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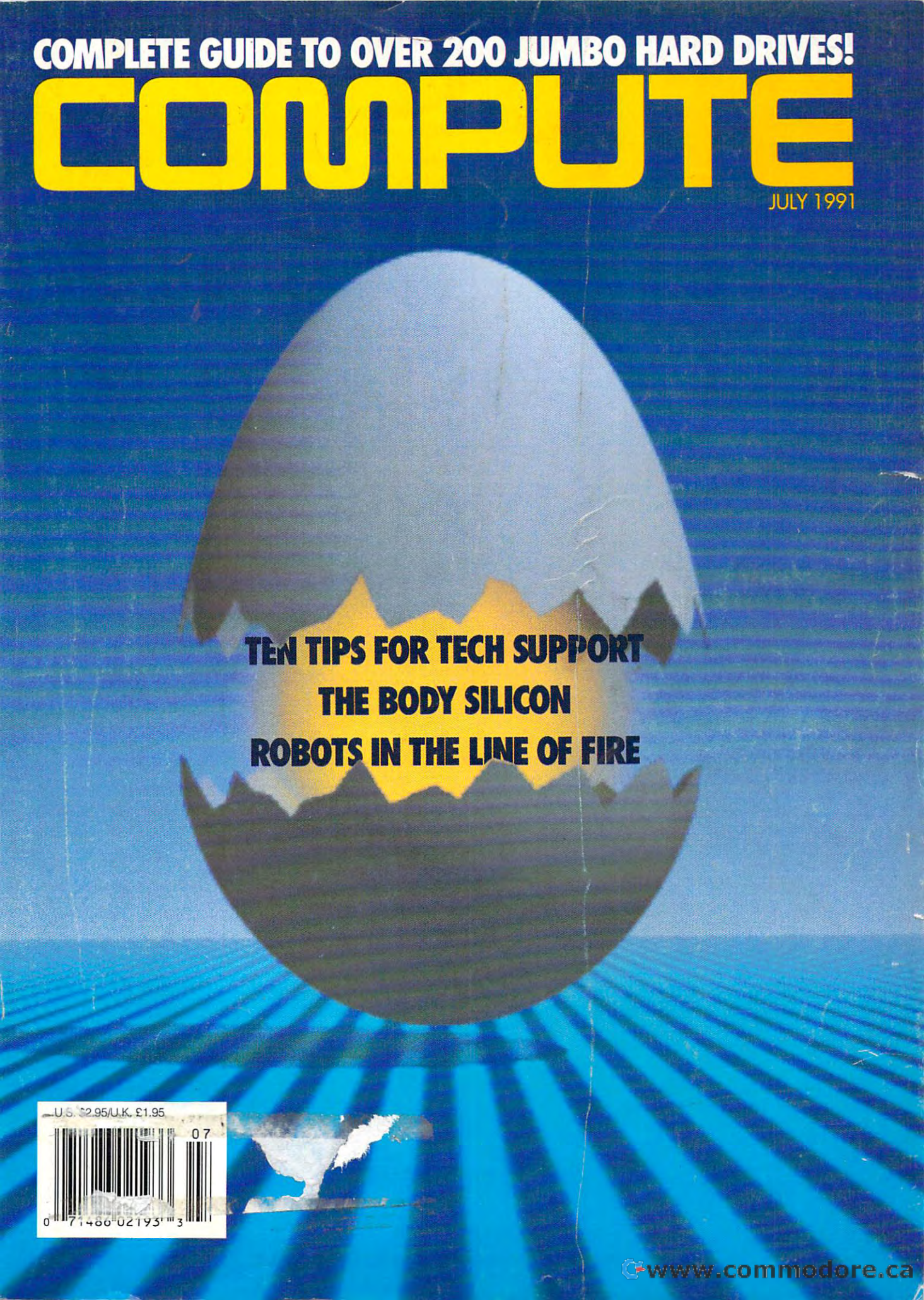

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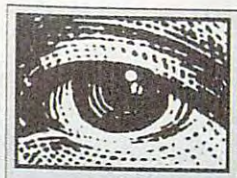

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PC Computing

[GeoWorks] has produced a GUI capable of making the PC a more friendly and powerful creature to the millions of people Windows and OS/2 have left behind...
FIRST LOOKS, PC Magazine

[PC/GEOS] thrives in a 640K 286, and even performs respectably on an 8088. On a run-of-the-mill 386, [PC/GEOS] peforms crisply in a way that Windows only dreams of...
PC Magazine

GeoWorks PC/GEOS: What Windows 3.0 Should Have Been.
INFO WORLD

The Geos environment sports a simplified (but sharper-looking) Windows-like interface with many of the same features, comes with Ensemble (a bigger and more capable suite of applications), and runs lickety-split on 80286s and XTs.
PC WORLD

The Small Office REPORT
SPRING/SUMMER 1991

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COMPUTE

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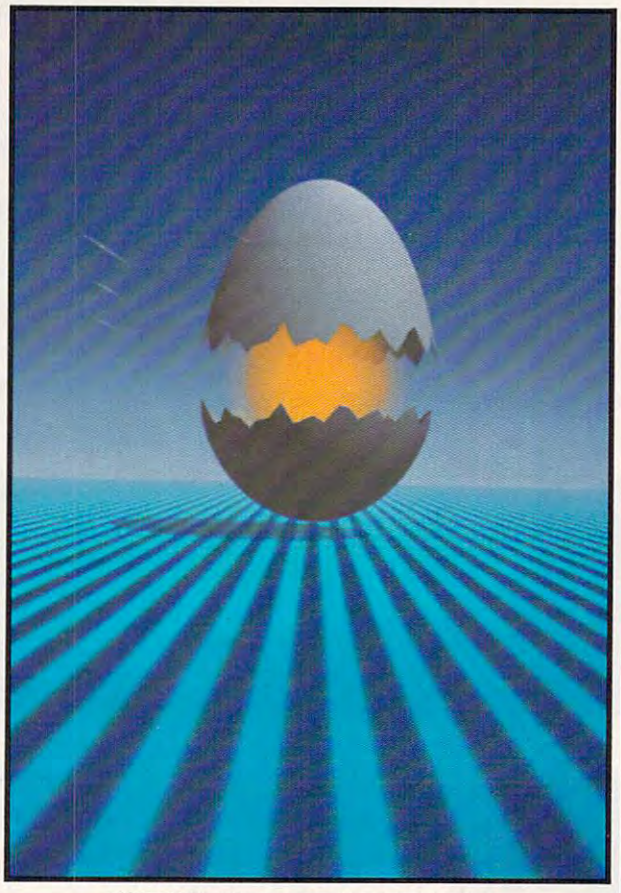

HIROMASMA SUGIURA/WESTLIGHT INTERNATIONAL

ON THE COVER

Hiromasma Sugiura employed ray-tracing techniques on an NEC computer to develop the art featured on our July cover.

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COMPUTE is looking for exceptional computer-generated art for use on future covers and with feature articles. If you're a computer artist interested in national exposure, send us examples of your work in either color slide or transparency format. Include a brief note listing the title of the work and the hardware and software used in its creation. Please address your samples to Art Director, COMPUTE Publications International Limited, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.

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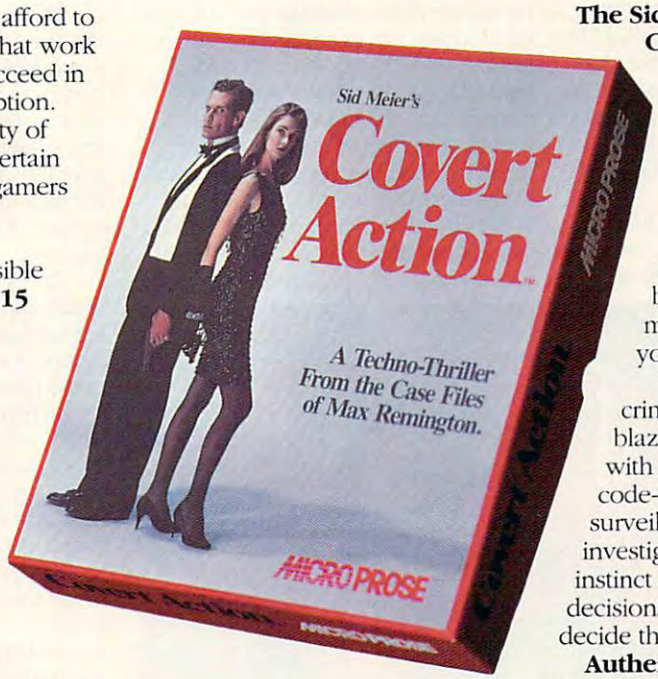
Sid Meier's Latest Game Is Just Like All His Others... Terrific!

Most game designers can't afford to repeat themselves. Formulas that work so well in one game rarely succeed in the next. Sid Meier is an exception. His games, despite the diversity of subject matter, always share certain qualities, qualities computer gamers have grown to love — and demand.

Now, the designer responsible for the award-winning hits **F-15 Strike Eagle, Pirates!, Red Storm Rising, F-19 Stealth Fighter** and 1990's Best Strategy Game*, **Railroad Tycoon**, presents the high-tech, dangerous world of international espionage. Once again the subject is unique; but Sid's "magic touch" remains.



The Sid Meier Checklist For Fun:

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Computer Gaming World • May, 1990

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* Software Publishers Association

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PETER SCISCO

Good health is a lot like the weather: Everybody talks about it, but nobody does anything about it. Despite Madison Avenue's efforts to convince us we should be stair-stepping, bicycling, and jumping for our lives, most people are just too busy to do more than rush home and grab a sack of chips in time to catch a flick on HBO.

Around the winter holidays, our thoughts turn to dieting, but we always wait for the New Year so we can make a resolution out of all this good-health business. Another broken promise. Another guilty conscience. Another raid on the fridge.

And then technology comes along to save us. From CAT scans to electronic microscopy, from jogger logs to nutrition guides, computers have had an amazing impact on our health over the last 20 years. Take a look around your doctor's office. Everything is automated, from insurance filings to blood analyzers.

There's no question that computer technology has brought the possibility of better health management, if not better health, to all of us, computer users and Luddites alike. Computers are good at counting numbers, at presenting facts we can compare and analyze, at turning raw data into charts and graphs we can pore over to our hearts' content. They can bring us to surprising conclusions in startling and innovative ways. That's the strength of technology and, in many ways, the basic pattern of healthy living—taking stock, analyzing, drawing conclusions, programming a solid nutritional base, establishing an effective exercise program.

This is all on the bright side, but there's a dark side as well—a venerable library of fact and folklore about the health risks of computers. Repeated motions, like entering data with a keyboard for several hours a day, can lead to Repetitive Stress Injury or Carpal Tunnel Syndrome. And although the effect of radiation from monitors, laser printers, and the rest of the electronic gear stashed in our homes is still a matter of debate, the discussions have become more agitated, much like the arguments about the greenhouse effect. Only this time we aren't talking about global warming that might affect the earth in 30 years; we're talking about microwaving our bodies to an early grave.

Fortunately, some manufacturers are concerned about health and computers, and they've answered with, for example, radiation screens and glare screens, extremely-low-frequency monitors, recycled toner cartridges, and recycled paper for packaging. Government and labor are taking a hard look at the situation as well—witness San Francisco's recent ordinance that sets health guidelines for computer operators.

I grew up with stories about how NASA's space program contributed to the development of pacemakers and about how the miniaturization of electronics contributed to the wonder machines of microscopic investigation and surgery. I also heard that NASA gave us Tang and it probably spawned the idea for pâté in a tube, an abomination I hope not to see twice in one lifetime.

In the future we'll have complete health-monitoring systems for our homes built around computer chips. Picture a small kitchen computer that tracks personal nutrition data for every member of the family. All of your data is encoded on a small data card, which you slip into the system like a bank card at an ATM. From the refrigerator comes a suggestion for a balanced, personalized lunch.

If you're low on staples, an electronic shopper zips to the food market of your choice and places your order for delivery. The money is debited to your bank account. Your microwave sets itself for optimal cooking time. Calorie and nutrient information is stored in your personal database for future reference, and your data card is updated for the next meal.

If this all sounds too George Jetson for you, pull your nose out of the funny papers. Many successful businesses have shown how computers can help to manage projects. And what better project than your health? ⊡

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IBM Screens Pictured.

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NEWS & NOTES

PC Paper

Computers have moved their users away from pen and paper. Now it appears that users are moving back. For certain applications, keyboard input isn't always best. Sometimes—especially when creating computer-aided art and design—it's better to be able to work with a pen in hand. It was this need, coupled with the growth of the field of Computer-Aided Design (CAD), that led to the birth of computer graphics tablets. These wonderful devices let you actually draw onscreen by tracing outlines with a pen on a flat pad that loosely resembles a sheet of paper. Slowly, other applications have adopted the graphics tablet philosophy, now commonly referred to as pen-based computing. One computer manufacturer has even based its entire operating system on pen-based computing.

