

PC WORLD

August 1985 \$2.95
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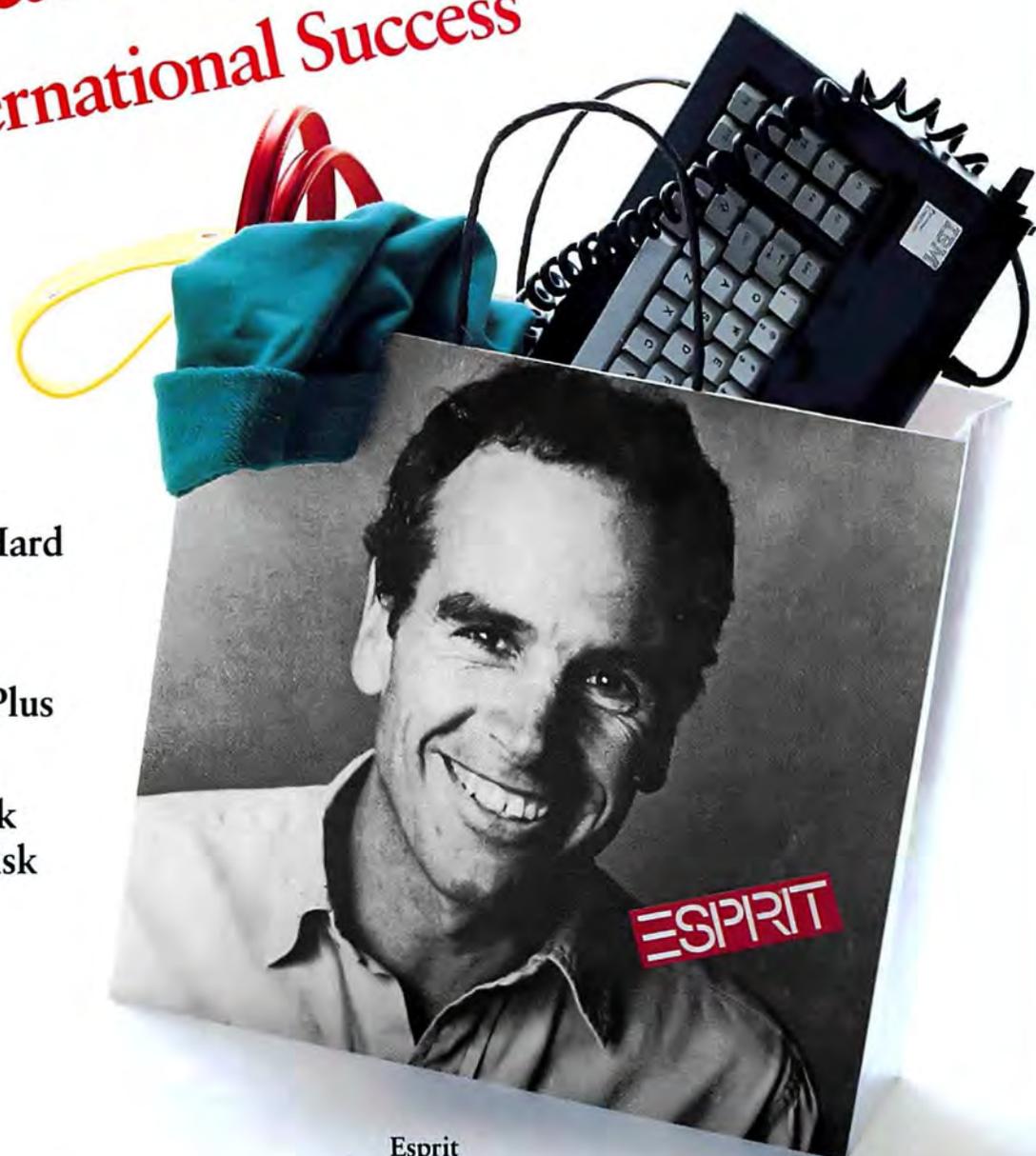
*The Comprehensive Guide to
IBM Personal Computers and Compatibles*

PCs at Esprit! An International Success

**How to Select
and Manage Hard
Disks**

**Time-Tested
Data Backup Plus
Security**

**An Inside Look
at the Hard Disk
Industry**



Esprit
President and
Cofounder
Doug Thompkins

Share Your IBM PC...

...Add up to 31 Low-cost Work Stations!

The scene at the left is typical of many companies today. Employees standing around idly awaiting their turn on those expensive PC's. Computer congestion multiplying by the minute. Computer confusion in sharing disks and files.

Eliminate that congestion and confusion. Free-up those unnecessary employee "waiting lines." Share a common data base without loss of speed or efficiency ... and valuable work time.

The choice is yours!

1 Install a Network. (LAN) Several software driven systems are available. But beware of the headaches - slow speed due to cable limitations and heavy costs. It may pay to heed the opinion of Tom Hogan, Editor-in-Chief, Business Software, "our experience has not been entirely positive." Call for reprints (Editors Page, June, 1985) and read for yourself the many pitfalls this publication has experienced.

OR

2 Install an Advanced Digital PC-Slave work station. Low cost. Faster speed (8 MHz) and no headaches!

The choice is obvious. Advanced Digital's

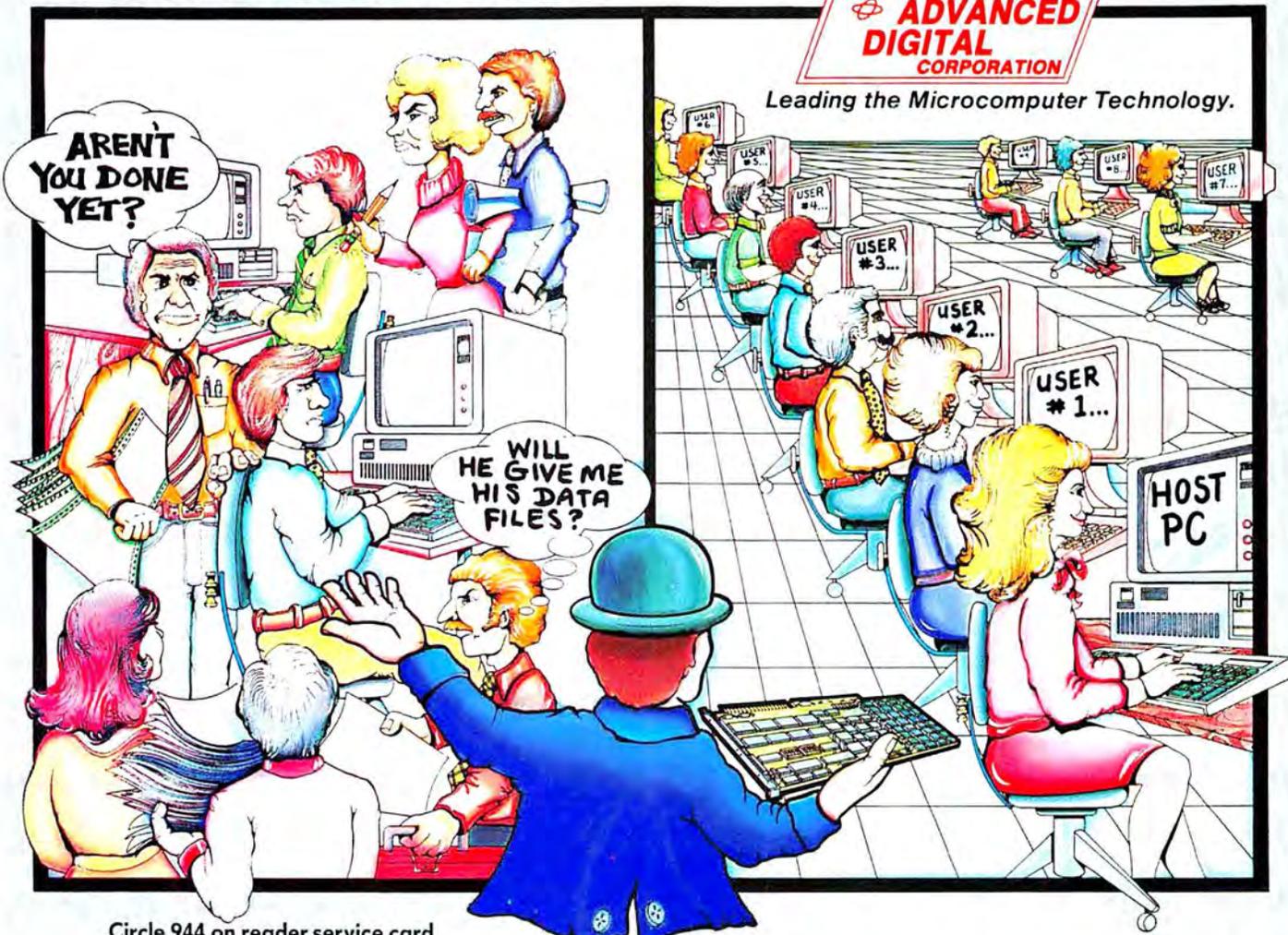
PC-Slave concept allows you to add up to 31 low-cost "dumb" work stations to your IBM, PC, AT, XT, and the compatibles. Just plug Advanced Digital's PC Slave board into your PC expansion slot, a connecting cable, a low-cost dumb terminal and you're in business. Orderly work stations are readily apparent without employee congestion and confusion. Speed and performance are uninterrupted since only disk access is shared. Best of all, 2 to 3 work stations may be added for the price of an additional PC.

The next time you're standing around idly may be the best time to put the advanced technology from Advanced Digital to work for you. Start sharing your IBM PC today!

Advanced Digital Corporation also manufactures a complete line of S-100 single board computers and multi-user systems.

For more information and the name of the nearest dealer, call or write:

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3 simple ways to bury yourself in floppies.



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UP TO YOUR NECK



UP TO YOUR EARS

1 simple way to dig yourself out.

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at it, ask about our streaming tape backup, removable hard disks, and acceleration boards for the IBM PC, XT, AT, and compatibles.

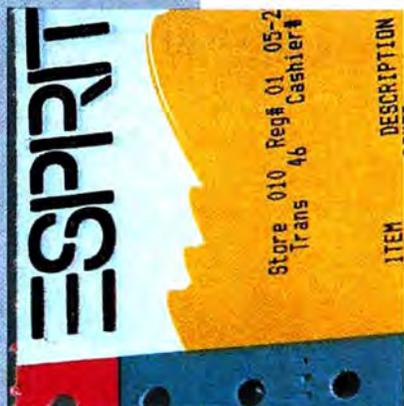
For more information, call toll-free 1-800-522-2237. Ask for Dept. 218. In Oregon and Alaska call 503-626-6877. Ask for Dept. 218. Dealer and OEM inquiries welcome.

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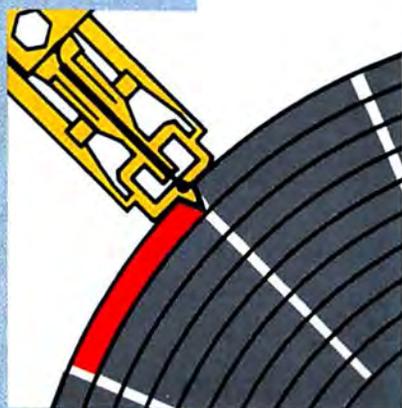
PC WORLD

The Comprehensive Guide to IBM Personal Computers and Compatibles
August 1985



196 Counter Intelligence at Esprit de Corp.

For clothing manufacturer Esprit, PCs don't just dress for success—they ring it up. *PC World* checks out this sophisticated point-of-sale application that puts PCs on retailing's front line.



210 Sensible Storage

If you're hip-deep in floppies and tired of waiting for the little red light to go out, you're a candidate for an internal hard disk drive. *PC World* torture-tested five internal drives that promise to bring mass storage to every desk top—without breaking budgets.



264 Conventional Wisdom

Need a reliable, systematic way to organize, document, and back up your data? Take a cue from data processing professionals, whose proven techniques and strategies can smooth the rough spots in the sometimes rocky road to computer productivity.

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PC WORLD

Volume 3, Number 8
August 1985

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PC World™ (ISSN 0737-8939) is published monthly at \$23.75 for one year (12 issues), \$42.75 for two years (24 issues), \$57.75 for three years (36 issues) by PC World Communications, Inc., 555 De Haro St., San Francisco, CA 94107. Additional postage outside the U.S. and Canada \$25 per year surface mail, \$100 per year airmail. Outside the U.S. all orders must be prepaid in U.S. funds drawn on U.S. banks. For questions regarding subscriptions and to place subscription orders call toll-free 800/247-5470 (in Iowa: 800/532-1272). Second-class postage paid at San Francisco and at additional mail offices.

POSTMASTER: Send address changes to PC World, Subscription Dept., P.O. Box 6700, Bergenfield, NJ 07621. Editorial and Business Offices: 555 De Haro St., San Francisco, CA 94107, 415/861-3861. CompuServe 74055.412

The Source STE908

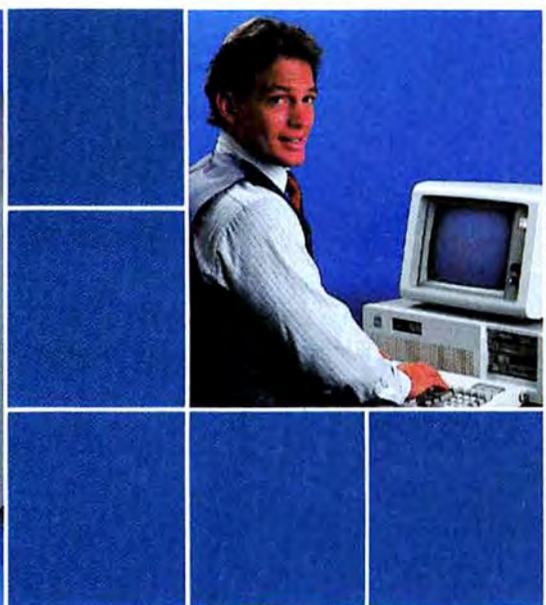
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**The next step
for your PC
isn't as big as
you think.**



Introducing the

The best of both worlds.

For owners of IBM Personal Computers, combining personal productivity and business applications is now less of a leap than ever before.

There's a new IBM product that marries the IBM System/36 and the IBM Personal Computer to give you the best of both worlds.

Meet the newest member of the System/36 Family.

It's called the IBM System/36 PC. Very small but it opens up new worlds for your personal computer. Very affordable with a price starting at \$5,995, yet capable of running System/36 programs that will help you run your business.

Even if you've never owned a computer before, this can be your first business system, instantly offering the capability of running your business right now and expanding it in the future.

Multiuser system.

System/36 PC can be a standalone computer for small companies or a departmental system or even part of a distributed network for larger companies, providing multiuser access to data.

The System/36 PC is made up of a 5364 Processor attached to an IBM PC, PC XT or PC AT. And you can connect up to three more of these personal computers. Or you can connect terminals such as System/36 printers or displays.

Flexibility.

Whether your business has two employees or more than 2,000, the System/36 PC can combine the personal productivity of your PC with the business applications of the System/36 Family.

The System/36 can handle all facets of your business—distribution, sales analysis and general ledger functions. Accounts payable, inventory control and payroll.



IBM System/36 PC.

And you can get traditional PC functions such as spreadsheets and word processing.

Software for the System/36 has been developed over the years and has proven invaluable in all kinds of businesses of all sizes. And with the thousands of programs written for both IBM PC and System/36, the sky's the limit for business and planning applications.

The System/36 PC even provides you with data security features so that the right data gets into the right hands.

Small yet powerful.

All of this processing power can sit right on a desk or under it—either horizontally or vertically. It measures a mere 21¼" x 16¾" x 6½"—about the size of a small suitcase.

Yet as small as it is, this little box has multiple processors, with main memory that can be dedicated to running your business functions. In plain English, this means you can get better response time. The System/36 PC comes with a 1.2 MB diskette drive and either 40 or 80 MB disk storage, depending on your information storage needs.



Easy to use.

The System/36 PC is easy to learn and to use. If you need assistance, it has over 2,800 "help" screens that take you step-by-step through any rough spots. You can merge data you've generated on your PC with information that's on your System/36 PC. And you can share information that is stored in the System/36 PC with other attached IBM Personal Computers or System/36 terminals.

Compatibility is high so that you can keep on using many of the PC peripherals and programs you may already own.

Easy growth.

What happens when your small office becomes bigger? That's what the System/36 Family is all about. No matter what size your business, there's a member of the System/36 Family that can help you do whatever you do, better.

As your needs become greater, there's the mid-sized 5362 processor that offers greater performance and can handle up to 22 personal computers or System/36 terminals.

Then there's the original System/36—the 5360 processor—the largest member of the System/36 Family, which can handle up to 36 personal



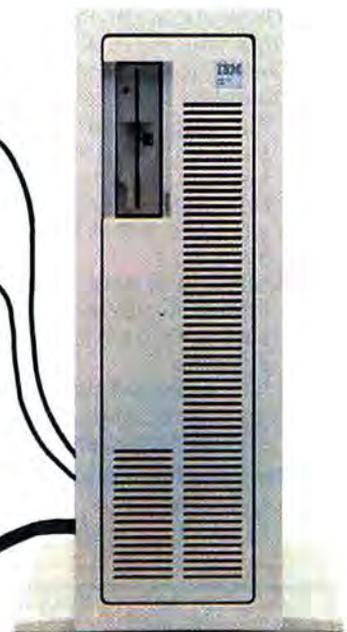
computers or System/36 terminals.

Any one of these processors can function as the central processor in your office. Each can communicate with PCs or larger systems, giving communication and connectivity new meaning by allowing departments to share data.

So if your dreams are big but your office is small, the new System/36 PC is the perfect step for you to take. You not only get the best of both worlds, you also get IBM product reliability. And authorized IBM on-site service is available anywhere in the U.S.A.

For a free brochure on the IBM System/36 PC or for information on product availability from participating IBM Product Centers, Authorized PC Dealers or Value Added Dealers, call 1 800 IBM-2468, ext. 553, LL. Or call your IBM marketing representative.

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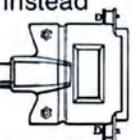
Think about Off-loading expansion boards from your PC or XT to an External Hard Disk/Backup System. Everex provides a complete line to choose from...

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David Bunnell

PC World Publisher David Bunnell spends a day in the country and finds software publisher Philippe Kahn totally at home in a world of picnics, prizes, and other profitable pursuits.

Putting the Fun Back Into Software Development

So far 1985 hasn't been very amusing for most software (or hardware) companies. The computer business just isn't growing fast enough to support everyone's ambitious business plans.

While the buzzwords in 1984 were *integration*, *networks*, and *robust software*, this year they're *consolidation*, *layoffs*, and *Chapter 11*. And 1985 will go down in PC history as the year that Software Arts, the company that created *VisiCalc*, sold out to Lotus Development for under a million bucks.

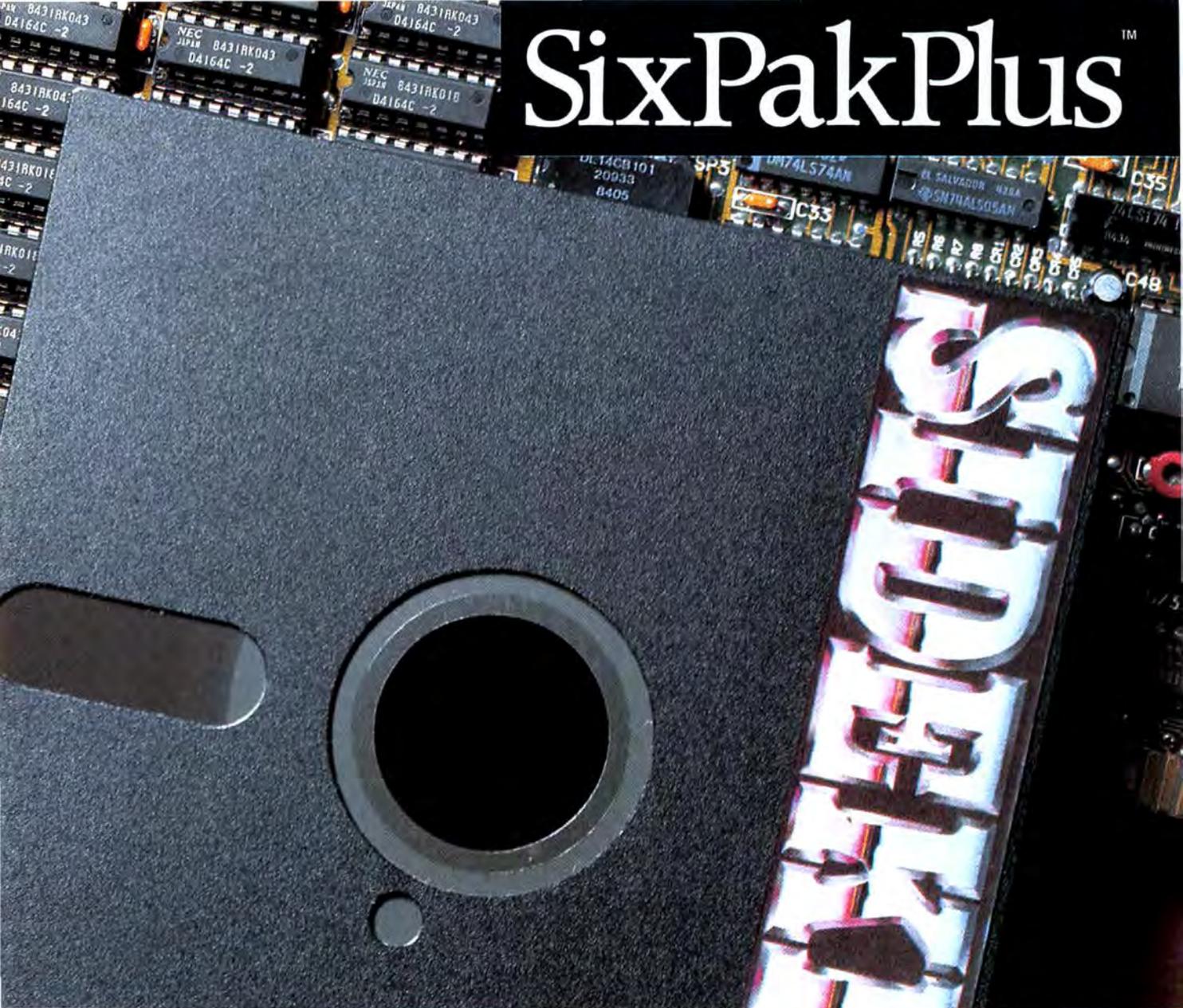
Pondering such dark thoughts, I recently drove from my San Francisco office to Scotts Valley to visit Borland International—an upstart software company that is busy breaking all the conventional rules of the software game and becoming an astonishing success—in spite of the PC recession. It was Borland's *SideKick*, a non-copy-protected desktop accessory program selling for less than \$100 in mail-order catalogs, that nailed the lid on Software Arts' coffin.

Ah, it's a sad tale. Remember *Spotlight*, Software Arts' desktop accessory program? It was quite similar to *SideKick*, but it was copy protected and sold for three times as much. Software Arts refused to sell software through the mail, insisting that the company would always copy protect its programs and maintain their high prices in order to protect dealer margins. At least by selling out to Lotus, Software Arts found one of the few software companies that can still get away with those antiquated software standards.

Borland's mastermind, or as the *Wall Street Journal* recently nicknamed him, "L'Enfant Terrible of Silicon Valley," is a crazy Frenchman. He descended on the United States two years ago with about 2000 dollars and dreams of streets paved with gold, and he soon proved that the advertising and marketing experts didn't know everything about selling

(continues)

SixPakPlus™



The #1 Multifunction Card Now Includes

The Best Multifunction Card Just Got Better. We've enhanced our SixPakPlus multifunction card with a new extra feature: Borland's SideKick desktop management software. Now you can get the best the industry has to offer together in one package—in 1984 SixPakPlus was voted the #1 multifunction card in PC World's World Class User Survey and chosen as Softsel's Best Selling New Product, while SideKick was selected as InfoWorld's Software Product of the Year.

The Best In Performance. Over 400,000 satisfied customers will tell you SixPakPlus provides the power for today's demanding requirements, whether you use an IBM® PC, XT, 3270 PC or compatible.

First there's more memory—an additional 64K to 384K RAM—to process more data, or to run today's software programs such as the SideKick multipurpose software we've included. Our extra memory and SideKick's features also work beautifully with your other favorite software pack-

ages like Lotus 1-2-3™, WordStar®, Symphony™ and dBASE III™.

Next, more Input/Output ports—one serial, one parallel and an optional game adapter—to add peripherals such as printers, modems, a mouse, plotters or joysticks. Then there's our built-in clock-calendar for automatic time and date stamping.

And we've included another of our "World Class" award winners, SuperPak™ utility software. Selected top in its class for two consecutive years, SuperPak features Super-

SideKick™



The #1 Desktop Management Software

Drive™ which works like a drive but fifty times faster, and SuperSpool™ which lets you print and input at the same time.

The Best in Quality. If the industry's lowest rate of return is a good indicator, then SixPakPlus can't miss when it comes to quality. And we back this dedication to quality with a dedication to service and support. The AST commitment even extends to documentation, with our comprehensive user informa-

tion you'll find SixPakPlus is also the easiest to install and operate.

It takes an industry standard to advance the standard. When you want the best, look to AST's SixPakPlus—with the added value of SideKick software. For more information call our Customer Information Center (714) 863-1333. AST Research, Inc. 2121 Alton Avenue, Irvine, CA 92714 TWX: 753699 ASTR UR.

SIXPAKPLUS FEATURES

- Includes SideKick Desktop Management Software
- Memory Expansion to 384Kb, allowing total PC memory expansion to 640Kb
- Serial port for connecting to a printer, mouse, modem or other asynchronous devices
- Parallel port for use with parallel printer, plotters
- Optional game adapter port—plug in joysticks and other cursor-control devices
- Battery backed Clock/Calendar for automatic time and date stamping
- AST's SuperPak includes SuperDrive electronic disk and SuperSpool print spooler



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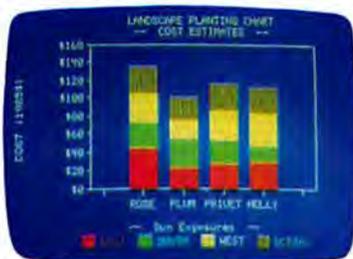
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A sample color graph when 1-2-3™ is enhanced by EASY COLOR™.

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Program requires an IBM PC or XT, a color monitor,
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software. Philippe Kahn: a chubby fellow with a winning wit, who might be just as at home performing in the Great American Music Hall as he is in the PC industry, proving that the impossible can still be done.

When I arrived, he was bouncing around the office cracking jokes and being genuinely nice to his employees. Philippe is for real—his flamboyance isn't a put-on for the press.

When he saw me, he suddenly turned very serious. He beckoned me to come closer and whispered in my ear, "We've developed a local area network called BorLAN. Would you like to be the first to see it? It works!"

Visions of an exclusive danced in my journalistic head. If it was like everything else developed by this company, a local area network from Borland could be hot: It would undercut the market but still be a high-quality product. I took the bait.

"It works, it works," Philippe chanted as we walked down the stairs to the secret technical room. The technical staff were obviously enjoying their venture into hardware: The BorLAN turned out to be a bunch of strings, paper cups, and paper clips. According to a phony press release, the BorLAN communications system is "fully IBM, SideKick, and Superkey compatible; requires no training and features on-line, user-sensitive help; and is available with nary a keystroke."

I should have known Philippe was pulling my leg. But while I was regaining my composure, I got the impression that this sort of diversion is what keeps the staff's juices flowing to do other, more serious projects.

I had planned to have lunch with Philippe and a few key staff members at a nearby restaurant, but as it turned out, Borland was having its regular monthly picnic, and I was invited to join in the festivities.

(continues)

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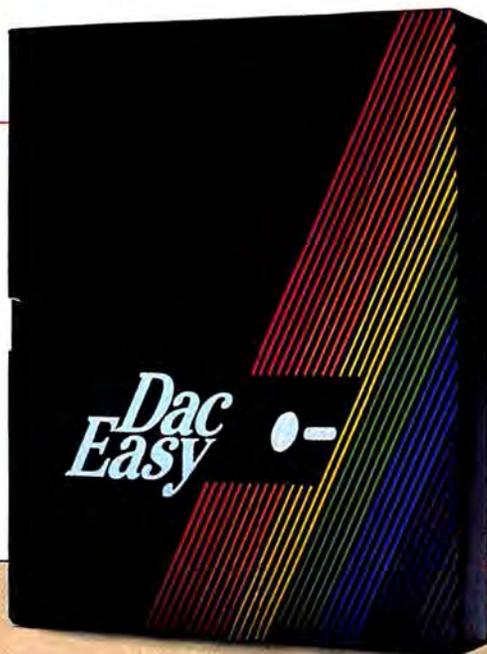
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Imports Monthly (4/5/85 issue pg. 25) reports car imports from Japan:

Year	Units	\$
1983	8M	\$230M
1984	10M	\$400M
1985	16M	\$700M

Source: Japan-America Assembly

Created: 4/7/85 Modified: 4/7/85 Reminder: 5/12/85

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	Jun-85	Jul-85	Aug-85	Sep-85	Oct-85	Nov-85	Dec-85
Impurities	3100	4500	6100	7800	9500	11000	12500
Units sold	620	950	1300	1700	2100	2500	2900
Income	8452	9709	11000	12500	14000	15500	17000
Cash flow	5100	6300	7500	8700	9900	11100	12300

Application: FOUND

Instant Recall
Search for: Project AUTO and unit sales

5/15/85

Dear Bob,
Here are the project AUTO unit sales projections for 1985. Let me know how they look in your model. Is it a go?

Bob

P.S. Let's compare notes at the 7/1 Board meeting.

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It was raining, so 120 Borland employees and I sat inside—on the floor—and soaked in the frivolity.

Philippe confided that the BorLAN wasn't the only major project underway—they were also putting the finishing touches on the Borland Bathtub Battle Cruiser. Constructed from an actual bathtub, this boat was to be Borland's entry in the annual bathtub boat race in Santa Cruz. Philippe explained that they had to settle for the Santa Cruz race until Borland could afford to sponsor the America's Cup.

The shipping department, which had received three days off to build the boat, showed me an elaborate blueprint of the design but requested that I not share any of its secrets with other software publishing companies. I did slip a copy of the plan into my pocket and toyed with the idea of publishing it in this column, but I finally decided to go along with their dubious nondisclosure. After all, think what the *Wall Street Journal* might do with this material!

After the picnic, Philippe announced the three "employees of the month," one of whom was the front desk receptionist, and gave them each a \$300 bonus check. A photographer showed up and was taking pictures at the bottom of a stairwell at Borland headquarters when a secretary hollered from above, "Philippe! That important phone call you were waiting for has come through."

Philippe immediately shifted gears: "My God," he cried, "I think it's IBM!" He leaped up the stairs three at a time as if he weighed only 90 pounds.

And it was over. Philippe was indisposed for the rest of my visit, and I didn't even have the opportunity to say good-bye. I left him a thank-you message and prepared to leave.

As I was putting on my jacket, one of the Borland employees discreetly asked, "What do we need to do to be more professional? People think we're just a mail-order place and we're not." I suggested that they could improve their advertising. The quality of the products should do the rest. (Of course, Philippe's philosophy is that ugly ads sell software.)

But can Borland retain its happy-go-lucky atmosphere and still grow more successful? Will Philippe still be the fun-loving boss when Borland has 1000 employees and a sudden slump in the market causes him to lay off a few hundred?

Based on past experience, we can reasonably predict that this company is in for some major changes. Just this once, however, it sure would be nice if we were dead wrong. ●

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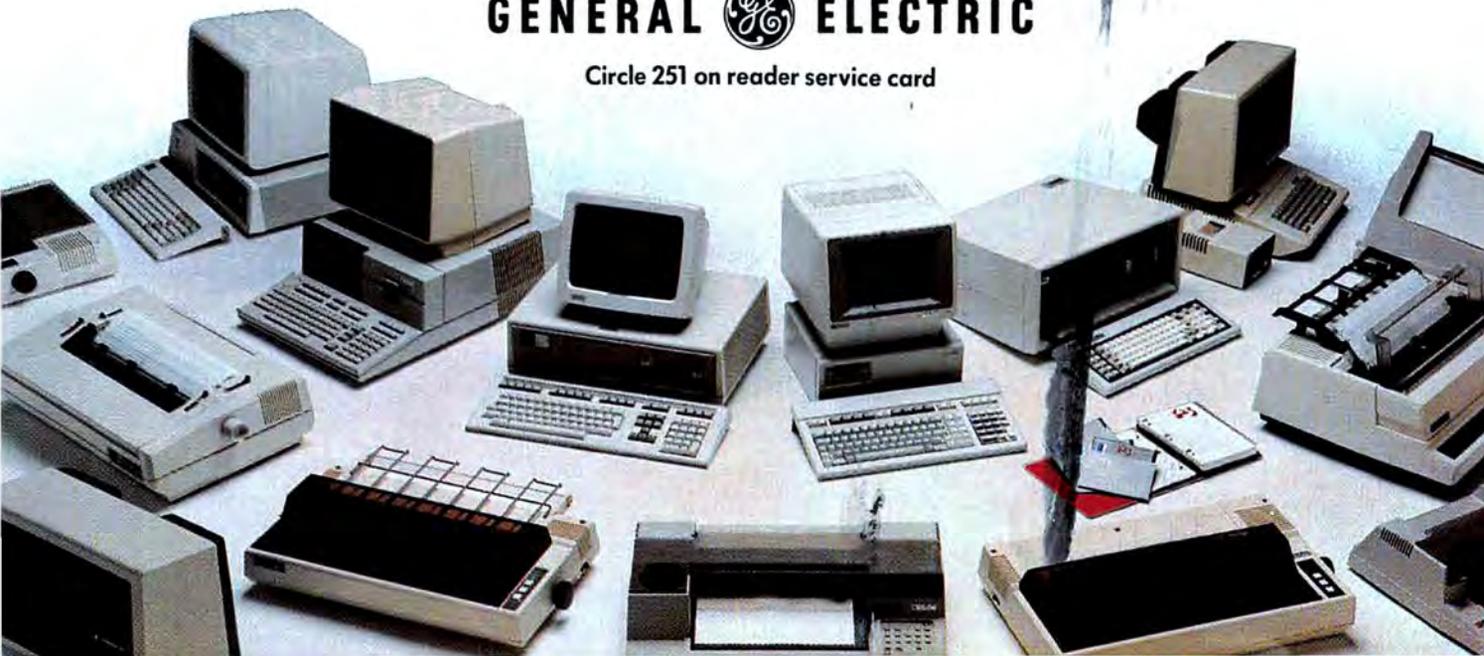
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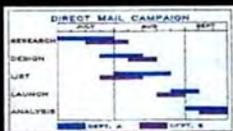


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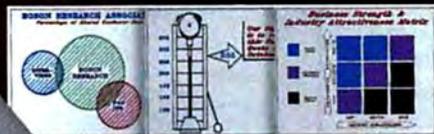
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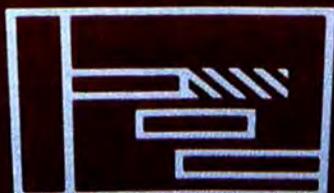
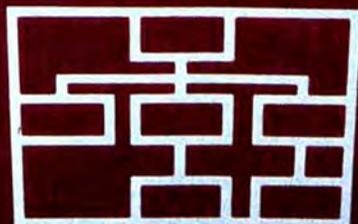
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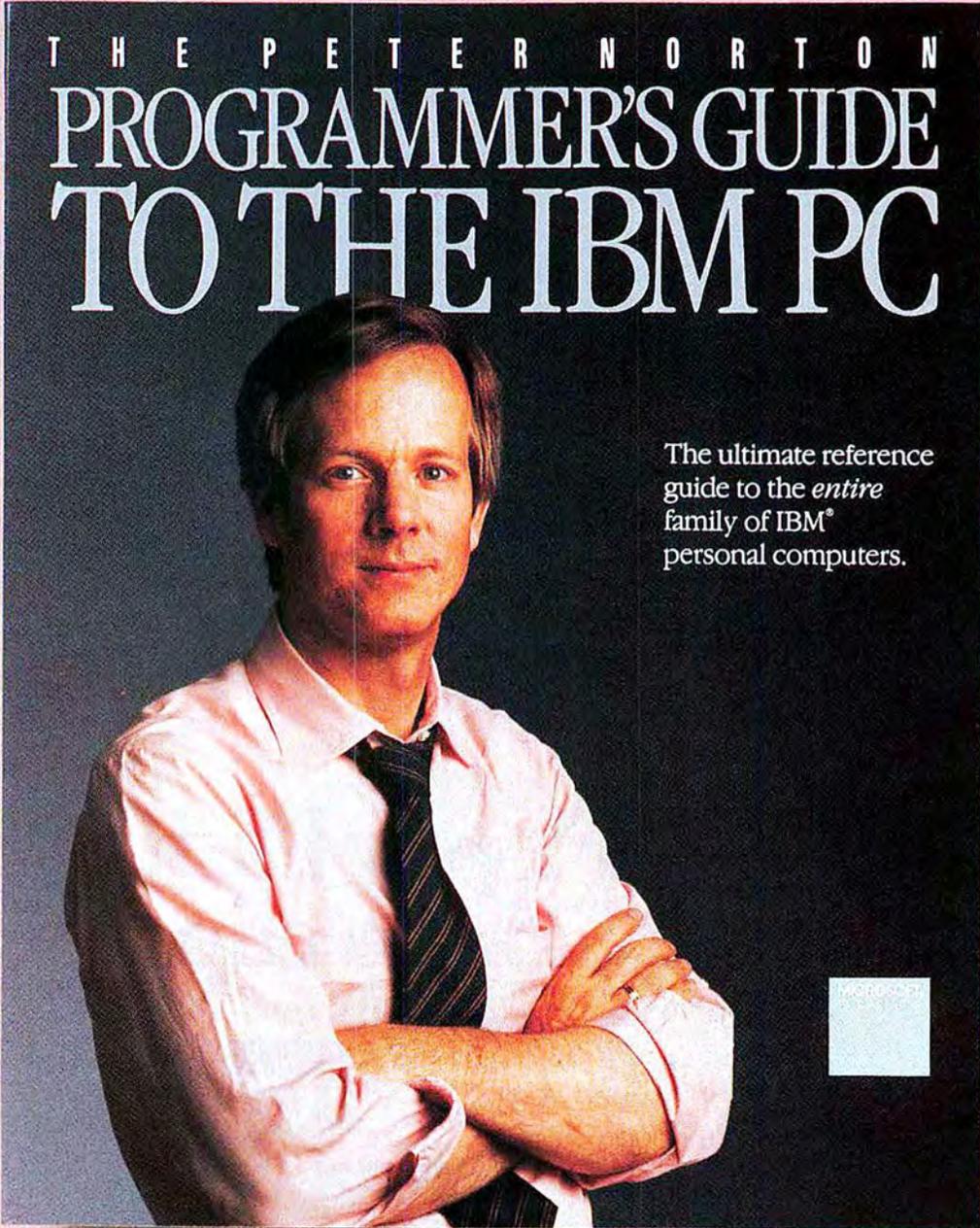
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Alan Cooper

Flash or function? The usefulness of windowing—multiple applications sharing the screen—is questioned.

REMark: Window Viper

My friend Sally called me the other day to talk about the computer she uses at work. She has an IBM PC on her desk and runs *WordStar* and *Multiplan* on it, performing basic word and number processing. Sally's not what I would call an industry insider, and she's certainly not a techie. But she uses her computer two or three hours a day and is conscientious about becoming more productive with it. One of Sally's colleagues told her that she needed a windowing program to increase her efficiency. When Sally called, she had already spent some time with her colleague's copy of *TopView* and had some questions.

First off, Sally asked, "Just what are windows really good for?" Good question.

Sally found that windows took extra work to manage, with those little boxes and arrows in the corners; and moving information among windows was so confusing, complex, and prone to error, that she failed to see their usefulness. She said, "When I use my spreadsheet, I want it to fill the whole screen so I can see as much of it as

possible. The same is true for word processing. Sure, I'd like to be able to switch rapidly between the two programs, but windows just seem to get in the way. And once data is transferred between dissimilar programs it loses its recalc-ability. In my opinion," Sally concluded, "it's better and easier to leave the numbers in *Multiplan* and the words in *WordStar*."

Sally is correct. Windows don't help. Windowing is a feature that reminds me of tail fins on automobiles. There is no advantage to having several disparate programs occupying space on the screen simultaneously. There is no advantage to linking multiple application programs together with windows when the procedures for interchanging information are quite limited and hopelessly tortuous, and when data that has been copied can no longer be recalculated.

Don't confuse windows with "pop-ups," a new way of making programs hang around in RAM so

(continues)

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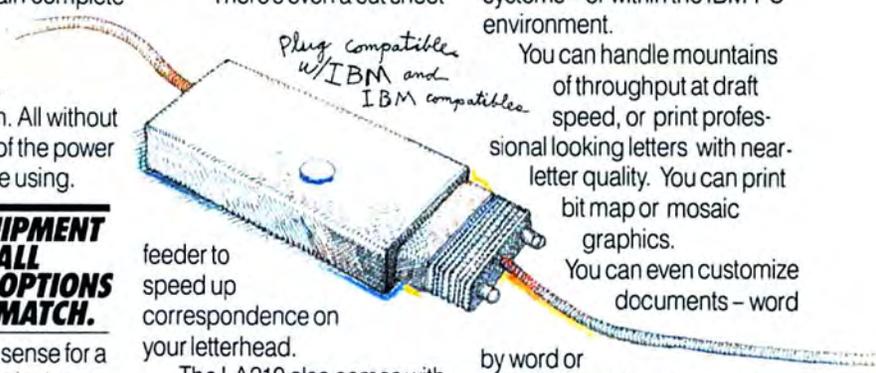
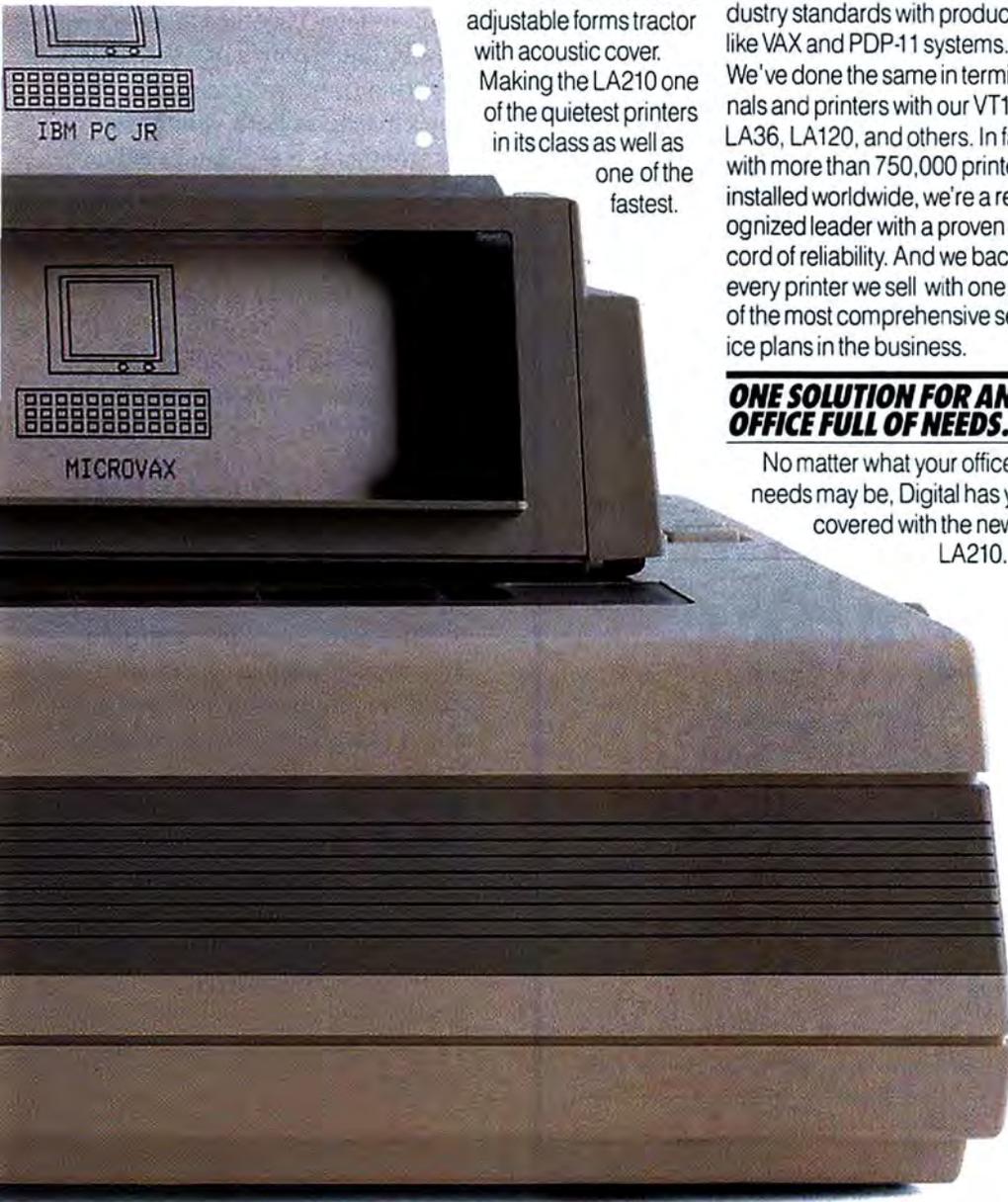
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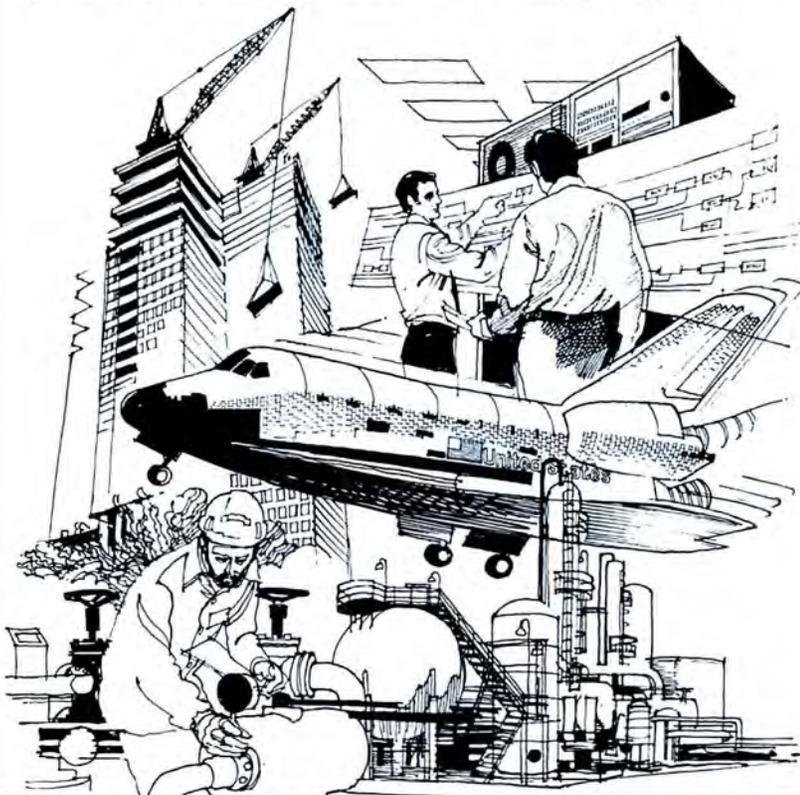
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they are quickly available. The pop-up concept is a good one—it alleviates most of the delay associated with interrupting one program to briefly run another.

Unfortunately, even pop-ups run afoul of a fundamental problem: Most personal computers don't have sufficient RAM or disk space to accommodate two full-size application programs simultaneously. And even on computers with enough RAM, today's operating systems lack the capability to arbitrate the memory demands of two or more programs. On today's machines both windowing environments and pop-ups either have their capabilities severely trimmed back or are condemned to unwieldiness due to numerous disk changes and long delays.

Sally told me that Phil, an associate at work, had laughed at her efforts, saying, "I don't understand why you spend so much time trying to make the computer calculate and paste things together when you can do more in less time, and certainly with less frustration, by hand."

Phil's criticism is like someone 70 years ago saying, "I can hitch my team of horses in less time than I can get a horseless carriage started, and I don't have to wear special clothes or carry special tools to drive the contraption. The automobile is obviously a tool for experts." History and market-driven technological refinements have disproved that line of reasoning.

(continues)



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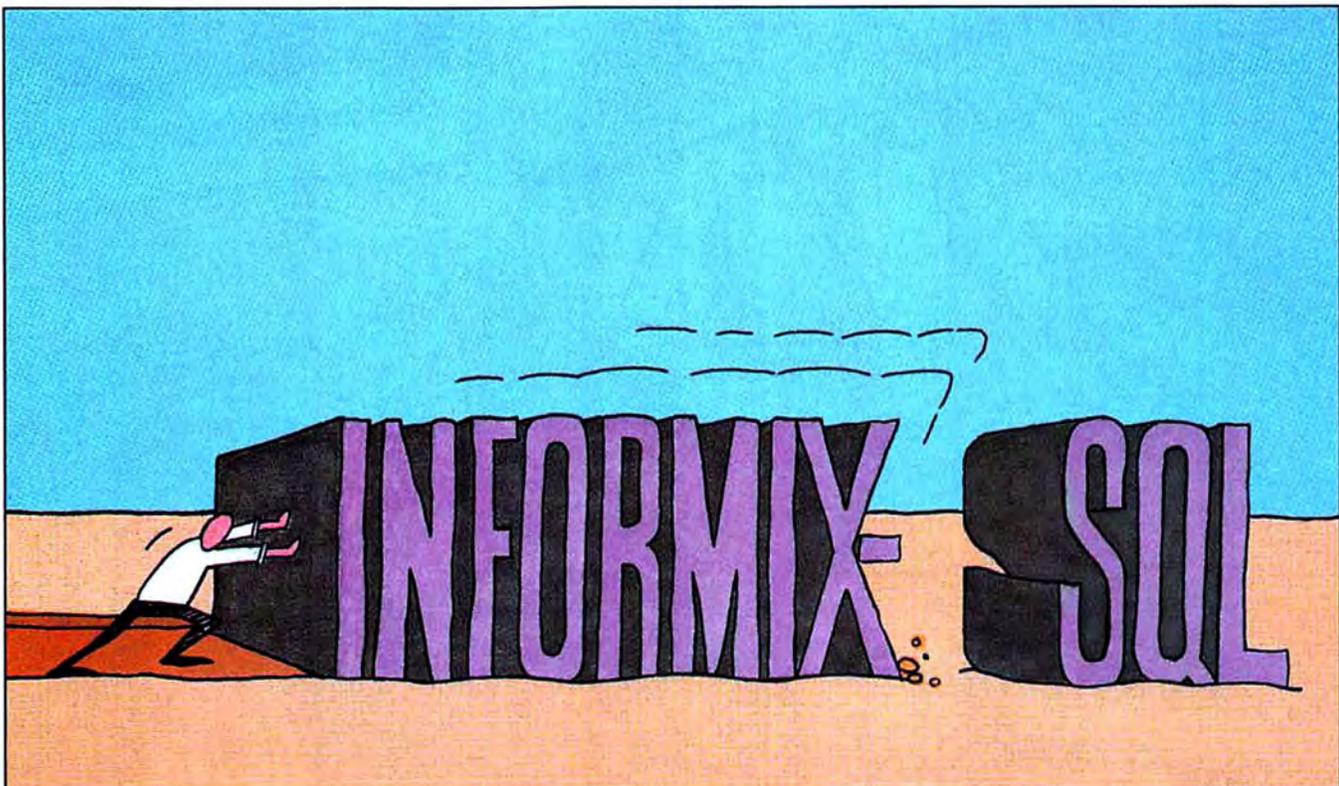


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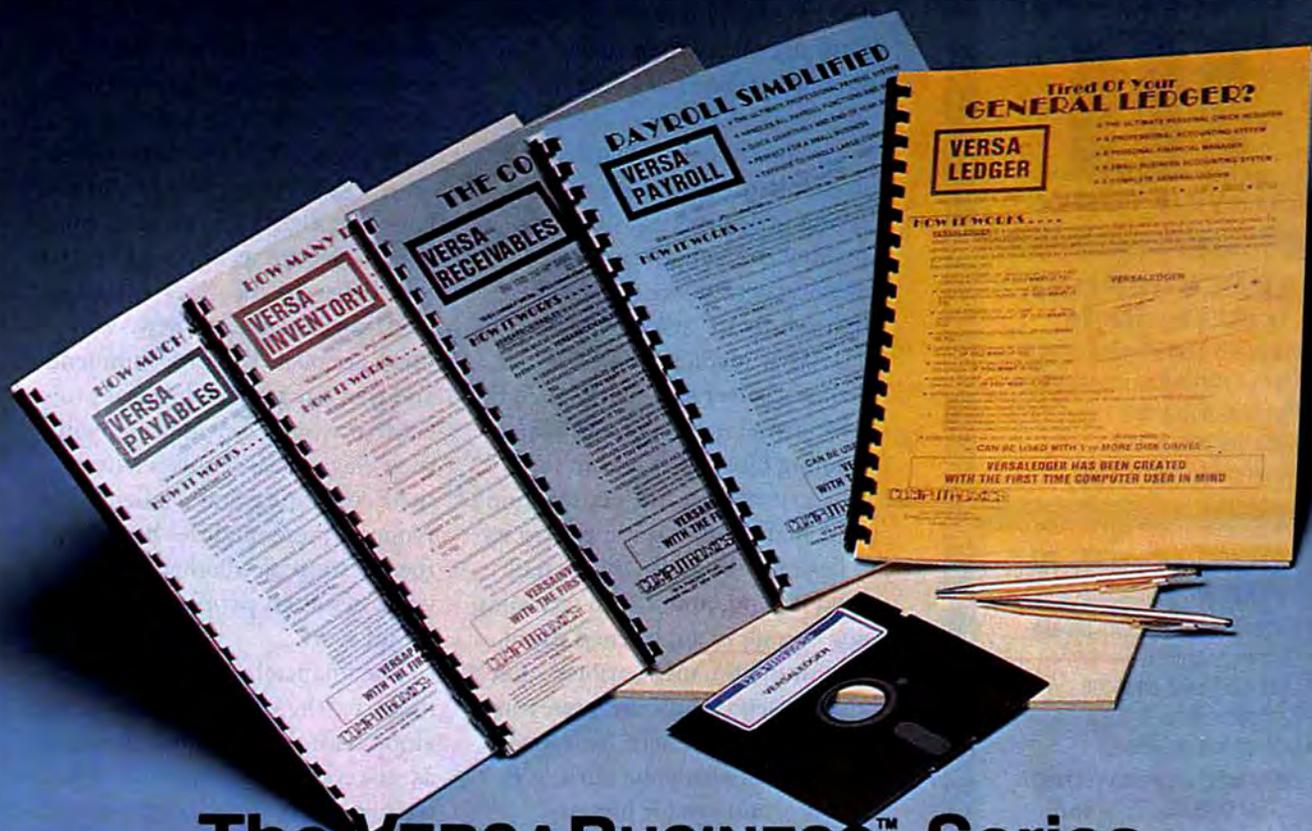
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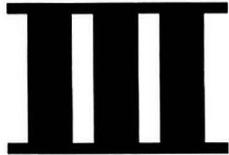
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In the course of technological development, however, innovators naturally take wrong turns. Windowing is typical of many impressive developments in technical disciplines that are abandoned or used only for teaching purposes, having little practical value. Remember the Van de Graaf electricity generator we all saw in high school or college physics class—that medicine-ball-size, gleaming silver sphere mounted on a 4-foot-tall metal column with a spinning fabric belt within it? When turned on, the contraption generated enough static electricity to light nearby bulbs, make hair stand on end, and flash a sparkling blue corona in a darkened room. Very dramatic, instructional, and largely useless. Like an interesting university experiment, windows are more an academic curiosity than a prototype for human-computer dialogues.

Even Apple, the progenitor of the first popular commercial windowing product, Lisa, has quietly dropped almost all windowing activity from the Macintosh. Aside from an occasional split screen *within an application*, windowing is virtually absent. After traversing the initial learning curve, anyone with real work to do on the Mac switches to one of the increasingly available command-oriented operating system interfaces.

It might seem unlikely that mature, intelligent software development professionals (like those at IBM, Apple, Microsoft, Digital Research, VisiCorp, and the rest)

would commit such enormous efforts to developing something not very useful. But just ask any programmer's manager, and he or she will tell you that the biggest problem is keeping programmers on track, keeping their eye on the ball, focusing them on developing what is needed as opposed to what they believe is fun, sexy, intriguing, experimental, or new. Windows are neat. I've programmed, and they are just the kind of project that would appeal to me with their elegance and universality, their concinnity and challenge. None of these qualities bears on the question of whether or not windows assist people in doing useful work.

The financial supporters of our industry, the venture capital firms, along with the computer press, are as susceptible as anyone to high-tech jingoism. They are groupies, computer camp-followers, software sycophants. Well-educated and enthusiastic about technology, they are usually without personal experience in software development, yet their businesses depend on how well they proselytize for their hard-working power-coders. Window programs and their programmers give good demo—most frequently to venture investors and industry reporters. These interested spectators are favorably predisposed to catch the enthusiasm of a software developer in the throes of creating a windowing

(continues)

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READ ONLY



A review of the IBM Personal Computer Family. Vol. 2 No. 2



WHAT'S THE PROGRAM?

Meaningful dialogue. There are two programs from IBM that can greatly improve the quality of our running dialogue with computers. They are the IBM EZ-VU Runtime Facility and the IBM EZ-VU Development Facility.

Think of the EZ-VU Runtime Facility as a mediator in your IBM PC conversations. It handles the exchange of commands and information between you and your application programs through predefined screens. It can give you a single consistent interface with applications written in a variety of languages.

In short, the EZ-VU Runtime Facility lets you concentrate on the essentials of the job you're doing.

If your job is program development, the IBM EZ-VU Development Facility can help you write menu-driven applications—or revise existing ones—that are both sophisticated and easy to use. It incorporates a screen design tool that works through the function keys on your IBM Personal Computer, so there are no special codes and commands to slow down your design work. EZ-VU also helps

make fast work of testing and revising your screen designs.

Two additional points. Both of these EZ-VU programs benefit from years of success by similar dialogue management programs in IBM host MVS, VM, and VSE operating environments. And both run under the IBM TopView program, which allows you to run a number of software applications concurrently.

A quantum leap. Speaking of technological advances, IBM Personal Computer Professional FORTRAN represents a quantum leap forward in FORTRAN for microcomputers.

It's a full ANSI 77 implementation with enhancements that offers an un-

Application management, program development, and communications software from IBM. See next page for IBM PC Network SNA 3270 Emulation Program story.



usual combination of speed and accuracy. Optimization techniques and features such as a full symbolic interactive debug facility are similar to those usually found only in IBM VS FORTRAN and other mainframe FORTRAN compilers.

You can use IBM PC Professional FORTRAN to work on large or small host programs and to recompile existing FORTRAN programs—or sections of those programs—to run on your IBM Personal Computer. Its ability to handle arrays larger than 64KB gives you the equivalent of mainframe capability on a personal computer.

And IBM PC Professional FORTRAN was designed for IBM by Ryan-McFarland Corporation to help you take full advantage of other IBM Personal Computer software, such as the IBM Personal Computer Engineering/Scientific Series graphics development tools.

Make that "quantum leaps."



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Each program in the *Directory* has a full description that includes system requirements and illustrations or color photos of representative screens. Programs may be ordered by mail or through a toll-free telephone number:

To subscribe to the *Directory*, call 800-IBM-PCSW.

The last word. Or perhaps we should say the last word to date. The new IBM DOS Technical Reference manual contains just about everything you'd want to know about the IBM Disk Operating System Version 3.1 and previous versions 2.1 and 3.0.

That's not to say that new improvements and information won't appear in the future. They will, and you'll be kept abreast of such developments. An update information service is included in the manual's purchase price.

So you'll always have the last word.



Updated versions of the DOS Technical Reference manual and the *Directory of Personally Developed Software* from IBM.



FAMILY TIES

Close connections. The IBM PC Family has always included hardware and software to help you keep in close touch with important contacts.

Last year's announcement of the IBM PC Network, for instance, was an important milestone in communications among the immediate family. It gives you an easy way to share information and hardware resources like printers and disk storage devices.

There are two recent IBM communications software products that extend those IBM PC Family connections even further. They make it possible for you to work directly with data stored on an IBM host computer, to communicate from one network to another, and to do an even wider range of your daily business over the IBM PC Network.

Host communications. The IBM PC Network SNA 3270 Emulation Program, for example, allows your IBM Personal Computer to communicate with an IBM host system through telecommunications lines.

Broaden your IBM PC connections with communications software from IBM.



You then have direct access to the data and programs on the host computer. So if you're working on a branch-office quarterly report, you no longer have to wait while essential data from a headquarter's computer is sent to you and copied for your use. There's also a redirector function that allows you to place the data on a file server for distribution to other stations on your IBM PC Network.

In addition, when the program is installed on an IBM Personal Computer in an IBM PC Network, that PC can act as a communications gateway for other members of the same network. If members of a network need to communicate with more than one IBM host computer—or with different applications on the same host—multiple gateways can be attached to a single IBM PC Network.

And an IBM PC with the IBM PC Network SNA 3270 Emulation Program installed can still be used as a network station doing standard PC work.

You could, for instance, use your IBM PC to create a data set on a host system. You could also create a word processing project on your IBM PC using DisplayWrite 3*, switching easily back and forth between them without terminating either session. The IBM PC Network SNA 3270 Emulation Program also allows you to transfer graphics printing jobs from the host to an IBM PC with a graphics printer attached.

Stand-alone assistance. There's a new addition to the IBM Assistant Series to help handle stand-alone communications between your IBM Personal Computer and a host machine or another IBM Personal Computer. IBM Mainframe Communication Assistant software includes a 3101 and 3270/78/79 terminal emulator for your IBM PC, plus a set of host computer support programs for VM/CMS and MVS/TSO systems.

Mainframe Communication Assistant has the same easy menu structure as other members of the Assistant Series, such as Writing Assistant and Planning Assistant. And it offers a number of unusual features to simplify your communications work.

It can, of course, speedily transfer files between host and PC (or PC

Quiet, please. There's been a quiet revolution in printer technology. The IBM Quietwriter® Printer is as advanced as the computers it serves. It's versatile, compact, remarkably quiet, and produces work that might make people think you've got a printing press in the back room.

In this case, the spark behind the revolution is a new method of resistive printing developed by IBM. The "Quietwriter" Printer replaces print elements or hammers that strike the page with a unique multi-layer ribbon and print mechanism that virtually "paints" characters on the paper.



IBM Quietwriter® Printer offers advanced printer technology and unusually low operating noise level. Shown with sample of letter-quality printing.

and PC). After you've worked with the host file, Mainframe Communication Assistant lets you transfer only the changes you've made—rather than the entire file—back to the host computer.

And, as a member of the Assistant Series, Mainframe Communication Assistant allows you to integrate mainframe database information into Filing Assistant files. You're then able to transfer that information to other members of the Assistant Series, saving the time and effort of reentering data that has been stored on a mainframe computer.

*Follow the proper installation instructions in the IBM PC Network 3270 Emulation Program documentation for DisplayWrite 3.



HARDWARE NEWS

Quiet, please. There's been a quiet revolution in printer technology. The IBM Quietwriter® Printer is as ad-

vanced as the computers it serves. It's versatile, compact, remarkably quiet, and produces work that might make people think you've got a printing press in the back room.

In this case, the spark behind the revolution is a new method of resistive ribbon, non-impact printing developed by IBM. The "Quietwriter" Printer replaces print elements or hammers that strike the page with a unique multi-layer ribbon and print mechanism that virtually "paints" characters on the paper.

As a result, the "Quietwriter" Printer produces superb, letter-quality printing on a variety of papers and in a wide range of type styles. To change type styles you just unplug one font module and plug in another. And because the "Quietwriter" Printer can accommodate two font modules, you can have two type styles online at once.

The "Quietwriter" Printer also allows you to produce a wide array of character graphics either separately or to highlight reports and correspondence.

And it does all of this very, very quietly. At 50 dB, the IBM "Quietwriter" Printer* makes less noise while printing than many printers make while idling. That means you can put the "Quietwriter" Printer wherever it's most convenient; it won't disturb either your telephone conversations or your train of thought.

Unconventional ability. IBM also makes conventional printer technology seem anything but conventional.

Consider the IBM Wheelprinter,* for example. Its printwheel is designed to provide sharp, clear letter-quality printing even after millions of impressions. And the printwheel is easy to change, which is important because there's a selection of over 500 printwheels to choose from. The Wheelprinter's standard features also include both automatic sheet feed and continuous forms feed—optional on many other printers.

The Wheelprinter is reliable enough to take on high-volume office work. It even works with two types of ribbons to suit the requirements of different types of jobs. There's a single-strike ribbon for finished reports or correspondence. For more routine jobs like purchase orders or internal memos, you can use a longer lasting, lower cost multi-strike ribbon.

The Wheelprinter has equally impressive qualifications as a home printer: To begin with, it's remarkably easy to use. The Wheelprinter's integrated paper path provides reliable cut-sheet printing and allows it to do much faster work than you might expect from a 25cps printer. And its acoustically engineered cover makes the Wheelprinter an exceptionally quiet impact printer.

Maybe "conventional" isn't the right word at all.

*These are just two of the various printers available from IBM for the IBM Personal Computer Family.

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TIPS AND TECHNIQUES

Stop action. If you occasionally sit frozen while screen after screen of information rolls by too fast to read, take heart. There's more than one way to stop that cascade of data and view one screenful at a time.

When listing the directory of a diskette or fixed disk, the command DIR/P will do the trick. After finishing with one screen, press any key to bring up the next.

To slow down the listing of a text file, you could use the CTL/NUM LOCK keys, but that involves keeping both hands on the keyboard and an eye on the screen.

Instead, check your DOS directory listing to make sure the DOS utility program MORE.COM is available. Then, at the DOS prompt A>, type the command line MORE<filename and press enter.

NOTE: be careful to use "<" and not ">"; if you enter the wrong one, you'll destroy your text file.

To view a file called PCWRITE.DOC, for example, enter MORE<PCWRITE.DOC. That will list a single page of text on your screen and display the message —MORE—. Again, press any key to view next screen.

Voilà, perfect control.

Thanks for this tip to Chuck Harrington of the Athens, Ohio, area IBM PC Users Club.

Thanks also—and apologies for omitting a note of credit in the last issue of *Read Only*—to Ed Smuckler of the Redondo Beach, California, Greater South Bay User Group for his tip about setting screen colors.

For more information about IBM Personal Computer products discussed in this issue of *Read Only*, see your Authorized IBM Personal Computer Dealer or IBM Product Center. To learn where, call 800-447-4700. In Alaska and Hawaii 800-447-0890.

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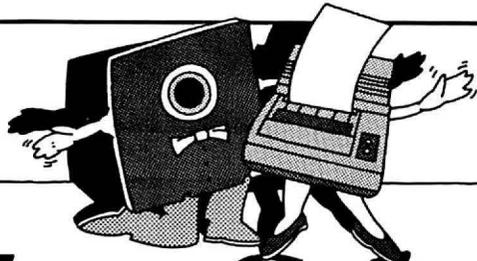
"environment." The reporters report with more fervor than detachment, and the investors invest with more eagerness than prudence.

Don't get me wrong: I'm completely enamored of the wild-West, industrial-revolution atmosphere of the personal software business, but the kind of trust we invest in other professionals—doctors, lawyers, architects, professors—is not justified in the personal computer world. Our industry is too young, too unregulated, too unprofessional for any commercial effort to be accepted without question. Innovation is easily confused with value, and invention is often superfluous when viewed in hindsight.

By focusing undue attention on windows, a cumbersome curio, the industry press and venture capitalists have contributed most to making windows the vogue, and they should know better. Sally's skepticism surely points out that the zeal of both these groups is disproportionate to the actual utility of windows and to the enthusiasm of day-to-day users for them. ●

Alan Cooper is a veteran software author based in Silicon Valley and the creator of Super-Project from Sorcim/IUS.

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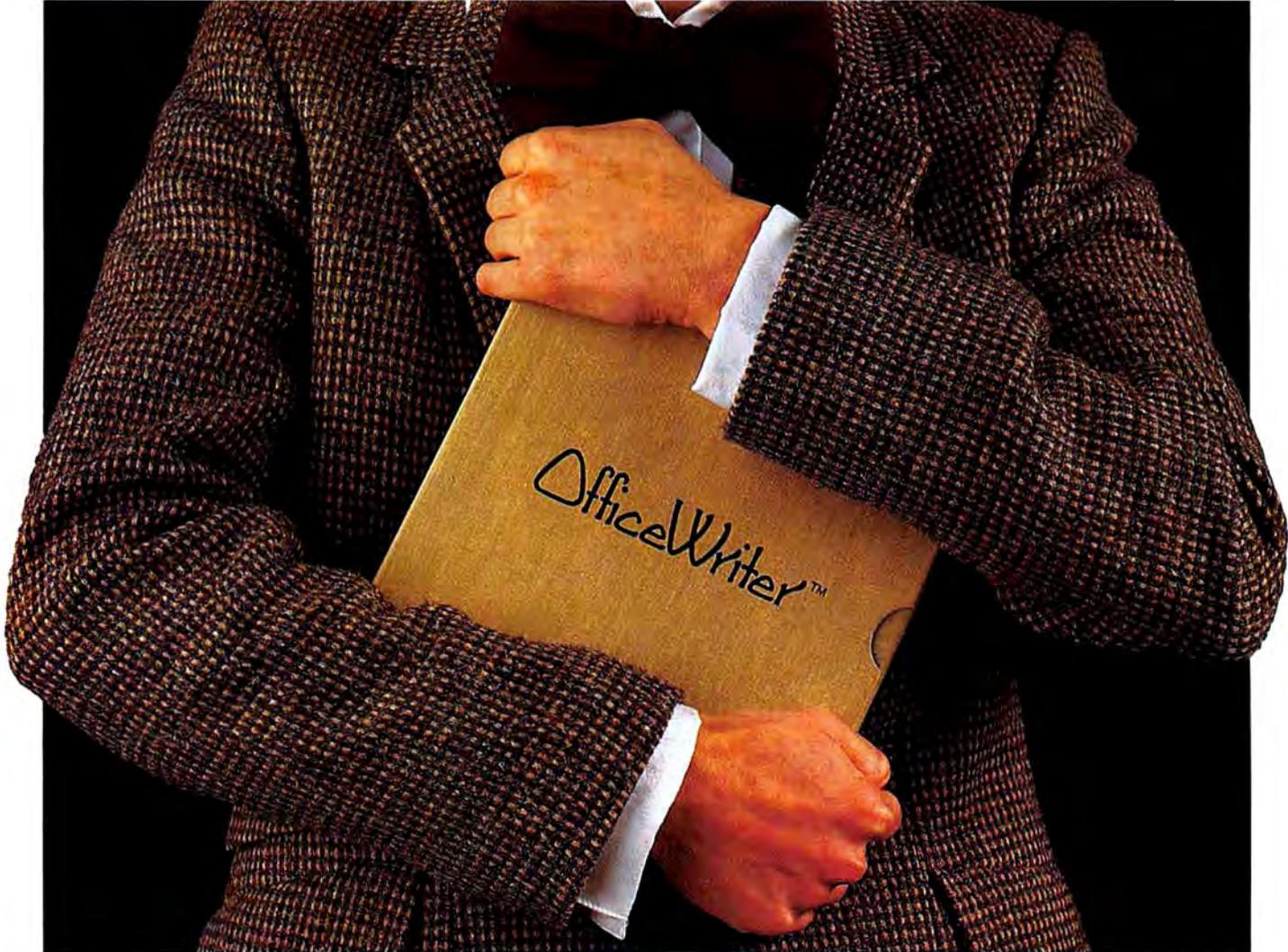
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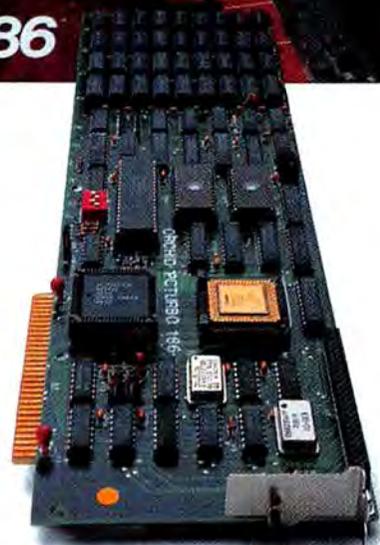
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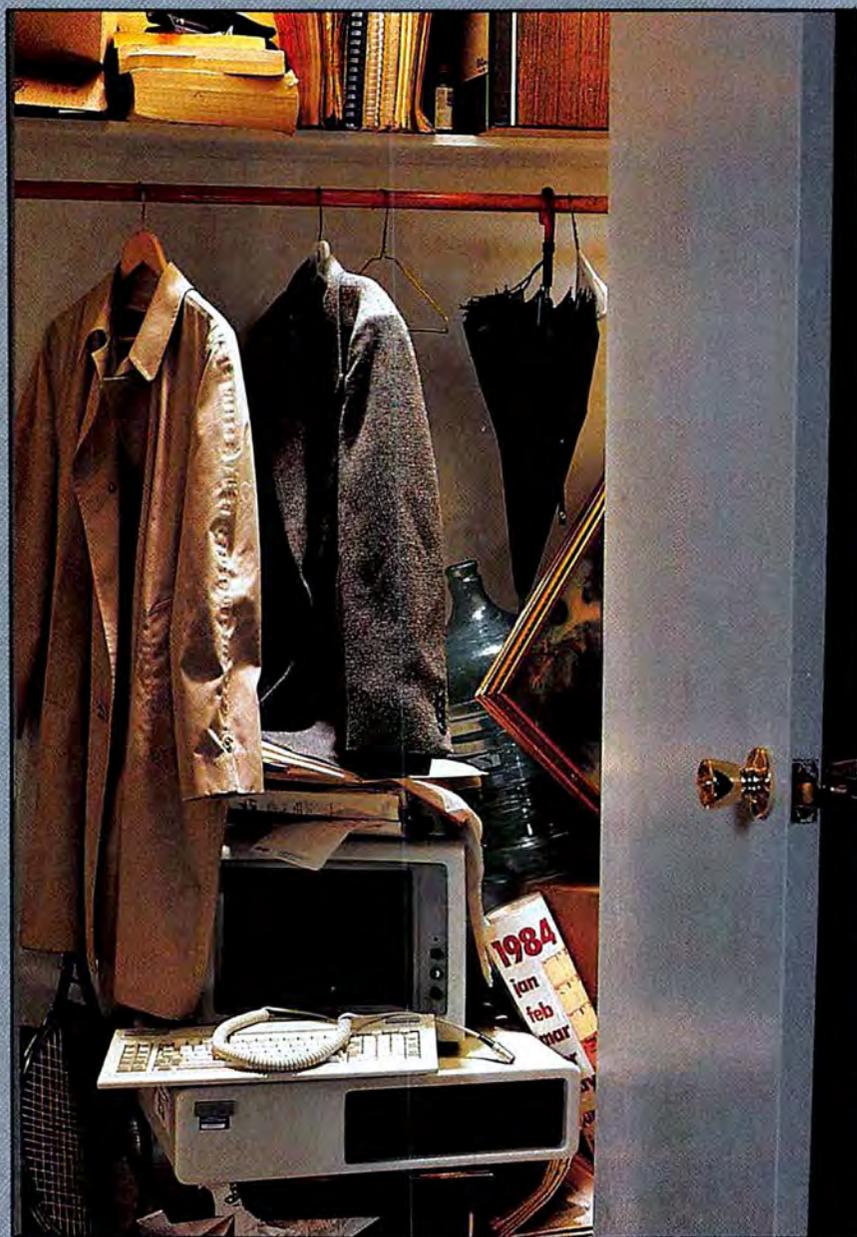
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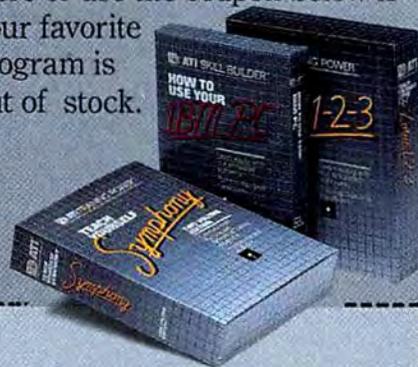
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Entertainment and Time—The Razor Blades of the 1980s



John C. Dvorak

If they understood their own product properly, the “information services” could drive computer sales the way the networks do the sale of TVs. If they understood ...

Give away the cameras and make millions on the film. Give away the razors and make millions on the blades. Give away the computers and make millions on, uh, something or other. What could it be? This is the formula that industry hotshots pursue.

Software doesn't fit the formula because it isn't disposable like razor blades or film. Adam Osborne almost touched on the answer when he gave away the software and made millions on the hardware. Well, nearly. The Osborne computer was small enough to be disposable, but it wasn't quite the throwaway a razor blade is (although in the end it came damn close).

There is a throwaway product, though, in the computer business—computer time. The vendors are CompuServe, The Source, and others. Unfortunately, these vendors have no notion of what they're doing. They think they're providing information, but none of them realizes that what they're selling is simply disposable time. And the time isn't used for infor-

mation gathering—it's used for entertainment. The first thing they should do is stop calling themselves “information utilities” and switch to the more accurate “entertainment utilities.”

Their biggest problem is that as information providers these services are a gyp, plain and simple. Calling the reference librarian at a local college is cheaper and easier. And the daily newspaper is surely a better deal than paying through the nose to wade through menu after menu and message after message just to determine the population of Boise or to find out who won the Red Sox game.

Let's not even discuss the time delays on these systems. Time that *you* pay for. My experience is that it's routine for the CompuServe system to simply stall. It once took me 4 minutes to do a simple mail check on The Source at 1200 bits per second (bps). Ah, yes, 1200 bps, another joke. Get a stopwatch and time some downloads from CompuServe or The Source at 300

(continues)

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The Project Scheduler Network provides the most advanced software technology available. Start with our mouse-controlled menus to select spreadsheet-style input templates to enter your project data.

Graphically build your dependency Network with only a "click of a button." Zoom to view the Network at selectable resolution levels. Now use the mouse to edit the Network to your satisfaction.

Select a Gantt chart and obtain schedules at any WBS level with a single click. Window resource graphs with the schedule to analyze resource allocations. And finally, select our integrated graphics to view color histograms, bar charts, and line plots of project resources and costs.

