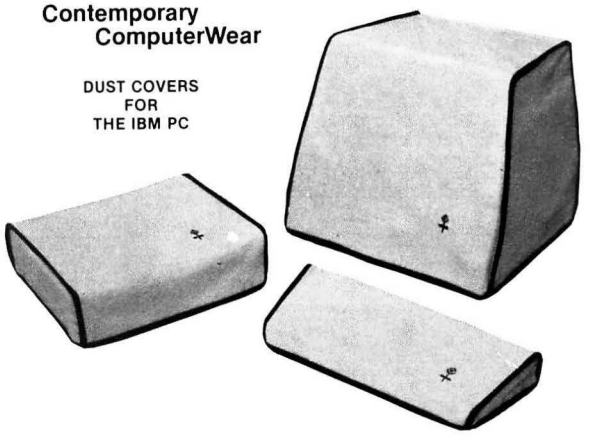

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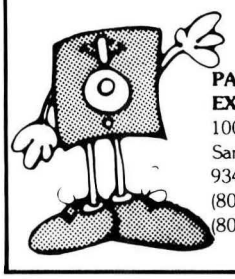

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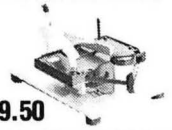

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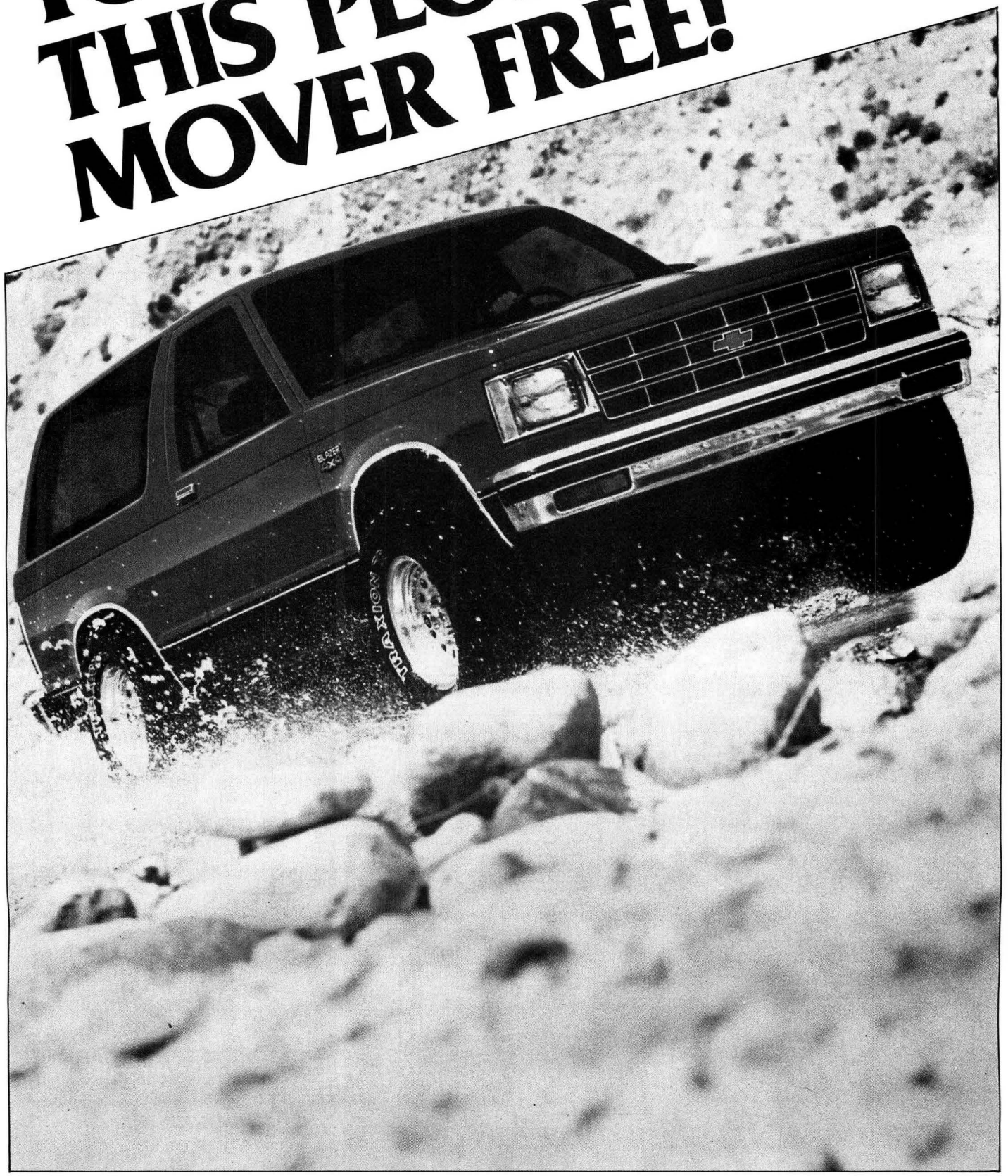