Summagraphics, long a leader in graphics tablet manufacturing, wants to see widespread use of pen-based computing. Toward this goal, the company is now planning to bundle its graphics tablets with *Microsoft Pen Windows.* The offer is designed to allow owners of desktop computers to upgrade their systems to take advantage of pen-based computing. *Microsoft Pen Windows* combines the established *Windows* graphic user interface with handwriting and gesture recognition, making the creation of a fully pen-based system much easier. The combination of *Microsoft Pen Windows* and pen-based computing with handwriting recognition presents virtually endless possibilities for distinct new markets for graphics tablets. These new markets will encompass general and new pen-based applications. The greatest area of interest is in editing and manipulating figures (as in spreadsheets), but more will certainly appear. For more information about graphics tablets, contact Summagraphics, 777 State Street Extension, Fairfield, Connecticut 06430.

Three Reasons Why

According to a new survey by COMTEC Market Analysis Services of the Gartner Group, the work-at-home industry has been most affected by personal computers, cellular telephones, and facsimile machines.

The survey tabulated information for approximately 45,000 households, representing a reasonable sample of the almost 90 million U.S. households as counted by the U.S. Bureau of the Census. According to the report, 52 percent of all households still don't use any of the three information technologies—even at work—and only 3 percent make use of all three. PCs are now used in 42 percent of households surveyed, however, while only 7 percent use cellular telephones. The survey also found that 14 percent of homes using PCs own and use cellular telephones. Clearly, this indicates that households that adopt one technology are more likely to adopt others.

An ongoing service since 1982, COMTEC Market Analysis Services studies the installed base of information industry equipment and services—telecommunications, computers, and office equipment. For more information, contact COMTEC Market Analysis Services, P.O. Box 10212, Stamford, Connecticut 06904.

The Electric Chair

Surely you have a favorite chair. Almost everyone does. One that just seems to fit you. It takes time to break in a favorite chair, molding it slowly, through hours of sitting and shifting in it, getting it to fit your exact shape like a glove. Fortunately, a new microprocessor-based interactive chair might make all that sitting and shifting and waiting for comfort obsolete. The new chair invented by Biomechanics Corporation of America (BCA) actually responds to each occupant's body by making hundreds of pressure-sensitive adjustments on its own, automatically providing a new level of seating comfort.

Computer technology enables the new Intelligent Seat to learn about its occupant, measure load distribution, rate the occupant's comfort, decide which adjustments to make, automatically make those adjustments, and optimize seat comfort. Soon, every chair in the house might provide that coveted perfect fit. For additional information, contact Biomechanics, 1800 Walt Whitman Road, Melville, New York 11747; (800) 248-3746 or (516) 752-3550.

Speed *and* Capacity

Not to be outdone by Intel's recent achievements, IBM scientists have managed to build what they refer to as the world's fastest high-capacity memory chip. The experimental chip can send or receive eight billion bits of information per second. The record breaker is a Static Random Access Memory (SRAM) chip that holds 512 kilobits (524,288 bits) of information.

The chip can read individual bits of information in four-billionths of a second, a benchmark known as *access time.* And it can read and write successive bits of information—a measure known as *cycle time*—in just two-billionths of a second. The lightning chip holds the world speed records for both cycle and access time for memory chips with more than 64K (65,536) bits of information storage. ▷

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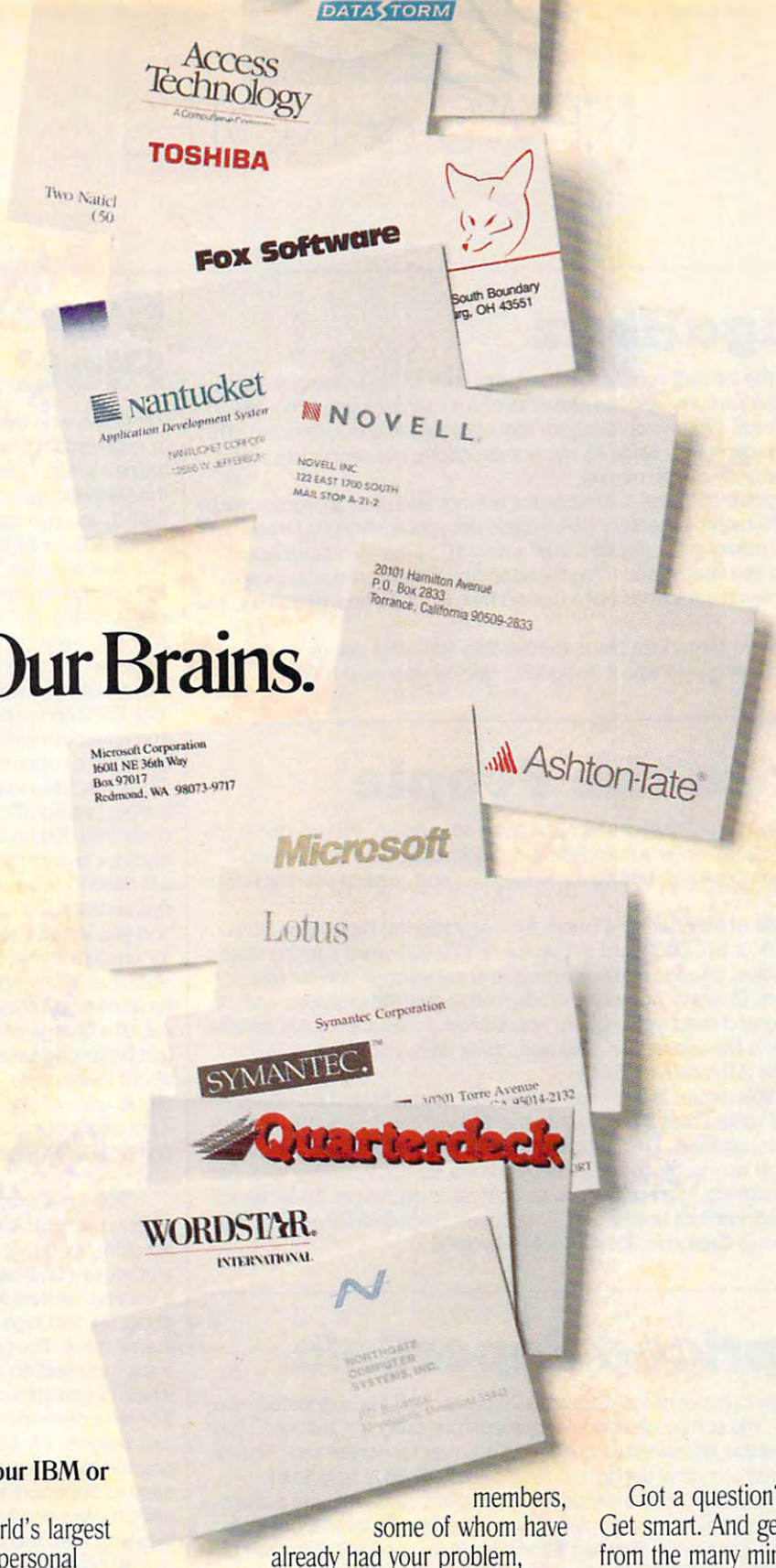

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0.10 GigaHertz

If you can imagine the current race for faster computers as resembling the Indianapolis 500, Intel has just unveiled the Maserati of microprocessors. The new chip is a fully functional 486 microprocessor that operates at a truly blinding 100 MHz, delivering approximately twice as many instructions per second as any microprocessor currently on the market.

This new microchip contains 1.2 million transistors and uses a process technology called CMOS (complementary metal oxide semiconductor) that minimizes the chip's electrical power consumption. Intel's new 100-MHz microprocessor features submicron line widths and three metal layers. One micron equals approximately 0.01 times the thickness of a human hair. Submicrons, of course, are much smaller.

Intel says it has no immediate plans to offer this 100-MHz device as a commercial product—but why else was it designed? Buckle your seat belts!

Power to the People

The VW of IBM PC word processors has just been souped up. *Volkswriter 4,* the midrange product in Volkswriter's complete line of low-cost word processing packages, has been upgraded, adding more features and ease of use than ever before.

The new release of *Volkswriter 4* offers full integration of Reference Software's *Grammatik IV,* a 310,000-word thesaurus, a 170,000-word spelling checker, footnotes, endnotes, page preview, macros, and autorecognition for five common file formats. Optional add-ons include multilingual thesauruses and dictionaries for spelling and autohyphenation, specialized dictionaries, LAN installation, and Volkswriter's file-conversion package, *Volks Word for Word. Volkswriter 4* release 2.0 retails for $249.

The complete Volkswriter line offers increasingly sophisticated products, from the entry-level *Volkswriter 2* program to the *Volkswriter 6* package with advanced publishing capabilities. The company's unique upgrade policy offers an easy and economical way to move between packages for considerably less than the cost of a new program. High-power, lower cost apps represent a new trend. For more information, contact Volkswriter, One Lower Ragsdale Drive, Building 2, Suite 100, Monterey, California 93940; (408) 648-3000.

Superpriced *SuperCalc*

Computer Associates has slashed a whopping 70 percent off the suggested retail price of *SuperCalc5,* the company's popular spreadsheet program. It doesn't take a spreadsheet to see this represents a major cost savings for consumers. The result is that *SuperCalc5*'s original suggested retail price of $495 is now $149.

Sanjay Kumar, CA's senior vice president of planning, said, "We are a client- and market-driven company. Users tell us they want the latest spreadsheet technology, but they need it at a price they can afford and in an application that will run on all of their MS-DOS based PCs. That's exactly what we're giving them."

SuperCalc5 provides advanced spreadsheet technology, including *Lotus 1-2-3* compatibility, spreadsheet linking, three-dimensional spreadsheet capabilities, presentation-quality graphics and output, and network support. The company also claims *SuperCalc5* is the only spreadsheet offering this level of functionality that can run across the complete range of PCs, from 8086 to 80486 machines. For more information, contact Computer Associates, 1240 McKay Drive, San Jose, California 95131.

Enormous Plot!

For those who think regular tabletop or freestanding plotters are just too darned small, Data Mate has released the Michelangelo Paint Jet System. With it, you can decorate the side of a van, a wall, or a giant canvas (up to 5.38 feet square). The source can be any graphic scanned into a computer with a Sharp JX-300 or compatible scanner. As you might imagine, the equipment doesn't come cheap. To begin with, you will need to have an IBM PS/2 computer, a color scanner, and an air compressor (Michelangelo is sort of a robotized airbrush artist). Once you have assembled this basic support equipment, Michelangelo itself costs $60,000 f.o.b. Japan (or $53,000 each for two or more). The paint (you will need to have yellow, magenta, and cyan installed) costs $15 per bottle, and you will use about a bottle of paint for each painting. Still, Data Mate insists that Michelangelo quickly pays for itself if you create four paintings a day at a charge of $600 per painting (each painting takes Michelangelo about four hours). The net cost per day is around $60, so you would make a net profit of around $2,340 per day (that's $70,200 per month). Or so they say.

The literature states that Michelangelo can paint on paper, glass, plastic, cloth, wood, or enamel (as used on automotive bodies). The unit looks like a vertical version of a flatbed plotter, about six feet high and a little wider than it is tall. The painter runs on a track mounted on a horizontal bar which is elevated on twin vertical bars. It breaks down into separate sections and weighs only 287 pounds (plus 40 pounds for the controller), making it easy to transport from one job to the next. It uses acrylic paint that is odorless and nontoxic but weathers well.

Although the price of the equipment may seem high at first glance, it compares well with the cost of silk screens. Silk screens are many times more expensive than Michelangelo, and they are not as flexible.

For more information, contact Data Mate, New Taro Building, 2-2-12, Fujimi, Chiyoda-ku, Tokyo, Japan. ▷

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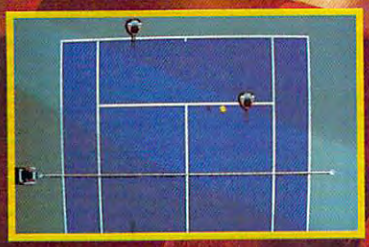
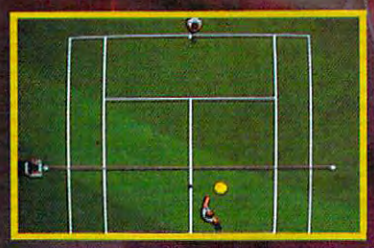
tie break





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Windowed *PageMaker*

PageMaker just opened up for *Windows. PageMaker* version 4.0 for *Microsoft Windows* 3.0 now boasts more than 75 new features, including a built-in word processor, extensive support for long documents, sophisticated text handling, and professional typographic controls. Capabilities previously available only in *PageMaker* 4.0 for the Macintosh have been included in this PC powerhouse, including memory management, networking options, and color capabilities. All the program's features have now been designed to take specific advantage of the *Windows* 3.0 environment.

With this new version, users can turn layout and text windows into easily accessible icons. Dynamic data exchange (DDE) links with *Microsoft Excel* 3.0 are also provided. The program's new high-speed Story Editor and built-in word processor allow you to do most of your work without leaving *PageMaker.* Advanced features such as search-and-replace for text and style attributes and add-on spelling checkers for 12 languages, as well as for legal, medical, and scientific terminology, make it easy to use the new *PageMaker*'s built-in word processor for virtually any document you might want to create.

For a limited time only, *Aldus PageMaker* 4.0 also includes a free copy of *Adobe Type Manager,* a $99 value (not available in 360K media). *Aldus PageMaker* 4.0 for *Windows* is available in the U.S. for a retail price of $795. For more information, contact Aldus, Customer Relations, 411 First Avenue South, Seattle, Washington 98104.