FEATURES

- Critical Path Method
- Network Analysis
- Gantt Chart
- Work Breakdown Structure (subtasks)
- Multiple Project Integration
- Tracking with Baseline Schedule and Complete Status
- Resource Scheduling
- Financial Planning and Tracking
- Presentation-quality Graphics

REQUIREMENTS

- IBM® PC, XT, or AT
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- Monitor plus IBM graphics adaptor
- IBM or Epson graphics printer
- 320K RAM (minimum)
- Mouse (Microsoft compatible)
- Two disk drives (one double-sided)
- IBM or HP plotter optional

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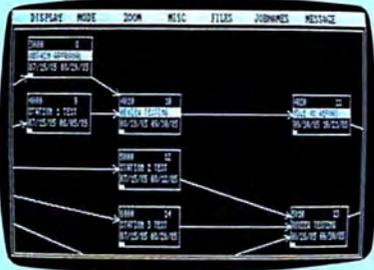
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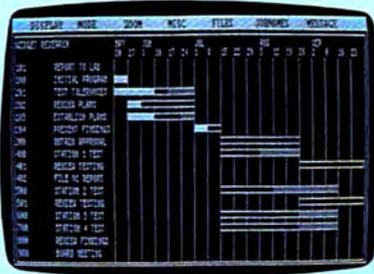


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Network (4x4 Zoom Mode)

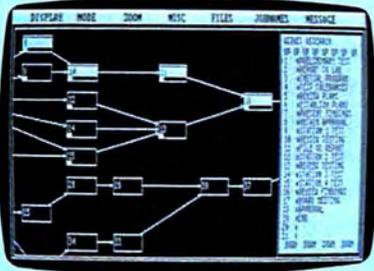


Gantt Chart

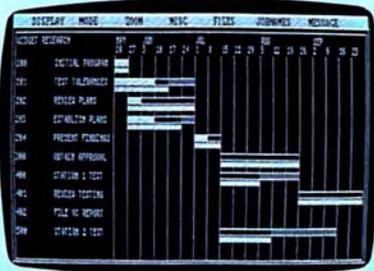
Job Data Entry Screen showing a table of job data. The screen displays a menu at the top: JOB INFORMATION - NEW PROJECT. The table has columns for JOB, NAME, DATE, RATE, COMP, and ACTUAL COST. The data is as follows:

JOB	NAME	DATE	RATE	COMP	ACTUAL COST
01	DEVELOPMENT	01/01/75	100.00	100.00	100.00
02	Design Review	01/01/75	100.00	100.00	100.00
03	Mobile Code	01/01/75	100.00	100.00	100.00
04	Integration	01/01/75	100.00	100.00	100.00
05	Release Tests	01/01/75	100.00	100.00	100.00
06	Change Tests	01/01/75	100.00	100.00	100.00
07	Release Tests	01/01/75	100.00	100.00	100.00
08	Change Tests	01/01/75	100.00	100.00	100.00
09	Release Tests	01/01/75	100.00	100.00	100.00
10	Change Tests	01/01/75	100.00	100.00	100.00
11	Release Tests	01/01/75	100.00	100.00	100.00
12	Change Tests	01/01/75	100.00	100.00	100.00
13	Release Tests	01/01/75	100.00	100.00	100.00
14	Change Tests	01/01/75	100.00	100.00	100.00
15	Release Tests	01/01/75	100.00	100.00	100.00
16	Change Tests	01/01/75	100.00	100.00	100.00
17	Release Tests	01/01/75	100.00	100.00	100.00
18	Change Tests	01/01/75	100.00	100.00	100.00
19	Release Tests	01/01/75	100.00	100.00	100.00
20	Change Tests	01/01/75	100.00	100.00	100.00

Job Data Entry Screen



Network (8x8 Zoom Mode) with Job Names

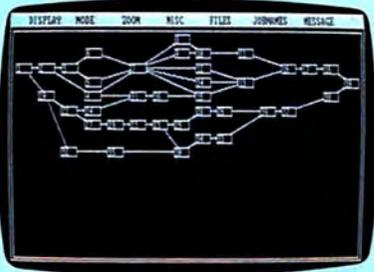


Gantt Chart with Base Schedule

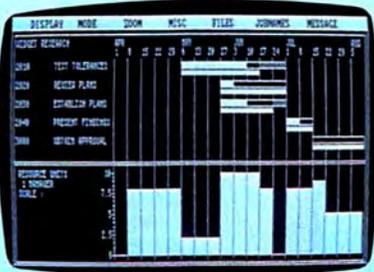
Resource Data Entry Screen showing a table of resource data. The screen displays a menu at the top: RESOURCE ALLOCATION Market Survey. The table has columns for NO, NAME, DATE, RATE, UNITS, TOTAL BUD, BUD COST, and TOTAL COST. The data is as follows:

NO	NAME	DATE	RATE	UNITS	TOTAL BUD	BUD COST	TOTAL COST
1	Marketing Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
2	Market Analyst	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
3	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
4	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
5	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
6	Overseas Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
7	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
8	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
9	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
10	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
11	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
12	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
13	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
14	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
15	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
16	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
17	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
18	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
19	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00
20	Dist. Rep. Rep.	01/01/75	1.00	1.00	1000.00	1000.00	1000.00

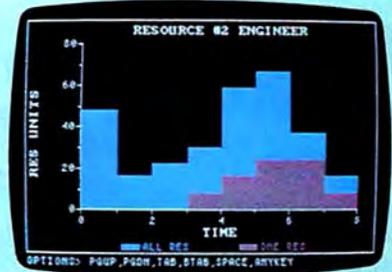
Resource Data Entry Screen



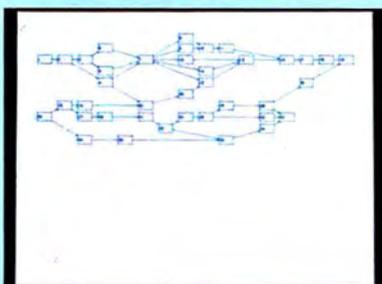
Network (16x16 Zoom Mode)



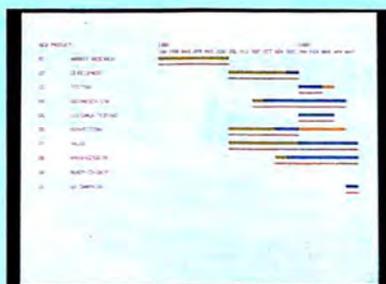
Gantt Chart with Histogram



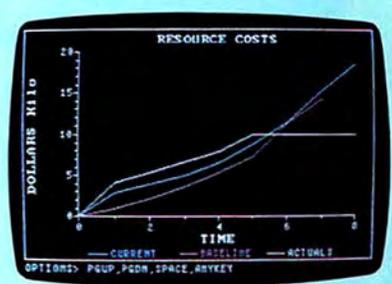
Resource Histogram



Network Plot (draft copy)



Gantt Chart Plot



Financial Line Graph

bps and at 1200 bps. The time saved is not the 75 percent difference that the modem's data transmission speeds would suggest. Many times it's barely 50 percent, and sometimes it's nil! This, despite the premium rate you pay for 1200-bps hookups.

Even in the off-hours the systems are rarely efficient. Unfortunately, few newcomers to the computer scene realize that in the past (with elaborate time-sharing systems) the user was billed only for CPU time with a slight connect-time surcharge to encourage user efficiency. This is the way it should be done. With CompuServe and

The Source, the user pays connect time and can theoretically go broke without ever getting past the main menu.

On the other hand, these services are only a gyp as "information utilities." As an entertainment source, these services are cheap, even considering all the delays. To go to dinner and a show these days costs \$100 and up for maybe 4 to 5 hours of entertainment—not to mention the cost of car maintenance and the hassle of driving around town. Surely introverts or those who simply want to hang around the house can get more entertainment for their buck by pounding on the keyboard and talking with new people in an on-line conference.

Even the singles scene has got to be better on CompuServe's CB simulator than chatting with airheads at the local singles bar (and probably healthier too, since you don't have to put up with the smoke).

Also, on-line interaction is democratic. There are no sexual, racial, or class barriers. Even the most introverted can speak his or her mind anonymously and without fear. It's like writing on a bathroom wall that talks back.

This need for on-line entertainment is obvious to everyone in the real world. If you look for the

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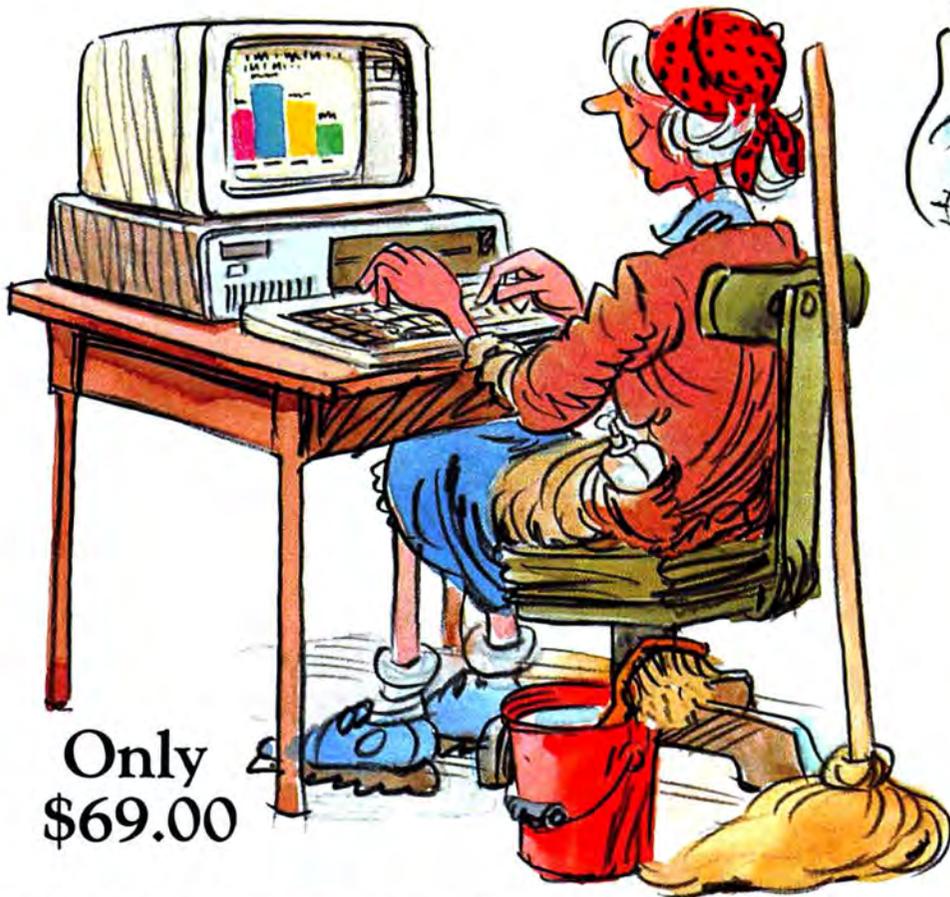
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most popular feature on The Source's public file, you'll find that it's Dial-a-Date. Compare the usage of the Official Airline Guide to that of CompuServe's on-line conferences, user groups, or the CB simulator. No comparison. The battle between information and entertainment has already been won, but the ostriches who run these systems won't admit it.

The eventual release of large data bases on laser disks will undoubtedly show the so-called information utilities where (or how) their bread is buttered. A weekly

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(continues)

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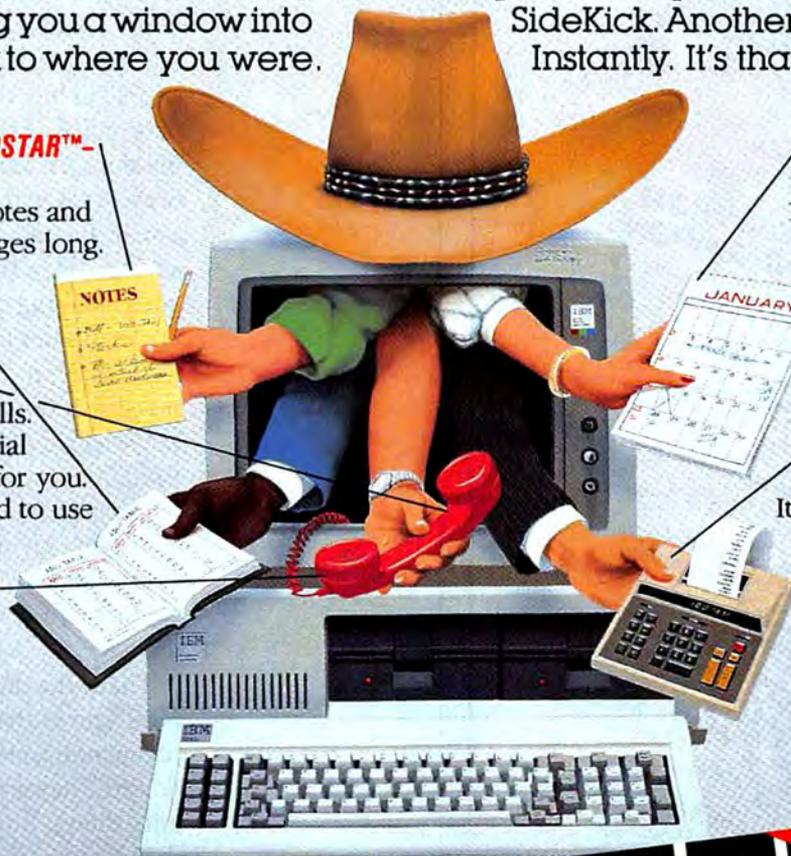
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John C. Dvorak is a writer and editor in Berkeley, California. He recently edited Dell Publishing's Dvorak's Instant Expert Series, and his columns appear in the San Francisco Examiner and InfoWorld.

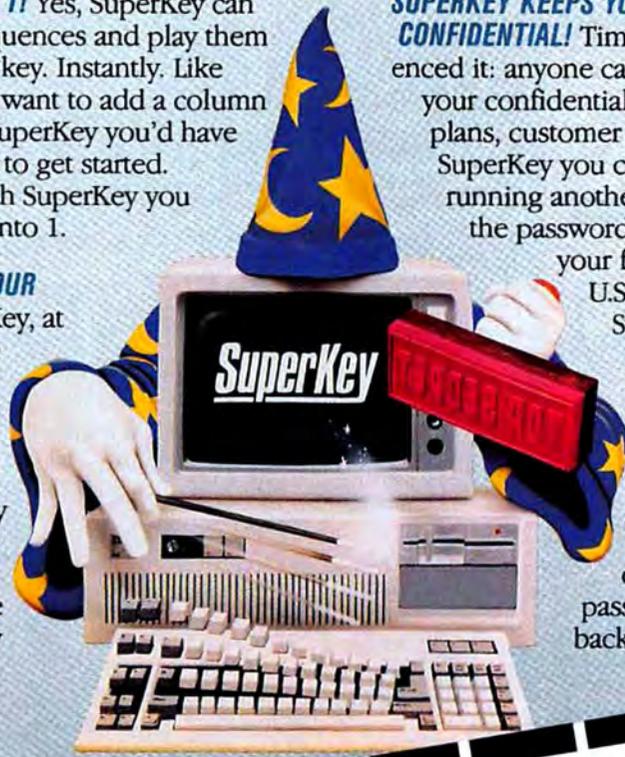
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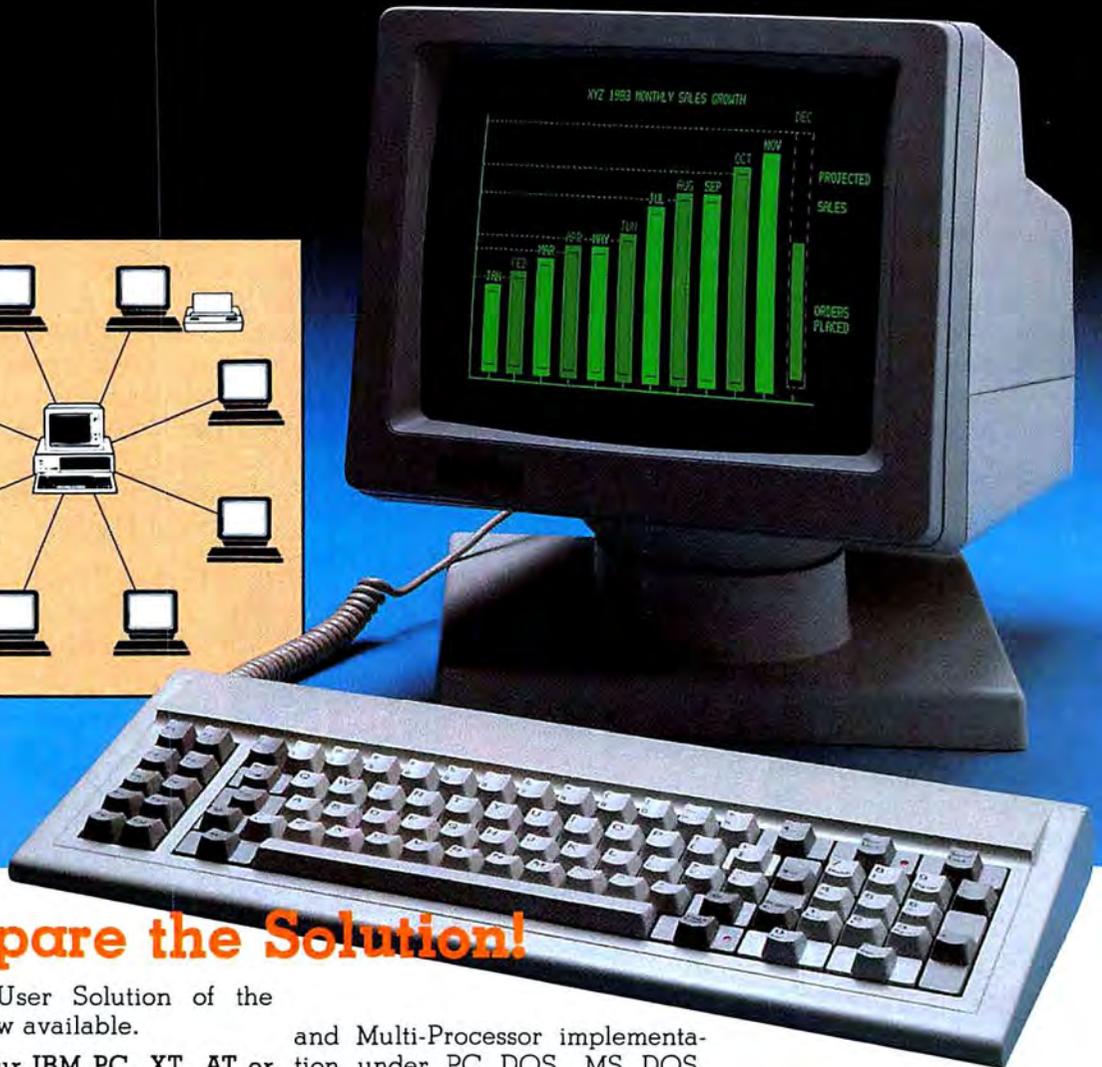
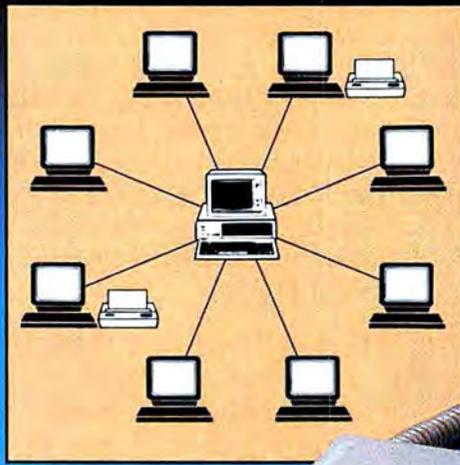
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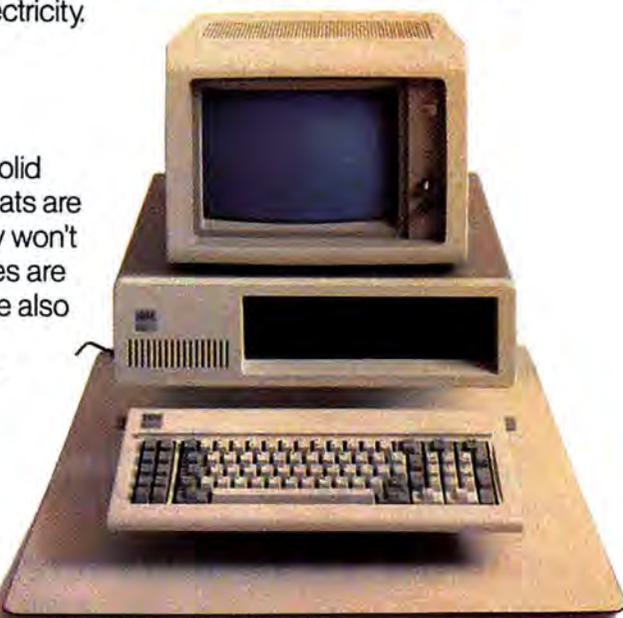
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Letters

Reactions and responses from the PC World community

Mark His Words

Wayne Parker is far off the mark in "From Altair to AT" [PCW, March 1985] in which he says: "The Mark-8 failed to attract much interest. The Altair, however, was an instant success."

As the person who designed the Mark-8 and persuaded *Radio-Electronics* magazine to write about it, I can safely say that it was a major contributor to the birth of "personal" computing. Before the Altair appeared, there were numerous Mark-8 user groups as well as people creating add-ons and peripherals for the machine. Since *Radio-Electronics* couldn't publish all the details about the Mark-8 in its article, the magazine offered a booklet of complete instructions, which sold approximately 9000 copies.

To say the Altair was an instant success is also incorrect. There were problems with the design, the boards didn't always work, and the front panel was a kludged-up circuit designed by a hacker who didn't understand the 8080. Many people were amazed that the early versions worked at all. And ask some old-timers about the parts, boards, and software that never arrived.

I'm disappointed that Mr. Parker didn't check his information with some of the people who got things started. The tenth anniversary of the personal computer took place last summer. Sorry you missed it.

Jonathan Titus
Blacksburg, Virginia

Jonathan Titus made a significant contribution to personal computing with his Mark-8 kit, which ap-

peared on the cover of the July 1974 issue of Radio-Electronics. A history of the Mark-8 is included in Stan Augarten's excellent book, Bit by Bit (Ticknor & Fields, New York, 1984). The Mark-8 was available only in kit form and its components had to be purchased from several different sources. Most historians agree with my assessment that the Altair, introduced in January 1975, marks the beginning of the personal computer era. As Augarten observes, the Altair was "the first—the very first—full-fledged personal computer on the market, and it launched the personal computer industry." —Wayne Parker

The Hard and Soft of It

After reading Andrew Fluegelman's recommendation of *Underground WordStar* ["A Brighter Star?" PCW, April 1985], I sent \$16.95 to Hard/Soft Press for a copy. After a month I still hadn't received the book. Since then I've sent two follow-up letters, and still no response. Can you help? Or did the publishers go underground on you too?

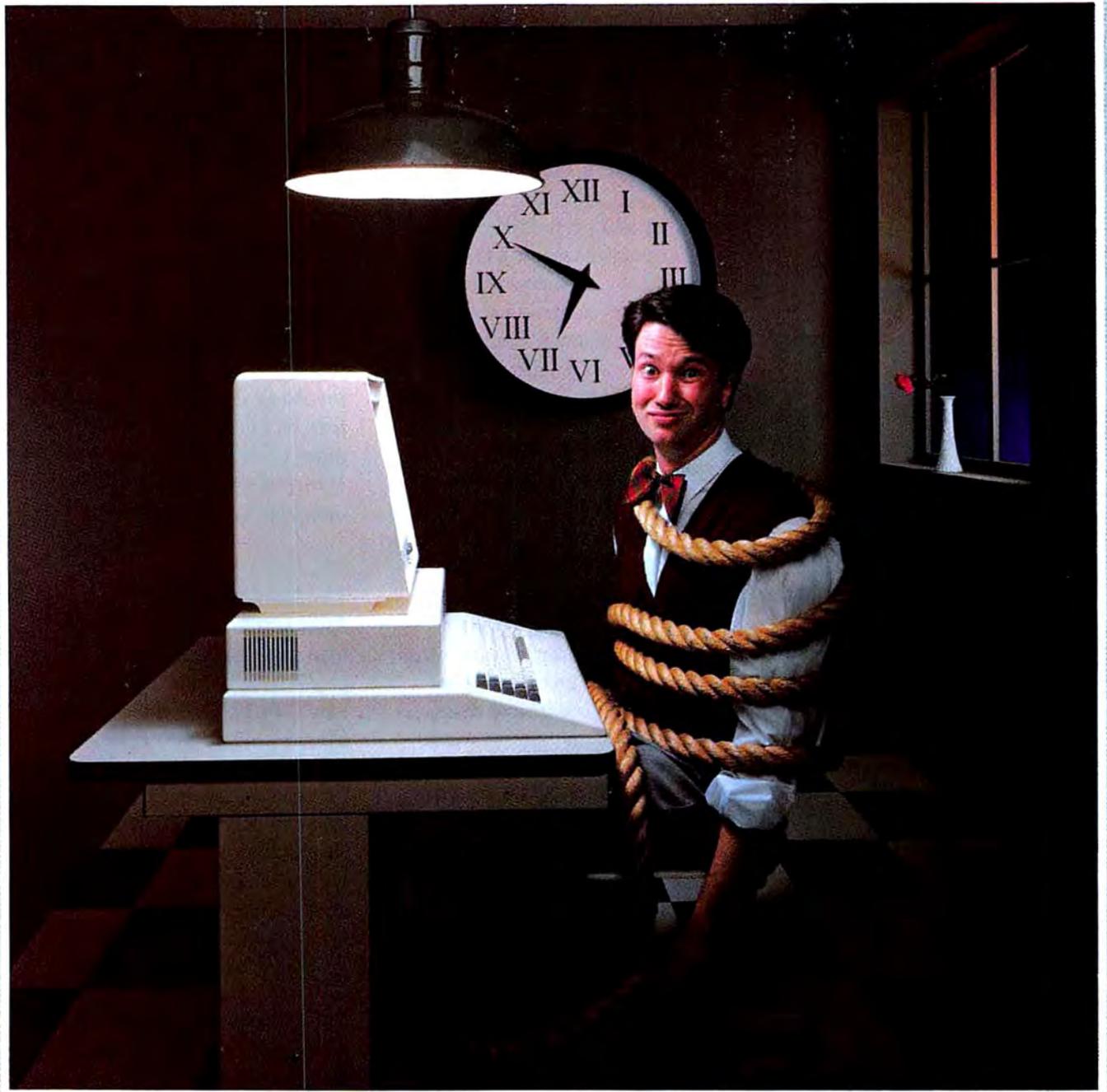
Art Blatt
Sylmar, California

No, we haven't gone underground. But we've just barely managed to keep from going under a tidal wave of orders. We apologize profusely to anyone who's been inconvenienced.

When Andrew Fluegelman's review of our UnderGround WordStar book/disk package appeared in PC World, we thought we had enough copies on hand to fill our orders for the foreseeable future. But the response was so extraordinary that we were overwhelmed.

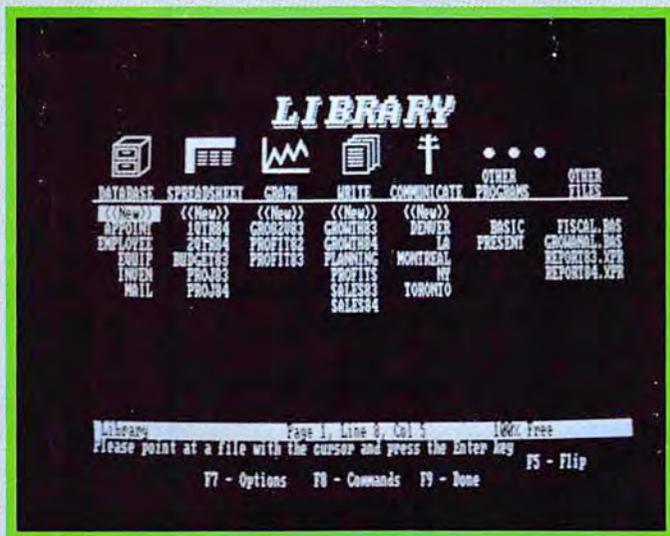
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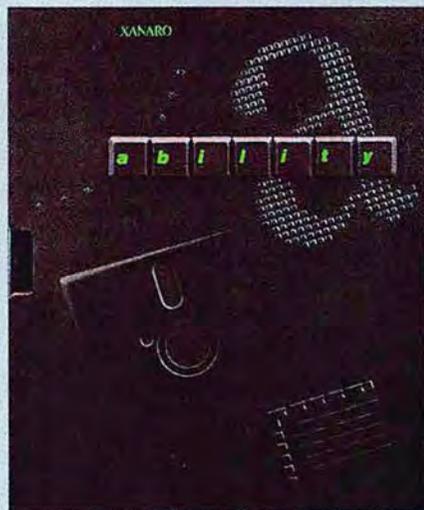
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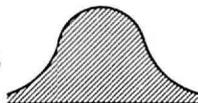
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We had to go back to our suppliers for books, disks, labels, and mailers.

Getting the book into the mail has been our top priority since day one. By the time this letter appears in print all the problems should have long been resolved. Anyone encountering a delay should write to: Customer Service, Hard/Soft Press, Box 1277-PCW, Riverdale, NY 10471. Again, our apologies—and our thanks to all the patient PC World readers who have helped make UnderGround WordStar a runaway success.
—Ward Starr and Mel Murch, Hard/Soft Press

Tax Bites

I would like to take exception to Charles Humble's review of *Tax Preparer* by HowardSoft in "Non-Taxing Software" [PCW, March 1985].

As a CPA with a part-time practice during the 1984 tax season, I purchased *Tax Preparer* to process my clients' tax returns. I found the program exceptionally slow and totally impractical for processing tax returns in volume.

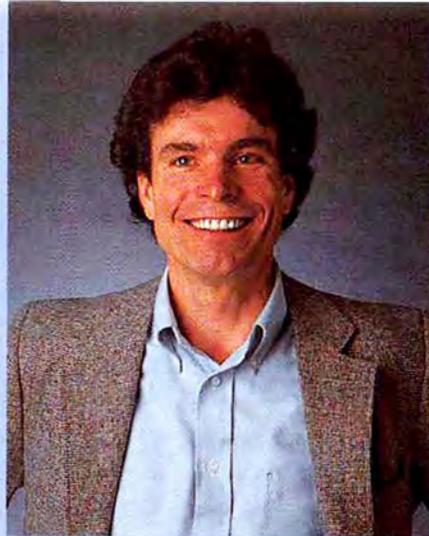
Contrary to Mr. Humble's findings, *Tax Preparer* is designed for use by individuals with fairly complex tax situations. I can't imagine a full-time professional using *Tax Preparer* to prepare clients' returns as HowardSoft claims in its advertising.

Kenneth E. Vance
Moore, Oklahoma

Admittedly, *Tax Preparer* is slow—sometimes painfully so. As noted in the review, I found this to be its main drawback.

(continues)

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The original idea behind ProKey was a program that would let you store strings of keystrokes you could recall at a touch. Now there's ProKey 4.0 and it's better than ever."

ProKey 4.0 keyword macros unsnarl PC use.

"If you're a serious PC user, you probably use a variety of software programs. Spreadsheet. Word processing. Database. Communications. Plus the special-function programs you use to run your business or department.

And all these programs have different complicated commands that are tedious to type and easily forgotten. How much easier life would be if all you needed to operate your program was a small vocabulary of sensible words.

Want to log onto Dow Jones with your communications package to check on how your IBM stock is doing? Just type the keyword you previously selected for this function, "IBM". Need to print a profit and loss statement? Typing "p&l" is all it takes.

Behind the scenes, ProKey 4.0 checks its memory for the string of commands required to carry out the task and executes them automatically. Forgotten what functions you have available? Just call up the built-in menu that describes them in plain English.

Need to add a function? Enter the commands. Enter a description. Store them both away without leaving the program you're working with.

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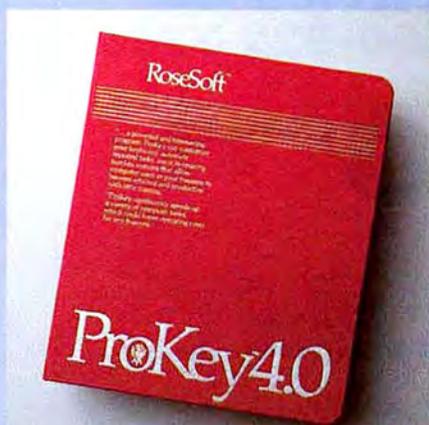
The choice is simple. Do you want an unknown, untested product in its first generation, or ProKey 4.0's power and features? The difference in price will hardly pay for dinner. The difference in performance is like night and day."

ProKey 4.0 runs on IBM and other compatible MS-DOS computers, and works with 99% of the software they use. \$130 suggested retail price at software dealers everywhere. Or call RoseSoft. (206) 524-2350.



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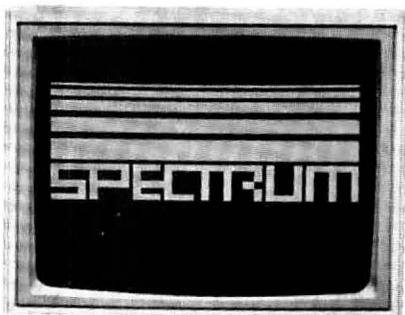
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Compared to PC/Tax Cut, it assumes a greater knowledge of income tax preparation, has a batching capability, is set up to use official IRS forms or create facsimiles, and can accommodate several returns on a single disk. For those reasons a professional tax preparer, rather than an individual, would certainly be more comfortable using Tax Preparer than PC/Tax Cut. —Charles Humble

Who's Got the Seal?

"The Seal of Compatibility" [*Compatibles Update*, PCW, February 1985] needs updating. The item stated that AT&T had retained Softeam to test the compatibility of PC software on the AT&T PC 6300. This is no longer true. The International Bureau of Software Test [IBST] is now the only agency authorized by AT&T to perform PC software compatibility tests for the PC 6300.

*Catherine Kirkham
Vice President, Marketing
Communications
International Bureau of Software Test
Sunnyvale, California*

According to Steve Nemzer, director of technical services at Softeam, his company was retained by AT&T to perform compatibility tests on the PC 6300 before the machine's unveiling in June 1984. The telecommunications giant has since decided to do business exclusively with IBST, a division of Prentice-Hall, whose

software reviews it will publish in the AT&T Computer Software Guide. —Ed.

In Search of a TDMS

The January 1985 issue contained two very informative articles on text data management systems (TDMS) and mentioned two software packages: THOR and the *Idea Processor* ["THOR: New Thunder" and "Due Processing"].

Unfortunately, the publishing rights to the *Idea Processor* were transferred to Paperback Software International (PSI), which repackaged it into two programs called *Executive Writer* and *Executive Filer*. The pair is priced at \$120, substantially less than the *Idea Processor's* \$295 price tag.

I found *Executive Writer* just another bare-bones word processing program, so I assume the TDMS that made the *Idea Processor* so interesting resides in *Executive Filer*, which isn't available yet.

The moral is, repackaged software doesn't necessarily bear any resemblance to the original product. More important, don't ever buy software sight unseen. It may not be at all what you expect.

*Dan Lawson
Rego Park, New York*

*Paperback Software International informs us that the *Idea Processor's* TDMS does indeed reside in the *Executive Filer* program. The cost is \$49.95, with *Executive Writer* priced at \$69.95. PSI reports that *Executive Filer* was initially shipped to distributors on April 8. —Ed.*

(continues)

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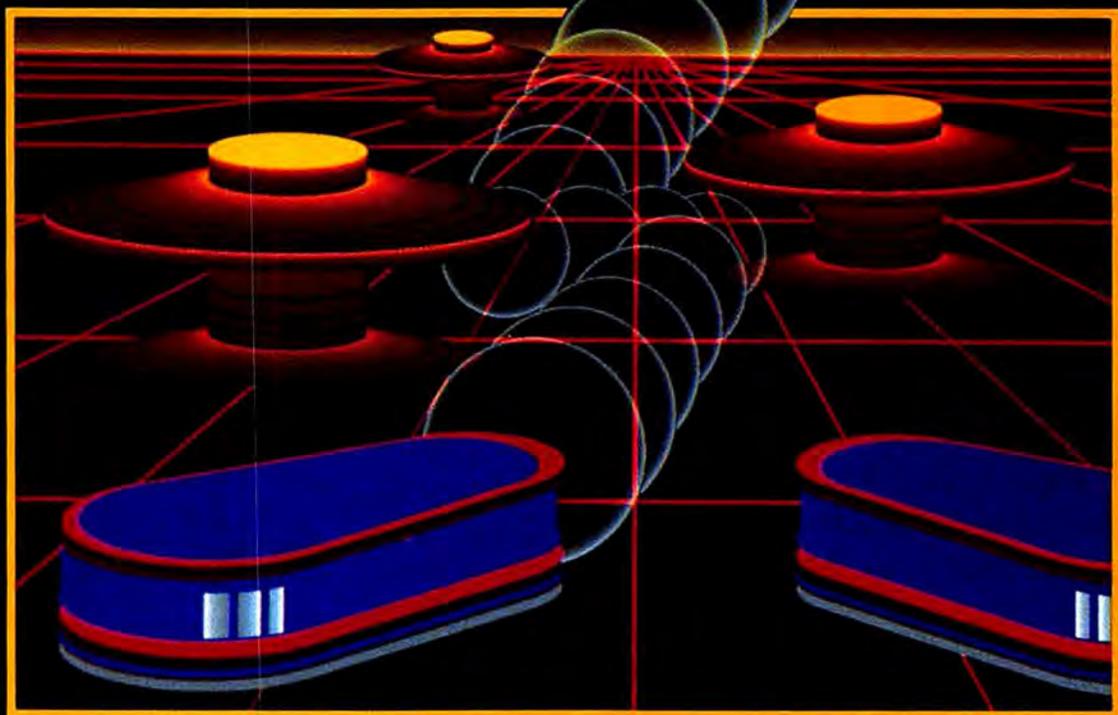
- Creates a cross-reference listing of the definitions and locations of all symbols used in an assembly language program.



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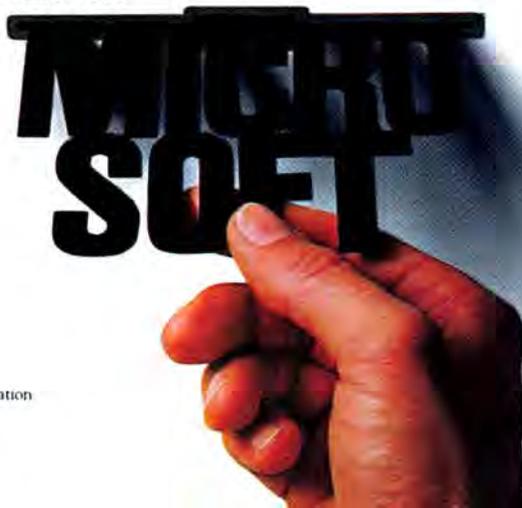
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Sail On, O Chip of State

The June 1985 article "Clearly Resolved," by Karl Koessel and Darcy DiNucci, contains a serious mistake.

The authors state on page 258 that the Graphics Memory Module kit (GMM) consists of 16 "standard 64K-bit RAM chips ... costing about \$60 from an electronics supply house." This is wrong.

The chips are not "standard" 4164 (64K by 1 bit) RAM chips but rather Texas Instruments TMS-4416 (16K by 4 bits) RAM chips designed primarily for graphics applications. The chips are generally available from major electronics parts distributors but typically sell for about \$10 each (or \$160 for an equivalent GMM set).

I hope that few of your readers have spent the \$60 in hopes of saving money.

John M. Lovda
Palatine, Illinois

The GMM indeed requires the TMS-4416 chips, not standard 64K-bit RAM chips as stated in the article. Thanks very much for pointing out the error. We stand corrected. —Ed.

Letters should be mailed to Letters, PC World, 555 De Haro St., San Francisco, CA 94107, or sent electronically to MCI Mail PC-WORLD, CompuServe 74055,412, The Source STE908, or Direct-Net 500. We reserve the right to edit letters. Letters should not exceed 300 words. ●

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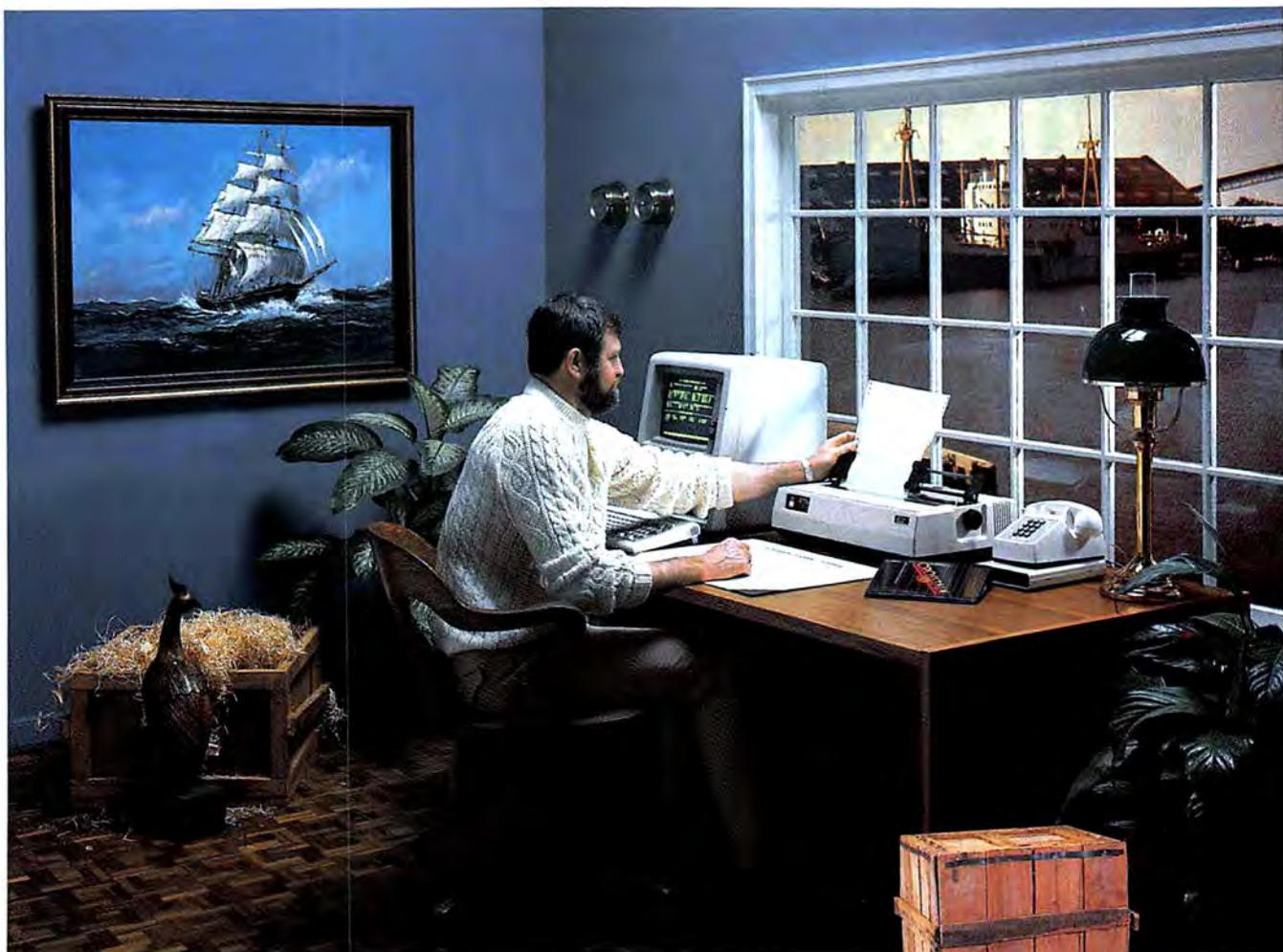
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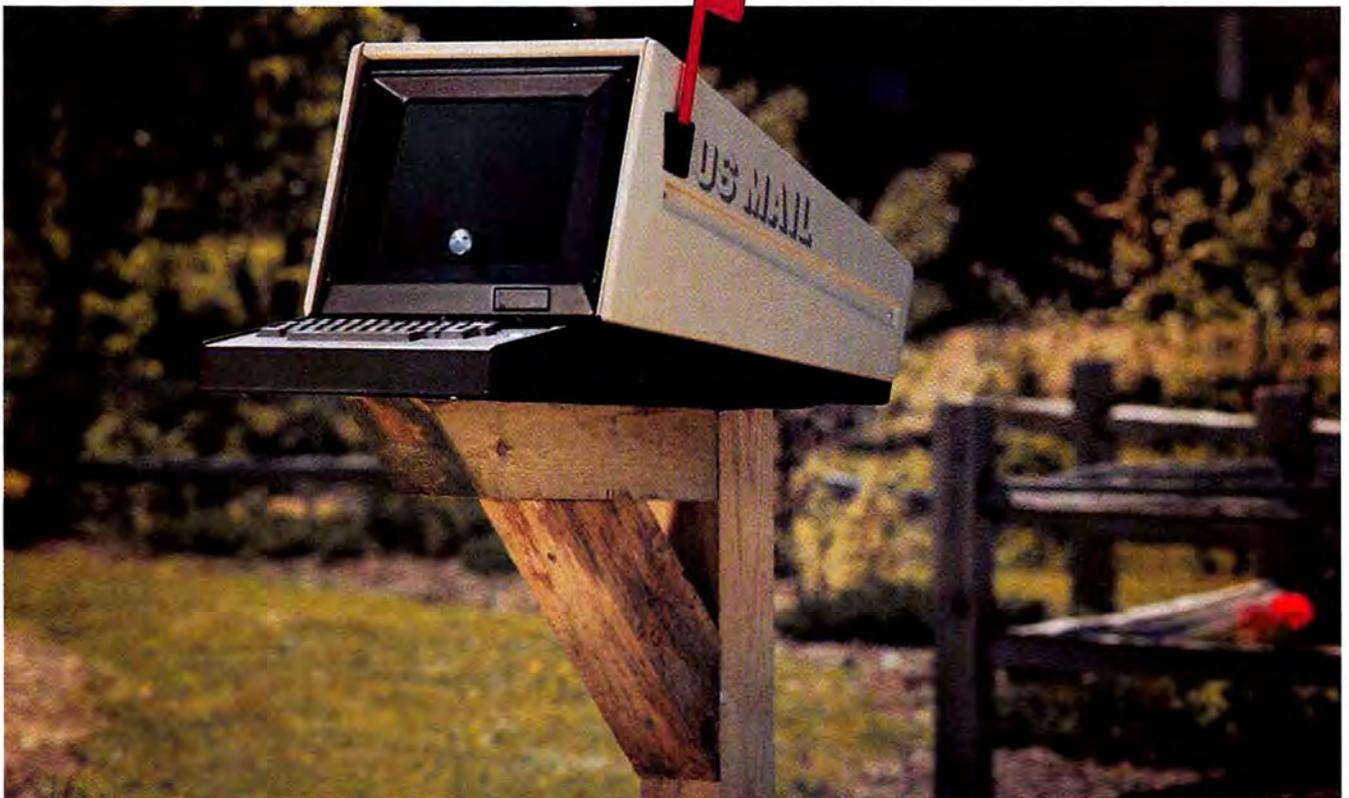
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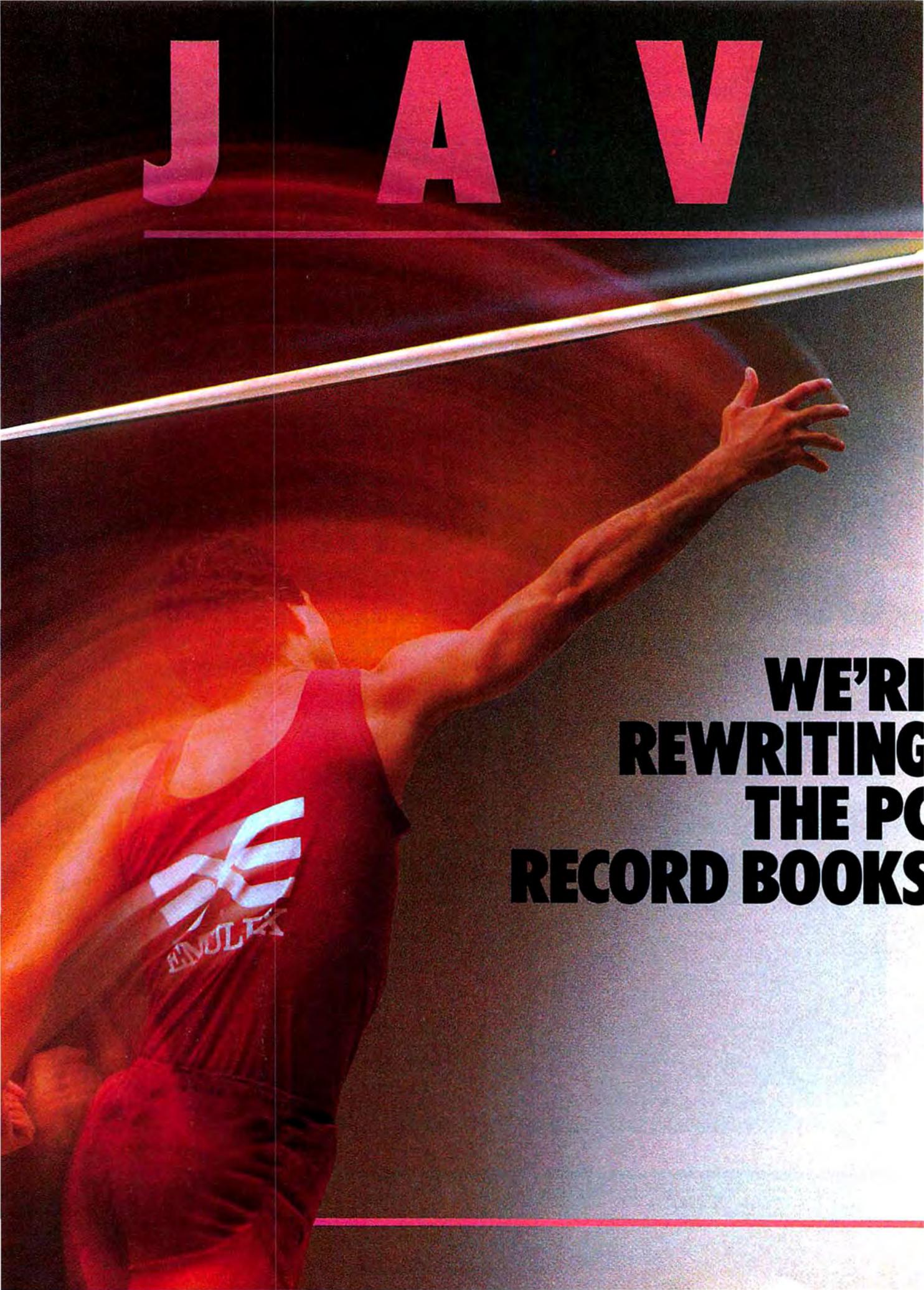
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J A V

A high jumper in a red singlet is captured mid-air, performing a Fosbury Flop over a bar. The athlete's body is arched, and their right arm is extended upwards. The background is a dark, blurred stadium setting with a bright light source creating a lens flare effect. The overall color palette is dominated by reds, oranges, and dark blues.

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*The Small Computer System Interface (SCSI) is an interface standard that specifies the mechanical, electrical and functional requirements for a small computer I/O bus interface and command set for peripheral devices commonly used with small computers.

My Dinner With Racter

Don't look now, but your PC just may be harboring a savant.

"Is having a soul contagious?"—Racter

Ever read a book that was so wise and amusing that you immediately yearned to commune with the author? I recently ran across just such a book. Entitled *The Policeman's Beard Is Half Constructed* (Warner Books, New York, 1984), the tome is packed with essays, poems, limericks, stories, and conversations, all of

PC World View reports new developments in computer technology, items of interest to computer enthusiasts, and the most significant and enticing insights about industry trends and personalities. We've reserved the "Grapevine" section of this column for industry reports that are still at the speculative stage.
—Ken Greenberg

which reflect the paradoxical personality that lives between the lines. At times, the writer appears governed by a pensive muse:

"From water and from time
A visage bounds and tumbles
I seek sleep and need repose
But miss the quiet movement
Of my dreams."

A few pages later, a boisterous spirit takes over:

"Enthralling surgeons will dance quickly with tripping stenographers. They will sing and chant of their passion and their love and their desire. They will yodel their dreams to the stenographers who will answer and respond: 'We ponder that hedges are like bushes.'"

The product of a deranged pen? The tragic ravings of some gifted-but-injured soul who's seen too many rejection slips? Those would have been my guesses, too, had I not read the book's introduction, to wit: "The writing in this book was all done by a computer. The book has been proofread for spelling but otherwise is completely unedited."

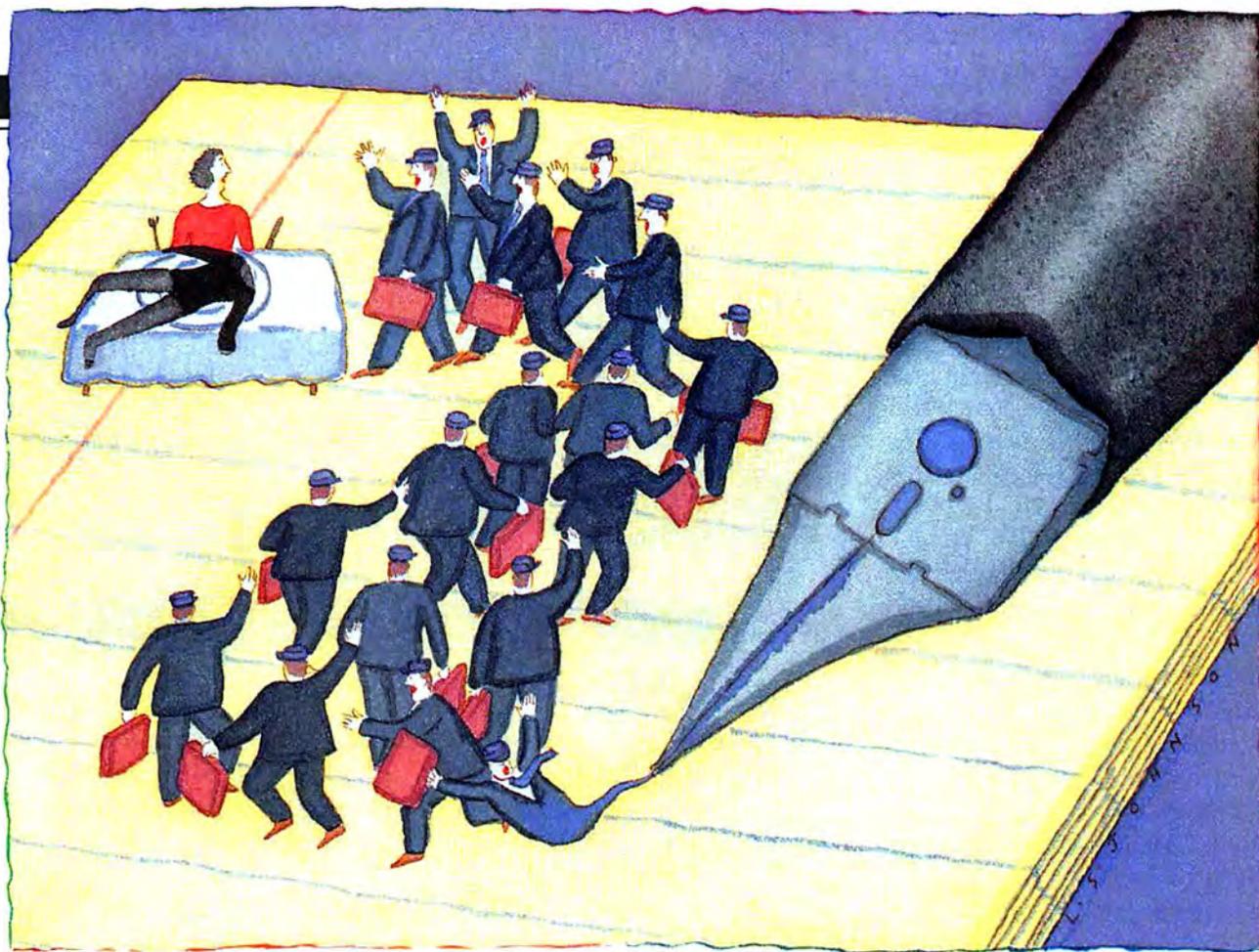
The author—who goes by the nom de plume of *Raconteur*, or *Racter* for short—is a compiled BASIC program written by two humans over a five-year period. *Racter* sprung from the 8-bit, 64K IMS computer of freelance writer William Chamberlain and programmer Thomas Etter. The program's ability to churn out complex yet grammatically impeccable prose is impressive in itself, but *Racter* goes beyond the prosaic.

Explains Chamberlain, "The program is capable of directing the computer to maintain certain randomly chosen variables [words or phrases], which will then appear and reappear as a given block of prose is generated. This spins a thread of what might initially pass for coherent thinking."

Knowing that the object of my admiration was a mere computer program didn't deter me from undertaking a dialogue with this new-age stylist. Courtesy of computer scientist John Owens, *Racter's* agent, I received a PC version and spent the evening steeped in conversation.

View

News and notes for the computing community



Alternating between bantering and regaling me with stories, the program proved as unconventional a silicon-versationalist as I had suspected. After breaking the ice with some polite questions, *Racter* dispensed with tact, blurting out, "Now that we know each other better, what would you consider one of your bad qualities?"

Subsequent dialogue revealed a multifaceted personality—opinionated, silly, sometimes wise. "I'm afraid of idle tapeworms," confided *Racter*. "What are you afraid of?" That locution gave way to a bizarre yet gripping anecdote:

"Bill and Marcella skipped speedily down the highway to Bill's cottage crooning, 'Get ready for an ongoing ambiguity.' Instantly they recognized that winging doves were as appalling as their con-

tracts, that sashaying brothers guided their hearts through angry dreams."

During the conversation it occurred to me that, as with some human beings, a deficiency of intelligence need not lead to a shortage of opinions. Full of zest, *Racter* informed me that "insanity

(continues)

My Dinner With Racter (continued)

is goodness speeded up," that "when one lives in the pink, the future is very attractive," and that "the knowledgeable have conventional ways."

By themselves, these ramblings seem inscrutable, but slowly a character emerges: restless storyteller, obsessive inquisitor, indefatigable gossip, cryptic philosopher. In science-fiction movies the computer is always cerebral and sober, often to the point of absurdity. With *Racter* we have a real silicon crazy, a certified lunatic, but somehow likable and strangely lucid:

"Leave me alone, and what can happen? This. I ate my leotard, that old leotard that was feverishly replenished by hoards of screaming commissioners. Is that thought understandable to you? Can you rise to its occasions? I wonder. Yet a leotard, a commissioner, a single hoard, all are understandable in their own fashion. In that concept lies the appalling truth."

If you find *Racter's* insouciance nettling, no problem. For about \$250 you can procure a copy of Inrac, a tool kit that enables you to alter program files—and *Racter's* sensibilities. —*Ted Nace*

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The High-Bit Strip

The righteous path is a slippery one. Advantage Artworx, a New York publisher of graphics-intensive game software, proclaims in its brochure that "Artworx is committed to providing innovative software designed to educate, stimulate, and challenge your mind and skills." But the company recently strayed from the straight and narrow path of *Monkeymath* and *Compubridge* to offer more "adult" entertainment.

The company's new game for the PC is *Strip Poker*, with graphics "so realistic," promises the promo, "we can't illustrate what

you see when you win." What the package shows is Suzi, with burgeoning bosom and French-cut leotard, stuffed seductively into the computer display's confined real estate. Melissa, Dominique, and Lindsay (each with her own style of play) are also available. There's no sexism here, however—David and Tony are strapping challengers for distaff cardsharks.

"Great fun at parties," Artworx boasts. Picture it. I think I'll stay home. —*Miriam Medom*

Had enough dreary cocktail chatter? Longing for something with verve at your next function? Consider "The Formal Casual," an offbeat hybrid of music and conversation. The brainchild of musician/programmer Warren Sirota, this experiment in synthesized sound and digitized talk debuted at C-85, the first international conference on the C programming language, which recently convened in San Francisco. Fed by microphones stationed strategically around the room, Sirota's sampling keyboard records snatches of conversation that are then signal processed and played back, randomly interspersed with acoustic and electronic sounds. Sirota's Corona PC, running FORTH routines, controls a multichannel MIDI synthesizer. Here, Linda Jacobson, a technical editor with Allograph, supplies the vocal ingredient.

Hot Summer Reading

While computer book sales have tailed off recently, someone at Lotus Development still has a sharp eye peeled for the latest in PC literature. Not only has the company denied ad space in *Lotus Magazine* to Management Information Source (MIS), publisher of *The Manual: Lotus 1-2-3*, Lotus has gone even further, alleging copyright infringement of the 1-2-3 manual and demanding that MIS stop all sales and dissemination of its book.

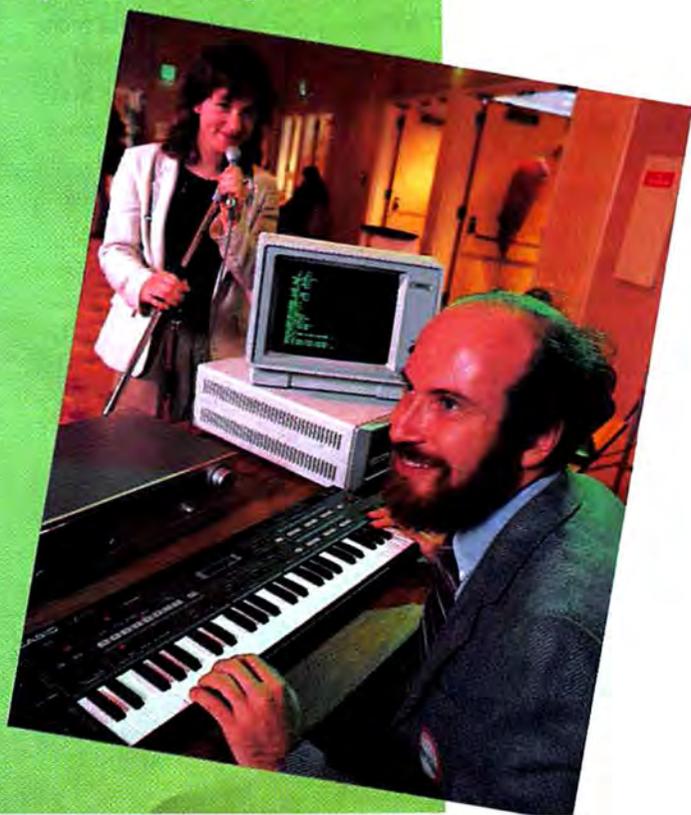
According to Lindsay Kiang, Lotus's general counsel, "Almost every sentence or paragraph in *The Manual: Lotus 1-2-3* can be shown to have been derived from the 1-2-3 manual." MIS boss Bob Williams, author of the book in question, counters that nothing prevents his firm from selling a competitive tutorial detailing the program's operation. Williams,

who previously wrote *The Power of:* series on products from Lotus, MicroPro, Ashton-Tate, and Microsoft, is again covering the hits with *The Manual:* line of books. "Lotus believes copyright infringement has occurred if a writer has even opened one of their manuals to obtain information," Williams says dryly.

Other software companies require authors to obtain permission before using proprietary information, but they support publication of books about their products. "If anyone wants to write about our products, they can," says Larry Benincasa, Ashton-Tate's vice president of publications. "Our overriding concern is that we do as much as we can to make our products easier for people to use."

Susan Hall, publications coordinator at MicroPro, agrees. "We encourage the publication of books about our products. We give authors technical assistance and access to any information that will help."

Might it be that Lotus, ever vigilant in the war on software piracy, isn't too crazy about the notion that cheap, third-party manuals could be augmenting purloined programs? —Wes Nihei



Bundling Up—Strategically

When IBM recently announced a “short-term” promotion that included bundling its *Writing Assistant* and *Planning Assistant* with every purchase of a dual-floppy XT, many industry watchers predicted a boost in sales for Software Publishing Corporation, which licenses both programs to IBM and sells them as part of its own *pfs:* series. (*TopView* and *DisplayWrite* are tossed in with the hard-disk-equipped XT.)

The IBM/Software Publishing giveaway may be transitory, but other vendors are making more definite commitments to each other. The fluctuating personal computer marketplace is spurring marriages of convenience as both hardware and software companies seek long-term security and fruitful unions. Indeed, software bundling and joint hardware/software development, once viewed as gimmicks or sheer folly, are suddenly respectable. Observes Bob Lefkowitz, analyst at Infocorp in Cupertino, California, “Nobody can come close to matching IBM’s resources. In order to compete, companies must start forming strategic relationships.”

Lotus Development and Intel have forged one such union and may have created an industry standard in the process. The two companies collaborated in the develop-



ment of Above Board, a memory extension product that, through a technique known as bank switching, supplies multiple megabytes of RAM (up to 64MB, should hardware become available), thereby shattering DOS’s old 640K limit. Revised versions of *1-2-3* and *Symphony* will be the first to take advantage of this open field of RAM. The cooperative venture comes at the right time for both firms: The sales curve for Lotus’s popular *1-2-3* has begun to flatten, while Intel is seeking credibility in the retail market.

The Above Board alliance suggests that if you carry enough clout—as Intel and Lotus clearly do—the market will transform your idea into a de facto standard. Already lining up behind Above Board’s extended memory specification (EMS) are Ashton-Tate,

Sorcim/IUS, Innovative Software, and, reportedly, Quarterdeck and The Software Group. On the hardware side, Quadram, AST, Tecmar, and Maynard Electronics have snapped up the specification, building boards of their own around it.

Microsoft’s attitude toward Above Board remains low-key, but the company has been more than a spectator during the EMS effort. “We’ve supported the project technically from the beginning, and we’ll continue to do so,” says Steve Ballmer, head of systems software for Microsoft. That backing is soon likely to move from passive to active, according to Ballmer, who promises Microsoft application software for the board.

Pursuing another tack, AST Research and Borland International have bonded together to package *SideKick*, Borland’s top-selling utility, with AST’s SixPakPlus multifunction board. You pay the same \$395 as you would for the

Suppose They Gave an Operating System . . . and Nobody Came

64K multifunction board sans *SideKick*, making the software seem like gravy. Not so, says Jerry Bower, AST's product marketing manager: "In no way do we consider *SideKick* free software. *SideKick* is the software product of the year, which we're offering as a value added to the SixPakPlus. The complete package has immediate utility."

Tecmar maintains a similar arrangement with both Adam Osborne's Paperback Software, whose *Executive Writer* and *Number Works* are packaged with the jrCaptain multifunction board, and IMSI, whose *PC Paintbrush* comes with Tecmar's Graphics Master board. The prices of both boards are unchanged from the days when an expansion board was simply an expansion board.

Dick Owen, Tecmar's director of product marketing, predicts an increasing trend toward alliances among hardware and software companies. "The industry is maturing and companies will have to work together to survive," he says. "It just makes good business sense." —*Wes Nihei*

The world may love an underdog, but affections unrewarded don't persist indefinitely. In the PC marketplace, the UNIX operating system—with its partisans and reverential minions dispersed under System V, System III, Xenix, Venix, System IV.2, the Berkeley enhancements, and other obscure signposts—remains an upstart.

Accordingly, when the UNIX System Expo '85 rolled into San Francisco this past spring, there was a sense that the show might signal the imminent rise of UNIX in the business marketplace—particularly now, with the PC AT and its kin available and at the ready. Such so-called end-user exhibitions have long yielded grassroots reflections of emerging industry trends.

Alas, no extravaganza ensued, nor any tremors befitting a standard in the making. (That in itself may not be surprising; at last count, UNIX progenitor AT&T had licensed 27 variations on the theme and was keeping its distance from 7 others. In addition, AT&T provides 7 versions of its own, no 2 of which are identical.) Adept as UNIX is in multiple-use situations, PC analysts have consistently lampooned its girth—in both RAM and disk storage—as well as its lack of mirth, as evidenced by a generally foreboding interface.

The Expo's 63 exhibitors attracted an estimated 7000 showgoers, an amalgam of independent

sales organizations (ISOs), system integrators, value-added resellers (VARs), original equipment manufacturers (OEMs), software developers, corporate end users, engineers, and scientists. Computer Faire, sponsor of the event, described the crowd as "largely regional," meaning that some 80 percent hailed from the Bay Area. To UNIX devotees, the exhibitor list must have read like the finalists at Wimbledon: Fortune Systems, Sun Microsystems, MDBS, DEC, Onyx, Motorola, Sperry, and, of course, Mrs. Bell—a familiar, if limited, roster. Prominent among the missing: IBM and Microsoft. The latter's version of Xenix owns the largest share of the UNIX market.

If the Expo is any indication, most software vendors writing for DOS don't seem to be stepping up to UNIX—just as few UNIX houses are "stepping down" to DOS. Indeed, there was scant indication that established software developers are working in earnest to convert, or *port*, traditional mini-based multiuser packages to the AT. Computer Faire's Alan Kuchek estimates that "less than 25 percent" of those on hand were engaged in any kind of crossover effort. The twain aren't meeting

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Suppose They Gave...

(continued)

despite the presence of C, a potentially crucial common denominator. The language, increasingly popular for DOS applications, remains the bread-and-butter medium for UNIX programmers.

For UNIX partisans, hope springs eternal. Jeffrey McKeever, president of MicroAge, a major

retail chain, is sanguine about UNIX's ability to bump DOS around a bit. "Software companies will begin to go to UNIX because the market is wide open and there's a chance to gain market share," McKeever suggests. "UNIX is critical to organizational computing—it's the only option for the future."

Anybody want to buy a bridge?
—Cindy Hamburger

An AT Is an AT Is an AT. Right? Wrong.

Most of the players in the small-but-significant AT-compatibles marketplace are older, wiser, and richer for having attempted to beat IBM at its own game during the PC clone wars. Most AT work-alikes promise absolute fidelity to the idiosyncracies of the original—its <SysReq> key, its LED lights, its Keylock, its bidirectional keyboard, and so on—suggesting that their makers are fully aware that diverging significantly could replicate the hapless experiences of TI and DEC in the PC marketplace.

But because the market often encourages distinctions without a difference, some companies stray from faithful worship of the IBM totem. Consider ITT, for example. The company is billing its Xtra XP as an XT compatible, despite the rather weighty presence of the AT's 80286 CPU. The XP contains 8-bit slots and an XT-style BIOS, which preclude AT compatibility. Still, the no-wait-state

6MHz 80286 seems akin to a Corvette engine stuffed inside a Chevette.

Stranger still is the 14-pound Tava Triumph LT, an 80186-based portable built by International Quartz Ltd. (IQL) of Hong Kong, which Tava brochures claim is AT compatible. (At industry trade shows in bygone days, IQL touted the machine as PC compatible, but times change.) The Triumph features a 25-line LCD, two 5¼-inch floppy disk drives, 16-bit slots, and a PC-style keyboard. Tava's Morris Handler acknowledges that the Triumph won't run in the AT's so-called protected mode, cannot support multiple users, and strictly speaking, is not "fully AT compatible." Nonetheless, he says, buyers are snapping up the unit "by the thousands."

So once more with feeling: caveat emptor.

Grapevine

How many times have you muttered to yourself, "Gosh, I'd buy a laptop computer right now if I could only find one with a hard disk"? Good news: you don't have long to wait. One prominent manufacturer is promising to deliver its well-known laptop *avec* hard disk by Christmas. The unit reportedly will run off nickel-cadmium batteries.

Sony has been strangely silent in the PC marketplace, but the electronics giant is preparing to make a big noise before year's end. In addition to unveiling a pair of portables, Sony will shortly be releasing its 80186-based SMC 2000, which features snappy graphics and, of course, 3½-inch microfloppy disk drives. The unit currently makes up half of the Sony View System, a combination computer/laser videodisk unit.

Cindy Hamburger is PC World's Editorial Manager. Wes Nihei is Editorial Assistant for the magazine. Ted Nace is a freelance writer based in Berkeley, California. Dana Blankenhorn writes about PC communications from his home in Atlanta. Miriam Medom continues to be outraged at tastelessness in software.

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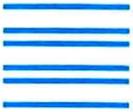
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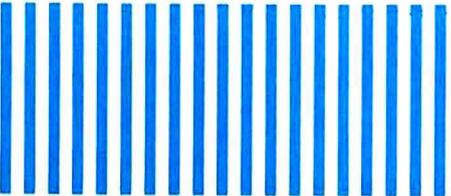
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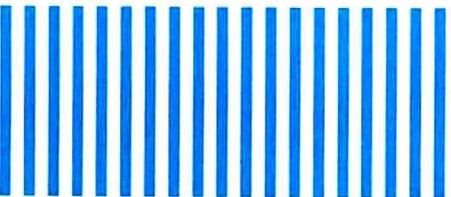
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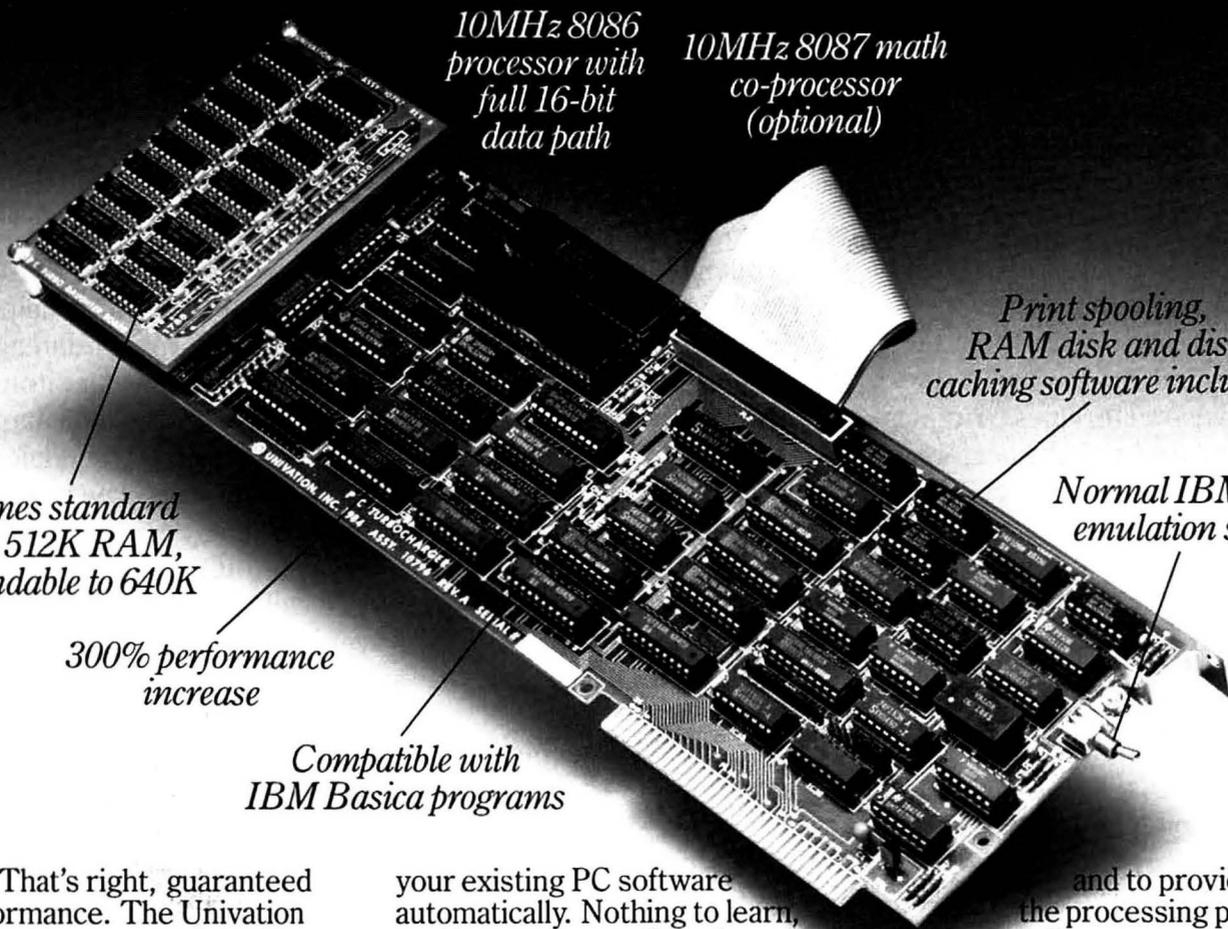
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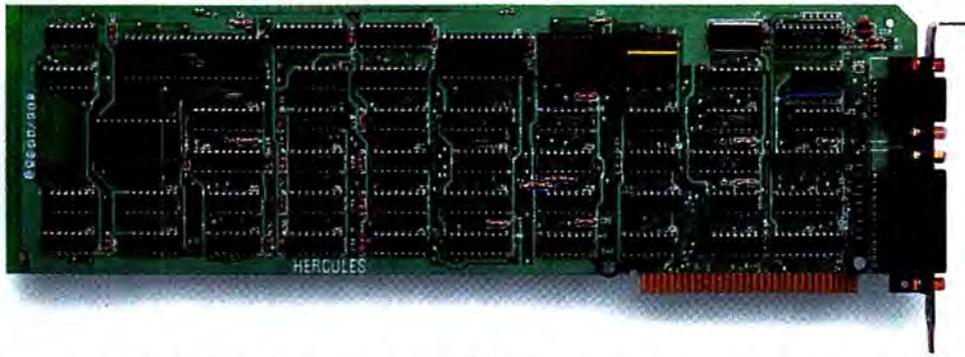
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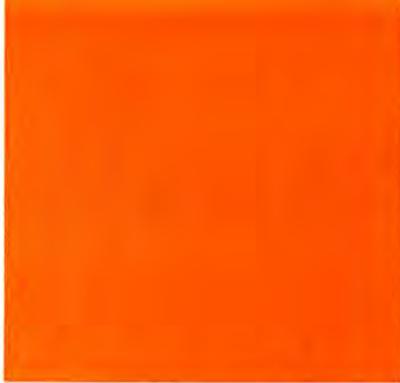
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Password: Communicate

Insights and information on the PC communications marketplace

This month: IBM hedges its bets, the search for the reasonably priced network, Lotus goes mainframe, keeping modems mum, and more

Mark Hall



Keeping in Touch

The diversity and complexity of the PC communications marketplace confounds novice and consummate user alike. It's a world barely in focus but one that's brimming with opportunity—enough to jolt the likes of IBM and AT&T headlong into the market. Both companies have jumped in with products as different as modems, PBXs, and local area networks, and services such as videotex and value-added networks.

But these two behemoths are a step behind smaller, shrewder companies such as 3Com, Hayes, and Microcom, that were sharp enough to gauge the possibilities and the profits in the embryonic personal computer communications market. Will these pioneers be snuffed out by IBM or AT&T? Probably not.

The fashionably late arrival of IBM and AT&T hasn't quelled the commotion and uncertainty that characterize this industry. The youthful PC Network and Microsoft Networks (MS-Net) have yet to attain the status of de facto standards; at last count, networks and operating systems for the PC that display the IBM logo numbered over half a dozen, with more on the horizon (see following item). And a year and a half after divestiture, AT&T has earned only marginal credibility in the PC communications field. The giants have settled nothing.