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Aztec C86 is the choice of professional programmers worldwide. Aztec C is the most complete implementation of UNIX V7C available for micros. The compiler also includes assembler, linker, debugging aids, library utility & overlay support. For a product review see the August 1983 issue of *Byte*. $249. *Manx Software Systems, P.O. Box 55, Shrewsbury, NJ 07701, 201/780-4004*

Cryptography

Crypt Master
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 indecipherable 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*

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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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Data Management

DBMS—Easy to Use
Rescue™ DBMS is the quickest to learn, easiest to use DBMS for the PC & compatibles. Menu-driven; on-screen, free-form; forms/report generation; 8 calculation levels, 10 password protection levels by item or file; fast sort. Plain-English tutorial & extensive help screens. Hard disk compatible. *Key Software, Inc., 2350 E. Devon Ave. #138, Des Plaines, IL 60018, 800/323-6556*

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A sophisticated data security program that protects the hard disk on an IBM PC/XT and COMPAQ. Provides three levels of protection: (1) Only authorized users can access the hard disk. (2) Users are segregated from each other. (3) Optional encryption allows floppies to be secured. Makes hard disk menu-driven. *Sophco, Inc., P.O. Box 7430, Boulder, CO 80306, 303/444-1542*

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). $95 + $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-I 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-I Chess Dr., Foster City, CA 94404, 415/341-6116*

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Financial Analyzer
A corporate financial analysis system of linked Multiplan templates used for developing & analyzing financial forecasts. Develops pro forma financials & other analytical reports including business valuation. Forecasts may be annual, quarterly or monthly. Dealer inquiries invited. *Financial Template Systems, 5295 Plum Tree, Irvine, CA 92715, 714/786-5717*

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PC-Title/PC-Projector
See PC mag's (Dec., pg. 619) review of this useful tool for creating professional text for slides, screen displays, fliers. Electronic "Slide Show" & automatic camera control capability. Add full graphics with PCcrayon. PC-Title/Projector $49.95. PCcrayon $44.95. All three $79.95. Shipping $2. Visa/MC. *PC Resources, Inc., 620 Hobart Terrace, Santa Clara, CA 95051, 408/243-4169*

Halo
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DMS Business Graphics (DMS/BG). A picture is worth a thousand words. DMS/BG is an easy to use color graphics system for the IBM PC that allows you to create, save, edit, and print graphic data. Types of graphs include 3D Bar, 3D Multi Bar, Bar,

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Operates on IBM PC or XT with dBASE II (2.4) or RunTime™, $100. DISKETTE INVENTORY, $24.95—searches by diskname, filename, ext., date, all like db*. RECORD & TAPE INVENTORY, $24.95—searches by name, song, performer. LITERARY REFERENCE INVENTORY, $49.95— searches by title, author, source or mult. key phrases in abstract. *Feller Associates, 550 CR PPA, Rt. 3, Ishpeming, MI 49849, 906/486-6024*

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Real Estate Software

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Instant Statistics

INSTAT: descriptive statistics & data screening ($85). INSTAT-R: full-featured multiple regression. Independent reviewer calls it "superlative" ($95). INSTAT-D: discrete data analysis with linear & log-linear models ($250). SCS.DAT: data file management ($35). Write for free catalog. *Statistical Consulting Services, 517 East Lodge Dr., Tempe, AZ 85283, 602/838-7784*

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Provides up-to-the minute information on key parts of investor's stock account. Market price updates by DOW JONES; easy link to Hayes Smartmodem. Sort by P/E, gain/loss, yield or any item in SPR's 8 useful reports. Friendly menu displays & manual. Requires 128K, 2dd. Demo disk avail. $279. Visa/MC welcome. *Micro Investment Systems, Inc., P.O. Box 8599, Atlanta, GA 30306, 404/892-3194*

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MultiLink turns PC-DOS into an efficient multi-user multi-tasking operating system. Additional users are supported by attaching inexpensive CRT terminals or modems to serial ports on the PC, and can run normal applications designed for PC-DOS. Includes host communications software for public dial-in. *Software Link, Inc., 6700 23-B Roswell Rd., Atlanta, GA 30328, 404/255-1254*

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1983 FED 1040 TAX PREP PROGRAM. Multiplan™ templates for IBM PC prints on preparer ed. forms (10 included) $95. 1984 Tax-planner $75. Visa/MC accepted. *Objective Planning, 3301 Executive Dr. #102, Raleigh, NC 27609, 919/878-0022*

TAX83/PC™

Use with your spreadsheet program to simplify preparation of 1983 taxes! Accurately computes form 1040 concurrently with high-use schedules A, B, D, & W. Also 1984 estimated taxes (1040 ES). Specify *1-2-3*, Multiplan, VisiCalc, SuperCalc or PeachCalc. On disk via first class mail. $14.95. CA res. add tax. *Tax Assistance Assoc., 3410 Lodge Dr., Belmont, CA 94002, 415/593-6875*