Two Batteries, No Waiting

Laptops are definitely *the* computers of the future. All sales figures indicate these little wonders are outselling their desktop competitors and there appears to be no end to their accelerating sales. But laptops aren't worth a whole lot without their batteries. That's why Epson's new 386SX notebook PC, the NB3s, comes equipped with not one but *two* 8-ounce ni-cad batteries, each with an estimated life of 1 to 1.5 hours per charge under typical usage conditions.

Even better, the 16-MHz machine weighs just 5.8 pounds (with battery) and comes with a slip case that accommodates the unit and the extra battery. It's just about everything you need in a high-powered portable PC, for a suggested retail price of $3,999. For additional information, contact Epson America, 2780 Lomita Boulevard, Torrance, California 90505; (800) 922-8911.

Expensive Software

The Software Publishers Association (SPA) has revealed that a settlement of $300,000, the largest ever reached in such a case, has been obtained in a software copyright infringement suit against Davy McKee Corporation, a Chicago-based construction engineering firm.

Using information supplied by a former Davy McKee employee, SPA filed a lawsuit on November 16, 1990, alleging that software copyrighted by Lotus, Software Publishing, and WordPerfect was routinely copied by the company in violation of the Copyright Act. After a surprise visit and an SPA-supervised audit of the software in use on all personal computers located at the firm, the company agreed to a settlement which, in addition to the cash, includes annual software audits for the next two years.

The company apparently thought it was saving money by using unauthorized copies of popular software on its computers. Of course, the cost was eventually much higher than was most likely anticipated at the time. Software piracy takes all forms, and SPA has been a dedicated force in education and enforcement geared to bringing it to a halt.

Affordable 486?

Headed into the fast lane, Intel has just created a new, less expensive version of the 486 microprocessor. Called the 486SX, the new chip will sell to computer manufacturers for roughly half the cost of a full-blown 80486. The new 486SX runs at a speed of 20 MHz, which is about 20 percent slower than Intel's slowest 80486 CPU and about 35 percent faster than Intel's fastest 80386 chip combined with cache memory chips.

According to a report pubished in the *Wall Street Journal,* the 486SX is basically the same as the standard 486 chip, but Intel has disabled circuits in the floating-point chip unit. The floating-point chip unit normally speeds up math calculations.

Intel says that for an additional $800 it will offer manufacturers another plug-in chip that will restore the coprocessor capability and will increase the speed of the 486SX to that of a standard 486 chip. The main advantage of a 486SX over Intel's 386 chip is the 486's built-in cache memory.

IBM has already begun shipping several new systems that use Intel's 486SX microprocessor. The new systems come standard with 4MB of memory, expandable to 64MB on the system board. All systems include a 32-bit SCSI busmaster that includes 512K cache for data input and output.

The desktop models are configured with either an 80MB SCSI hard disk (Model 90 XP 486 SX-0G5) or a 160MB SCSI hard disk (Model 90 XP 486 SX-0G9) and with 80-, 160-, 320-, and 400MB SCSI hard disks as options. Suggested retail prices range from $8,345 to $8,945.

Also available (in July) are two new Model 95s featuring the same amount of memory as the Model 90s, a 160MB or 400MB hard disk (with the same list of optional hard disks as the Model 90s), price ranging from $9,995 to $12,695. In addition to the difference in hard disk size, the Model 90 machines are desktop units, while the Model 95s are designed to stand on the floor beside a desk.

"News & Notes" is by Alan R. Bechtold, editor of *Info-Mat Magazine,* an electronic news weekly from BBS Press Service. ⊡

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SHAREPAK

RICHARD C. LEINECKER

Since summer months are the biggest travel months, we've collected three terrific programs targeted to the laptop audience. If you don't have a laptop, though, don't worry. The same principles that apply to laptop-specific software usually apply to desktop systems as well.

You may be running a floppy-only system, or your available hard drive space may be in short supply. If you're in either situation, hang on; these programs are for you, too.

First, there's *SimplyWrite,* a text editor for writing letters, outlines, and documents. *PROspector* is a prospect tracker for salespeople who need to stay organized. And when you get back to the office, *Filesync* will copy over and update only the files you've worked on while you were away.

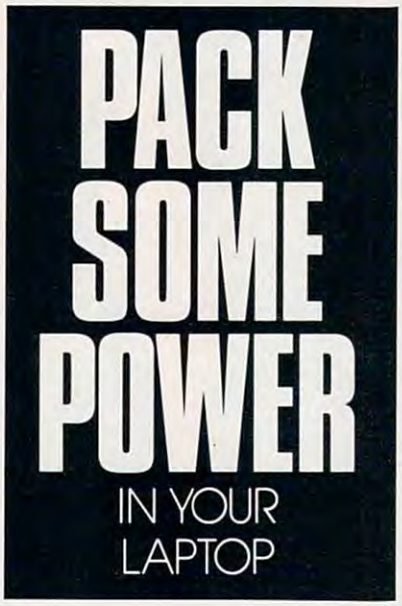
Why should you order our *SharePak* disks? Because they're always packed with the best programs, hand-picked from hundreds of submissions. The cost of downloading these programs from an online service alone is worth many times the cost of the disk. And we spend many hours screening them to select the very best programs so you don't have to. There's one more important incentive: We guarantee our *SharePak.* If for any reason you're not happy, just send it back with your reason, and we'll refund your money. A subscription can save you even more money. You can get 12 disks for $59.95, a 37-percent savings over individual disk purchases.

SimplyWrite

This ASCII text editor does more than just edit ASCII text. It has the full list of features you would expect: search and replace; insert and overwrite toggle; block operations like cut, copy, and paste; keystroke macros; word-wrap and autoindent; margin and tab operations; complete print-formatting commands like bold, italic, compressed, and letter quality; and much more.

There are some surprises, too. You can edit the cursor size, set the keyboard speed, edit documents with up to 1000 columns, and use a built-in pop-up calculator and calendar. These features aren't even found in many commercial word processors.

The keypresses I needed were easy to learn—thanks mainly to the great online help that's merely a keystroke away. *SimplyWrite* was easier to learn than most text editors I've used, and the best part is that the required disk space was 273K—small enough to put on a single floppy and have plenty of room for documents.



For laptop owners, *SimplyWrite* is the answer to the fight for programs small enough to fit on a single floppy. If you need to economize on disk space, this program is also for you. Not only is it a quality piece of software, it's small and won't hog your system's resources.

PROspector

You're on the road or in the air, and you need to refresh your memory. Instead of fumbling through legal pads, take out your laptop computer and run *PROspector* 1.0. It'll give you a complete picture so you can mentally prepare for upcoming events.

PROspector is pretty easy to use; if you're familiar with similar programs, you shouldn't have any trouble learning how to use it. Entering data is simple. The program gives you a box, and all you have to do is type in the information and press Enter. It does all the worrying about updating your disk files and keeping track of them.

You can sort the entries just about any way you want, and you can set the search criteria for a wide range of uses. The search routines can find entries in any of the fields. That way you can search for all references to *Bill,* for example, and then turn around and find all the phone numbers with a 919 area code.

For such a powerful program, you won't have to give up much disk space. The directory I put *PROspector* in contained a total of 359K of files, including several test-data files. That leaves plenty of room on a 3½-inch disk for your files.

If you want to keep track of appointments, clients, and contacts, this program is a must. It will give you a needed edge in your business, and it won't tax your computer's resources too heavily.

Filesync

Once you're back in the office, you'll want to copy your files back to your desktop system, but it isn't always a good idea to copy everything. That's why *Filesync* is so handy. It compares the dates and times of files and makes sure you're left with the latest updates.

The program is simple to use. Just type in the source and destination directories, and let it go to work. This handy utility can save you time and aggravation, and possibly prevent mistakes that will wipe out your latest file changes.

When using a laptop, you have to find ways to get the most computing power out of the least amount of disk space and memory. These programs do that *and* provide some of the most useful tools to use on the road—and they're useful for desktop systems, too. ⊡

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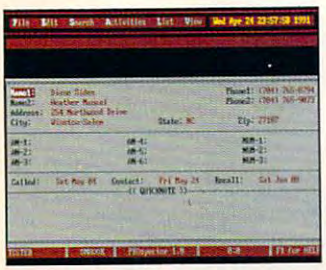
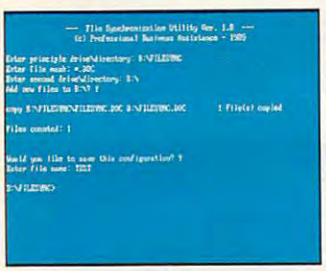


PROspector

SimplyWrite



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FEEDBACK

LETTERS FROM OUR READERS

The IDEs *Démarche*

You could help your readers avert a fatal mistake by running another paragraph about low-level formats ("IntroDOS," April 1991).

Before you do anything to your hard drive, you should find out what kind it is. IDE drives are low-level formatted at the factory and should not be low-level formatted again.

S. M. RUSSELL
W. PEABODY, MA

Reader Russell makes an excellent point, and his letter goes on to quote his user manual's warning against low-level formatting of IDE (Integrated Drive Electronics) drives.

April's "IntroDOS" column failed to note the differences between IDE and other drive types. During the factory low-level format, certain information is written to IDE drives, and subsequent low-level formatting could destroy that information, rendering the drive inoperable.

The column's intended message was that you should not be afraid to use low-level formatting utilities if appropriate for your drive. If such utilities came packaged with your drive, you can be pretty sure you won't harm your drive through their use.

No hardware procedure, however, should be attempted without checking the user manual for information about how that procedure might affect your specific computer system.

Missing Link

I read with interest the telecommunications-related articles in your February 1991 issue but was dismayed to observe the almost total lack of recognition of and discussion about American People/Link (Plink). It has been online since December 1984 and has tens of thousands of satisfied users. Plink offers a wide variety of services to its subscribers, not the least of which are its Amiga support clubs, which I run. To ignore People/Link is a disservice to your readers.

HARV LASER
TORRANCE, CA

People interested in learning more about People/Link can call (800) 524-0100 (voice) or (800) 826-8855 (modem) or write to American People/Link, 165 North Canal Street, Suite 950, Chicago, Illinois 60605.

Worth More Than 1000 Words

I understand that a scanner can transfer images from a printed page to a computer for desktop publishing applications, but why is it necessary to use another device to accomplish the same for printed words? What's the difference to the computer between an illustrated page and one filled with text?

HSIN TU
N. HOLLYWOOD, CA

To start with your second question, computers store text as a series of discrete characters. Each character occupies one byte of storage space. Programs that display these characters—word processors, for example—have a series of rules to follow in displaying this text so that it appears organized when displayed.

With a graphic, the entire illustration is considered one element. The image is stored using a code that describes how the pixels (picture elements) on the screen are to be lighted when the graphic is displayed.

When an image is scanned, the scanner bounces its light off of the image, measures the reflection, and records the information about the lightness and darkness of the image. To a scanner, a page of text is no different from a picture of a sailboat—both represent varying amounts of reflected light.

A scanned image fits nicely into a paint program, which is essentially a pixel-manipulation program.

To turn scanned text into editable text, additional software is needed. This software, called OCR *or* Optical Character Recognition software, *examines the scanned image (a graphic) for character patterns that it can match with patterns in its character li-*

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brary. When it finds a match, it stores the matched character in a file as a discrete letter.

*Optical Character Recognition presents many challenges that are slowly being overcome. One problem is that the same letter—*a, *for example—can take different forms depending on the typeface. We've trained our brains to recognize and adjust for these differences, but programming such nuances into OCR software is a mammoth task that requires great amounts of memory.*

Newspapers were among the first businesses to use OCR software regularly. As recently as ten years ago, an OCR scanner was larger than today's full-featured office copier. Writers typed their stories on special paper using special type balls on their IBM Selectric typewriters. Their letters had to line up properly and fall within certain margins.

The finished pages were then fed into the scanner, which took several minutes to digest a typical story. The machine beeped constantly, asking for help when it couldn't quite make out a character.

Today's OCR software is improving, but it still isn't perfect, and even 99-percent accuracy isn't good enough. Imagine trying to scan this magazine page, which holds approximately 6000 characters, using OCR software. Even if your software correctly identifies 99 percent of the characters, it's still going to stop and ask you for help 60 times.

Troubling Memories

I recently expanded the memory in my system from 512K to 1MB. My first use for the memory was to install a RAM disk for use with my *Money Counts* files, but I'd also like to use the extra memory when I run *Quattro Pro.* How can I delete the RAM disk when I'm through with it?

ROBERT M. MERRITT
BLUE SPRINGS, MO

Little in computing causes as much frustration as the extended memory between 640K and 1MB. It's a crime to let that memory go unused, but it's difficult to use it effectively.

Any device you install through your CONFIG.SYS, such as RAMDISK.SYS or VDISK.SYS, is with you until you rewrite CONFIG.SYS and reboot. Switching a standard DOS-supplied RAM disk on and off isn't possible. However, you can buy commercial RAM-disk programs that can be temporarily disabled or permanently removed.