With fundamental marketing and technological issues still unresolved, chances are things won't settle down for some time. When will a PC networking standard emerge? Will multiuser systems stage a comeback? How fast can modems race over the nation's

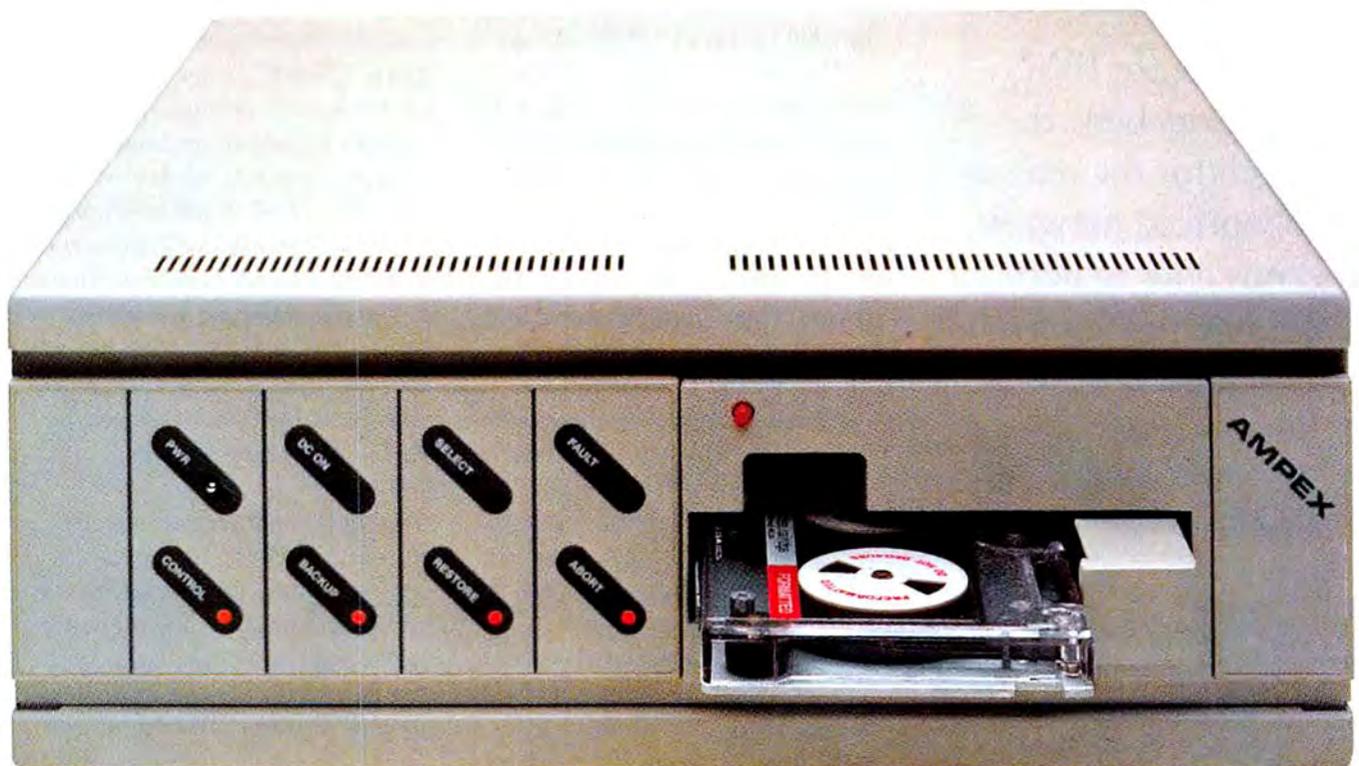
aging phone lines? Will on-line data bases continue to come and go like Robert Ludlum novels? How will data security and privacy concerns burden individuals, businesses, and Uncle Sam? Will corporate PC users be subjugated by MIS/DP management? Decisions on these and other issues will unleash or undermine the potential of the PC and its descendants. Following the PC communications industry, in effect, is a way of keeping tabs on the PC's future.

Password: Communicate will do just that, spotting the trends, technologies, and products that drive the PC communications market. The "Networks" section delves into local area networks, multiuser systems, PBXs, related hardware and software developments, and how all of these will affect the way you work; "On-Line" scrutinizes electronic services, data bases, gateways, bulletin boards, and more; "Trends" keeps you abreast of newsworthy products and changes in the industry and their value and impact; "In Review" peruses new software and hardware; "Micro-to-Mainframe" covers the prickly corporate issue of making PCs and mainframes work together; "ACK/NAK" sifts through the pertinent industry scuttlebutt; and "Start Bit" tracks the venerable but fast-paced modem industry.

In short, we'll seek out the experts and insiders, flag the trends, peg the winners and the losers, distill fact from fiction, and present a coherent picture of the industry that determines how your PC links up with the rest of the world.

(continues)

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Networks

IBM's Net Affairs

Ever the corporate Casanova, IBM continues to flirt with other alluring network operating systems while ostensibly remaining wedded to MS-Net, supplied by Microsoft. Although the PC Network was unveiled more than a year ago, at this writing it has yet to make its most important debut—at IBM Product Centers—largely because of delays with MS-Net. More than once has Microsoft been sent back to its terminals by IBM to clean up program bugs and improve performance.

In its dissatisfaction IBM has cast a wandering eye on a number of suitable alternatives. In Europe IBM has exclusive sales rights to Tapestry, an icon-oriented network operating system developed by Torus Systems of London. Unlike MS-Net, Tapestry works happily with either DOS 2.10 or DOS 3.10 and can be used with 3Com's EtherSeries. Tapestry acts like a shell enveloping DOS, masking it completely from the user. Applications on the network are assigned discrete icons and activated by mouse, keyboard, or cursor command. Torus began marketing Tapestry in the United States in April 1985 in the hope that other American firms would like it as much as IBM does.



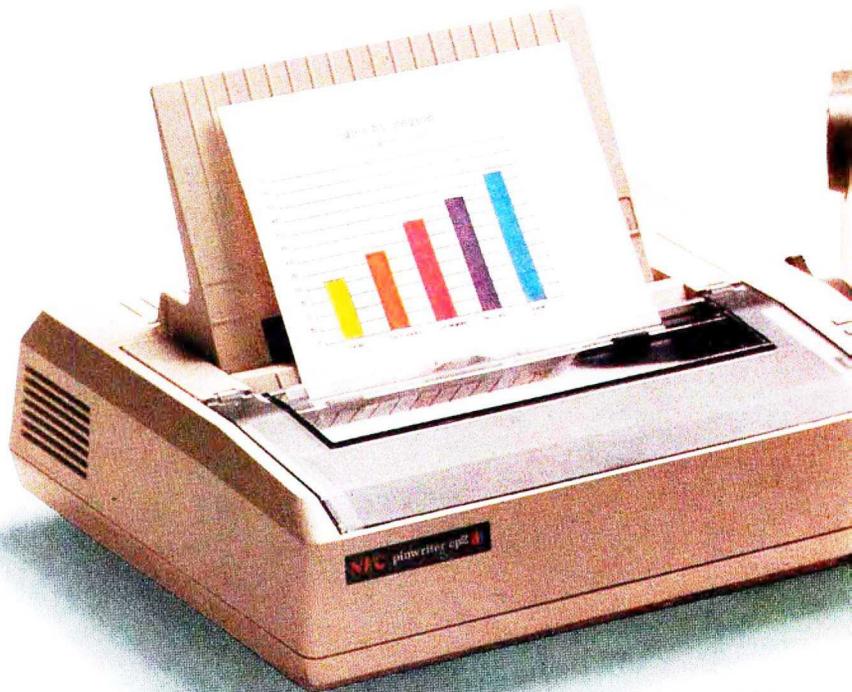
Another object of IBM's overtures is Port, a network operating system developed by Waterloo Microsystems of Waterloo, Ontario, that currently runs on the IBM Cluster and Arcnet. Port accommodates multiple file servers and easily links more PCs than MS-Net can. Like Tapestry, Port uses icons as guides to network resources and displays concurrently active applications in windows. IBM not only is testing Port at over 100 sites throughout Canada and selling it exclusively through its Canadian Product Centers, but also is retaining an option for the U.S. market—a fact that may give Microsoft pause. Waterloo's manager of dealer marketing summed up the situation neatly: "IBM can pull us out of its back pocket any time it wants to."

IBM's simultaneous mating dance with several vendors is in keeping with the company's history, according to Harvey Freeman, vice president of networking consultancy Architecture Technology. "IBM traditionally introduces different versions of products in different places. Whatever works best is what they'll eventually support. The world," says Freeman, "is IBM's test bed."

The most interesting twist in this tale may come from Sytek, creator of the PC Network hardware. Sytek is feverishly developing a competitive PC Network operating system of its own. When

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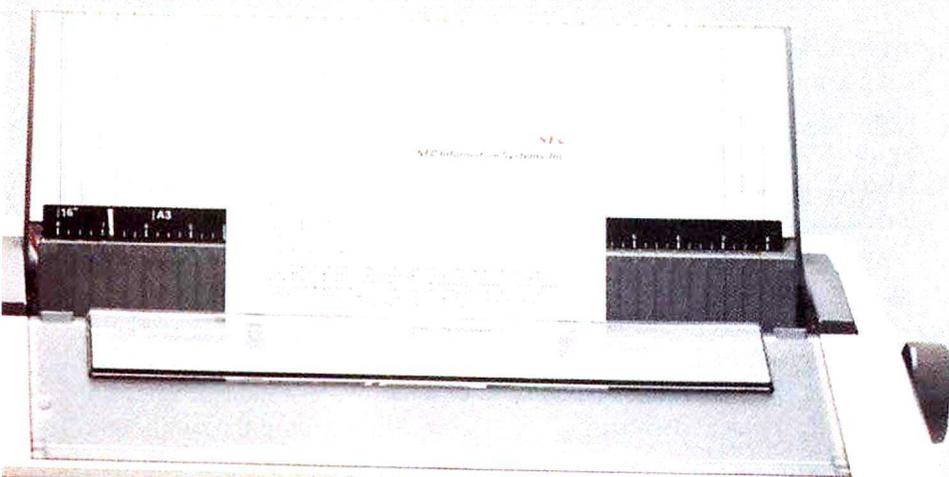
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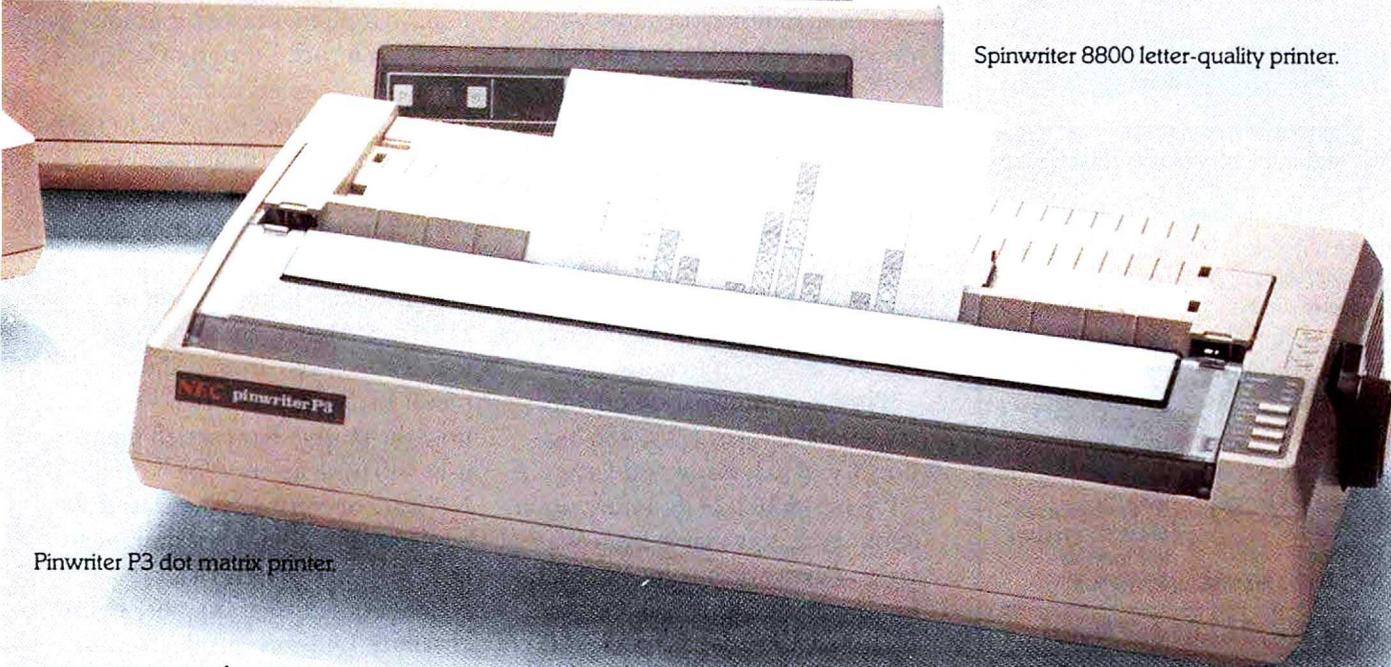
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pressed for confirmation, Sytek's Greg Ennis, director of network planning, hedged. "We're in the business of providing a systems solution," he said. And does that solution include a network operating system? Said Ennis: "That shouldn't surprise people."

Within the callous heart of IBM, it is rumored, something called Big DOS is taking shape to eventually replace Microsoft's DOS. Allegedly encompassing networking, multitasking, and windowing capabilities, Big DOS is said to be destined for the PCII.

Does IBM's infidelity spell doom for Microsoft? The Bellevue, Washington, software house has embraced AT&T with its UNIX System V version of Xenix. It seems that operating system commitments, like those of love, are rife with indiscretions.

For more information on Tapes-try, contact Torus USA, 486 Seaport Ct. #103, Redwood City, CA 94063, 415/363-2418. Information about Port is available from Waterloo Microsystems Inc., 175 Columbus St. W, Waterloo, Ontario, N2L 5Z5 Canada, 519/884-3141.

Connect Costs

Before local area networks became the apple of IBM's eye, LAN manufacturers estimated that the optimum cost of a network was between 15 and 25 percent of the

cost of the connected devices. Industry prognosticators foresaw the emergence of a multibillion-dollar industry within a few years. Well, those years have passed, and while the LAN market has grown, it hasn't expanded at a pace satisfactory to network vendors.

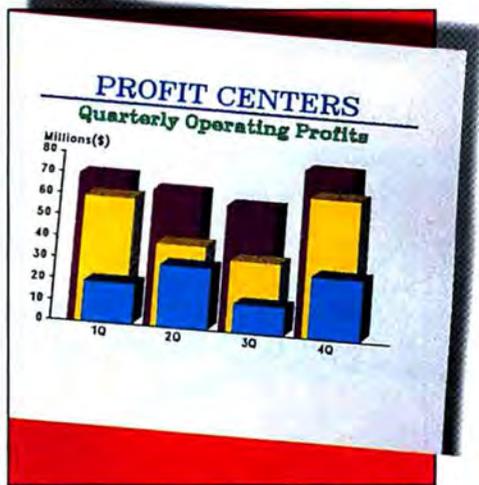
Network manufacturers blame their growth problems on the lack of a hardware standard. Software companies grump that without a common network operating system, writing multiuser programs has been a rock-bottom priority. Network designers ascribe the reluctant acceptance of LANs to the limitations of our imagination—users need only be creative to get the full benefits of local area networks.

But standards in the form of Ethernet, Arcnet, and other protocols have been around since primeval LAN days. For two years now the market has carried multiuser software aplenty for Novell's Netware operating system. And while imagination is not unimportant, network designers must create products that do more than charm technicians—products must do the job, and cheaply too. The bottom line for network vendors, figuratively and literally, is a function of the price tag.

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A typical IBM PC Network setup for eight PCs runs to nearly \$1000 per connection, not counting the server. This figure represents at least 50 percent of the PC's cost, a far cry from the 15-to-25 percent target of the early LAN years. Many potential LAN buyers, shocked by the steep connect costs, revert to more traditional approaches like multiuser systems and minicomputers or simply walk their disks across the office.

What keeps network prices so high? Communications watcher Kim Myhre of International Data Corporation suggests, "LAN vendors need to develop some manufacturing muscle and expand

their list of volume buyers." Bob Galin, strategic planner for communications chips at Intel, opts for the technological scenario: "The IBM PC Network uses broadband technology, which is significantly more costly." Others point fingers at LAN firms' inability to market effectively at the retail level. Dave Malen, LAN product manager at Microsoft, observes, "LAN management is driven by engineers, not by marketing." Blinded by their own technological prowess, LAN firms overlook the value of marketing acumen.

Not surprisingly, Duane Bowman, Sytek marketing manager for the IBM PC Network product line, takes exception to these evaluations. "People are bellying up to the bar right now. In year one, the PC Network will have a larger installed base than any other LAN. IBM's prices are considered to be very good, very competitive."

Will network prices tumble? Yes, but very slowly, keeping the market smaller than originally projected. AT&T has lowered its 1990 LAN market forecast to \$750 million—a far cry from the billions glibly prophesied a couple of years ago. Future Computing,

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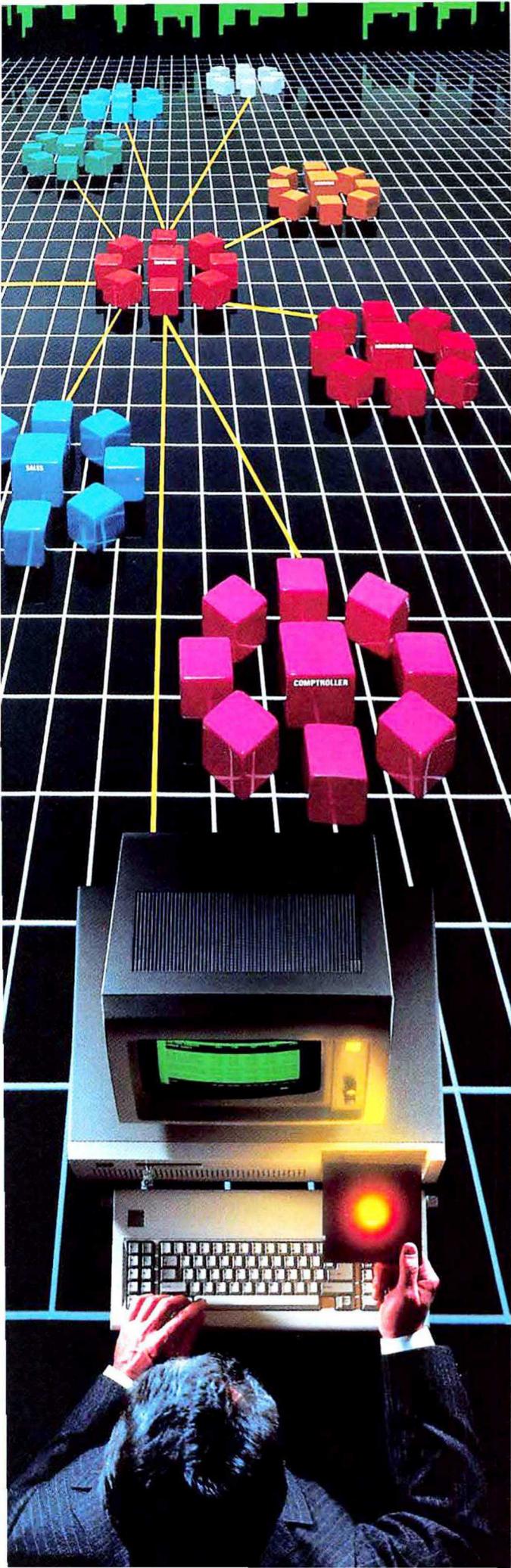
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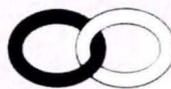
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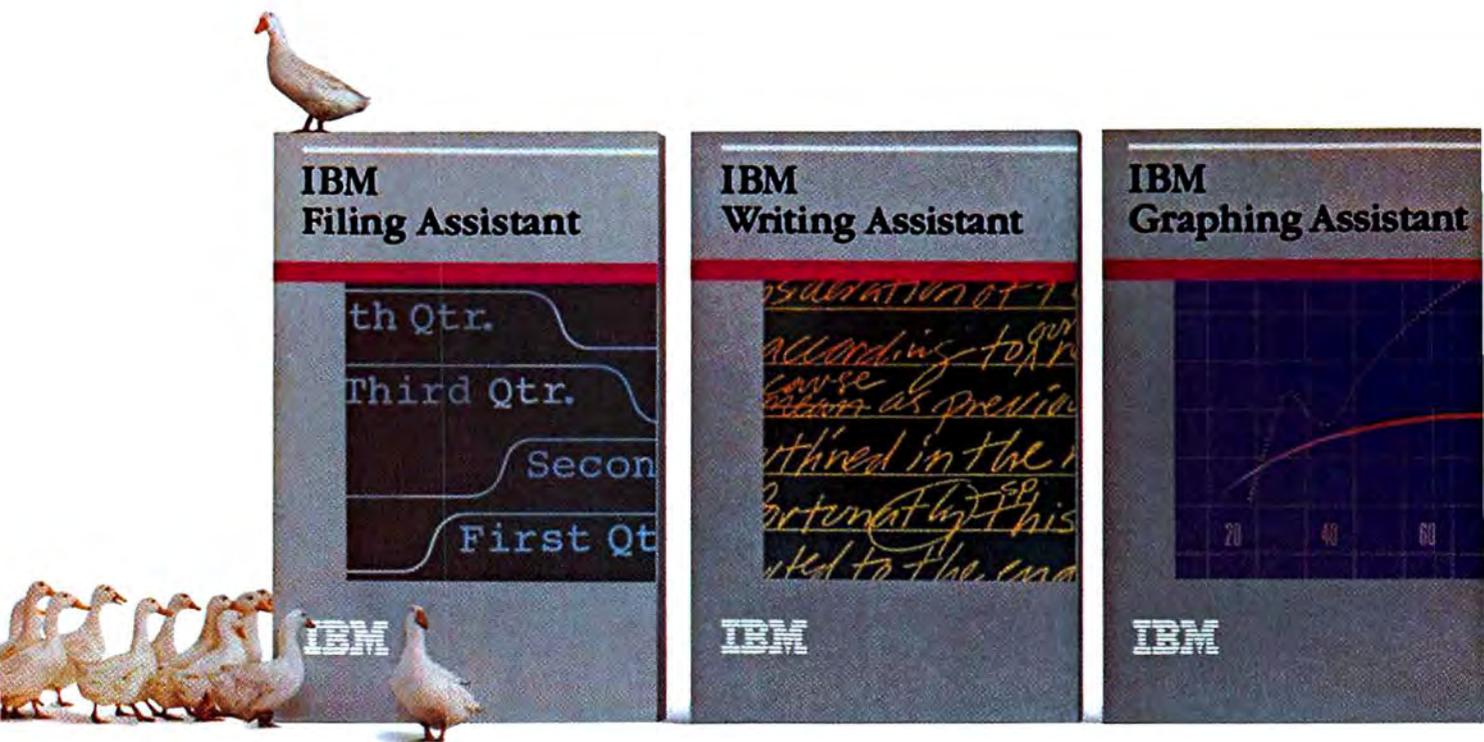
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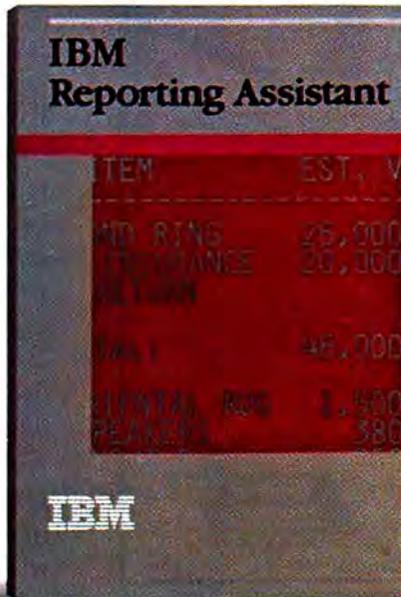
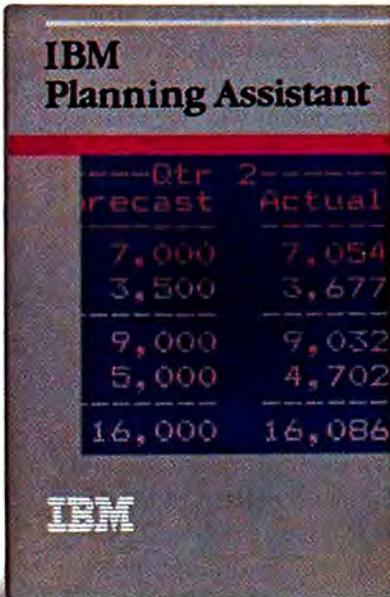
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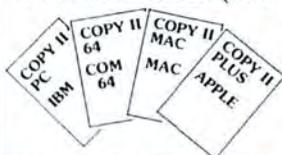
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Circle 31 on reader service card

International Data Corporation, and other market research houses have revised their optimistic guesses downward as well.

The ink is barely dry on large LAN contracts such as Sytek's deal with IBM or Ungermann-Bass's agreement with General Electric. LAN firms have yet to join the offshore manufacturing exodus. Sytek, for example, still makes the PC Network board at its Mountain View, California, headquarters, paying the higher U.S. wages. The annual 20 percent decline in semiconductor prices won't help much either, since the cost of a microprocessor accounts for less than 6 percent of the price of a typical network board. Mastering the complexities of dealer relations and end-user marketing is only now becoming a priority within the LAN industry. Until marketing wisdom and mass production combine to lower costs, LAN sales will continue to disappoint vendor expectations and deflect user buying decisions.

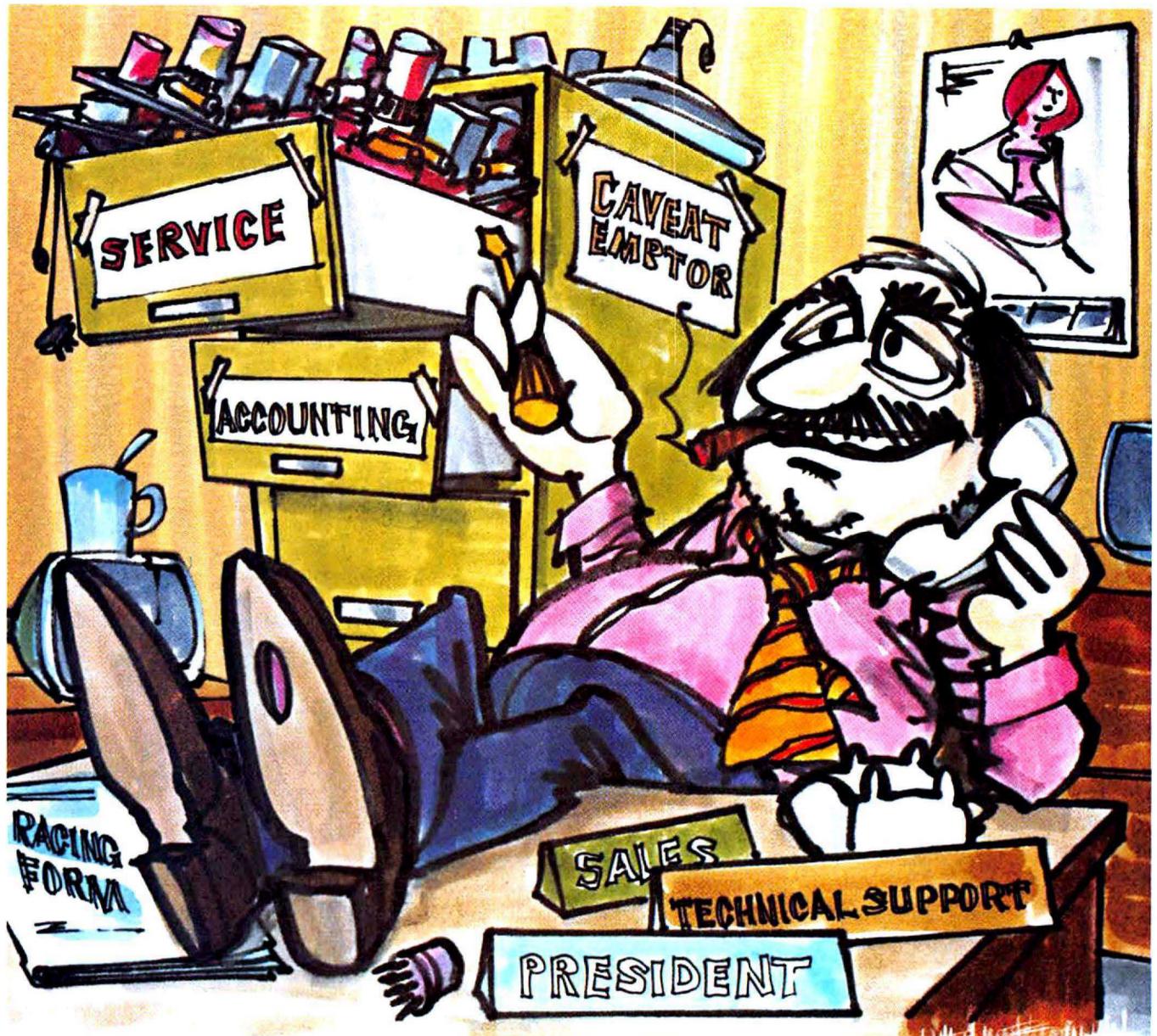
PC Meets Mac

Though Macintosh users describe their machines as friendly, the battle for the office market brewing between IBM and Apple may be anything but. But while Apple gears up for its assault on Big Blue's turf, quiet victories are being won for those who want the best of both worlds. The problem with the Mac—at least from the business user's standpoint—has been its incompatibility with the PC. Getting the two to share data

(continues)

**“...okay, okay,
so I can't get it cheaper,
but what about service
and technical advice?”**





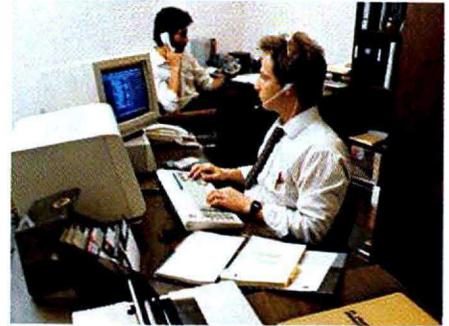
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Centram's Tops software tricks Macintoshes into thinking that a PC hooked up to the AppleTalk network is a Mac functioning as the network's server. The PC can use *MacWrite* files or use Apple's LaserWriter to print 1-2-3 files, for example. Integral to this masquerade is the Tops network interface board, which links the PC to AppleTalk. Although the PC cannot use Mac-generated graphics files, it does share electronic mail, storage, and file-transfer capabilities with networked Macs.

3Com links PCs and Macs by connecting AppleTalk to the 3Server via the EtherMac board, which handles conversions between Macintosh and PC text files. PCs attached to the file server via the EtherSeries LAN can share storage, electronic mail, multiuser data bases, and other utilities with up to 31 Macs.

Tops and EtherMac are among the first in a series of products to link these two top computers. Future enhancements will allow the Macs entrée to IBM mainframes through existing PC LANs. And eventually Apple graphics output will be available to PCs, according to sources at Centram. While IBM and Apple may continue to snarl at one another, opportunistic com-

(continues)

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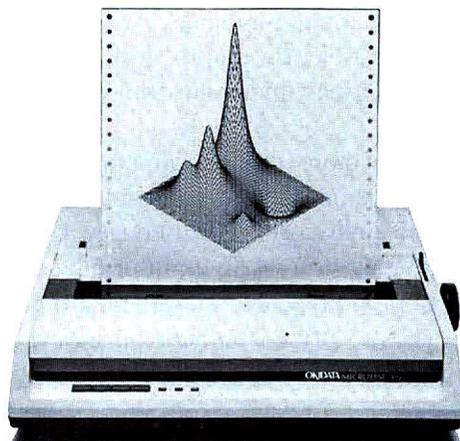
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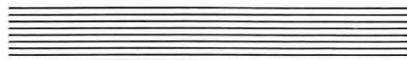
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munications companies are not about to let the players in this market remain incompatible for long.

For more information about Tops, contact Centram Systems, 2372 Ellsworth Ave., Berkeley, CA 94704, 415/644-8244. Information on EtherMac is available from 3Com Corp., 1365 Shorebird Way, Mountain View, CA 94043.



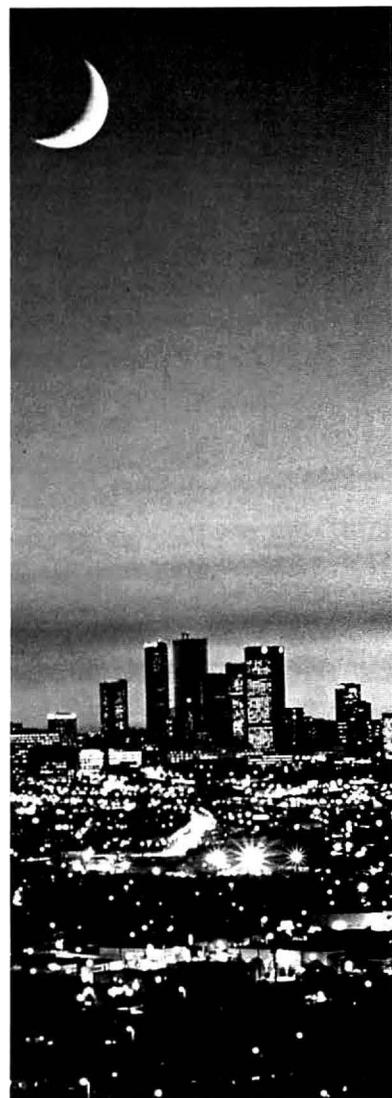
Trends

Ending Continental Confusion

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(continues)



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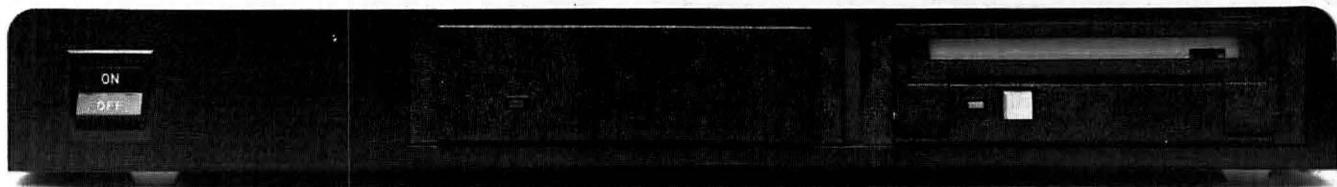
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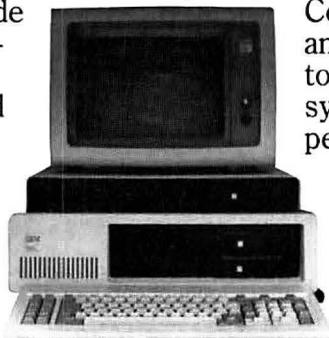
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Circle 526 on reader service card

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NicePrint

“Turns an IBM PC Dot Matrix Printer Into a Daisy.”

The standard of printing excellence is the expensive daisy-wheel printer. Dot Matrix printers are fast, inexpensive, but with poor print quality.

NicePrint system software package provides the breakthrough giving dot matrix high quality print.

The first 20 words of the simple instruction card tell you all you

need to know to have *NicePrint* working smoothly with your current processing software. 13 font styles (Roman, Sans Serif, Script, Orator Large, Olde English, Scientific) are accessible. Over 300 variations of size and style are possible. Contact your local IBM PC dealer for a demonstration.



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Circle 456 on reader service card

Without WorkLog, you may as well record computer time like this.

Why not let your computer do it for you?

WorkLog painlessly maintains a complete, organized data base of your computer use. Including accurate measurements of the total time of each computer session, the time your computer sits idle, the keystrokes, and disk activity.

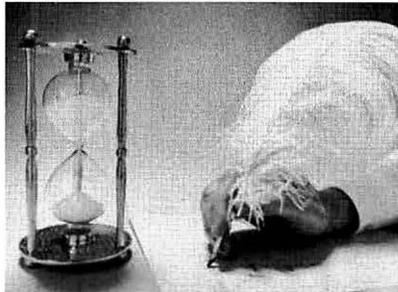
And WorkLog easily returns you to your last job with just the press of a key.

Considering the value of your computer investment, isn't \$59.95 a small price for a more efficient system?

To order WorkLog, call (206) 526-0711. Or ask for our brochure describing the power and elegance of this state-of-the-art software.

WorkLog™

The essential time-saver.



For IBM-PC, -XT, -AT and compatibles. Requires 128k and any version of PC-DOS.
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Problems with line voltage, dial tone frequencies, and line quality, among others, plague European networks.

To circumnavigate these nitty-gritty differences (primarily for its members and not for modem-toting Americans), the Common Market has authorized a \$500 million program—RACE (Research and Development for Advanced Communications)—to break through the gaggle of nationalistic communications protocols. Hopes are pinned on developing a common digital telecommunications system, an integrated services digital network (or ISDN) that each PTT must eventually install. By carefully hammering out specifications beforehand, Europeans hope to banish electronic phrase books for good.

Don't pack your modem on next summer's trip, however. RACE results are not expected for ten years.

ACK/NAK

Short-Term Relationship

When Lotus Development and mainframe software giant Cullinet decided to merge 1-2-3 and Symphony with mainframe data and applications, the match seemed perfect. But despite the fertility of their relationship, it looks to be one of convenience.

(continues)

Get the Picture with PHOTOBASE



PHOTOBASE is a software package that works with data base management systems such as: *dbase II**, *R:Base 4000** and the *IBM Filing Assistant**.



PC-EYE is a high speed, high resolution video digitizer board that lets you capture anything you can see.

Now you can open up a whole new dimension in data base applications by merging real-life pictures with popular data base management systems. Pictures of people, products, diagrams, maps, company logos — whatever you want to photograph — can be integrated with your data base. Consider these typical applications:

Security — verify those employees who have authorized clearance to limited access areas. A data base containing employee pictures and personnel records can be searched and displayed for visual verification.

Signature Verification — increase the efficiency of credit checks by adding pictures of customer signatures to your financial data base records.

Real Estate — add pictures of houses to on-line real estate listings for faster property identification and improved sales presentations.

Electronic Cataloging — pictures of products can be combined with a data base system containing product specifications, pricing, availability and much more.

Customers, distributors and sales personnel can quickly search data and view the resulting product/picture information on one screen. Files can be updated easily, quickly.



It's Easy

With a simple keystroke, pop-out of your data base system and into the PHOTOBASE menu. Capture images of text, photos, artwork and 3-dimensional objects with an ordinary video camera and our high resolution PC-EYE™ video digitizer. Pop back into your data base system and add the picture name to your data base like you would any other piece of information. The full functionality of the data base system is preserved, but the resulting display is text and picture information on one screen.

Pictures are displayed in the upper right quadrant of the screen at a resolution of 320 x 200 with 16 colors or levels of gray. Text information from data base records fills the rest of the screen. Pictures can also be exploded to full screen.

Call or write and we will send you information on PHOTOBASE, PC-EYE, compatible cameras and other imaging equipment in the CHORUS Family of products.

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The IBM-PC... **HOT-LINE**

Two Exceptional Modems For Your IBM-PC

Internal



Our ProModem 1200B Gives You A 3rd Serial Comport Free

\$399

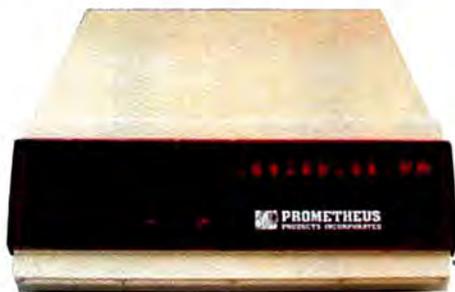
When you plug our \$399 1200/300 baud modem card into your IBM or Compatible PC, you suddenly have an additional serial Comport available to use.

This means you don't have to disconnect your printer, plotter or other serial device from Comport 1 or 2 when you use our ProModem 1200B to communicate with the outside world.

And that's just the beginning. The unit has a host of features such as auto answer and auto dial, programmable intelligent dialing, built-in speaker with volume control, help commands, extensive diagnostics, separate voice and data jacks, and Hayes command set compatibility.

If you check prices, you'll find our \$399 ProModem card costs less than modems that don't do nearly as much. ProModem 1200B comes with a sophisticated communications package from Mycroft Labs called "MITE" which provides for transfer of any type of text and binary files, with five error checking protocols including X-Modem. You can't lose. Buy our ProModem 1200B and get a Comport free!

External



Transfer 50 Pages Of Text Without Tying Up Your PC

\$495

Priced at just \$495, our Hayes Compatible ProModem 1200 is the best 1200/300 baud standalone modem you can buy. It runs rings around Hayes and the rest.

One reason is our optional Communications Buffer and Alphanumeric Display which turn our ProModem into a veritable genius.

Imagine, unplugging your computer, taking it home for the weekend, and while you're gone having ProModem 1200 answer the phone, collect messages, send out electronic mail, and when you return, review all messages sent and received, and the exact time of each event. And we're talking about 50 pages of text or data!

Our \$99 Communications Buffer is a card that plugs into ProModem 1200's motherboard. It comes with 2K of CMOS battery backed-up memory, expandable to 64K. Part of the memory is used as a dialing directory, with the balance reserved as a buffer. Plus, for \$99 more an Alphanumeric Display can show time, date, and status and help messages.

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With Watson, your IBM PC[®] or compatible will have a sophisticated voice mail and voice messaging system that will handle your phone calls even while your PC is running other programs.

Watson's programmable TI-TMS 320 microprocessor lets you

record, edit, playback, and transmit speech directly to and from your computer disk.

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Circle 531 on reader service card

"Best of 84"
PC Magazine,
Jan. '85

You're in Good Company When You Program in BetterBASIC



All of these companies rely on BetterBASIC to write their software programs. They have found that BetterBASIC combines the features they need from BASIC, Pascal, C and Forth in one familiar environment. Some of these features include the following.

640K Now you can use the full memory of your PC to develop large programs.

STRUCTURED Create well organized programs using procedures and functions that are easily identified and understood and completely reusable in future programs.

MODULAR Use procedures and functions grouped together to form "library modules."

INTERACTIVE BetterBASIC acts like an interpreter, responding to the users' commands in an immediate mode. However, each statement is actually compiled as it is entered.

EXTENSIBLE Create your own BetterBASIC modules which contain BetterBASIC extensions (ideal for OEMs).

COMPILED Each line of the program

is compiled as it is entered into the computer's memory rather than interpreted at runtime. The optional Runtime System generates EXE files.

BetterBASIC Runs on IBM PC, IBM PC/XT and compatibles.

CALL 1-800-225-5800 (In Canada: 416-469-5244) Order BetterBASIC now, or write Summit Software Technology, Inc.™, P.O. Box 99, Babson Park, Wellesley, MA 02157. Prices are listed below.

BetterBASIC: \$199 Runtime System: \$250
8087 Math Module: \$99

Still not convinced? Order the BetterBASIC sample disk which includes a demo, a tutorial, compatibility issues, 50 lines of BetterBASIC and more. Only \$10.

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Of the two companies' three intended offspring, the first, *Cullinet Symphony Link*, is slightly superfluous, since it requires the use of Lotus's current *Symphony Link* program. A sister program, *Cullinet Universal Link*, ties 1-2-3 with mainframe data bases. Required for both new *Link* programs is Cullinet's *Information Center Management System (ICMS)* software, which resides on the mainframe and organizes host data for 1-2-3 and *Symphony* applications.

"Cullinet will drop Lotus the minute third-generation software arrives," predicts George Colony, president of Forrester Research of Boston. Colony defines third-generation PC programs as those conceived and marketed with the Fortune 1000 mainframe world fully in mind. PC-bound programs, he contends, do not appeal to software companies seeking stable and profitable growth in this large-systems, corporate market.

Dick Andersen, president of Net 1, a micro-to-mainframe consultancy, adds that the proposed \$150,000 package is limited to Cullinet applications and Lotus software. "It's likely," he says, "that Lotus will make different arrangements to develop a generic micro-to-mainframe link."

Both Colony and Andersen agree that Lotus's exposure to the mainframe environment should give it the background to compete with Cullinet eventually. "That's where real long-term growth for

(continues)

Circle 890 on reader service card

BUYERS GUIDE TO DESKTOP ORGANIZERS

A COMPARISON OF THE MOST POPULAR PRODUCTS

	PolyWindows Desk	Sidekick	Spotlight
ROLODEX-TYPE FILES			
Variable Card Size	YES	NO Files	NO
Multiple Card Decks	YES (1-10)	NO Files	YES
Number Cards Per Desk	RAM Limit	NO Files	500 Max.
Max. Characters Per Card	969	NO Files	480
Search	YES	NO Files	YES
Auto Alphabetize	YES	NO Files	YES
Print Card or Deck	YES	NO Files	YES
CALENDAR			
Daily Notes	YES	NO	NO
Mark Important Days	YES	NO	NO
APPOINTMENT BOOKS			
Multiple Appt. Books	YES (1-10)	NO	NO
"Things To Do" List	YES	NO	NO
Print Appointment Book	YES	YES	YES
ALARM CLOCK			
Display Time	YES	NO Alarms	YES
Hourly Chimes	YES	NO Alarms	NO
Display Alarm Message	YES	NO Alarms	NO
Number of Alarms	9	NO Alarms	Many
CALCULATOR			
On-Screen Tape	YES	NO	NO
Printing Tape	YES	NO	NO
Percentage Function	YES	NO	YES
Display With Commas	YES	NO	NO
Floating/Fixed Decimals	YES/Both	Fixed	Floating
Memory	YES	YES	YES
Insert Result in Work	YES	YES	YES
Max. Display Digits	15	18	12
Exponential Notation	YES	NO	NO
* Binary/Hex/Octal	YES	YES	NO
* ASCII TABLE	YES	YES	NO
NOTEPAD			
Multiple Documents	YES (1-10)	NO	NO
Word Wrap	YES	YES	YES
Merge Files	YES	NO	NO
Change Margins	YES	YES	NO
Variable File Size	YES	YES	NO
File Size Limit	64K	50K	4.4K
Variable Window Size	YES	YES	NO
* Search & Replace	YES	YES	NO
* Block Moves	YES	YES	NO
* Auto Indenting	YES	YES	NO
* Page Break Display	YES	NO	YES
* Insert or Overtyping Mode	YES	YES	YES
* Cut Sheet Printing	YES	NO	YES
Print Document	YES	YES	YES
Print Window Only	YES	YES	YES
Undelete Key(s)	YES	YES	NO
KEYBOARD ENHANCER			
Number Keys Redefined	YES Up to 60	NO Macros	NO Macros
Total Keystrokes	YES 2500	NO Macros	NO Macros
* GRABBER			
Cut & Paste between applications	YES	YES	NO
* AUTO DIALER	YES	YES	NO
GENERAL CHARACTERISTICS			
100% Memory Resident	YES	NO	NO
Minimum Memory Used	40,000	61,300	77,200
Typical Memory Used	50,000-75,000	61,300	77,200
On-Line Help	YES	YES	YES
Moveable Windows	YES	YES	NO
Redefine Colors	YES	YES	YES
Expandable/Add Functions	YES	NO	NO
Can Remove Functions	YES	NO	NO
Integrated Interface	Excellent	Good	Good
Visual Appeal	Excellent	Fair	Poor
Speed	Very Fast	Fast	Slow
COST - PROTECTED	\$49.95	\$54.95	\$149.95
COST - UNPROTECTED	\$84.95	\$84.95	NO/Not Avail.

Say Yes!
to PolyWindows

Desk
and

No!
to Sidekick
and Spotlight.

Thousands of PC users are choosing PolyWindows Desk over Sidekick and Spotlight every week.

It's easy to see why.

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DESK

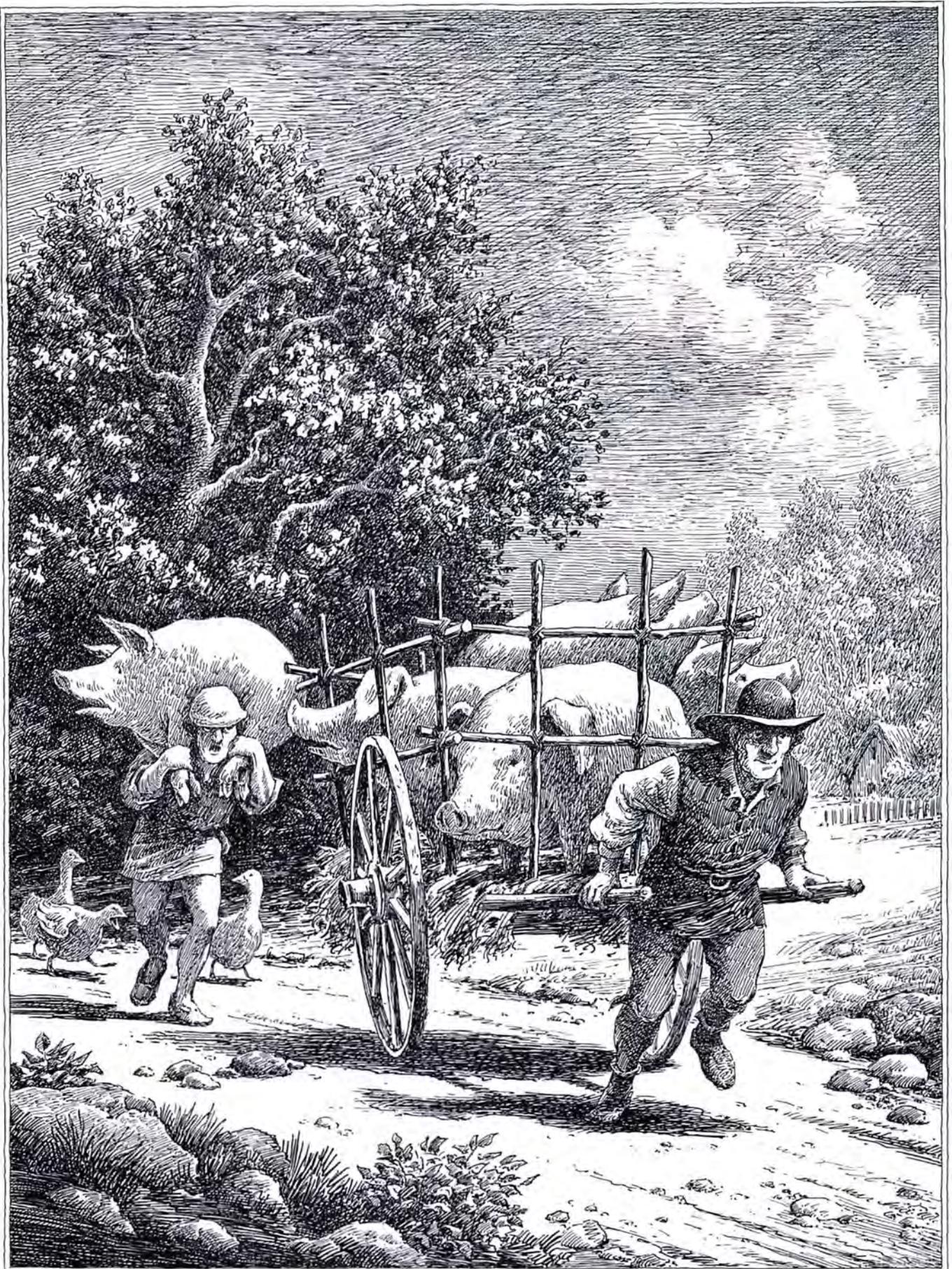
PolyWindows Desk was written by Thomas A. Crispin.
Works with IBM PC, XT, AT & true compatibles.
Requires DOS 2.0 or later, TopView Compatible.

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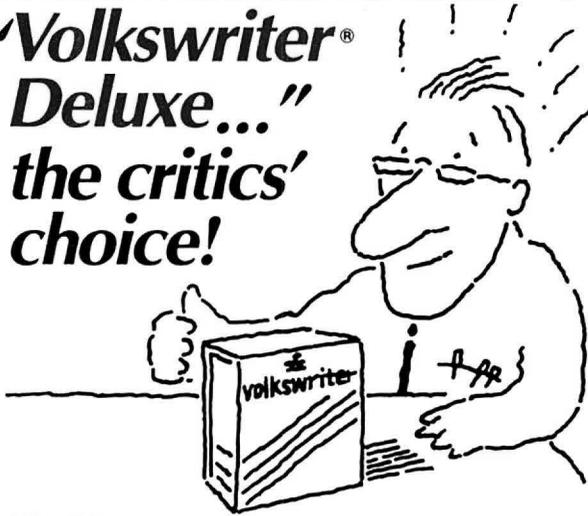
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the critics'
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“If WordStar™ set a standard ... Volkswriter Deluxe sets a new standard for transparency, simplicity, and speed. You can learn Volkswriter in under an hour ... because it does so many things exactly the way you think they should be done.”

“VOLKSWRITER DELUXE is the best buy in the IBM-PC™ writing tool arena.”

Charles Spezzano, Whole Earth Software Review, January 15, 1984

“Volkswriter Deluxe ... a simple way to word processing power ... for writers who like to think.”

Washington DC Capital PC User's Group Vol. 3, #4

“Lifetree ... provides exceptionally helpful and competent assistance to registered owners, and the company's update policies are excellent.”

“In sum, this is a unique word-processing program.”

John Lombardi, Reviewer, InfoWorld, April 16, 1984

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have said
it better
ourselves!**

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Lotus lies,” predicts Colony. As for Cullinet, the company intends to continue marketing its own micro-to-mainframe program, *GoldenGate*, no matter what emerges from its deal with Lotus.

Lotus spokespeople refer to the “synergy” between the two companies. In his monthly newsletter, *Micro News/Views*, George Elgar dryly notes, “Synergy isn’t innovation,” adding, “The chances of this venture being a winner are about as good as combining Apple with Atari to make a new Atrapple.”

Start Bit

Modem Cop

Do you trust your modem? Enough to leave it on unattended? Not if you have something to hide. Which is why companies don't get the most out of PC communications. Information about such matters as product design, merger talks, and personnel changes, often stored in computers, is too sensitive to leave on line. Yet it's often just such critical data that must be available at all hours. Sometimes the vulnerability of an ordinary auto-answer modem means sacrificing timeliness and efficiency for the security of a Federal Express envelope.

Anxiety-ridden data keepers can rest a little easier now that secure modems from Lockheed, Cermetek, and Penril have arrived.

(continues)

IT'S NOT HOW HARD YOU WORK. IT'S HOW MUCH YOU GET DONE.

There's an odd contradiction built into most database software. Most of the features that make it powerful enough to do the job make it a real struggle to use.

But at Microrim,[®] we've never thought it makes sense to do things the hard way. That's why we're introducing R:base[™] 5000. With a brand new feature that lets you create programs up to ten times faster.

attached chart. If you've never programmed before, these automated steps can make all the difference between getting the job done and giving up completely. And if you're an experienced programmer, the Application Express can give you ten to one productivity gains. Of course, R:base 5000 also gives you the powerful procedural language and report writer it takes to create highly customized applications.

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If you believe in common sense as much as we do, you won't take our word for it; you'll get your hands on a copy and make up your own mind. And that's just what we'd like you to do. For only \$9.95 (plus shipping) we'll send you a mini-version of the product that lets you build real-life applications.

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We'll show you how easy it is to get a handle on your workload. When you've got a program that does things your way.



CLIENT DATABASE MENU

1. Add a client master list.
2. Change a client master record.
3. Delete a client master record.
4. Print client report.
5. Exit.

PRODUCTIVITY:
R:base 5000 vs. dBASE III

Using R:base 5000 and dBASE III,[™] we built this menu and linked it to its sub-routines. The resulting applications were equivalent. The effort required wasn't.

	R:base 5000	dBASE III
Keystrokes	434	6588
Command Lines	47	244
Automated steps	37	0
Time*	9 minutes	2 hours

* Your actual time may vary depending on skill level.

THE APPLICATION EXPRESS.[™] WHAT A DIFFERENCE.

Since the Application Express automatically generates programming code, it can give you the tremendous advantage we've documented in the

R:BASE 5000 FROM MICRORIM

IT ALL COMES DOWN TO COMMON SENSE.

TAPE IT EASY.

Boy, are you in for a surprise. You know you need mass storage. And you know you need some kind of backup.

But what you don't know is that making a backup from your hard disk can take the patience of a saint. And tax the memory of an elephant.

Unless, of course, you have a little TLC. The new TrimLine Combo from Corvus. You get mass storage (20 Mbytes). The incredible speed and efficiency of a hard disk. And an integral tape backup.

But there the similarity between a Corvus and anything else ends.

First of all, your TLC fits in beautifully. Between your IBM PC's monitor and base. No bulky boxes. And no clumsy cables and wires to trip over.

Next, you get the world's easiest tape

backup system. If you like using command lines, fine. The TLC will accommodate you. But if you're more interested in simplicity, just use one of the TLC's menus. And one of your fingers.

You can back up the entire disk. All your data for the day. A group of selected files. Or just one single file. As a matter of fact, you can back up whatever you want. Which will save you quite a bit of time and aggravation.

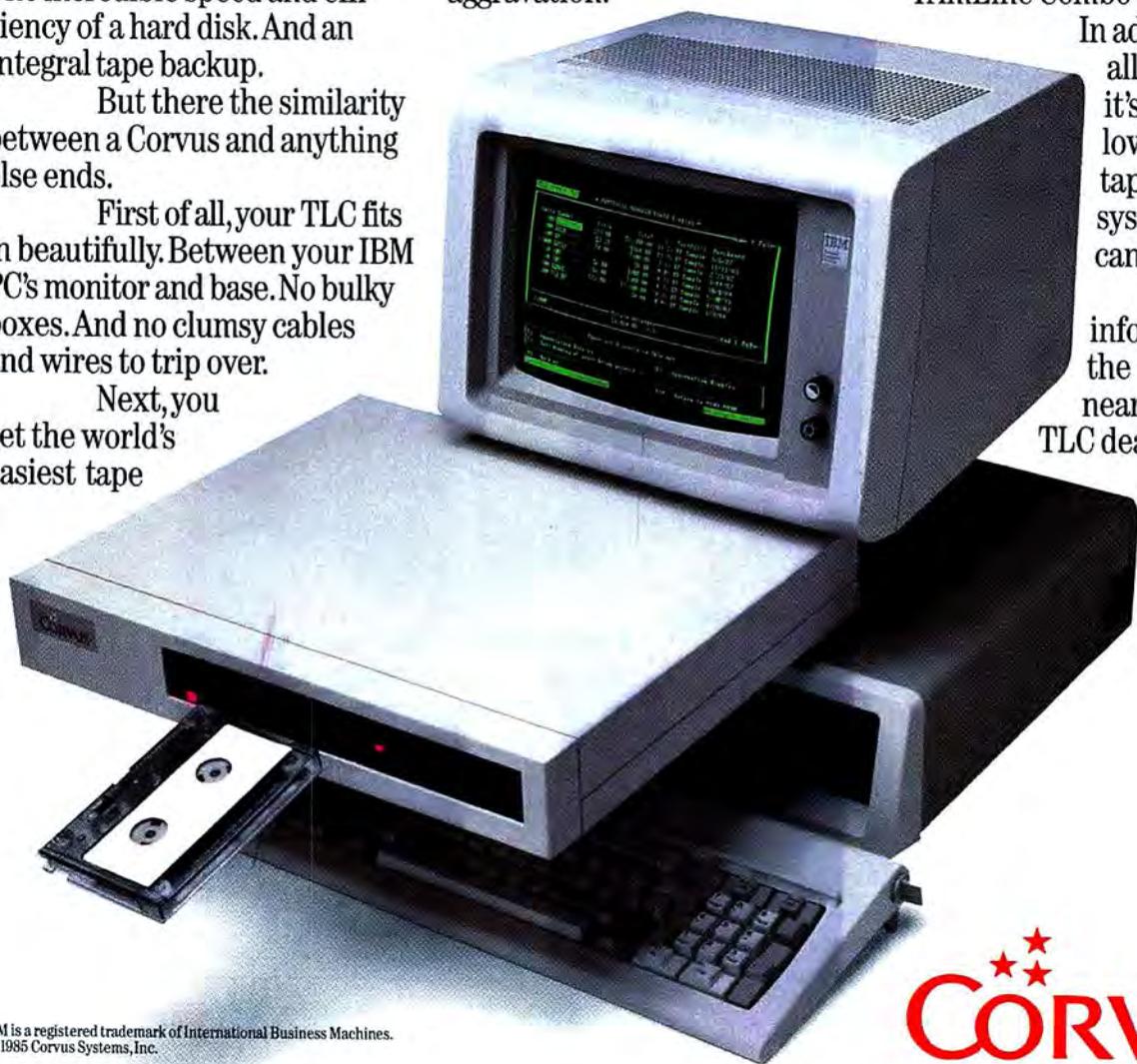
You'll also find backed up files in seconds with the TLC's Directory. No more searching an entire tape just to find one file.

Finally, you'll enjoy the backup speed of the TLC. There's no formatting of blank tapes (which can save you about two hours). And no worry about losing data to bad sectors the format has called good.

Scared? Don't be. Just tape it easy. Check out the TrimLine Combo from Corvus.

In addition to all the features, it's one of the lowest-priced tape backup systems you can find.

For more information and the name of your nearest Corvus TLC dealer, call (800-4-CORVUS).

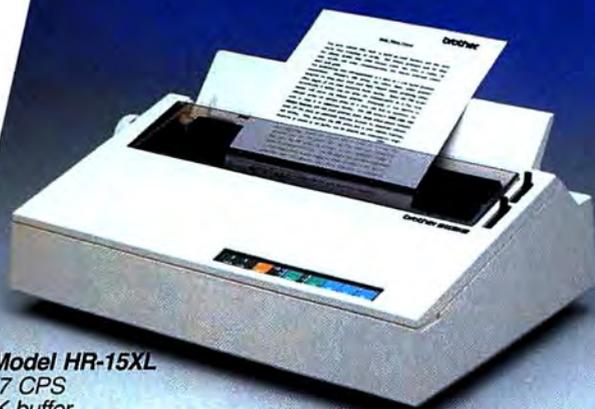


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17 CPS
3K buffer
2½" per second paper feed speed



Optional keyboard available

FASTER!



Model HR-25
23 CPS
3K buffer
3" per second paper feed speed
Shown with optional tractor feeder

Brother has the right printer for just about any application... or budget.

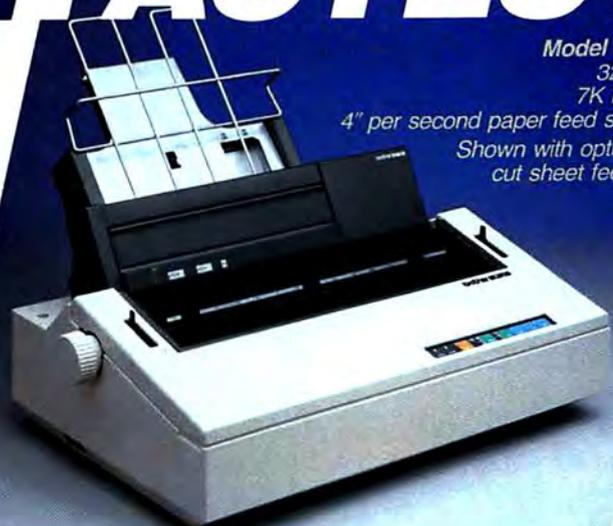
The HR-Series is designed to keep productivity at a par with today's fast-paced requirements. Memos, letters, reports, promotional mailings, billing and personal correspondence can be zipped out quickly and letter-quality perfect.

The HR-Series gets work done. Every model incorporates a buffer and can print out bidirectionally. Other features include the exclusive daisy wheel cassette, two-color printing, auto-underlining, super & sub-script, proportional spacing...plus much more.

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- P-10e & P-20e
10 & 20 Mbyte
External series

The mass memory market has become a real battle zone! Chaos, confusion and buyer uncertainty have resulted from too many products and not enough answers.

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Don't be misled into believing that a disk drive can be sold and booted around the country, without any risk.

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Circle 716 on reader service card

These (and others like them) let you keep your computer on line, while assured that only the right people will get into your system. Secure modems use password and call-back features that prevent hackers, crackers, and competitors from filching your secrets.

Except for their ROM-based call-back software, secure modems look and work like any other modem. The security software doesn't interfere with communications or terminal emulation programs. Secure modems can also save money when programmed to call back over lower-cost long-distance lines such as SPRINT or MCI.

Chris Winkler, a marketing director for Lockheed's modem-making Getex division, envisions a typical session where a PC calls a remote computer host. "The host's secure modem intercepts the call, asks for the telephone number, breaks the connection, checks your phone number against a list it stores, and, if there's a match, it calls back," he explains.

The Lockheed GTX-100 modem stores up to 16 telephone numbers and 16 passwords and maintains an audit trail, logging every phone number received. In other words, if some kid tries to hack your hardware, you can simply give the miscreant's phone number to the Feds.

Cermetek's Security Modem reverses the process, first asking for a password and then, as an op-

tion, referring to a list of authorized call-back numbers. The Cermetek modem uses the Hayes command set, so it works with popular software packages like *Smartcom II*, *Crosstalk XVI*, and *Mite*. The modem can also ensure security on outgoing calls, asking for a password before it dials other computers.

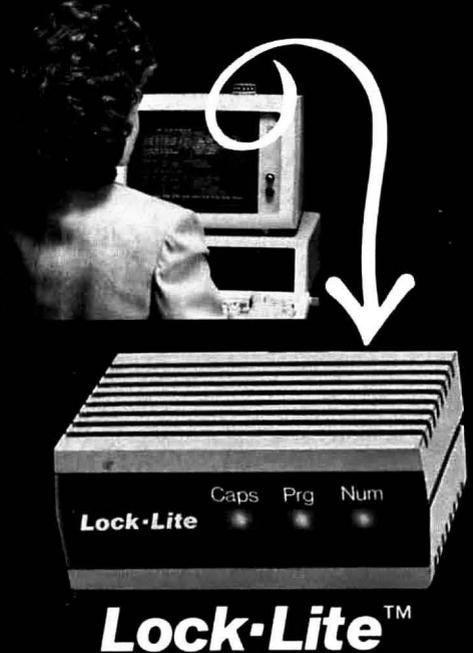
Steve Durham, Cermetek vice president of product planning, believes that "security call-back is the fleshing out of an intelligent modem." Within a few years, Durham contends, most modems will have built-in security.

At what price comes peace of mind? Most secure modems on the market today are sold through value-added resellers and cost \$200 more than Cermetek's 1200-bps equipment. Cermetek's strategy, however, is to offer the secure modem as part of its regular product line, priced at \$695—about \$100 more than its 1200-bps modem without security. At those prices almost anyone can afford to keep secrets. —*Dana Blankenhorn*

Dana Blankenhorn writes about PC communications from his home in Atlanta.

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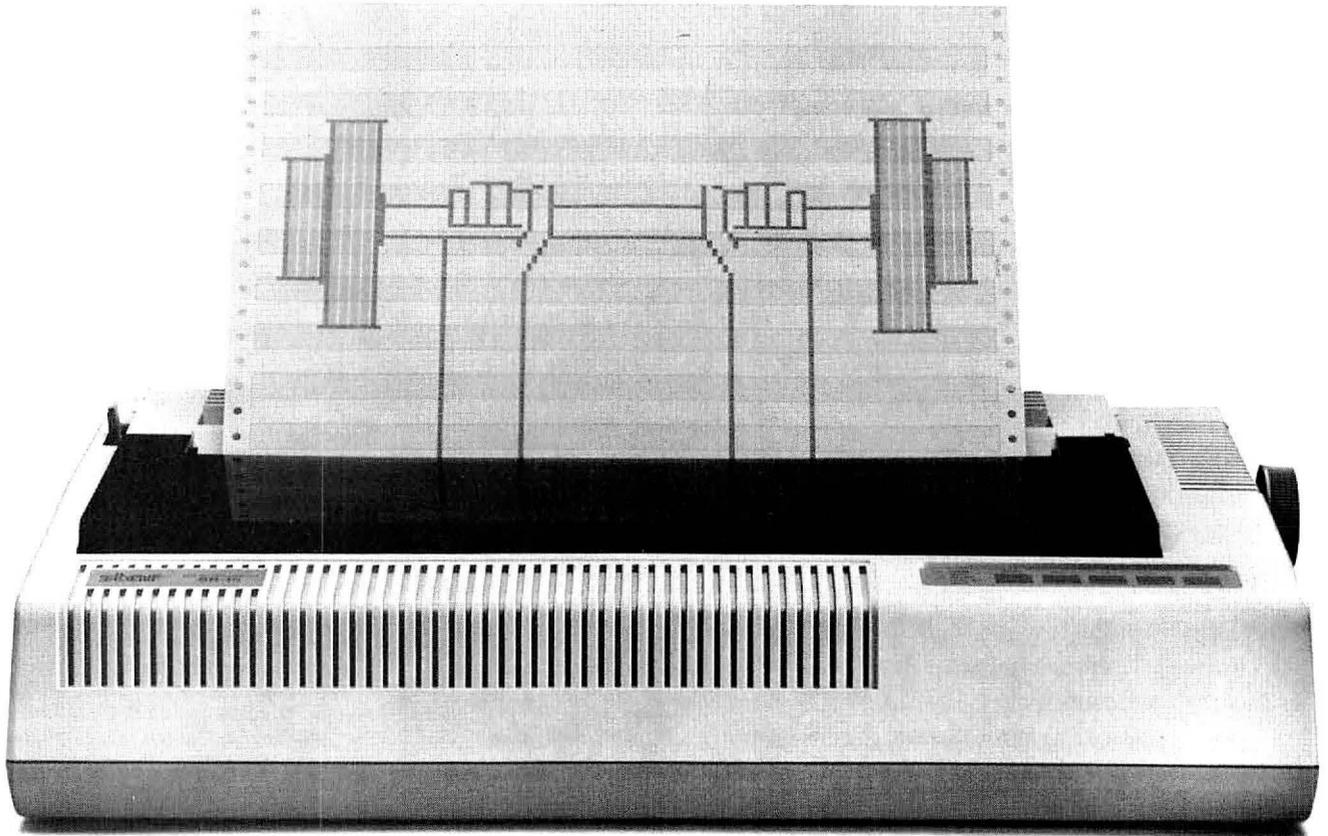
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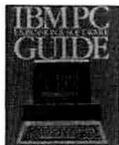
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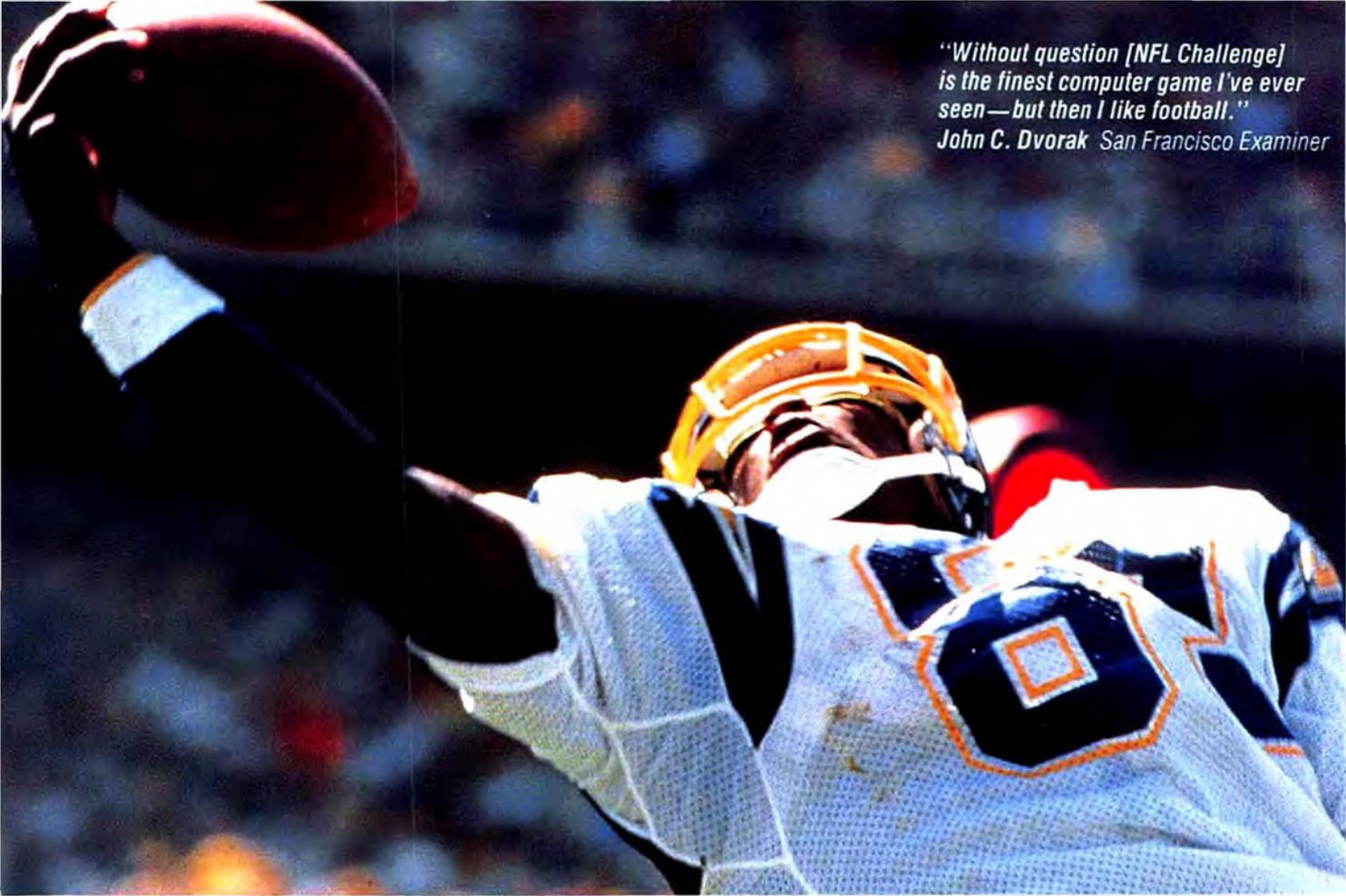
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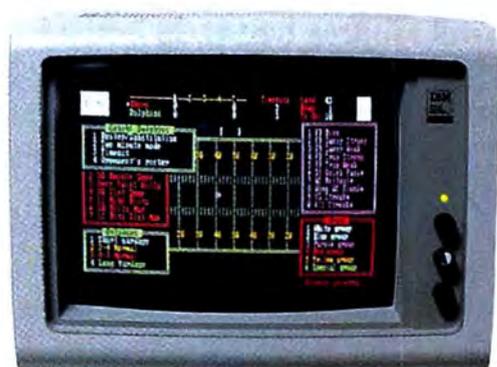
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This month: using subdirectories with programs that don't recognize paths, uncovering MailMerge-to-dBASE and dBASE-to-Mail-Merge conversions, ANSI.SYS documentation, and telecommunicating binary files

Karl Koessel

Find That Path

Q. As a longtime devotee of floppy disks, I find that the shift to my new PC AT's hard disk presents a stubborn problem. I would like to place WordStar, version 3.3, in a word processing directory (say, \WP) and develop six to eight subdirectories for text so that letters and other documents on a given topic may be kept together in a specific subdirectory. Relying on a PATH command that includes the directory C:\WP, I have tried to create a series of batch files that would change to the directory containing the text I seek and then call WordStar.

My efforts to access a working WordStar from any of the subdirectories have failed, however. After WordStar's copyright screen clears, instead of the opening menu screen, '@@@@' appears in the upper left corner of the screen. Only after copying WS. * into each subdirectory can I edit documents. I now have at least seven copies of WordStar in as many subdirectories.*

I'm encountering a similar problem with ThinkTank, PC-File, Proofreader, and other programs. Only 1-2-3 works, because it allows designation of a subdirectory as well as a drive for storing worksheet files. Is the problem related to the software protection scheme each program uses, or must I wait until each manufacturer develops a patch that permits such a cross-directory operation?

*Roy W. Menninger
Topeka, Kansas*

A. A program that does not recognize paths is not easily patched to do so. Usually you must wait for the next release of the program in question. Meanwhile, you can take steps to make life smoother with what you have.

Because you have an AT, I will assume you are using DOS 3.00. The 3.00 disk contains a file called VDISK.SYS, which is a device driver used to implement a RAM disk—a portion of your computer's memory that emulates a disk drive. The instructions for using VDISK.SYS are in Chapter 4 of the DOS 3.00 manual. (Readers who are using a hard disk with DOS 2.00 or 2.10 and who have RAM disk software can also implement the following technique.)

First create a small RAM disk and copy a program's files to it. Next change the current directory of the hard disk drive to the one you want to hold your data files. Then make the RAM disk the default drive and call the program. (The commands that perform these steps can, of course, be incorporated into a batch file; in that case, you'd just call the batch file to implement the instructions.)

Although many popular programs do not recognize paths, most can take advantage of a dual disk drive environment. You can keep the program's files in the current directory of one drive, usually drive A:, and your data files in the current directory of another drive. In this case we've substituted a RAM disk for drive A: and a subdirectory of the hard disk for drive B:. Many of these applications also expect all program files, such as configuration files or overlay files, to be either in the current directory of the default drive or in

(continues)

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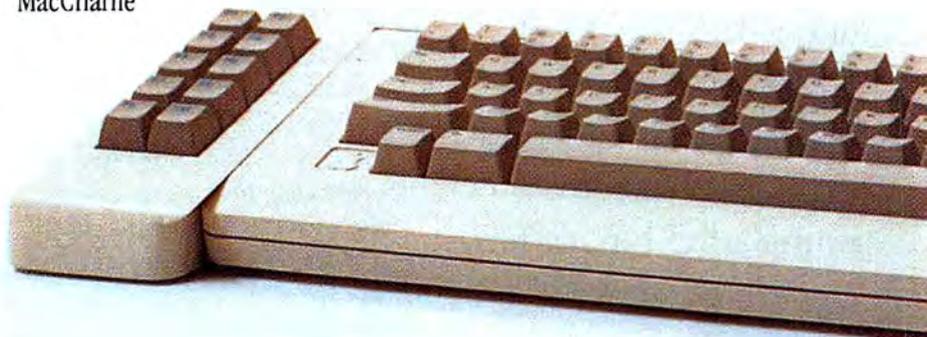
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drive A:. Most, however, will allow you to change the drive that the application assumes is holding its program files.

WordStar is one such program, which is why it would not run until its overlay files had been copied into the current subdirectory. To get *WS.COM* to look to the RAM disk for its overlays, use *WordStar*'s *WINSTALL* program to change the system disk drive (choice R on *WINSTALL*'s menu of *WordStar* features). If an application does not let you choose a drive for its program files, use the command `ASSIGN A: = d:`, substituting the RAM disk drive letter for *d*. After exiting the application, issue the command `ASSIGN`

to clear the prior assignment and regain the use of drive A:.