Tax 4-5-6

Template for *1-2-3*. Forms: 1040, A, B, C, D, E, G, R, RP, SE, W, 2106, 2441, 3468, 4562, 4797, 5695, 6251 + 1040ES & 2210 update. Entry to one form is autoposted to other forms. Printouts are IRS approved. Calcs all taxes in 6 secs & chks for errors. Use for planning or actual 1983 return. Sample return & instr. 256K req. $65. COD OK. *Austin Scientific, Inc., 1259 El Camino #260W, Menlo Park, CA 94025, 415/364-0240*

Templates

1-2-3 Templates

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Teaches Lotus Usage Thru
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The Impersonator

An asynchronous communications tool with emulations for ADM-3A, VT-52/100, Hazeltine Esprit, IBM 3101, TeleVideo 912 & Teletype terminals. Custom-design additional emulations. Features Xmodem protocol, window support, ability to remember logon procedures. IBM PC/PC XT. $195 + $5 shipping. *Direct.aid, Inc., P.O. Box 4420, Boulder, CO 80306, 303/442-8080*

Tools

Pascal and C TOOLS

TOOLS includes full string use, screen handling, graphics, and a general BIOS gate. TOOLS2 supports all DOS 2.00 functions, including program chaining. VIEW MANAGER screens are painted with a Screen Painter and stored in the Screen Database. Source code is provided. TOOLS $125, TOOLS2 $100, VIEW MANAGER $275. *Blaise Computing Inc., 1609 Acton St., Berkeley, CA 94702, 415/524-6603*

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THE Full Screen Editor for programmers that combines the best features of SPF, FSE, ICCF and CMS. Exceptionally FAST. Maximum file size 32K records. Requires 128K RAM. Insert, Delete, Copy, Merge, etc. Introductory price $79 with 30 day money back guarantee if not satisfied. MC/Visa welcome. *Data Processing Development Corp., 909 N. Mayfair Rd., Milwaukee, WI 53226, 414/778-1175*

PAL

Programming Alternative Language is the easiest & quickest way to develop structured BASIC programs for the PC. Great features: no fielding of data for data files; a b+tree filing system, no sorting required; the most optimum screen design for data entry & report screens; and procedures with parameter passing! Only $200! *K.R. Waletzki, P.O. Box 992, Rosemead, CA 91770, 213/285-3077*

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C Library

THE GREENLEAF FUNCTIONS—over 200 routines for CI-C86, Lattice, or Microsoft C, includes DOS 2.00, string, printer, color text, graphics, video, function keys, lots more. With 180 page manual, examples, source code, demos. Specify compiler/version. $175. Check/MC/Visa. THE MOST EXTENSIVE C LIBRARY ANYWHERE. *Greenleaf Software, 2101 Hickory Dr., Carrollton, TX 75006, 214/446-8641*

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Solves problems with 256 origins & 256 destinations. Fully menu-driven, spreadsheet style display, Transportation Simplex Algorithm start/restart options, primal & dual solutions, sensitivity analyses, report generator, storage of problems & solutions, user's guide & examples. $88. *Eastern Software Products, 4804 Tarpon Lane, Alexandria, VA 22309, 703/360-6942*

Utilities

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Eliminate the need under PC-DOS 2.00 to reformat disks in order to add, change or delete volume labels. Prints sorted list of files (including hidden files) from disk directory to labels or to a listing. Also allows recovery of files erased inadvertently. Requires PC-DOS 2.00. $30. NJ add 6%. MC/Visa. *ErgoSoft, P.O. Box 454, Oakhurst, NJ 07755, 201/493-8352*

PC File Compare
Compare disk files & get meaningful results. PC File Compare displays records that fail to compare, and highlights the differences. Allows displayed data to be changed. Compares files of different lengths, individual files. Allows global filename specification. $50. NJ add 6%. MC/Visa. *ErgoSoft, P.O. Box 454, Oakhurst, NJ 07755, 201/493-8352*

Backup Program
Copy II PC copies protected and unprotected software without modifying data and verifies the disks it creates. Available memory is fully utilized to minimize diskette duplication time. In addition, Copy II PC includes a drive speed utility that can pinpoint drive problems. See our ad in this issue! $39.95. Add $2 s/h. *Central Point Software, P.O. Box 19730 #203, Portland, OR 97219, 503/244-5782*

DOS 2.00 & 2.10 Users
DOSshell—enhances DOS. Features: Creates a user-friendly "shell" surrounding your system/ Automates commands/Organizes programs & data by menus/ Online help at all levels/Utilizes function keys. Includes: disk archive, data search & more. Extensive manual makes sense of DOS. For hard disk systems. Disk & manual: $70. *XTC Software, P.O. Box 902, Santa Barbara, CA 93102, 805/967-7837*

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EZdBASE
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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*

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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*

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Just Announced

The wide world of PC products

Edited by Art Wilcox and J. Schaffner

In the fast-paced personal computer marketplace *Just Announced* acts as a 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.