Although a RAM disk can be extremely valuable on a floppy-disk-based system with no hard disk, it tends to be a bother when you have a hard disk. You do save a little time reading and writing files with a RAM disk, but you also have to spend time copying the files from the hard disk to the RAM disk and back again. In addition, you run the risk of losing updated data if the power fails before your RAM disk files are saved on the hard disk.

Perhaps the extra memory could be better used by installing a disk cache or by using it as a swap area for certain resident programs.

A cache speeds disk access by keeping frequently read disk sectors in memory and by trying to anticipate which sector you'll need next. When the cache is successful, data is fetched directly from memory rather than from the disk drive, resulting in a faster data transfer.

Swapping is a technique used by many resident utilities to minimize their footprint when not in use. A small portion of the utility stays in memory at all times. When you press that program's hot key, the resident portion loads the "swapfile." If the swapfile is on disk, this process takes a few seconds, but if the swapfile is in extended memory, it's almost instantaneous.

Memory prices are currently as low as they've been in years. Why not add three or four more megabytes? Then you'll face some really tough decisions about how to use your memory.

Playing the Slots

All the slots in my system are full, but I don't want to buy a larger unit at this time. Is there any way to add an expansion box with more slots?

LEE COTE
FOLSOM, CA

A computing truism seems to be that expansion slots fill faster than gullies in a thundershower. Look at computing's recent history, and you'll see expansion everywhere.

My first computer, for example, held 64K of memory. Friends who used systems of 16K and 32K thought I was nuts. Today, I can't run the software I want with 3 megabytes of RAM. As software and hardware advance to new levels, there are many more cards I can plug into my system—modems, mice, scanners, MIDI.

As time passes, demand on your system's resources will only increase. When you shop for a computer, buy as much expansion capability as you can afford; then spend the next year or two filling it up.

Many corporations have come to accept the inevitability of this cycle and are now budgeting to replace their computer systems every three years in order to stay abreast of technology.

If you've run out of slots, you may be able to consolidate the expansion boards you have to gain some room, but there doesn't seem to be any practical external expansion system for today's PCs.

Consolidation can be achieved by using multifunction boards to replace dedicated cards. Many memory boards, for example, can accommodate serial and parallel ports in addition to RAM chips.

If you have an unused serial port, you could free a slot by switching from an internal to an external modem or by trading a bus mouse for a serial mouse.

If consolidation is impossible and you need more power, it's time to shop for a system you can live with for another two or three years. If you have no need for two computers, you may be able to sell the old system through a classified ad in a community newspaper. Or consider giving the less powerful computer to a son or daughter for schoolwork. Then you can start thinking about setting up a household LAN—but there goes one more precious expansion slot. ⊡

Readers whose letters appear in "Feedback" will receive a free COMPUTE's PC clock radio while supplies last. Do you have a question about hardware or software? Or have you discovered something that could help other PC users? If so, we want to hear from you. Write to COMPUTE's Feedback, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. We regret that we cannot provide personal replies to technical questions. ⊡

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HEALTH & COMPUTERS

Is a computer your best friend and personal trainer? Or is it a potentially dangerous appliance? Can the PC help the disabled lead more normal lives? Or is it a powerful tool in the hands of medical professionals? The answers are *Yes, Yes, Yes,* and *Yes.*

A personal computer much like the machine sitting on your desk can be everything from a coach to a diagnostician. And it helps enable the disabled.

On the downside, your computer's monitor showers you with extremely low frequency (ELF) and very low frequency (VLF) radiation every minute you use it. And, unless your workspace is ergonomically designed, your keyboard may be dooming you to chronic, painful repetitive strain injury.

Your PC has its own health to worry about, too. Viruses can strike at a PC's heart and soul—its hard disk drive—and cripple the machine as effectively as a flu virus lays you low.

As they say, if you have your health, you have everything. The PC, *the* household tool of the 1990s, can help to ensure that you keep your health—your everything.

GREGG KEIZER

Eat Right, Lose Weight, Stay Fit

Your PC can't do it alone. Before it can help you get a grip on your diet, before it can tell you how healthy (or unhealthy) certain foods are, and before it can motivate you to exercise, you have to give it the right software.

Several comprehensive nutrition and diet programs let you record what you've eaten and see exactly what nutrients make up each food. They'll even note your physical activities. Most are flexible enough to let you enter new foods and play what-if games with your diet and exercise. Noteworthy software in that category ranges from the graphical *DINE Windows* to the more traditional *Food Processor II.* Some products treat your diet as the key to good health, monitoring not entirely for the sake of weight loss, but for nutritional content. Parsons Technology's *Diet Analyst* checks your food intake for deficiencies in vitamins and other nutrients. *Diet Analyst* can also help you track caloric intake, but its principal claim is health maintenance rather than weight loss. If your diet is intended to maintain weight or is a reduced-sodium, -sugar, or -cholesterol diet, *Diet Wise/Energy Wise* from Nutritional Data Re-

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sources not only assists you via your computer but also provides toll-free access to a registered dietitian.

Your computer can't nag you to get up in the morning for your daily run or swim, but it can motivate you by tracking your progress. A small amount of software is available to help you develop daily exercise plans, while logging your workouts. *Fitness Profile,* an expensive package, scores your current fitness from several tests, many of which you can do at home or at the local club. *Personal Fitness Planner* designs a daily activity and eating plan and then lets you record activities to show how you're doing.

Software can also turn your PC into a rudimentary self-diagnostic tool. Packages like *Family Medical Adviser* and *Home Doctor* consider symptoms, ask questions, and let you narrow down the possibilities for personal and family illnesses. They can't replace a doctor's expertise, of course (expert system software isn't at that stage yet), but they can help answer questions about simple ailments.

If you go to the trouble to look for it, you can find specialized software on almost any health topic imaginable. Want information about AIDS? *Understanding AIDS* takes you through an interactive lesson on the disease, from its history to its symptoms and prevention. *Birds 'N Bees for 7–12 Year Olds* explains sex and reproduction in a clear and simple fashion to youngsters, and it even lets you customize the content as well as direct it for your child's age and sex.

The Doctor Is Always In

Transform your PC into a fascinating medical- and health-information terminal with a phone line, a modem, and access to one of the online services. Connect to CompuServe, for instance, and you can peruse medical journals, order prescription drugs, and even chat with others about anything from exercise to cancer treatments.

Although other online services offer health information, none of them match CompuServe. If you call on Health Database Plus, for instance, you can retrieve complete articles from general-interest publications like *American Health, Hippocrates, Runner's World,* and *Psychology Today.* If you want to keep up with breaking medical news, you can pull down short summaries of articles from prestigious journals such as the *New England Journal of Medicine,* the *British Medical Journal,* and the *American Journal of Medicine.*

Want specific information about the medication your family doctor has prescribed? Then go to HealthNet, an online medical reference library. You can consult it at any hour of any day to learn about symptoms, diseases and disorders, home health care, drugs, and more. If your child's doctor prescribes Amoxil to fight an infection, for instance, you can quickly find out how it works, what it's best used for, its side effects, and even its wholesale cost.

CompuServe also includes Court Pharmacy, an online drugstore that fills prescriptions. The doctor's prescription must be mailed to the pharmacy, so it's best for maintenance medications, not drugs you need immediately. Court is an interesting and price-competitive alternative to your local pharmacy and may be especially attractive to the homebound or those living in remote rural areas.

But perhaps the most impressive way online services like CompuServe help your health is through their forums. Forums gather together people with common interests, allowing them to talk electronically about their illnesses, share their experiences, and offer support and advice.

Your PC is no replacement for an intelligent, caring medical professional, but it can certainly put a wealth of information at your fingertips.

PCs for the Pros

Personal computers do more for health care than just make out the bills and keep track of a doctor's schedule. Although they may be ever present in the office, handling the same sorts of chores as in any business, PCs may actually be making a bigger and better contribution to medicine long before an M.D. goes into practice.

At the Louisiana State University Medical Center in Shreveport, Louisiana, PCs are a prominent part of the library. Linked in networks, they connect to any number of online medical databases, including the publication listing of MedLine. Medical students can scan recent journals, pulling down abstracts of articles from the screen. Interlibrary and interregional loan programs ensure that hardcopy gets to students quickly. Teaching faculty and physicians link up from the PCs in their offices via the network or modems.

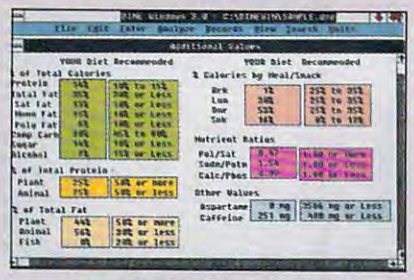
Off to the side, PCs drive an interactive videodisc lab. IBM PS/2s control laser disc players to simulate medical emergencies and put prospective doctors under pressure. At one station, the videodisc shows a shotgun victim arriving at a hospital's ER. By pressing a touchscreen on the PC's monitor, users call for examinations, order medications and fluids for the patient, and review vital statistics like blood pressure, respiration, and heartbeat. Choices determine the wounded man's condition. A wrong diagnosis at the PC can kill the patient; a moment of hesitation can waste what little time the victim has left. ▷

The Dieter's Edge

Nobody likes counting calories, yet keeping track of your food intake is an integral part of any sound personal health plan. It's easy to lose sight of the fact that a diet isn't a quick means for taking off unwanted weight. A good diet balances fitness and nutrition into a pattern you can maintain for life.

That's where a program like *The Dieter's Edge* comes in. This isn't just a simple calorie counter; it's a comprehensive system of measuring personal metabolism rates, eating habits, and exercise regimens. The data you enter is cast against background information compiled from the United States Department of Agriculture's nutritional databases. The results are displayed in graphs and charts that bring a picture of your health into clear focus and help you maintain weight-loss and exercise programs.

The Dieter's Edge is designed for home use, and its sophisticated techniques are particularly suited for those people working with a physician, coach, or dietitian. The program tracks the protein, fat, carbohydrate, mineral, and vitamin levels of the foods you eat daily. It also tracks your energy expenditures from such common exercises as bicycling, walking, running, swimming, and tennis. More than that, however, you can define home recipes and special exercises with customizing options.



How does your diet stack up?

It's difficult to gain mastery over the program's complex and comprehensive data because the interface isn't as intuitive as it needs to be. Fortunately, the manual provides a clear guide through the basic processes, and the program itself comes with some sample data you can experiment with. Mastering *The Dieter's Edge* takes time. But if you're serious about your nutrition and you need some help staying with your program, this software turns your computer into a personal health coach. Best of all, you never have to listen to Richard Simmons.

—PETER SCISCO

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If I Only Had a Brain

"Dr. Bodine! Dr. Bodine to the operating room!"

"Beverly Hillbillies" folk hero Jethro Bodine swore he was going to be a brain surgeon. If only he'd had *Life & Death II: The Brain.*

Though it's a long way from a simulation, *Life & Death II* carries a certain realistic feel, enough to make the squeamish squirm when the scalpel is in their hands and the EKG monitor is beeping in the background.

You play doctor as you diagnose patients with a variety of neurological ailments. After a quick examination, you can request CAT, MRI, x-ray, or angiogram tests to pinpoint the problem. Then it gets interesting. You hit the operating room, instruments at your fingertips, with no idea of what to do. The hospital classroom is available, but the text lessons are in big chunks, they're hard to remember, and they don't include any visual aids.

Sounds and sights on a VGA-equipped PC with an Ad Lib or Sound Blaster board are impressive. You see the blood well up as you make an incision, hear the whine of the drill as you bore a hole in the skull looking to relieve a subdural hematoma. If you don't follow correct procedures, or heaven forbid, you make a wrong diagnosis, you'll get yanked from the OR and sent back to class with calls of *Quack!* echoing down the hospital halls.

Life & Death II is, believe it or not, great fun—even for someone like me who early

on decided that the fame and glory of medicine weren't worth passing out over. It may be no simulation, but it's the closest to a sharp knife any of us deserve to be. Move over, Jethro!

—GREGG KEIZER

"Hospitals are leery of letting students practice on people," says Bonnie Sellig, the library's assistant director. Instead, computer-assisted instruction lets rookie doctors try treatments and immediately see the outcome, just as a student pilot uses a simulator before climbing into the cockpit. "Computer technology is the very beginning level of medical training," Sellig says.

But medicine holds even more hope for the PC. Sellig spells out a not-too-distant future in which doctors use an integrated system to pull up all the records of a patient; see the treatments, diagnoses, and medications given; and then review current literature to ensure that everything possible has been done. "Doctors are going to have to be knowledgeable about computers," Sellig asserts. "[Computers are] going to be part of their life from now on."

Linked with other commonplace technologies—the facsimile machine and the CD-ROM drive—PCs already send copies of crucial medical articles to doctors in rural areas and provide entire textbooks on disk. In the years ahead lie simpler point-and-click software and even voice-activated computers. "It's just a matter of keeping up," says Sellig. "And computers are what's doing it for us."

Talk It Up

The PC may play surrogate physician or help diagnose common illnesses, but these contributions pale nearly to insignificance in comparison with its impact on the handicapped. Computers, including heavily modified laptops, are providing the power and freedom of communication to people who can't speak.