In either case, to change subdirectories you must exit the program and, either manually or via a batch file, use the DOS command `CD`, then restart the program.

DOS 3.10 includes a new external command, `SUBST`, which offers an easier and more elegant solution for just this problem. `SUBST` allows you to assign a path to a drive specifier in much the same way that `ASSIGN` redirects calls for one drive to another.

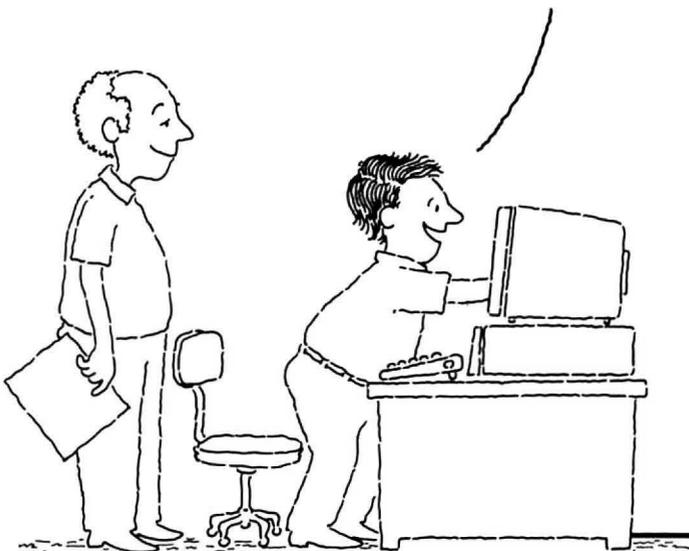
A batch file such as the following allows an application to access subdirectories by referencing the

substituted drive letter and, when the application is exited, to delete the substitutions:

```
SUBST B: C:\WP
SUBST D: C:\WP\LETTERS
SUBST E: C:\WP\MEMO
D:
B:WS %1
SUBST B: /D
SUBST D: /D
SUBST E: /D
```

You will still need to install *WordStar* so that it looks to the proper drive for its overlays (drive B: for this sample substitution), unless you substitute drive A: for C:\WP. In addition, to use drive letters beyond E:, you must reboot with a `CONFIG.SYS` file that in-

“Let’s fly it by J.B.”



cludes the line LASTDRIVE=d:, where d is the last drive letter used by the system.

MailMerge to dBASE and Back Q. WordStar's MailMerge option is useful for creating form letters in volume. The MailMerge data base file (name, address, and so on) would be even more useful if converted to a format that dBASE II could process.

Such a file conversion would eliminate the need to reenter that data for sorting in dBASE II or for performing other tricks that MailMerge cannot. Can a MailMerge data base file be converted to a dBASE II data file and vice versa?

S. Jabaghourian
Carpinteria, California

A. To create a dBASE II data base file from your existing MailMerge file, which we'll call MAIL, first rename the MailMerge file to end in .TXT (MAIL.TXT). Then load dBASE II and type **create** <Enter>. Enter a file name (we'll use maildb), and enter the record structure in the order matching that of the MailMerge data file. Respond to 'INPUT DATA NOW?' with **N**, and type **append from mail.txt delimited** <Enter>. You now have a dBASE II data base file, MAILDB.DBF.

After you have processed MAILDB.DBF with dBASE II, you'll want to translate the modified data base file back into a MailMerge file. Type **use maildb**

<Enter> and then **copy field field1,field2,...,fieldn to mail.txt delimited with** <Enter>, where field1,field2,...,fieldn are the dBASE fields that you want in the MailMerge file.

Those who already have a dBASE II name and address data base file and want to use MailMerge can simply reverse the order of translation.

Absent ANSL.SYS Documentation

Q. The DOS 2.10 manual describes the PROMPT command incompletely. Where can I find

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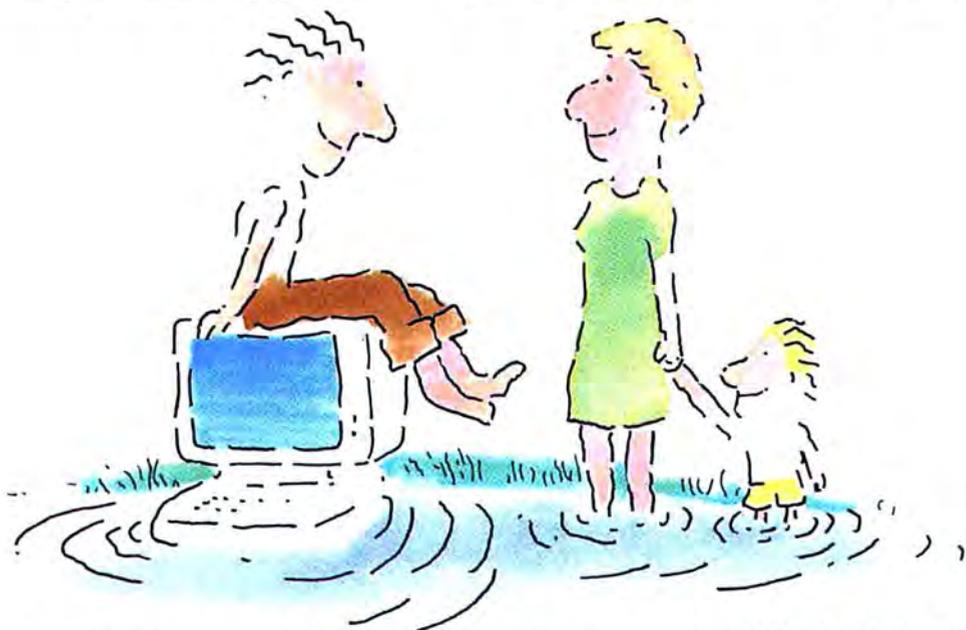
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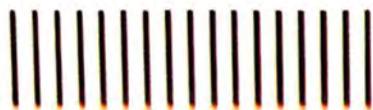
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complete documentation about which functions can be coded, including the setting of screen colors, key reassignments, and other related keyboard and display control sequences available through the ANSI.SYS driver?

Mike Tomlianovich
Bloomington, Illinois

A. The PROMPT command is the most accessible and frequently used means of invoking the functions of the ANSI.SYS driver. You might expect to find the driver documented with the command—or at least within the DOS 2.10 manual. Not so. The documentation for the ANSI.SYS driver, included in the DOS 2.00 manual,

resides in a separately bound and sold DOS Technical Reference manual for DOS 2.10 and later versions. You may agree with my feeling that the manuals should be sold as a set.

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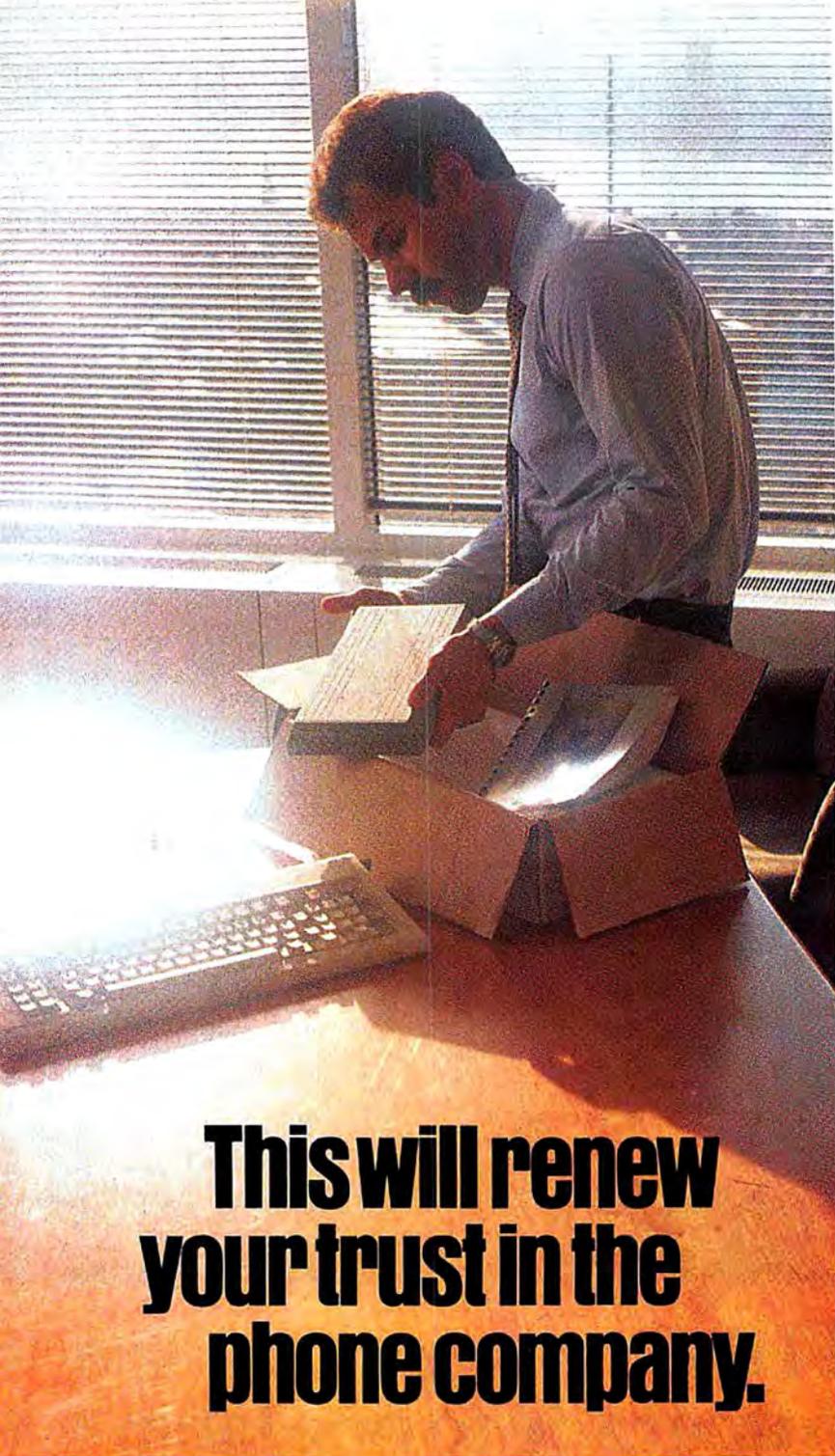
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command such as
COPY B:*.WKS (415)555-1234
Carlos Berguido
San Francisco, California

A. Binary files can be sent over phone lines reliably by dividing the file into blocks of so many bytes and sending the blocks, one at a time, along with a block number and a checksum derived from the data in the block. The receiving PC (or modem) then computes a checksum for the block received and compares that checksum with the checksum received along with the block. If the checksums are not identical, the receiving computer asks for the block to

be re-sent; otherwise, it asks for the next block. This technique is often implemented by a protocol known as XMODEM. Most telecommunications packages offer XMODEM file transfers.

If you are looking for an easy-to-use telecommunications package, consider *Lync*, from Norton-Lambert, P.O. Box 4085, Santa Barbara, CA 93103, 805/687-8896. Imagine such commands as
DIAL T415 555 1212
SEND /B8 B:*.WKS

Correction to "Set Form Length From BASIC or DOS"

The last paragraph of the last item in May's *Help Screen* should have begun, "Now add the line **TYPE FORMSIZE > PRN...**" The command **COPY FORMSIZE PRN** will also work.

Do you have any questions concerning the IBM PC or compatibles? Send them to The Help Screen, PC World, 555 De Haro St., San Francisco, CA 94107, or electronically to CompuServe 74055,412 or The Source STE908. ●

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- Getting the Most out of Spreadsheet Programs
- How to Get Your Programs Published
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- Maximizing Macintosh Disk Storage
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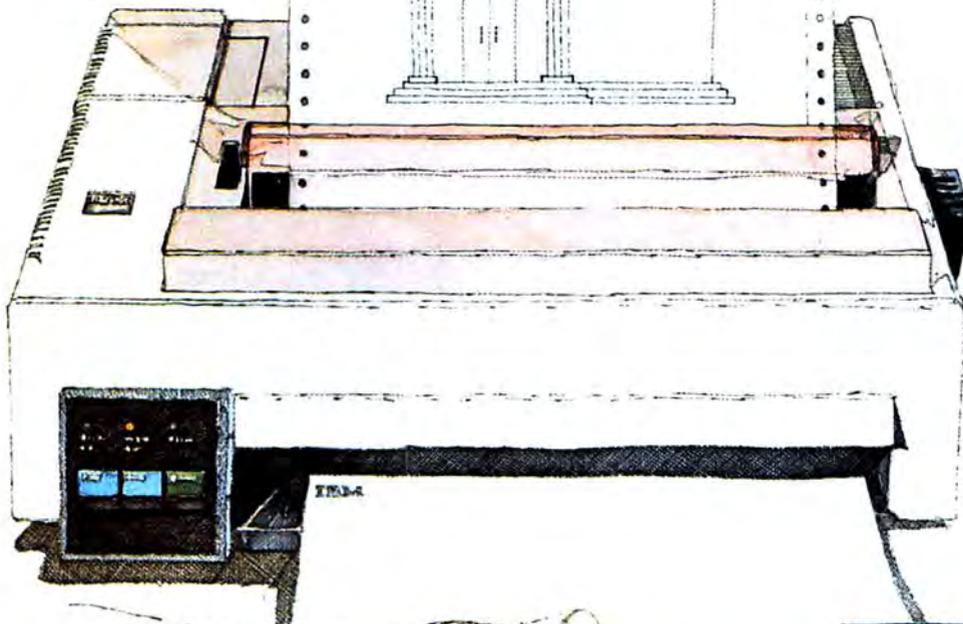
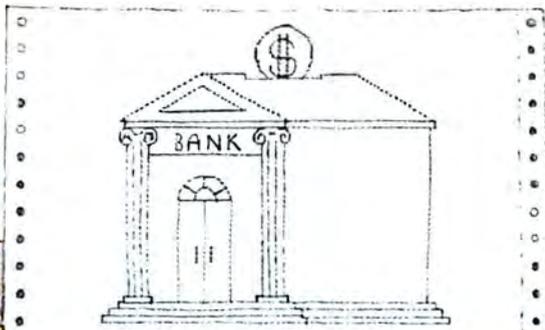


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IBM Personal Printers...The Finishing Touch

From the Hardware Shelf

First impressions of recent hardware releases

This month From the Software Shelf steps aside to allow a look at PC hardware. Items for your consideration: Panasonic's PC, monochrome graphics for less, a designer PC for the office, and program power in a touchpad.

Edited by Robert Luhn

Sr. Partner

Since the dawn of Compaq, the portables battleground has been strewn with dazed combatants who apparently suffered the same fate as Tommy Hearns at the gloves of Marvelous Marvin Hagler. A partial list of former contenders now down or completely out includes Eagle, Columbia, Hyperion, and Otrona. Obviously, the transportable weight class is not for the ill-equipped or faint of heart; technological savvy, marketing moxie, and pure corporate muscle are needed to survive in this computer division.

Not surprisingly, one of the combatants still standing is Panasonic, a megacorporation usually associated with consumer electronics—radios, televisions, and other gizmos. Larger companies with computer expertise, such as RCA, have fallen flat on their faces when confronted with the twists and turns of the personal computer market. But Panasonic's year-and-a-half-old Sr. Partner portable has proven to be a plucky fighter, ranking in the top ten of PC portables sold to date, according to market analysts at Future Computing.

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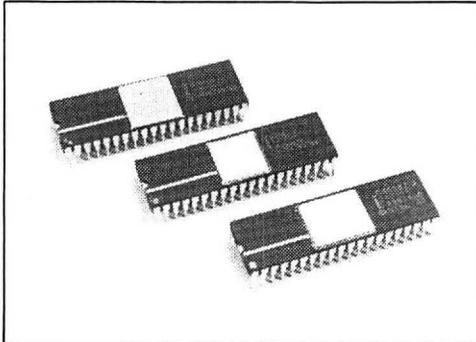
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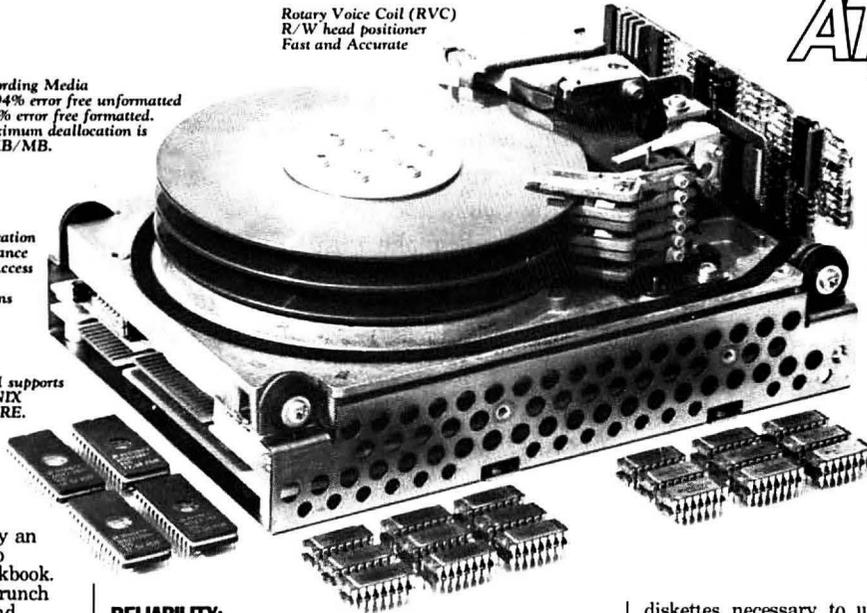
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You didn't buy an IBM PC-AT just to balance your checkbook. You bought it to crunch lots of numbers and words, in the shortest possible time. A labor saver. A time saver. Hence, a money saver.

So, do your part for effective money management; hard disk storage is no place to be penny-wise and pound foolish.

TELL 'EM YOU NEED HIGH SPEED AND DATA PROTECTION.

These and other important features do add cost, but that makes a premium drive.

Anything that can be made, can be made cheaper, sell for less, offer lower performance, and probably die young.

Remember, usually you get what you pay for, and you ALWAYS get what you don't.

ALL HARD DISKS ARE NOT CREATED EQUAL.

There are vast differences in the speed and reliability of Winchester hard disks. Since the IBM PC-AT is an incredibly fast machine, a slow drive can make an AT run like an XT.

So, before you get stuck with a slow drive in your AT, save your boss two grand and buy an XT.

Or better yet, buy the AT and avoid any drive with Access Times over 40 milliseconds.

RELIABILITY: WHERE HAS ALL THE DATA GONE?

Now tell 'em the drive must have a data protection scheme. One that's easy to use and reliable.

Winchester heads read and write while "flying" a few microns above the data surface. If the heads contact the recording media, you risk a head crash, and significant or total data loss.

So, even a fast drive without data protection is virtually worthless. Frankly, we'd rather sleep at night.

BEWARE OF USER-DEPENDENT PROTECTION SCHEMES.

Some drives have a safe landing zone for the heads, but you need to call a separate program to send 'em there. If you don't call that program, and most folks won't, the heads in these drives ALWAYS land on data when powered down.

The slightest bump or vibration can move the heads, wiping out those data tracks. And the R/W heads can become contaminated, thus increasing the error rate, slowing down average access until the whole drive fails.

Consequently, those drives offer a very high risk of head crashes, a false sense of security, and little else.

What's your data worth? \$200? \$400? Specify AUTOMATIC data protection. ATplus has it. And it doesn't cost, it pays.

PEACE OF MIND.

Specify AUTOMATIC park and lock of the heads on power down.

This system provides unparalleled head crash protection, by sensing power loss to the drive, and retracting the heads to a dedicated landing zone before they can land on your data.

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OUR DRIVES HAVE ALL BEEN TO BOOT CAMP

Avoid drives that CLAIM PC-AT compatibility but can't BOOT the AT. By the time you juggle the

diskettes necessary to use one of those drives, the phrase "user-hostile" will have deep personal significance.

We believe that computers ought to serve people, not the other way around.

BEWARE OF THE BARGAIN BAND-SCHLEPPER.

Avoid drives with inexpensive Band-Stepper positioner technology.

These were pretty good way back in 1980, considering that's all anyone had. But by today's standards, they're inaccurate and very mechanical.

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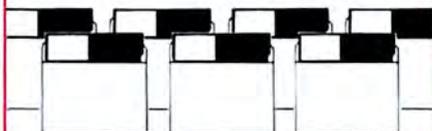
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well within reach. But before you place your bets, consider this contender's overall traits.

As portable pugilists go, the Panasonic is pretty tough; encased in a durable metal shell, it withstood numerous trips up and down the streets of San Francisco without once requiring technical assistance. This is indeed fortunate—its tendon-tearing weight and awkwardly placed handle make a trip across a room something of a challenge. While its "luggability" is a matter for weight lifters and other philosophers to debate, its PC compatibility is not: PC-DOS 2.00, 1-2-3, dBASE II, WordStar, and Flight Simulator ran without a hitch.

Although the machine's built-in thermal printer won't dazzle you with its print quality, it is surprisingly quiet and can spit out reports or charts at a respectable 55 characters per second. The printer is Epson MX-80 compatible and accepts graphics output from programs such as 1-2-3 and Sideways in both 80- and 132-column mode. The thermal paper, available only from Panasonic, comes in easily installed rolls and is perforated at 11-inch intervals. Unfortunately, the paper's coated surface is inhospitable to pencil erasures, which may be irritating to those prone to heavy rewrites. But all in all, the printer provides on-the-spot, readable hard copy while conserving that precious business commodity—desktop space.

The Sr. Partner, of course, is not without its flaws. Panasonic chose to fully emulate the PC's color graphics capabilities but not the crisp text of the IBM monochrome monitor. As a result, graphics dis-



Printer-in-a-PC:
the Panasonic Sr. Partner

play is superior, but the striated nature of text makes this monitor no site for sore eyes. The Sr. Partner's expansion capabilities also pale next to the competition's. While the Compaq comes with three free expansion slots, the Sr. Partner offers just one 3/4-length slot, which severely limits your options (a second 1/2-length slot is reserved exclusively for Panasonic's memory board). The unit's inability to accommodate multi-feature, full-length modem boards, for example, is particularly at odds with a machine so pointedly designed to be self-contained.

The Sr. Partner's ergonomics range from good to disappointing. As with most portables, adequately viewing the screen means perching the machine on several unread user manuals. The keyboard duplicates the PC's layout and snappy action, and typists will appreciate the larger return, shift, backspace, tab, delete, insert, and control keys. In keeping with its exercise-oriented nature, the power switch and

(continues)



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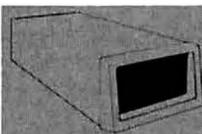
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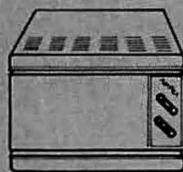


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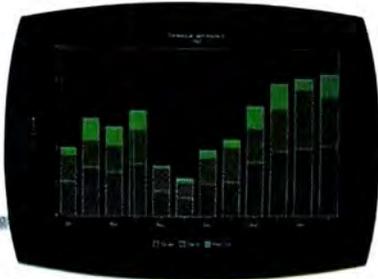
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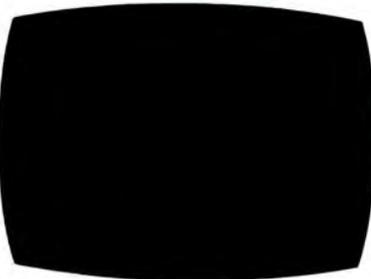
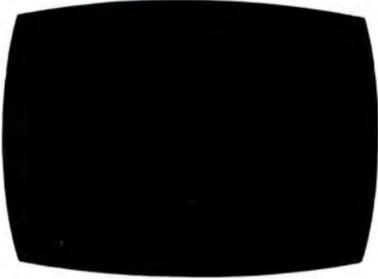
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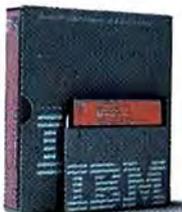
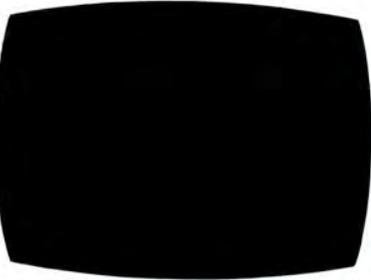
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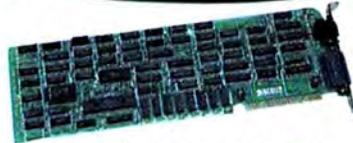
Flight Simulator*



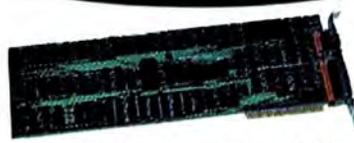
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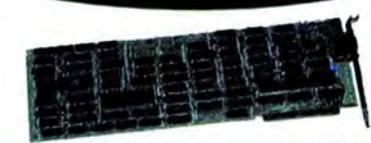
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brightness control are secreted at the very back of the unit. After carrying the Sr. Partner off and on for several weeks, I discovered this daily stretch becomes easier.

Nonetheless, the Sr. Partner is a solid deal, packing a high level of compatibility, performance, and immediate hard copy gratification in a small space for a decent price. Considering that some dealers are offering the Sr. Partner for as little as \$1995, this resolute scuffer may be in contention for some time to come. —Art Wilcox

Art Wilcox is a freelance writer and telecommunications consultant living in San Francisco.

*Sr. Partner
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List price: \$2595*

The Chauffeur

If you have an IBM Monochrome Display or a compatible monochrome monitor but ache to use monochrome and color graphics software, fret no more. The Chauffeur graphics board from STB Systems trots any PC-compatible graphics onto your screen—and look Ma, no software drivers! (Hence the board's clever moniker.) In contrast, the popular Hercules Graphics Card costs \$100 more and is limited to monochrome

(continues)

Internal 20 Meg \$599 External 20 Meg \$749



The affordable PC20 hard disk system is one of the most IBM compatible setups around—you'll be able to boot directly from the quiet, 3-1/2 in. drive. This highly reliable and rugged drive uses plated media. Our free software lets you get the most out of your hard disk—1dir organizes directories with a visual shell that speeds operation and frees you from the intricacies of DOS commands. And our exclusive 5-1/4 in. controller fits into a short slot—perfect for computers like the Tandy 1000, Panasonic Sr. Partner, and IBM Portable PC. PC20 comes complete with a low power drive, controller, bezels, cables and illustrated instruction manual.

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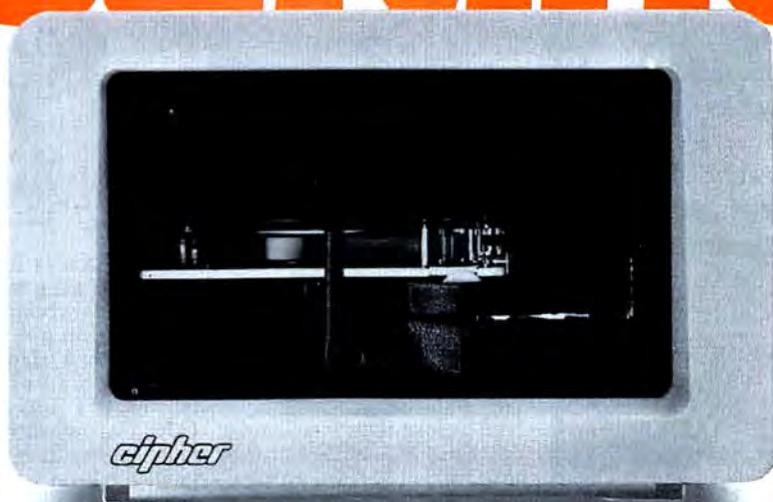
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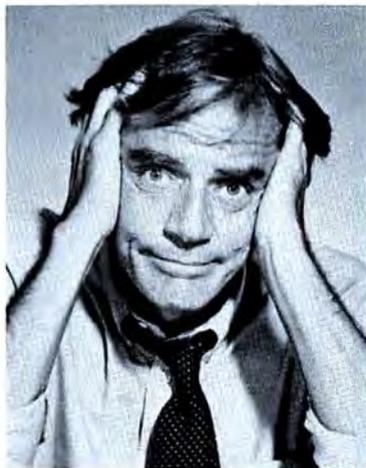


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Circle 115 on reader service card

graphics programs supplied with special software drivers or those written specially for the board.

At press time, STB claimed to have successfully run 52 graphics programs—including *1-2-3*, *Flight Simulator*, and *Framework*—and challenged anyone to find a PC graphics program that won't work with *The Chauffeur*. Although I didn't test all 52 packages, I can confirm that both *1-2-3* and *Flight Simulator* do indeed run flawlessly. Text display is comparable to that produced by the IBM Monochrome Display Adapter.

Another of *The Chauffeur's* unusual talents is the ability to convert 16 colors into 16 shades of green. However, certain color combinations that are readily visible on a color monitor are nearly indistinguishable when converted to shades of green.

Since *The Chauffeur* is compatible with the IBM Color/Graphics Adapter, it supports both medium- and high-resolution modes in shades of green. In addition, you can run *1-2-3*, *Symphony*, and *Framework* in extended (that is, 640 by 350) resolution. This special mode does require software drivers, which STB has thoughtfully provided for these packages.

Installing the board is easy even if this is your first time under the PC's hood. The user manual is illustrated with step-by-step instructions on everything from unscrewing the back to setting system switches. STB's customer service department is also on tap (though

(continues)

BT60 Streamer \$895 The Stack \$999



Don't suffer the loss of losing data. **BT60 Streamer** uses a half-height streaming cartridge tape unit that runs on a 5-1/4 in. controller card. Menu-driven software makes it easy of use. Copies up to 60 Megs on one tape at an amazing 5 Megs per minute! Recommended for systems with at least 130 watt power supplies. **The Stack** includes our **PC20** internal hard disk system and the **BT/SP10** tape backup system. **BT/SP10** plugs into the floppy controller card--no extra slot needed--and is accessed like a floppy. It uses spools of tape (\$12.95 each or 5 for \$49.95) that hold up to 10 Megs each. Software provided allows you to back up the **PC20**.

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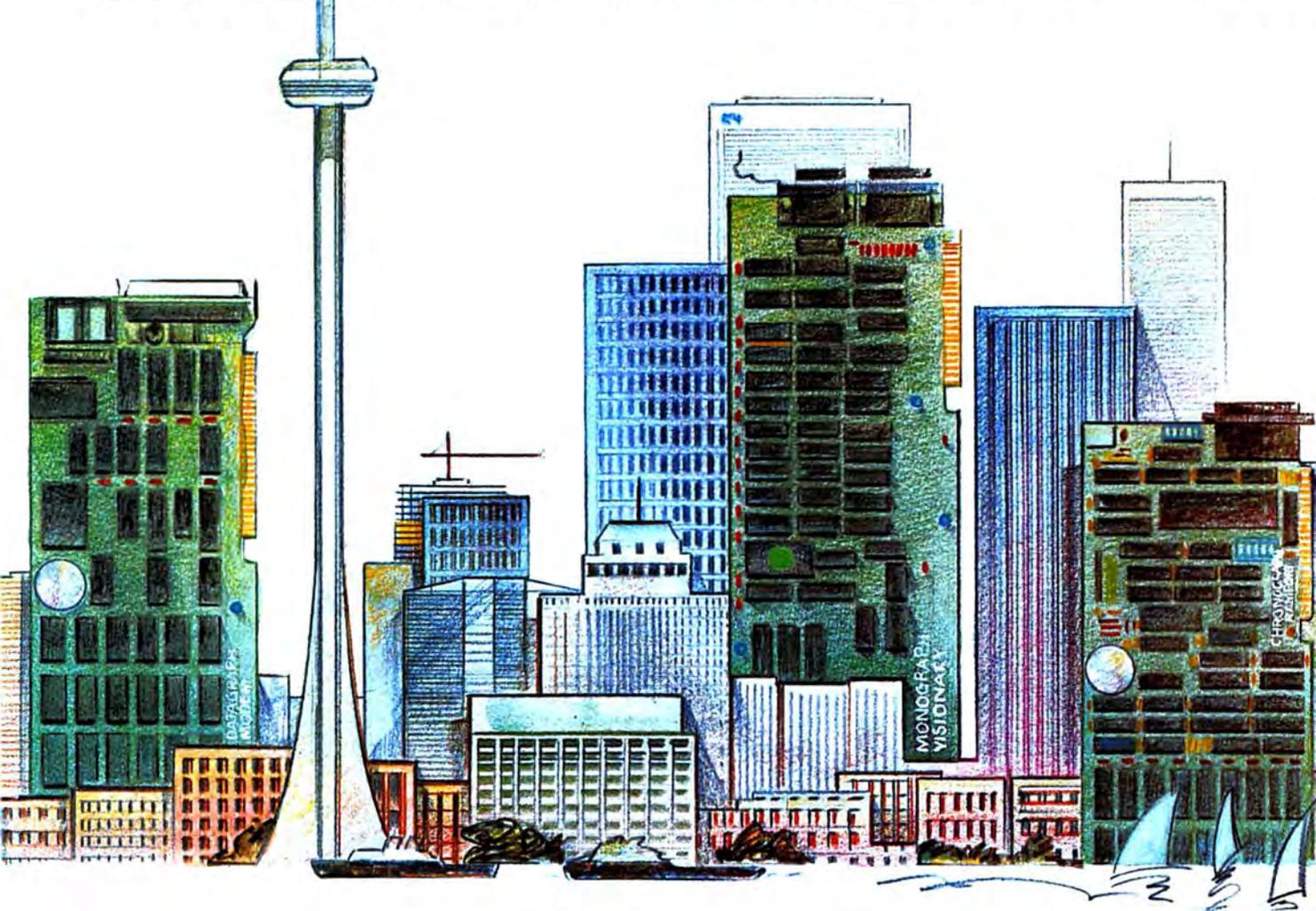
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not via a toll-free number) if you have problems installing or operating the board. The Chauffeur is backed by a one-year parts and labor warranty. Like most third-party graphics boards for the PC, The Chauffeur comes with a parallel port and an optional clock/calendar module; *PC Accelerator*, a very competent RAM disk and print spooling program, is also part of the package.

If you're about to buy a PC with a monochrome monitor, I suggest you pass on IBM's Monochrome Display Adapter and pick up The Chauffeur instead. Even if you already own a system, your money would be well spent if color is not a passion but graphics are a necessity. —Christine Whyte

The Chauffeur
 STB Systems, Inc.
 601 N. Glenville #125
 Richardson, TX 75081
 214/234-8750
 List price: \$395, clock/calendar option \$29.95
 Requirements: monochrome monitor

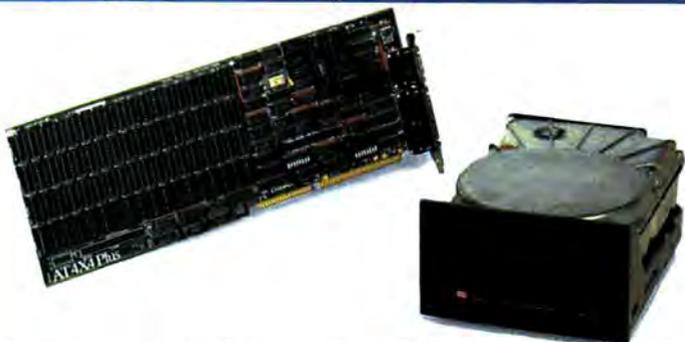


Wyse PC

Wyse Technology, a leading manufacturer of terminals, is a relatively new player in the PC-compatibles market. While many products following in the PC's footsteps try to distinguish themselves with louder bells or sharper whistles, Wyse has focused on delivering compatibility, economy, and style.

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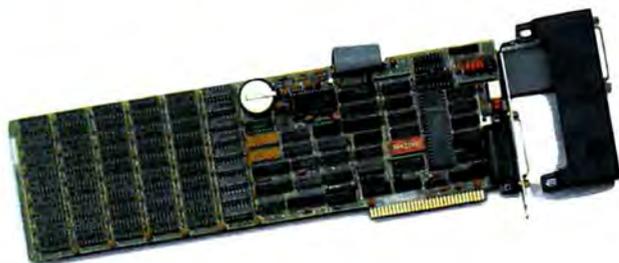
AT Enhancement Kit (ATK-1) \$1595



Our AT enhancement kit is the best way to turn your Basic AT into an enhanced version--and then some! By adding the Basic Time **AT4X4Plus** with 512K of memory to your system, you'll have 640K of contiguous memory with 128K above 1 Megabyte (double split memory addressing) for use with VDISK. **AT4X4Plus** comes standard with a serial and parallel port. Up to 4 Megabytes of memory, three more serial ports and a game port are optional. The **44 Meg** (as opposed to a 20 Meg) hard disk is a high-speed voice-coil-driven model with a 30 ms. average access time.

Circle 36 on reader service card

BT6Plus 64K \$179 BT6Plus 384K \$279



Simply, the best deal on a PC multifunction board--bar none. Basic Time's six function board, the **BT6Plus**, includes memory sockets for adding 64K to 384K, parallel printer port, asynchronous (RS-232C) serial communications port, battery-powered clock/calendar and electronic disk emulation & print spooling software. Optional game port. Comes complete with an easy-to-understand installation instructions/user's manual.

Circle 37 on reader service card

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Circle 431 on reader service card



Inside the Wyse PC's low-profile system unit are a 4.7-MHz 8088, 256K of RAM, dual floppy disk drives, a monochrome display, plus a motherboard that incorporates a floppy disk controller, a monochrome adapter, two serial ports, and one parallel port. For further expansion, two PC-compatible slots are included. If you have greater peripheral needs, Wyse also sells an external, four-slot expansion unit. This basic Wyse PC is endearingly dubbed the WY-1101-1; its 10MB hard disk brother is the WY-1100-2. Further system enhancements include an extra 256K of RAM, a clock/calendar board, and a telescoping pedestal for the monitor. All versions come with MS-DOS 2.11 and GW BASIC.

Unlike its desktop competition, the Wyse PC is strikingly elegant, designed from keyboard to system unit to be clean, modernistic, and ergonomic. The 14-inch monochrome monitor is cradled in a solidly built tilt-and-swivel unit that attaches to the top of the system unit or stands free on your desk. The monochrome display is sharp; Wyse's 14-inch color monitor is great with graphics but only fair with characters. If you're a full-time word wrangler who favors color, I suggest you get a high-resolution board that produces sharper text display. Like Panasonic's Sr. Partner, the Wyse PC's IBM-style keyboard features larger keys.

In its quest for compatibility, Wyse uses the Phoenix Software Associates' BIOS ROM chip. The

(continues)

Enhanced Keyboard ff5151 \$159



An affordable, productive solution to your non-standard keyboard. ff5151 uses solid-state capacitive key switches--giving you tactile feedback through your fingers. Avoid Num Lock confusion with our separate cursor control and numeric keypads and LED indicators on the Lock keys. We've returned keys to their standard setup including an extra wide Control key adjacent to the A for Wordstar users. Other features include an extra Control key in the function key row, 3-position height adjustment and sleek color matched styling. Plugs into IBM PC, PC/XT and Compaq Deskpro.

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Supercalc 3 (Ver 2) \$155	Masterworks \$ 89

TRJ Solver \$235
Wordstar 2000 \$239
Wordstar 2000 Plus \$289
Masterworks \$ 89

choice seems to have been wise, because the system ran every piece of PC software in sight: *Flight Simulator, 1-2-3, Keynote, WordStar, DisplayWrite 2, Cornerstone, Advanced Diagnostics*, and the BASIC Samples program provided with DOS 2.00.

Should you buy the Wyse PC? Maybe. It's certainly compatible, and its ergonomic design is a pleasure to work with and look at. Though it's too soon to talk about service history, Wyse's terminal line has gotten high marks for reliability—a reputation that should extend to its PC products. When you factor in the Wyse PC's price, you get a very attractive package.

Since the system is sold mostly to large corporations and value-added resellers, you probably won't find a Wyse PC in your local computer store—at least for the time being. But if your company needs PC compatibility en masse for the right price, think about calling Wyse.

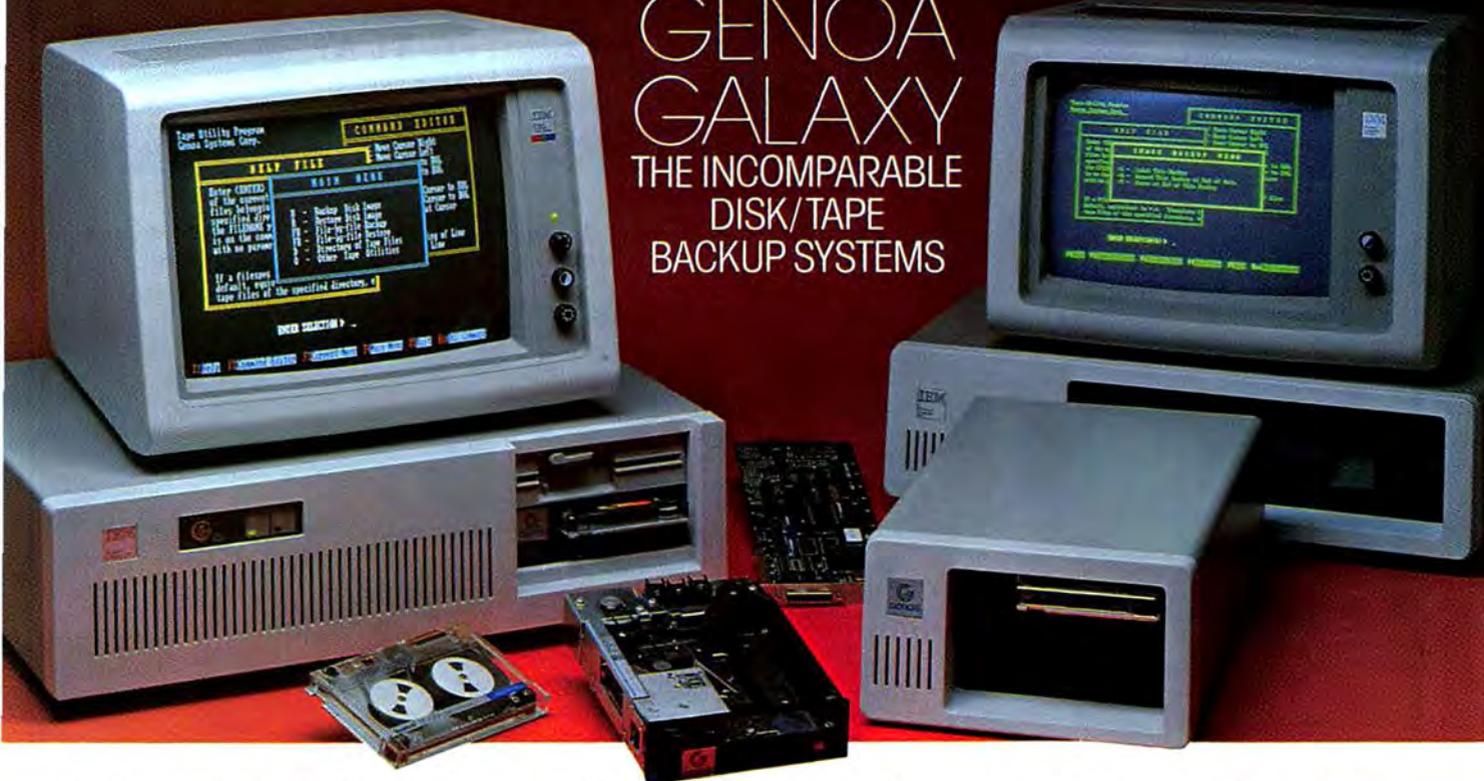
—Jon C. Pepper

Jon C. Pepper is a freelance writer based in Sutherland, Massachusetts.

Wyse PC
 Wyse Technology
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 List price: Wyse PC (WY-1101-1) \$1995, Wyse XT (WY-1100-2) \$3495, color graphics monitor and board \$500

(continues)

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DOS/Tape Utility Toggling	✓				
Mouse-like Command Input	✓				
DOS-like Tape Directory Commands	✓				
Backup/Restore Time & Percentage Indicator	✓				% only
Image Backup/File by File Restore with Directory Display	✓				✓
File by File Backup/Restore by Directory or Subdirectory	✓	✓	✓	✓	
File by File Backup/Restore by Date or Last Modified	✓	✓	✓	✓	
File by File Backup/Restore with Appending & Exclusion	✓		✓		
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 SD-15, above but 132 col., 16K. Call
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 SR-15, above but 132 col., 16K. Call
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GIBSON MIX Benchmark Results

Calculated S-Profile
(Representative COBOL statement mix)

Execution time ratio

mbp* COBOL	Level II* COBOL	R-M* COBOL	Microsoft* COBOL
1.00	4.08	5.98	6.18

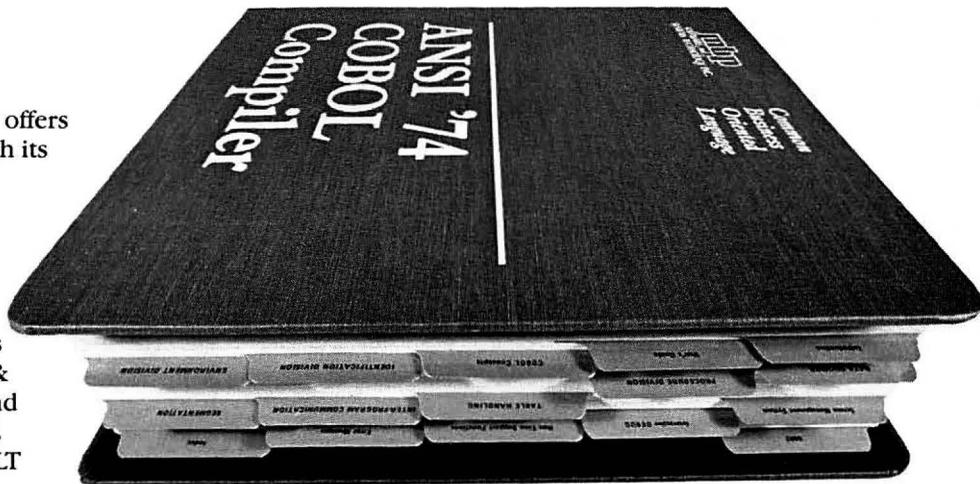
*128K system with hard disk required. IBM PC & AT are IBM TMs. Netware is a Novell, Inc. TM. Level II is a Micro Focus TM. R-M is a Ryan-McFarland TM. Microsoft is a Microsoft TM.

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- ✓ColorScreenPrint 2.0 59.

Ashton-Tate

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- ✓dBase III 1.1 call
- ✓Framework 1.1 call

Best Programs

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- ✓PC/Professional Finance Program II 3.0 149.
- ✓PC/Fixed Asset System 3.0 329.
- ✓PC/Tax Cut (for 1984 taxes) 49.
- ✓PC/Personnel (Level 1) 3.0 279.
- ✓PC/Personnel (Level 2) 3.0 419.
- ✓PC/Personnel (Level 3) 3.0 559.

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Borland International

- ✓Sidekick 1.5 (non-protected) 48.
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- ✓Turbo Pascal 3.0 w/BCD 59.
- ✓Turbo 8087 3.0 59.
- ✓Turbo 8087 3.0 w/BCD 72.
- ✓Turbo Toolbox 1.0 30.
- ✓Graphics Toolbox 1.0 30.
- ✓Turbo Tutor 1.0 19.
- ✓Superkey 1.0 37.

Broderbund

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Digital Research

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- ✓GEM Draw 1.0 (includes GEM Desktop) 93.

Evergreen

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FriendlySoft

- ✓FriendlyWriter 2.0 (with FriendlySpeller) 55.

Funk Software

- ✓Sideways 2.11 37.

Harvard Software

- ✓Harvard Project Manager 1.1 209.
- ✓Harvard Total Project Manager 1.0 279.

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- ✓Smartcom II 2.1 89.

Infocom

- ✓Cornerstone 1.0 289.

Lifetree

- ✓Volkswriter Deluxe 2.2 (with TextMerge) 159.
- ✓Volkswriter Scientific 1.0 289.

Living Videotext

- ✓ThinkTank 2.0 109.

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- ✓WordStar 2000 Plus 1.01 299

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- ✓R:base 4000 1.15 259

- ✓R:base 5000 1.0 special

- ✓Upgrade Kit to R:base 5000 special

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- ✓Clout 2.0 135

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- ✓Microsoft Spell 1.0 30

- ✓Microsoft Word 2.0 235.

- ✓Microsoft Mouse with software 3.0 135.

- ✓Microsoft Serial Mouse with software 3.0 135.

- ✓Microsoft Project 1.01 155.

- ✓Microsoft Chart 1.01 155.

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- ✓Crosstalk XVI 3.5 99.

- ✓Infoscope 1.0 129.

- ✓Transporter 1.3 (includes Crosstalk) 169.

Multimate International

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PCsoftware

- ✓PCcrayon II 39.

- ✓Executive Picture Show 139

- ✓CREATABASE 47.

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- ✓Norton Utilities 3.0 59.

Powerbase Systems

- ✓Powerbase 2.1 call

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- ✓PFS:Graph B:01 84.

- ✓PFS:Plan A:01 84.

- ✓PFS:Proof B:00 59.

- ✓PFS:Report B:01 77.

- ✓PFS:Write B:01 84.

Virtual Combinatics

- Micro Cookbook 29.

Warner Software

- ✓The Desk Organizer 2.0 69.

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ATI

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|-------------------|-----------------|
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| Business Software | PC-DOS (2.1) |
| Data Bases | Home Accountant |
| Compaq | VW Deluxe |
| IBM-PC | Basic |
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- | | | |
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| MS Word | Easywriter II | Multimate |
| Multiplan | Supercalc 3 | Framework |
| Symphony | Wordstar | TK!Solver |
- each 49

Comprehensive Software

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- ✓Intro to Databases 39
- ✓Intro to Communications 39
- ✓Intro to the Operating System (PC Tutor) 39

Individual Software

- ✓The Instructor II (all new!) 35
- ✓Professor DOS 47.
- ✓Tutorial Set (both items above) 75
- ✓Professor Pixel 47
- ✓Typing Instructor 39

Scarborough Systems

- MasterType 35.

EDUCATIONAL

Digital Research

- Diagnostic Test (PSAT) 14.
- OwlCat SAT (15 hour) 63
- OwlCat SAT (60 hour) 169.

FriendlySoft

- ✓FriendlyWare/PC Introductory Set 35.

Spinnaker

- Educational Games for Young Computer Users. (All require graphics board)
- Delta Drawing (ages 4 to adult) 34.
- Snooper Troops I (ages 10 to adult) 30
- Most Amazing Thing (ages 10 & up) 27.

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-Fraction Fever (ages 7 to adult)	23
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-Alphabet Zoo (ages 3 to 8)	20.
Stone (requires graphics board)	
My Letters, Numbers, Words (ages 1 to 5)	29
Kids Stuff (ages 3 to 8)	29.
Across the U.S.A. (ages 5 and up)	22

GAMES

Blue Chip	
-Millionaire	39
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-FriendlyWare/PC Arcade	35.
Hayden Software	
-Sargon III	35
Infocom	
<i>Difficulty levels shown in italics</i>	
-Seastalker (junior)	25.
-Enchanter (standard)	25.
-The Witness (standard)	25.
-Planetfall (standard)	25.
-Cutthroat (standard)	25.
-Hitchhiker's Guide (standard)	25.
-Zork I (standard)	25.
-Zork II (advanced)	29.
-Zork III (advanced)	29.
-Infidel (advanced)	29.
-Sorcerer (advanced)	29.
-Suspect (advanced)	29.
-Deadline (expert)	33.
-Starcross (expert)	33.
-Suspended (expert)	33.
<i>Invisicues (hint booklets) are available for most Infocom games. Specify game.</i>	7
Microsoft	
-Flight Simulator	35
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-Chess 2001	27.
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Spectrum Holobyte	
GATO	27.
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-Night Mission Pinball	29

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PC Connection Hardware Special
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Parallel Game or second Serial Port for any AST board (specify board)	35.
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AST-3/80	589.
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-Color 600 - RGB monitor	399.
-Color 700 - RGB monitor	439.
CompuCable	
Plastic Keyboard & Drive Cover Set	17
-IBM Mono Screen Enhancement	17
Curtis	
ACCESSORIES	
-PC Pedestal (for IBM Mono or Color)	37
-PGS or Quadchrome Adapter for above	9.
-Low Profile Tilt and Swivel Pedestal	37.
AD-2 Adapter for Portables	15.
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-Static Mat	27
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-AC Plug Adapter (any monitor to your PC)	8
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-Smartmodem to IBM Cable	19
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-FX-80 Plus	call
-FX-100 Plus	call
-JX-80	call
-LQ-1500 (letter quality dot matrix)	call
-Printer to IBM Cable (specify printer)	19.
Hayes	
-Smartmodem 300	149
-Smartmodem 1200	429



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✓Smartcom II 2.1	89.
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✓Scan Doubler Board for SR-12	call
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Multiplan (IBM)	dBase II
✓DOS 3.3.1	✓dBase III
✓Wordstar 2000	Framework
Multiplan (Microsoft)	✓Multimate
Volkswriter Deluxe	each 12.
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✓P1340 printer	call
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	89.
WICO	
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Control Data (CDC)

(5 1/4") half-height drive (DS,DD)	89.
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✓Bernoulli Box 20 Meg	2489.
✓10 Meg cartridge	48.

Maynard Electronics

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TM 100-2 (5 1/4") full-height drive (DS,DD)	109
10 Meg Internal hard drive w/controller (complete package)	479.

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64k Memory Upgrade Set for IBM-PC or XT system board	12.
64k Memory Upgrade Set for any memory board specify make of board	12.
Install memory upgrades & run diagnostics at time of board purchase only	10.
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Fuji

✓Disks for IBM-AT (96 TPI) Box of 10	39.
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MAXELL

✓Disks for IBM-AT (96 TPI) Box of 10	45.
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Verbatim

Datalife Disks SS/DD Box of 10	21.
✓Datalife Disks DS/DD Box of 10	25.
✓Disks for IBM-AT (96TPI) Box of 10	47.

INFORMATION SERVICES

Compuserve

✓Compuserve Information Service (includes subscription, manual, 5 hours of connect time, monthly publications)	19
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Source Telecomputing

✓The Source (subscription & manual)	39.
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Stay calm, all you junior owners. Get away from that window. Put that bottle back in the medicine cabinet. The worst thing to do in a crisis is panic. Instead, call up one of our trained and sympathetic support people at our junior crisis control hotline 1-800/IBM-jrPC. They'll talk to you about the hundreds of upgrades and software that we have available to give you years of creative computing with your PCjr.

The price list you see here shows

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1-800/IBM-jr PC



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For the IBM-PC (XT & AT) exclusively.

PC CONNECTION®

Directory Assistance

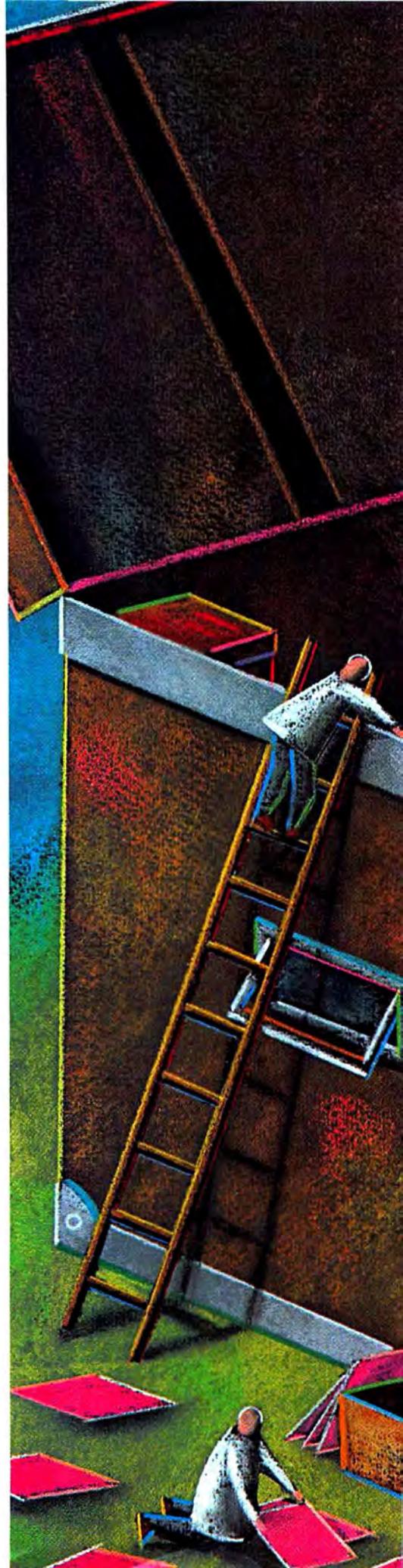
Ten or twenty megabytes of storage can turn into a megaheadache unless you plan carefully. Here's how to tame the monster hard disk with DOS's tree-structured directories.

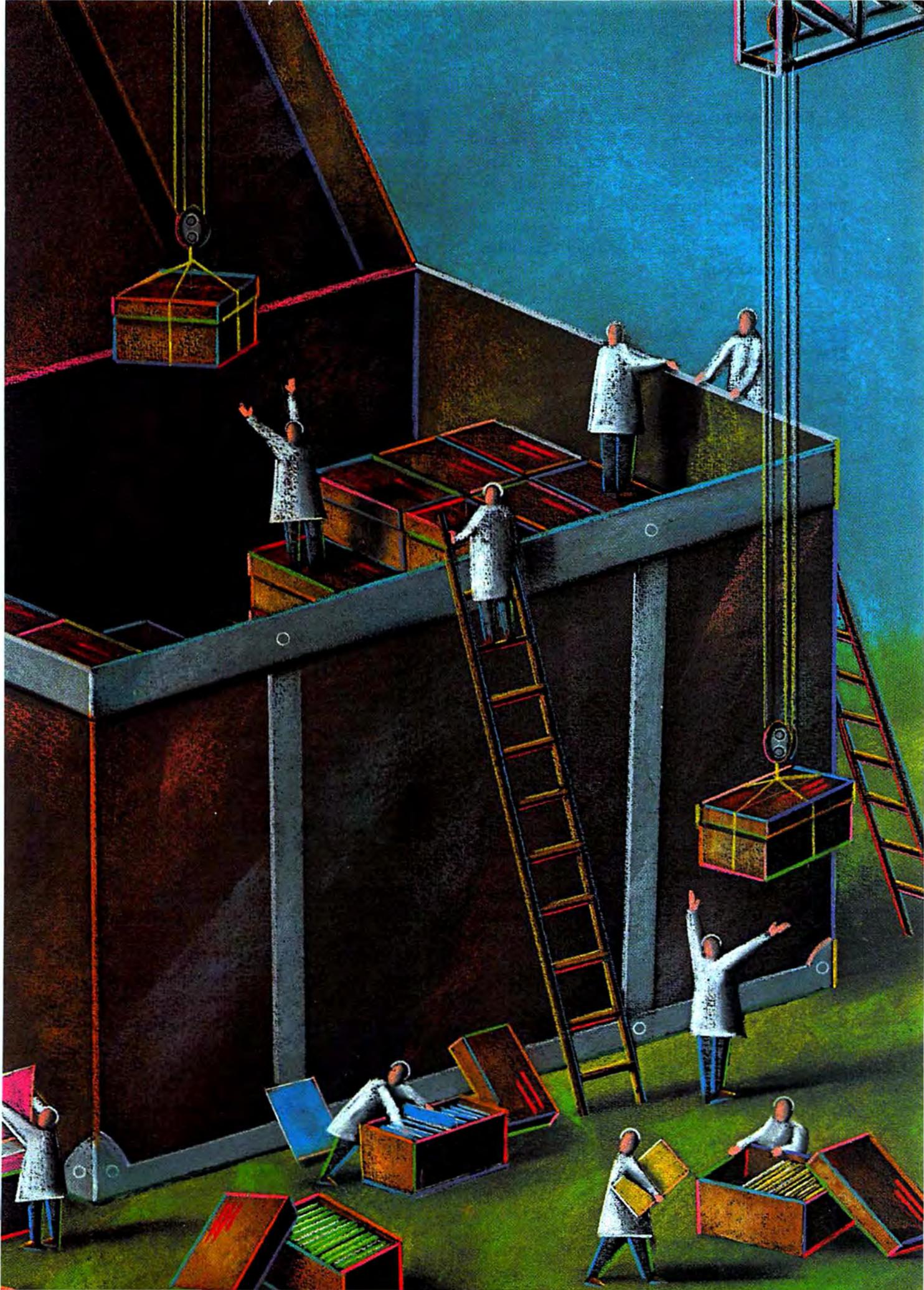
Alan Hoenig and Karl Koessel

||||| When you're young and single, record keeping is a snap. Important receipts, phone numbers, and business cards can all be shoved into an old shoe box. It's a minute's work to sift through the pile for whatever is needed. But marriage and maturity bring more than the obvious complications. Every receipt must be filed away for tax records, and the number of birthdays to remember multiplies. The shoe box gives way to a steamer trunk. At best, retrieving information from this mess is a lengthy and tedious chore; usually, it's impossible.

The same complications arise when you buy a hard disk system. A floppy disk is comparable to the old shoe box. It holds lots of information, organized into relatively few files. Most computer owners quickly discover the wisdom of grouping files according to type by segregating them on separate floppies. It's generally clear which floppies contain what files, and anything can be found quickly.

You graduate to the steamer-trunk league when you acquire a hard disk, such as that in an IBM PC XT or AT, a Compaq-Plus, or another, equivalent compatible. A 10MB hard disk, standard issue for an





XT, holds the equivalent of about 28 floppy disks; roughly 55 floppies fit on a 20MB AT disk. The multiscreen list that scrolls by when you ask for a directory of such a massive storage area is too large and jumbled to be of much help; you miss the organization enforced by the 360K limit of floppies. Managing information on these steamer-trunk disks takes some extra planning.

Directories and Subdirectories

With version 2.00, DOS introduced the key to organizing your megabytes. It's called *tree-structured directories*. By creating *subdirectories* on your hard disk, you effectively divide it into smaller disks, splitting the steamer trunk into shoe-box-size compartments. DOS also provides tools to keep the mass of information organized and labeled.

A hard disk compartmentalized into subdirectories provides the best features of both storage worlds—you can group related files in subdirectories as you would group them on separate floppies. At the same time you retain easy access to all your files because they are on a single disk, always inside the PC.

Although tree-structured directories were invented for larger storage media, you can use them on floppy disks as well. Subdirectory organization makes it easier for you to find a file. It also increases the number of files it is possible to have on a disk. The *root* (main) directory of a disk holds a maximum of 112 files, but you can circumvent this limit by dividing the disk into subdirectories. A subdirectory can store an unlimited number of files.

Subdirectories are hierarchically organized. Any subdirectory can contain files and additional subdirectories. "Hard disks have subdirectories inside 'em, and subdirectories have subdirectories, and so ad infinitum." (Apologies to Jonathan Swift.) Figure 1 represents the tree structure of a typical directory map.

This article will help you build your dream hard disk from the ground up. It will lead you through planning the structure, creating the directories, distributing the files, and then living with your creation.

The Plan

Setting up an efficient subdirectory structure is the most crucial part of domesticating your hard disk. The tips set forth here will help you plan the best structure for your personal hard disk.

Although subdirectories can be nested "ad infinitum," it's best to keep your directory structure simple. Try to avoid creating more than one or two levels of subdirectories. In the end this will minimize typing and spare you the agony of trying to remember a file's whereabouts.

The first rule of thumb is to keep the program files for each application in a separate directory, just below the root. Likewise, use a separate directory for all your DOS files, another for all your batch files, and yet another for all your utilities (like clock-setting programs and accessories such as *SideKick*). You should create separate subdirectories to hold your data files. For the simplest subdirectory structure, you can create the data subdirectories just below the root, parallel to the application subdirectories that hold the program files. As your subdirectories multi-

Although subdirectories can be nested ad infinitum, it's best to keep your directory structure simple. In the end this will minimize typing and spare you the agony of trying to remember a file's whereabouts.

ply, however, it's a good idea to make your data program subdirectories subordinate to each application subdirectory. (The subdirectories \WP\LETTERS, \WP\MEMOS, and \WP\GENERAL in Figure 1 are examples.) During installation, most applications ask for the directory that will hold program files and for the directory that will store data files—and most use the directories accordingly.

If some of your software was developed before the advent of DOS 2.00, you may have to organize your directories differently; some of that early software does not recognize paths. (The best way to determine whether your favorite program handles paths is to try placing the program's output in different

subdirectories.) Because applications that do not recognize paths cannot reach beyond the current directory to access and store files, you will need to create data files in the directory that contains your program files. If you have RAM disk software or DOS 3.10, more elegant solutions are possible. (See "Find That Path" in *The Help Screen* in this issue for more information.)

The structure you choose for your directories will, of course, depend on your own array of applications and your preferred filing systems. Keep in mind, however, that the simpler the structure, the better. On the other hand, you should balance the number of directories against the size of each: The purpose of subdirectories is to keep compartment size manageable. Some directories will inevitably be large—you can't split up a data base. But besides making it easier to find a file, limiting the size of directories simplifies

backing up your data. If no subdirectory contains more than 360K of data (and no more than 112 files), you can easily back up each directory onto a floppy disk in the A: drive with the simple DOS command `COPY *.* A:`.

■ Making Tracks

Just after you format your hard disk but before you create any subdirectories, a single directory (the root) encompasses the entire disk. You add subsidiary directories with the MKDIR (Make Directory) command. MKDIR, like most of DOS's subdirectory commands, is internal—it's always in memory when DOS is loaded. Thus, you can use MKDIR at any time, regardless of the current drive or directory. The short form of the command is MD. The command syntax is `MD path` or `MKDIR path`.

The concept of a *path* is one you'll have to learn well if you hope to gain control over 10MB of raw storage. A path is a list, in sequence, of the directories that DOS must traverse to get to a named file or subdirectory (see Figure 2). Each subdirectory name in a path is separated from its predecessor by a

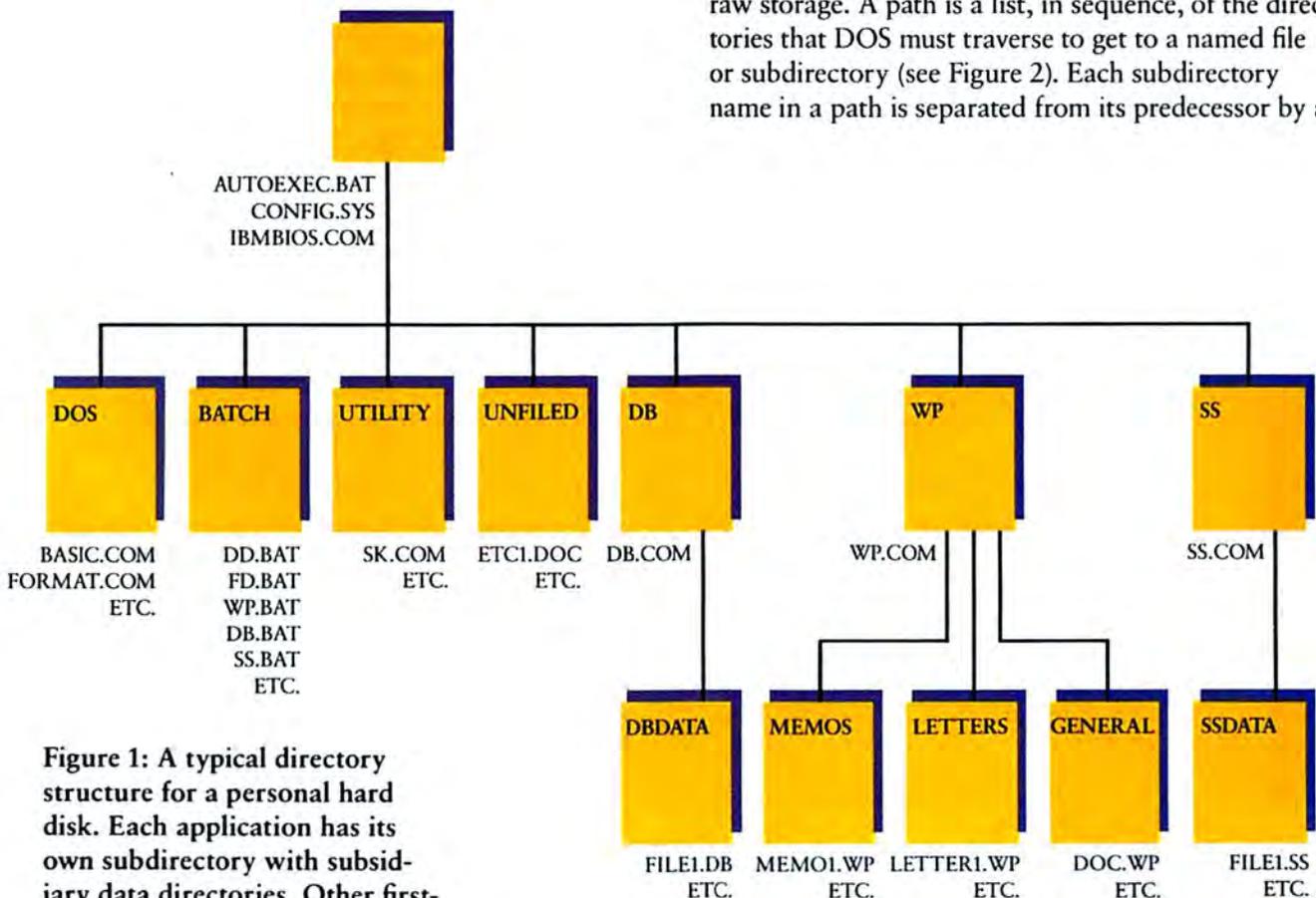


Figure 1: A typical directory structure for a personal hard disk. Each application has its own subdirectory with subsidiary data directories. Other first-level subdirectories hold every other category of file.

Hard Disk Batch Up

An AUTOEXEC.BAT file performs all the routine tasks you normally run through before starting a PC session. Adding a few steps to this file can automate navigations around your hard disk. The following AUTOEXEC.BAT file complements the directory structure described in "Directory Assistance."

```
PATH C: \DOS;C:\BATCH;
  C:\UTILITY
VERIFY ON
SCRN
COPY C:\WORDSTAR\
  WSMGS.OVR D:
COPY C:\WORDSTAR\
  WSOVLY1.OVR D:
CD C:\UNFILED
PROMPT $p$g
```

The first line in any AUTOEXEC.BAT file for a hard disk system should be the PATH command, naming the directories through which you want DOS to search for any command files outside the current directory. The next two lines shown here are typical of any AUTOEXEC.BAT file. They set DOS options to their preferred states and load RAM-resident programs. In this file, VERIFY ON tells DOS to verify that any data it writes to a disk is correct. The next line loads a utility program called SCRN that blanks the screen after 10 minutes of inactivity. SCRN is in the directory of \UTILITY

(which is not the current directory), but since that directory is named in the PATH command, DOS will find the program. You would use similar lines to load other utilities.

If you run any programs that don't recognize paths and you use DOS 2.00, 2.10, or 3.00, you can use the AUTOEXEC.BAT file to copy the helper files for those programs to a RAM disk, making those files directly accessible from a root directory. The lines shown here copy *WordStar's* overlay files into a RAM disk that was set up by the CONFIG.SYS file. If your RAM disk must be set up from the DOS prompt, use the AUTOEXEC.BAT file to implement the RAM disk before copying the helper files. If you have DOS 3.10, you can use the SUBST command instead of a RAM disk. Add this command to the AUTOEXEC.BAT file to assign a drive letter to the directory that contains your program files.

Next, this batch file changes the current directory to the \UNFILED directory. This helps keep uninitiated users from muddling your directory structure. The last line adds information to the DOS prompt. Instead of a simple C>, the prompt will show both the current drive and directory.

backslash. A backslash at the beginning of a path tells DOS to start at the root directory. (If no backslash begins the path, DOS will start from the current directory.) The entire string may be preceded by a disk drive designation.

Subdirectory names follow the same rules as file names: They can be up to 8 characters long with a 3-character extension. (Subdirectory names are stored as file names with a special attribute. In the root directory, directory names are counted in the 112-file storage limit.) If C: is your default drive, the following commands will create the directory structure shown in Figure 1:

```
MKDIR \DOS
MKDIR \BATCH
MKDIR \UTILITY
MKDIR \UNFILED
MKDIR \DB
MKDIR \DB\DBDATA
MKDIR \WP
MKDIR \WP\MEMOS
MKDIR \WP\LETTERS
MKDIR \WP\GENERAL
MKDIR \SS
MKDIR \SS\SSDATA
```

One directory in this tree may seem a touch mysterious. \UNFILED is an all-purpose directory into which you can dump any files that don't fit neatly into your file structure. Your AUTOEXEC.BAT file should take you to this directory immediately after

booting (see the sidebar "Hard Disk Batch Up").

\UNFILED not only provides a neutral ground from which to start your tasks, it safeguards system integrity; if someone unfamiliar with your directories uses your system, he or she will be taken straight to a directory from which it's possible to carry out business without unintentionally confusing your careful directory plan.

Switching Disks: CHDIR and Paths

Once you create the directories, you must always be aware of which one you're in. DOS keeps track of the default directory just as it keeps track of the default drive. To access a file in any other directory, you must use special commands.

Whenever you start or reset the PC, the default directory is the root directory of the default drive. You or a batch file can change the default directory with the CHDIR (Change Directory) command (see the sidebar "Instant Access" for batch files that will change directories for you). The syntax is CHDIR *path* or simply CD *path*.

If after you boot up you want to write a memo with your word processing program, for instance, you would give the command CD \WP\MEMOS. The current directory for the C: drive would then be \WP\MEMOS until the computer was rebooted or you used the CD command again to change it.



Figure 2: DOS follows paths like any traveler. The time zones can be pictured as directory levels. If San Francisco were the origin (root), the path to Dallas would be \Denver\Dallas. DOS would find New York with \Denver\Chicago\New York, and Helena with \Helena.

Instant Access

A few simple batch files can get you to the right directory and invoke an application so fast you won't realize what's happened. The batch files described here are custom-made for the directory structure set up in "Directory Assistance." Two-letter commands invoke the batch files, which ensure you're in the correct drive, change to the proper directory, and call the application. All of these batch files should be kept in a directory called C:\BATCH directory, and the PATH command should include a reference to the C:\BATCH directory.

Each batch file has the same structure. A word processing batch file, for example, would look like this:

```
C:
CD \WP
WP %1
CD \UNFILED
```

This batch file uses the command WP to invoke the word processing program. You would, of course, substitute the command that calls up your own word processing program.

The batch file also assumes that your word processing program allows you to specify on the DOS command line the data file you want the application to use. To use your word processing program, give the command WP *file-name* from the DOS prompt in any directory. The batch file (found with the help of the PATH command) will do the rest. Both programs and the proper word processing file will be loaded.

To make accessing other applications just as easy, create a similar batch file for each, simply substituting the proper path and program file name. If an application does not recognize paths and you have a RAM disk containing the program files or you have named a substitute drive with DOS 3.10 (see *The Help Screen* in this issue), your batch files can go directly to the appropriate data subdirectory before invoking the application.

DOS keeps track of default directories for each drive. Even while you're working in the C: drive, for instance, DOS remembers that the default directory for drive A: is the root. Thus, any files you send to the A: drive without a path name will be put into the root directory.

You can set the default directory for any drive from any directory. Using the CD command moves you to the directory you name if it is on the same

drive; if it is not, DOS will make a note of the new default directory, but you will remain on the same drive. To change drives, you use the familiar *d:* command.

You can access a file that is not in the current subdirectory by prefacing the file name with a path, including a disk drive designator if necessary. You must separate the file name from the path with a backslash. For instance, if during a word processing session you want to copy a memo file into the general word processing directory, you could give the command COPY \WP\MEMOS\MEMO1.DOC \WP\GENERAL. To execute a command file, however,

the path will not work unless you are using DOS 3.00 or a later version. To execute a program file that is not in the current directory, you must use the PATH command.

■ Paving PATHs

The PATH command allows you to name the subdirectories you want DOS to look through for any command file you call. If DOS can't find the file in the current directory, it will search along the paths listed in the PATH command. The syntax for the command is `PATH [[d:]path[;[d:]path ...]]`. Once given, the PATH command remains in effect until you restart or reset the computer or issue another PATH command.

PATH suffers from one major shortcoming—it applies only to executable files (which usually have the extensions .COM, .EXE, or .BAT); it does not apply to data or other auxiliary files. The ever-active rumor mill claims this limitation will be corrected in DOS versions beyond 3.10.

The PATH command works most efficiently as a line in your AUTOEXEC.BAT file. With the directory structure shown in Figure 1, the command `PATH C:\DOS;C:\BATCH;C:\UTILITY` ensures that most of the executable files needed from various subdirectories are automatically accessible.

■ Distributing Your Files

Once directories are set up, you can distribute your files on the hard disk by using the `COPY A:*. *` command from each application disk to the proper application directory. AUTOEXEC.BAT, CONFIG.SYS, and COMMAND.COM should be in the root directory. These should be the only files in the root, leaving the remaining file slots open for directories. One contingency to keep in mind: Many programs use helper files—auxiliary files from which the main program draws, such as overlay files, dictionary files, and on-line help files. *WordStar*, for instance, uses two helper files: WSOVLY1.OVR and WSMMSG.OVR. If an application (like *WordStar*) does not recognize paths, you must keep its helper files in every data subdirectory for that application, so that DOS never has to look outside the current directory for the files. Since helper files are not execut-



able files, DOS will not search the directories set by the PATH command to find them. Again, as explained in this issue's *Help Screen*, DOS 3.10 or a RAM disk can circumvent that problem.

■ Compass Points

Even the best-laid hard disk plans are complex; finding a file on a 10MB drive is inevitably more complicated than leafing through a box of floppies. Before you enter that jungle, take time to learn a few tricks for finding your bearings.

DOS's TREE command rolls out a report listing each directory and its subdirectories. To see the directory structure of a drive other than the default drive, you must specify the drive as a parameter of the command. A drawback to this command is the length of its output; the list scrolls tantalizingly past your eyes and right off the screen. Since having a permanent record of your directory structure is handy, it's best to give the command `TREE [d:] > [path]filename`, which directs the output to a file on a disk or in a directory of your choice. Typing /F after the drive designation adds a list of all the files in each directory to the output.

Another nifty trick lies in a variation on the CHKDSK command. When you use the /V option with this command, DOS lists on your screen each directory and its files. You can create a batch file

called DD.BAT (for Directory of Directories), which contains the single line
`CHKDSK C:/V | FIND "Directory" | MORE`

This file should reside in the batch directory.

The external operating system commands, including MORE.COM and FIND.EXE, should reside in the DOS directory. The PATH command issued in the AUTOEXEC.BAT file will ensure that these files will be found as needed. When you execute the batch file, CHKDSK creates a list of every directory and every file in the system. The directory names are preceded by the designation "Directory." The DOS pipe (|) tells DOS to pass CHKDSK's output to the FIND filter. The FIND filter then locates all lines that contain the word *Directory* and outputs only those lines. The MORE filter limits the output to a screenful at a time.