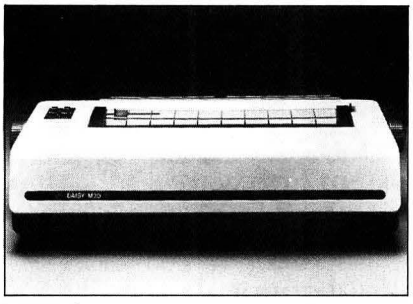
Hardware

Printers

Sprinter
A portable dot matrix printer that provides correspondence-quality printing at 160 cps. It requires a parallel port; RS-232C serial and IEEE-488 bus ports are available. Measuring 18 by 14.5 by 7 inches and weighing 16 pounds, the Sprinter provides print densities of from 10 to 17 characters per inch, double-wide characters, and a front sheet feed that automatically positions paper at the first print line. Other features include foreign and special character fonts that can be downloaded and a 4K print buffer that can be expanded to 68K. Dot-addressable graphics are available with a vertical resolution of 72 dots per inch and selectable horizontal resolutions of 50, 60, 72, 75, 80, or 85 dots per inch. Maximum paper width is 9.5 inches. List price: $795. Micro Peripherals, Inc., 4426 S. Century Dr., Salt Lake City, UT 84123, 800/821-8848, 801/263-3081 in Utah.

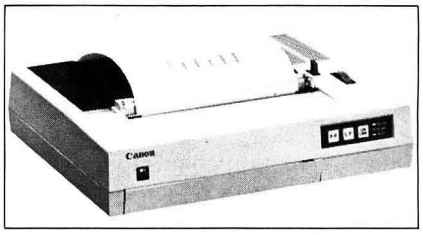
Sprinter portable printer, Micro Peripherals

M20
A letter quality daisy wheel printer that features 10, 12, and 15 pitch, proportional spacing, and a 20 cps print speed. It has switch-selectable parallel and serial ports for use with a variety of computers and software. The M20 provides a resolution of 23,000 dots per square inch for plotting, offers bidirectional printing, and can accommodate paper up to 16.5 inches wide. List price: $999. Daisy Systems Holland, P.O. Box 1010, Torrance, CA 90505, 800/4-A-DAISY, 800/441-5273 in California.



M20 daisy wheel printer, Daisy Systems Holland

Canon PJ-1080A
An ink jet printer that prints up to seven colors on paper or transparencies. It requires a parallel port. The PJ-1080A prints at 37 cps in four character types (international fonts available), at a noise level less than 50 dBA. The printer provides high-resolution color graphics of 640 dots per line on a black or white background and includes two ink cartridges, one tricolor and one black. List price: $595. Canon USA, Inc., One Canon Plaza, Lake Success, NY 11042, 516/488-6700.



PJ-1080A ink jet printer, Canon USA

Modems

INFO-MATE 212PC
An internal modem for the IBM PC and compatibles that transmits data at 110, 300, or 1200 bps. It requires 64K and one disk drive. The INFO-MATE 212PC supports auto-dial, auto-answer, automatic speed and parity selection, detection of busy signals with ring-back, and selection of tone or pulse dialing. The modem comes with *MODEM-MATE*, a communications program that features ASCII and binary file transfer, and a 60-entry dialing directory. List price:

$495. Cermetek Microelectronics, 1308 Borregas Ave., Sunnyvale, CA 94089-3565, 408/734-8150.

INFO-MATE 212PC internal modem, Cermetek Microelectronics

Monitors

Color IV
A high-resolution color monitor that is available in two versions; one is compatible with the IBM Color/Graphics Adapter, and the other is RS-170A interface compatible. It requires a color graphics board. The Color IV provides 720 by 420 resolution, .31 mm dot pitch, and a 96 by 24 display. The monitor displays up to 16 colors. List price: $995. Amdek Corporation, 2201 Lively Blvd., Elk Grove Village, IL 60007, 312/364-1180.

Color IV monitor, Amdek Corporation

Miscellaneous

CR200-PC
A punched-card reader for the IBM PC that processes 200 80-column cards per minute. It requires an RS-232C serial port. The CR200-PC's "software handler" enables the unit to be used in data entry, election tabulation, test scoring, and other applications. List price: $4100, software handler $150. Cardamation Company, 446 Lancaster Ave., Frazer, PA 19355, 215/647-8260.

System Software

Languages

Personal COBOL
A version of COBOL for the IBM PC and XT that includes a text editor and graphics support. It requires 192K RAM and two disk drives. Based on the ANSI '74 COBOL, Personal COBOL provides programming menus and prompts, on-screen help, and custom form generation. For debugging, source code tracking enables users to visually monitor source code line by line while the program runs. List price: $399. Micro Focus, 2465 E. Bayshore Rd. #400, Palo Alto, CA 94303, 415/856-4161.