Sitting in a wheelchair, a quadriplegic man watches the laptop's LCD screen. Using specialized software, he writes, not by pressing keys, but by almost imperceptibly moving an eyelid. A flat sensor attached to his muscles reads the movement, and as a bright cursor scans across a graphic of the keyboard, it stops momentarily to enter a letter. Tedious? Not really, since the word processor leaps to conclusions and offers a list of words it thinks should come next. A single flick of the eyelid, and the word pops up on the screen. The program can even be trained to remember the user's most-used words.

Laptop speech add-ons like DecTalk put natural-sounding voices on chips inside the PC, letting the computer speak—even sing—for those who can't. Quick-response software like *Talking Screen* and *E-Z Keys* from Words+ let the disabled "talk" much faster and more normally. Drawing programs provide a creative outlet and can be manipulated on the portable computer when switches are pressed, sipped, or squeezed.

All this technology doesn't come cheap—customized laptops run $5,000 and up. But they're portable, they have legible screens, and they can carry on conversations for as long as two hours between battery changes.

Advanced technologies like voice recognition and virtual reality combine to show the future of computerized aides for the handicapped. At Pacific Gas & Electric, Bill Yee, a senior programming analyst, works with a robotic assistant. Yee, a quadriplegic, talks, and the robotic arm responds, bringing reams of computer printouts to his side, turning pages on command, and tearing sheets off the

Feel the Burn

Using a computer for extended periods can cause eyestrain for many people. But coupled with a program like *Vision Aerobics*, your computer can actually be used to strengthen the eyes. What's more, the 3-D glasses that come with this health-oriented software will let you play the role of Dr. Jacoby at your neighbor's next "Twin Peaks" party.

Vision Aerobics combines three separate exercises into an interactive exercise program for your eyes. The Eyes in Motion exercise resembles an arcade game and is designed to improve your ability to make rapid and accurate eye motions. Letters flash onto your computer screen at different points, and you must press the key that corresponds to that letter.

The Images exercise is aimed at promoting the muscles that align your eyes in order to improve your depth perception. It consists of a set of convergence and divergence exercises, during which you try to keep a set of images combined into one image as long as possible. To do this requires the 3-D glasses (not required in all exercises) and opening your eyes as wide as possible. You can really feel yourself work during this exercise, and it's easy to see where the program got the *aerobics* in its title.

The last exercise, Relaxation, is a kind of electronic visual mantra, during which images float across the screen and tend toward the background while you think pleasant thoughts and try to relax your shoulder muscles.

Taking a break from long periods of computer use is a good idea whether you own this program or not. You should look away from your screen and focus on something across the room or outside the window for at least five minutes every hour. *Vision Aerobics* claims to be able to strengthen your eyes with continued use. If your physician thinks you can benefit from this kind of exercise, it's worth looking into.

—PETER SCISCO

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Repetitive Strain Injuries

ELF and VLF electromagnetic radiation is certainly not the only hazard associated with lengthy sessions at the computer. The very act of typing could be crippling you, causing repetitive strain injuries, known as *RSIs*. How? The answer is both simple and complex.

For generations, piano teachers have urged students to play with their hands suspended above the keyboard. Unfortunately, typing instructors seem to care more about accuracy and speed than proper placement of the hands, so most of us never learn the correct way to use a keyboard. Our modern office environments have conspired against us, too. It's much faster and easier to send a message from one networked terminal to another than it is to handwrite a note or actually deliver the message in person. All this typing might only be a pain in the fingertips if it weren't for our posture and the placement of our hands.

Many people type with the heels of their hands on the desktop and their hands angled upward to raise their fingers above the keys. This results in a constriction in the carpal tunnel, which is a conduit for the tendons that actuate the fingers. Constant movement through this tunnel has the same effect as rubbing your skin against the edge of a tabletop. Heat is generated, and the tendons become sore. This is the most common—and painful—form of RSI, but any motion you perform constantly can cause this kind of injury. Even the way you sit in your chair could lead to backache and other muscle pains and strains.

If you can't (or don't care to) lift the heels of your hands from the desktop while typing, pads are available that will elevate your hands slightly, or you could make your own pad with a square of cardboard and some foam rubber. Also think about the way you sit at your desk. Would your grade-school teacher have given you satisfactory posture marks for the way you sit? Consider the possibility that your chair or desk may be too low (many are) or that the placement of your computer equipment causes you to sit in an unnatural or uncomfortable position. Don't be afraid to experiment to find the right way to sit.

Finally, take a break. Go and look out a window every so often. If you're fascinated by your work and don't really want to stop, set a timer on your watch or alarm clock to go off every hour or so. Just getting up and stretching your legs, looking at distant objects, and conversing with friends can keep you fresh and alert and inoculate you against the stresses associated with being sedentary.

—ROBERT BIXBY

printer as he programs and debugs software. It performs the functions of a human assistant but does it more economically. The robot will pay for itself in less than two years.

Virtual reality—creating artificial environments inside the PC that can be experienced like a sketchy version of the real world—also promises much for the handicapped. Connected to a powerful PC in the not-too-distant future, people bound to wheelchairs will be able to "walk" through computer-made worlds, "run" for an imaginary touchdown, or simply free themselves from the constraints of their afflictions.

Hey, Coach!

Imagine how motivated you'd be to eat right and keep fit if it meant your job. Think how you'd watch what you eat if, when you arrived at the office each day, you were paid by how quickly you charged through the halls or by how many chairs you could knock out of the way.

San Francisco 49er football players, like everyone else in professional sports, are constantly judged on how well they perform, how often they win. It's no surprise, then, that Jerry Attaway, the 49ers strength and conditioning coach, uses PCs to help players manage their diets and calculate their conditioning.

Attaway has calibrated the ergometers on the exercise bicycles and combined them with a custom PC program that tells his charges how long they've got to pump the pedals to consume a set number of calories. "It really hits home that way," Attaway says, "about how much work is involved to burn off the calories in a food."

But it's in nutrition that he excels. Using a program called *Nutritional Analysis,* Attaway tries to get professional athletes to change their eating habits. He's really trying to change their lifestyles. "There's only one or two guys on the team with a weight problem," he says. "I'm trying to get everyone to eat for their performance. I sit down and explain some physiological principles and, with the computer, show them what they normally eat, then do what-ifs on the bottom line—the calories. They go, 'Oh, yeah, I can do that,' or 'Coach, what if I do this?' The computer gives us all sorts of options."

Calculating a nutritional plan used to take Attaway half a day, and then it wouldn't be quite correct. Now it takes only ten minutes. "I make them do it," he says. "They see the numbers, and it's a way of teaching them how to enhance their performance or reduce the risk of heart disease or even certain kinds of cancer."

The 49ers also use PCs to log injuries and treatments, whether that means ice on an ankle or a session in

More Miscarriages: Are VDTs Responsible?

Pregnant women who work in front of VDTs for more than 20 hours a week run an 80-percent higher risk of miscarriage. That was the conclusion reached by researchers at the Northern California Kaiser Permanente Medical Care Program in Oakland, California, after studying 1583 pregnant women who attended Kaiser Permanente obstetrics and gynecology clinics during the years 1981 and 1982 (*American Journal of Industrial Medicine,* June 1988).

In the study, researchers compared the miscarriage rates of VDT users with those of women who performed the same type of work at their jobs but without VDTs.

Video display terminals (VDTs) are known to emit very low frequency (VLF) and extremely low frequency (ELF) electromagnetic fields (EMFs)—that much has been proven. The question is whether EMFs at those frequencies are harmful to humans, and more specifically, to the unborn.

While the evidence so far seems to weigh against VDTs, a recent study from the National Institute for Occupational Safety and Health reached a completely different conclusion (*New England Journal of Medicine*, March 14, 1991). Of the 730 women included in the NIOSH study, 307 were directory-assistance operators who used VDTs, and the other 430 were general operators who performed similar work using both LED (Light-Emitting Diode) and NGT (Neon Globe Tube) monitors, which emit no EMFs.

Both VDT and non-VDT workstations were measured directly for VLF and ELF emissions, as were background areas away from the workers.

In their detailed study, researchers concluded that VDT use did not, in fact, increase the risk of miscarriage: "The rate of spontaneous abortion for women with more than 25 hours of VDT use per week was similar to that for women with no hours of use per week. . . . The use of VDTs and exposure to the accompanying electromagnetic fields were not associated with an increased risk of spontaneous abortion in this study."

The study did confirm several other factors already known to be associated with an increased risk of miscarriage: previous miscarriage, the use of alcohol, the use of cigarettes, and the presence of a thyroid disorder.

Until more studies are conducted comparing VDT use and miscarriages, the jury will remain out on this one. Whatever the findings of the next study, however, one thing is for certain: Enough studies have been conducted that we can say with fair certainty that exposure to EMFs is harmful. That fact alone may render any future correlation between VDT use and the risk of miscarriage purely academic.

—JILL CHAMPION

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the whirlpool. Everything goes into a player's file at the end of the season—missed practices, missed games due to injuries—and is reviewed by the organization. That PC use probably makes some players nervous. "Pro football players don't like to keep records," laughs Attaway. "You can't let the paranoia take over. If you don't win, they're going to fire all of us anyway. You just do the best you can."

Warning: Computer in Use

Your PC may pose a potential threat to your health. Surprised?

Monitors are the prime suspect. They emit electromagnetic radiation at VLF and ELF levels. Although studies are far from conclusive, many researchers warn of possible health risks associated with high electromagnetic radiation levels, including miscarriages and cancer. San Francisco, the first American city to regulate working conditions at computer monitors and terminals, has even established a Video Display Terminal Advisory Committee to report on, among other things, electromagnetic fields.

You can reduce the risk simply and inexpensively. Don't crowd your screen: Radiation levels drop sharply two to four feet from the monitor. Turn off any monitor you're not using, as well as laser printers and copiers, because they also throw out large electromagnetic fields. And if you have several computers in your home office, position them so that the monitors' sides and backs don't face your work space: Radiation levels are typically weakest from the front.

More costly solutions range from antiradiation screens to low-radiation monitors. For $139 you can buy NoRad's screen, which, according to the company, stops 99 percent of the electric radiation at VLF and ELF levels. Low-radiation monitors are pricey but available from major manufacturers like NEC, Sigma, and Qume. They block electromagnetic radiation, but only at VLF levels. Or you may want to switch to an LCD monitor, like those on laptops. LCD screens emit negligible radiation. Safe Computing makes desktop-sized LCD screens, but the cost—$2,495 for a backlit VGA model—is prohibitive to all but the wealthiest home computer users.

The catalog of less threatening, but still harmful, effects includes everything from headaches and eyestrain to backaches and carpal tunnel syndrome, a persistent pain in the wrist. Tired muscles and eyes can be relieved by wrist support pads at the keyboard, an adjustable chair, and properly positioned lighting to reduce glare on the screen. Headaches can be combated by taking breaks from the computer.

Heal Your PC

Unaccountable system crashes. Extraordinarily long times to load programs. Corrupted (and crucial) files. Sound familiar? If so, your PC may be the sickest thing in your house.

A PC can succumb to illnesses, too. Some ailments come from care-

Food for Thought

Have you ever wondered exactly what's in that pizza you've been gnawing on during a late-night session with *King's Quest*? Or those potato chips you clogged your keyboard with while chatting on CompuServe? Now your computer can tell you. *Santé* (pronounced *santay*, which is French for *health*) is a new computer program designed to help you eat better by providing computerized meal and recipe analyses.

Created under the strict supervision of a registered dietitian, *Santé* first asks you a few short questions about yourself and then lets you select your foods from 3000 possible choices, supplying you with a full analysis of your meals and full day's intake. Detailed reports cover calories, cholesterol, fat, and essential vitamins and minerals—29 nutrients in all. How you measure up to the government's Recommended Dietary Allowances is computed automatically. It even takes into account your age, sex, and other information. The software comes with a dozen dietitian-tested recipes and a coupon good for hundreds of additional free recipes.