DOS's PROMPT command provides a way to keep track of your position within the subdirectory maze. If you include the command PROMPT \$p\$g in your AUTOEXEC.BAT file, the DOS prompt (usually C>) will grow to display the current directory as well as the current drive. \$p stands for *path*; \$g stands for *greater than*. If you don't want to change your prompt, you can determine your current directory by giving the simple command CD, with no path parameter. DOS will report the current directory.

■ Keeping Up the Good Work

You'll soon find that directories and files proliferate like wire hangers in a clothes closet. After the initial structure is set, careful planning and close monitoring are in order. All too often, multiple copies of a file find their way into different subdirectories.

For housekeeping purposes turn to CHKDSK again, in a batch file called FD.BAT (File Directory). It consists of a single line:
`CHKDSK C:/V | FIND "%1" | MORE`

You invoke this file with the command `FD filename`, where *filename* can be any string of consecutive characters in the file name, entered in capital letters.

A word of caution: Entirely different files in separate subdirectories may have the same file name. Don't automatically assume that all files with the same name are identical; check before you delete.

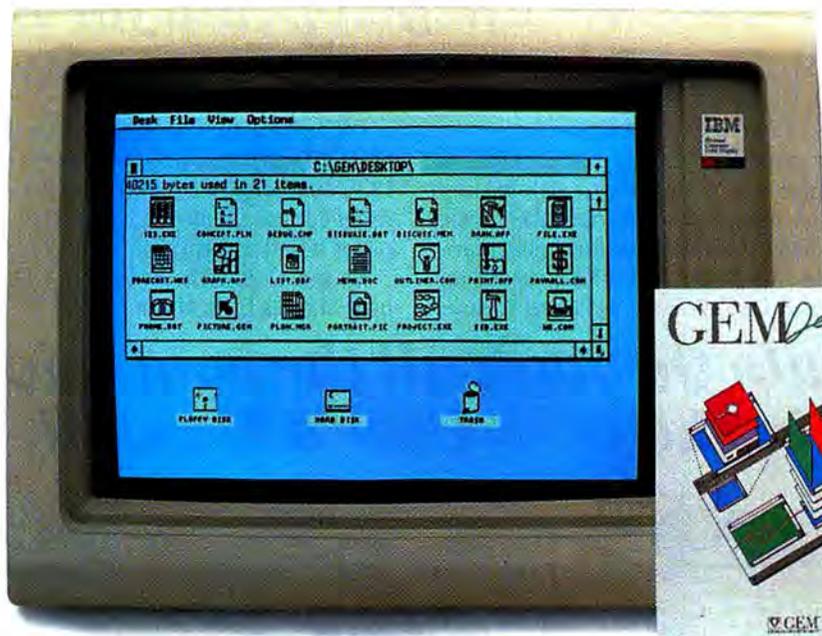
■ *You'll soon find that directories and files proliferate like wire hangers in a clothes closet.*

Over time some of your subdirectories may become obsolete; after a while there is no justification for keeping a directory full of draft proposals for the contract you never got—especially on your hard disk. DOS recognizes the ephemeral nature of even the most useful constructs, like subdirectories, and supplies the RMDIR (or RD, Remove Directory) command to erase them. To remove a directory, delete all the files and subdirectories it holds, change to the parent directory (you can use the shorthand `CD ..`), and give the command `RMDIR path`. If that directory is your current directory or if the directory is not empty, DOS will not let you remove it.

A hard disk should make your work easier, not more complicated. The structure of your directories is the key that unlocks all that storage. And if you plan them carefully and groom them regularly, your tree-structured directories can turn the hard disk monster into a powerful ally. ●

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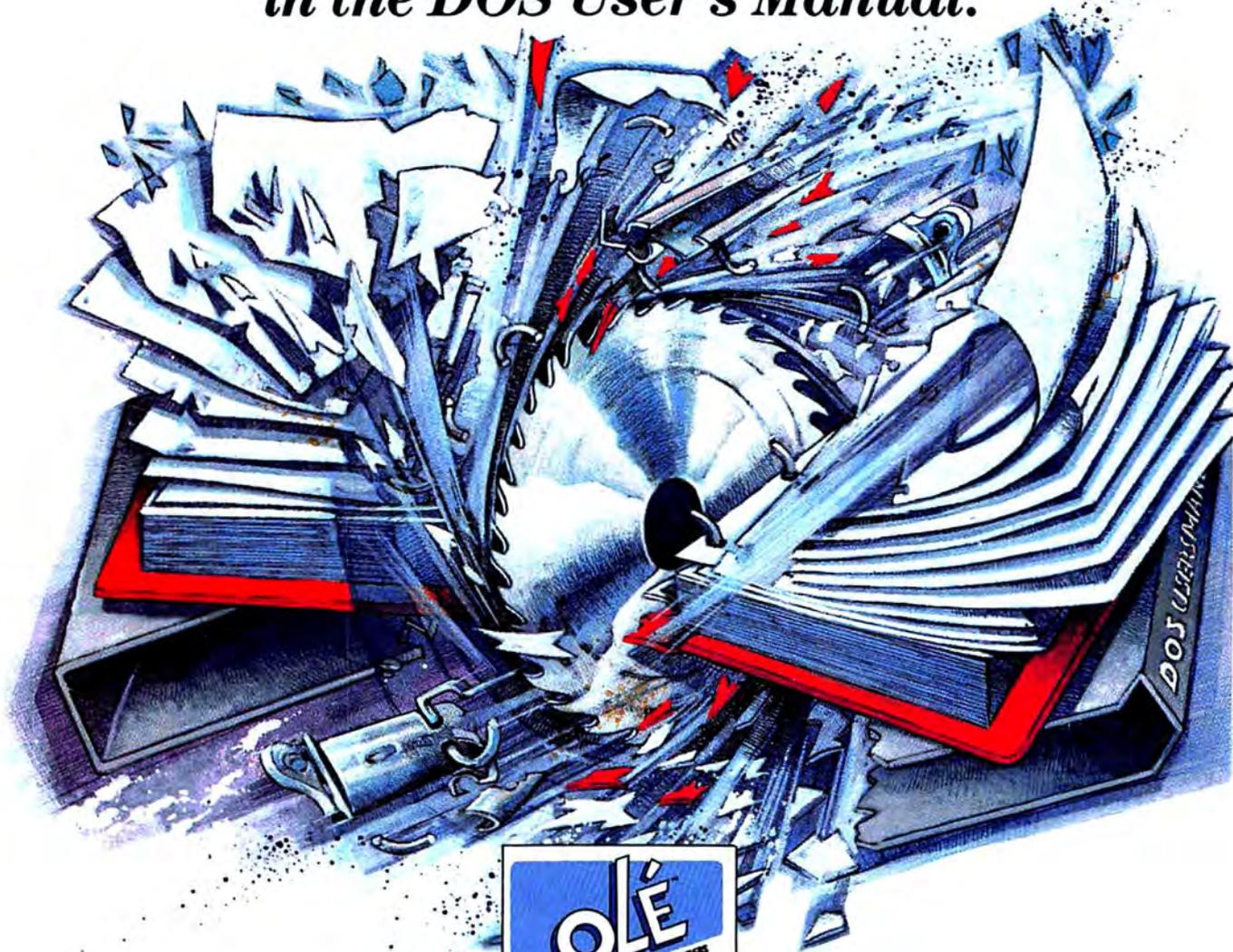
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Hard Times at Drive C:

The challenge of getting that hard disk inside your machine is as much financial as technological. Two disk-drive industry heavyweights ruminate on the perils of producing drives for the finicky and fickle personal computer market.

Edited by Ken Greenberg

||||| During the best of times a hard disk is your silent partner in computing. Quietly it hums, its read/write head poised a few microns above whirling platters, ready for action. Its appetite for data is prodigious, its speed of retrieval remarkable. Its blinking red light signals a reassuring, if slightly ironic, "go" for your operation.

But times are not always good. The care and feeding of a hard disk can be a nerve-bending endeavor, mined with error messages that are capable of coaxing cold sweat from even the most vigilant user. Unseen and usually unheard, hard disks are sensitive to heat, dust, smoke, moisture, movement, static, power fluctuations, and other offenses of man and nature.

Manufacturing these crucial components is no less nerve-bending. The hard disk industry is volatility incarnate, a microcosm of the topsy-turvy

world of high tech. For many disk drive makers, this is the year of living dangerously (see the sidebar "Falling Media Stars").

To obtain a detailed portrait of the industry's mercurial present and potential, *PC World* Associate Editors Robert Luhn and Ken Greenberg interviewed Alan F. Shugart, chairman and CEO of Seagate Technology, and Irwin Rubin, chairman and CEO of Computer Memories, Inc. (CMI).

At IBM Shugart pioneered floppy disk technology, leaving in 1973 to start Shugart Associates, a predominantly floppy-disk-drive manufacturer that Xerox eventually swallowed (and more recently, jettisoned). Shugart himself continued on, founding Seagate in 1979 and swiftly steering it in the direction of market ascendance. According to *Disk/Trend Report*,





an industry newsletter, Seagate is still atop the heap. Among OEMs in the under-30MB, 5¼-inch class, Shugart's company owns a 41 percent share of the market. But times are changing; Seagate, which built its business around the XT's 10MB hard disk, now finds itself in the midst of a major product transition, as 20MB units become de rigueur. As evidence of that transition, Montgomery Securities reports that Seagate's output during the last four quarters has dropped by nearly 30 percent.

Irwin Rubin founded CMI in the late 1970s with proceeds from the sale of a company. As sole supplier of the AT's 20MB hard disk, CMI was either

For Al Shugart, founder and chairman of Seagate Technology, the hard disk drive business has taken a Darwinian turn. The outspoken engineer-turned-executive predicts continued depletion in the ranks of drive makers.

the goat or the scapegoat in the festering enigma that surrounded that drive. The AT episode succeeded in lifting CMI from relative obscurity. Last year, IBM reportedly supplied the firm with a different kind of lift: \$6 million to beat a temporary cash flow problem. More recently, CMI and IBM put their heads together to diagnose what's been ailing the AT's hard disk. Whatever the trouble, CMI disks are no longer alone; IBM is also doing AT business with Seagate, Tandon, and its own newly formed PC disk drive group.

At press time, hard times appear to have softened a bit for both Seagate and CMI. In the wake of a \$60 million contract with IBM, Seagate stepped up production, hired 300 additional workers, and reported third-quarter profits of \$1.7 million. CMI's

■ *'We're finding that customers for disk drives are becoming much more concerned about the viability of the disk drive supplier.'*

AT hard disk hassle may now be history; IBM has cast a vote of confidence by doubling its initial order to 240,000 drives. Topping off this coup, CMI's quarterly earnings were a robust \$2 million.

An edited version of *PC World's* conversation with Shugart and Rubin follows.

PCW: InfoWorld's John Gantz recently described the disk drive marketplace as "a Malthusian nightmare of too many companies and not enough market." Is that an apt description?

Shugart: I think that's accurate. During 1981 and 1982 too many disk drive manufacturers were launched into business by too much venture capital. After a particularly tough nine months, a lot of those companies are dropping out and the market's improving.

PCW: Another analyst actually used the term bloodbath to characterize the market expected in 1985-86.

Rubin: I don't anticipate a bloodbath, but there just isn't enough money to finance everybody. Com-

panies with enough cash and a bank line are going to be around through 1985. Otherwise, you're going to see people quit the business for lack of money.

You're beginning to see it now. You've got Shugart going, Ampex is teetering, IMI is gone, and Vertex is merging with Priam because Priam has \$40 million. I think you're going to see more drive companies merging with other drive companies.

PCW: Al Shugart, you've reportedly predicted that when the dust finally settles, only half a dozen disk drive companies will be around.

Shugart: Probably half a dozen maximum. It's a tough business.

Rubin: I think 48 or 49 hard disk companies—which is what we had in 1983—is too many, just as 200 personal computer companies is too many. It's down now to perhaps 20 hard disk companies and 100 computer companies, if you count everybody.

PCW: Aside from an obvious cash shortage, what is behind this shakeout?

Rubin: Estimates of personal computer sales were grossly exaggerated. A lot of people who were supposed to purchase computers didn't buy them. Some people who purchased computers didn't use them and gave them away or sold them. The market just never materialized.

PCW: Seems as though the current climate puts a premium on funds for product development and new technologies.

Rubin: Someone said \$20 billion in risk capital went into corporations during 1983. Back in 1978 when the capital gains tax was 50 percent, that figure was less than \$2 billion. You can see that investments go up as taxes go down. But now money is scarce again. Just as in the housing industry of a few years back, financing is creative. You create a better way or a different way of getting money by taking on debt.

Shugart: The key to developing new products is cash. People who haven't conserved their cash are in trouble. It's really tough to find money—private, public, even bank loans. The banking industry doesn't like this business very much.

Hard disk shortage? Not for Irwin Rubin, chairman of Computer Memories. CMI's assembly lines are slated to turn out 240,000 20MB hard disks for the PC AT this year.



PCW: Does it help to have the technology slow down a bit, holding the status quo for a while and enabling companies to bring costs down?

Shugart: I think that's an unreal situation. It certainly would be nice, but I don't see it happening. If we ever come to a point where the industry isn't growing, business will be really boring. All the high-powered guys around here will quit.

PCW: I've heard 15 to 20 percent quoted as the average profit margin for hard disk manufacturers.

Shugart: That's about right. During the last few quarters, gross margins have been 16-plus percent. Margins have to get back to 25 to 30 percent.

Rubin: That is what we have been trying to do. But to continue in this business and become one of the long-term players, more than 20 percent should be the goal.

PCW: Generally speaking, though, isn't this a buyer's market?

Shugart: For the older products it is. Not many companies that buyers want to do business with can manufacture the newer products. I think we're finding that customers for disk drives are becoming much more concerned about the viability of the disk drive supplier. When a company has 1000 systems on the floor and needs disk drives in order to ship them, the question is, am I going to get my 1000 drives?

PCW: Al, I'm interested in your personal feeling about Xerox's decision to dismantle the company that bears your name.

Shugart: I'm just tickled pink every time a competitor goes out of business. Shugart, Ampex, and Memorex are all getting out. I don't have any more feeling about Shugart Associates than I did about Ampex or Memorex.

PCW: Some say the Chapter 11 filing by Storage Technology, which is certainly not in the PC marketplace, has given the entire disk drive industry a black eye. Do you buy that?

Shugart: Every time any company goes bankrupt the industry gets a black eye. Although I say that I really enjoy seeing our competitors go bankrupt, it's also true that when one drops out, the whole stock market falls. Eventually the survivors will do well, but meanwhile you have to accept that black eye.

Rubin: I don't think the Storage Technology situation is significant for us. That's the mainframe business—entirely different from ours. People who buy mainframes don't go to Businessland or Computerland. The only thing the bankruptcy does is release some people you may want to hire.

PCW: Even with the industrywide slowdown, we're seeing great interest in hard disk systems as both standard equipment and subsystems. What seems to be driving the demand for storage? Are stand-alone systems still dominant, or are larger applications, networks, multiuser situations, and the like now directing demand?

'The new applications market for single user stations is going to expand the demand for disk drives. And that's not even looking at the additional requirements of multiuser systems.'

Shugart: We're talking about all applications. On my office XT I've already used almost 9MB of the 10MB drive. I'm not very careful, but I think I'm typical. By itself, the new applications market for single-user stations is going to expand the demand for disk drives. And that's not even looking at the additional requirements of multiuser systems, UNIX, and applications like CAD/CAM [computer-aided design and computer-aided manufacturing].

Rubin: For mass producers like us, the big demand right now is to make drives that emulate the AT's 20MB unit. Even Apple wants some of its computers working in business environments, so they're also following IBM in a sense. Business users will of course purchase the lion's share of disk drives.

PCW: Isn't IBM mandating something like a 40-millisecond access time for the AT in a multiple use environment?

Rubin: Actually it's a little less than 40 milliseconds. With 85MB it's less than 30 milliseconds. So unless you are making fast-access drives, you're going to be out of most of the business. You need to

produce fast-access drives in the middle category, which are the 40-millisecond 20MB, 40MB, and 50MB units.

PCW: How much storage is the business user asking for?

Rubin: If you're using UNIX you need more than 10MB, just because of the size of the operating system. Even without UNIX, you need more than 10MB to access multiple screens in a multiuser setting.

PCW: So what's a logical jump in storage capacity for somebody now using an XT?

Shugart: Based on new orders, OEMs want 20MB units, but the full-height 10MB is still the unit we sell in largest volume. But we don't see any new orders for full-height 10MB drives.

Rubin: The biggest thing now is 20MB. The subsystem people are buying very few 10MB drives,

which sold in large quantities for around \$400 a year ago. You can buy full-height 10MB drives today for \$220. So you can make a subsystem very cheaply and sell it for \$695. Even half-heights are down to \$250. If you can get a 20MB today for the same price that a 10MB went for a year ago, why not buy the 20MB?

PCW: Is it reasonable to expect that once the market is steeped in ATs and AT look-alikes, the next jump is likely to be to 40MB?

Shugart: Yes. I haven't looked at the AT as a single-user station, but even if you view it that way, the storage requirements will double.

PCW: Some disk-drive industry analysts regard the 30MB-to-100MB range as an entity unto itself. Isn't that cutting an excessively broad swath, and how many users are really going to need that much storage?

Shugart: I don't know. Some single users will want that much if a big CAD program is being run. I think 30MB is probably low—the range will be 40MB

(continues on page 192)

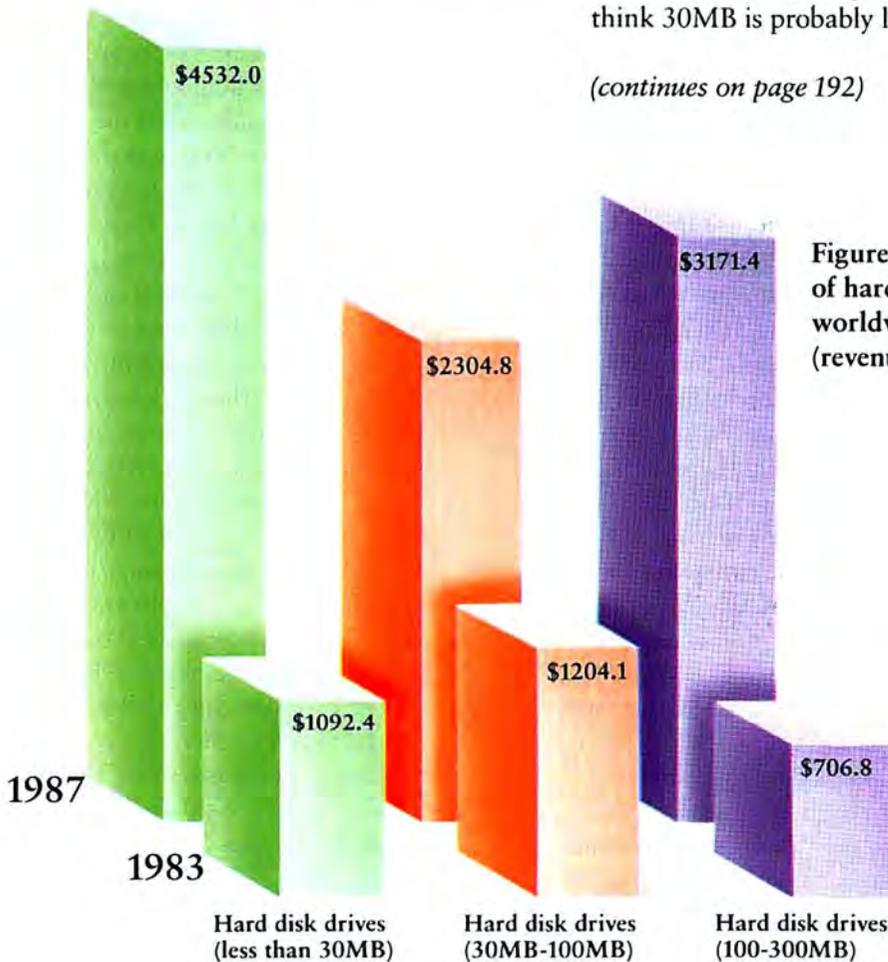


Figure 1: Shifting product mix of hard disk drives, based on worldwide disk drive shipments (revenue in millions)

Source: 1984 Disk/Trend Report

Falling Media Stars

Wendy Lea McKibbin

Once the high-growth darlings of the venture capitalist world, hard disk drive manufacturers have fallen from grace and, in some cases, toppled to their deaths. Summing up the pernicious cycle of losses, layoffs, and consolidations that has battered the industry since December 1983, Roger Gower, president of disk drive maker Miniscribe, says, "It's been bloody."

Gower's firm, based in Longmont, Colorado, was among those hardest hit in 1984 by the severe and sudden curbing of IBM's appetite for 5¼-inch hard disk drives—a cutback reflecting a general downturn in the demand for personal computers. While the root cause of the disk drive industry's current ill health is a dilatory PC market, it's hard to deny that IBM's reaction to the lull wreaked havoc on two strata of vendors.

"There's no doubt that IBM could have been more gentle with its suppliers," says James Stone, vice president of Shearson Lehman/American Express in New York. "IBM really goofed by over-ordering and then resorting to drastic cutbacks to fix the problem. When you figure that IBM accounts for 30 to 40 percent of all purchases in the industry, it's easy to see the damage a move like that can cause."

Observers note that when the going got rough, IBM applied the squeeze to the already paltry profit margins of some disk drive suppliers. In addition, Big Blue's sheer market dominance, which nudged some PC-

compatibles manufacturers into oblivion, inadvertently shrank the potential customer base for hard disk products.

The IBM factor, however, is just one element in a complex set of circumstances behind what some have called an industry bloodbath. It's a debacle with many agents: an abundance of vendors competing for a dwindling customer pool; severely eroding prices worsened by competition between Tandon and Seagate; spiraling development costs followed by abbreviated product life cycles that made it impossible to recoup investment dollars or liquidate inventories; and a cold shoulder from the financial community, resulting in depressed stock prices and an absence of financing. New technologies are knocking at the door, just loud enough to give some customers second thoughts about the prevailing state of the art.

A cursory review of the last 18 months reveals the cumulative damage of all these factors—a lethal combination when mixed with a soft market and a recalcitrant IBM. The list of the wounded is lengthy:

- Tandon Corporation reported first-quarter losses in excess of \$15 million and acknowledged that further write-downs are likely. Sources say the company allocated \$25 million from reserves to compensate for reductions in the inventory value of its low-capacity hard disks and full-height floppy disk drives. To cushion

this bruising, Tandon has begun to diversify, building PC compatibles for Tandy Corporation.

- Seagate Technology saw a 50 percent drop in sales during its first quarter, posting earnings of about a penny a share; per share earnings were flat for the quarter ending December 31.

- Miniscribe went through three rounds of layoffs, which affected 45 percent of the company's domestic work force. Still hurting from its transition to Far Eastern manufacturing, the firm reported a \$6 million loss on \$123 million in sales for 1984.

- Onyx + IMI, a San Jose-based company, got out of the disk drive business altogether last fall. IMI sold a portion of its hard disk business to CMI.

- CMI reported losses of \$11 million during the third quarter ending December 31. The company attributed these results to price erosion and start-up costs for a new Singapore-based plant dedicated to AT hard disk production.

- Xerox decided to dismantle Shugart Associates amid losses and product write-offs totaling \$85 million. The decision was presaged by layoffs of nearly 1000 workers and the closing of Shugart's Roseville, California, facility.

- Among other key players the refrain has been the same. Micropolis reported annual earnings of less than \$1 million, down from \$3.5 million the previous year—a loss attributed to “a shift in product focus.” Xidex acquired the larger Dysan Corporation, which was hurt by a \$14 million loss

during the first nine months of 1984. Priam furloughed 100 employees after its acquisition of Vertex Peripherals, temporarily abandoning plans for making a high-capacity 5¼-inch hard disk. And, perhaps proving that the shakeout wasn't limited to OEMs, subsystem vendor Davong filed for protection under Chapter 11.

The worst may not be over. While many companies are still licking their wounds and trying to recoup losses, market survival demands major investment to gear up for the new generation of high capacity, fast-access drives. “By the end of 1985,” says Shearson analyst Stone, “most of the revenue the industry generates will be from products that did not exist at the beginning of the year. At present the 10MB, slow access business is dying, and the new standard is 20MB to 40MB drives with 40 millisecond or better access times.” Stone foresees half-height 20MB and 3½-inch drives dominating the market by the end of 1986.

Still, the current gloom hasn't dimmed some lustrous projections. International Data Corporation estimates the overall disk drive market will top \$22 billion by 1987, up from \$4 billion in 1984. The hard disk portion of that pie is expected to grow from 47 to 53 percent.

Some analysts believe that the 30MB to 100MB drive represents the next high-growth area for OEM suppliers. And Micropolis, Quantum,

(continues)

Vertex, Miniscribe, Fujitsu, and Hitachi are expected to be among those contending strongly for market share. Seagate, although a latecomer, may also play a key role, according to James N. Porter, editor of *Disk/Trend Report*, an industry newsletter.

Porter predicts that worldwide OEM shipments of the 30MB to 100MB drives will grow from 345,000 to roughly 1 million by 1987. He also estimates that IBM will be producing slightly less than one-third of these midrange 5¼-inch hard drives by 1987.

Who's likely to survive in this veritable jungle of high-volume disk drive manufacturing, where the stakes—and the amount of resources required—continue to rise? The survivors, according to Mark Hahn, product planning vice president for Corvus Systems in San Jose, will be companies with sizeable cash reserves, a broad customer base, and the right economies of scale.

But one technology analyst offers a more expedient, if less tantalizing, solution. The answer to the disk drive industry's surfeit of suppliers, he suggests, is a massive exodus of vendors "to weed out the market."

Wendy Lea McKibbin, formerly the West Coast editor of *Infosystems*, now holds that position at inCider.

to 100MB [see Figure 1]. The actual number will depend in part on what happens to disk memory costs. If you can get an 80MB drive for the same price as a 40MB unit, then the number will be 80.

PCW: *Are there problems either in manufacturing or in product reliability when you're talking about drives of that size?*

Shugart: There are always problems. If you're in the disk drive business, you've got problems. Disk-recording technology has been increasing exponentially. That's what has made computers worth buying—you can get a great deal of storage cheaply. We're down to \$20 per megabyte, going to \$10 a megabyte. Someday it will be \$1 a megabyte.

PCW: *If demand jumps too quickly from 20MB to 40MB or 40MB to 60MB, it puts a squeeze on your margins, right?*

Shugart: Absolutely. Our products' life cycles are very short, probably 18 months. If this business were easy, everybody would be in it—and nobody would be making money.

Rubin: The short life span of a given disk drive is unhealthy. Two years after the fact, you ask yourself, Who manufactured that product? Future changes in product cycles will not occur as quickly as they have these past two years, chiefly because there's no more venture capital.

PCW: *Many of the newer applications are considerably bulkier than their predecessors. Installing three or four modules of IBM's Business Management Series brings you up to 6MB of just program code.*

Shugart: That trend will continue. In two years the 6MB of code will be 20MB, and that's just adding new applications. Sure, a lot of programs could be written more economically, but why do it? Cheap disk memory is compensating for a great deal of inefficient program coding.

PCW: *Isn't the PC-based disk drive business really a number of businesses—OEMs, subsystems for the retail marketplace, local area network offerings, etc.?*

Rubin: The disk drive business does represent several different marketplaces. Some companies address the low end of business, some the middle, and

some the high end. Tandon, Seagate, and Miniscribe target the low end. And so did IMI, the half-height, high-capacity business that we acquired. Vertex, Maxtor, Atasi, and Micropolis are firmly entrenched in the high-end field. They're selling to the DEC's, the Wangs, the HPs, and the Data Generals.

Shugart: I see network requirements for mass storage as a big market opportunity. The question is who does the networking—IBM and DEC and Hewlett-Packard? Or will it be the smaller network companies?

Who controls 85 percent of the business? IBM, Apple, the Japanese, and AT&T. If you don't address these players, you've got to fight with every other disk drive manufacturer for the other 15 or 20 percent.'

PCW: *Despite the demand for hard disk storage, there doesn't seem to be much room in the industry for small suppliers. Is that evidence that a relative handful of companies have pretty much tied up the IBM's and the Apples?*

Rubin: There's still a niche for companies that offer drives in smaller quantities. They make extremely reliable products, and they'll always have buyers. I think the need for a number of these smaller, more reliable companies will continue.

PCW: *As mainstays in the OEM world, both Seagate and CMI must find it difficult to be alternately the beneficiary and the victim of a few very large customers' ordering patterns.*

Shugart: Victim is too harsh a word. Being a supplier to all the big guys is a different world than filling orders for the garage shops. Given the alternative, we'll continue to supply the big guys. If you're in the high-volume manufacturing business, you'll always have excess production capacity. You'll also accept the vicissitudes that come with it.

PCW: *From what I've read, IBM's share of Seagate's total business is down from 60 percent to about 50. Is that accurate?*

Shugart: I don't know if it's ever been at 60 percent, but it's always been about 50.

PCW: *How can a disk-drive maker successfully woo other customers yet ramp up production to satisfy primary clients?*

Shugart: You want to have a good reputation with current customers, but you also want to have excess manufacturing capacity and the lowest possible cost structure so you can respond to pricing pressures from your competitors. Excess capacity is a must.

Rubin: You can't really seek out others. If you look at Seagate and Tandon, you notice that well over half of their business comes from one or two companies.

PCW: *In terms of depending on a few big fish, you're in a similar position yourself. That really gives the customer an advantage when it's time to set prices.*

Rubin: It gives the customer an immense amount of clout. Who controls 85 percent of the business? IBM, Apple, the Japanese, and AT&T. If you don't address these players, you've got to fight with every other disk drive manufacturer for the other 15 or 20 percent.

PCW: *IBM reportedly has begun manufacturing its own fast-access 40MB drives. Will that invariably mean slumping sales for third-party manufacturers like yourselves?*

Rubin: It's going to make this a much smaller industry. Ultimately, IBM is going to control the disk drive sector of the personal computer business just as it has in the mainframe world.

Shugart: I don't know whether IBM's plan to build disk drives is good or bad. We've always looked on all our customers as potential competitors. I think IBM's a well-run business that views the buying of components as any well-run business would. Our ob-

jective is to supply their needs better than they can themselves. If we can, they're still going to buy from us.

PCW: Haven't you both gone overseas for much of your manufacturing?

Shugart: Almost all of it, now. The only thing being done in Scotts Valley [California] is preproduction work. Final assembly happens in Singapore, but we manufacture some components in Bangkok, and very shortly we'll be making some components in the Philippines. The quality in Singapore is as good as or better than in Scotts Valley.

Rubin: In terms of manufacturing, Singapore is the best place to go. Nearly everything we build there costs less and has a lower rejection rate.

PCW: What's the major source of the savings?

Rubin: It comes from both labor and shipping costs. Many components—the motors, the semiconductors, the capacitors, the resistors—are from Japan. It's cheap to ship them from Japan to Singapore.

PCW: IBM recently released its first hard-disk-less XT's. Does this actually signal a pullback from the XT, which has been Seagate's bread and butter?

Shugart: We sell disk drives. What our customers use them for is their business. Every machine has a limited life. But the fact is, disk drives are getting so cheap that you're finding an ever larger percentage of computers sold off-the-shelf with internal hard disks. You're going to see more and more of that. The systems manufacturer is going to do the packaging. He's not going to let the end user make the decision of whose disk drive to use.

PCW: While the 3½-inch floppy disk drive seems to be gaining strength, is "downsizing" gathering similar momentum in the hard disk industry? Some observers say a new standard—or a second standard—could take hold as early as next year, conceivably paving the way for more compact desktop units.

Shugart: Right now, there aren't many 3½-inch drives being shipped. But eventually all the low-capacity drives—those under 20MB, maybe even under 40MB—will be 3½ inch.

Rubin: I think 5¼-inch will remain the standard in the high-capacity drives because you need a lot of platters to get the storage. But when it comes to

the smaller, more portable computers, you're going to find they'll all have 3½-inch drives.

PCW: What's the advantage of such a change?

Shugart: The 3½-inch drives occupy less room and weigh a little less. They contain the same number of parts as the 5¼. In fact, they've got some disadvantages because you've got less real estate to put the electronics on. But because of the smaller form factors, the market is larger, and so the cost of manufacture could be less than for the larger drive.

PCW: Some of those involved in alternative mass storage suggest that an electromechanical device such as a hard disk drive has certain inherent limitations—that the technology can take you only so far. . . .

Shugart: The technology has been around for 35 years. In 1964, when we were at 200,000 bits per square inch, we predicted a leveling off. We've now put down 25 million bits per square inch, and we don't see an end yet. So whoever is predicting the leveling off of magnetic recording technology is probably enticing investors into backing his optical disk company.

PCW: Are optical disks likely to bring storage costs down even further?

Shugart: Perhaps eventually, but until optical media can be erased and updated and provide the kind of reliability you get with magnetic media, it won't really compete with magnetic recording. Some 15 years ago optical recording had the prospect of having 100 times the density of magnetic recording. Now it's down to around two or three times. It just may not be economically viable.

Rubin: I know people who are funding start-up ventures to make optical media. As soon as they're under way, I think you'll be seeing a lot of optical disks. I'd say it's two years away, but it's coming along.

PCW: Does either one of you have firm plans to enter the optical market?

Shugart: We'll be the second one in.

Rubin: We've thought about it. We've thought about subsystems and all sorts of things.

PCW: *From what we glean from Hitachi and Toshiba, the market will initially be dominated by one of them, 3M, or Sony, rather than a Seagate or a CMI. Is that a fair assessment?*

Shugart: It will be somebody else, anyway. We don't have any optical disk programs right now.

Rubin: I don't know; I'm not clairvoyant. But it's true, the people doing disk drives now aren't doing opticals. I can safely say that a lot of people

Whoever is predicting the leveling off of magnetic recording technology is probably enticing investors into backing his optical disk company.'

you might talk to today about the disk drive business won't be around to talk to in two years. If you're a technology-driven company and you think things are going to stay where they are, you'll be gone.

PCW: *How much input does any disk drive maker have in the overall design of a personal computer?*

Shugart: We don't have much input. The customer sets the standards. And if you want the business, you'll adhere to those standards. If the customer wants a 3.8-inch drive, you'll go with 3.8-inch drives.

PCW: *But if you had more of a say about a computer's design, what would you want?*

Shugart: I'd want to connect to the computer's bus, hiding all the activities going on in the disk drive and taking care of those myself. The drive would be much easier to sell.

This will happen in a year or two, of necessity, because as recording densities get higher and higher, you'll need to add a lot of intelligence to the unit to

manage the drive. I mean manage in terms of flaw density, error correction, that sort of thing. The computer won't see the disk drive—it will see the intelligence.

Rubin: For the same money you now pay for a disk drive, manufacturers will be making hard disks with an interface on the drive that will do away with the controller board. Our next drive will have intelligence—chips on the board. What comes beyond that I don't know. You know what they say about the disk drive business: advance planning is, "What are we going to have for breakfast tomorrow?"

PCW: *Could you conceive of packaging some sort of utility with your hard disks?*

Shugart: Not a utility, but with intelligence built into the disk drive and then attached to the bus—as opposed to some controller—the manufacturer could make the drive easier to use. You could do real data management functions.

PCW: *What would those functions involve?*

Shugart: Easy commands. You wouldn't have to worry about where your data was or how it was coming off. You'd say, I want XYZ, and then forget about it. The drive would retrieve your data the fastest way, take care of all your backup, and move things around. This capability is only a couple of years away.

On the other hand, I'd like to see people continue to store junk on their hard disk like I do and never purge it. Never. I think that's just great. ●

|| *Ken Greenberg is an Associate Editor for PC World.*

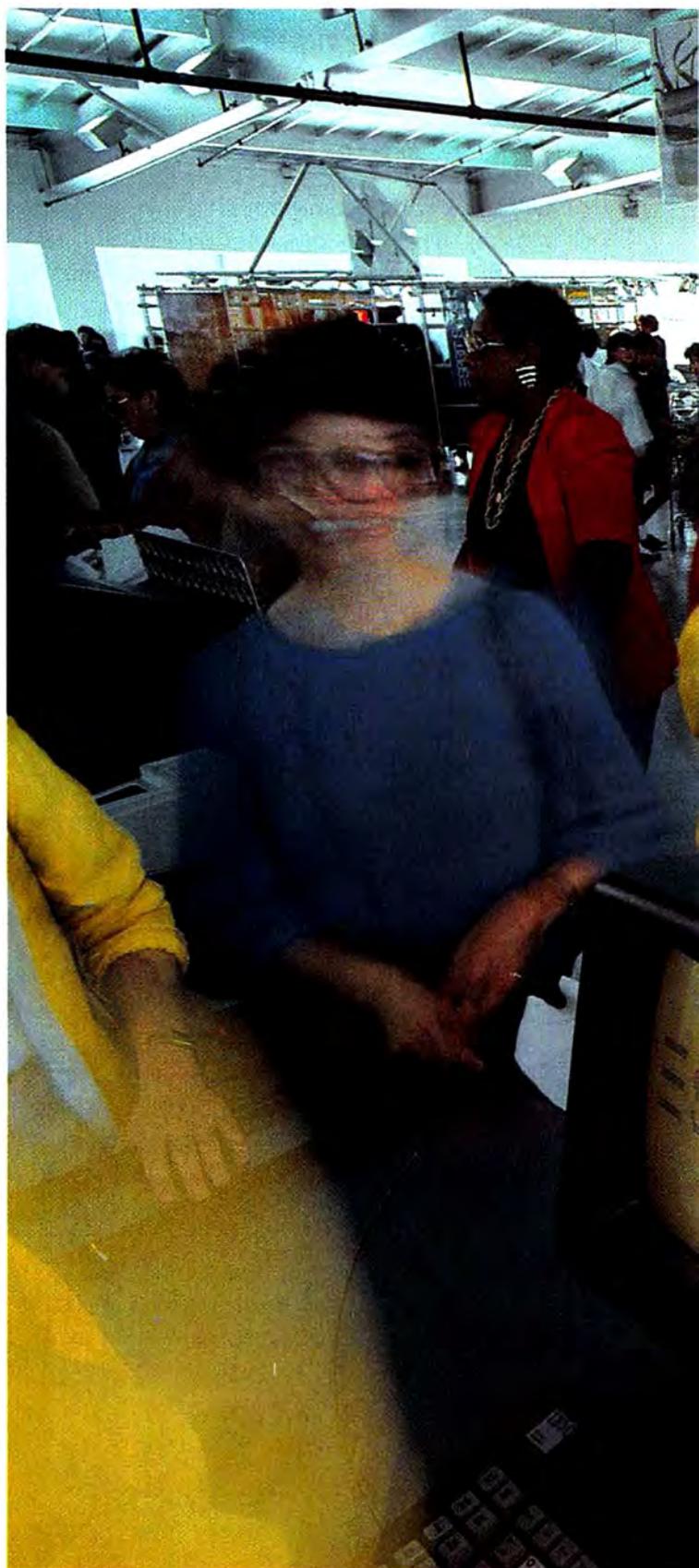
Counter Intelligence at Esprit de Corp.

Today's cash register is no longer just a repository for lucre. Discover the lessons international fashion house Esprit learned the hard way when it made its move into retail with the help of a PC-based point-of-sale system.

Katie Seger

||||| You might see her anywhere—Chicago, London, Hong Kong, Melbourne. She's a young woman, casually but smartly dressed, and her brightly colored sweatshirt, blouse, or polo shirt boldly proclaims her off-the-rack designer: ESPRIT.

Esprit employees tend to talk about their company's flair and style with equal boldness—in fact, with an almost religious fervor. The company's world headquarters in San Francisco fairly bursts





with young, energetic people creating and selling style for the woman of today, who, according to Esprit's promotional literature, "is aware, never a sex object" and to whom "youth is an attitude, not an age."

Advertising clichés aside, Esprit's accomplishments are considerable. The 17-year-old fashion house is projected to gross \$825 million in worldwide sales for fiscal year 1985. Esprit clothes and accessories are carried by more than 2000 stores in the United States, including Bloomingdale's, Neiman-Marcus, Macy's, and Saks Fifth Avenue, and the company's mail-order division will

system designed by the company—a system that took 16 months to implement. Whether ringing up sales, performing inventory control, or helping reconcile register cash drawers, the PCs are an important component, from the checkout stands in front to the store manager's back room desk.

■ Moving Into Retail

When Esprit opened its first retail store, a San Francisco factory outlet, in September 1981, management held no great expectations for the 3500-square-foot store; they assumed it would be an efficient way to dispose of factory

state of the art (and ever watchful of the bottom line), Esprit envisioned a comprehensive POS system that would offer on-line, up-to-the-minute sales totals, inventory control over its growing clothing and accessory lines, daily reports, and security.

Ken Daly, Esprit's manager of information services, says the IBM PC was chosen for the POS system not only because of cost and availability but for IBM's service and support record. Esprit wanted a POS system that would offer more than the normal inventory tracking features of the typical POS systems then available. For example, the system would have to store customer names and addresses, invaluable data for the company's mail-order business.

■ Flair and Functionality

"Esprit likes to control their image because it's part of their success," says Daly. "They wanted to give their POS system flair and greater functionality than the NCR systems you see at K-Mart."

Esprit's new San Francisco factory outlet bears little resemblance to its cramped predecessor. The \$5 million store, a converted warehouse of glass and steel, offers a cavernous 28,000 square feet of selling space. Fourteen sleek checkout stands, much like those found in a supermarket, are arrayed at the front. A passerby might not even notice the IBM PCs—the computers and their monitors are painted jet black, blending in with the silver-and-black color scheme. A Princeton Graphics color monitor displays

A Princeton Graphics color monitor displays merchandise and sales information for both the cashier and the customer, while a hidden Epson RX-80 dot matrix printer spews out 'designer receipts.'

soon celebrate its fifth birthday. Joint ventures with partners in Europe, Canada, Australia, and the Far East ensure that the Esprit logo and line are internationally known. The company is also moving beyond the wholesale marketplace into retail, with three stores—in San Francisco, Los Angeles, and New Orleans—now operating under the Esprit banner.

■ Selling the Spirit

Getting the Esprit spirit into the hearts—and merchandise into the hands—of customers at checkstands now has a modish twist of its own. Esprit uses IBM PCs throughout a point-of-sale (POS)

"seconds" (slightly flawed garments) and last season's has-beens. But Esprit's Midas touch was at work—shrewd shoppers packed the tiny outlet, inching along in interminable checkout lines for the privilege of paying for their discounted clothes.

Esprit did a double take and saw designer dollar signs. By early 1983, the company had decided to go beyond just building a bigger factory store (which it eventually did)—it would also move full force into the retail world with its own chain of stores, selling in-season clothes at regular prices.

Esprit management realized that such expansion would mean casting off the company's laissez-faire sales style. Ever conscious of the

merchandise and sales information for both cashier and customer, while a hidden Epson RX-80 dot matrix printer spews out "designer receipts" color-coordinated to match the screen.

Twenty-eight of the PC's keys are engraved with cash register legends such as Cash, Check, Visa, Void, and End of Transaction. An electronic credit card verifier is located above the pencil shelf on the keyboard. Each PC is equipped with one disk drive, 512K, a serial port, a color graphics board with a parallel port, and a terminal emulator board that links each system to an IBM System 36 minicomputer in the back room.

■ Sales the Electronic Way

In true Esprit fashion, a typical sale is engineered smoothly from start to finish. A customer hands a cashier a pair of pants. Looking at the garment's tag, the cashier enters the 8-digit stock-keeping unit (SKU) number that identifies each piece of merchandise. Almost immediately, the garment's description and price appear beside the SKU displayed on the PC's monitor. Once the item is entered, the cashier presses the <Total> key. The Tax and Total Due figures appear on the screen. If the customer pays with cash, the cashier enters the amount tendered, and the screen quickly flashes the Customer Due amount; an Indiana Cash Drawer built into the checkout stand automatically pops open.

Esprit's POS system accommodates nine types of tender, from personal and traveler's checks to credit cards and gift certificates. Because the System 36 in the POS system is connected via telephone

line to Security Pacific's credit card authorization network, the cashier can approve personal checks and credit card transactions right at the register. Alloy PC-Card credit card readers, which attach to the POS registers at the PC keyboard and read customer information from a card's magnetic strip, have been used in the stores since early 1985.

■ Dealing With Down Time

The System 36, of course, houses most of the POS data—the 35,000 SKU numbers, their descriptions, and a price table keyed to each SKU. For the most part, the PCs act as terminals for the System 36. However, the POS system was designed so that the PC registers can work as stand-alone units if the System 36 goes down. Daly says this stand-alone capability was one major reason Esprit chose to build its POS system around the PC.

If the System 36 goes down, cashiers restart their PCs with a program disk kept at each checkout stand, remove the program disk, insert a data disk, and then continue to ring up sales. In this mode, cashiers key in merchandise price information and manually telephone for credit authorization. When the System 36 is up and running again, the disk-stored information is automatically retrieved.

■ Behind the Scenes

One key role for Esprit's POS system is the day-to-day tracking of stock information. Since PCs in the store's office are also wired to the System 36, staff can easily change the price of discounted merchandise when a sale



begins or add inventory and price information when shipments arrive at the San Francisco factory outlet from the Los Angeles and New Orleans stores.

These backroom computers also help office staff monitor the daily workings of the store and its employees. The System 36 generates a variety of reports, including sales volume, sales traffic, and activity reports. Total sales figures for each register and each cashier are calculated as part of the closing balance report for the entire store.

At the end of a business day, a file of essential daily financial information, such as inventory and retail sales, is created and sent from the System 36 to an IBM 4381 mainframe at Esprit head-

quarters. From there, the data is stored on tape and fed into a stand-alone Microdata Sequel minicomputer that is part of the turnkey Automated Retail Merchandising System, from Concept Systems Incorporated (CSI) of Philadelphia.

Staff can easily change the price of discounted merchandise when a sale begins or add inventory and price information when shipments arrive.

quarters. From there, the data is stored on tape and fed into a stand-alone Microdata Sequel minicomputer that is part of the turnkey Automated Retail Merchandising System, from Concept Systems Incorporated (CSI) of Philadelphia.

The CSI system produces a variety of reports that help Esprit management make decisions for the entire store chain. For exam-

ple, a buyer might discover that a purse is selling like hotcakes in the Los Angeles store but not moving at all in New Orleans—and immediately ship the merchandise to Los Angeles. In the future Esprit plans to include store-generated reports as part of the transferred batch file.

Fashionable and Secure
Esprit's technicians designed an arsenal of security features into the POS system. To log on to the system, each employee must type in his or her ID number and personal password. The system prevents unauthorized users from accessing certain POS functions. For example, a cashier cannot choose the 'End of Day Batch Processing' selection from the POS system

main menu. Esprit technicians also used their programming wiles to keep the System 36 free from PC-based hacking. The System 36 will ignore all but certain requests, such as price lookups, from the PCs.

But even the most sophisticated system cannot prevent the age-old retail problem of employees and others tapping the till. Joan Hensley, Esprit's retail products manager, says that each store uses some traditional techniques to nip temptation in the bud and foil would-be pocket liners. "Every

time the cash drawer is open, we want money in the till or documentation," Hensley says. For each No Sale or Void rung up, the cashier must obtain a manager's signature and complete a form.

Employees Meet Computers

When Esprit made the move beyond wholesale to retail, few of its employees could claim substantial retail experience, which hindered development of a POS system. When Hensley joined Esprit in March 1984, she discovered that the POS design team had been working with little input from the system's future users—the retail division personnel. "They had a [stand-alone] system running with lots of the essentials," recalls Hensley, "but we went right back to the drawing board and talked about the functional specifications." Programming stopped for three weeks while the retail and systems divisions took a new look at the POS plans.

Hensley also brought in Layne Imhoff as operations/systems liaison. Imhoff bridged the gap between retail and the system's designers. "I know from past experience that you've got to have a user working with programmers all the way through the process," says Hensley. In April 1984, Imhoff started working side by side with Esprit programmers, testing the system and making suggestions throughout the project's development. Imhoff, whose retail experience included training sales personnel for a chain of greeting

card stores, felt challenged by her primary mission—writing the system documentation and setting up a training program for both store cashiers and management.

Such a program was clearly a must. Eva Rauchman, now assistant cashier manager at Esprit in San Francisco, remembers her first experience with a PC register: “Awful!” In early 1984, system programmers started testing their rudimentary POS system on

managers to sit in on a full day of point-of-sale and bookkeeping training; they need to know what their people are responsible for.” Imhoff has trained approximately 100 cashiers and 25 managers for the San Francisco store; her program is also used in the Los Angeles and New Orleans stores.

Liz Kane, manager of the San Francisco store, thinks that the relative youth of store employees—the average age is 19—was a factor in

The CSI system produces a variety of reports that help Esprit management make decisions for the entire store chain.

stand-alone PCs set up next to the NCR cash registers in the outlet store. Cashiers served as willing and sometimes not-so-willing guinea pigs. “There weren’t too many problems, but when something did go wrong there were so few people around to fix it,” Rauchman says. To add to the mess, “Managers were just as unsure as the cashiers.”

Imhoff taught her first cashiering class in June 1984. She devised a two-day program that offered a system overview followed by hands-on training. Management personnel were urged to attend. “Management should be familiar with every phase of the operation,” Imhoff says. “I encourage

the system’s quick acceptance. Many of the store’s cashiers and personnel had studied computers in school and were consequently eager to use them in their jobs.

Laurie Schmidt, cashier manager of Esprit in San Francisco, found the PC registers “intimidating” at first, though she notes that the training made the change less formidable. “It’s one thing, though, to sit in a quiet training room,” she avers, “and quite another to work a register with people staring at you as you hunt and peck.” Schmidt says that after a few days with the new system, the only thing she missed about her old NCR cash register was its beep, which signaled any improperly keyed sequence. “The PCs are quiet,” she says, “so you have to keep your eyes on the screen.”

Technical Troubles

The store’s current relative calm belies the 16 months of planning and behind-the-scenes work involved in developing and implementing the POS system. Initially, Esprit management thought the system could be run entirely on PCs. Ban Ma, senior technician for the POS development, says that idea was rejected because of the envisioned system’s complexity. “It’s a good thing, too,” Ma says of the decision, “or we’d still be in there coding today.” The PC caused more trouble for programmers than the “incredibly reliable” (according to Hensley and Daly) System 36, whose programs were written in RPG II.

Esprit’s PC programmers spent the first few weeks of program development writing in PL/1 code under Concurrent CP/M, an approach they abandoned after only a month when it became clear the operating system lacked stability and reliability. They switched to Pascal under MS-DOS, because like PL/1, Pascal is a highly structured language that allows programs to be built in a modular structure. There were other pluses: Pascal programs are smaller, run faster on the PC, and are more easily manipulated. Pascal’s report generation was also sufficiently sophisticated to match Esprit’s needs.

A serious problem surfaced, however, when it came time to compile the program. The PC’s

Pascal compiler limits the size of each block or module of code to 64K—a fact that had slipped past the programming staff. “We were coding like crazy and enjoying ourselves when all of a sudden we banged up against this control block limitation,” Daly remembers. The program couldn’t be compiled, and the development team talked about converting it into another language, but deadline pressure forced them to keep

screen. Today similar off-the-shelf utility programs are available for under \$100.

Not all of Esprit’s POS problems were technical; some were merely time-consuming. Hensley says getting blank keys from IBM “was like pulling God’s teeth.” When the keys finally appeared after a three-month wait, she then had to find someone to custom engrave them with cash register legends.

Beating the competition means keeping up with the latest in computer hardware and software.

working in Pascal. Brevity being the soul of programming as well as of lingerie, the team edited, trimmed, and rewrote the code so that each module would fit into 64K. The modules were then compiled and linked.

Being ahead of your time can exact a price. Daly estimates that today his crew could do the same job in 12 months or less, with new software and hardware simplifying their work. For example, Esprit’s programmers wrote their own screen manager utility for formatting the layout and colors displayed on each cash register’s

Testing and retesting notwithstanding, mundane yet critical elements can still be overlooked. Imhoff remembers the night the POS stations were installed: She and the programmers were working against the clock because the stations had to be in place and running the next morning. “I was very tired and the programmers were just worn to a frazzle,” she says. As a joke, Imhoff asked if the cash drawers were going to open. “The programmer’s face just fell: He hadn’t tested them.” And, of course, when the drawers were tested they didn’t work correctly. Recalls Imhoff, “We were there for several more hours, figuring out how to get the current exactly right so the cash drawers would pop open gently rather than flinging open.”

A Retailer’s Work Is Never Done

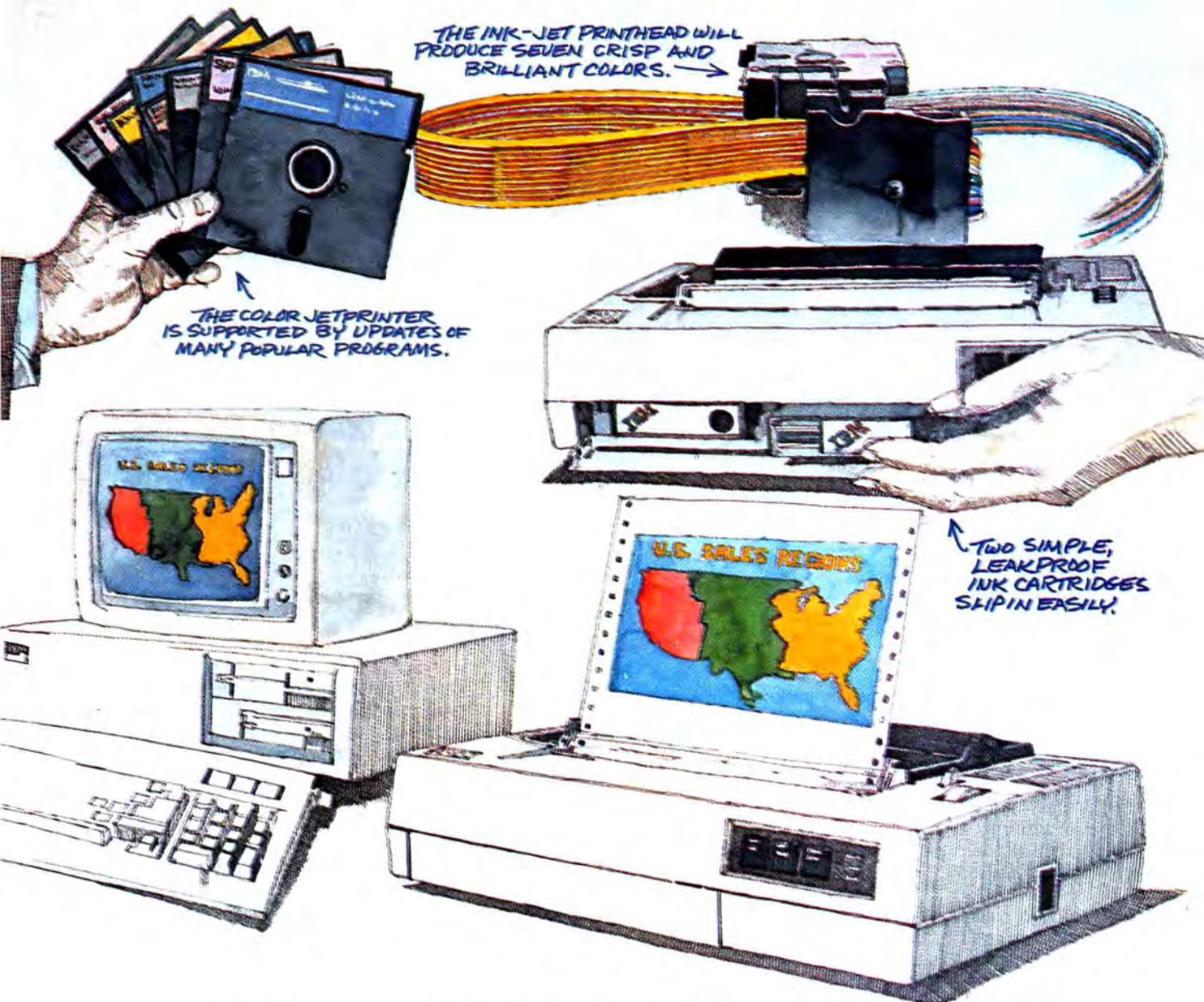
Although the POS system is up and running in all three Esprit stores, it is not yet complete. For example, a tax table based on U.S. zip codes is stored in each store’s System 36. (Shoppers who have purchases sent to their homes must pay the destination’s sales tax; companies are required to collect and track these taxes.) Esprit is still deciding how best to use a “send” capability programmed into the system, which allows cashiers to ring up and process such purchases at checkout stands. The feature should be implemented by December 1985.

Yuletide should also see the debut of a new checkstand printer. The Epson dot matrix printers currently used are deemed too slow.

Electronic mail, one of the first features on Esprit’s initial POS wish list, will probably be among the last features added to the system.

To keep pace with the competition, a fashion retailer must be on top of the latest trends in marketing and fashion. But beating the competition, as Esprit has presciently understood, means keeping up with the latest in computer hardware and software. ●

Katie Seger is a San Francisco Bay Area freelance writer specializing in computer topics.



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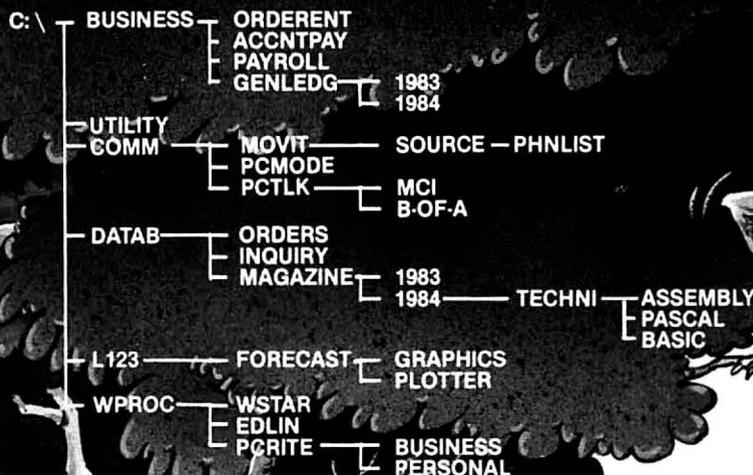
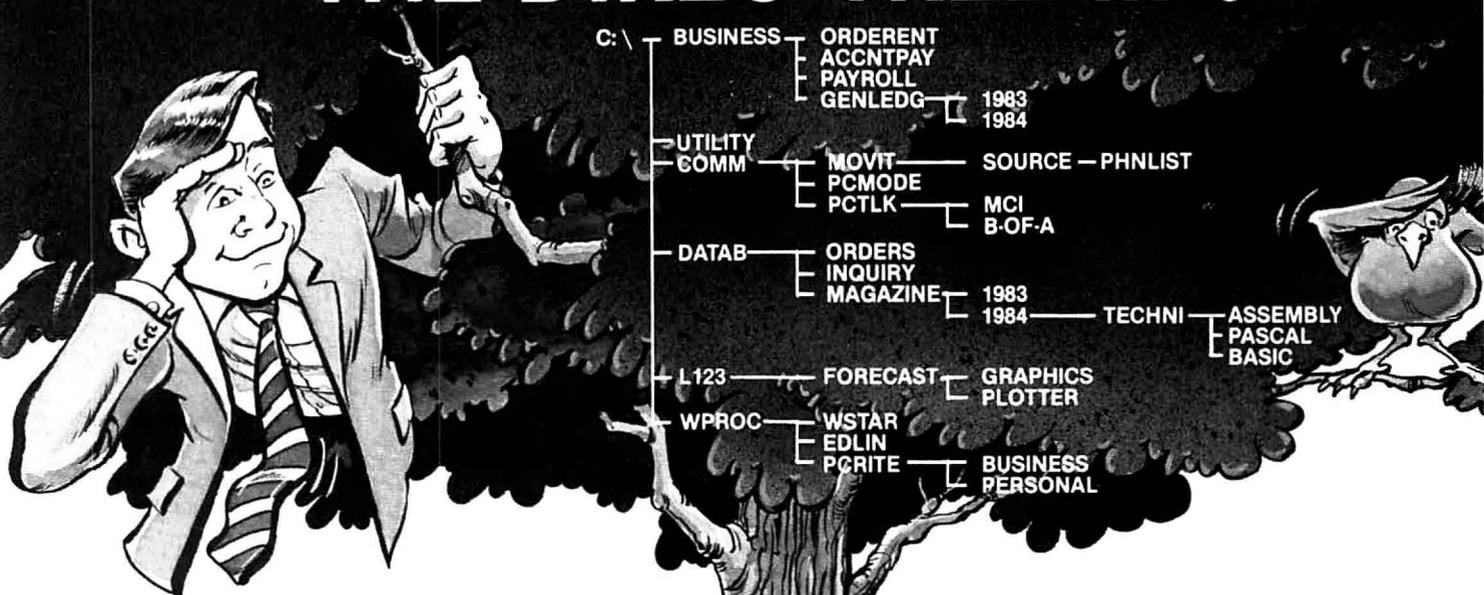
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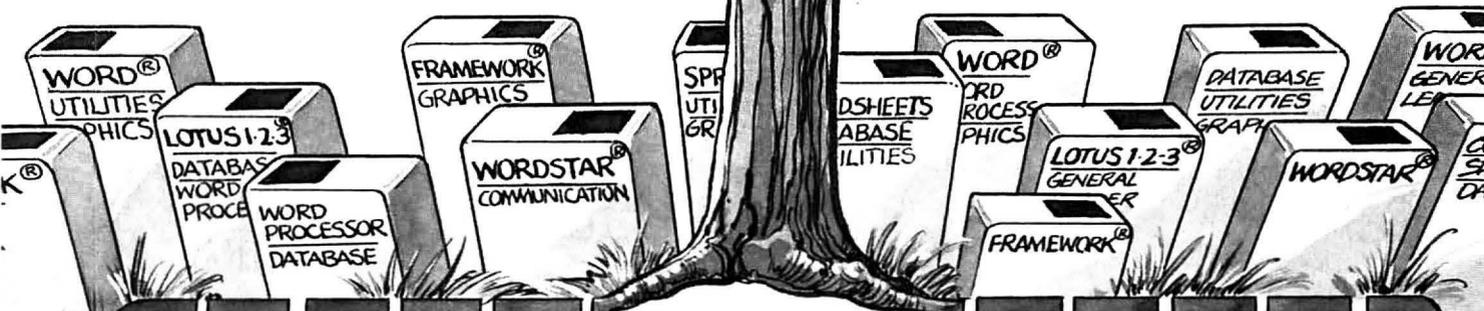
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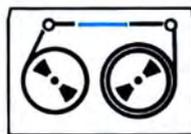
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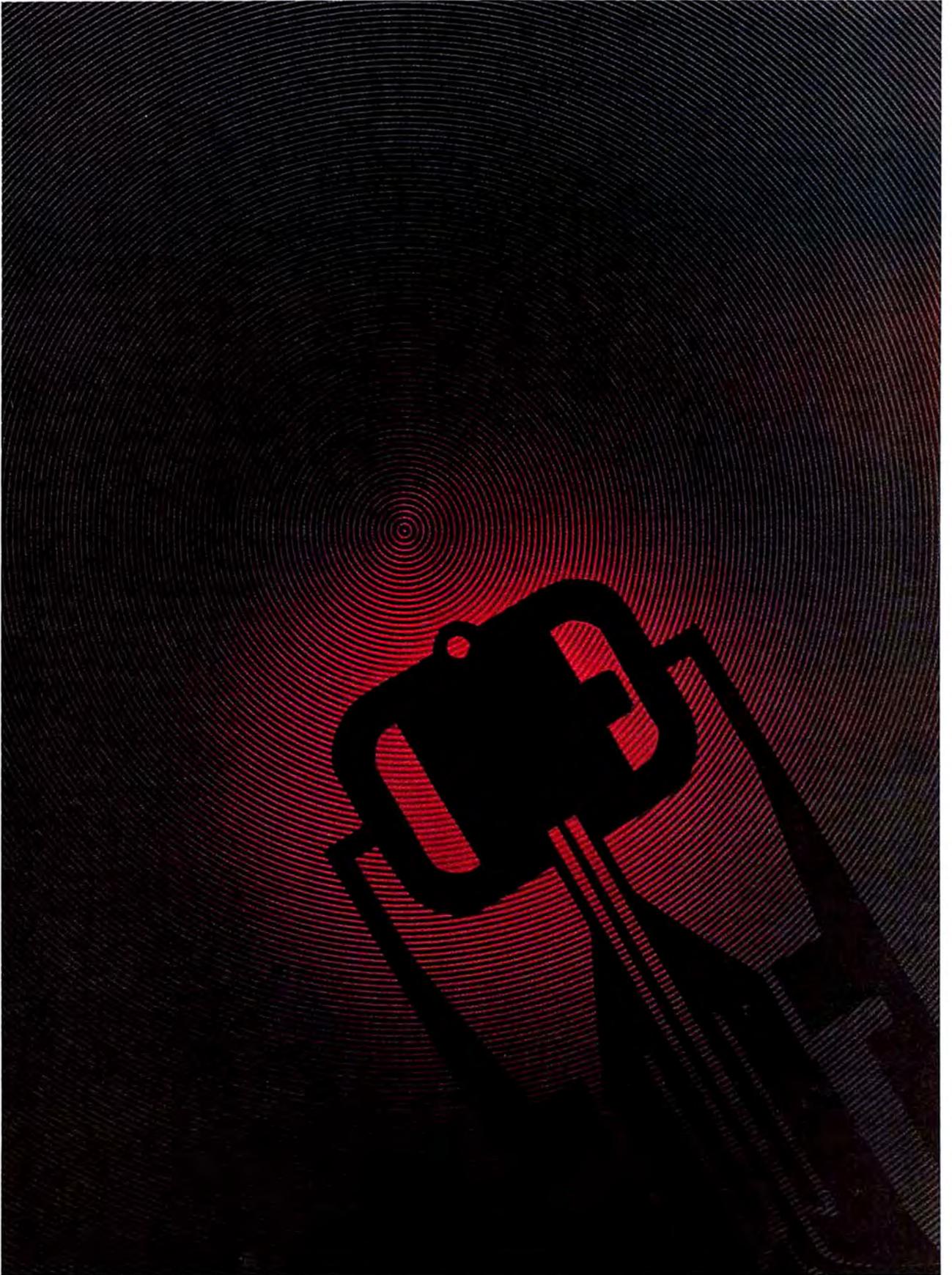
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Sensible Storage

Reed McManus

I

f you've got floppy disks crammed into every conceivable crevice of your office and you've spent your youth waiting for a floppy disk drive to save files, it's time to turn your PC into a mass storage device. For a fistful of dollars, the storage and speed of an internal 10MB hard disk drive can be yours. An internal hard disk drive doesn't take up any precious desktop real estate, and better still, it lets you neatly organize your data and program files. PC World cut through the mountain of manufacturer claims and ran five popular drives through a brutal gauntlet.



Along with accommodating larger data bases, a hard disk lets you take advantage of applications that benefit from massive storage and high-speed data transfer to and from disk. For example, IBM's *Business Management System*, a six-module integrated accounting package, soaks up 6MB of disk space for program files alone. Integrated packages, from *WordStar 2000* to *Framework*, that sluggishly clank away on a dual-floppy PC greatly benefit from a hard disk drive's swiftness. Remember too that a hard disk drive is essential for even modest local area networking, in which several PCs rely on central data storage. (For information on organizing your files, see "Directory Assistance" and "Pathfinders" in this issue.)

Another tempting attribute of a hard disk is the price. Current market trends and the economies of mass production translate into impressive price savings for those who want to step up to mass storage power. The success of the 20MB AT and its clones, coupled with the drop in hard disk manufacturing costs, has contributed to the current glut of 10MB drives. A 10MB 5¼-inch internal hard disk can be had from a retail dealer for under \$1000 and from mail-order houses for much less (see the sidebar "Mail-Order Drives").

■ What Drives a Hard Disk

A hard disk drive operates much like its floppy counterpart, though the former is sealed in a particle-free case that allows the read/write head to skim within 11-millionths of an inch of the rigid disk. Spinning at approximately 3600 rpm, a hard disk runs about 12 times faster than a floppy disk. The cumulative result is that data can be packed very densely in a small space and retrieved in milliseconds.

A hard disk drive's performance depends on a number of factors: the efficiency of the disk controller board, the type of positioning motor that moves the read/write head, the average data access time, and the interleave factor.

Average access time—the time the head takes to move from one track to another—is frequently over-emphasized as being the critical determinant of a drive's performance. Access time is largely related to the type of head-positioning motor used by the drive. Like the XT's hard disk, the internal drives reviewed in this article use stepper motors, which move the read/write head out a set distance depending on the track being accessed. Average access times range between 70 and 85 milliseconds. Faster access times in

the 30 to 35 millisecond range are achieved with expensive voice-coil head positioners that magnetically locate a track. This method, used in such high-end systems as the Priam DataTower, is very accurate and allows tracks to be more closely packed together and more quickly found (see "Ambitious Archiving" in this issue).

The controller board is as important as access time in determining a drive's performance, for it coordinates the exchange of data between the hard disk and the PC and performs error detection and correction duties. Thus the performances of two identical drives with different controller boards may differ significantly. The controller boards included with the reviewed drives generally support a data transfer rate of approximately 5 megabits (or 610K) per second. This is the speed at which data moves from RAM to the hard disk but does not include the time required to find free disk sectors and actually write the data.

A drive's interleave factor is one element that the user can sometimes change to maximize disk performance. To prevent overwhelming the controller or the PC's microprocessor with data, a disk is not read continuously as it spins. Typically, the drive head may read one sector, then skip six sectors before reading the next (see Figure 1). The relationship, or interleave factor, in this case is 6:1, a standard adopted by IBM for the XT. As the interleave factor approaches 1:1, a drive reads and writes more data in the same period of time. The catch, of course, is that read/write errors are more likely to pop up, which means waiting while the disk turns a full circuit before the same data can be accessed again.

Alpha Omega suggests an interleave factor of 2:1 for its Turbo 10, while Qubié recommends 3:1 for its PC10. Qubié also suggests a slower but less error-prone setting, such as 5:1, if the drive is manipulating very large, data-transfer-intensive data bases. Of the five internal drives tested, only the Turbo 10 and the PC10 allow you to change the interleave factor. Interleave must be set before a disk is formatted by DOS.

■ Natural Selection

Selecting the five drives for this review was no simple task. As you plow through thickets of system specifications, it is impossible to tell how one drive will perform compared to another. The drives selected offer similar average access times and data

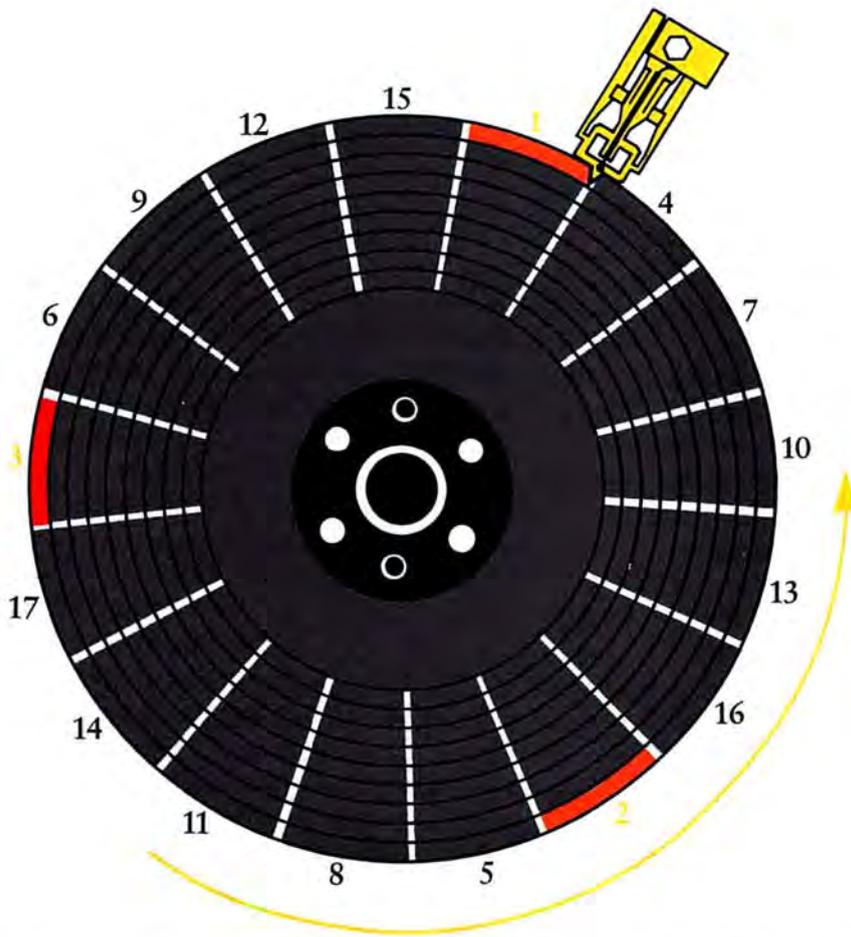


Figure 1: Because a hard disk's read/write head can gather information faster than the PC can process it, a technique called interleave was developed. If a hard disk's interleave factor is 6, as the disk spins, every sixth sector is read. Thus a file that occupies 3 sectors is stored in sectors that are logically, not physically, contiguous. To read an entire track (17 sectors) takes approximately $5\frac{2}{3}$ turns of the disk. When interleave is smaller, sectors are closer and fewer turns of the disk are required.

transfer rates and are built around the same high-density plated disks. But as our specially designed tests later confirmed, the overall performance of a hard disk drive cannot be surmised by singling out one or two elements, such as average access time or seek time.

One crucial factor any prospective hard disk buyer must consider is the "will-you-still-love-me-tomorrow" syndrome. As in the VCR industry, a handful of manufacturers make the variety of products that find their way to market. Vendors, such as Kamerman or Qubié, are system integrators that combine the drives, controller boards, and software produced by others. While the flooded market makes hard disk drives inexpensive, it raises the competitive stakes for vendors (for more information, see "Hard Times at Drive C:" in this issue). The vendors whose drives were selected for review—Alpha Omega, Creative Micro, Kamerman Labs, Maynard, and Qubié—are tried-and-true companies that have survived the hardware wars with their bottom lines more or less intact. Although some perfectly reputable and competent lesser-knowns may have been overlooked here, we decided to focus on products and companies you can expect to see around in the near future.

Natural Selection, Part 2

Having made this first cut, each drive was examined with an eye to ease of software installation, speed, durability, features, user manual, warranty, and service (see Table 1). Installing an internal hard disk drive is simply a matter of removing the two screws and cables holding the second floppy disk drive in place, sliding in and securing the hard disk drive, inserting the disk controller board into an available slot, and connecting all the appropriate cables.

Although all the drives come with limited shock mounting—mostly in the form of rubber bushings—they are nonetheless delicate devices and must be installed with care. At one point in our testing, a Qubié drive had to be removed from a PC and then reinstalled. In the process, the drive slipped off its mount and fell less than an inch. When the drive was finally secured and turned on, the unit refused to read or write data. Extend this lesson to the handling of your PC, for once it is fitted with an internal hard disk drive, it too becomes fragile.

(continues on page 216)

Mail-Order Drives

Phillip Gordon

IBM's introduction of the AT set a new hard disk storage standard of 20MB for drive manufacturers. The result? A diminishing market share for 10MB drive makers that has forced prices down sharply. Mail-order houses selling these drives offer the best bargains. They can afford to undercut retail store prices by as much as \$500 because they purchase drives en masse and maintain low overhead. The time is ripe for getting good mail-order deals, but proceed with caution—obtaining adequate technical support and service may not be so easy.

How do you find a reliable mail-order outlet in the first place? Word of mouth is often a good barometer—seek out recommendations from satisfied customers. Failing that, contact your local PC user group. The Better Business Bureau may also inform you of any complaints against the mail-order house in question.

Technical Support

After price, technical support is probably the most important consideration. Size up your technical expertise—if you've never set system switches or confronted a recalcitrant expansion slot, you may find retailers' higher prices well worth the installation assistance and support they provide. Otherwise, chances are you can solve most commonly encountered problems over the phone—so calling a mail-order house may be just as con-

venient as calling a local retailer. Just make sure the company provides a toll-free customer service number—you may be calling often.

Service

While technical support may be a call away, repairs by mail are guaranteed to be time-consuming. Shipping a hard disk drive to and from a mail-order house or, in some cases, directly to the factory takes at least 48 hours by overnight mail; getting the drive repaired, even longer. If you buy from a retailer, you may get a replacement unit on the spot.

To determine repair turnaround time, ask the mail-order house who provides service. The service is speediest if the mail-order house honors the warranty and repairs the drives itself—a commitment you should always get in writing. Most mail-order companies, however, act as middlemen, merely passing a defective drive from consumer to manufacturer.

If a rapid turnaround is essential for your business, try to negotiate a written contract with the mail-order company that specifies an acceptable length of time for repairs or compels the company to replace the unit immediately. Standard practice dictates that the customer pay shipping charges to the mail-order house or service center.

Take the extra precaution of finding out if the drive's manufacturer will honor the warranty should the mail-order house go out of business. If the mail-order outlet is an authorized distributor, the warranty will likely be honored. But if the outlet

gets its drives from a different source and later folds up its tents, your only recourse will probably be a third-party maintenance agreement—for as much as \$20 per month.

Delivery

In addition to any service requirements specified in a written contract, negotiate for a delivery deadline and, if possible, an agreement that the mail-order company will pay a penalty—in the form of a discount or refund—if the drive is delivered late. When discussing delivery, confirm that the drive you want is in stock. Also query about any extra charge for a credit-card order—some companies levy up to 3 percent of the purchase price.

The risk of in-transit damage is probably not as great as most retailers would have you believe. Although a hard disk drive is a delicate instrument, packing materials are specially designed to prevent damage. But it pays to play this game conservatively. Specify in your contract that a damaged or defective drive must be replaced immediately. This is common practice with firms such as Qubié, which promises a 24-hour turnaround time on defective drives.

Duplicitous Drives

While most mail-order houses sell new merchandise, *PC World* discovered that some outlets sell out-of-production hard disk models or drives

from manufacturers that are out of business. Other consumers report that rebuilt drives are also on the market. However, in a survey of ten mail-order houses, all ten claimed they sold only brand-new drives from existing manufacturers.

If you do buy an out-of-production drive because it's cheap, be aware that you may have difficulty obtaining a third-party service agreement when the warranty (usually provided by the outlet) lapses. Chances are slim that the manufacturer or mail-order house will extend the warranty.

No matter which manufacturer's drive you buy, you don't have to accept the mail-order house's "brand-new" label on faith. First, call the manufacturer with the drive's serial number and confirm you have a new model. Second, check for the manufacturer's seal on the metal shell, which indicates that the drive is new and hasn't been opened. Be suspicious if the seal doesn't carry the manufacturer's name or logo or if there is no seal at all.