Utilities

ScrollMate
A utility program that provides line and page scrolling functions for on-screen DOS files. It requires 64K and one disk drive. *ScrollMate* writes every line that scrolls off the upper screen display into an internal buffer that holds up to 14 screens of data. The program works with any DOS file that writes sequentially to the display, including DIR, EDLIN, DEBUG, compilers, the assembler, and the linker. Any buffer information can be printed or written to disk. List price: $69.95. Inner Loop Software, 5456 McConnell Ave. #120, Los Angeles, CA 90066, 213/822-2800.

Applications Software

Data Management

ASAP FIVE
A data base manager that uses English commands and includes a multifunction word processor and a form generator. It requires 192K and two disk drives. *ASAP FIVE* is a "universal relation" data base; once a user names items, the system automatically indexes and arranges them into files, and the files into data bases. The program lets users build data bases limited in size only by disk space, modify screen formats after data entry, and generate reports using one keystroke. The program's word processor features headers and footers, automatic page numbering

and page breaks, and automatic column wraparound. List price: $575. ASAP Systems, Inc., 2425 Porter St., Soquel, CA 95073, 800/345-ASAP, 800/247-ASAP in California, 408/476-3935.

Savvy PC

An integrated data base manager, programming language, and operating system that uses "adaptive pattern recognition," which interprets and "learns" user commands rather than restricting users to one rigid command set. It requires 64K RAM and one double-sided disk drive. The *Savvy PC* programming language includes a command dictionary of 100 everyday words that is automatically updated with any commands a user has modified. The data base provides random and sequential access, decimal arithmetic, and a 20-megabyte program capacity. *Savvy PC* accommodates up to four floppy disk drives, a 20M hard disk, and either serial or parallel printers. List price: $395. Excalibur Technologies Corporation, 800 Rio Grande Blvd. NW, 21 Mercado, Albuquerque, NM 87104, 505/242-3333.

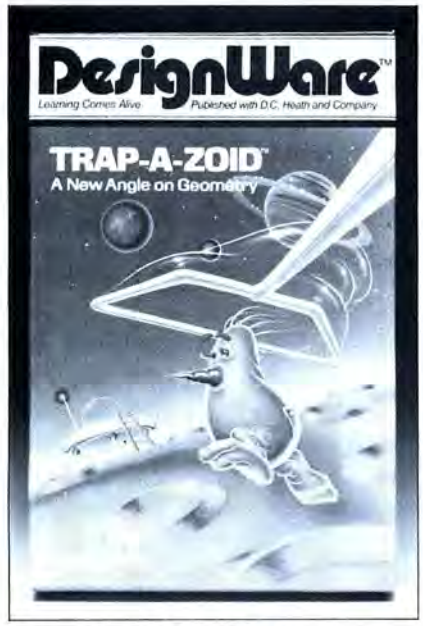
Visi On Query

A relational data base that integrates data stored in tables with other *Visi On* products. It requires 256K and a hard disk drive. *Visi On Query* tables hold up to 65,000 records, with 1000 characters per record, 70 fields per record, and 256 characters per field. The data base features arithmetic and trigonometric calculations, tabular review using a mouse, up to five sort criteria per field, and built-in formats for reports. The program lets users combine data from up to five files, summarize data by category or field, delete and recover records, and add or reformat fields without affecting data. List price: $375. VisiCorp, 2895 Zanker Rd., San Jose, CA 95134, 408/946-9000.

Educational

Trap-a-Zoid

An educational game that teaches children age seven and up geometric concepts and terms. It requires 64K, one disk drive, and a color graphics



Trap-a-Zoid, DesignWare

board. To play *Trap-a-Zoid*, children must trap moving creatures, called Zoids, by connecting dots to form geometric shapes around the Zoids. The game offers five levels of difficulty and three Zoid speeds. Players win points by drawing the smallest possible geometric shapes and by an-

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Elephant DS/DD	$ 24.95
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HA02	- Pie Speller	79
HA11	- Pie Writer & Speller	219
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swering bonus questions. List price: $39.95. DesignWare, Inc., 185 Berry St., Bldg. 3 #158, San Francisco, CA 94107, 800/572-7767, 415/546-1866 in California.

Entertainment

Charles Goren: Learning Bridge Made Easy

A tutorial bridge program that teaches hand evaluation, opening bids, responses and rebids, and other basics. It requires 64K and one disk drive. The program provides 100 practice hands that allow players to bid before discovering the correct answer and its explanation. The tutorial comes on one disk and includes a 144-page book. List price: $79.95. CBS Software, One Fawcett Place, Greenwich, CT 06836, 203/622-2503.