—ALAN BECHTOLD

Product List

Birds 'N Bees for 7–12 Year Olds
$14.95
IntraCorp
14202 SW 136th St.
Miami, FL 33186
(800) 468-7226
(305) 252-9040

Clean-Up
$35.00
Scan
$25.00
McAfee Associates
4423 Cheeney St.
Santa Clara, CA 95054
(408) 988-3832

CompuServe
5000 Arlington Centre Blvd.
Columbus, OH 43220
(800) 848-8199

The Dieter's Edge
$49.95
Training Table Systems
17624 Golfview
Livonia, MI 48152
(800) 336-6644

Diet Wise/Energy Wise
$159.00
Nutritional Data Resources
P.O. Box 540
Willoughby, OH 44094
(800) 637-3438
(216) 951-6593 (in Ohio)

DINE Windows
$295.00
DINE Systems
586 N. French Rd., Ste. 2
Amherst, NY 14228
(716) 688-2492

E-Z Keys/Talking Screen
$1,195.00
Words+
44421 10th St. W. #L
Lancaster, CA 93534
(800) 869-8521
(805) 949-8331

Fitness Profile
$395.00
Wellsource
15431 SE 82nd Dr., Ste. D
Clackamas, OR 97015
(800) 533-9355
(503) 656-7446

Food Processor II
$295.00
ESHA Research
P.O. Box 13028
Salem, OR 97309
(503) 585-6242

Home Doctor
$39.95
Dynacomp
Dynacomp Office Bldg.
178 Phillips Rd.
Webster, NY 14580
(716) 671-6160

Life & Death II: The Brain
$49.95
Software Toolworks
60 Leveroni Ct.
Novato, CA 94949
(415) 883-3000

Lifecycle Aerobic Trainer
$1,598.00
LifeFitness
9601 Jeronimo Rd.
Irvine, CA 92718
(800) 735-3867
(714) 859-1011

NEC 3DS Low-Emissions Monitor
$1,049.00
NEC
1255 Michael Dr.
Wood Dale, IL 60191
(708) 860-9500

Norton AntiVirus
$129.95
Symantec/Peter Norton Computing
10201 Torre Ave.
Cupertino, CA 95014
(800) 343-4714
(408) 253-9600

PageView, L* View, SilverView Reduced-Emissions Monitors
$1,299.00–$2,495.00
Sigma Designs
46501 Landing Pkwy.
Fremont, CA 94538
(415) 770-0100

QM835VLF Super VGA Monitor
$699.00
Qume
500 Yosemite Dr.
Milpitas, CA 95035
(800) 457-4447
(408) 942-4000

Santé
$149.00
Hopkins Technology
421 Hazel Ln.
Hopkins, MN 55343-7117
(612) 931-9376

Understanding AIDS
$49.95
SAE Software
P.O. Box 13738
Edwardsville, KS 66113
(800) 748-7734
(913) 441-1868

Virex-PC
$129.95
Microcom
P.O. Box 51489
Durham, NC 27717
(919) 490-1277

ViruCide
$49.00
Diet Analyst
$59.00
Parsons Technology
375 Collins Rd. NE
P.O. Box 3120
Cedar Rapids, IA 52406
(800) 223-6925

Vision Aerobics
$129.00
Vision Aerobics
10 Mechanic St., Ste. G
Red Bank, NJ 07701
(201) 219-1916

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lessness or unforeseen events, like using out-of-date printer drivers or electrical blackouts. Others are harder to diagnose and treat, like incompatible software or a damaged hard disk drive. But nothing comes close to a computer virus for sheer terror.

Viruses, those small bits of computer code maliciously placed inside innocent software carriers, can rob you of valuable data or make your PC virtually unusable. Where you pick up a virus—from public domain software, from a program you eagerly "borrowed," or in some limited cases, even from commercial software—is almost beside the point. Once your PC has a virus, once your PC starts acting strangely and unpredictably, it may already be too late. Fortunately, several good detection programs can spot and eliminate viruses before they have a chance to lay your PC low.

One capable package is *Virex-PC*. This three-program combination scans your disk, checking each file for 137 different virus strains. It also constantly watches over your computer and alerts you when potential viral activity is detected. And it eradicates some (though not all) of the viruses it finds. You pay a price for this protection—*Virex-PC* consumes 31K of precious RAM.

Norton AntiVirus is a slightly more expensive virus-protection package. *AntiVirus* identifies 142 strains and uses three methods to detect viruses: It watches each disk read, scans memory for viruses, and scans disks for suspicious strings of characters that may mark a virus. Once *AntiVirus* spots a virus, it tries to destroy it and repair the damage done.

Actually, viruses are rare. That's why you may want to use *Scan* and save yourself the RAM used by programs like *Virex* and *AntiVirus*. *Scan* and its companion, *Clean-Up*, don't constantly watch for viruses. Instead, you run *Scan* if you suspect your PC has caught a bug and then run *Clean-Up* to mend any faulty files. The combination takes care of most viral infections and damage, but if you don't remember to regularly check your PC, it could become irreversibly infected before you notice.

Another option is *ViruCide* from Parsons Technology. It should be run regularly for file maintenance, like *Scan*. It removes viruses and repairs files wherever possible. As a premium, Parsons provides a book about computer viruses so you will know what you are up against.

Prevention is the key to computer health.

Only the Beginning

Crude. That's the current state of health computing. In ten years, or even in five, what you'll be able to do with your household PC will make today's possibilities seem laughable.

As the information revolution continues to hit home, you'll be able to contact your family doctor electronically to book appointments and ask simple questions. You'll be able to keep up with groundbreaking medical research by going online and reading clips your computer has collected for you from professional journals and consumer magazines. Your doctor will send prescriptions to the pharmacy via computer, and you'll file claims to your medical insurance company the same way. The PC will monitor your wellness, reminding you of immunizations for the kids and watching your blood pressure and cholesterol through the add-on diagnostic tools you'll connect to it. It will become an invaluable adjunct to your health.

Your home PC is a good health tool now. Someday it'll be great. ⊡

Dr. Future

Modern medicine consumes technology. From CAT scans to computerized diagnostic databases, medicine pushes the technological envelope harder than almost any other profession. Its appetite for high-tech solutions is voracious. On the whole we accept that appetite, since we believe the end—saving lives—justifies almost any means. But where is high-tech, particularly computer technology, taking medicine? We asked two editors at *Omni, COMPUTE*'s sister magazine that specializes in science, to dream a bit about Dr. Future.

"In the well-equipped middle-class household [of 2010], your bathroom will be an adjunct to your doctor's office, with monitors, sensing devices, and other high-tech paraphernalia," says Keith Ferrell, editor of *Omni* magazine. "You'll go to the doctor, for instance, to have bones set, but certainly blood pressure, blood, urine, feces, and semen can all be examined at home and the data transmitted electronically to your doctor. More important, though, the computer will replace the experimental animal. The computer will act as a virtual guinea pig," says Ferrell, outlining how computer simulations will test new drugs and procedures, all without the necessity of animal or human testing.

Mary Glucksman, *Omni*'s medical editor, suggests other home health care technologies. "There will certainly be very detailed prenatal care [software]," she says. "This will help women maximize their nutritional intake as well as help them avoid harmful foods." And women will use software for both contraception *and* conception. "Programs will analyze temperature fluctuations on a daily basis, then chart and compare [them] to the norm" as women track their menstrual cycles to either boost the chance of conception or as a form of chemical- and device-free birth control.

And technology-intensive developments of today foreshadow what health care may be like in 20 years. Micromachines with metallic gears a couple of hairwidths wide will be used to "Roto-Rooter" clogged arteries or for superprecise surgery beyond the abilities of the steadiest surgeon. Computer-controlled x-ray equipment will put the inside of your body on a video screen in realtime, letting doctors watch the inner workings of the human body without lifting a scalpel. Robotic assistants will grind sockets for a perfect fit of replacement joints in the hip and knee.

It's all in the hands of Dr. Future.

—GREGG KEIZER

Biking Rough Terrain—at Home

You hope your muscles won't give out before finishing the last leg of this vigorous bike ride through rough terrain. That's easier said than done: A 3K hill looms before you. You begin the ascent, pedaling harder and harder—and then the telephone rings. Pressing Pause on the display console, you hop off your bike and race to the next room to answer the phone.

Come again? A *pause* button? Weren't we just in the throes of pre-Olympic bike training? The answer is *Yes*—sort of. Actually we were about to finish the last leg of one of the numerous exercise programs on the Lifecycle. While you weren't actually riding over rough terrain, the hills were very real where it counts—in your legs, heart, and lungs.

The Lifecycle is a stationary bike computerized to simulate actual outdoor bike riding, and, indeed, you'll feel as though you've been on an outdoor trek if you can make it through a full 12-minute program.

Unlike other stationary bikes, the Lifecycle is programmed for "interval training with progressive overload." In plain English, that means your pedaling will change periodically—becoming sometimes more difficult, sometimes easier—as the program emulates the various ups and downs you'd encounter on a real outdoor ride. Both hills and valleys are visualized on the bike's display console as red and yellow lights that move up and down as pedaling difficulty increases and decreases. As for the 3K hill, you may have to use your imagination to see the real thing, but you'll feel as though you were there.

One of the best things about training with the Lifecycle, besides the fact that neither wind, nor rain, nor dark of night will keep you from taking a ride anytime you want, is that beginners as well as conditioned athletes will find complete pedaling programs compatible with their abilities. The different levels of programs vary in hill intensity and duration, allowing you to graduate to higher levels as your conditioning progresses. Among other things, you can test your heart rate and maximum oxygen uptake (MOU) and watch the number of calories expended per hour and miles pedaled. Now, if they only could add a few trees and a nice breeze. . . .

—JILL CHAMPION

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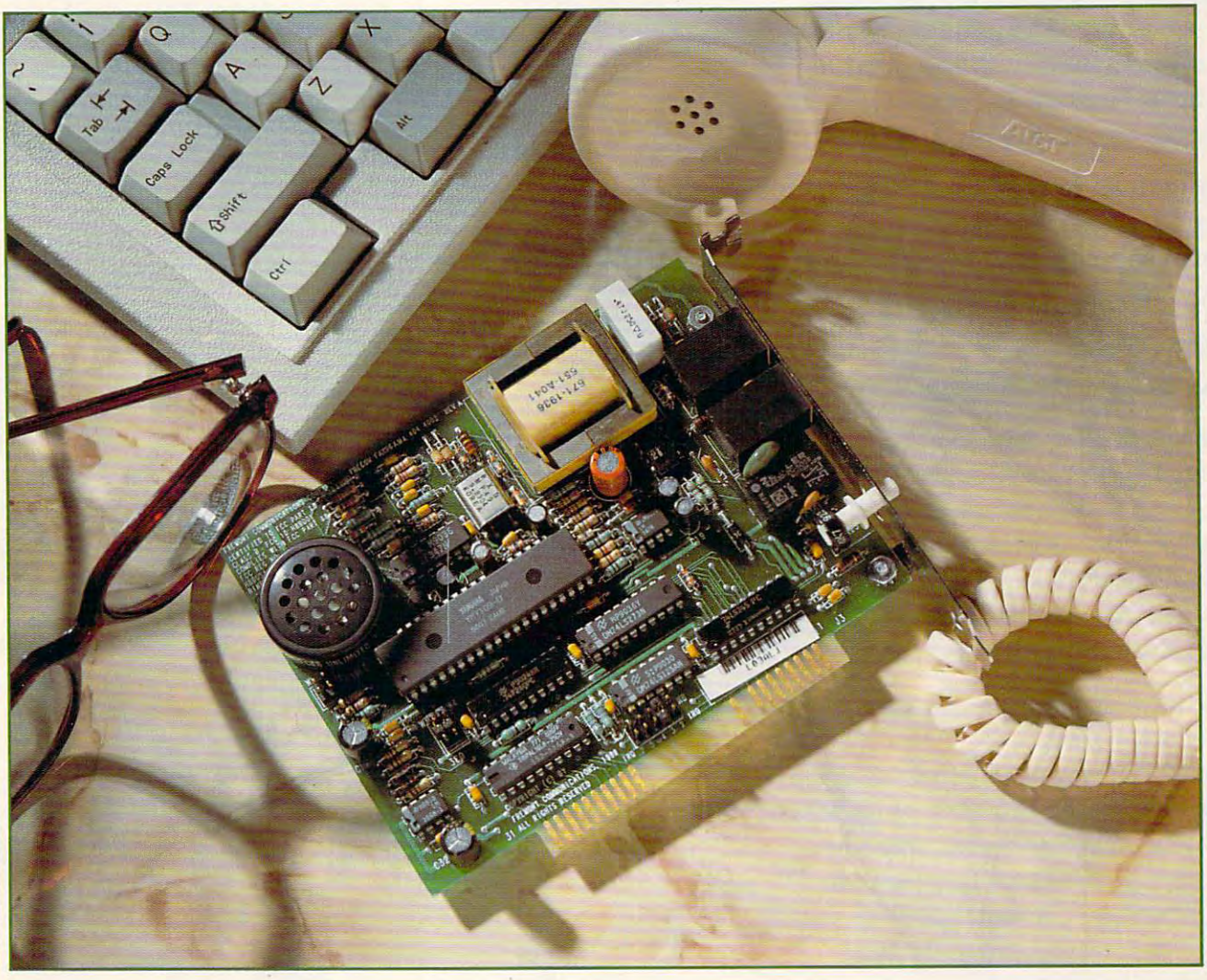

MARK WAGONER © 1991

This month *COMPUTE*'s Test Lab focuses on modems, fax boards, and fax/modems. With these technological marvels, you can use your computer to order airline tickets, send and receive important documents, do your banking, communicate with people who have similar interests, and tap into a world of information. *COMPUTE*'s expert reviews will help you decide what you want and need, as our reviewers examine installation, software, hardware requirements, and special capabilities in clear, unintimidating language. You'll get the facts and the figures, the sidebars and the statistics you need to understand these devices and make the right buying decision.

Brooktrout Fax-Mail 96
The Complete FAX/Portable
Fremont Frecom Fax96
GVC Mini-FaxModem FMM-4824
Hayes JT Fax 4800 Portable
Hayes JT Fax 9600B
Intel SatisFAXtion
Okidata Okitel 2400B Plus PC Modem
Tandy FaxMate
Touchbase WorldPort 2400 Modem
Zoom/Modem HC2400S SendFax

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Circle Reader Service Number 143

*Additional messages will be billed at only 25 cents each. Bank fees may apply. PRODIGY is a registered service mark and trademark of Prodigy Services Company. IBM is a registered trademark of IBM Corporation. Macintosh is a registered trademark of Apple Computer, Inc. © Copyright 1991 Prodigy Services Company.