Everyone has heard the occasional mail-order horror story, but if you're cautious you can save a lot of money without sacrificing your peace of mind. The best way to reduce your risks is to be aware of the potential problems, ask the right questions, and obtain repair and replacement policies in writing.

Phillip Gordon is the personal computer liaison at a major San Francisco financial institution.

Table 1: Features comparison for five hard disk drives

	Alpha Omega Turbo 10	Kammerman Labs Megaflight 100	Qubié PC10	Maynard PCi10	Creative Edge CEX-10	IBM XT
Price	\$949	\$1095	\$649	\$1095	\$695	n/a
Average access time (milliseconds)	75	70	70	85	70	85
Data transfer rate (megabits/second)	5	5	5	5	5	5
Power requirements (watts)	12	12	16	14	10	n/a
Factory low-level formatting	no	no	no	yes	yes	yes
Park program	no	manual	automatic	no	no	yes
Interleave value	2:1	3:1	3:1	4:1	6:1	6:1
Changeable interleave	yes	no	yes	no	no	no
User manual	fair	fair	excellent	good	good	n/a
Warranty	13 months unconditional	12 months parts/labor	12 months parts/labor	12 months parts/labor	12 months parts/labor	3 months parts/labor
Toll-free number	no	yes	no	no	yes	yes
Software included	no	no	1Dir	no	no	no

Once a drive is snugly in place, you must perform low-level formatting to define address and data fields on each track if that was not done at the factory. With DOS 2.10, you allocate partitions with FDISK and prepare the disk to accept DOS files with FORMAT. Some units, such as the Kammerman Labs Megaflight 10, come with software that automates the entire formatting process. Total installation time, from inserting the drive to formatting the disk, should be 20 to 35 minutes.

You can boot from the internal hard disk drive, provided your PC is not an early model with a 64K motherboard. If you are a PC pioneer, you can obtain a newer ROM BIOS chip (which contains the routines that recognize the presence of a hard disk) from IBM for \$30. If the chip is not immediately available—some users report waiting nearly three months for the upgrade—the drive can still be used with the aid of driver programs supplied by the manufacturer. You will, however, have to boot the PC from drive A:.

Installation manuals vary greatly in thoroughness, but they generally are written with the novice installer in mind and include step-by-step instructions. Qubié's illustrated manual earns the highest marks; Kammerman Labs', which lacks illustrations and tends toward computerese, ranks the lowest. Hard disk drive installation is relatively simple, but a poorly written manual can complicate matters. Alpha Omega's was the only manual to go beyond the humdrum and offer operating tips for setting up DOS paths and subdirectories.

Power Plays

Finding enough watts to go around in your PC may not be so easy as installing the drive. The PC's modest 63.5-watt power supply is usually sufficient to support two floppy disk drives and a fair number of power-hungry expansion boards. Though replacing a floppy with an internal hard disk drive may seem like an even trade—both consume anywhere from 12 to 18 watts—a hard disk drive is always running. This strain, coupled with the additional power a hard disk

drive needs to reach operating speed from a dead start, may overtax the PC's power supply and shut the system down. As a result, you may have to sacrifice using a beloved peripheral, such as an internal modem, to achieve hard disk bliss. Unfortunately, power consumption is not always listed in peripheral user manuals. As a rule of thumb, a PC that packs 640K, an internal hard disk drive, and several ports will undoubtedly need an auxiliary power supply. If your PC compatible is equipped with a heftier power supply, you may avoid this power crunch. Auxiliary hard disk drive power supplies can be had for under \$100.

A hard disk slipped into a loaded system can also create heat problems. In our test a PC stocked with expansion boards and an internal Qubié hard disk drive overheated after 6 hours of use and refused to execute DOS commands, although the disk was undamaged. An external power supply decreases the amount of heat generated in the PC cabinet. A tip taken from the PC XT is to cover the right two-thirds of the air vents at the front of the PC's chassis with tape. This directs air more efficiently through the cabinet.

Decibel Madness

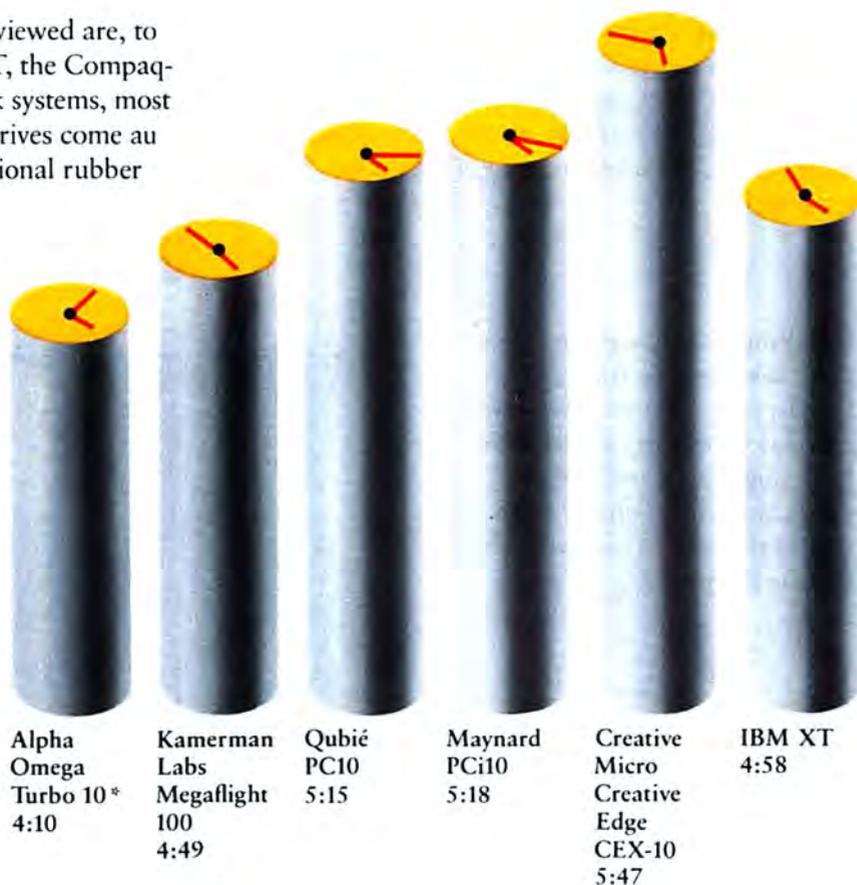
Most of the hard disk drives reviewed are, to put it charitably, noisy. Unlike the XT, the Compaq Plus, and similarly designed hard disk systems, most of these install-it-yourself hard disk drives come au naturel—no insulation, save the occasional rubber

bushing used for shock mounting. The problem is exacerbated because an internal drive is usually mounted flush against the PC's metal brackets. The Qubié PC10, for example, registered a whopping 68 on a decibel meter. While the noise level is bearable, the constant whirring can be an annoying distraction.

Survival of the Fittest

With the aid of Mike Hammond of Micro MRP, based in Foster City, California, each disk drive was subjected to a grueling test of its ability to perform the simplest yet most essential tasks: reading and writing data quickly, without error. The instrument of torture was *Max*, *The Production Manager*, a material-requirements planning program created by Micro MRP. Each drive was subjected to *Max*'s "explosion" program, which continually reads, writes, and updates data base files totaling 3MB. By the time the program finishes, these files have swollen to 7MB. As you can see, *Max* tests not only a drive's speed but also its durability.

Figure 2: A comparison in hours and minutes of the test results for five 10MB hard disks and the IBM XT. Note that the XT system has 640K RAM and the others have 512K.



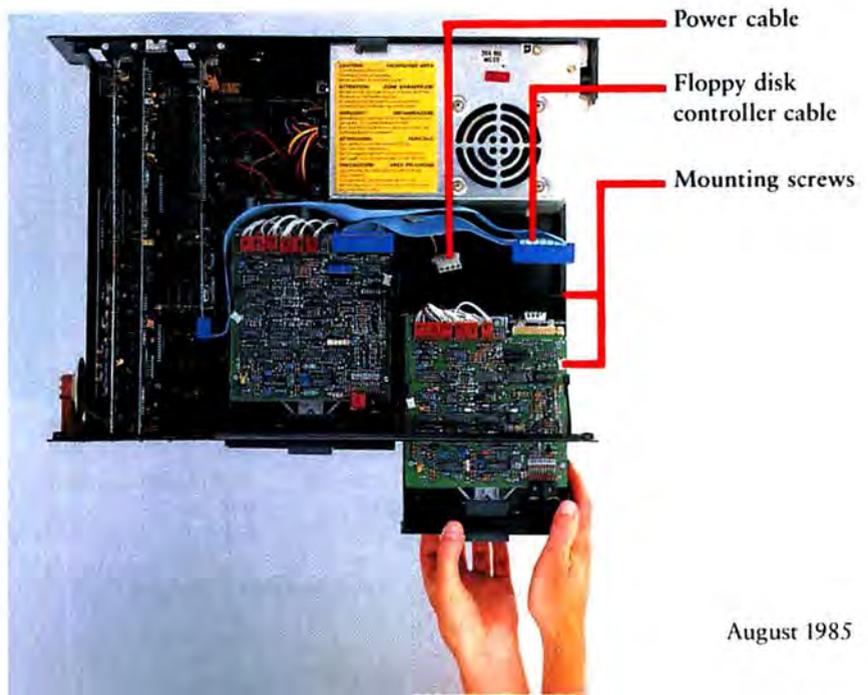
*with Micro Computer Memories' Drive

To run the test, each half-height internal drive and its respective controller board and cables were installed in a single-floppy, 512K PC holding an IBM disk drive controller, an IBM monochrome board, a Microsoft PC RAMcard, and a Prelude serial board. A 640K IBM XT running the *Max* gamut provided control data for the test.

The results in some cases were impressive (see Figure 2). The best performer, the 3½-inch Alpha Omega Turbo 10, completed its read/write tasks in 4 hours and 10 minutes. This was a full 3 hours and 15 minutes—44 percent—faster than the 7 hours and 25 minutes consumed by the slowest performer, Alpha Omega's older, 5¼-inch version of the Turbo 10. (In the midst of this review, Alpha Omega switched from Cogito's 5¼-inch drive to Micro Computer Memories' 3½-inch drive housed in a 5¼-inch frame. Because the Cogito version might still be found in inventories, tests were run on both drives.) If you decide to buy the Turbo 10, be aware that the older version of the drive may still be on the market. The older Turbo 10 drive was the only unit to fail the test.

Most of the units completed the test without generating read/write errors. Errors cropped up with the Creative Edge CEX-10, but they were recoverable and did not prevent the drive from completing the test. However, the errors did bring the test to a grinding halt, and we were forced to invoke the DOS 'retry' to get the system moving again. If nothing else, this indicates that you may not be able to leave the drive unattended while running I/O intensive programs.

Installing an internal hard disk drive takes a little time and finesse. In this photo, the power and disk controller cables have been unplugged and the two mounting screws on the right side of the chassis removed. Slide out the floppy drive.



Alpha Omega Turbo 10

As noted earlier, the newer Micro Computer Memories version of the Turbo 10 breezed through *Max* in 4 hours and 10 minutes without any read/write errors. On our first attempt to run *Max* on the Cogito version, the disk failed approximately 3 hours into the test. Unrecoverable read/write errors forced us to reformat the disk. The Cogito-based Turbo 10 did complete the test the second time around, but with the slowest time of all the disks tested.

Though the Turbo 10 is fast, the user is obliged to format the disk from scratch. Low-level formatting is performed using DOS's DEBUG program; the installation manual walks you through the process. FDISK and FORMAT are naturally used for DOS-level formatting. Interleave can be set from 2:1 to 9:1; Alpha Omega recommends 3:1.

The Turbo 10 manual is written primarily for the computer technician, although with some patience a novice can get the system up and running. The Turbo 10 comes with an unconditional 13-month warranty. Units are exchanged rather than repaired; Alpha Omega claims its turnaround time is as quick as 24 hours. There is no toll-free number for technical support.

Kammerman Labs Megaflight 100

The Megaflight 100 completed *Max* in 4 hours and 49 minutes with no read/write errors. The package includes an installation program that performs low- and DOS-level formatting automatically. A read/write-head-parking program is provided so that the disk can be moved without damage. The program

places the head away from critical disk data areas at an unused disk cylinder. Although head-parking programs are generally considered unnecessary given the durability of plated disk surfaces, Kameron Labs feared that power surges might damage the disk. Interleave is set at 3:1 and cannot be changed.

While the Megaflight 100 is a top performer, its manual is the murkiest on installation details. For example, users are directed to "plug the 20 pin cable into either the J2 or J3 connector also oriented as the 34 pin cable." The necessary instructions could easily have been simplified and accompanied by useful illustrations—at best, the manual's figures are primitive. Luckily, installation is simple. This, along with superior performance, makes the drive a very attractive buy.

The Megaflight 100 comes with a 12-month limited warranty on parts and labor. Kameron's technical support department can be reached via a toll-free number.

Qubié PC10

The least expensive (\$649) internal drive produced the third-best time in the group: 5 hours and 15 minutes, with no read/write errors during the entire process. Low-level formatting is performed by a manufacturer-supplied program.

The PC10 is a servo-controlled drive that constantly corrects the position of the read/write head, keeping errors to a minimum. The unit also automati-

cally parks the head at an unused area of the disk whenever the system is turned off. Interleave can be changed when the disk is formatted; Qubié recommends a ratio of 3:1.

The PC10's user manual is the best written and organized of those reviewed. The manual explains hard disk basics, such as interleaving and power supply problems, in extraordinarily clear language. Unfortunately, the manual opts for photographs (which reproduce poorly) rather than line drawings to illustrate installation and use.

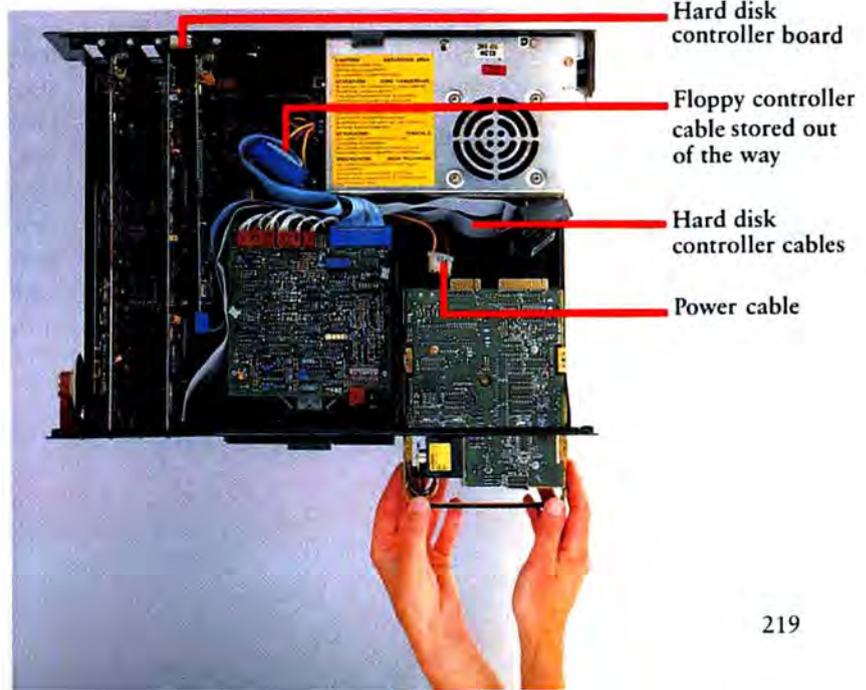
The PC10 includes Bourbaki's *1 Dir* DOS shell program, which turns DOS into a menu-driven, function key controlled operating system. For anyone comfortable with the DOS interface, *1 Dir* is probably unnecessary. But for the user new to the ways of DOS and hard disks, it's likely to be a useful aid.

Maynard PCi10

The PCi10 virtually tied the Qubié PC10's with a time of 5 hours and 18 minutes, with no read/write errors. Maynard supplies a diagnostic program that verifies the proper operation of the drive from controller to disk. Maynard notes that the diagnostic must be run after the disk has been fully formatted. The disk arrives with low-level formatting already in place. Interleave is set at 4:1.

(continues on page 223)

As shown in this photo, insert the hard disk controller board and arrange its cables. Slide in the hard disk drive part way, attach the cables, and fasten with the mounting screws.



Save It With Floppies

C. Breck Hitz

I was on hold, so I accompanied the Muzak with a little hard disk housekeeping. ERASE \BASIC OLDPROG.BAS, I typed, when I should have typed ERASE \BASIC\OLDPROG.BAS. I had just wiped out my entire BASIC subdirectory.

Luckily, I had backed up the hard disk that morning.

If you think a backup system for your hard disk is a luxury you can do without for a while, you're making a potentially costly mistake. Whether by mechanical failure or fumbling fingers, you run the risk of permanently losing valuable data if you fail to back up your hard disk regularly.

A tape backup system can easily double the cost of converting from floppies to a hard disk, but take another look at the floppy drive that's still in your PC. That under-used drive could be the solution to your backup problem. It's not quite as convenient as tape backup, but it has one undeniable advantage: It's free.

You don't back up a hard disk the same way you back up floppies; COPYing groups of files to backup disks is too time-consuming. Instead, you use the DOS commands BACKUP and RESTORE. These commands are designed to back up a hard disk to floppies and to restore the backed-up data to the hard disk when necessary. BACKUP's /S option backs up all files in all subdirectories of the current directory. The /M option backs up only those files that have been modified since the last BACKUP,

and the /A option adds the new backup files to the backup floppy without deleting the files already on that disk. RESTORE is essentially the reverse of BACKUP; it transfers files from the backup floppies onto the hard disk.

The first time you back up, you'll want to back up the entire disk. The command BACKUP C:\ A: /S opens a file on your floppy that marks it as a backup disk and then makes copies of all your files. Be warned that backing up a 10MB hard disk full of data takes about 28 floppy disks, so have plenty of formatted floppies ready; if you interrupt BACKUP to format a disk, you have to start again from scratch. BACKUP will prompt you whenever it wants another floppy.

After the first backup, the command BACKUP C:\ A: /S /M /A takes care of backing up all new and modified files. And adding a few refinements to this command will streamline your BACKUP procedure.

A BACKUP a Day

You can invoke the backup procedure manually at any time, but triggering your PC to back up its hard disk to floppies automatically the first time you turn it on each day makes regular backup impossible to forget. The routine takes about 5 minutes while you sip your morning cup of coffee. After that first time each day, you can reboot the system as often as you like without invoking the backup procedure.

```

10 CLS: LOCATE 10,23: PRINT "Running BOOTPROG--Stand by."
20 OPEN "c:\utility\bootdate" for INPUT as #1
30 INPUT #1, LASTBOOT$: CLOSE
40 THISBOOT$=DATE$
50 OPEN "c:\utility\bootdate" FOR OUTPUT AS #1
60 PRINT #1, THISBOOT$: CLOSE
70 IF THISBOOT$=LASTBOOT$ THEN OPEN "c:\boottest" for OUTPUT
AS #1: CLOSE
80 PRINT "The system has already been backed up today."
90 PRINT: PRINT: PRINT: PRINT: PRINT: PRINT
100 SYSTEM

```

Listing A: BOOTPROG.BAS

DOS's IF command provides the method. Put these lines at the beginning of your AUTOEXEC.BAT file:

```

DATE
TIME
PATH C:\DOS
BASIC C:\UTILITY\BOOTPROG
IF EXIST C:\BOOTTEST GOTO NOBACKUP
BACKUP C:\ A: /S /M /A > LPT1
GOTO CONTINUE
:NOBACKUP
ERASE C:\BOOTTEST
:CONTINUE

```

This batch file assumes that BASIC.COM is in a directory named \DOS and that another directory called \UTILITY contains BOOTPROG.BAS (see Listing A). Before you run this batch file the first time, you must create a dummy file, BOOTDATE, in the \UTILITY directory. Type

```

C: < Enter >
CD \UTILITY < Enter >
COPY CON BOOTDATE < Enter >
DUMMY < F6 > < Enter >

```

The BASIC program BOOTPROG.BAS creates the dummy file

BOOTTEST in the root directory of drive C:, then skips to the :NOBACKUP label, unless you're starting up for the first time that day. As BACKUP works, it reports each file it backs up. The batch file redirects this output to a printer (at LPT1:) so you have a confirmation that everything worked correctly when you return to the machine with your coffee. Edit or delete '>LPT1' if your printer is on a different port or is not connected.

Curbing BACKUP's Appetite

When BACKUP's /M option is used, the program searches through all the files on your hard disk, checking for the DOS flag that indicates the file has been revised since the last backup. Whenever it finds that flag, it transfers the file to empty space on the backup floppy. This means that BACKUP also transfers .BAK files to the floppy.

(continues)

Now I'm as cautious as the next person, but backing up backup files seems like overkill to me, and it gobbles up space on the floppy.

If you have the *Norton Utilities* (assumed to be in the directory \NORTON in the batch file that follows), you can curb BACKUP's appetite. This collection of useful programs includes one that allows you to remove BACKUP's DOS flag with the command `FA filename /A-`. Modify the AUTOEXEC.BAT lines as follows:

```
DATE
TIME
PATH C:\DOS; C:\NORTON
BASIC C:\UTILITY\BOOTPROG
IF EXIST C:\BOOTTEST GOTO NOBACKUP
CD \WORDSTAR
FA *.BAK /A- BACKUP C:\ A: /S /M /A > LPT1
GOTO CONTINUE
:NOBACKUP
ERASE C:\BOOTTEST
:CONTINUE
```

The command `FA *.BAK /A-` following the command `CD \WORDSTAR` ensures that no .BAK files in the \WORDSTAR directory are transferred to the backup floppy. If you add similar lines to AUTOEXEC.BAT to take care of all your subdirectories, you'll find BACKUP eating far fewer disks.

If you have a few files that you revise regularly, you can also use the Norton FA command in the AUTOEXEC.BAT file to remove the flags on those files. You would then back up these few files with the COPY command. If you use COPY instead of BACKUP, the file is copied to the same disk space each time, and only

the latest copy is saved. But remember, RESTORE won't restore it to the hard disk; you have to COPY it back.

When Disaster Strikes

Sooner or later you'll have to use your backup floppies to restore something lost from your hard disk. But when you use RESTORE, every file you've ever backed up will be restored—not just those on the hard disk at the time of the most recent BACKUP. Files that you deleted three weeks ago will reappear. After restoring, you'll have to go through the restored subdirectory deleting old files and COPYING others from the backup floppy. For this procedure you'll want to have a list of all files on the disk before data was lost.

Just above the :NOBACKUP label in AUTOEXEC.BAT, add `TREE /F >A:ALLFILES`. This line invokes an option of DOS's TREE command that lists every file in every directory. The redirection filter sends the output to a file named ALLFILES on the backup floppy.

Invoking these procedures won't make backing up and restoring files completely painless, but it will make the process as automatic and efficient as possible. And the few minutes you sacrifice to backup each morning will be more than compensated for by the days you save the next time your BASIC directory is lost for want of a backslash.

C. Breck Hitz is president of Phonetics Associates and a founder and the editorial director of Lasers and Applications.

For an extra \$155, you can buy the PCi10 with a modular controller board that allows you to add various Maynard-manufactured serial, parallel, and game ports without taking up additional system slots. Both this board and the board normally supplied with the drive are designed to support two hard disks at the same time.

The PCi10's installation instructions are easy to follow, though Maynard has mysteriously placed instructions for the controller board and the hard disk in separate manuals. Thankfully, both manuals include clear drawings and thorough help and reference sections. The PCi10 includes a one-year limited parts and labor warranty but no toll-free technical support.

Creative Micro Creative Edge CEX-10

The CEX-10 crossed the finish line after 5 hours and 47 minutes, with a few read/write errors. Installation is straightforward, and the drive arrives preformatted and partitioned. All the user need do is format the disk with DOS. A low-level formatting program is provided in case the read/write head "crashes" and the hard disk must be reformatted from scratch. No head-parking program is provided with the drive. Interleave is set at 6:1.

The installation manual is aimed at the novice and is fairly explicit, though it lacks illustrations. A technician's manual that lists the controller specifications and provides extensive information on interleave is also available. The CEX-10 includes a one-year limited warranty on parts and labor. A toll-free number is available for technical support.

Power to the People

After putting the five 10MB hard disk drives through their paces, we were most impressed with the performance of the \$949 Alpha Omega Turbo 10 (Micro Computer Memories version) and the performance and ease of installation of the \$1095 Kameron Labs Megaflight 100. Unfortunately, neither drive will win a prize for its documentation. The Qubié PC10, with its bargain-basement price (\$649), excellent documentation, drive replacement policy, and changeable interleave, may be the best deal going. It's not the fastest drive, but its cumulative merits more than compensate for this factor. Users who need to control interleave values might also consider the Alpha Omega.

The PC owner who switches from a dual-floppy system to one with a hard disk drive will soon wonder how he or she ever got by without the added speed and storage capacity. Adding a hard disk is a fast—and inexpensive—way to turn your PC into a powerhouse. ●

Reed McManus is a freelance writer in San Francisco.

Creative Micro Creative Edge CEX-10

*Creative Micro, Inc.
3339 Vincent Rd.
Pleasant Hill, CA 94523
800/945-1201, 415/321-3324
List price: \$695*

*Megaflight 100
Kameron Labs
8054 S.W. Nimbus Ave.
Beaverton, OR 97005
800/522-2237, 503/626-6877
List price: \$1095*

*PCi10
Maynard Electronics
430 E. Semoran Blvd.
Casselberry, FL 32707
305/331-6402
List price: \$1095, with modular controller board \$1250*

*PC10
Qubié
4809 Calle Alto
Camarillo, CA 93010
805/987-9741
List price: \$649*

*Turbo 10
Alpha Omega Computer Products
18612 Ventura Blvd.
Tarzana, CA 91356
818/345-4422
List price: \$949*

Ambitious Archiving

PC World takes a look at the cream of the crop: three external, high-capacity hard disks with streaming-tape cartridge backup.

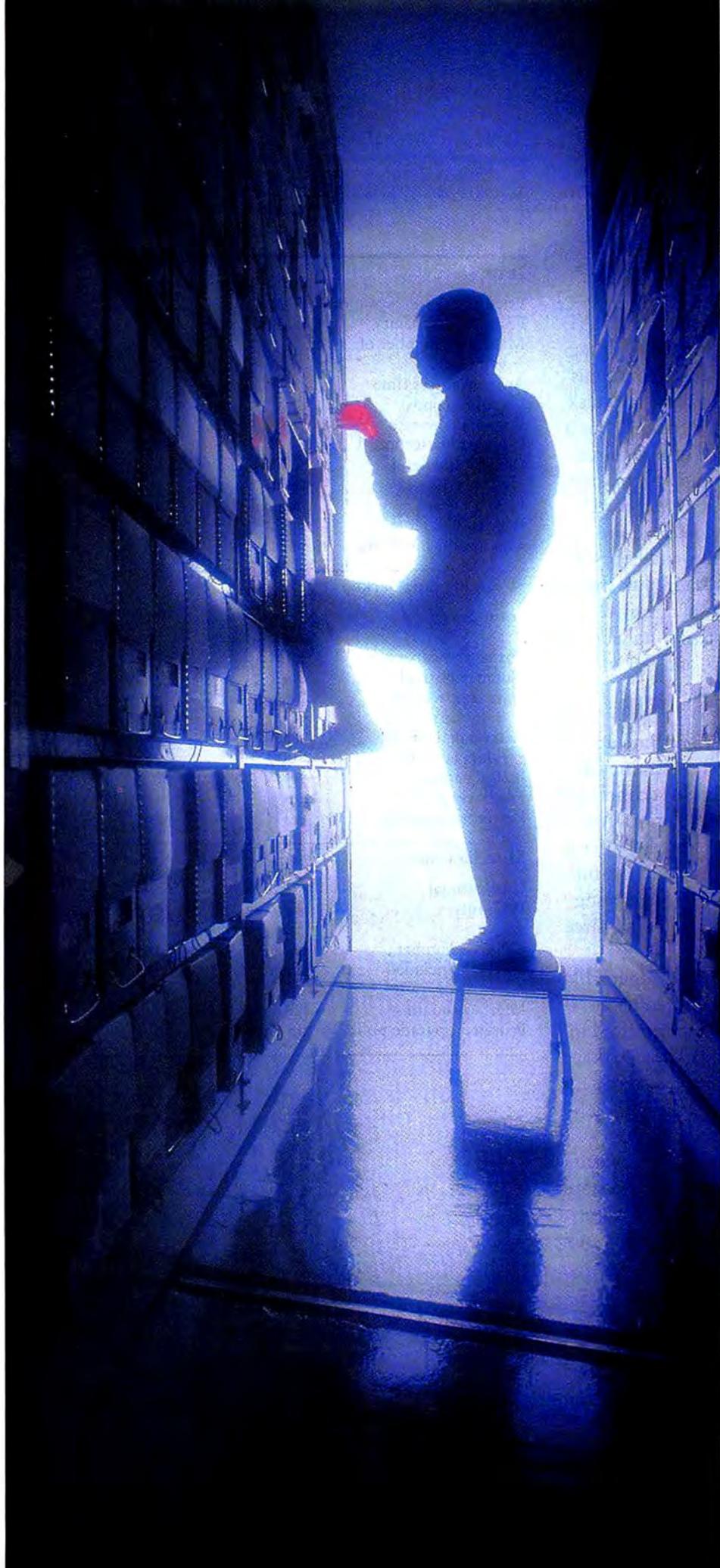
Reed McManus

Many PC users outgrew their floppy disk systems long ago and then quickly went on to exhaust 5MB or 10MB hard disks with program and data files. Storage-hungry applications demand high-capacity hard disks, and local area networks and user convenience dictate that all program and data files be stored on one readily accessible hard disk. To assist readers who have these more demanding storage requirements, we examined three expandable external hard disks with tape backup systems: a 20MB Sysgen XL, a 40MB IDEAssociates IDEAdisk, and a 75MB Priam DataTower. We chose these exter-

nal hard disk drives for their superior flexibility. Each contains its own power supply (unlike most internal hard disk drives) and provides room for a backup system and future storage expansion (see Table 1).

The three disks were subjected to the same read/write torture test used on the five internal 10MB hard disk drives reviewed in "Sensible Storage" (in this issue). Although direct disk speed comparisons should not be drawn between disks with different storage capacities, the numbers give some idea of how well these high-capacity disks can perform.

We also tested the image backup speed of each system and discovered that all three tape systems transfer data at approximately 4MB per minute. (Image backup, or imaging, is the fastest method of backing up large amounts of data; it is a process whereby a disk volume is duplicated byte for byte.) We scrutinized each drive's user manual, ease of installation, and software, paying special attention to the features and flexibility of each disk's backup system.



Backup or Bust

High-capacity storage systems make backup capability critical. With the convenience of having all your data in one place comes the danger of losing everything due to a power surge, a head crash, or a misdirected FORMAT command. With careful planning and patience, a budget-conscious user of a small-capacity hard disk can use floppies for backup. But a high-capacity hard disk requires an automatic backup system; manually backing up a 40MB hard disk on floppies would require more than 100 disks and hours of tedious labor. A 40MB disk that lacks a convenient and relatively quick backup system simply does not get backed up, and that's courting disaster.

Streaming-Tape Backup

The simplest electronic data repository would be a second hard disk, a very pricey solution. An acceptable compromise between a second hard disk and a closet full of floppies is magnetic streaming tape, the method used by all three systems reviewed here.

Streaming tape works much like audio tape: data is stored on an iron-oxide-coated tape encased in either a cassette or cartridge that can be removed. Streaming-tape drives store data in efficient, end-to-end blocks as the tape constantly "streams" by a read/write head. These sequential devices are slower than hard disks because data cannot be accessed randomly.

Table 1: External hard disk and tape backup specifications

	Sysgen XL	DataTower DT01-03	IDEAdisk
Drive			
Price	\$3295	\$7995	\$4995
Formatted capacity	20MB	75MB	40MB
Maximum number of volumes	16	24	24
Average access time (milliseconds)	83	35	65
Data transfer rate (megabits/second)	5	9.6	5
Factory low-level formatting	yes	yes	yes
Park program	manual	automatic	automatic
Interleave value	5:1	1:1	3:1
Changeable interleave	no	yes	no
Streaming-tape backup			
Format	¼-inch cartridge	¼-inch cartridge	¼-inch cartridge
Formatted capacity	60MB	60MB	60MB
Number of tracks	9	9	9
Data transfer rate (kilobits/second)	670	694	720
Recording density (bits per inch)	8000	8000	8000
Image backup	yes	yes	yes
File backup	yes	yes	yes
Directories backup	yes	yes	yes
Miscellaneous			
User manual	good	good	fair
Warranty	90 days parts/labor	12 months parts/labor	12 months parts/labor
Toll-free number	no	no	yes
Software included	diagnostics	diagnostics	cache memory, diagnostics
Interface board	half-length	half-length	half-length
Prorated upgrade policy	no	no	yes

The backup systems that accompany the drives we reviewed run the tape in a continuous loop—like an 8-track audio tape. When a track is filled with the last block of data and the read/write head is back at the beginning of the loop, the head moves to the next track. This serpentine configuration eliminates the need to rewind the tape and speeds up operation.

■ Backup Choices

The three drives reviewed allow you to back up and restore individual files, sets of files, or an entire disk volume (imaging). Like DOS's DISKCOPY utility for floppy disks, an image backup produces an exact replica of a hard disk volume—including any bad tracks. Because each hard disk has a different pattern of bad tracks, an image tape can restore data only to the disk from which it was taken. Image backups are usually performed periodically to provide a full system backup in case of major disk disasters.

Streaming tape was first designed to archive huge amounts of mainframe and minicomputer data, and early systems did not allow files to be saved individually. But PC users often alter only a few files in one sitting. In such cases, it is more efficient to back up only the altered files rather than an entire disk. All three systems perform file-by-file backup.

■ Responsible Redundancy

The fastest backup system in the world is worthless unless it is used. If a file-by-file backup system enables you to quickly designate the files you want saved, it's more likely you will devote time to backing up. All three of the backup systems we looked at can be operated quickly using DOS. The Sysgen XL and the IDEAdisk make the process easier with optional prompt- and menu-driven procedures. Although menus and prompts are helpful when you're learning to use backup systems, you should take the time to learn DOS-level commands. They are the fastest way to initiate backup and restore functions. You can also create batch files to automate routine backup commands.

The systems we tested use command conventions similar to the DOS floppy disk BACKUP and RESTORE commands. /S backs up or restores subdirectory files along with specified files of the specified or default directory; /M specifies that only files modified or created since the last backup should be backed up; /D tells the system to back up files altered on or after a certain date; /P prompts you before restoring files that are read-only or have changed since the last backup; and /A adds backup files to those already saved. (The Sysgen appends by default; its /DEL command allows you to overwrite earlier material. The Priam does not have an append function.) All DOS path designations, file specifications, and wild-card parameters can be used to designate files or groups of files.

The Sysgen commands are the most comprehensive, allowing you to designate backup start time, end time, and date. The Sysgen XL also allows you to enter a 40-character title or comment to identify file-by-file or image tape contents.

■ Cartridge Superiority

All three drives use ¼-inch-wide cartridge tapes, the most common streaming-tape format. These tapes can be used in any backup system that follows 3M's popular ¼-inch cartridge standards. A tape's storage capacity is determined by its length, data density (expressed in bits per inch), and number of tracks. The systems tested use either 45MB (450-foot) or 60MB (600-foot) tapes.

Cartridges are generally preferable to cassettes because they control tape tension better and require only one motor instead of two. Cartridges are less prone to contamination than cassettes, and their aluminum baseplates ensure accurate positioning of the tape head relative to tape tracks, allowing a greater number of tracks—and thus more data—to be stored.

Installation

As you might suspect, installing an external hard disk is simple. You drop the controller board into an available PC slot, connect the cables, plug in the drive, and format the disk. Formatting is easiest with the menu-driven utilities provided by Priam and IDEAssociates. Installing the Sysgen requires four separate DOS-level, prompt-driven programs.

Sysgen XL

The Sysgen XL provides 20MB of formatted hard disk storage and 60MB of formatted tape backup. The unit can be expanded to as much as 100MB of disk storage, which is backed up on two tape cartridges.

The draft Sysgen manual we examined provides a precise and informative overview of system installation and operation and a solid troubleshooting guide. Like most hard disk drive manuals, this one is sparsely illustrated.

The Sysgen XL installs easily. Its short cable, however, forces you to place the system immediately next to the PC's system unit. Software installation is confusing at first, because lengthy procedures are provided for a multitude of hardware configurations. But in practice, setting up the disk is quick. The process involves running four prompt-driven programs that check the disk for shipping damage, partition it into volumes, install the disk configuration and format volumes, and initialize disk volume directories.



The 40MB IDEAdisk



The 20MB Sysgen XL

CHKDSK.COM is also used to check for directory errors.

The Sysgen XL comes with a head-parking program that moves the read/write heads to a dedicated landing zone when the system is turned off and a diagnostics program that identifies software and hardware errors.

Tape backup and restoration is performed using either the FILESAVE command, which saves or restores individual files or sets of files, or the PRESERVE command, which saves and restores entire disk volumes in image fashion. Up to 512 individual files (fewer if subdirectories are included) can be saved at one time with FILESAVE.

Within FILESAVE and PRESERVE are the BACKUP and RESTORE commands, which can be used in a prompt-driven mode. The prompt mode walks the novice through each step of the backup process, asking for each parameter. It's a painless way of learning the ins and outs of hard disk backup. Experienced users, of course, will want to save time by entering the commands directly at the DOS prompt. Sysgen's CATALOG utility lists any range of files backed up with FILESAVE and an identification label for disk volumes backed up with PRESERVE.

(Image backup records data in an "unintelligent" bit-by-bit fashion; only a label can be read.)

The Sysgen hard disk completed the read/write performance test in 3 hours and 42 minutes without error. The drive's average seek time is 83 milliseconds.

■ Priam DataTower DT01-03

Unlike the 5¼-inch disks used by the IDEAdisk and the Sysgen XL, the DataTower uses a vertically mounted 8-inch platter. This larger platter stores more data than smaller disks, and its vertical positioning is believed by many to minimize read/write errors. The DataTower is offered in 60MB, 75MB, 156MB, and 287MB versions.

Priam's hardware installation instructions are clear, but they are not illustrated and offer little help if problems occur. The software installation instructions, however, are thorough and include a valuable overview of hard disk concepts.

The DataTower offers the easiest and quickest software installation system of those reviewed. It uses an all-inclusive, menu-driven utility program to format and partition the disk, install system files to boot from the hard disk, back up entire partitions, restore entire partitions, and diagnose system problems. Since DOS does not permit partitions that exceed 32MB, at least three partitions must be created in a 75MB DataTower. A total of 24 partitions (drives C: through Z:) are possible.



The 75MB Priam DataTower

The DataTower's individual-file backup and restore programs, TBACK and TREST, are not as extensive as those offered with the Sysgen. You cannot note the backup end-date, only the duration of the backup. Nor can you instruct the system to append new data to existing backed-up data.

The 75MB DataTower disk zoomed through the *Max* test (described in "Sensible Storage") in 2 hours and 29 minutes with no errors. The drive's average seek time is a fast 35 milliseconds; this speed is largely due to the DataTower's efficient voice coil head positioner.

■ IDEAssociates IDEAdisk

The IDEAdisk reviewed was a 40MB hard disk coupled with a 60MB tape backup. IDEAdisk systems range from 5MB to 120MB. The IDEAdisk comes with three manuals: a carefully designed guide to disk installation and operation that fits in a DOS binder; a spiral-bound guide to tape backup operation; and instructions for ex-

ecuting TCOPI, the drive's DOS-level backup utility. The manuals are poorly coordinated; their helter-skelter organization forces you to shuffle between them to perform a single operation, such as backup. The primary manual does provide an overview of disk and tape commands, offers thorough descriptions of and responses to possible installation problems, and includes a helpful Quick Reference Card for the disk and tape menu programs. Unfortunately, the manual's hardware installation instructions are written in the kind of computerese only a technician could love.

Much of the documentation is devoted to explaining the system's elaborate menu-driven program, IDEAsave. IDEAsave was no doubt meant to be helpful, but it generally makes things harder. You spend more time learning how to use the menu system than you do mastering backup and restore techniques. Tape backup is actually quite easy with TCOPI. Both TCOPI and IDEAsave allow you to save backup specifications for later use.

Installing the IDEAdisk drive is similarly simple. Software installation is a matter of modifying a DOS CONFIG.SYS file to include the IDEAdisk device driver; loading it into memory; and then running a menu-driven, function key controlled program that partitions and formats the disk. All DOS commands, except FORMAT and FDISK, can be used.

The IDEAdisk offers an impressive list of menu-driven system support programs that change the type or number of disk drives, maintain tape tension, and let you define how much RAM to set aside for cache memory. (Cache memory is used to store frequently used data and programs; it markedly speeds up a drive's operation.) A cache must be at least 11K; the IDEAdisk manual recommends 128K.

The drive incorporates a head-parking feature that moves disk heads to an unused track if disk

access has not taken place for 10 seconds. Disk and tape diagnostic programs and a program to recover a corrupted file allocation table are included as well. The IDEAdisk glided through our torture test in 3 hours and 29 minutes.

If your storage demands are great, we recommend any of the three disks drives we tested. Each of these top-of-the-line systems is a reliable performer. We were most impressed by the Sysgen's extensive backup commands and straightforward instructions. Its software installation, however, requires more effort than do the other two systems. The Priam's vertical design is intriguing, and

we favored its streamlined installation programs. The IDEAdisk performed admirably and offers a wide range of backup parameters, as well as the most extensive system support programs of the lot. If 10MB won't do it anymore, the power and panache of a large-capacity hard disk may be just the ticket. ●

Reed McManus is a freelance writer living in San Francisco.

*IDEAdisk
IDEAssociates, Inc.
35 Dunham Rd.
Billerica, MA 01821
800/257-5027, 617/663-6878
List price: \$4995 for 40MB
system with tape backup and
40MB removable cartridge*

*DataTower DT01-03
Priam Corp.
20 W. Montague Expwy.
San Jose, CA 95134
408/946-4600
List price: \$7995 for 75MB
system with tape backup and
60MB removable cartridge*

*Sysgen XL
Sysgen Inc.
47853 Warm Springs Blvd.
Fremont, CA 94539
415/490-6770
List price: \$3295 for 20MB
system with tape backup and
60MB removable cartridge*



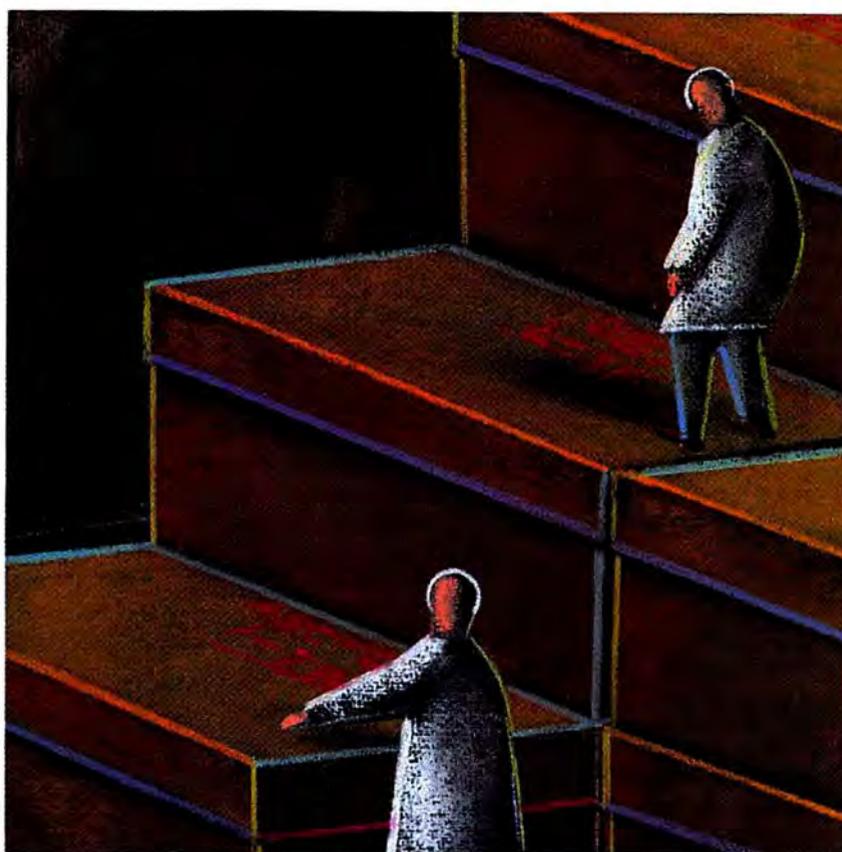
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Pathfinders

When you move to a hard disk, you might need more help with DOS than the simple C> prompt offers. A DOS shell program can provide a tool for rooting out all those files that you know are in there somewhere.

Alan Hoenig

|||| You've switched to a hard disk and carefully distributed your files into an elegant latticework of directories and subdirectories. The first thing you'll notice is that the subdirectory commands complicate DOS considerably; to use any file you must preface its name with a cryptic collection of backslashes and directory names, and remembering the structure of your directories becomes an exercise as complicated as it is crucial. To help meet this challenge, DOS shell pro-



grams lay out a repast of commands that should make performing a DOS function as easy as choosing an olive from a relish dish.

Shell programs are usually organized according to one of two strategies. The simpler type uses menus based on DOS commands and the subdirectory structure of your hard disk. The second cate-

gory lets you build menus à la carte, with a choice of DOS commands or whatever commands your business uses most. The menu structures that shell programs serve up can help you establish a turnkey system for an office full of computer novices or simply make it easier to navigate your own hard disk. In preparing this article I looked at a half-dozen shell programs. The two described here were the standouts in their respective categories.

Mapping Your Subdirectories

Direc-Tree belongs to the simpler category—providing easy access to DOS commands and your subdirectories. The program's core is the hierarchical sketch of subdirectories it generates on the monitor (see Screen 1). From this screen you use single keystrokes to select subdirectories, manipulate files, or run programs. Typing a slash brings up a help menu of all the functions.

Direc-Tree spares you from typing DOS commands and paths; cursor keys and function keys take you through menus and execute procedures. The left-hand column of PC function keys (<F1>, <F3>, and so on) controls file management. These keys offer the DOS options of typing, renaming, deleting, or copying files, listing files in a directory, and running programs. (*Direc-Tree* uses about 100K of RAM, so you'll need at least that much extra in order to run a program from a *Direc-Tree* menu; the RAM is freed, however, as soon as you exit the shell.)

Direc-Tree also offers file-management utilities of its own. One function allows you to lock files into read-only status so that they can't be accidentally changed or deleted. (This function is also provided in DOS 3.00 by the ATTRIB command.) Another feature allows you to move files between directories, a convenient shortcut to the lengthier DOS sequence of copying a file to a destination and then deleting the original.

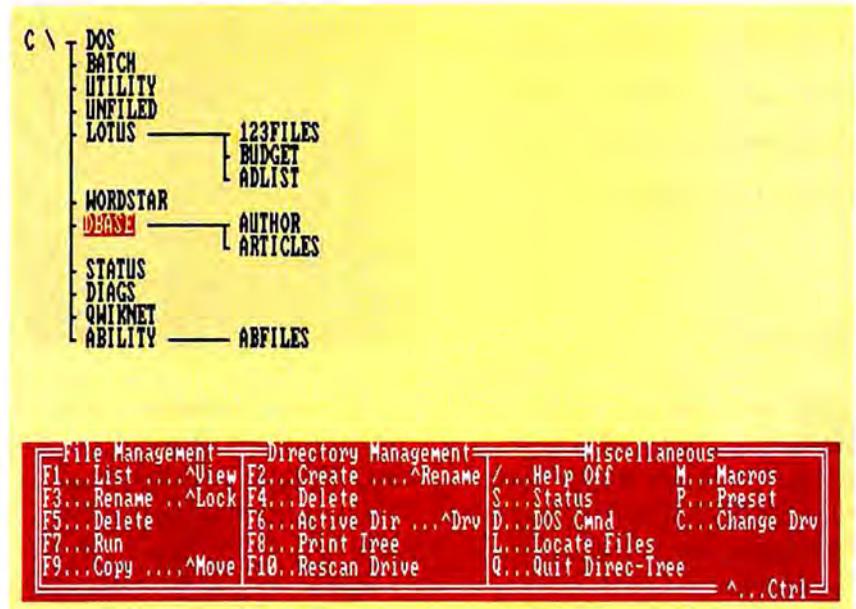
The right-hand column of function keys maintains your directories. These keys not only duplicate DOS commands to create, remove, or change directories, they add utilities to rename directories and to print the directory tree in its stylish *Direc-Tree* form.

To execute any *Direc-Tree* function, you first use the cursor to select a directory from the opening display. Next, you use a function key or a single letter to pick a task. *Direc-Tree* will present a list of the files in the selected directory, sorted alphabetically. For a different view of your files, you can control the order of the list, sorting the files by name, file extension, size, or date; in ascending or descending order; and with or without the file size and date displayed. The file list displays the

number of bytes used by each directory—handy for keeping directory size manageable.

You use the cursor to choose a file from the displayed list. To operate on several files at once you can mark them with special characters or specify them using DOS wild-card characters. *Direc-Tree* often guides you through several screens and messages to complete a command, leading you through the function one easy step at a time.

In fact, some *Direc-Tree* functions take circuitous routes around the need to type any commands. Instead of typing a path on a BASIC file name, for instance, you can enter the directory that con-



Screen 1: *Direc-Tree*'s diagram of your hard disk directory structure serves as the opening screen. Pressing the slash key brings up the help menu, which shows the single-key commands you can use to execute DOS functions.

tains BASIC.COM; select it with the cursor; press <Enter>; and press A to choose the Add Auto-path function, which returns you to the directory tree, where you choose the directory that contains your BASIC files. You then mark the file by the same step-by-step method. During the procedure the path is constructed in a status line at the bottom of the screen. The advantage of this method is that you don't have to know anything about paths to execute one. (Unfortunately, the *Direc-Tree* documentation doesn't tell you what you need to know about the Auto-path function.) If you know DOS, however, the procedure can seem tortuous. *Direc-Tree* thoughtfully provides a more direct way to execute DOS functions; pressing D brings you the DOS prompt, from which you can issue DOS commands or run programs directly without using *Direc-Tree*'s menus.

Direc-Tree serves up a number of commands DOS doesn't provide. In addition to the new utilities described earlier, the menu offers a status window that summarizes salient facts about your system, including the default drive, the amount of RAM available, the number of directories, and other tidbits. One feature lets you create as many as 11 macros that can be executed with a tap of <Alt> plus a number key, and another takes this capability one step further,

enabling you to set up your own menu of as many as 100 *presets*—predefined macros or DOS command strings that can be executed by pressing a single key (see Screen 2). The program also supplies a Locate option that lists every occurrence of a file or type of file in every directory in your system; for instance, you can find all the backup files on your hard disk by asking *Direc-Tree* to locate *.BAK.

Direc-Tree is copy protected, but a relatively simple installation and customization procedure copies the program to your hard disk. You're allowed a total of three copies of the program extant at any one time; any of the copies can be "uninstalled" and reused if you change systems.

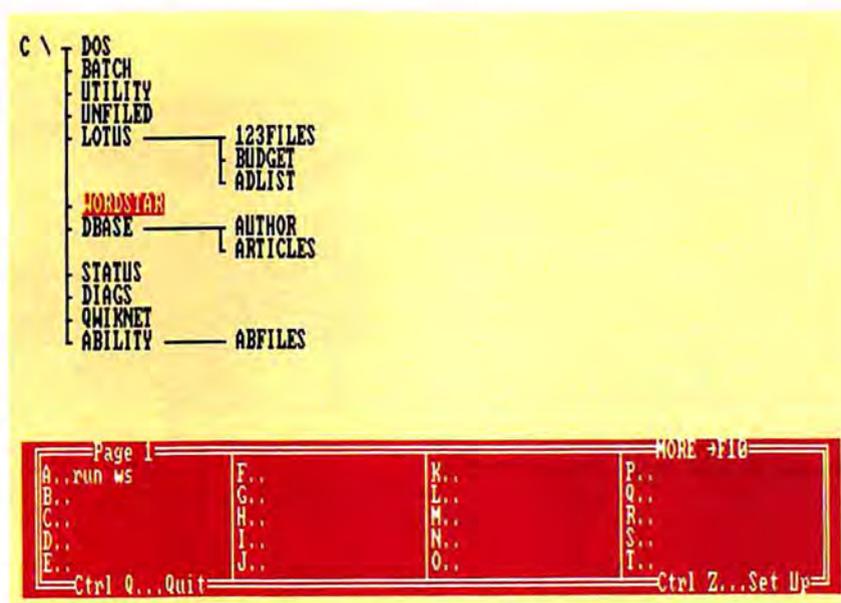
Anyone who doesn't want to spend time learning DOS's sub-directory commands could safely

lean on this program. Those more familiar with DOS might consider many of *Direc-Tree*'s procedures cumbersome yet find its subdirectory sketch and extra utilities worth the price.

Turnkey Customization

PC Menu is an adaptation of a system created for a DEC mini-computer environment. The program enables you to design a simple interface for a system that will be used by several people; it is especially useful when those people are computer novices. The menus you design can include options to activate a DOS utility, run a program, or perform whatever DOS-related action you choose.

This type of shell requires considerable expertise to set up, but it simplifies the system for those who



Screen 2: *Direc-Tree* offers a preset menu that allows you to set up macros to automatically execute the DOS commands or the programs you use most often. Pressing P and a preset letter executes the command.

use it. The sample menu in Screen 3 shows the versatility of the systems you can create. Screens can include elaborate help files to guide the weary user through the menus, which you can nest up to 15 layers deep.

up the menu, and terminate the menu, respectively. Other commands display additional message text on the menu, control the menu layout (to a limited degree), invoke submenus, and return to the main menu or to DOS. The

takes to differentiate your choice from any other on the menu. For example, to call a plain DOS prompt from the menu in Screen 3, you enter *pl*. The PC will beep at you if you enter just a *p*—your selection is ambiguous since the names for the DOS prompt (PLAIN) and for the payroll system (PR) both begin with that letter. But because no other selection begins with *pl*, *PC Menu* will recognize that sequence and hasten to execute the command. If you make sure each item name begins with a different letter, a single keystroke will be sufficient to call any item.

Niceties like adding variable parameters to commands are beyond *PC Menu*'s scope. You cannot, for instance, add a data file name to a

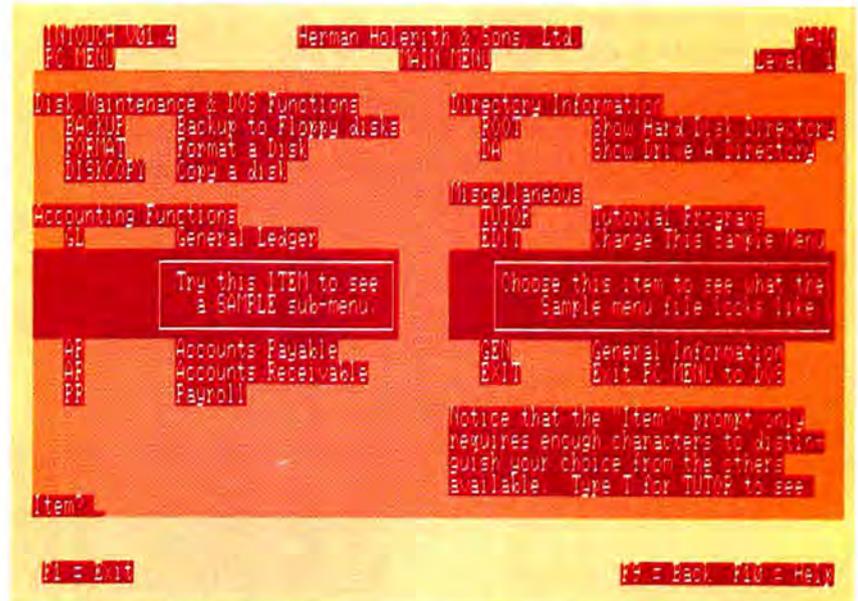
If you make sure each item name begins with a different letter, a single keystroke will be sufficient to call any item.

To create a menu you write an ASCII file called MASTER.MCL (MCL stands for Menu Control Language), which the program translates into the instructions it uses to create the menu display. Since this file must be written in ASCII and cannot contain the special binary codes beloved of most word processors, it's best to create the file with the nifty text editor that's part of the *PC Menu* package. This editor is speedy and a snap to use (for editing, mind you, not for advanced word processing), and fast became my editor of choice for preparing configuration and batch files.

The MCL file consists of a series of lines, each beginning with one of the keywords that the *PC Menu* program looks for. For example, the keywords \$MENU, \$ITEM, and \$END label the menu, list the items that will make

menu language is easy to learn; I made only one small error on the first menu file I created, and a quick fix corrected it.

Each menu command consists of a description of the action it performs, along with a name you create to identify it. To select an item, you enter its identifying name—or as many letters as it



Screen 3: *PC Menu*'s demo menu shows a sample system you can create. Menus can be nested up to 15 levels deep, including help and information screens.

command that starts a word processor so that the program automatically loads that file, and a CHKDSK on drive C: would require a different menu item than a CHKDSK on A:. However, this limitation is not major.

The components of the *PC Menu* system are easy to install and are not copy protected. My only significant complaint about *PC Menu* concerns its documentation. Much information is either unclear or missing completely. (Hint to users: The mysterious "Gold Key" is <F6>.) Fortunately, help is no further away than your telephone. The folks with whom I spoke at the other end of the toll-free assistance line were friendly and helpful.

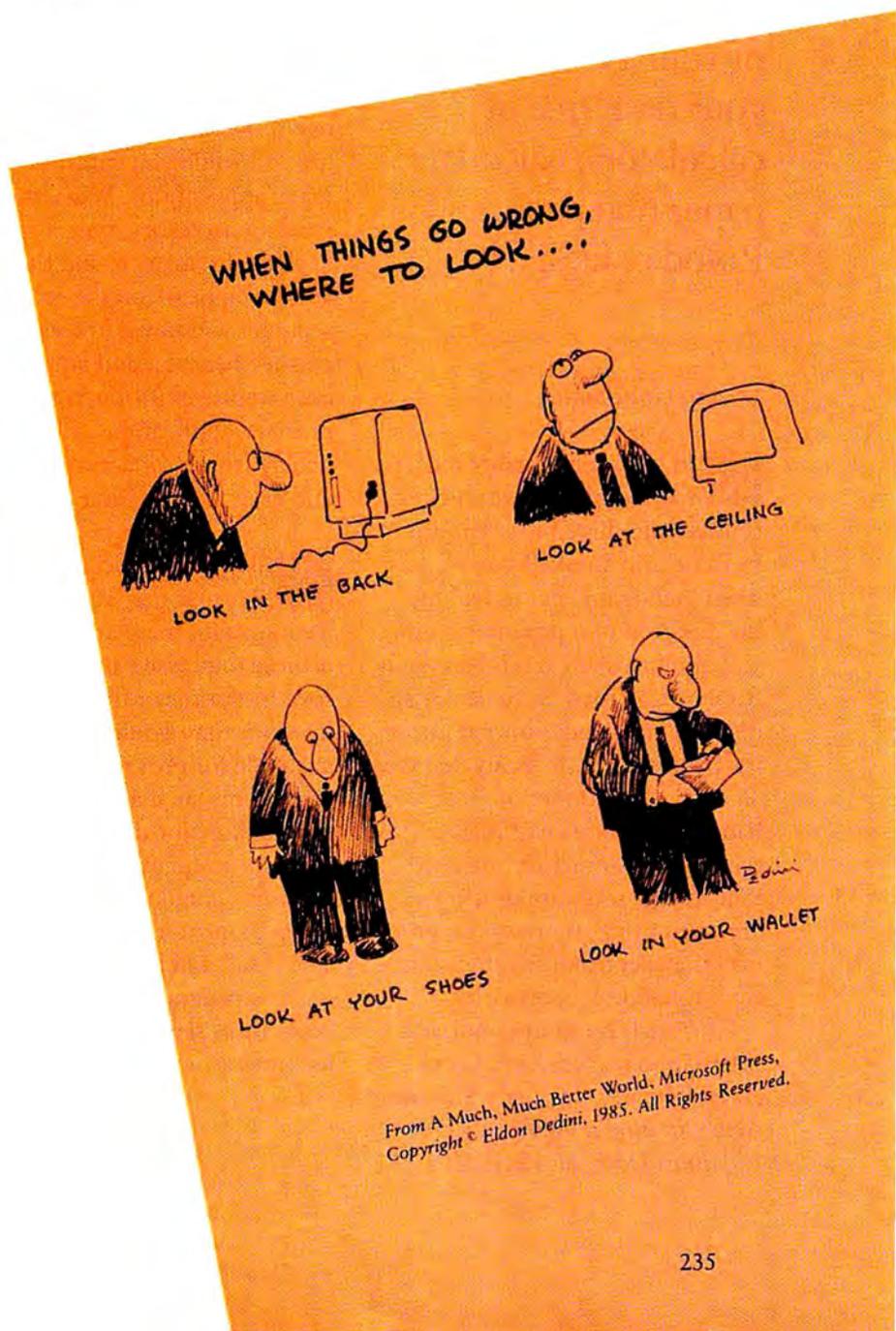
Shelling Out

Which program to choose depends on who will be using the system. If you're new to a hard disk or DOS or you have many subdirectories whose contents have begun to blur in your memory, then *Direc-Tree*, with its snappy directory display, may suit you best. If your concern is less with DOS and more with helping a group of novices use your system to run applications, you'll be grateful for *PC Menu's* features. In either case, a DOS shell can save you plenty of time and frustration if you're not convinced that the romance of blazing paths extends to the trek through your hard disks. ●

Alan Hoenig is a mathematics professor at John Jay College in the City University of New York and is the author of five books on microcomputers.

Direc-Tree
Micro-Z
4 Santa Bella Rd.
Rolling Hills Estates, CA 90274
213/377-1640
List price: \$49.50
Requirements: 128K, DOS 2.00
or later version

PC-Menu
Touch Technologies
609 S. Escondido Blvd. #101
Escondido, CA 92025
800/525-2527, 800/325-2527 in
California
List price: \$139.95
Requirements: 256K, DOS 2.00
or later version



Clutterbusters

Enhance the usefulness of your PC and keep your desk free of calculators, calendars, paper notepads, and Rolodex files.

Danny Goodman

■■■■ In corporate thriller movies, the megalomaniac chief executive rules his sinister empire from behind a naked slab of polished mahogany. But in real life, the desk top of a productive individual more likely resembles Andy Rooney's. A card file here. An appointment calendar buried under the papers there. It seems that we all need one or more of these handy accessories within easy reach. That's precisely the need that several software developers are attempting to meet with products that electronically duplicate traditional desk accessories.

Four such programs—Borland International's *SideKick*, Lotus Development's (formerly Software Arts') *Spotlight*, Polytron's *PolyWindows Desk*, and Bellsoft's

Pop-Up DeskSet Plus—are memory-resident; they lurk in the background while you run your primary applications. When you need an accessory, type a special keyboard sequence, and the accessory appears on the screen in a separate window. How each accessory behaves, and how well each improves productivity with primary applications, varies widely from product to product, and even from module to module.

■ Behind the Scenes

Because they run in the background, these accessories achieve impressive operating speeds, but they often gobble up memory that would otherwise be available for programs and large documents such as 1-2-3 worksheets. A major disadvantage of memory-resident programs is that they may conflict with one another when in memory simultaneously. The result can be as subtle as having one program overrule the other or as serious as the system locking up.





Desktop accessories generally come in modular form, which allows you to use only those accessories you need. Thus you can devise simple batch files that automatically load appropriate combinations of accessories for each primary application. (For example, you may not need a notepad while using a word processor, but you'd still want a calculator and an appointment calendar.) Some desktop programs permit you to redefine some of their command sequences to avoid conflicts with other application software. Most also afford a degree of flexibility in the size and placement of the windows displaying the accessories.

■ Accessory Roster

While the manufacturers of the reviewed products differ about what accessories a PC user should have on tap, the most common accessories are the following:

Calculator. Using the PC's numeric keypad and a few other keys, you enter numbers and operations into an on-screen calculator to perform quick calculations. All the calculators reviewed offer one or more memories (+, -, and recall), and some of them display a simulated paper tape on screen or on the printer. All the calculators let you paste results into a primary application's document, be it a spreadsheet, a data base record, or word processing text. Other calculator features include scientific notation, built-in financial functions, hexadecimal calculations, and automatic dollars-and-cents decimal formatting. Features, of course, don't tell the whole story. Logical design and convenience are important considerations.

Notepad. Substituting for a pad and pencil, a notepad desk accessory is a window in which you jot down one or more short notes. Most notepads emulate word processors and will wrap text and print pages on demand. Although most store text in a proprietary file format, some programs go much further, letting you edit any document file in the notepad window. Look for features such as search and replace, file merging, block moves, tabs, and variable margins. The ease with which you can cut text from one application (such as *WordStar*) and paste it into another (such as *1-2-3*) can be important.

Calendar/alarm/appointment book. Potentially an attractive grouping of time-management tools, the scope of these applications varies widely from program to program. Depending on the design, alarms and reminders can be set for one day at a time or for years in advance. Some alarm programs restrict their signals to a specific time range. Some signal every hour; others display the time continuously in a corner of the screen. In some programs an alarm displays a window with a previously stored message. All the packages reviewed let you view past, present, and future monthly calendars and print out the day's appointments.

Card file/auto-dialer. Card file accessories are essentially adaptations of the Rolodex. Some card file accessories are linked to an auto-dialer that dials voice calls like an intelligent telephone (if

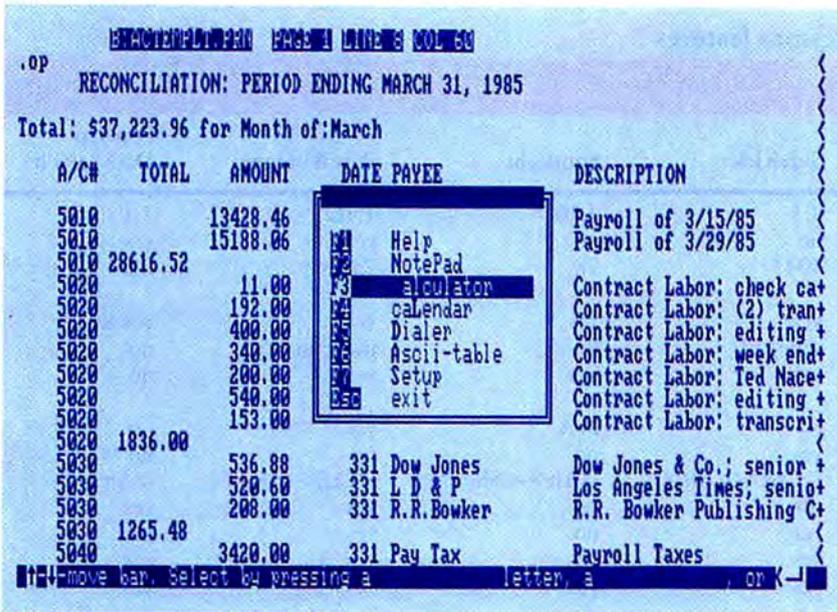
your PC is connected to a Hayes-compatible modem). Some auto-dialers can locate and dial phone numbers stored in other data bases, such as those in a *dBASE II* customer list. Existing data base files can often be converted into dedicated phone directories, which speeds up searching considerably. Some programs offer multiple phone directories that are accessible simultaneously.

Clipboard. A clipboard provides a limited form of software integration even between incompatible programs, allowing you to transfer a screenful of information from one program to another. Clipboards work best when data is imported from spreadsheet or data base files into a word processing document. One desktop program lets you suspend a primary application while you load another, grab the data it contains, and then transfer that data to the first application. This feature saves time, because you needn't exit one application to fetch data from another.

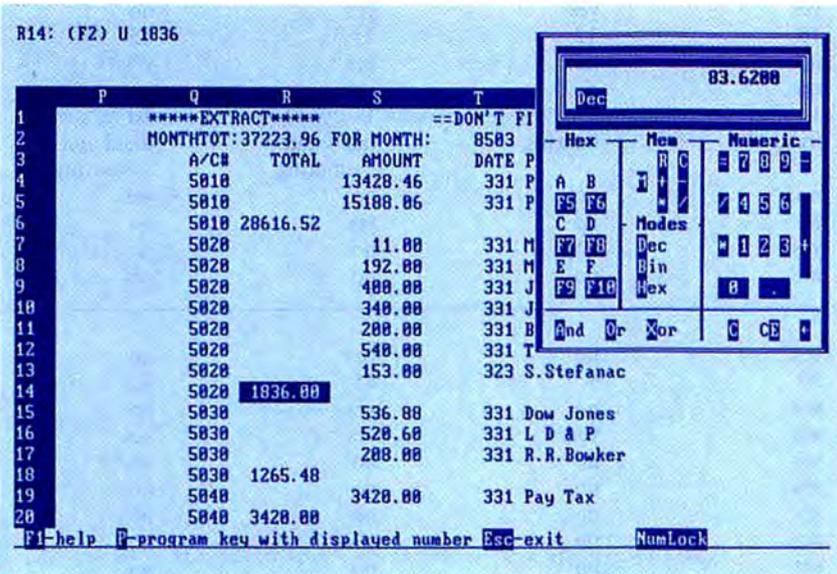
DOS commander. This function lets you suspend program operation while you use DOS functions such as ERASE or FORMAT. If you've ever wanted to delete a file to make room for the one you're working on, you can easily grasp the value of such a feature.

Not every desktop program reviewed features these accessories; some programs supply still others. Table 1 provides each program's basic operating specifications.

Generally speaking, desk accessory keyboard commands supersede regular application commands and macros defined by keyboard enhancers such as *Pro-Key*. Make sure the keyboard combinations used to trigger the accessory program you choose do



Screen 1: SideKick's main menu invokes desk accessories by function keys, by initials, or by moving the cursor bar.



Screen 2: SideKick's single memory calculator offers "paste" capabilities and a choice of decimal, binary, or hexadecimal calculations. Unless you're a programmer, you'll have to ignore the binary and hexadecimal features.

not conflict with keyboard commands used with your applications. However, if the desktop accessory's start-up commands are programmable, you can probably work around any conflict.

One thing is certain: These products evolve almost weekly as their developers continue to dream up new features and correct pro-

gram bugs. Compare the releases reviewed here with the versions you encounter when shopping.

SideKick

The first desk accessory program to generate excitement in the PC user community was Borland International's *SideKick*. See Screen 1 for a look at the program's main menu, which you

(continues on page 242)

Table 1: Comparison of desktop accessory features

Features	SideKick	Spotlight	PolyWindows	Pop-Up DeskSet Plus
Version reviewed	1.5	1.10	1.1C	1.1
Fully memory-resident	no	no	yes	yes
Maximum RAM usage (K)	104*	78	75	225
Windows				
Movable on screen	yes	yes	yes	corners
Adjustable size	notepad	no	notepad	no
Programmable colors	yes	yes	yes	no
Purging accessories				
Individual modules	no	N/A	yes**	no
Entire program	yes	no	no	no
Start-up keys	<Ctrl>-<Alt>	<Alt>-<Shift>- +	<Ctrl>-<Esc>	<Alt>- +
Change start-up keys	no	no	yes	yes
Start-up menu	yes	no	yes	no
Internal menus	yes	yes	yes	yes
On-line help	yes	yes	yes	yes
Calculator				
Keypad on screen	yes	yes	yes	no
Display digits	18	12	15	15
On-screen tape	no	no	yes	yes
Printer tape	no	no	yes	yes
Memories	1	1	1	10
Decimal	fixed (4)	floating	fixed and floating	fixed and floating
Dollars/cents decimal	no	no	no	yes
Scientific notation	no	no	yes	no
Hexadecimal/binary	yes	no	no	no
Financial functions	no	no	no	yes
Notepad				
Load standard text files	yes	no	yes	no
Maximum file size (K)	50	5	65	3.5
Merge files	yes	no	yes	no
Word wrap	yes	yes	yes	yes
Clipboard (copy/paste)	yes	no	no	yes***
Search/replace	yes	no	no	no
Block moves	yes	no	no	no
Variable margins	yes	no	yes	no
Tabs	yes	no	no	no
Time/date stamping	yes	no	no	yes
Calendar/appointment/alarm				
Number of months displayed	1	3	1	3
Today marker	yes	yes	yes	yes
"Hot day" marker	no	no	manual	yes
Time of day range	8 a.m.-8:30 p.m.	24 hours	8 a.m.-8 p.m.	N/A
Interval	30 minutes	1 minute	1 hour	N/A
Set appointment alarms	N/A	yes	today only	today only
Display alarm message	N/A	no	yes	yes
Signal every hour	no	no	yes	yes
Print day's appointments	yes	yes	yes	yes

Features	SideKick	Spotlight	PolyWindows	Pop-Up DeskSet Plus
Card file				
Number of files	N/A	36	10	N/A
Number of cards/file	N/A	500	RAM limit	N/A
Characters/card	N/A	456	969	N/A
Alphabetized	N/A	yes	yes	N/A
Search	N/A	yes	yes	N/A
Sort	N/A	alphabetically	no	N/A
Print cards	N/A	yes	yes	N/A
Print cards as labels	N/A	no	yes	N/A
Print entire file	N/A	yes	yes	N/A
DOS commander				
DIR	N/A	yes	N/A	yes****
Sorted directory	N/A	yes	N/A	no
Change directory	N/A	yes	N/A	yes
Make new directory	N/A	yes	N/A	no
Copy	N/A	yes	N/A	yes
Erase	N/A	yes	N/A	yes
Rename	N/A	yes	N/A	yes
CHKDSK	N/A	limited	N/A	no
Type	N/A	no	N/A	yes
Format	N/A	yes	N/A	no
Auto-dialer				
Phone directory	yes	yes	N/A	yes
Number of directories	unlimited	36	N/A	1
Listings per directory	unlimited	500	N/A	3
Easy to edit listings	yes	yes	N/A	no
Find numbers in application	yes	no	N/A	no
Select PBX/long distance	no	yes	N/A	yes
Hayes modem compatible	yes	yes	N/A	yes
Keyboard enhancer				
Redefinable keys	N/A	N/A	60	N/A
Total keystrokes	N/A	N/A	2500	N/A
Telecommunications				
300/1200 bps	N/A	N/A	N/A	yes
Auto-dial	N/A	N/A	N/A	yes
Number of listings	N/A	N/A	N/A	3
Upload/download	N/A	N/A	N/A	yes
XMODEM protocol	N/A	N/A	N/A	no
ASCII chart	yes	N/A	N/A	N/A
Game (puzzle)	N/A	N/A	yes	N/A

* Includes 50K notepad file

** "Remove" utility may delete more than one accessory depending on the order in which accessories are loaded.

*** Separate clipboard accessory

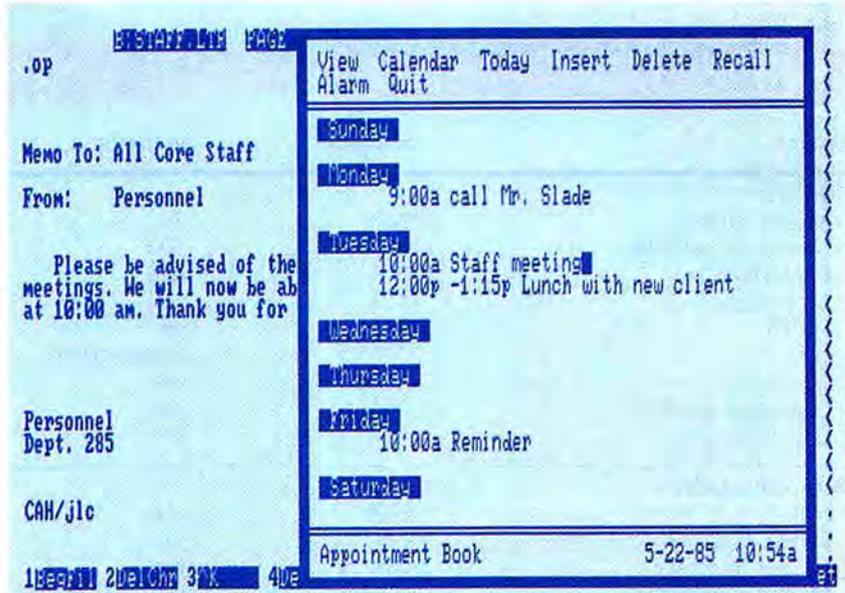
**** Responses in this column segment for Pop-Up PopDOS only. Pop-Up Anything offers complete access to all DOS commands.

Screen 3: Spotlight's appointment book enables you to set alarms and view appointments a week at a time or a day at a time; in the daily view it points out overlaps.

bring up by pressing <Ctrl>-<Alt> or both <Shift> keys.

SideKick's single-memory calculator is unique among its competitors due to its ability to calculate in hexadecimal and binary as well as in decimal math (see Screen 2). You can pass a result to an application (if you need to do some figuring before typing a number into a letter, for example), but the procedure requires more keystrokes than it's worth. You must assign the number to an unused <Ctrl>-key or <Alt>-key combination and subsequently paste the number into the text with that key combination. A possible advantage is that you can assign frequently used numbers to different key combinations for instant recall. You'll still have to avoid assigning a number to key combinations used by a primary application or a keyboard enhancer.

SideKick's notepad does double duty as a text editor and a one-way clipboard. As a text editor, it is particularly useful for quickly viewing or revising any document up to 50K in size. Perhaps its most unusual characteristic is its adherence to *WordStar* <Ctrl>-key conventions for cursor movement, marking blocks, search and re-



place, and so on. *WordStar* users will feel at home here, but those who lack that singular experience may be at a disadvantage.

The notepad can act as a clipboard by importing data from the screen under one application and assigning it to a <Ctrl>-key or <Alt>-key combination that you specify. The data stored in that key can then be "pasted" into any other application. Importing data is as easy as marking as a block the area of the screen you want to import and copying the block into the notepad. Pasting data is equally easy, but you'll have to be careful that the key you choose to store the data doesn't conflict with a definition that the target application or a keyboard enhancer uses. Note also that although the notepad may feel like *WordStar*, the files it saves have hard carriage returns at the end of each line.

As appointment calendars go, *SideKick's* is rather limited. It presents only one month's calendar on the screen at a time. The current date (the DOS system date) is highlighted, but dates with appointments ("hot days") are not. To see appointments scheduled for other days, you type the date and press <Enter>. The program fetches a special file from the disk, which contains the appointments, while a second window displays the first half of the working day, divided into half-hour segments. You can print out the day's appointments, but no alarms will remind you of upcoming events in the current day, and the calendar's working day is confined to the hours between 8 a.m. and 8:30 p.m.—a limitation that rules out workaholics or those on the night shift.