Financial

Bellies '83

A historical file of all pork bellies futures contracts traded on the Chicago Mercantile Exchange during 1983. It requires 64K and one disk drive. Statistics provided for each day include the open, high, low, and closing prices; total volume; and total open interest and interest change. The file states whether or not a USDA Hogs and Pigs Report was released on a given day. List price: disk $125, hard copy $135. ComFax Financial Research, P.O. Box 3523, Wichita, KS 67201.

Graphics

CAD MASTER

A two-dimensional design and drafting program that operates with a high-level command language, a mouse, or a digitizing tablet. It requires 256K, an RS-232C serial port, and the Scion, Hercules, Conographic, or Orchid Technology graphics board. *CAD MASTER* features auto-dimensioning, volume generation, selective erase, and user-defined parts libraries and symbol tables. The program provides 16 text sizes, eight line styles, and 11 pattern fills. *CAD MASTER* supports several plotters and dot matrix printers, the 8087 processor, and the Quadscreen monitor. With one of the above graphics boards, *CAD MASTER* provides 640 by 480 graphics resolution. You can display 16 colors out of a possible 4096. List price: $995. Datagraphic Systems, 7011 Biscayne, Milford, MI 48042, 313/887-2880.

Integrated Applications

Condor Plus

An integrated package that combines graphics, communications, and data base applications. It requires 128K and two disk drives. The graphics program, *uGRAF,* provides typical business applications, such as bar graphs and pie charts, without any additional programming. The communications program, *AutoCom,* provides binary and ASCII file transfer, Modem7/Modem16 protocol, unattended operation, and terminal emulation of the DEC VT-100. The relational data base, *Condor 3,* allows users to compare multiple files, merge information from several data bases, generate reports, and index up to eight items for reference. List price: $295. Condor Computer Corporation, 2011 Landings Dr., Mountain View, CA 94043, 415/962-0242.

Corporate MBA

An updated version of *Context MBA* that now includes terminal emulation, keyboard macros, and the ability to exchange data with other applications. It requires 320K, an RS-232C serial port, Technical Analysis Corporation's IRMA board, and two disk drives. Designed for large corporations, *Corporate MBA* features IBM 327X terminal emulation and 3270 communications protocols for direct access to IBM data bases, including selective data retrieval. The program can exchange data with other programs such as *WordStar, VisiCalc,* or *dBASE II.*

Standard *Context MBA* applications include graphics, word processing, and communications. *Corporate MBA* can split the screen into four windows, each running a different application. A tutorial disk is included. List price: $895. Context Management Systems, 23868 Hawthorne Blvd., Torrance, CA 90505, 213/378-8277.

Jack2

An integrated package that combines word processing, data base management, and spreadsheet and graphics applications in a windowless format. It requires 128K and two disk drives. *Jack2* can run several applications simultaneously. It manipulates data with English commands and icons. *Jack2* allows spreadsheet and graphics data to be inserted into text; changes made to spreadsheets are reflected automatically in the corresponding text or graphs.

Jack2 allows data selection by any criteria and provides three-level, al-

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See page 112 for details.

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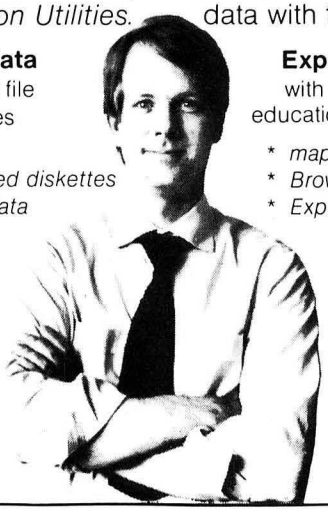

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phabetic, numeric, and ascending and descending sorts. The size of the data base is limited only by the storage available, and the program provides 1024 fields per record. A report generator and a utility package are optional. List price: $495, report generator $250, utility package $125. Business Solutions, Inc., 60 E. Main St., Kings Park, NY 11754, 516/269-1120.

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Master Legal System/PC
A menu-driven legal management system with separate modules for legal, patent, and trademark information. It requires 256K, a printer with 132-column capability, and a 10M hard disk drive. *Master Legal System/PC* features help screens; automatic indexing; user-defined print formats

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Spreadsheets

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entific symbols on the screen as they will appear on paper. It requires 64K and one disk drive. With *Spellbinder/Scientific,* users can display and print complex formulas up to one page in length, including chemical structural diagrams with six-member rings. The program provides 128 scientific and Greek characters; automatic formation of square roots, rectangles, integrals, and brackets in user-defined sizes; and automatic printing of superscripts, subscripts, and exponents in small characters. List price: complete package $790, separate scientific module $295. Lexisoft, Inc., P.O. Box 1378, Davis, CA 95617, 916/758-3630.

Miscellaneous

Absolute Reference

A monthly journal for users of Lotus Development's *1-2-3*, edited by the authors of *Using 1-2-3,* Douglas Cobb and Geoffrey LeBlond. *Absolute Reference* will provide users with an ongoing source of information about *1-2-3,* including columns on the program's more complex features; reviews of available courses, products, and books; and examples of business applications for the program. Annual subscription (12 issues) $60. Que Corporation, 7960 Castleway Dr., Indianapolis, IN 46250, 317/842-7162.