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BROOKTROUT FAX-MAIL 96

I hold the record for fax-document jams. That's why I was thrilled to get something other than the standard manual-feed fax machine. The Brooktrout Fax-Mail board met and exceeded all of my hopes, and I've gotten over my fax phobia at long last.

Fax-board installations can stump even expansion-card installation veterans. That's because they often conflict with other devices and software already installed. This was no exception to that rule. But the manual was complete and walked me through troubleshooting steps that anyone could've followed.

The software that comes with the system is menu driven and easy to use. I had no trouble adjusting the configuration and preferences for my needs. The configuration and system software passed the No Manual Needed test. They were so easy to use that, until I was ready for the advanced features, the manual wasn't necessary. And my AUTOEXEC.BAT file was automatically updated, saving me from having to manually edit it.

Sending faxes from text files is simple. Select the file, enter the destination phone number, and tell it to start. The Fax-Mail system does the rest—converting it to the correct format, dialing the phone, sending the fax, error checking, and terminating the call. On the other end the faxes arrive looking just as if I'd sent them through one of the old-fashioned faxes (probably better since I would've had at least one document jam). Sending graphics files in PCX format is just as easy. The software takes care of all the conversion details for you.

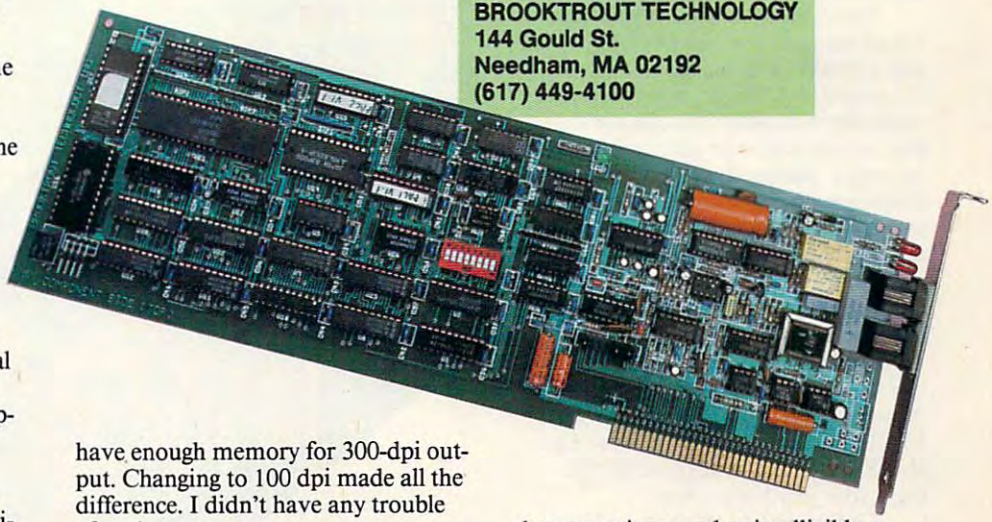
Receiving was almost as easy. The documents are saved to a disk file and can be viewed on the screen or sent to your printer. My Panasonic KX-P4420 laser printer's RAM filled up and generated an error message occasionally. Then I read the documentation and found out that I didn't have enough memory for 300-dpi output. Changing to 100 dpi made all the difference. I didn't have any trouble after that.

If you fear or loathe fax machines, the Brooktrout Fax-Mail 96 is your ticket. With it, you can forget document jams and unintelligible errors—and enjoy smooth sailing into a better-working office or business. ▷

RICHARD C. LEINECKER

Installation: internal
Slot/Bus Required: 8-bit
Fax Group Supported: 3
Other Requirements: n/a
List Price: $499.00

BROOKTROUT TECHNOLOGY
144 Gould St.
Needham, MA 02192
(617) 449-4100



Xerox Fax Firsts

First with LDX (Long Distance Xerography)—1964
First to introduce desktop fax—Telecopier I—1966
First to use automatic document handler—Telecopier 410—1973
First in plain paper laser fax—Telecopier 200—1975
First to use an automatic dialer—Telecopier 200—1976
First to use white line skipping—Telecopier 485—1980
First to enhance fax multifunctionality—FaxMaster software—1984
First to introduce plain paper use—Telecopier 7020—1986
First to develop a fax terminal capable of communicating with computers—Telecopier 7021—1987

—DAVID DAY

Facsimile Facts & Figures, 1990/91, International Facsimile Association

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THE COMPLETE FAX/PORTABLE

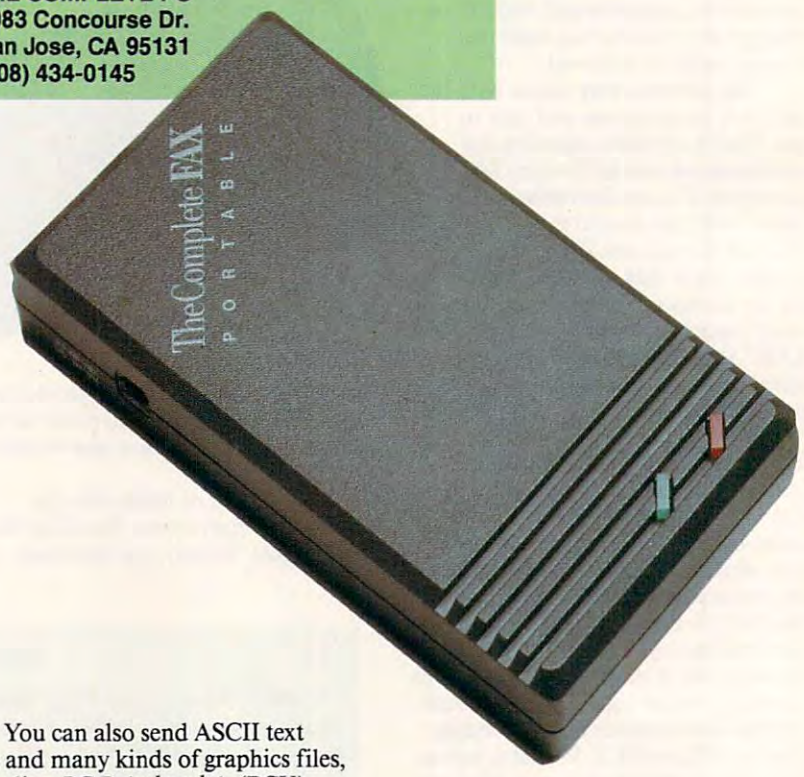
Talk about small. Who would've thought you'd be able to buy a fax machine that's only 5½ inches long and 2½ inches wide? Before you rush out to buy one, let me explain. This fax machine doesn't come with a printer, and you can't put paper in it—but when hooked to a computer, it can do just about everything a conventional fax machine can do and more.

Here's how it works. If you have a page scanner, you can feed your pages directly into the fax machine. Otherwise, you'll need to prepare your pages electronically. You can use the built-in text editor or your own word processor. Rather than convert the various word processor file formats, the Complete FAX/Portable includes a memory-resident program that captures your word processor's printer output and automatically sends it out as a fax. You simply configure your word processor for an Epson printer (it's OK if you have another kind of printer), press the hot key (usually Alt-F), fill out the information in the Fax Hot-Key window, and print the file from your word processor.

Unfortunately, the pop-up Fax Hot-Key window won't work from some programs, including *Microsoft Windows, DESQview,* and any application that operates in the Hercules graphics mode. There are workarounds for most of these programs. With *Windows,* for example, although you can't use the hot key, you can print files from *Windows* to the fax board as long as you've installed the fax program before going into *Windows.* There are two drawbacks. First, any printing from *Windows* at that point will be faxed and you won't be able to print to your printer. Second, to regain printing control in *Windows,* you'll need to exit *Windows* and deactivate the fax program. This would be a strong argument for not starting the fax program from your AUTOEXEC.BAT file.

Installation: external
Slot/Bus Required: n/a
Fax Group Supported: 3
Other Requirements: 640K RAM, graphics adapter, hard disk with at least 3MB available, serial port
List Price: $499.00

THE COMPLETE PC
1983 Concourse Dr.
San Jose, CA 95131
(408) 434-0145



You can also send ASCII text files and many kinds of graphics files, including *PC Paintbrush+* (PCX), *Microsoft Windows Paint* (MSP), Tagged Image File Format (TIFF class B), and *Dr. HALO II* and *III* (CUT) files.

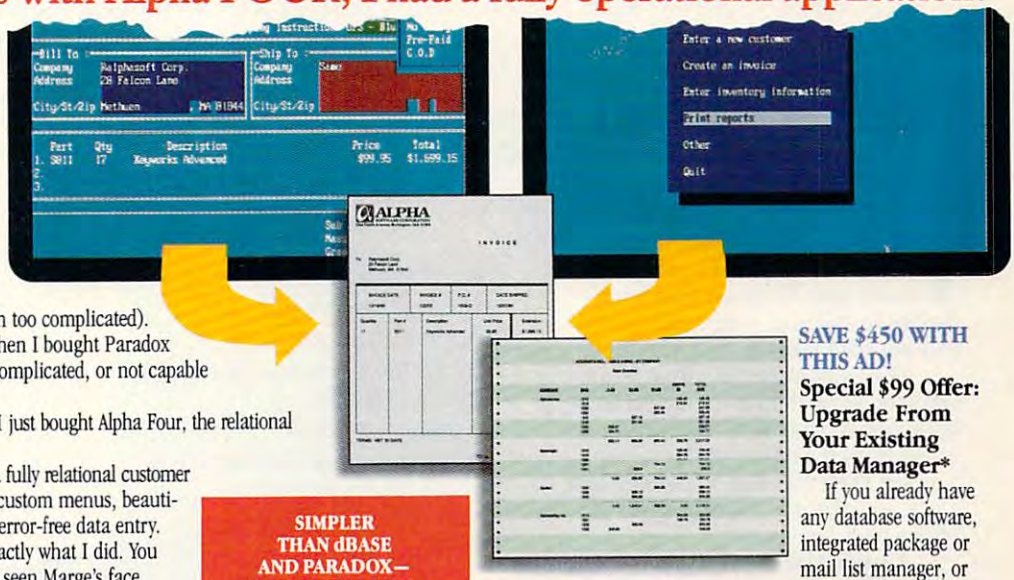
While the software could've been easier to use (especially with *Windows*), I had no trouble sending or receiving faxes. It's a bit pricey, so you'd be better off buying a less-expensive fax card for your desktop computer. On the other hand, the unit's small size makes it a good choice for laptops, especially if you already have a modem. ▷

DAVID ENGLISH

www.commodore.ca

After I bombed with dBase, I almost gave up automating our office...

...but after a few hours with Alpha FOUR,® I had a fully operational application!



At our Monday morning staff meeting, I announced I was going to automate our sales tracking and invoicing system later that day.

Skepticism ran high. "Paul, you promised me an application like that two years ago," said Marge. "You couldn't do it, and neither could that dBASE programmer you hired. It'll never happen!"

I'd already tried three times before to program a database: first with dBASE (much too complicated). Then I tried Q&A (not powerful enough). Then I bought Paradox (just like dBASE). They were all either too complicated, or not capable enough for our needs.

This time, I was confident. Why? Because I just bought Alpha Four, the relational database for non-programmers like me.

I knew within hours, I'd be able to build a fully relational customer tracking and billing system, complete with custom menus, beautiful screens and extensive help messages for error-free data entry.

SIMPLER THAN dBASE AND PARADOX— MORE POWERFUL THAN Q&A

And that's exactly what I did. You should have seen Marge's face when the first, perfectly formatted invoice came off the printer.

I DEVELOPED MY APPLICATION & REPORTS IN MINUTES

With the "application outliner," I automatically set up a system of menus, sub-menus, and procedures based on the outline I laid out.

Alpha Four's report writer was even more impressive. I "painted" reports and invoices on-screen. They looked exactly like I wanted them to—much better than our old paper forms. I always ran out of power with other simple-to-use databases; they weren't relational. With Alpha Four, I created different databases for customers, invoices and inventory and then related them into a "set," just by drawing on-screen, a diagram of the links between the databases.

I'LL NEVER KEY IN DATA TWICE AGAIN

Now, we never have to enter the same information more than once. New invoices can be generated for existing customers without having to re-enter their information—we just "look it up" in our customer database.

And I was delighted that Alpha Four is totally compatible with dBASE .dbf files. Our mailing list went right into the new application without even having to convert the files!

FASTER, MORE ACCURATE DATA ENTRY

When you enter data, you can automatically change the case of letters from lower to upper. You can display data entry templates for formatted fields like phone numbers, or skip over fields when certain conditions are met. Of course, all calculations are performed automatically.

Look-ups are super flexible. You can display information from a look-up database in a multi-column window anywhere on the screen. Select from the window and Alpha Four automatically fills in the related information.

*Qualifying packages include: programming databases (dBASE® II, III, and IV, Paradox, Clipper,® Foxbase® Fox Pro,® Revelation, etc.), flat-file databases (Q&A,® PFS:Professional File,® Rapid File,® etc.), integrated packages (Microsoft Works,® PFS:First Choice,® Lotus Works,® etc.), and mailing list managers (Fastpack Mail, etc.) or spreadsheets with databases (Lotus 1-2-3,® Quattro Pro®).