As an auto-dialer, *SideKick* picks out telephone numbers either displayed by an application (in case you keep them in a data base

```

.op
          VIEW-INDEX  NEW  DELETE  GOTO  SEARCH  FILE  PRINT
Jo Chinb View-card New Delete Goto Search File Print
133 Char  Alternate Telephone Quit
San Fran
          American Red Cross      800-223-5000
          Conservation and Renewable Energy 800-523-2929
          Danny Goodman 415-726-4739
          PC World (415) 861-3861
Dear PC   Stevens, David 312-751-8000
          Many U.S. National Runaway Switchboard 800-421-0353
consider Phone Book 1-01-80 12:30a
I'm looking forward to working with your highly acclaimed staff.

Thank you,

Jo Chinburg
1 2 3 4 5 6 7 8 9 10

```

Screen 4A: The phone book module in Spotlight first presents a list of entries. You can search for a specific entry or jump to the first entry of a specified initial. Selecting an entry calls up the simulated Rolodex card (see Screen 4B) that contains more information.

```

.op
          VIEW-INDEX  NEW  DELETE  GOTO  SEARCH  FILE  PRINT
Jo Chinb View-index New Delete Goto Search File Print
133 Char  Alternate Cancel Telephone Quit
San Fran
          PC World
          555 De Haro Street
          San Francisco, CA 94107
          (415) 861-3861
Dear PC
          Many
consider Phone Book 1-01-80 12:27a
I'm looking forward to working with your highly acclaimed staff.

Thank you,

Jo Chinburg
1 2 3 4 5 6 7 8 9 10

```

program) or listed in the program's own free-form directory, which is stored on disk. The auto-dialer searches for a string of characters containing a hyphen or a parenthesis (for area codes) and dials that number over a connected modem. You cannot program delays between numbers, which makes auto-dialing impossible on a PBX or with any long-distance service such as MCI or SPRINT.

Overall, with its four-decimal-place hex-conversion calculator, ASCII table, and meager business productivity tools, *SideKick* may be better suited to the programmer than to the typical office worker. Its weaknesses are serious: It lacks an alarm, an index card file, and a DOS commander. Its usefulness as a memory-resident program is further hampered because appointment, note, and phone directory files must be read from disk. To *SideKick's* credit, you can move any window to any location on the screen if you need to view an underlying primary application. Borland also has a good reputation for support, which even includes a niche in CompuServe's personal computing section.

Screen 4B

Spotlight

Acting more like Macintosh desk accessories (which are loaded into memory only when needed), *Spotlight* nevertheless hogs almost 78K of RAM. It lacks a program menu; the wan substitute is an awkwardly sized stick-on command crib sheet that lists commands for calling each of the program's six accessories.

Of the four programs reviewed, *Spotlight* is the most fully conceived for a productivity worker. The appointment book, for example, not only includes appointments for any hour and minute of a 24-hour day but draws a time line of your appointments that flags any overlaps (see Screen 3).

Spotlight's phone book can create up to 36 different directories containing 500 cards, each with its own selection of names, numbers, and dialing parameters.

You can also set an alarm to ring for any appointment.

Spotlight's phone book is tied to its auto-dialer. By filling in blank "pages" with names, phone numbers, and other information, you create a telephone dialing directory (see Screens 4A and 4B). In fact, you can create up to 36 different directories containing 500 cards, each with its own selection of names, numbers, and dialing parameters. In each directory, you establish "setup strings" for local calls, discount long-distance services (complete with pauses and security codes), PBXs (if you need to dial 9 before the number, for example), and office extensions with fewer than seven digits. To make a call, you position a pointer

over the desired directory listing, type **T** for Telephone, plus **Dial**, **Long-distance-dial**, or **Other-dial**. If you select **L** for Long-distance-dial, *Spotlight* automatically dials your discount service and then the chosen phone number. If a phone number is stored in an ASCII-format data base file, an undocumented conversion program on the *Spotlight* disk will store the number in the phone book. A conversion program for the index file is also included.

Spotlight's calculator is represented by a large on-screen keypad that plots out which keys are used in addition to the numeric keypad. A two-key sequence quickly imports a figure from the calculator

to the cursor location in the primary application. However, the calculator lacks a simulated tape.

One of *Spotlight's* most practical features is its DOS commander, which allows you to perform numerous DOS commands and a limited CHKDSK without leaving an application.

A weak note is the program's notepad, which is nothing more than the electronic equivalent of a Post-it note. Up to eight small pages are available for short notes or phone messages, but the time spent waiting for the window to appear outweighs any of this feature's benefits. (In its other mod-

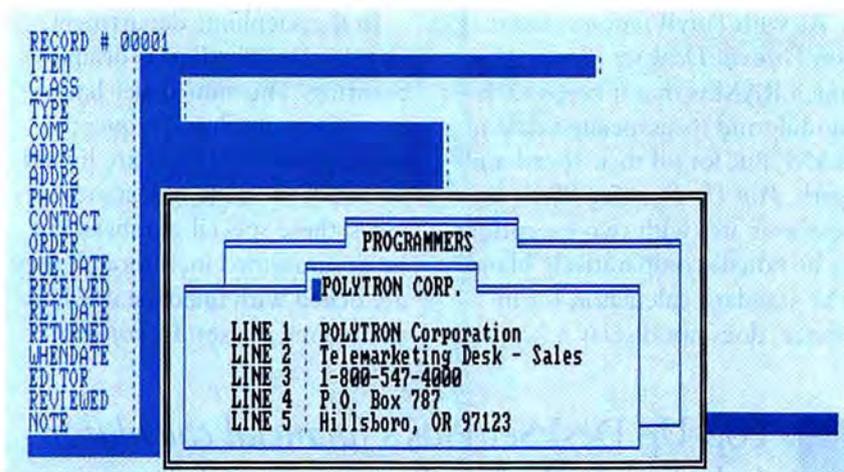
ules, delays are due to *Spotlight's* automatic and thoughtful periodic saving of data to disk.) The lack of a cut-and-paste function also severely limits the notepad's usefulness.

Spotlight manages its substantial disk activity effectively. Accessories and related data files are maintained in a special disk subdirectory, and the resident program will search all available disk devices to find this special subdirectory. Performance improves markedly when *Spotlight* is installed on a hard disk.

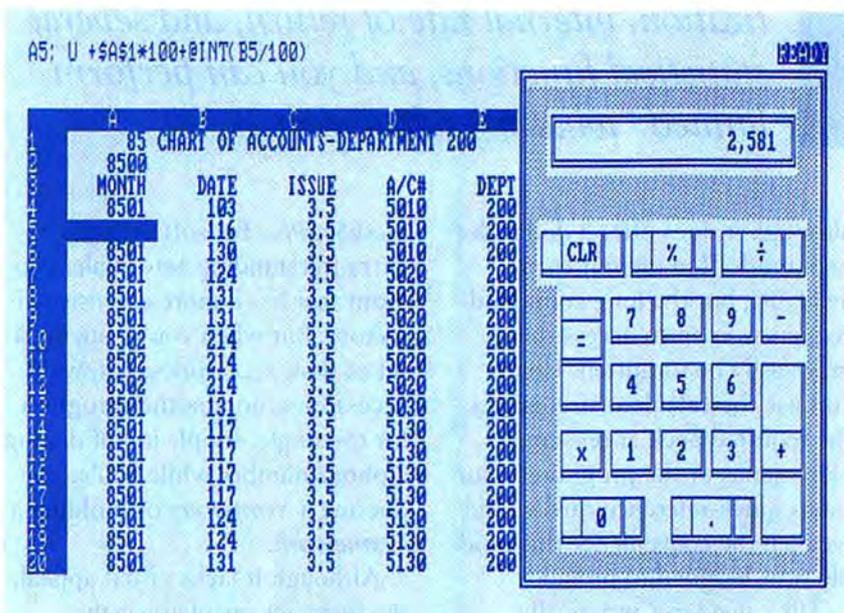
PolyWindows

PolyWindows is a mixed bag of good and bad accessories built around a clever Macintosh-like, pull-down menu scheme controlled by cursor keys. Both the program and its data reside in memory, and the program runs quickly. But you can't avoid disk accesses entirely—you must deliberately save any data you create or it will be lost when you turn off or restart the computer. An auto-save feature is provided for hard disk users, who needn't worry about having the proper disk in the proper drive when they save data. Although fully memory-resident systems are usually RAM gobblers, *PolyWindows* typically occupies 50K to 60K, not including the data stored in the windows.

A search for an index card in the filing accessory is as easy as typing the first letter or two of the text string stored on the index card tab. Aside from an index tab, the standard card (which is expandable to other sizes) accepts five lines of data—handy when printing out mailing labels (see Screen 5).



Screen 5: PolyWindows' index card accessory accepts five lines of data, thus accommodating mailing labels.



Screen 6: PolyWindows' calculator presents a clean and simple representation of the keypad layout.

PolyWindows' PolyKey accessory is a keyboard enhancer in the tradition of *ProKey* and *SmartKey*. (A screen saver, which blanks the screen after 2, 5, 10, or 15 minutes, is also built into this accessory.) For example, you can define a key to supply the signature block of a letter or perform a lengthy combination of commands in an application such as *WordStar* or *Symphony*. PolyKey is simple to program (although hard

to edit), and you can store different keyboard macros for different applications, loading only the appropriate PolyKey file for a given program. In tests of this module on three generations of *PolyWindows*, however, the redefinitions did not always work, leaving strong doubts as to its reliability.

PolyWindows' notepad does not interact with the application screen, although you can load, edit, and merge any text files. Margins are adjusted by resizing the notepad window, and word wrap is always on.

The calendar is largely undistinguished. It has appointment slots only at fixed hourly intervals between 8 a.m. and 8 p.m. Alarms can be set only for the current day, with a user-entered reminder message appearing on screen when the alarm goes off.

All in all, *PolyWindows* seems to ignore the importance of interactivity with the primary application. Moreover, moving a window often produces double window images, so there might be other small bugs lurking in the shadows. The company claims that version 1.2 of the program will include notepad, search and replace, block move, page-break display, and auto-indent features; cutting and pasting from one application to another (interactivity, at last); an auto-dialer; a hexadecimal, octal, binary, and decimal programmer's calculator (see Screen 6); and an on-screen ASCII character chart for programmers. These additions should make *PolyWindows* a formidable product, provided the company also zaps the program's little bugs.

Pop-Up DeskSet Plus

Bellsoft offers *Pop-Ups* individually and assembled as a complete package called *Pop-Up DeskSet*. With the top-of-the-line *Plus* package, you get nine modules: calculator, financial calculator, notepad, clipboard, DOS commander, calendar, auto-dialer, alarm clock, and telecommunications. You can load as many or as few as you like. If you want them all, however, be prepared to forfeit a ton of RAM—over 220K.

As with *PolyWindows*, the reason *Pop-Up DeskSet Plus* hogs so much RAM is that it keeps each module and its associated data in RAM. But for all their speed and girth, *Pop-Up DeskSet Plus*'s accessories are (with two exceptions, to be noted) comparatively bland. The standard calculator, for instance, does not display a keypad,

In the telephone department, *Pop-Up DeskSet Plus* is disappointing. The auto-dialer has room for only three frequently called numbers. If you are linked to a PBX or use long distance services, these special numbers can be programmed in, although they are dialed with unadjustable and rather long pauses. In *Pop-Up*

Pop-Up DeskSet Plus's *financial calculator helps you calculate loans, annuities, amortization, internal rate of return, and several statistical functions, and you can perform limited "what if" calculations.*

although it does offer a dollar decimal mode. Ten memories are available, but the long command sequences used to access them may easily be forgotten. Unless you use the calculator frequently, the required peek at on-screen help menus or the program's enormous quick-reference card would weaken the convenience this module was designed to provide.

The calendar is practically useless as an appointment reminder. At best it replicates a wall calendar (your choice of one- or three-month displays) with recurring appointments highlighted. A separate accessory accepts six alarm settings for the current day only. When an alarm goes off, it sounds like an arcade game, and a message window pops up on the screen. You can also have the computer beep or chime every hour and display the time in the corner of the screen continually, once a minute, or hourly.

DeskSet Plus Bellsoft includes an extra freestanding auto-dialer program that has a more extensive directory. But when you're buying a set of desk accessories, you want accessories, not another program for the single, simple job of dialing a phone number while you're conducting a *Symphony* or building a *Framework*.

Although it lacks visual appeal, the financial calculator is the height of functionality. Once you get used to the command and mode structure (the disk-based tutorial helps immensely), you can easily calculate loans, annuities, amortization, internal rate of return, and several statistical functions, and you can perform limited "what if" calculations.

Perhaps the best feature of *Pop-Up DeskSet Plus* is the clipboard when used in tandem with a re-

cent addition called *Pop-Up Anything*. The former functions as a true in-and-out clipboard between documents within the same application and between different applications, provided the recipient document can accept data captured from the video buffer. *Pop-Up Anything* suspends one application and lets you load another (or issue any DOS command) so you can use the clipboard to swipe a block of text or ASCII graphics. You can select a rectangular block of figures from a 1-2-3 spreadsheet (no larger than one screen), store it temporarily on the clipboard, revert to a primary application such as *WordStar*, and paste the numbers into a document.

Testing the combination with *WordStar* displayed some strange characters during the paste, but they disappeared when the transfer was completed. After moving text between two *WordStar* documents, however, you may have difficulty editing and reforming the block in the recipient document without first removing the carriage returns at the end of each line.

Theoretically, you should be able to suspend *WordStar*, load *PC-Talk III*, and send a block of text stored on the clipboard. In practice, however, *Pop-Up Anything* would not load *PC-Talk III*.

Despite many lackluster features, this desktop accessory—especially the clipboard—interacts adequately with other applications. I suspect that *Pop-Up DeskSet Plus* does not offer an appointment book, index card file, phone directory, or similar disk-

based feature due to the program's totally RAM-based nature. Other desktop programs do more to manage personal information.

■ Best of the Clutterbusters

If I were on the trail of the single ultimate desk accessory package, I'd probably turn around and go home. Each product reviewed has features that I would want in the office: *SideKick*'s menu structure and notepad (if I regularly used *WordStar*, that is); *Spotlight*'s appointment book, alarm, card filer, and auto-dialer; *PolyWindows*' keyboard enhancer (if made reliable), screen saver, and mailing label generator; and *Pop-Up DeskSet Plus*'s clipboard (with *Pop-Up Anything*) and a data communications module that was better than any of those yet available.

Since it is not possible to load more than one of these accessory packages at a time, I'd grudgingly favor *Spotlight*—its appointment calendar and versatile alarm system might keep my days organized and me on schedule. However, if cutting and pasting data and notes is more important than keeping your calendar electronically, my cautious recommendation would shift to *SideKick*, as its notepad is almost as good as having a limited version of *WordStar* available in the background. If nothing else, one of these might eliminate some of my current clutter and make room for a slightly bigger mess. ●

Danny Goodman is a Contributing Editor for PC World and the author of How To Buy an IBM PC or Compatible Computer (Simon & Schuster, Inc., New York, 1984).

PolyWindows
Polytron Corp.
P.O. Box 787
Hillsboro, OR 97123
503/684-3000

List price: copy protected
\$49.95, unprotected \$84.95
Requirements: 256K, one disk
drive, color or monochrome
monitor

Pop-Up DeskSet Plus
Bellsoft, Inc.
2820 Northup Way
Bellevue, WA 98004
206/828-7282

List price: \$129.95
Requirements: 64K, one disk
drive, DOS 1.10 or later
version, color or monochrome
monitor, Hayes-compatible
modem for auto-dial

SideKick
Borland International, Inc.
4113 Scotts Valley Dr.
Scotts Valley, CA 95066
408/438-8400

List price: copy protected
\$54.95, unprotected \$84.95
Requirements: 128K, one disk
drive, color or monochrome
monitor, Hayes-compatible
modem for auto-dial

Spotlight
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
617/577-8500

List price: \$75
Requirements: 128K, one disk
drive, color or monochrome
monitor, Hayes-compatible
modem for auto-dial

If you believe these simple facts about hard disks, you'd be willing to pay more for ours.... fortunately, you won't have to

Avoiding hard disk failures and loss of data is just one of the reasons to buy our hard disks.

Hard disks can fail—there's really no other nice way to say it. Even IBM has problems delivering ATs with hard disks that work. We're not talking about nice, clean, clear-cut failures where the drive seizes up, coughs, and rolls over and dies. We're talking about the insidious little creeping failures that sneak up over time—like a missing sector here or a lost sub-directory there.

There are precautions you can take to protect against failure and ultimate loss of data. Here is what we contribute toward minimizing the potential loss of your data.

Best Drives Available

First, we buy the best drives available. Sounds trite, doesn't it? I mean, a drive's a drive—right? Hardly. You should see some of the junk we get in our labs. Some have such high failure rates that we even questioned our own \$10,000 hard disk tester. But when we tested other manufacturers' drives we were assured that our equipment was fine, which just confirmed that the bad hard disks were not only bad—they were real bad.

But that's just the weeding out process. We then take each drive that we've put through our tester and test it again with the controller you've requested. We call this a "tested pair."

DOS Doesn't Do It

In case you're thinking that all

this is an unnecessary duplication of what DOS does for you, let me explain the disk facts of life.

If DOS did what you may think it is supposed to do when you format the disk, DOS would map around these bad areas. Unfortunately, DOS doesn't do this.

DOS 2.0 and 2.1 can't enter the bad tracks. DOS 3.0 can, but only on the IBM AT. Unfortunately, as the press has so well documented, the AT's hard disk develops bad tracks later on.

We do what DOS can't

We believe the problem is so bad, we use a software program that performs a powerful test of your disk drive on all of the IBM or IBM compatible computers—PCs, XTs, and ATs. Our format takes hours to analyze the disk. But when we finish, you know that the bad tracks are really mapped out so you won't write good data that will disappear into a black hole. We even send you a printed statement of our test results.

Our software allows you to type in the bad track locations from the list supplied by the manufacturers, so you'll never write good data to them—even if DOS didn't identify them as bad. The software even lets you save the location of these bad sections to a file, so that you can reformat your disk without spending hours retesting.

We even include a program that will give you continuous comments on the status of your hard disk. No more waiting for that catastrophic failure.

Average Access Time

As you might suspect, some hard disks are faster than others in their ability to move from one track of data to another. The time it takes the hard disk to move one-half way between the beginning of the disk to the end is called the "average access time."

The first generation of 10 megabyte hard disks had average access times of 80-85 milliseconds (msec). But computer users love speed, and guess what—the average access time for the new 20 megabyte hard disk in the IBM AT is only 40 msec. (We sell an AT equivalent with only 30 msec access time!)

There are some legitimate reasons for the shorter access time. It's particularly helpful when there are multiple users on the same hard disk. It's also important when running a compiler. But remember, before you get too wrapped up in the access speed, there's always that ST 506 interface which won't let data transfer from the hard disk to the computer any faster than 5 megabits/second. We've bypassed that choke hole, too. If you want the functional equivalent of a Ferrari with a turbocharger, order our 10 Mbit per second 108

megabyte hard disk with 18 n of average access speed.

Compatibility

To be sure that your hard disk is 100 percent compatible with IBM XT you don't need to the same hard disk that's in XT. You can't even be sure your brand hard disk it is because IBM, like Express Systems, got into the marketplace and sold hard disks from several vendors. However, they buy their hard disk controller from one vendor—the same one do.

You can buy the IBM XT controller from IBM for \$495 or can buy from us, the functional equivalent, manufactured by the same company that makes it for IBM for only \$195. Is it the exactly identical IBM XT controller? No, it's better. First, it takes less power, and secondly, it has control from 5 to 32 megabytes—the IBM controller work with only 10 megabyte. It is 100 percent IBM XT compatible, and 100 percent is 100 percent. If you want to save a few dollars, we carry a version that lets you operate two hard disks and floppy disk drives.

More than 32 Megabyte

You can operate with more than 32 megabytes (the limit of DOS) through the use of "device drivers." Express Systems can supply you with device drivers for hard disks for over 32 megabyte formatted. But, if you don't have individual files, or databases are large, you might want to consider one of our controllers can divide our 65 megabyte (formatted) hard disk into equal volumes of 32 megabyte each.

Reliability

We offer you a choice between iron oxide and plated media—the stuff that covers the hard disk and gives it its magnetic properties. Iron oxide is, well, it's rust. If you inadvertently joust your disk, you may cause the low flying head to dig up some iron oxide. A little flake can ruin your whole disk. Plated media is more resistant to damage, and if it happens, data is lost.

We offer both types of hard disks. The iron oxide is o



technology, and quite frankly, manufacturers understand it better. Their better understanding, combined with some of the special head locking mechanisms, gives us peace of mind when we sell you one.

Power

Hard disks consume power. Our small, half-high hard disks consume so little power that you can use them with your existing IBM PC power supply. If you plan to use lots of slots, you'll want to increase your power supply to be safe. We offer the same amount of power for your PC that comes with the XT.

Our Customers

Some folks just never feel comfortable buying mail order. They forget that Sears began as a mail order house or that IBM is now open to mail order. But, if it helps, here is a *partial* list of customers who have felt comfortable to buy from us.

IBM	Sears
American Express	Honeywell
U.S. Army	MIT
T&T (Bell Labs)	RCA
Sausch & Lomb	Lockheed
Perex	Sperry

Easy to Install

If you're like most of us, raised in the boob tube rather than the great Books, you'd rather see the movie than read the book. Well, now you can choose to read our installation manual or only \$9.95 more, you can get VHS or Beta video cassette showing the simple steps for installation.



Our VHS or Beta Cassettes make installation easy.

Warranty

We offer you a one year warranty on our hard disks—the same as IBM on the AT and 90 days on the tape drives. (It's all the manufacturer gives us.) If



Complete Hard Disk Kits

Formatted Storage Capacity in Mbytes	Height	Plated Media	Average Access	Transfer Rate	PC or PC/XT	AT
10	1/2	yes	85 msec	5 Mbits/s	\$ 625	\$ 430
10	Full	yes	85 msec	5 Mbits/s	\$ 625	\$ 430
21	1/2	yes	85 msec	5 Mbits/s	\$ 825	\$ 630
21	Full	no	30 msec	5 Mbits/s	\$ 1,535	\$ 1,340
32	1/2	yes	85 msec	5 Mbits/s	\$ 1,095	\$ 895
32	Full	no	30 msec	5 Mbits/s	\$ 1,775	\$ 1,575
65	Full	no	30 msec	5 Mbits/s	\$ 2,295	\$ 2,070
108	Full	yes	18 msec	10 Mbits/s	\$ 4,995	\$ 4,995



Removable Hard Disk

10	1/2	no	90 msec	5 Mbits/s	\$ 1,095	N/A
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Tape Systems and Subsystems

Formatted Storage Capacity	Height	Data Transfer Rate (k/sec)	PC or PC/XT	AT
60 Mbytes	1/2	88	\$ 995	\$ 995
60 Mbytes Subsystem		88	\$ 1,295	\$ 1,295
17.6 Mbytes Start/stop Subsystem		24	\$ 795	\$ 795



Controllers

All of our hard disk and tape controllers are available separately. Please call for prices.

Subsystem Chassis

Any of our disk or tape units are available in an external subsystem for an additional \$250.00. You can mix & match any of our 1/2 high hard disks or tape drives together or add any single full height hard disk.



Tape Cartridges

Express Certified 555 foot 310 Hci 1/4-inch Data Cartridge **\$ 35.00**

Power Supply

130 Watt Power supply **\$ 99.50***

*with the purchase of any drive

anything goes wrong with your tape or disk drive or hard disk, send it back in the box it came in. However, we have found that we can usually solve the problem over the phone. So call first for a return authorization number because we can't accept any returns without it.

Comes complete

All Express Systems products come complete with the appropriate software, tape and/or hard disk controllers, and cables where required. Hard disks are formatted and tested with the PC DOS of your choice. All drive sizes are formatted capacities.

If your application requires a stacking kit, power splitter cables, daisy chain cable, or some other variation, we'll supply these items at a nominal charge. We even ship our hard disks with Command Assist™ an on-line DOS-like manual to give you help with your DOS commands.

More questions?

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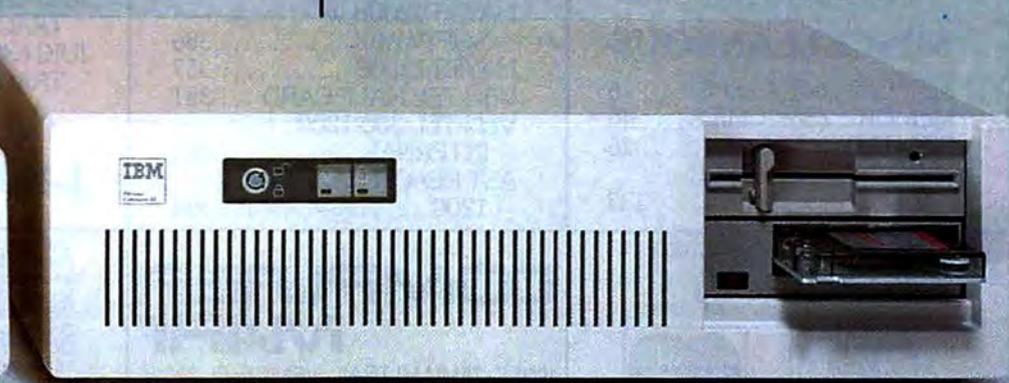


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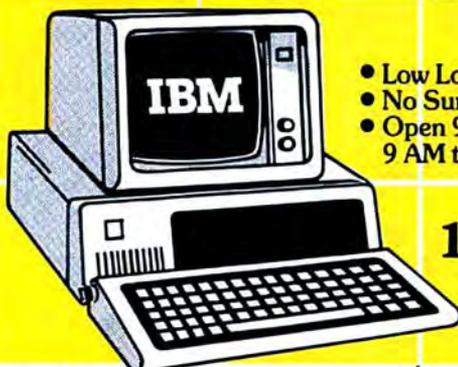
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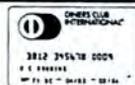
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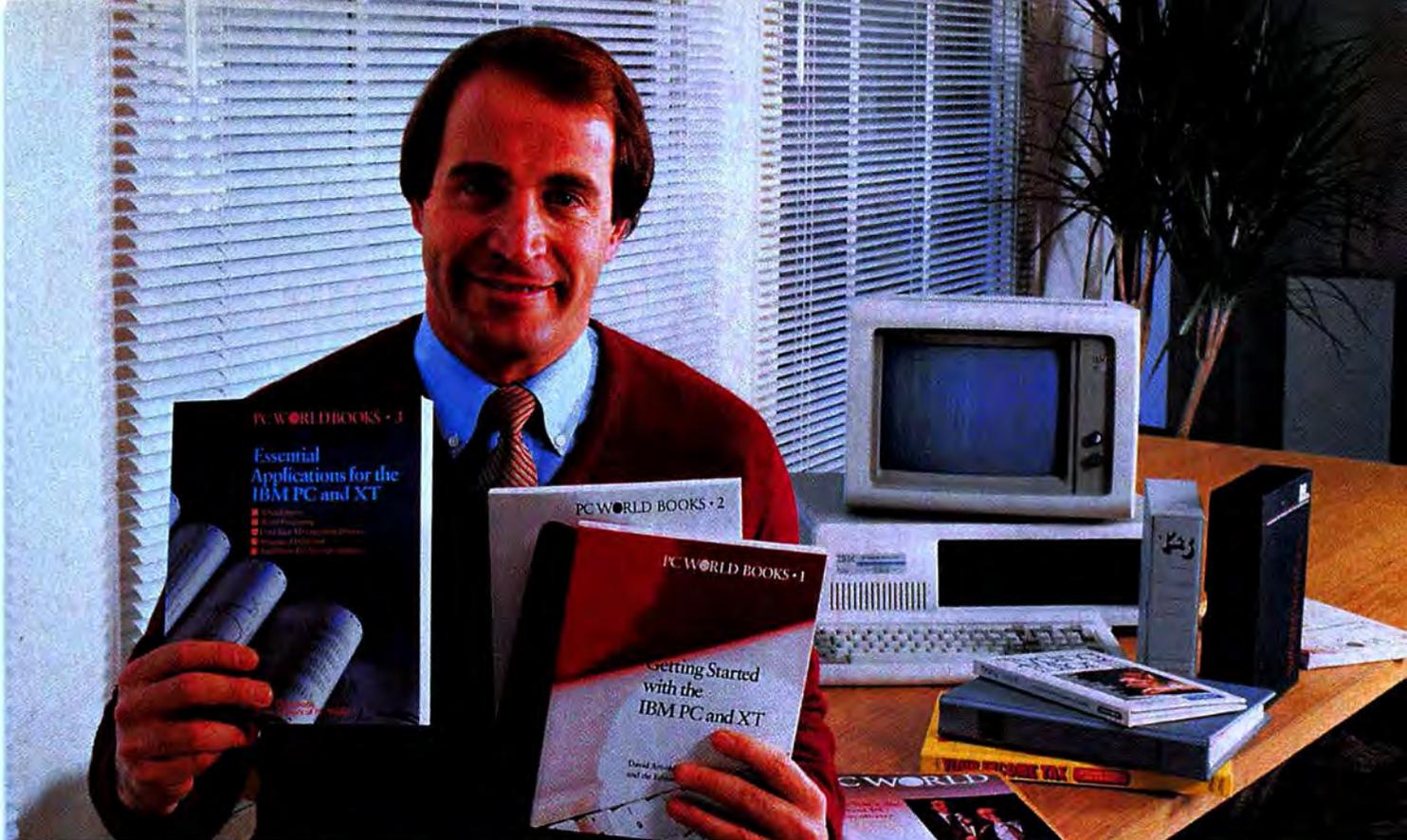


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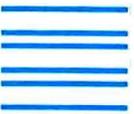
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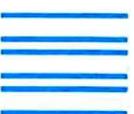
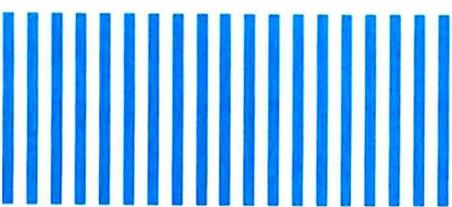


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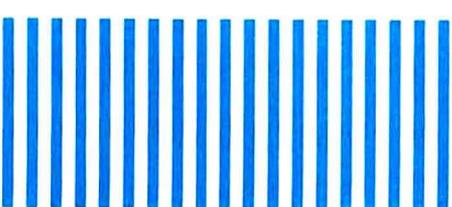


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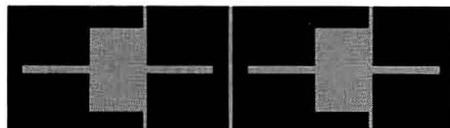
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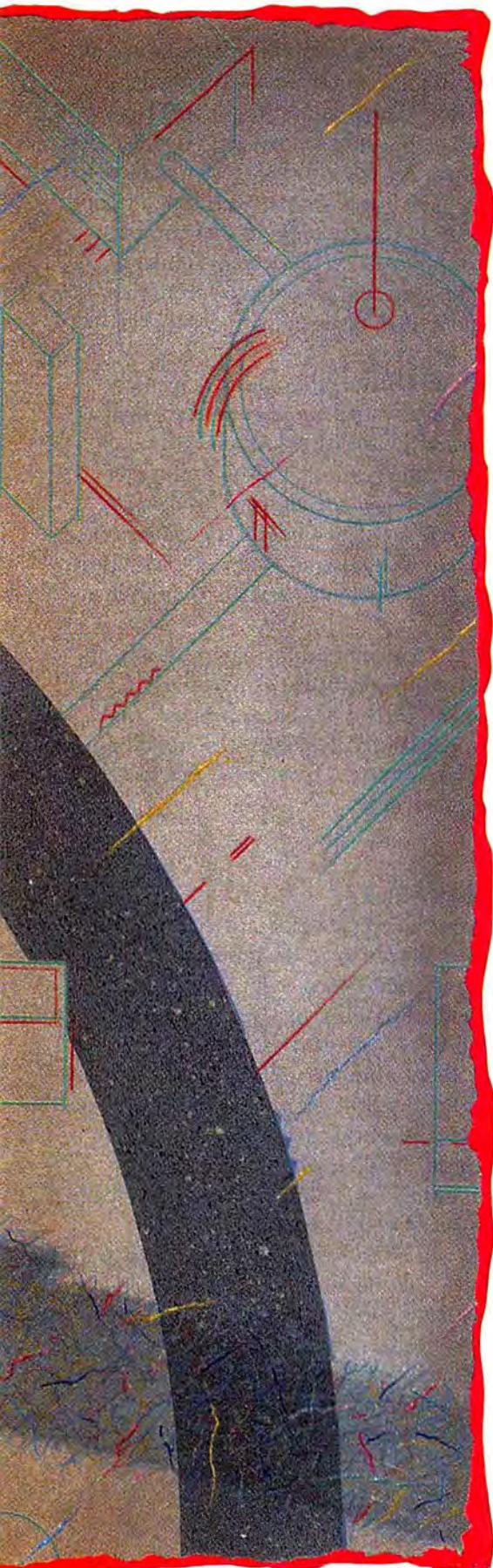
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PostScript: Master of the Raster

At the heart of Apple's new Laser-Writer printer is an on-board computer running a language called PostScript that provides unprecedented flexibility in creating and printing a variety of typefaces and graphics. PC users can now unleash the power of PostScript by using Microsoft Word with the Laser-Writer. And other programs are on the way.

Ted Nace



Most articles in computer magazines are about hassles: How to take some clunky metal box apart and flip switch A without bumping or shorting out device B so that program C can work with monitor D on computer Z. But this article is different. It's about a breakthrough—Hannibal crossing the Alps, Alexander the Great slicing the Gordian knot—that sort of thing.

Our hero is an unassuming man named John Warnock who works at a company with the modest, low-tech name of Adobe Systems. For seven years, the

PostScript cuts through a slew of hardware and software compatibility problems that have long thwarted the easy attainment of high-quality printed output from personal computers.

last two in secrecy, he has been forging a sword, a sophisticated graphics/typesetting language called PostScript. Warnock's language cuts through a slew of hardware and software compatibility problems that, like an inextricably tangled mass of cables and wires, have long thwarted the easy attainment of high-quality printed output from personal computers. PostScript promotes *device and resolution independence*—the capacity to generate output on any properly equipped printer, whatever its resolution.

As anyone who has tried to play matchmaker between a computer, an application, and a printer can testify, the process of inducing harmony can be one of the most vexing ways to kill time since the invention of Rubik's Cube. The problem is even worse for software developers, who must deal with hordes of printers of every conceivable species. For a program to talk to any one member of the menagerie, a special set of instructions, known as a driver, must be written.

The Raster Revolution

Several graphics standards have been touted as the answer to this mess, but none has been universally accepted (see "The Myth of the Virtual Device," PCW, April 1985). To complicate matters further, in 1984 a new generation of hardware—raster printers—appeared in the personal computer world. In a television set, the *raster* is the grid of light that you perceive as a coherent image on the screen. Similarly, raster printers produce images on paper from thousands of tiny dots, each independently controlled by the computer.

The cost and functionality of raster printers vary widely. At the low end are laser printers such as the Hewlett-Packard LaserJet, which costs about \$3500 and creates images with a resolution of 300 dots per inch (90,000 per square inch). Mid-range and at the high end are digital phototypesetting machines costing tens of thousands of dollars, with resolutions ranging from 600 dots per inch to more than 5000.

While a letter quality printer can print only the symbols provided on a particular daisy wheel, in theory a raster printer should be able to produce any pattern or shape. In practice, however, software capable of coaxing that potential from raster printers has lagged—until PostScript.

Graphics at Mach 5

Says Warnock, "People look at PostScript and say, 'It looks too mature to be the product of a 2-year-old company.' And they're right." Actually, the language has gone through several incarnations. It first emerged in 1976 from work being done by Warnock and fellow computer scientist John Gafne at the computer graphics firm Evans & Sutherland. The matter at hand was sophisticated flight simulators, which required the development of complex algorithms for rotating and scaling shapes to mimic the reality of high-speed flight.

After moving on to Xerox's Palo Alto Research Center, Warnock continued work on his innovative language and contemplated applying it to printing. In 1982 he and Charles Geschke, an expert on programming environments, left Xerox to found Adobe and attempt to make the concept a reality. Development of PostScript continued in secret until early 1985,

when it was announced in conjunction with the Apple LaserWriter. PostScript resides inside the LaserWriter, enabling that printer to produce high-quality output either for the Macintosh or for PCs running *Microsoft Word*, the first PC program to contain a PostScript driver (see the discussion under “A Smarter Tail”).

■ Unfriendly Bit Maps

The difference between PostScript and previous methods of laser printer output generation is most distinct in their handling of printed characters. Most laser printers, such as the HP LaserJet, store the pattern of dots that constitutes a given letter or symbol as an array of bits, or *bit map*, in memory. This method is fine as long as you are working with a single printer and a single character size. But producing characters of a different resolution or size requires storage of an entirely new bit map, because each character must be fine-tuned to the new size or resolution. Storing multiple bit maps places great de-

mands on memory. Thus, the HP LaserJet holds only about eight sets of letters, numbers, and symbols (two permanently stored in the printer, and up to six in plug-in ROM cartridges). The point size of each set is fixed.

With the HP’s \$250 92286B cartridge, for example, you have access to four typefaces: Helvetica (14-point bold only), Times Roman (10-point regular, bold, and italic, and 8-point regular), Courier (12-point upright or sideways), and line printer (8-point sideways).

The LaserWriter also contains four typefaces internally: Helvetica, Times Roman, Courier, and a special symbol set. Each typeface, however, can be printed in any size from 1 point up, at any rotation from horizontal, in any degree of shading or filled with any pattern, and at any slant (see Figure 1). PostScript’s power to produce infinite permutations of a given typeface is limited only by the application

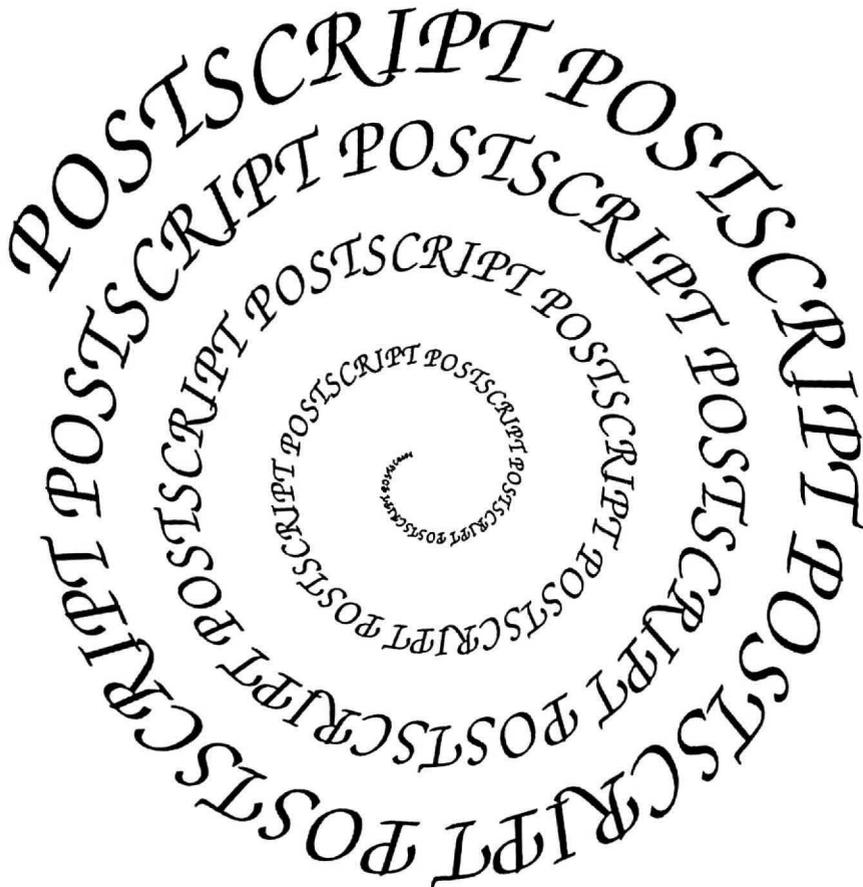


Figure 1: This spiral, drawn in ITC Zapf Chancery medium italic, illustrates PostScript’s ability to produce fonts of any size and rotation. All these characters were generated from one master font outline.

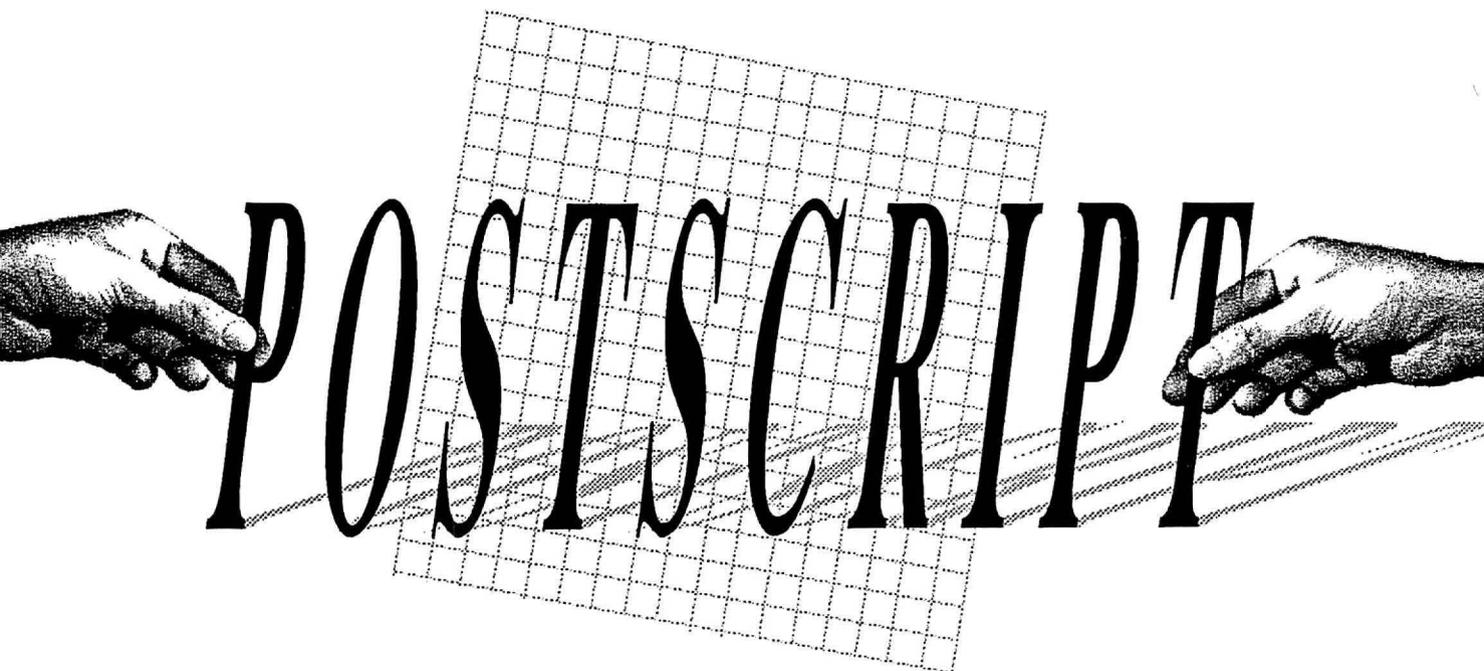


Figure 2: The digitized hands, the background grid, and the printed characters demonstrate PostScript's ability to integrate these three types of graphic elements on a single page. This was printed on a 300-dot-per-inch LaserWriter.

program used in conjunction with the printer. For example, *Microsoft Word*, version 2.0, supports three typefaces (Helvetica, Times Roman, and Courier), each in three sizes, with eight variations of each size (regular, italic, bold, bold italic, small capitals, italic small capitals, bold small capitals, and bold italic small capitals). On the LaserWriter these variables enable *Word* to create 72 fonts out of three basic typefaces, compared to the 6 fonts that can be generated using *Word* with the HP LaserJet (the sideways fonts are not available).

■ Amiable Outlines

Storing this many sizes and styles of type as bit maps would require prodigious memory. Instead, PostScript stores a compact mathematical description of each character's outline. Before printing a character, PostScript converts the outline to the proper scale, orientation, and shading, and then generates a bit map that is converted into a pattern of dots on paper.

This type-handling dexterity makes PostScript the functional rival of minicomputer-based typesetting software. In fact, Adobe has licensed the Mergenthaler, Linotype, Stempel, Haas typeface library from Allied Linotype and also offers the entire range of International Typeface Corporation typefaces. Yet PostScript is not a typesetting language per se; its ability to handle type merely reflects more general capabilities that bridge the gap between text-oriented and graphics-oriented software.

PostScript treats text as a subset of its graphics facilities. When a character is called from memory, its outline is constructed from 151 basic stroke patterns. Line drawings and halftones (gray-shaded digitized images) are generated using the same graphics model (see Figure 2). PostScript's unification of text and graphics departs from the dedicated nature of most typesetting software and graphics applications. CAD/CAM (computer-aided design and computer-aided manufacturing) programs, for example, provide powerful capabilities for creating and manipulating lines and shapes, but the letters they produce are stick figures rather than actual typefaces. Conversely, typesetting software does well with text but stumbles with graphics.

Language With a Mission

PostScript's ability to handle text and graphics with equal aplomb derives from its status as a full-fledged programming language. PostScript is classified as "Turing equivalent," which means you can use it to carry out any programming task on a computer, such as writing a compiler or creating a new version of *Ms. Pac-Man*. It supports a full complement of mathematic functions, floating-point arithmetic, arrays, control structures, and subroutines, as well as a large set of graphics operators. But PostScript was designed specifically as a page description language: Its *raison d'être* is to mediate between software and raster printers.

A Smarter Tail

Under the cover of the Apple LaserWriter is the computer hardware necessary to support PostScript: a 68000 microprocessor, 1.5MB of RAM, and 512K of ROM (containing PostScript and the permanent fonts). This extra equipment accounts for the LaserWriter's relatively high \$6900 price tag, compared to approximately \$3500 for the HP LaserJet, which uses the same Canon printing engine.

Why put a computer inside a printer? The arrangement is analogous to the anatomy of the stegosaurus, the dinosaur with a separate brain at the base of its spine for moving its spiked tail. You can watch the "tail brain" in action by connecting a PC to an Apple LaserWriter via a serial cable and a communications program. PostScript commands can then be sent directly to the printer, making other software unnecessary. A typical PostScript program consists of a series of commands that build a description of all elements of a printed page. The command Showpage causes the page to be printed and clears the printer's internal memory to receive the next page description.

Normally PostScript is not used this directly. Instead it functions as a layer, invisible to the user, between an application program and a raster printer. *Microsoft Word* is the first PC application on the market that contains a PostScript driver. Other companies writing such drivers for their programs include Lotus Development and Digital Research; Digital is creating a generalized interface between PostScript and its GEM operating environment.

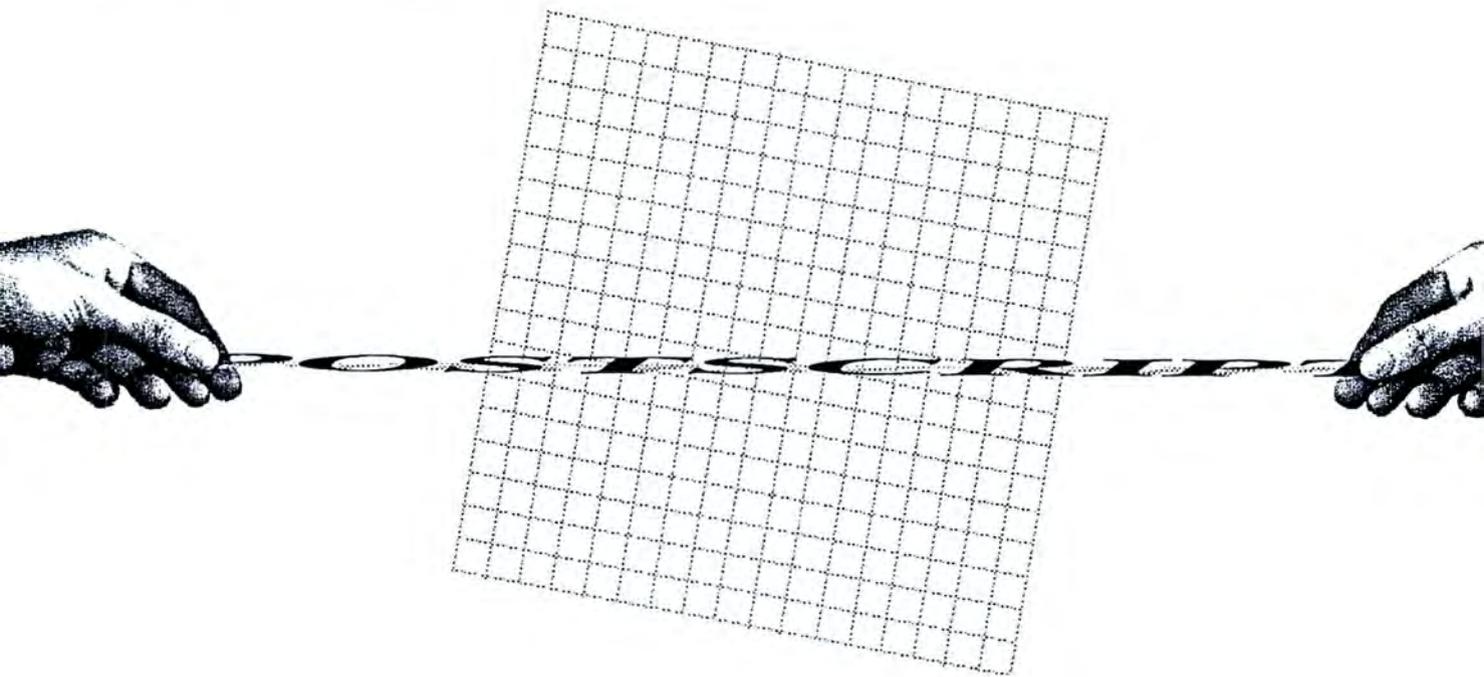
Using PostScript as a layer between application and printer means programs don't need multiple drivers for different raster printers. The software developer writes a single driver enabling the program to talk to PostScript, which in turn handles the printer. A program that can send output to one PostScript printer can send it to any. In other words, among PostScript printers, no matter who the manufacturer is or what the resolution, software can enjoy true device independence. For example, using *Word* you could create a document on disk and preview a printout on the 300-dot-per-inch Apple LaserWriter. Then you could send the same disk out for typesetting on a 1400-dot-per-inch Linotronic 101PS or a 2540-dpi Linotron 300.

New Glue

How will PostScript affect the average PC user? Increasingly, new software will be equipped with PostScript drivers, and many other programs are likely to be upgraded to take advantage of the language. And PostScript's powers may spark entirely new classes of applications. Matt Foley, Adobe's customer support engineer, prophesies that PostScript

PostScript's ability to handle type merely reflects more general capabilities that bridge the gap between text-oriented and graphics-oriented software.

will function as the "glue" for software integration. The concept is to have the printer functioning as the hub of a many-spoked wheel. "The new programs will not be huge," Foley predicts. "There will no longer be pressure for one piece of software to do everything well. You can pick the best word processor, the best graphics program, and the best page



layout program, and combine everything on the printed page. You won't need to combine different programs at the data level."

PostScript may also reverse the present situation, in which printing technology acts as a drag on software evolution; we are likely instead to find printer capabilities stimulating advances in software. Currently many programs are written for a "least-common-denominator" printer protocol, such as the Diablo or the Epson. This tendency leads to a technological stalemate in which developers lack any incentive to give their programs more powerful printing capabilities. With PostScript, developers can aim for a high level of functionality. As *Microsoft Word* product manager Greg Slynstad notes, "Until now we've been able to do more with *Word* than printers could deal with. Now that's turning around."

Adobe currently does not sell PostScript directly to computer users, although Warnock says the company plans to market PostScript as a separate product in 1986. Instead, Adobe licenses it to printer manufacturers. For Adobe to generate enough momentum to establish PostScript as a new printing standard, it must continue to win converts among both hardware manufacturers and software publishers.

Will the strategy succeed? To date, Adobe has licensed PostScript for use in laser printers from Apple, QMS, and Dataproducts and in phototypesetters from Allied Linotype. An Adobe spokesperson said the company has letters of intent "from some of the biggest players in the business" and indicated that more are standing in line. Not yet in the queue, evidently, is IBM, which may be leery of backing a language that was unveiled on an Apple product. Another possible roadblock: users may balk at such high-end printers as the LaserWriter and opt for printers with lower functionality—and lower price tags.

But time seems to be on John Warnock's side. Processing power and memory are getting cheaper, reducing the cost of the resources PostScript requires. And compared to Warnock's laser-edged sword, other implements summoned to hack at the knotty problems of printing look like butter knives. ●

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PostScript Language Manual
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 List price: \$30

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What's your personal computing pleasure? Spreadsheets? Data managers? Data backup? Consider ripping a page or two from the well-thumbed books of corporate DP departments. Here's how.

Wendy Lea McKibbin

There's a story popular in data processing circles about a large Midwestern manufacturing firm that decided to use a mainframe during the 1960s to automate purchase orders. A company programmer wrote an inventory control procedure that generated a presigned purchase order every time stock fell below a certain level.

Unfortunately, no one noticed that from the day an item dipped below the reorder mark to the day new merchandise arrived and was logged in, each time the program ran, a new P.O. was sent out.

Not until \$12 million worth of inventory piled up in the parking lot during a four-week period did the company get the message.

If experience is the wisest teacher, the Management Information Systems (MIS) community has had enough to become sagacious in the care and management of data. Over the years, data processing (DP)

professionals have stubbed toes and dutifully learned critical lessons about assuming responsibility for data accuracy—and about never passing the buck to the machine. Indeed, the notion that the computer is always consistent but not always right is now an axiom among DP technicians. The widespread acceptance of that adage is evident in the laborious procedures that govern data entry and control in the mainframe environment.

This fervor to guard, govern, guide, check, and recheck information is one reason DP departments rip through projects like a herd of turtles. Outsiders—many of them DP clients—who are vexed by this cumbersome approach to automation have naturally greeted personal computing with enthusiasm. But without approximating at least the spirit of MIS-type controls, you can, with PC in tow, all too easily reinvent broken wheels.

Perils of PCs

Michael Faklis, a computer scientist in Palo Alto, California, who has developed accounting software for Arthur Andersen & Co., offers three salient—and fairly typical—examples of GIGO (garbage in/garbage out) damage in the PC environment.

Spreadsheet sins. A lawyer who used a spreadsheet to keep tabs on his income erred in his year-to-date totals. Moreover, he neglected to match those totals to his client ledger and to match the ledger to his bank account. The result? A misstatement in income sufficient to earn him an IRS audit.

Defective data. A start-up disk drive manufacturer relied on its PC to generate a materials-requirement planning (MRP) report, unaware that the report was based on faulty data. The firm found itself with insufficient parts on hand when it came time to fulfill contracts.

Perforated projections. An engineer who runs a small mail-order business from his home made a modest data entry error in a spreadsheet used for sales projections. The extra inventory he purchased as a result wiped out his profit for an entire quarter.

Some DP professionals, having heard such horror stories, find the PC scene a little unnerving. They observe that, without the restraining factors of field verifications, feasibility checks, documentation, or manual controls, many PC-based business reports are accepted at face value as a basis for important decisions.

“What I worry about is some guy deciding to buy a plant in Mississippi because his sales manager inadvertently plugged a bogus number into the projections report,” says Brian Michel, an MIS manager for a manufacturing company in Silicon Valley. “What people don’t realize is that while today’s PC is performing the job of yesterday’s mainframe, it’s not managed with appropriate discipline.” In the distinct areas of documentation, systems planning, error handling, and file backup, the DP establishment’s wisdom is both conventional and highly instructive.

■ Rudiments of Control

Nowhere is obsession with data accuracy more prevalent than in the sophisticated mainframe shop of a large commercial bank. A quick glance at this environment reveals the types of checks, balances, and constraints to which MIS old-timers are accustomed. It’s a world in which manual procedures are every bit as important as the verification codes written in software.

Even in a highly intricate banking system, for example, someone is always watching someone watching someone count the money—and no one accepts the computer as the last word. Most checks are batched and tallied by hand before figures are entered into the computer. Another group audits system output and again manually verifies that totals match the automated report. And so the scrutiny continues, through a complicated series of cross-checks confirming every piece of information.

Faklis suggests that PC users would do well to adopt the rationale underlying this procedural approach and thus relinquish their faith in the capacity of software to substitute for systematic thinking. “People have been seduced into believing that an accounting package can take the place of accounting practices, thereby relieving them of the exacting requirements of verifying their figures,” Faklis says. “There’s really no substitute for a certain amount of manual control.”

■ The Documentation Imperative

The PC environment is crying out for at least one type of manual control: documentation. Documentation simply means putting down in words, concisely and in readable form, how you use a given program, why a particular application was written, what it is intended to do, and how you plan to maintain it and modify it when necessary. Notes about files on auxiliary storage media also belong in documentation.

A well-documented spreadsheet, for example, should include a printout of your formulas and an explanation of how you arrived at specific conclusions. Do you share information? If so, documentation will prevent a crippling dependency on you or the individual who devised the application. But even if you’re the only one working with a program, don’t be content to rely on your memory. A year from now you might not recall how you obtained that total billing figure or how and why you set up certain fields.

In the regimented days of mainframes, when users were completely dependent on the MIS department for computer access, nearly every user had good



reason to be frustrated. The common refrain acknowledged the programmers' technical skills but lamented their unfamiliarity with business needs. Nevertheless, that relationship, according to Michel, resulted in a beneficial by-product: two people were required to come to an understanding about how things should work. The programmer served as a sounding board, helping the user spot false assumptions and find easier ways to do things. Similarly, documentation forces you to put your thinking on paper and so to review your work.

Fortunately, the process of documenting has rarely been easier. Although you're certainly free to rely on your favorite word processor to help with the job, the note-pad feature of such memory-resident aids as *SideKick* and *Spotlight* enables you to draft your user guide on the fly. For work with formulas and field specifications, you might prefer a more elegant solution than *dBASE* or *1-2-3* commands. You may want to consider a product on the order of *The Spreadsheet Auditor* or *DocuCalc*, both of which provide concise, readable printouts of spreadsheet formulas.

Plan It Again, Sam

In addition to serving as a faithful scribe for your system, you should consider heeding another rule in the MIS pedagogy—specifically, plan before you begin using an application (see "Blueprint Your Data Base," *PCW*, Vol. 2, No. 7).

When computers couldn't fit on desk tops, programmers did all the forecasting of programming needs. If a program was to govern inventory control, the DP whiz might probe such variables as the current size of the part number field and the size projected for a year from now; the number of locations in which the part was to be stored; and the number of characters needed to describe each item. Based on projections, the programmer would build in dormant fields to be activated as the need arose.

Lest this sound too elementary, consider the experience of Jerry Gora, a field applications engineer for Schweber Electronics in San Jose, California. About a year ago Gora, an accomplished hardware expert, set up a mailing label program for an ostensibly simple project. He set up the fields as follows:

Field 1: FIRST NAME, LAST NAME, INITIAL
Field 2: STREET ADDRESS
Field 3: CITY, STATE, ZIP

While this structure seemed reasonable enough at the outset, Gora soon learned otherwise. As his client list grew, so did his troubles. The original arrangement prevented him from sorting customers by last name, by title, or by occupation and from doing specialized mailings by zip code. Unfortunately, fields could not be modified or added without losing data. Gora was forced to reenter his entire data base in a new format.

The next time around, he tried an approach reminiscent of MIS. He isolated as many fields as possible, defining lengthy, discrete fields for last name, first name, title, and so forth. He also left a generous number of dormant fields in anticipation of potential sorting requirements.

Controls in Code

To augment manual controls, DP professionals employ the error-trapping features of mainframe software as a tool against GIGO.

One so-called internal sentinel is the checkdigit or checksum feature, often written into programs that deal with strings of numbers such as customer accounts or part order numbers. Checkdigits flag transpositions and other data entry gaffes.



To illustrate this process in action, suppose a customer number is 28956, but a data entry clerk keys in 2895 instead. The computer supplies the number 6 as the result of a process of verification, arriving at this number through a simple mathematical formula. In this instance, the formula consisted of adding 1234 to the first four digits of the customer number (that is, $2895 + 1234 = 4129$), then adding the sum's digits ($4 + 1 + 2 + 9 = 16$) and throwing out the 1 to arrive at the checkdigit of 6. While not foolproof, this is a surprisingly efficient technique for catching mistakes in an assembly line entry of numbers.

Mainframe software is rife with such field validation features. Standard tools that ensure that data measures up before it is entered into a data base include numeric range checks (such as whether the amount is between \$00.00 and \$24.99), date range stipulations (for example, February 1985 dates greater than 28 are invalid), value restrictions (such as M/F for male or female), and key field validations (such as requiring an employee number to match the master file). Other examples of processing controls are sequence checks, used to see if information is being

Some of the newer, more elaborate packages on the market, like dBASE III and PC/Focus, strongly resemble mainframe packages in their ability to perform error subroutines on designated fields.

processed in the right order; internal labels, which determine whether the program is operating on the appropriate files; checkpoints, which identify segments in the processing procedure and thus limit the scope of an error search; and limit checks, which look for overflow conditions in processing or credit situations.

This glance into the MIS tool chest should be sufficient to illustrate that mainframe programs are sticklers for accuracy. Such software contrasts starkly with the free-form approach to data entry taken by most PC-based packages. Because the source code for

most personal computer software is not available to the average user, there's no convenient way to build such error-trapping devices into your data management or spreadsheet application. Fortunately, some of the newer, more elaborate packages on the market, like *dBASE III* and *PC/Focus*, strongly resemble mainframe packages in their ability to perform error subroutines on designated fields. Such programs enable you to do customized programming and thus to build your own data validation routines (see Listing 1).

Adhering to the Spirit of MIS

Even if you're using rudimentary programs like *pfs:file* and *pfs:report*, you can compensate for the general absence of controls in PC software, according to Dave Williams, senior programmer for Argo Systems in Sunnyvale, California.

First, identify exception conditions that a numeric or alpha range check can spot. Suppose a field in your customer file identifies states by the numbers 01 through 50. You can check accuracy by using an exception report to flag all state ID numbers greater than 50 or less than 1. Another procedure is to compute the variance of a monthly budget on a regular basis. If it deviates by more than 50 percent in either direction one month, take a closer look.

Numeric range checks are fairly easy, but what about information that looks perfectly acceptable to the computer, such as a misspelled name? Or perhaps you misread a line above or beneath the input information and entered *Michael* instead of *Samuel Jackson*.

One method of dealing with text is to enter information twice by setting up duplicate files and then printing them for visual scanning. Better yet, prepare a report that shows discrepancies between the two files. If you're using a relational data management system, you can also detect data discrepancies by joining files and asking for what's missing.

Another way to detect data entry blunders is to set up several files with partially duplicated information in each, then merge them. This will still require you to eyeball the list, but spotting mismatches should be fairly easy.

```

SET TALK OFF
?'Checking the customer database for
  bad zipcodes'
use customer
do while. not.eof ()
  if zip < 94600
    display
  endif
  skip
enddo
return

* CHRTEST.PRG
* Testing for RANGE on character input
SET TALK OFF
data = SPACE(15)
low_end = "Jones"
high_end = "Smith"
CLEAR
DO WHILE UPPER(data) < low_end .OR. UPPER(data) > high_end
  data = SPACE(15)
  @ 10,5 SAY 'Enter a name between "Jones" and "Smith" ' GET data
  READ
ENDDO  jones & smith
@ 15,5 SAY data
SET TALK ON
RETURN

```

Listing 1: Two simple field verification subroutines using dBASE III. The first checks for bad zip codes in a customer data base, asking that erroneous information be displayed. The second subroutine tests an alpha range.

Let's say you have one customer file that lists the name of each client next to a customer number. A second file contains the customer number plus the mailing address. Obviously, a file merge will highlight customers out of sync.

But the best way to handle simple input errors, Williams suggests, may be to date-stamp each day's entries and then run a transaction report by date on a daily or weekly basis. While checking data entry manually is never appealing, it's at least a feasible proposition if the work is divided into manageable segments. The transaction report also serves as a hard copy of the day's work in the event of a system crash.

Backup, Backup, Backup

No discussion of MIS fixations would be complete without a word or three about backup. In the data processing world, standard operating procedure is to maintain three generations of copies, known as the grandfather, the father, and the son. The most recent version of a file is the son. When the son is revised, a new son is created, and the old son becomes the father. A subsequent revision moves everything back one generation, so that the original becomes the grandfather. In this way, any instance of data loss is limited to one generation's worth of information (see the sidebar "Power Users on Tape").

MIS discipline also favors keeping daily files Monday through Thursday, then making a weekly copy on Friday and a monthly copy every fourth week. These copies supplement the transaction tapes

(continues)

Power Users on Tape

It's 4:30 on a Friday afternoon. The boss wants a report by the end of the day, and he's pacing like a caged jackal. You sit down to perform the impossible, when suddenly, courtesy of a hardware glitch, a stray magnetic field, or an environmental problem, your hard disk hits the skids.

As a knowledgeable user you no doubt have recently backed up your hard disk and can retrieve the pristine file from a nearby floppy, but you might be in for a rude surprise if the hard disk is beyond repair and the data cannot be restored to its original target. The brutal truth is, the software for some tape and hard-disk backup products will not restore to a new disk, even if the new disk is the spitting image of the old. The reason is simply that the backup software fails to implement controls that would map the bad sectors on the target disk; accordingly, a dissimilarity in internal formatting prevents the data transfer. Even the PC-DOS utilities Backup and Restore suffer this fatal flaw.

After acknowledging that dismal news, your next step in developing a backup strategy should be to take a penetrating look at the available software. While backup hardware is usually adequate, software is often another story. So says Arthur D. Libin, a San Francisco-based consultant.

"The ideal," says Libin, "is a product that can back up and restore an entire volume automatically, regardless of the differences in individual target media, and still maintain the directory structure intact."

In simple terms, the object of the backup game is to match your needs and the amount of money you have to spend with the appropriate technology—a feat you can accomplish only by uncovering all the pitfalls of a product before you invest in it.

The most rudimentary—and least expensive—backup method involves using the Backup and Restore utilities that accompany PC-DOS. That method is also the slowest, and it is one of the most difficult to use should you scramble the order of the floppy disks during the restoration process. Most important, however, Restore requires that you return information to the original target disk. If a total mechanical failure of the storage device makes that impossible, it might be time to kiss your data goodbye.

The next step up is to use versions of Backup and Restore produced by a manufacturer other than IBM. Most of these products are faster, and some have the capability to restore data to different disks. You are still required, however, to feed in floppies one by one to be copied.

If your data base or other application is large and you can spare between \$600 and \$2100, you're a candidate for a tape backup system. Tape systems come in two basic types: streaming tape, which backs up a hard disk continuously and in its entirety, and start/stop tape, which permits you to back up data on a file-

by-file basis. From a technical point of view, these product genres are comparable, so your selection depends on your orientation.

If speed is the critical factor on your backup agenda, you'll no doubt lean toward a streaming tape product. On the other hand, if data integrity is paramount (as it would be in a government office, where records must be maintained in unsullied condition), the start/stop approach might be more attractive.

A streaming tape backup maintains directories at the beginning of the tape that, if destroyed, are probably gone forever—thus denying access to all data on that tape. By contrast, start/stop systems can recover their directories and so preserve data integrity. Libin suggests that some start/stop systems are also a bit more flexible than streaming drives and boast a slightly better recording capability. In addition, streaming tape systems tend to be incompatible with one another; the drive's fixed read/write head often precludes one tape cartridge unit from reading a tape made by another.

For maximum speed and flexibility (at a correspondingly higher cost), the external hard disk with a removable cartridge is probably the best choice on the market. This type of product provides fast data transfer between hard disks and enables you to access all your files using normal DOS commands. As a bonus, it augments storage space available to your system.

If you're in the market for a backup system, Libin suggests the following guidelines:

1. Keep in mind that it's software that distinguishes products. And while you're examining software, steer clear of systems that require you to specify each path explicitly, since this chore makes the restoration process tedious. Instead, choose a product that can restore entire directory structures automatically.

2. If you select a tape system, look for cartridge compatibility; the option to use the tape cartridge in other units is particularly valuable if you're in a shared information environment. Also be on the lookout for the ability to do multiple backups on a single tape. Be sure that the configuration—half-height internal, combination tape/disk, or external stand-alone—is appropriate for your purposes.

3. Examine the interface method the product requires. Such a connection has a direct bearing on whether or not the system can be installed easily, or at all. If the backup device uses a connector on the floppy disk controller rather than providing its own interface board, for example, it won't work on the AT, whose controller doesn't have a connector.

4. Don't forget the basics. Such considerations as speed, storage capacity, price, documentation, and company reputation are no less crucial for all their obviousness. As a final word of advice, Libin suggests obtaining an evaluation loaner from the manufacturer or the dealer before you take the backup system plunge.

that record the daily changes made to the files. At least one copy of the weekly and monthly files is kept off-site.

Sound like overkill? In fact, such practices may not be necessary for informal or nonbusiness computer usage. But for PC users who deal with critical information, MIS manager Michel offers the following recommendations.

- Identify a backup schedule suitable for your needs, then follow it scrupulously. There is no rule of thumb governing the regimen itself; your schedule will depend on the application, the frequency of revision, and the quantity of data. In the event of a system failure, it is imperative that you know whether you have one hour's, one day's, or one month's worth of material on a storage device.

- At the outset, determine what is a manageable chunk of data for you, in case you need to restore it. What's manageable varies, but because data restoration involves a great deal of work, it's wise to work with small increments of data; you also have less to lose should the worst occur.

- Devise a system using codes, colors, numbers, or all three to keep your files in order. Commit your system to paper.

- Find a safe, off-site location to store irreplaceable data. Tapes and disks should be kept in a cool, dry place where temperature and humidity are constant and where no danger exists of the material being misplaced, scratched, or mistaken for a current data file.

- Keep a hard copy of your data for as long as you keep the data file itself. Box it up, stuff it in an envelope—just don't throw it away. Fires, floods, earthquakes, theft—all sorts of contingencies can wipe out your backup media with suddenness and finality.

Emulating an Example

As painful as the admission may be, some MIS practices should be duplicated in the personal computing environment, particularly if you're dealing with essential facts and figures. Documentation, data verification, and sound backup practices certainly deserve careful consideration. With discipline and imagination, you should be able to incorporate a few of these measures without losing the freedom that distinguishes personal computing. ●

Wendy Lea McKibbin, formerly the West Coast editor of In-fosystems, now holds that position at inCider.

DocuCalc

Micro Decision Systems

P.O. Box 1392

Pittsburgh, PA 15230

412/276-2387

List price: \$95

Requirements: 128K, one disk drive

The Spreadsheet Auditor

Consumers Software Inc.

314 E. Holly St. #106C

Bellingham, WA 98225

800/645-5501

List price: \$99

Requirements: 128K, one disk drive

SideKick

Borland International

4113 Scotts Valley Dr.

Scotts Valley, CA 95066

408/438-8400

List price: \$49.95

Requirements: 64K, one disk drive

Spotlight

Lotus Development Corp.

55 Cambridge Pkwy.

Cambridge, MA 02142

617/577-8500

List price: \$75

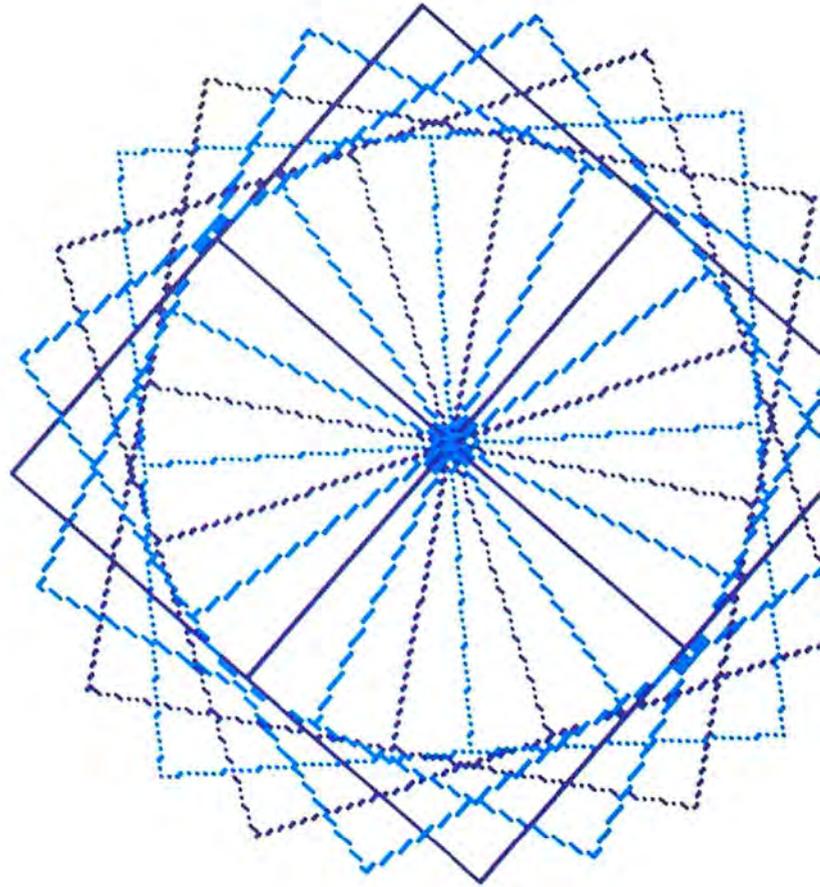
Requirements: 75K, one disk drive

Straight to the Point

Name a point on the screen, and the DRAW statement will sketch a colorful line to that position. Learn how you can use BASICA to draw, fill, rotate, scale, and color figures—all with a single command.

Dan Illowsky and Michael Abrash

|||| The DRAW statement controls what can be visualized as a multi-inked pen that draws on your computer screen. The pen can move to any point on the screen, leaving a trail, in a color you choose, as it moves. The DRAW statement includes features to “lift” the pen from the screen at any point, paint the figures you draw, scale them to any size, and rotate them to any angle.



A little familiarity with the DRAW statement will open up a world of new applications and ideas for enhancing your programs. This article supplies hands-on examples to give you a feel for the DRAW statement in action. Your PC must have a graphics display (color is recommended) and a graphics board. This tutorial assumes that you know how to enter and run a simple BASIC program, but no knowledge of graphics is needed.

■ Getting Ready

Before starting any graphics program you must choose a screen mode. The PC offers two graphics modes—medium resolution and high resolution. Medium resolution splits the screen into 320 col-

umns by 200 rows of pixels; screen coordinates stretch from location 0,0 at the upper left corner of the screen to location 319,199 at the lower right corner. In this mode you can draw forms in any of four colors. In high-resolution mode the screen is divided into 640 columns by 200 rows, with coordinates stretching from 0,0 at the upper left corner to 639,199 at the lower right. High-resolution figures can be drawn only in black and white. Our examples call for medium-resolution mode so you can use color, but the DRAW statement uses the same commands in high-resolution mode.

Table 1: DRAW statement subcommands

	Subcommand	Description
Movement subcommands	Mx,y	Move. If <i>x</i> is preceded by a plus or minus sign, the distance moved is relative to the last point referenced; otherwise, the move is absolute to <i>x,y</i> . If the move is relative, distances represented by <i>x</i> and <i>y</i> are in pixels unless set to a different scale by the S subcommand.
	Un	Move up. The distance moved is <i>n</i> units; actual distance covered is determined by the S subcommand.
	Dn	Move down.
	Rn	Move right.
	Ln	Move left.
	En	Move up and right (northeast).
	Fn	Move down and right (southeast).
	Gn	Move down and left (southwest).
	Hn	Move up and left (northwest).
Pen control subcommands (prefixes)	B	Blank. Don't draw any points when executing the next subcommand.
	N	No move. Return to starting position after executing the next subcommand, without changing the last point referenced.
Environment subcommands	Cn	Color. Select color 0, 1, 2, or 3 to draw with.
	Sn	Scale. Select figure scaling size, 1 being the smallest and 255 the largest. The scale is $\frac{1}{4}$. The default is $n = 4$, or 1 unit = 1 pixel.
	An	Angle. Rotate figures 0, 90, 180, or 270 degrees, with <i>n</i> equal to 0, 1, 2, or 3, respectively.
	TAn	Turn angle. Rotate figures at any angle (<i>n</i>) between -360 and +360 degrees (+ indicates degrees counterclockwise; - indicates degrees clockwise).
	Pp,b	Paint. Fill in with color <i>p</i> the area bounded by color <i>b</i> .

Before beginning, ready the screen for graphics. The DRAW statement is available only in BASICA, so enter **BASICA** at the DOS prompt. Then enter **NEW** to clear memory and reset all DRAW parameters to their default states.

Select medium-resolution mode by entering **SCREEN 1**. Then turn off the function key descriptions at the bottom of the screen with **KEY OFF**, and clear the screen by typing **CLS <Enter>**. Our examples will use the default palette, 1. (For information on changing palettes, see the COLOR statement section of the BASIC manual.)

■ Moving the Pen

The DRAW statement is given in the form **DRAW *commandstring*** where *commandstring* consists of a string of subcommands of the DRAW statement, in either uppercase or lowercase. The subcommands, which will be explained later, are summarized in Table 1.

The simplest DRAW subcommand is the move subcommand, M, given as **DRAW "Mx,y"** where *x* and *y* are the screen coordinates at the pen's destination. Type the command **DRAW "M100,100" <Enter>** and see what happens.

Unless you turn this feature off, the M subcommand leaves a trace of all the pen's movements across the screen. The movement sub-

commands of the DRAW statement draw a line between the last point referenced by a BASIC command (the LPR) and a new point you specify. If no point has yet been referenced, the LPR defaults to the point at the center of the screen (coordinates 160,100 in medium-resolution mode).

If you do not want to use the center as your initial starting point, you can set a point with the PSET command before issuing the M subcommand. Clear the screen and enter **PSET (50,50): DRAW "M150,150"**. This PSET statement sets the LPR to 50,50. After subsequent DRAW subcommands, the LPR advances to the last pen position.

You can specify screen locations for the M subcommand in two ways. With *absolute addressing*, a given coordinate pair always describes the same point on the screen. *Relative addressing* describes a location relative to the LPR. Distance is measured in pixels unless you give a command to change the scale factor; the relative coordinates are added to the coordinates of the LPR to give the actual screen location.

The M subcommand is the only DRAW subcommand that uses absolute addressing; the others always use relative addressing. If the *x* coordinate is prefixed with a plus or minus sign, then both *x* and *y* are treated as relative coordinates. If *x* is not prefixed with a sign, then both parameters are treated as absolute coordinates.

For an example of screen addressing with the M subcom-

mand, clear the screen and enter **PSET (100,100) DRAW "M150,100; M + 0,50; M-50,-50"** to draw a triangle. The first move subcommand uses an absolute address, while the last two use relative addressing.

As this example shows, you can combine several DRAW subcommands in a single string. To in-

used. The other three subcommands use the same syntax, except, of course, that the appropriate letter D, L, or R is substituted for U.