Datalife Disk Drive Analyzer

A diagnostic program that checks the performance of disk drives without requiring their disassembly. The *Disk Drive Analyzer* performs a test on head alignment, disk clamping, read/write accuracy, and disk speed in less than 3 minutes. The test provides good, fair, or poor ratings for each

test area, and recommends which drive parts need adjustment or repair. List price: $39.95. Data Encore, 585 N. Mary Ave., Sunnyvale, CA 94086, 408/720-7400.

NetWare
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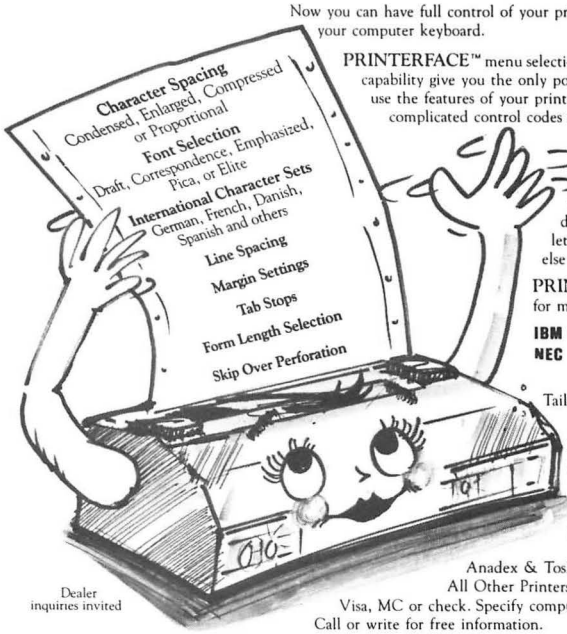

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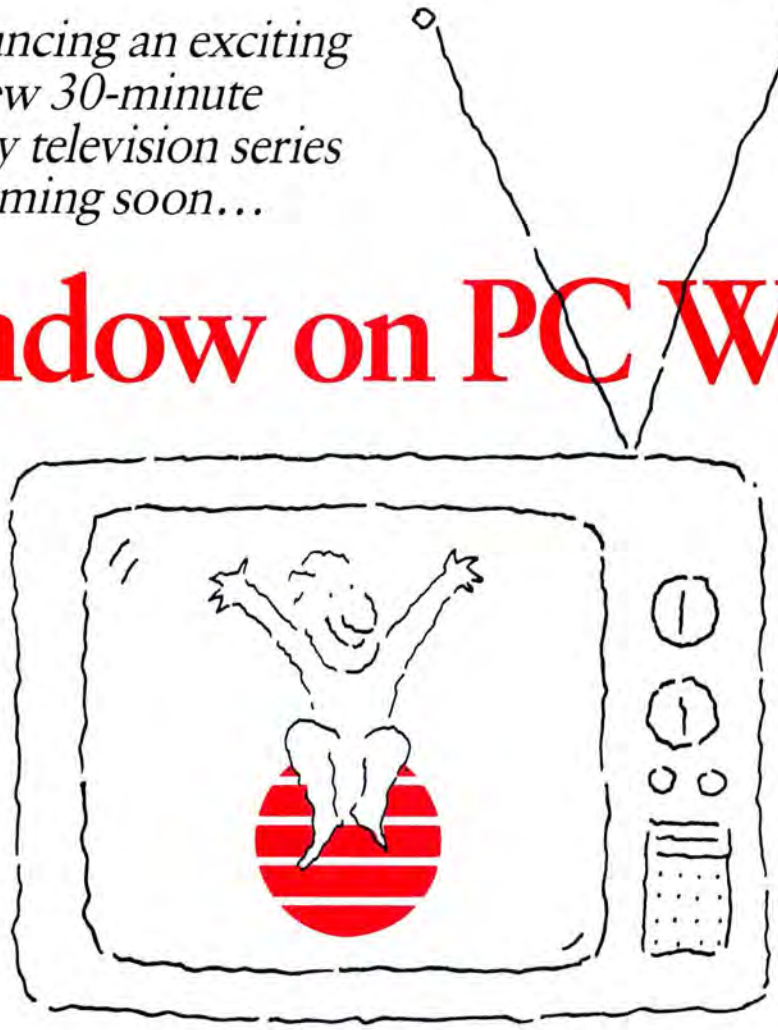

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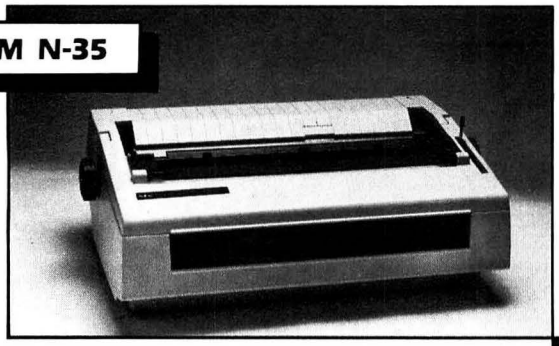