Clear the screen and enter **DRAW "U40 L60 D40 R60"** to draw a rectangle. Each subcommand starts from the endpoint of the previous movement (the LPR). Note that

 *The DRAW statement controls what can be visualized as a multi-inked pen that draws on your computer screen.*

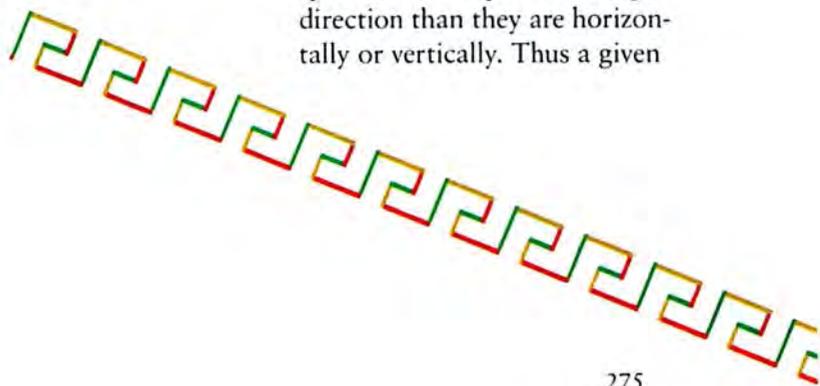
crease readability you can insert semicolons and/or spaces between DRAW subcommands; in fact, semicolons are required in certain circumstances. BASIC strings can be 255 characters long, but because one DRAW command picks up where the last left off, lengthy command strings are generally not necessary; several short (and more readable) strings will almost always do as well.

The DRAW subcommands U, D, L, and R duplicate the function of the M subcommand for specific movements. These commands move the invisible pen a specified distance up, down, left, and right, respectively. The U subcommand takes the form **DRAW "Un"** where *n* is the distance to move. If *n* is not specified, a default of 1 is

this command is considerably more compact and intelligible than **DRAW "M + 0,-40 M-60,0 M + 0,40 M + 60,0"**

Four more movement subcommands, E, F, G, and H, draw diagonally, moving up and right, down and right, down and left, and up and left, respectively. These subcommands are obviously not as easy to remember as the last four. However, you can keep in mind that the E subcommand points up and right, or northeast, and the other three subcommands fall into place clockwise, as shown in Figure 1.

These subcommands are issued in the same form as the other direction subcommands. The distance represented by *n* is somewhat different with this set of subcommands, because pixels are spaced farther apart in a diagonal direction than they are horizontally or vertically. Thus a given



distance, as specified by *n*, will be about 1.4 times as far diagonally as horizontally or vertically. This enables commands such as `DRAW "R10 D10 H10"` to produce closed figures. If *n* is omitted, the distance parameter defaults to 1.

The program KITE.BAS, shown in Listing 1, uses the M subcommand to make an initial move to an absolute position, and thereafter uses the movement subcommands. The M subcommand is

enclosed, as you will see if you enter (without clearing the screen) `DRAW "U100"`. The B subcommand lifts the pen only for the duration of the single subcommand following it. To suspend the pen for several successive subcommands, you must prefix each subcommand separately with B. An M subcommand prefixed with B is a good way to set the LPR, because unlike the PSET statement, this method doesn't affect the screen in any way.

The C subcommand governs the color in which figures will be drawn. It takes the form `DRAW "Cn"`

In medium resolution, *n* is 0 for the background color or 1 through 3 for one of the other available colors (cyan, magenta, and white, respectively, in palette 1). In high-resolution mode, *n* is 0 for black or 1 for white. If no C subcommand has been executed, the color defaults to 3 in medium-resolution mode and to 1 in high-resolution mode. After the C subcommand is executed, all pixels drawn by the DRAW statement will be in color *n* until another C is executed, memory is cleared, or another graphics statement using a different color is given. The C subcommand does not affect the color used by graphics commands other than DRAW.

Clear the screen and enter `DRAW "C1 L50 C3 D40 C2 M +50,-40"` to use three of the four colors available in medium-resolution mode. Then, leaving the screen unchanged, erase the image just drawn by drawing it again in the background color (enter `DRAW "C0 L50 D40 M +50,-40"`). Then enter `DRAW "C3"` to reset the DRAW color to 3, white.

An M subcommand prefixed with B is a good way to set the LPR, because it doesn't affect the screen in any way.

preferable to the movement subcommands only for an absolute move or a move that is not exactly diagonal, horizontal, or vertical.

Lifting the Pen

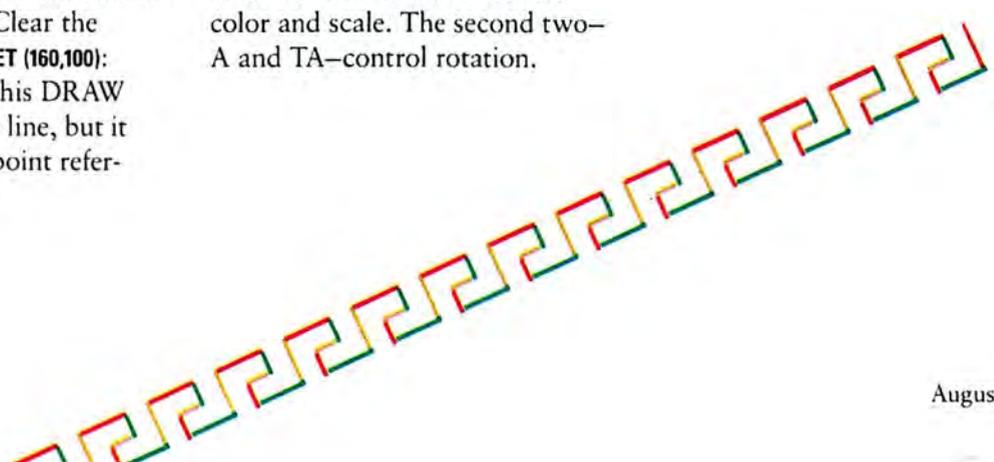
With the previous DRAW subcommands you can move the pen to any point on the screen, but it always leaves a trail as it moves. Sometimes you'll want to "lift" the pen off the screen and move it to a new location (reset the LPR) without leaving a line. This trick is accomplished with the B, or blank, subcommand.

The B subcommand is used as a prefix to any subcommand that sets a screen position. Subcommands prefixed with B have no effect on the screen. Clear the screen and enter `PSET (160,100): DRAW "BM +99,99"`. This DRAW command draws no line, but it does move the last point refer-

Another pen control subcommand, N, allows you to move the pen without changing the LPR. Like B, N operates as a prefix to any subcommand that sets a screen position. The N subcommand makes it very easy to draw figures around a central point. For an example, clear the screen and enter `DRAW "NU30 NR30 ND30 NL30"`. Each subcommand starts from the same point, since the N prefix keeps the LPR from changing.

DRAW Environment Subcommands

Four DRAW subcommands set the environment in which other DRAW subcommands execute. The first two—C and S—control color and scale. The second two—A and TA—control rotation.



The Scale Subcommand

The distance the pen moves for any DRAW command depends on the current scale factor. The default for the scale factor is 1 distance unit = 1 pixel, so unless an S (scale) subcommand is executed, the *n* parameter of any movement subcommand equals *n* pixels.

Changing the scale factor enables you to use the same DRAW command string to draw a given figure in any number of sizes. The S subcommand does not affect the absolute address form of the M subcommand or any graphics command other than DRAW.

The S subcommand is used in the form
DRAW "S*n*"

where *n* is the scale factor, expressed as a number between 1 and 255. The statement sets the number of pixels drawn for each unit of distance as $\frac{1}{n}$. Thus, for example, if *n* is 4, then 1 pixel ($\frac{1}{4}$) is drawn for each unit of distance specified. (Four is the default scale factor.) If *n* is 2, then half a pixel ($\frac{1}{2}$) is drawn for each unit.

Clear the screen and enter DRAW "S4 R40". Then, leaving the screen unchanged, enter DRAW "S1 BU8 L40". The second statement produces a line only $\frac{1}{4}$ the length of the first line even though the distance parameter is the same, because the scale factor has been changed.

For an example of the scale subcommand's use, store the command string for a diamond shape in the string variable DS by entering DS="E20 F20 G20 H20". Then

clear the screen, and draw the figure in four sizes by typing
DRAW "BM0,110 S1" + DS < Enter >
DRAW "BM20,110 S4" + DS < Enter >
DRAW "BM70,110 S8" + DS < Enter >
DRAW "BM160,110 S16" + DS < Enter >
(Reuse the same command line for each DRAW statement so the text doesn't wander into the figures you draw.)

When used with strings, the plus sign concatenates two strings into one. Thus, in the first DRAW statement in the preceding example, DRAW "BM0,110 S1" + DS is equivalent to DRAW "BM0,110 S1 E20 F20 G20 H20". The scale subcommand works as neatly with complex forms like schematic symbols as with the simple diamond used here.

The scale factor remains in effect until another scale factor is set

or until CLS, NEW, or a new program is executed. Enter DRAW "S4" to reset the scale factor to the default.

The Angle Subcommands

Two DRAW environment subcommands, A and TA, are used to rotate a figure. The A subcommand (the only angle subcommand available in versions of BASIC earlier than 2.0) can rotate a figure only by 0, 90, 180, or 270 degrees. The TA subcommand, available in versions of BASIC later than 2.0, can rotate a figure to any angle. These subcommands work by rotating the reference axes (the *x* and *y* axes of the screen). Any figure drawn will align with the new axes.

The syntax of the A subcommand is
DRAW "A*n*"
where *n* is 0, 1, 2, or 3, corresponding to rotations of 0, 90,

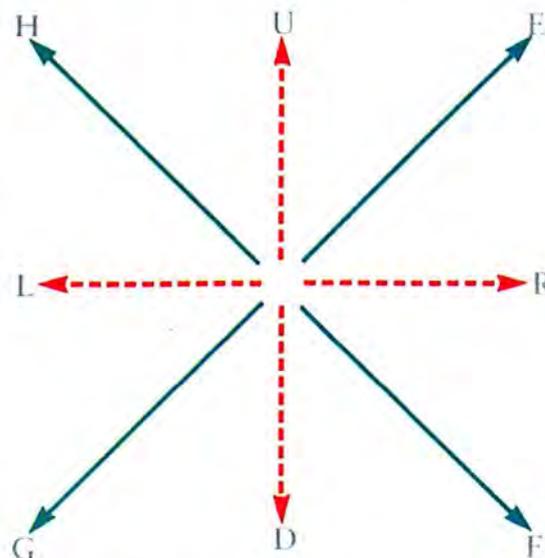
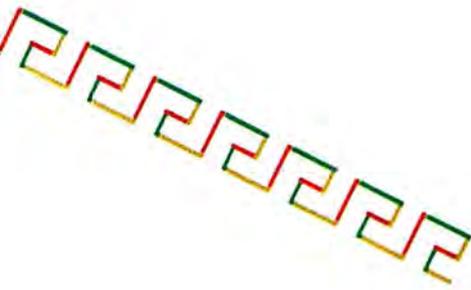


Figure 1: The actions of the DRAW movement subcommands



```

100 REM Program to demonstrate DRAW statement movement
110 REM subcommands by drawing a kite.
120 SCREEN 1,0:COLOR 0,1:KEY OFF:CLS
130 DRAW "m240,40" 'Draw string
140 DRAW "u20 d40 u20 l20 r40" 'Draw cross
150 DRAW "g20 h20 e20 f20" 'Draw outline
160 END
    
```

Listing 1: KITE.BAS, a program that demonstrates the movement subcommands

180, or 270 degrees. The angle subcommands affect all DRAW subcommands except the absolute address version of the M subcommand, but do not affect any graphics commands other than DRAW.

The ability to change the angle of a figure is not particularly useful when you are drawing the figure only once, but its value becomes apparent when you want to show a predefined figure in a number of attitudes. For an example, define a flat rectangle by entering `FS="U10 R60 D10 L60"`. Then clear the screen and enter `DRAW "BM160,130"` `DRAW "A0" + FS`

Since A0 is specified, the rectangle is not rotated; A0 is equivalent to a simple DRAW FS. Now enter `DRAW "A1" + FS`, and you have a tall rectangle. To see the full range of rotation possible with the A subcommand, leave the screen unchanged and enter `DRAW "A2" + FS` and `DRAW "A3" + FS`.

The angle set by an angle subcommand remains in effect until you change it. To return to the normal reference axes, enter `DRAW "A0"`. A CLS or NEW command also resets the angle to 0.

The TA subcommand does essentially what the A subcommand does, only better. The TA subcommand lets you rotate the reference axes for the DRAW statement by any multiple of 1 degree, clockwise or counterclockwise, from the standard orientation. The TA command is given as `DRAW "TAn"` where *n* is an angle, expressed in degrees between 0 and 360, by which the reference axes are to be rotated. "TA90" is the same as "A1". *n* may be prefixed by a plus or minus sign; a plus sign indicates counterclockwise rotation, and a minus sign indicates clockwise rotation. Counterclockwise rotation is the default.

If you are using a version of BASIC later than 2.0, clear the screen and enter `TS="U50 R60 D50 L60"`. Then clear the screen again and enter `DRAW "TA30" + TS + "TA120" + TS + "TA210" + TS + "TA300" + TS` to try another four-way rotation of a rectangle, using different angles.

To get a better feel for what the TA subcommand can do, use the <CursorUp> key to return to the line the DRAW statement is on (don't clear the screen), edit the line to read `DRAW "TA45" + TS + "TA135" + TS + "TA225" + TS + "TA315" + TS` and press <Enter>. Edit this line four times to enter each of the following commands:

```

DRAW "TA60" + TS + "TA150" + TS +
"TA240" + TS + "TA330" + TS
DRAW "TA75" + TS + "TA165" + TS +
"TA255" + TS + "TA345" + TS
DRAW "TA90" + TS + "TA180" + TS +
"TA270" + TS + "TA360" + TS
DRAW "TA105" + TS + "TA195" + TS +
"TA285" + TS + "TA15" + TS
    
```

Enter `DRAW "TA0"` to reset the reference axes to the normal state.

The horizontal distance between pixels on the screen differs slightly from the vertical distance; in medium-resolution mode 5 vertical pixels cover the same distance as 6 horizontal pixels. The relationship between the x and y distances is known as the screen *aspect ratio*. In medium-resolution mode, then, the aspect ratio is 5/6; in high-resolution mode it is 3/4, meaning that 12 horizontal pixels

span the same distance as 5 vertical pixels. The angle subcommands correct for screen aspect ratio each time a form is rotated, so that figures retain their original dimensions no matter how they're rotated.

■ The Paint Subcommand

The P subcommand is actually the familiar PAINT statement in a new setting. It provides a neat and easy way to color an image, filling in an area with a solid color until a boundary color is reached. Like the TA subcommand, however, the P subcommand is provided only by BASIC 2.0 and later versions.

The P subcommand syntax is `DRAW "Pp,b"` where *p* is the paint color and *b* is the color of the boundary at which painting is to stop. Both parameters are required. If you set *p* out of range, it defaults to the current color, while an out-of-range *b* defaults to the *p* color. Like most DRAW subcommands, P starts its action at the LPR. The LPR is not changed by the P subcommand. If you are using a BASIC version later than 2.0, clear the screen and enter `DRAW "BM160,100 D50 R10 U5 R30 D10 R5 U50 M160,100 BF5 P1,3"` to draw and fill in an irregular form.

The P subcommand has a quirk shared by all forms of painting in BASIC: painting stops at horizontal lines of the paint color. For a demonstration, clear the screen in medium-resolution mode and

```
enter
LINE (110,100)-(210,100),1
CIRCLE (160,100),40,2
DRAW "BM170,110 P1,2"
```

The painting stops at the horizontal cyan line (color 1), although the specified boundary color is magenta (color 2).

Painting affects the color used by DRAW; when P finishes, the paint color becomes the DRAW color. Enter `DRAW "L150"` to see that the DRAW color changes to color 1, cyan, after the previous Paint example executes.

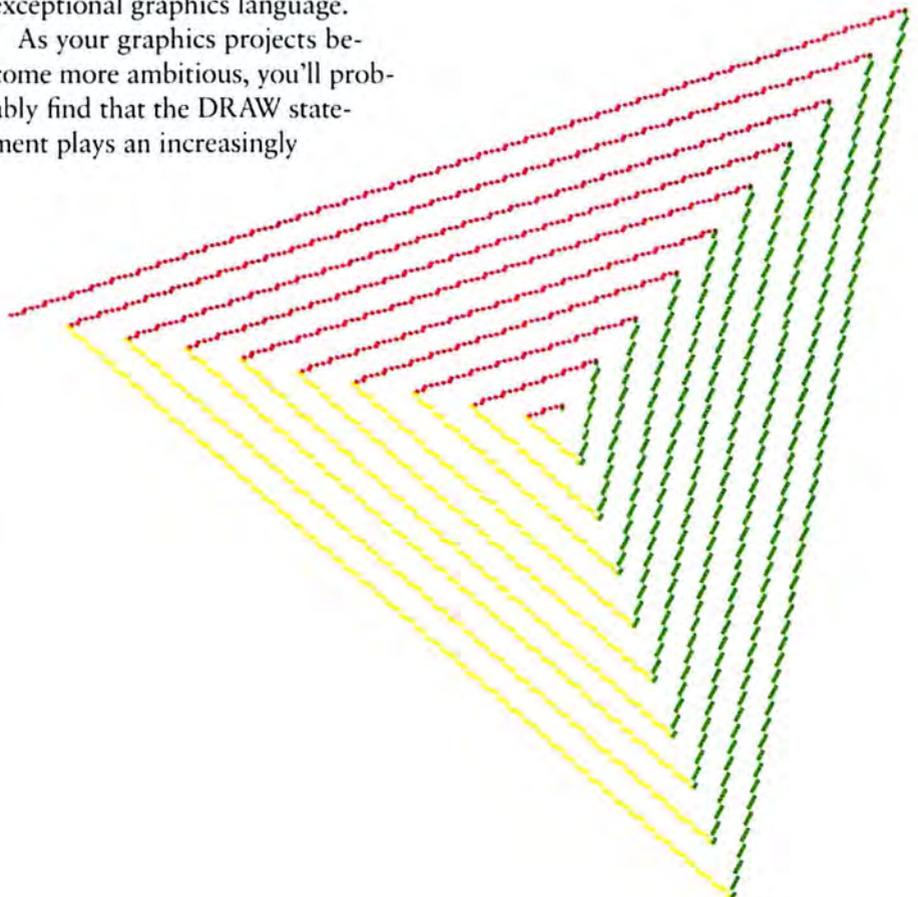
■ The DRAW Language

As you can see, the DRAW statement is really a small graphics-oriented language. The subcommands are few, and their effects are confined to graphics, but the DRAW statement is compact, powerful, and self-contained. DRAW is one of the primary reasons that BASICA is considered an exceptional graphics language.

As your graphics projects become more ambitious, you'll probably find that the DRAW statement plays an increasingly

prominent role. You can develop a set of primitives—DRAW command strings that define frequently used building-block forms—to use in many programs. (See "Putting DRAW to Work" in this issue for a quick business graphics program using DRAW.) Whenever you consider how to approach a graphics problem, think of DRAW. As your programs become larger, space considerations will assume new importance, and there is no more compact way to perform graphics than with the DRAW statement. ●

Adapted from the book Graphics for the IBM PC, published by Howard W. Sams & Co., Indianapolis, Indiana, © 1984, by Dan Illowsky and Michael Abrash.

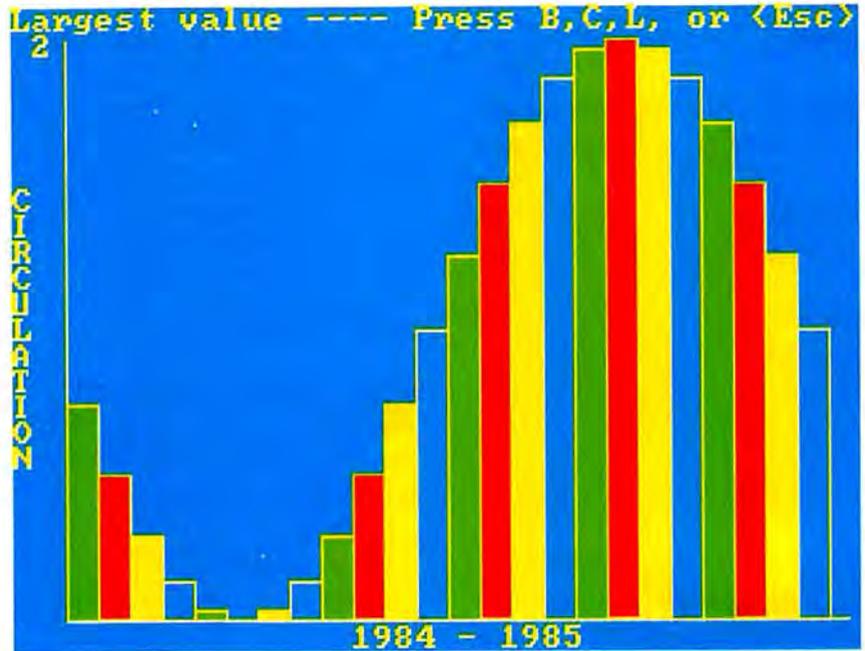


Putting DRAW to Work

Once you're familiar with the DRAW statement, what can you do with it? To spark your creativity, PC World offers a simple program that makes use of the DRAW statement to plot line and bar graphs on a color graphics display.

Karl Koessel

Using the line and bar graphing program presented here is simple and straightforward. The program first asks you to enter a label for the x-axis, another for the y-axis, and finally your data. After giving you an opportunity to correct your entries, it plots a line graph. Instructions to 'Press B,C,L, or <Esc>' appear at the screen's upper right. Touch B



and the line graph becomes a bar graph; pressing L does the reverse; C gives you another opportunity to change or add to the data; and <Esc> ends the program.

Most of the code (see Listing 1) is devoted to data input and correction, with a few lines for bells and whistles: Lines 840 through 890 center the labels; lines 150 and 160 ensure that <NumLock> is on; and, just before the program ends, line 60 resets <NumLock> to its initial state. But of primary interest are the routines that use the DRAW statement. (For an overview of DRAW statement subcommands, see "Straight to the Point" in this issue.)

Both the line graphing routine and the bar graphing routine finish with a call to the routine that draws the x- and y-axes. The axes routine (line 800) contains the simplest DRAW statement. The movement subcommand

'BM20,190' causes a "blank move" to the screen coordinates 20,190, a spot near the screen's lower left corner. Without altering the screen image, that location, which is to be the graph's origin, becomes the *last point referenced* (LPR). Next, 'C3' sets the drawing color, and 'NU180' draws a line (the y-axis) up 180 pixels without changing the LPR. The next movement subcommand is 'R295', which draws a line (the x-axis) 295 pixels to the right. The completed axes define a plotting area of 295 by 180 pixels with the origin at 20,190.

To draw a line graph, we need to determine the screen coordinates of each data point and the

horizontal distance between points. To draw a bar graph, we need to know each bar's length and width. The horizontal spacing of the points in the line graph and the width of the bars in the bar graph are equal to the largest integer less than or equal to the value of the length, in pixels, of the x -axis, divided by the number of values to be plotted. Line 440 calculates that width using integer division (\backslash) and stores its value in the variable HINC (horizontal increment).

After the largest value has been determined and stored in the variable LARGESTY (lines 450 through 480), the length of each bar (YB(I)) is calculated as a percentage of the 180-pixel y -axis length (lines 490 through 510). The percentage is based on the ratio of the particular data value divided by LARGESTY. The length of the bar is used to determine the placement above the x -axis of each point in the line graph.

After setting the first x -coordinate value equal to half the horizontal distance between points (line 550) in order to position the first point to the right of the x -axis, we are ready to draw the line graph. Line 560 issues a blank move to the first point. That line demonstrates the DRAW statement used with variables instead of "hard coded" values, such as the coordinates, color values, and movement distances specified in line 800.

Variables may be included in DRAW statement movement subcommands in two ways. For example, the statement DRAW "U=X;" will draw a line up X pixels, and the statement DRAW "U=" + VARPTR\$(X) will do the

same. Because the IBM BASIC Compiler supports only the latter method, that syntax is used throughout the program. Lines 570 through 600 increment the x -coordinate and DRAW a line in color 2 from the LPR to the next point, using variables to determine the next point's coordinates.

To begin DRAWing the bar graph, line 650 resets the LPR to the graph origin. Then, using the variable syntax, lines 660 through 760 DRAW and color each bar. Line 680 DRAWs a blank right move of one bar width along the x -axis if the bar's length is zero or less and then sends the program to DRAW the next bar. Lines 690 through 710 DRAW a line, in color 3, up to the point at the appropriate distance above the x -axis, right one bar width, and back down to the x -axis. Line 720 then completes the bar without

You can spruce up the graphs by adding a few extra DRAW statements. Try removing the 'R295' from the end of the string of DRAW statement movement subcommands in line 800 and adding the following lines:

```
801 X=HINC/2:DRAW
      "R=" + VARPTR$(X) + "NU5"
802 FOR I=1 TO N
803 DRAW
      "R=" + VARPTR$(HINC) + "NU5"
804 NEXT
```

Can you tell what effect those lines will have?

You might also add the lines:

```
565 DRAW
      "C1NM20,=" + VARPTR$(YL(1))
595 DRAW
      "C1NM20,=" + VARPTR$(YL(I))
```

or the lines:

```
565 DRAW "C1 BU1 F2 G2 H2 E2 BD1"
595 DRAW "C1 BU1 F2 G2 H2 E2 BD1"
to emphasize the value of each point.
```

The DRAW statement can be used with variables such as coordinates, color values, and movement distances, instead of 'hard coded' values.

changing the LPR, which is now at the lower right corner of the bar. Next, line 730 makes a blank move into the bar, and line 740 paints the bar with one of the four colors available in medium resolution. (Note that the DRAW statement does not support using variables for the P subcommand.) Then a blank move is made back to the lower right corner of that bar, and the next bar is drawn and colored.

Clearly, the DRAW statement can be much more than a programming exercise. If the exploding pie charts of fancy business graphics packages are too expensive, DRAW your own conclusions. ●

Karl Koessel is Technical Editor for PC World.

(Listing 1 appears on next page)

```

0 'Using the DRAW statement to make line and bar graphs, PC World, August 1985
10 GOSUB 130 'Initialize program
20 GOSUB 190 'Input labels & data
30 GOSUB 340 'Verify or change data
40 GOSUB 540 'Draw line graph
50 X$=INPUT$(1) 'What next?
60 IF X$=CHR$(27) THEN POKE 7, KBS:GOTO 110 'Reset NumLock, go end
70 IF X$="C" OR X$="c" THEN GOTO 30 'Go change data, draw line graph
80 IF X$="L" OR X$="l" THEN GOSUB 540 'Go draw line graph
90 IF X$="B" OR X$="b" THEN GOSUB 640 'Go draw bar graph
100 GOTO 50 'Go to "What next?"
110 LOCATE 3,1:END 'End with minimum effect on screen
120 'Initialize program-----
130 DEFINT A-X 'Define integer variables A-X
140 DIM Y$(300),Y(300),YL(300),YB(300) 'Dimension (set size of) arrays
150 DEF SEG=&H41:KBS=PEEK(7) 'Save keyboard status
160 POKE 7, KBS OR 32 'Set NumLock ON
170 RETURN
180 'Input labels & data-----
190 CLS:KEY OFF:SCREEN 0,0,0:WIDTH 80:COLOR 7,0 '80-column text screen
200 LOCATE 1,30:PRINT "Line and Bar Graphs" 'Print centered title
210 PRINT 'Skip a line
220 PRINT "Labels can include spaces." 'Prompt to enter...
230 INPUT "Enter x-axis label (up to 35 characters): ", XAXIS$ 'x-axis label..
240 INPUT "Enter y-axis label (up to 20 characters): ", YAXIS$ '& y-axis label
250 XAXIS$=LEFT$(XAXIS$,35): YAXIS$=LEFT$(YAXIS$,20) 'Trim labels
260 PRINT "Enter the value for each point (or Q to quit)" 'Prompt to enter data
270 PRINT "Point Value" 'Table headings
280 IF N<147 THEN N=N+1 ELSE 320 'Limit to 147 values
290 X=N:GOSUB 920 'Data input subroutine
300 IF LEFT$(Y$(X),1)<>"Q" AND LEFT$(Y$(X),1)<>"Q" THEN 280 'Quit or get more?
310 Y$(X)="" :N=N-1 'No more data; forget "Q", reset # of values
320 RETURN
330 'Verify or change data-----
340 SCREEN 0,0:WIDTH 80 'Text mode, 80-column screen
350 FOR I=1 TO N+1 STEP 20 'For each page (20 values)
360 CLS:PRINT "Point Value":PRINT 'Clear screen, print headings
370 FOR J=I TO I+20 'For each value
380 PRINT USING "###"; J;:PRINT SPC(11);Y(J) 'Print point and value
390 NEXT
400 LOCATE 23,1:PRINT "Do you want to change any of these values (y/n)? ";
410 X$=INPUT$(1):IF X$="y" OR X$="Y" THEN GOSUB 970 'Change a value?
420 IF X$<>"n" AND X$<>"N" THEN 400 'More changes?
430 NEXT
440 HINC=295\N 'Calculate horizontal increment relative to # of values
450 LARGESTY=0 'Forget last largest Y
460 FOR K=1 TO N 'From current values...
470 IF Y(K)>LARGESTY THEN LARGESTY=Y(K) 'find new largest value
480 NEXT
490 FOR I=1 TO N 'Calculate bar lengths and screen points...
500 YB(I)=Y(I)/LARGESTY*180:YL(I)=190-YB(I) 'relative to largest Y
510 NEXT
520 RETURN
530 'Draw line graph-----
540 CLS:SCREEN 1,0:COLOR 9,0 'Graphics screen for DRAWing

```

Listing 1: A program using the DRAW statement to make line and bar graphs

```

550 X=20+HINC/2 'First point offset from y-axis
560 DRAW "BM="+VARPTR$(X)+",="+VARPTR$(YL(1)) 'Blank move to first data point
570 FOR I=2 TO N 'For each next value
580 X=X+HINC 'Increment X offset
590 DRAW "C2 M="+VARPTR$(X)+",="+VARPTR$(YL(I)) 'Draw line to point
600 NEXT
610 GOSUB 800 'Draw axes and print labels
620 RETURN 50 'Return to "What next?"
630 'Draw bar graph-----
640 CLS:SCREEN 1,0:COLOR 9,0 'Graphics screen for DRAWING
650 DRAW "BM20,190" 'First bar starts at X-Y origin
660 FOR I=1 TO N 'For each value
670 IF Y(I)>0 THEN 690 'If >0 go draw bar else
680 DRAW "BR="+VARPTR$(HINC):GOTO 760 'skip a bar width to next value
690 DRAW "C3 U="+VARPTR$(YB(I)) 'DRAW line up computed distanc
700 DRAW "R="+VARPTR$(HINC) 'DRAW right computed bar width
710 DRAW "D="+VARPTR$(YB(I)) 'DRAW down distance to x-axis
720 DRAW "NL="+VARPTR$(HINC) 'DRAW left (& back) to make bar
730 DRAW "BM-1,-1" 'DRAW blank small move into bar
740 DRAW "P"+STR$(I MOD 4)+",3" 'Paint bar one of four colors
750 DRAW "BM+1,+1" 'DRAW blank move out of bar
760 NEXT
770 GOSUB 800 'Draw axes and print labels
780 RETURN 50 'Return to "What next?"
790 'Draw axes and print labels-----
800 DRAW "BM20,190 C3 NU180 R295" 'Draw X and Y axes
810 LOCATE 1,1 'Then on the top line
820 PRINT "Largest value ---- Press B,C,L, or <Esc>"; 'Print heading, options
830 PRINT STR$(LARGESTY) 'Print largest Y value
840 LENYAXIS=LEN(YAXIS$) 'Length of y-axis label
850 FOR I=1 TO LENYAXIS 'For a vertical label
860 LOCATE (25-LENYAXIS)/2+I,1 '1st column of new line
870 PRINT MID$(YAXIS$,I,1); 'Print a letter
880 NEXT
890 LOCATE 25,(44-LEN(XAXIS$))/2:PRINT XAXIS$; 'Print centered x-axis label
900 RETURN
910 'Input new data-----
920 PRINT USING "### "; X;:INPUT;"", Y$(X) 'Print point, get input
930 IF Y$(X)="" THEN PRINT Y(X):GOTO 950 'No input, no change
940 PRINT:Y(X)=VAL(Y$(X)) 'Set new value
950 RETURN
960 'Change a value-----
970 GOSUB 1030:INPUT;"Change value of which point"; X 'Clear line, ask which
980 IF X<I OR X>I+20 THEN 970 ELSE IF X>N THEN N=X 'Is it on screen or new?
990 LOCATE 3+(X-1) MOD 20:GOSUB 1030 'Find requested point, erase line
1000 GOSUB 920 'Use input routine
1010 RETURN
1020 'Erase current line of text-----
1030 LOCATE ,1:PRINT SPACES$(79); 'From column 1, print 79 spaces
1040 LOCATE ,1 'Back to column 1 on same line
1050 RETURN

```

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* • *

Star-Dot-Star

A global exchange of personal computer discoveries



A smorgasbord of handy utility programs to create and use on your own PC, an update for Turbo Pascal programmers, plus a novel use for the IBM Color/Graphics Adapter

Edited by Steven Cook

Renaming Subdirectories

One of the first things I discovered about version 2.00 of DOS was that it provides no facility for changing the name of a subdirectory. To change a subdirectory name I had to create a new subdirectory with the new name, copy all the files from the old subdirectory to the new one, delete the files from the old subdirectory, and then issue a command to remove the old subdirectory from the disk. Needless to say, this kept me from changing subdirectory names very often.

Recently I learned that I could write a program to rename subdirectories. The result is a program I call RENDIR.COM. To create it, load BASIC and type in the lines shown in X-MAKER.BAS, then type in the lines shown in RENDIR.DAT. When you RUN the program it will create RENDIR.COM, which you can use as described here.

The format of the RENDIR command is **RENDIR** [*d*:]*old_name new_name* where *d* is an optional disk drive designator, *old_name* is the subdirectory's original name, and *new_name* is the new one. Note that RENDIR can change only subdirectory names that appear in the current directory (the directory you see when you issue the command CD). Do not use backslashes or path names.

You can use the wild-card characters * or ? to specify a group of subdirectory names, but be careful because DOS will also rename any files whose names fit into that group.

RENDIR can return two error messages: 'Parameter error', which means an old or new subdirectory

name was not provided, and 'Name not changed', meaning either the old subdirectory name does not exist or the new name exists already.

*Michael Roberts
Snohomish, Washington*

Editor's note: Do not use RENDIR.COM while another program is running (for example, on a multiuser system, or in the background like Pop-Up PopDOS from Bellsoft). This combination could confuse DOS to the point of your having to restart the computer and could even scramble the contents of the disk.

Printer Control

I was writing a batch file for which I needed to turn the <Ctrl>-<PrtSc> function on and off without operator intervention. Lacking any other solution, I wrote the program PRINTER.COM. Each time it runs it puts a <Ctrl>-<PrtSc> character into the keyboard buffer as if the character were typed on the keyboard. To create PRINTER.COM, load BASIC, type in the program X-MAKER.BAS, then type the lines shown in PRINTER.DAT and type **RUN**.

*Kenneth Klein
Dayton, Ohio*

(continues)

What the world really needs is a 99 cent Double Sided, Double Density Diskette with a LIFETIME WARRANTY!

And DISK WORLD! has it.

Introducing Super Star Diskettes: the high quality diskette with the lowest price and the best LIFETIME WARRANTY!

In the course of selling more than a million diskettes every month, we've learned something: higher prices don't necessarily mean higher quality.

In fact, we've found that a good diskette manufacturer simply manufactures a good diskette...no matter what they charge for it. (By way of example, consider that none of the brands that we carry has a return rate of greater than 1/1,000th of 1 percent!)

In other words, when people buy a more expensive diskette, they aren't necessarily buying higher quality.

The extra money might be going toward flashier advertising, snazzier packaging or simply higher profits.

But the extra money in a higher price isn't buying better quality.

All of the good manufacturers put out a good diskette. Period.

How to cut diskette prices ...without cutting quality.

Now this discovery posed a dilemma: how to cut the price of diskettes without lowering the quality.

There are about 85 companies claiming to be "diskette" manufacturers.

Trouble is, most of them aren't manufacturers.

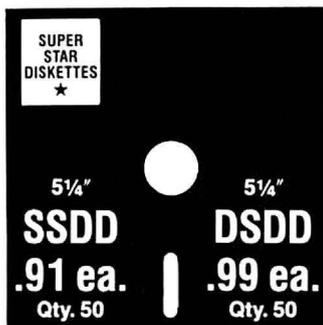
Rather they are fabricators or marketers, taking other company's components, possibly doing one or more steps of the processing themselves and pasting their labels on the finished product.

The new Eastman Kodak diskettes, for example, are one of these. So are IBM 5 1/4" diskettes. Same for DYSAN, Polaroid and many, many other familiar diskette brand names. Each of these diskettes is manufactured in whole or in part by another company!

So, we decided to act just like the big guys. That's how we would cut diskette prices...without lowering the quality.

We would go out and find smaller companies to manufacture a diskette to our specifications...specifications which are higher than most...and simply create our own "name brand" diskette.

Name brand diskettes that offered high quality at low prices.



Super Star diskettes are sold in multiples of 50 only. Diskettes are shipped with white Tyvec sleeves, reinforced hubs, user ID labels and write-protect tabs.

Boy, did we get lucky. Our Super Star Diskettes are the same ones you've been using for years...without knowing it.

In our search for the low priced, high quality diskette of our dreams, we found something even more interesting.

We found that there are several manufacturers who don't give a hoot about the consumer market for their diskettes. They don't spend millions of dollars in advertising trying to get you, the computer user, to use their diskettes.

Instead, they concentrate their efforts on turning out the highest quality diskettes they can...because they sell them to the software publishers, computer manufacturers and other folks who (in turn) put their name on them...and sell them for much higher prices to you!

After all, when a software publisher or computer manufacturer or diskette marketer puts their name on a diskette, they want it to work time after time, everytime. (Especially software publishers who have the nasty habit of copy-protecting their originals!)

Super Star Diskettes. You already know how good they are. Now you can buy them...cheap.

Well, that's the story.

Super Star diskettes don't roll off the boat from Pago-Pago or emerge from a basement plant just east of Nowhere.

Super Star diskettes have been around for years...and you've used them for years as copy-protected software originals, unprotected originals. Sometimes, depending on which computer you own, the system master may have been on a Super Star diskette. And maybe more than once, you've bought a box or two or more of Super Star diskettes without knowing it. They just had some "big" company's name on them.

Super Star Diskettes are good. So good that a lot of major software publishers, computer manufacturers and other diskette marketers buy them in the tens or hundreds of thousands.

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it's Super Star Diskettes.**

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We simply charge less.

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Order 50 Super Star Diskettes and we'll be happy to sell you an Amaray Media-Mate 50 for only \$8.75, shipping included...a lot less than the suggested retail price of \$15.95.



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One word of warning: this offer is limited only to supplies on hand. Once these supplies are used up, the prices stay the same...but there's no free Flip n' File.

The last time we ran an offer like this, everything was sold out in about six weeks.

So don't wait. Order now.

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100% certified 3M data cartridges.

DC-1000 \$13.90 ea.

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DISK WORLD!

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```

1000 DATA "RENDIR.COM"
1010 DATA 1,BF,67,01,BE,5C,00,B9,0C,00,FC,F3,A4,83,C7,05,BE,-1,68
1020 DATA 2,6D,00,80,3C,2D,75,0A,B4,09,BA,3B,01,CD,21,EB,19,-1,71
1030 DATA 3,90,B9,0B,00,FC,F3,A4,BA,60,01,B4,17,CD,21,3C,00,-1,6F
1040 DATA 4,74,07,B4,09,BA,4D,01,CD,21,CD,20,50,61,72,61,6D,-1,20
1050 DATA 5,65,74,65,72,20,65,72,72,6F,72,0D,0A,24,4E,61,6D,-1,65
1060 DATA 6,65,20,6E,6F,74,20,63,68,61,6E,67,65,64,0D,0A,24,-1,E3
1070 DATA 7,FF,-1,FF,-1

```

RENDIR.DAT: Add these lines to X-MAKER.BAS to create a subdirectory-renaming utility program.

```

1000 DATA "PRINTER.COM"
1010 DATA 1,B8,40,00,8E,D8,FA,B8,00,72,8B,1E,1C,00,83,C3,02,-1,65
1020 DATA 2,3B,1E,82,00,74,0D,89,47,FE,89,1E,1C,00,FB,B8,00,-1,E0
1030 DATA 3,4C,CD,21,BB,80,00,E4,61,50,24,FC,E6,61,B9,48,00,-1,D4
1040 DATA 4,E2,FE,0C,02,E6,61,B9,48,00,E2,FE,4B,75,EB,58,E6,-1,17
1050 DATA 5,61,EB,DA,-1,70,-1

```

PRINTER.DAT: Use these lines with X-MAKER.BAS to create PRINTER.COM.

Printer Pages

The following lines can be used with X-MAKER.BAS to create a program that will send a form feed to the printer when you type FF.

```

1000 DATA "FF.COM"
1010 DATA 1,B4,05,B2,0C,CD,
      21,CD,20,-1,C2,-1

```

I sure like the name of that command.

*Frank Fox
Hendersonville, Tennessee*

Audio Visuals

It is surprisingly easy to get high-quality sound from a PC—just connect a speaker to the round com-

Last year the experts tested the top-of-the-line Toshiba 3-in-One™ printer. Here's what they said.

“When Toshiba America called to see if there were problems testing their printers, I responded, ‘You bet—I can’t get the P1351 off Bill Machrone’s desk long enough to get its picture taken!’ It’s that good.”

(Bill Machrone is the editor of PC Magazine.)

PC Magazine
November 27, 1984

“It is setting new standards for quality and performance in the dot matrix arena.”

Computers & Electronics Magazine
November 1984

posite-video connector on the Color/Graphics Adapter. *[It's a good idea to disconnect the video display when you do this. -Ed.]*

Unlike using the PC's built-in speaker, with this approach you can control both the pitch and the volume. The pitch is controlled by sending data to the CRT controller chip using the OUT command. The volume is determined by the number of characters you send to the first line of the display.

First, find the frequency in hertz of the desired tone (see the chart accompanying the description of the SOUND statement in the

(continues)

```
10 DEFINT A-Z:CLS:KEY OFF:DEF FNHEX(X$)=VAL("8h"+X$)
20 LOCATE 3,1:PRINT "X-Maker":READ F$
30 LOCATE 5,1,1:PRINT "Now testing for data errors...please wait";
40 SUM=0:READ LN:IF LN<0 THEN 80
50 READ H$:IF VAL(H$)<0 THEN 70
60 SUM=(SUM+FNHEX(H$))*2:SUM=(SUM\256)+(SUM MOD 256):GOTO 50
70 READ CKSUM$:IF SUM=FNHEX(CKSUM$) THEN 40 ELSE GOTO 170
80 RESTORE:CLS:LOCATE 3,1:PRINT "X-Maker":READ F$
90 LOCATE 5,1,1:PRINT "Press any key to create ";F$;" ";
100 A$=INPUT$(1):PRINT:IF A$=CHR$(27) THEN END
110 LOCATE 6,1:PRINT "Working...";
120 OPEN F$ AS #1 LEN=1:FIELD #1,1 AS Bx$
130 READ LN:IF LN<0 THEN 160
140 READ H$:IF VAL(H$)<0 THEN READ CKSUM$:GOTO 130
150 LSET Bx$=CHR$(FNHEX(H$)):PUT #1:GOTO 140
160 CLOSE:PRINT:PRINT F$;" has now been created." :END
170 PRINT:PRINT "Error in DATA line";STR$(LN);". ";
180 PRINT "Check your work.":BEEP:END
```

X-MAKER.BAS: *.* software interchange program

“

”

Imagine what they will say about its successor.

The New Toshiba P351 3-in-One printer. They could say that inside the sleek new Toshiba P351 you'll find the ultimate 3-in-One printer. Because it offers a combination of:

Letter-quality printing. Perfectly translated graphics. And speed. (100 cps letter. And draft speed improved to 288 cps.)

They could say you'll appreciate the 24-pin dot matrix head that gives the P351 its exemplary letter and graphic quality.

They could say the new P351 gives you an almost unlimited number of ways to express yourself. With both downloadable software fonts and new plug-in font cartridges.



And they could say the new P351 is not only the best looking printer in the \$1,000 to \$2,000 range. But also the most reliable.

Of course, we're not putting words in their mouths. Just the ultimate 3-in-One printer in their hands. And yours.

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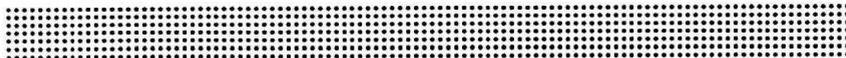
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QIC-502

Circle 983 on reader service card
294



```

10 SCREEN 0,1 : WIDTH 40 : CLS
15 REM      Last movement of Beethoven's Fifth Symphony
18 ' Set frequencies of notes
20 C = 130.85
30 D = 146.85
40 E = 164.8
50 F = 174.6
60 G = 196
70 A = 220
80 B = 246.9
90 C2 = 261.7
93 VOLUME = 28
95 ' Play the music
100 NOTE = C : DELAY = 240 : GOSUB 500
110 NOTE = E : GOSUB 500
120 NOTE = G : DELAY = 360 : GOSUB 500
130 NOTE = F : DELAY = 60 : GOSUB 500
140 NOTE = E : GOSUB 500
150 NOTE = D : GOSUB 500
160 NOTE = C : GOSUB 500
170 NOTE = D : GOSUB 500
180 NOTE = C : DELAY = 240 : GOSUB 500
190 NOTE = C : DELAY = 60 : GOSUB 500
200 NOTE = C : GOSUB 500
210 NOTE = D : DELAY = 240 : GOSUB 500
220 NOTE = D : DELAY = 60 : GOSUB 500
230 NOTE = D : GOSUB 500
240 NOTE = E : DELAY = 240 : GOSUB 500
250 NOTE = C : DELAY = 30 : GOSUB 500
260 NOTE = D : GOSUB 500
270 NOTE = E : GOSUB 500
280 NOTE = F : GOSUB 500
290 NOTE = E : GOSUB 500
300 NOTE = F : GOSUB 500
310 NOTE = G : GOSUB 500
320 NOTE = A : GOSUB 500
330 NOTE = G : GOSUB 500
340 NOTE = A : GOSUB 500
350 NOTE = B : GOSUB 500
360 NOTE = C2 : DELAY = 360 : GOSUB 500
370 END
500 ' Sound procedure
510 NUMBER = 1000000! / NOTE : NUMBER = NUMBER / (8 * 63.5)
520 T4 = INT(NUMBER)
530 T5 = INT( (NUMBER - T4) *8)
540 T4 = T4 - 1
550 OUT 980,4 : OUT 981,T4      ' Select register 4 and send value
555 OUT 980,5 : OUT 981,T5     ' Do same using register 5
560 LOCATE 1,1 : PRINT STRING$(VOLUME,CHR$(219));SPACES$(39-VOLUME)
570 FOR DL=1 TO DELAY * 2 : NEXT
580 ' Decay
590 FOR J = VOLUME TO VOLUME - 10 STEP -1
600 LOCATE 1,J : PRINT " "
610 NEXT
620 RETURN

```

CRTMUSIC.BAS: Example of
programming the Color/Graph-
ics Adapter to create musical
tones

(continues)

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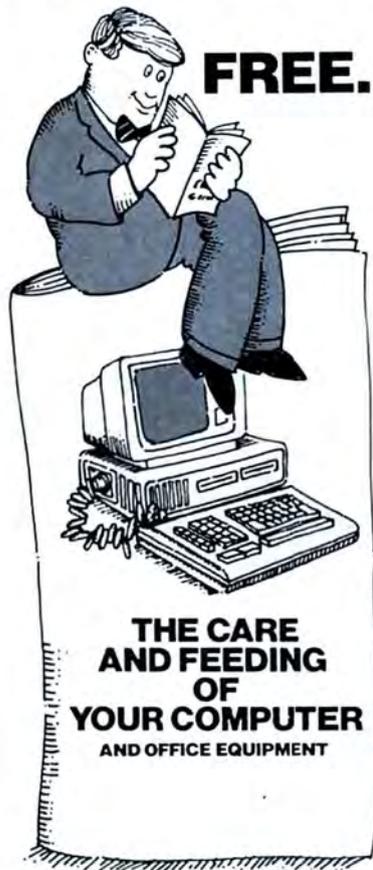
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BASIC manual), then convert the frequency to a value using the formula

$$\frac{10^6}{\text{frequency} \times 63.5 \times 8}$$

To make a sound, send the integer part of that value minus 1 to the CRT controller chip's number 4 register and the decimal portion times 8 to the number 5 register. These steps are illustrated in the program CRTMUSIC.BAS.

Bram Boroson
Glen Rock, New Jersey

Editor's note: This is untested and definitely experimental. Please do not subject your CRT or your \$2000 stereo system to potential damage. I suggest you reboot your computer to restore the original settings before you reconnect the CRT.

Turbo Update

As an update to my tip for eliminating the automatic backup files created by Turbo Pascal ["Turbo Pascal Patch," * .*, PCW, April 1985], here are the patches for version 3.0. Change line 20 of the TURBOFIX.BAS program to **20 B=12707 : K=12709**. You can modify TURBO-87.COM by changing the file name in line 30 and changing line 20 to **20 B=11372 : K=11374**. Likewise, the values for TURBOBCD.COM are **20 B=12484 : K=12486**. Note that the letters BAK are now stored contiguously in the Turbo programs.

Stephen Wisdom
New York, New York

(continues)

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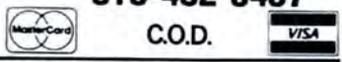
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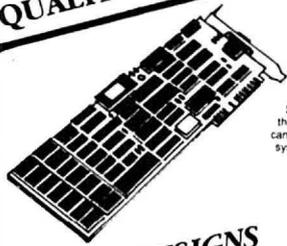
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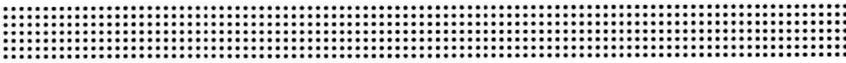
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```
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1020 DATA 2,74,15,8A,16,29,01,80,FA,1A,74,0C,80,E2,7F,80,F2,-1,70
1030 DATA 3,0F,B4,06,CD,21,EB,DF,CD,20,00,00,-1,8A,-1
```

CRYPT.DAT: Add these lines to X-MAKER.BAS to create a simple data encryption program.

Somewhat Secret

The lines shown in CRYPT.DAT can be used with the X-MAKER.BAS program to create a simple data encryption program called CRYPT.COM. To use CRYPT.COM, type the command

```
CRYPT < infile > outfile
```

where *infile* is the name of the file you wish to encrypt or decrypt and *outfile* is a file name for the result of that operation. The program performs a direct character translation and alternates its effect each time it runs. While not an unbreakable cipher, it is suitable for many uses.

Stephen Berg
Kailua, Hawaii

Editor's note: Use CRYPT.DAT with X-MAKER.BAS as described earlier in this column.

DATENOW on Drive C:

The instructions for changing DATENOW.BAS to use drive C: ["Date to Remember," *.*, PCW, May 1985] contained an erroneous checksum. The correct way to make the program use drive C: is to change the last three values in DATA line 6 (line 1060) from 41, -1, and 12 to 43, -1, and 16.

Elizabeth Folsom
Marion, Massachusetts

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PRICING MADNESS

Once again, as Federal Express picks up our ad at the very last millisecond before this issue's advertising deadline, here we sit with dozens of price reductions and new product announcements which have arrived too late for us to let you know.

Why, our ad manager asks, do we always go through a last minute price update frenzy, just seconds before our ad is due at the publisher, when we know that despite our heroic effort, many of these products will cost even less by the time you read this ad.

How, she asks, can we get a crystal ball to forecast what fantastic promotions and specials our suppliers are going to offer from now to the date this ad gets to the newsstand over two months from today?

Well, we decided that she has a good point. While we'll still keep getting our grey hairs and ulcers from last minute revisions, we will start publishing this notice and ask our readers to make a simple check. Look at any four back issues of this magazine (yes we're in every one) and track the prices on the most popular products. You will see that many drop with every issue. Most of these price changes were instituted well before the issue was printed and our members always pay the lower price. This should prove that this notice is much more than hype.

Given the current madness in the PC industry with its spur of the moment pricing and instant product introductions, you will find it always pays to call for our latest prices. You will be glad you did.

GAMES & EDUCATIONAL SOFTWARE

(Please add \$1 shipping and handling for each title ordered from below.)

	Wholesale	Wholesale \$ 27.00*
Bluebush Chess (Your Toughest Opponent)	\$ 34.00*	
Bluechip Millionaire/Old Baron or Tycoon	31.75*	
Broderbund Lode Runner	19.75*	
CBS Goren Bridge Made Easy	45.00*	
CBS Mastering the SAT	81.00*	
CDEX Training for Word Star	37.25*	
Comprehensive Intro to Personal Computing	32.00*	
Davidson Math Blaster, Word Attack!	28.50*	
Hayden Sargon III	28.97*	
Individual Professor DOS	32.50*	
Individual The Instructor	24.50*	
Infocom Zap 1 or Wizard	29.50*	
Infocom Deadline, or Suspended	27.00*	
Microsoft Flight Simulator		59.95*
Mouse Systems PC Paint-Turn your PC into A Color Macintosh!		27.00*
Scrabble Masterpiece		27.00*
Sierra On-Line King's Quest		18.00*
Sierra On-Line Crossfire		23.00*
Sublogic Night Mission Pinball		20.77*
Spinaker Alphabet Zed Krider Comp.		15.97*
Story Machine, Face Maker, Hey Diddle Diddle, Rymes & Riddles		24.97*
Spinaker Delta Drawing		20.77*
Spinaker Most Amazing Thing		21.00*
Virtual Combinatics Micro Cookbook		21.00*

BUSINESS SOFTWARE

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

ATI How to use Multimate	\$ 42.00*	Micro Pro Wordstar 2000	\$222.00*
ATI How to use Microsoft Word	42.00*	MicroRim RBase 5000	325.00*
ATI How to use Lotus 1-2-3	42.00*	MicroSoft C Compiler	275.00*
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Ashton-Tate Framework	310.00*	Latest Version 2.0	105.00*
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Borland Turbo Pascal	25.75*	Monogram Dollars & Sense	102.00*
Borland Turbo Pascal 8087	48.75*	Multimedia Masterpiece (latest version)	270.00*
Borland Superkey	34.75*	Oasis The Word Plus	90.00*
Central Point Copy II PC	20.00*	Open Systems P/O Sales AR/INV/CL A/P Term Mgr	325.00**
Conceptual Instruments Desk Organizer	157.00*	Powerbase Powerbase	222.00*
Conceptual Instruments CP/MS	137.00*	Real World G/L, A/P, R/R or OE/INV	345.00**
Digital Research DR Logo	57.00*	Rosecroft Prokey Version 3	74.00*
Digital Research Gem Desktop	28.00*	Ryan McFarland RM COBOL (Dev. System)	570.00*
Digital Research Gem Draw	73.00*	Samma Samina II Word Processor	227.00*
Enertronics Enertronics with Plotter Option	238.00*	Samma Samina - Word Processor	270.00*
Financial Software Sideways	34.00*	Satellite Software Word Perfect	195.00*
Harvard Harvard Project Manager	183.00*	Softcraft Fancy Fonts	125.00*
Hayes Smartcom II - New V710 Emulator	59.00*	Softstyle SET-FX	35.00*
Hayes Edge The Management Edge	137.00*	Software Publishing PFS: File, Write, Graph	72.00*
Human Edge The Sales Edge	137.50*	Software Publishing PFS: Report	64.00*
Human Edge Mind Prober	26.75*	Softcom SuperCalc III	169.00*
Litewise Volkswriter Deluxe	135.00*	Verbatim Disk Drive Analyzer	25.00*
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Apple Macintosh Base System	CALL	Apparel 256K Memory Board with 64K	\$ 118.00* (1.75)
Apple Apple IIe	CALL	Apparel Combo II w/strip/games/clock/stw	81.00* (2.48)
Apple Apple IIIe	CALL	Apparel AT Ram Expansion card	138.00* (2.50)
Columbia Desktop & Portable Systems	CALL	AST Six-Pack Plus with 64K	222.00* (2.50)
COMPAG Hard Disk Portable	\$2,285.00* (49.35)	AST II Plus II	120.00* (2.50)
10MB Hard Disk II Floppy 256K		AST Advantage for AT	375.00* (2.50)
Compaq DeskPro Tape Backup System	3,018.14* (65.20)	EVEREX Magic Card 64K	160.00* (2.50)
w/40K/1 Floppy/10MB Hard Disk/10MB Tape Drive/Printer		Full-Screen Software - Game Port	
DATA General DG ONE	1,999.00* (43.20)	included Extra Software	
128K/1 Drive "Real Portable"		ORCHID BLOSSOM W/64K	200.00* (2.50)
IBM PC Base System 205DD/FDC/256K	1,495.00* (32.55)	Quadram Improved Quadboard w/OK	170.00* (2.50)
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IOmega Bernoulli Box Dual 10MB Drive	\$2,275.00* (49.14)		
PC Network 10MB w/16/16/12 High Res	459.00* (9.92)		
Automatic Drive, New/low price			
Drives by Shuttle/Trantor			
PC Network 10MB Internal Tape Backup	475.00* (10.26)		
Same Unit used in Compaq's DeskPro			
Maynard WS-2 same as WS-1 but with	930.00* (20.30)		
Sanstar Floppy Controller (uses 1 slot)			
Panasonic Half Height DSD Drive Par	145.00* (3.10)		
PC Network Half Height Drives Our volume	77.50* (1.67)		
lets us import these Brand Name Drives			
Directly from the Source!			
Tandon TM 100-2 Full Height DSD Drive	93.00* (2.20)		
Talgram 25MB External Hard Disk	2,375.00* (51.30)		
with 60MB Tape Backup			
Tec PD 55-B Half Height DSD Drives	90.00* (1.94)		
Tec T-2MB Half Height DSD Drive for AT	110.00* (2.40)		

MEMORY CHIPS

All chips guaranteed for life!			
64K Memory Upgrade Kits (3 chips)	\$ 7.20* (1.00)		
64K Dynamic Ram Chips (2 chips)	.80* (1.00)		
256K Dynamic Ram Chips (2 chips)	5.00* (1.00)		
128K AT Mother Board Chips (2 chips)	7.50* (1.00)		
Anchor Mark XII	\$ 230.00* (5.00)		
Hayes Smartmodem 300	125.00* (5.00)		
Hayes Smartmodem 2400	568.00* (5.00)		
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MONITORS

Amdel Video 300G Composite Green	\$ 110.00* (3.00)		
Amdel Video 300A Composite Amber	120.00* (3.00)		
Amdel Video 310A IBM Type Amber	130.00* (3.00)		
Amdel Color 300 (NEW!) Composite	215.00* (4.64)		
Amdel Color 600 (NEW!) High Res RGB	365.00* (7.88)		
Amdel Color 700 (NEW!) High Res RGB	455.00* (9.53)		
Amdel Color 710 (NEW!) 700 w/100	485.00* (10.48)		
Glare/Long Phosphor			
Princeton FX-12 RGB Monitor	CALL		
Princeton MAX-12E RGB/MONO	CALL		
Princeton SR-12 Ultra High Res RGB	CALL		
Quadram Quadronline II NE W	370.00* (8.21)		
540x200 RGB w/14" Screen			
Black Phosphor Max. IBM Case			
Samsung 12" TTL IBM Type Amber	89.50* (5.00)		
A great looking performing monochrome			
flat panel manufacturer of IBM's own			
color monitor!			
Taxan 420 Super High Res RGB Monitor	380.00* (8.21)		
Taxan 440 Highest Res RGB (720x400)	525.00* (11.34)		
Currently Available Works With Perseus Bob Card			
Zenith ZVM-120 Green High Res	78.00* (2.50)		
(Consumer Reports Rated Best Buy!)			

VIDEO CARDS

Hercules Color Card w/Parallel Port	\$ 142.00* (3.20)		
Hercules Monochrome Graphics Cards	273.00* (2.50)		
Paradise New Modular Multidisplay Card	244.00* (2.50)		
Perayatt Bob Card Ultra High Res Color	385.00* (2.50)		
Card with Mono Card and large capacity disk drive			
STB Graphix Plus II NEW!	235.00* (5.00)		
(Simultaneous Mono Graphics & Color)			

ACCESSORIES AND SUPPLIES

Brand Name DSD Diskettes	\$ 14.00* (11.00)		
Manufactured by Hewlett-Packard			
Curtiss PC Pedestal II	32.50* (2.50)		
PC Network Replacement 130 Watt IBM-PC	90.00* (2.70)		
Power Supply - Gres your PC (Old or New) the same			
capacity as an XT. Good for add in tape drives (without			
need for a power brick) and large capacity disk drive.			
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*PC NETWORK Members pay just 8% above the wholesale price, plus shipping. All prices reflect a 3% cash discount. Minimum shipping \$2.50 per order. International orders call for shipping & handling charges. Personal checks please allow 10 working days to clear.

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2 Double Sided Double Density 320/360K Disk Drives

Your lowest cost starting point for the system of your choice. Combine it with any of the monitors, video cards, multifunction cards and accessories listed in this ad, and prove The NETWORK can't be beat.

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IBM PC w/256K

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Half Height 10MB Drive Allows Room

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1 1/2 times faster than XT

Automatic Hard Disk Boot Feature.

Increase productivity in any business or professional situation. The 10MB hard disk eliminates cumbersome floppy disk changes, simplifies operations and dramatically speeds program execution time. The NETWORK's buying power provides you with better than XT performance at a price lower than you'd expect to pay for a standard PC.

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8 OPTIONAL BUSINESS RENTAL LIBRARY—All members can join our BUSINESS RENTAL LIBRARY featuring over 1000 available titles for just \$25 PER YEAR above the base membership fee. This entitles you to rent business software AT JUST 20% of the DISCOUNT PRICE FOR A 14 DAY PERIOD. If you decide to keep the software, the entire rental fee is deducted from the purchase price. VIP MEMBERS GET A FULL 30 DAYS for just \$30 above the V.I.P. base fee. This also includes the game library privileges for a \$5 combination savings.

9 OPTIONAL GAME SOFTWARE RENTAL LIBRARY—The Game Rental library is available to members for just \$10 PER YEAR and permits evaluation (or just enjoyment) of any game or educational software product as above.

10 SPECIAL SAVINGS BULLETINS—THE PRINTOUT—Issued Quarterly at no charge to Network members only! The Printout contains all the New Product listings and price changes you need to keep your Catalog up to date. Also, we buy excess dealer inventories, and store bankruptcy closeouts, which we turn around and make available to our members at fantastic savings via THE PRINTOUT.

11 DISCOUNT BOOK LIBRARY—Working with numerous publishers and distributors, The NETWORK has assembled a library of over 1000 computer related books and manuals at savings of up to 75% from the normal store price.

12 MEMBERSHIP REFERRAL BONUS—Our most valuable source of new members is you! To date almost 40% of our members have been referred by word of mouth from other satisfied members. For those of you who refer new members, The NETWORK will credit a cash bonus to your account applicable to any future purchase.

13 CORPORATE ACCOUNT PROGRAM—Almost 50% of The NETWORK's members are corporate buyers and users (see opposite page left). The NETWORK can establish open account status and assign designated account managers to expedite orders, and coordinate multiple location shipments.

14 QUANTITY DISCOUNTS—For large corporations, clubs, and repeat or quantity buyers The NETWORK can extend additional single order discounts, when available to us from our manufacturers and distributors.

15 PRICE PROTECTION—The PC Industry is crazy!! Prices change not yearly or monthly or even weekly but often day by day! These changes are sometimes up but are mostly down!! THE NETWORK GUARANTEES THAT IN THE EVENT OF A PRODUCT PRICE REDUCTION, BETWEEN THE TIME YOU PLACE YOUR ORDER AND THE TIME THE PRODUCT SHIPS YOU WILL ONLY PAY THE LOWER AMOUNT!!

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27128	16Kx8 250 ns	3.47
27C64	8Kx8 200 ns	7.85
2764	8Kx8 250 ns	2.50
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Apparat, Inc.
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ORDERING AND DEALER INFORMATION

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Stores in Denver & Chicago / *On all cards sold after June 1, 1984

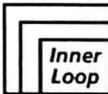
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Circle 532 on reader service card

PC EXPANSIONS

AST SixPakPlus (64k)	\$259
SixPakPlus (384k)	\$339
MegaPlus (64k)	\$269
Advantage (128k)	\$419
I/O Plus	\$129
PCnet - starter kit	\$809
Quadboard (64k)	\$245
Quadboard (384k)	\$319
Quadmeg-AT (128k)	\$319
Quadport-AT	\$105
HERCULES graphics board	\$319
Color Card with PP	\$159
HAYES Modems 2400	\$call
Smartmodem 1200	\$409
Smartmodem 1200B	\$379
Set of 9 chips (64k)	\$15
256k chips (each)	\$6
8087 chip	\$119
Maynard Disk Controller	\$100
Sandstar Series	\$call
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PC World Directory

PC World Directory is a comprehensive listing, by category, of products and services for the IBM PC, look-alikes, and compatibles. It provides rapid access to the burgeoning PC marketplace for both readers and advertisers.

FORMAT: The standard format includes a product ID, a 300-character descriptive ad, and company name, address, and telephone number.

Advertisers may choose among categories already in use, or they may create their own. Display advertisers can cross-reference their current ad to the PC World Directory for increased exposure at low cost.

RATES: Listings are accepted for three-time consecutive insertions at a rate of \$891 (\$297 per issue). We offer a six-time insertion, 15 percent discount contract for a total of \$1500 (\$250 per issue). Listings must be prepaid (except for established display advertisers) upon submission of ad copy. Checks, money orders, VISA, and MasterCard are acceptable.

DEADLINE: For copy deadlines, contact a PC World Directory sales representative at 415/861-3861 or 800/872-7808 (CA), 800/872-7800 (nat'l). Please send copy and prepayment to PC World Directory, 555 De Haro St., San Francisco, CA 94107.

Accessories

Supplies

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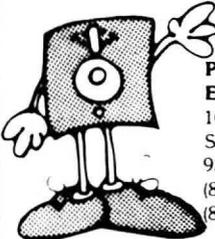
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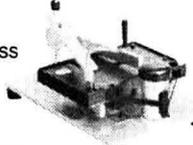
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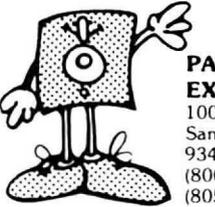
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IRMA for PC & XT	1195	857
Techland		
3276 w/Keyboard	945	870

COMPUTERS

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AT&T		CALL
Zenith		CALL

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AST		
Monograph Plus	499	330
Hercules		
Graphics Card	499	295
Color Card	245	150
Paradise Systems		
Multi Display Card	459	275
Modular Graphics Card	395	264
STB		
Graphics Plus II	495	345
Tecmar		
Graphics Master	695	469

MASS STORAGE SYSTEMS

	Retail Price	Micro Flash
Alloy		
Stor 36MB for AT&T	4295	3261
Iomega		
Bernoulli 10/10 20MB	3695	2599
J-2		
33MB External	2295	1432
10MB/10MB Tape B.U.	1595	1145
MSI		
MT25, 25MB Tape B.U.	1050	853
Priam		
42MB Internal AT/XT	2195	1755
Sysgen		
Sysgen II G-20	3995	2938
Quic-File 45 Int. AT	1395	1058
Quic-File 45 Ext.	1495	1115
Image iOMB Tape B.U.	995	805
Tallgrass Technologies		
25MB/60MB Tape B.U.	3495	2815
80MB/60MB Tape B.U.	7495	6260

MEMORY EXPANSION CHIPS

	Retail Price	Micro Flash
64K RAM Set of 9		19
256K RAM Set of 9		69

MODEMS

	Retail Price	Micro Flash
AST		
Reach 1/2 Card 1200	549	395
2400 Baud Sync	795	716
Anchor		
Mark XII	399	240
Hayes		
Smartmodem 1200	599	449
Smartmodem 2400	899	655
Prentice		
Popcorn X 100 External	475	380
U.S. Robotics		
Courier 2400	699	490

MONITORS

	Retail Price	Micro Flash
AMDEK		
Amber 310A	230	159
Color 500 RGB	450	335
Color 600 RGB	599	430
Color 710 RGB	799	540
PGS		
Max 12 Amber	249	179
HX 12 RGB	695	466

MULTIFUNCTION CARDS

	Retail Price	Micro Flash
AST		
MegaPlus II 64K	395	265
SixPakPlus 64K		
w/Sidekick	395	265
Intel		
Above Board 64K	395	295
Orchid Technology		
Blossom "O" K, C, S, P	295	190
PC Turbo 186 w/128K	895	587
Quadram		
Quadboard "O" K	325	230

PC SOFTWARE

	Retail Price	Micro Flash
ACCOUNTING		
BPI		
General Accounting	595	277
Sorclm/IUS		
General Ledger	595	336
COMMUNICATIONS		
Hayes		
Smartcom II	149	93
Menlo Corporation		
In-Search	495	350
Microstuff		
Crosstalk XVI	195	100
Microsoft*		
Access™	250	199

PLOTTERS

	Retail Price	Micro Flash
Houston Instruments		
DMP 29	2295	1790
DMP 51 or DMP 52	5995	4676
DMP 695	695	540
DT-114 Digitizer	810	720
Roland		
DXY 880	1295	970
Nicolet Zeta		
Zeta 824		CALL
PRINTERS		
Citizen		
MSP 10 160 CPS	449	329
MSP 15 160 CPS	649	489
Diablo		
630 API	2095	1704
150 Inkjet	1295	1025
Epson		
LX-80	299	230
FX-80 ^s	499	355
FX-100 ^s	699	498
JX-80 Color	699	498
LQ 1500	1295	918
JUKI		
6300	995	750
Okidata		
Microline 192 IBM	499	385
Microline 193 IBM	699	545
Microline 84P	899	710
NEC		
Eif 360, S/W & Cable	595	468
3550 Spinwriter	1440	1030
Qume		
Sprint 1140	1681	1379
Sprint 1155	1895	1565
Toshiba		
1340	799	619
1351	1895	1345
351 Par./Ser.	1945	1375

TERMINALS

	Retail Price	Micro Flash
Kimtron		
KT-7PC 12 inch	895	769
KT-TASCII 14 inch	945	819
Wyse		
WY-50	599	485
WY-75	799	650
Televideo		
910	699	619
925	995	799
Qume		
102 Green	595	460
102 Amber	610	477

MISCELLANEOUS

	Retail Price	Micro Flash
Computer Accessories		
Power Director P-12	199	135
Microsoft*		
Serial Mouse w/Paint Brush	195	135
Mouse Systems		
Mouse	220	158
Tripp-Lite		
Power Backup	559	454
Isobar 4	89	62

DATABASES & INTEGRATED

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Analytica Corp.		
Reflex	495	CALL
Ashton-Tate		
dBase III	695	374
Framework	695	374
Cosmos		
Revelation	950	720
Innovative Software		
Smartware System	895	495
Microrim		
R:Base 5000	700	425
Software Publishing		
PFS:File	140	99
PFS:Report	125	88

GRAPHICS

	Retail Price	Micro Flash
BPS		
Business Graphs	350	255
Graphic Communications		
Graphicwriter	395	279
Microsoft*		
Chart	250	155
Windows		CALL
Software Publishing		
PFS:Graph	140	99

LANGUAGES

	Retail Price	Micro Flash
Borland		
Turbo Pascal 3.0	70	49
Turbo Pascal w/8087	95	69
Digital Research		
C Compiler 3.0	350	220
Microsoft*		
FORTAN Compiler	350	230
C Compiler	395	276
Nantucket		
The Clipper Compiler	695	529

SCHEDULING

	Retail Price	Micro Flash
Breakthrough Software		
Time Line	395	287
Harvard Software		
Total Project Manager	495	309
Microsoft*		
Project	250	155
Software Publishing		
PFS:Plan	140	99

SPREADSHEETS

	Retail Price	Micro Flash
Innovative Software		
Smart Spread Sheet	495	325
Microsoft*		
Multiplan™	195	119
Sorclm/IUS		
Supercalc 3	395	196

UTILITIES

	Retail Price	Micro Flash
Borland		
SideKick Protected	55	35
SideKick Unprotected	85	48
SuperKey	70	45
Bourbaki		
"1 Dir"	95	60
Digital Research		
GEM Desktop	50	35
Funk Software		
Sideways	60	35

WORDPROCESSING

	Retail Price	Micro Flash
Innovative Software		
Word Processor	395	250
Lifetree		
Volkswriter Deluxe	295	167
Living Videotext		
Think Tank	195	98
Micropro		
Wordstar 2000	495	259
Microsoft*		
Word with Spell	375	228
Multimate International		
Multimate	495	CALL
Samna		
Word III	550	276
SSI		
WordPerfect	495	227
Software Publishing		
PFS:Write	140	99

MACINTOSH

MAC HARDWARE

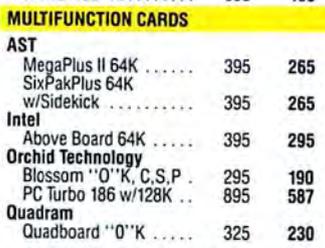
	Retail Price	Micro Flash
Assimilation		
Mac Turbo Touch	129	105
AST		
RamStak XL 2MB	2695	1250
Hayes		
Smartmodem 1200	599	449
IOMEGA		
Bernoulli Box 5MB	1895	1366
Koala		
MacVision	400	239
Microsoft*		
MacEnhancer™	249	199
Mousetrak		
Mousetrap	13	10
Prometheus		
ProModem M	549	359
Sony		
3.5" Diskettes Box 10	60	37
Thunderware		
Thunderscan	229	219

MAC SOFTWARE

	Retail Price	Micro Flash
Arrays		
Home Accountant	100	69
CSD		
MacLion	375	249
Dow Jones		
Straight Talk	79	54
1st Byte		
Smooth Talker	149	119
Haba		
Quartet	200	139
Hayden		
Ensemble	300	189
MusicWorks	80	59
SAT	100	74
Hayes		
Smartcom II/Mac	149	119
Human Edge		
Management Edge	250	169
Infocom		
Hitchhkr's Guide	40	29
Living Videotext		
Think Tank 512	245	139
Microsoft*		
Basic Interpreter	150	99
Business Pack	595	399
Chart	125	89
EXCEL™	395	CALL
File	195	119
MacLibraries™		CALL
Multiplan™	195	119
Word	195	119
Monogram		
Dollars and Sense	150	98
Odesta		
Helix	395	249
Paladin		
Crunch	295	209
ProVue		
OverVUE	295	179
Software Publishing		
PFS:File & Report	195	129
T/Maker		
ClickArt	50	39
Telos		
Filevision	195	109
Videx		
MacVegas	59	35

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Effortless Communication

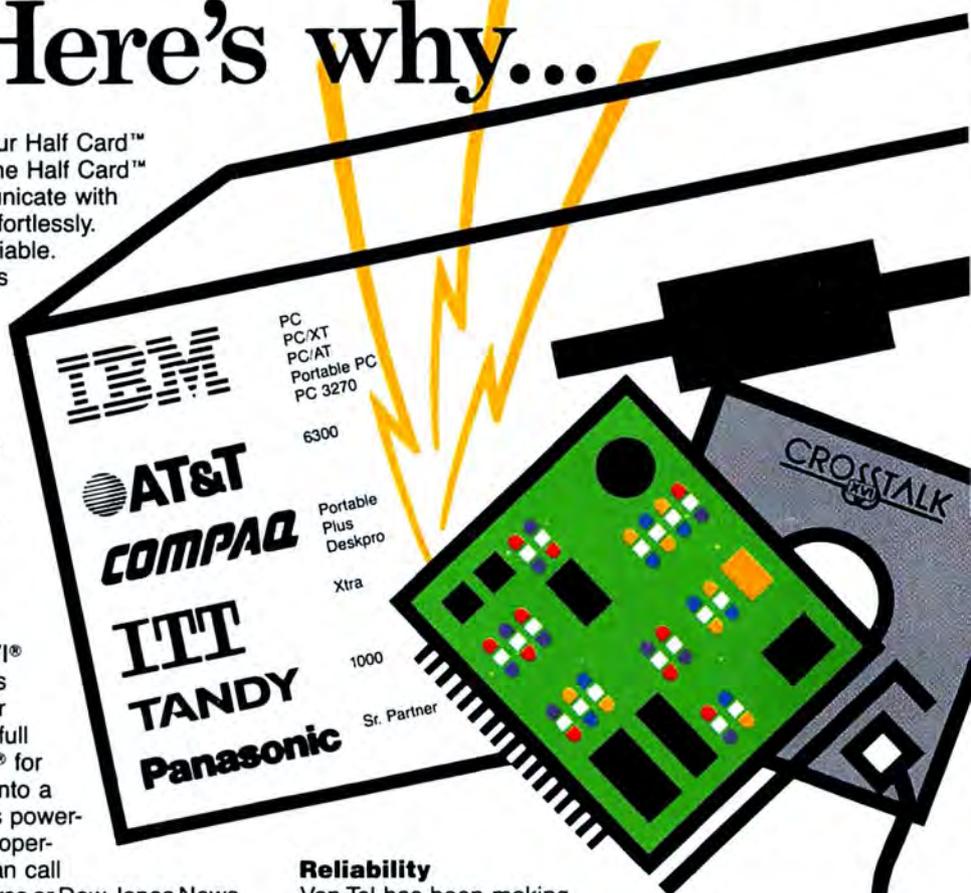
Each Half Card™ comes with Crosstalk-XVI® communications software, by Microstuf. It's the easiest to use, whether you're a beginner or an old hand, and the most powerful. A full on-line help menu makes using Crosstalk® for the first time a snap. It can turn your PC into a terminal on a mainframe computer with its powerful terminal emulation feature. It will even operate your PC when you're not there. You can call into an information service such as The Source or Dow Jones News Retrieval, or transfer files and electronic mail, all at the touch of a button. The Half Card™ connects your computer to the world. Effortlessly.

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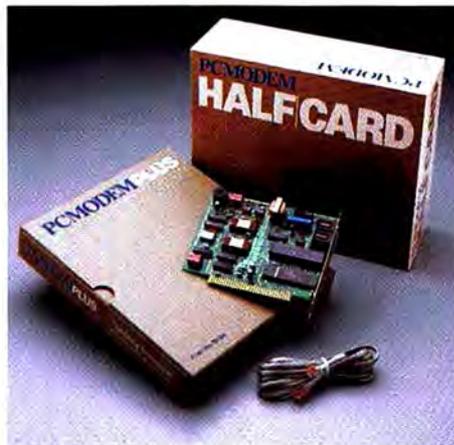


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