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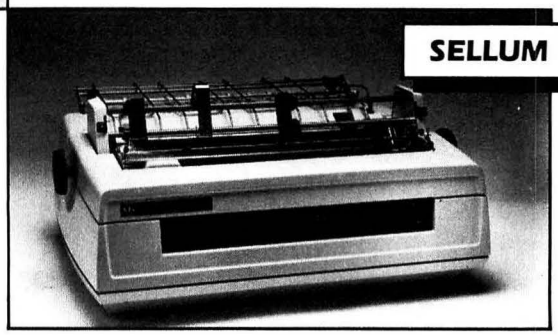

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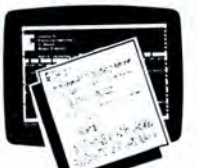

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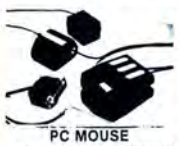

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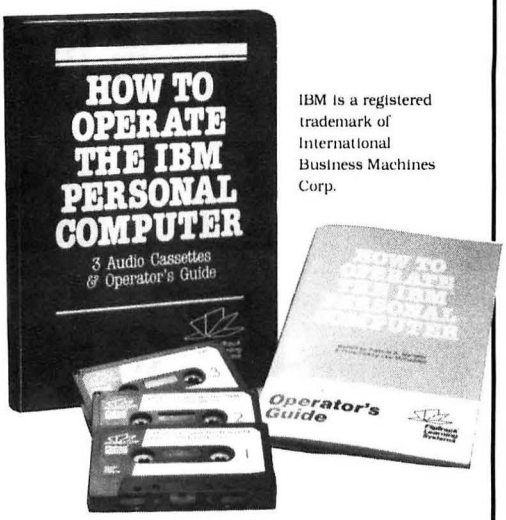

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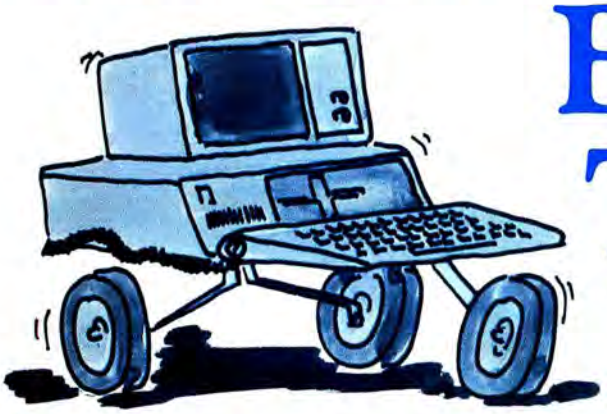

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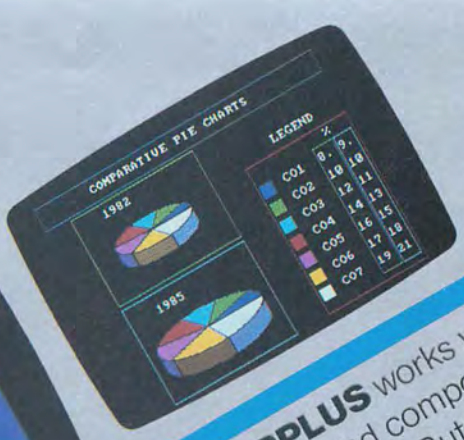

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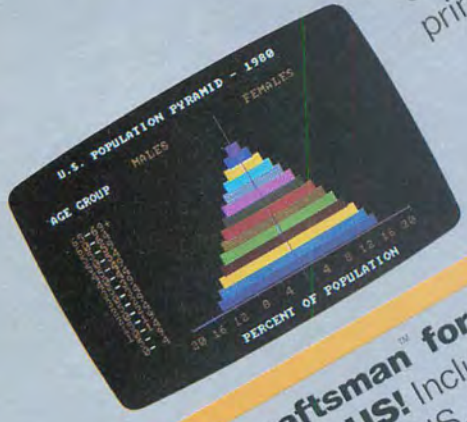

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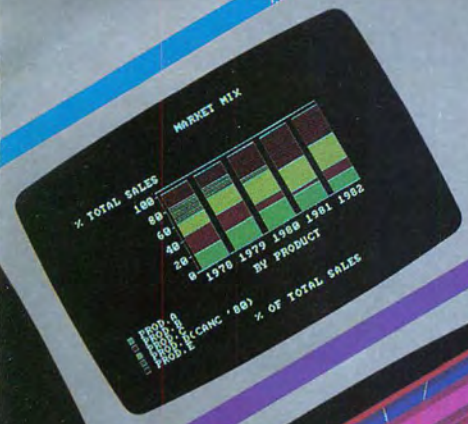

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