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"RATED # 1" PC WEEK

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For Fastest Service Call: 1-800-852-5750, Ext. 117 Orders Only Hotline: 1-800-336-6644 Or Fax the order form to: 1-617-272-4876. Or mail to: Alpha Software Corporation, One North Avenue, Burlington, MA 01803.

In Canada Call: 1-800-451-1018, Ext. 177. Or fax your order to: 1-416-365-1024. Or mail coupon to: Alpha Software Corp. 626 King Street, Suite 301, Toronto, Ontario M5V 1M7.

Alpha FOUR $99 Upgrade Offer

(Suggested Retail Price $549)

ALPHA SOFTWARE CORPORATION

One North Ave., Burlington, MA 10803
1-800-852-5750, Ext. 117
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☑ **Yes!** Please send me the Alpha Four relational database for non-programmers for just $99 (SRP: $549), plus $8.50 shipping and handling. I understand it is fully guaranteed and I may return it within 60 days for a full refund. I have enclosed the cover page of my existing qualifying product* manual (or original diskette).

Method of Payment (MA. residents, add 5% sales tax)

☐ Check Enclosed ☐ Charge my: ☐ MC ☐ Visa ☐ AMEX

Card # _____ Exp. _____

Name _____

Address _____

City, State, Zip _____

Daytime Phone _____
(in case we have questions about your order)

Diskette Size Select one: ☐ 3-1/2" ☐ 5-1/4"

Offer subject to change without notification

TAN

Circle Reader Service Number 162

www.commodore.ca

FRECOM FAX96

The fax has come of age! No longer must you wait in line at the fax machine. With the Frecom Fax96 board from Fremont Communications installed in your computer, you can send faxes at your leisure.

The Frecom Fax96 software lets you send several faxes to one person or broadcast a fax to several people selected from the online phone book. You can even schedule a fax to be sent when you're out of the office and the phone rates are lower.

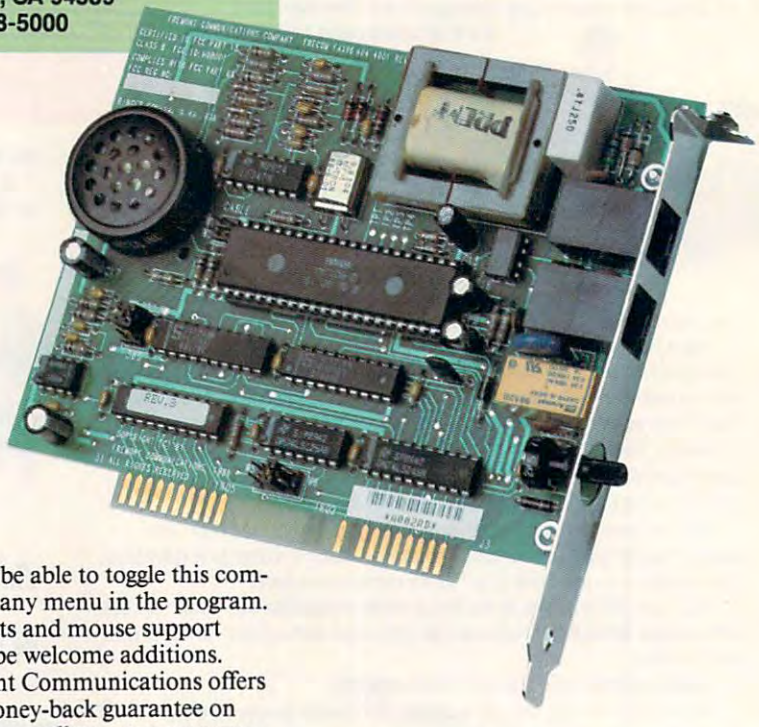
A special feature included with the Fax96 is the ability to send TIFF or PCX file formats, or if you use a scanner, you can send images directly from the scanner as well as scanned disk files. Another handy feature is the log that automatically records the faxes you send. The quality of the graphics faxes I received could compete with graphics from any fax machine I've ever used. The printout of the PCX file (640 × 350 resolution) transmitted almost to the dot resolution of the original.

Demo and tutorial modes take you through procedures step by step. There's also online help available, but you won't need these aids if you've used a fax machine. The control panel buttons make it easy to use the program even with limited exposure to the manual.

The documentation is relatively easy to follow as far as the installation of the board and the software goes. The manual is straightforward and easy to read, but some topics aren't easily found because some of the new features are not in the orginal operator's manual. An addendum describes the new features.

The positive features of the Frecom Fax96 move this board to the top of my list of favorite peripherals, but there are several options that I would like to see added in the next software update. The background receive option is accessible either from the command line or from the Exit menu.

Installation: internal
Slot/Bus Required: 8-bit
Fax Group Supported: 3
Other Requirements: CGA, EGA, VGA, or Hercules
List Price: $195.00
FREMONT COMMUNICATIONS
46309 Warm Springs Blvd.
Fremont, CA 94539
(415) 438-5000



You should be able to toggle this command from any menu in the program. Custom fonts and mouse support would also be welcome additions.

Fremont Communications offers a 30-day money-back guarantee on the product as well as a one-year warranty. If one year isn't adequate, you can add a second year for 10 percent of the current price. As a convenience, you send your warranty through the fax board to test its installation.

If you're constantly sending faxes and you'd like to improve your productivity, a fax board is the way to go. The Frecom Fax96 provides this convenient, timesaving way to transmit faxes for a reasonable price. ▷

JOYCE SIDES

Fax Groupies

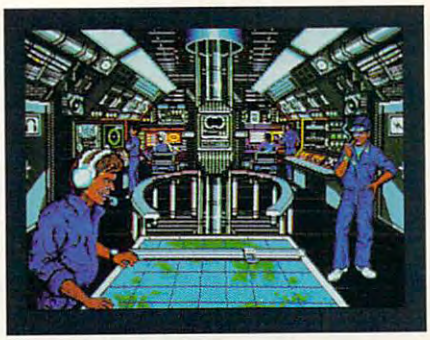
Group 1. Speed of six minutes per page. Introduced in 1974.
Group 2. Speed increased to three minutes per page. Introduced in 1976.
Group 3. Speed increased to one minute or less. Introduced in 1980.
Group 4. Speeds as fast as 3 seconds per page. Introduced in 1984.

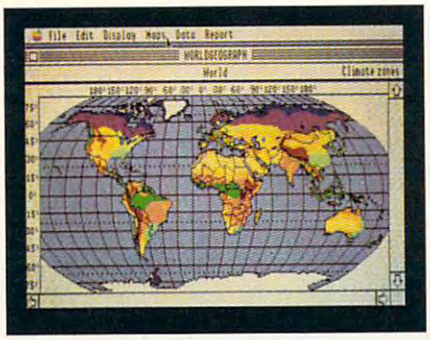
—DAVID DAY

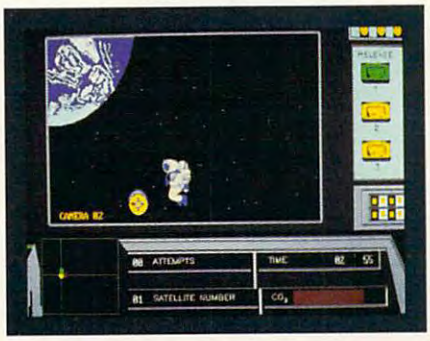
Facsimile Facts & Figures, 1990/91
International Facsimile Association

www.commodore.ca

See The World







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GVC MINI-FAXMODEM FMM-4824

Be careful with this fax machine; it's easy to misplace. When you realize that two of them can hide under a business-sized envelope, you'll have some indication of just how small GVC's Mini-FaxModem FMM-4824 is.

Weighing in at 6.5 ounces (including battery), the Mini-Fax is about the size of a pack of cigarettes, but it works like a full-sized machine. It sends fax files at 4800 or 2400 bps and doubles as a conventional modem at speeds up to 2400 bps.

The Mini-Fax won't tie up any of your PC's internal slots. It plugs directly into a 25-pin RS-232 port. If your PC's serial port has 9 pins, the Mini-Fax connects easily with an optional 25-pin to 9-pin converter.

The Mini-Fax is 100-percent Hayes compatible, has a built-in speaker, and can schedule transmissions to take advantage of lower night rates. It will also send faxes to multiple destinations that you select from its dialing directory, and it can operate in a background mode while your computer performs other chores.

This mighty midget handles graphics as well as text files. With its *Quick Link II Fax* software, you can send text, *PC Paintbrush* (PCX), *MacPaint* (MAC), or Tagged Image File Format (TIF) graphic files from your desktop or laptop PC. It includes a text editor and a function for merging text and graphic files. It also generates cover sheets and can include your logo graphic, if desired.

The Mini-FaxModem FMM-4824 comes with software on 3½- and 5¼-inch disks, an AC adapter, a telephone cable, a modem holder, and a carrying pouch. Whether you use it at home, in the office, or on the road, you'll find the Mini-Fax compact, easy to set up, and simple to operate. ▷

TOM NETSEL

Installation: external
Slot/Bus Required: n/a
Fax Group Supported: 3
Other Requirements: 128K RAM
List Price: $219.00

GVC TECHNOLOGIES
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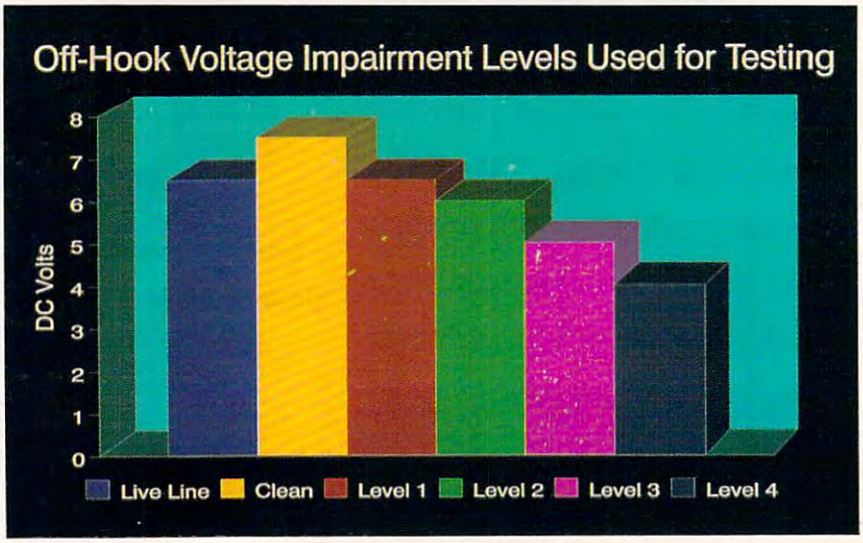
Sparta, NJ 07871
(201) 579-3630



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How to Talk to Your Modem

You may not realize it, but you can talk directly to your modem in its own language. Give it the right commands, and it will dial your phone, answer incoming calls, and do just about everything else in between.

Human-to-modem communication is simplified by the fact that almost all PC modems speak the same language (with minor variations), a lingo based on commands originated by modem manufacturer Hayes. This language is appropriately called the *Hayes command set*.

As you might suspect, your modem has to know the difference between when you're talking to it and when you're talking to a computer at the other end of the line. To keep these two situations straight, all Hayes-compatible modems have two operating modes: command, in which you can issue commands to the modem, and data, in which the modem simply sends what you type over the phone line.

The best way to get your feet wet with modem talk is to run your telecommunications program and enter its terminal mode. In this mode, as long as you're not connected to another computer, you'll be in command mode, and whatever you type will go directly to the modem.

Although the Hayes manual lists nearly 15 pages of commands, there are really just 10 essentials. Master these, and you're on your way to being a modem expert.

AT Type AT to grab your modem's attention. You precede almost every Hayes command with an AT. Type it now, followed by Enter. (You follow all AT commands with Enter, just the way you do DOS commands.) Your modem should respond with the message *OK*. It's worth mentioning that some modems require that you enter commands in uppercase; others aren't so choosy.

A Sets the modem to answer mode. If you're talking with a friend and you want to switch to computer communication, one of you types ATA, the other types ATD, and your PCs will take over. Before this magic can happen, however, you need to make sure that both communciations programs are set with the same parameters and that the modems for both computers are connected through the phones.

DT This is the main touch-tone dialing command. To call 123-4567, you'd type ATDT1234567. If you don't have a touch-tone phone, use DP, for Dial Pulse.

, The comma pauses for the number of seconds specified in register S8 (see below). This command is handy if you're dialing from a switchboard system, like those found in hotels, that can't handle numbers as fast as your modem rolls them out.

H Hang up. If you've had it, ATH is the command to use.

L*n* This is the speaker's loudness. Values for *n* are 0, 1 (low), 2 (medium), and 3 (high). If you want your modem to annoy as many people as possible at the office, use ATL3.

M*n* Controls your modem's speaker, with values for *n* of 0 (off), 1 (on when dialing), 2 (always on), and 3 (on after carrier detected). To turn your speaker off, for example, type ATM0.

+++ When you're connected to another computer, you're in data mode, and the characters you type go directly to the other computer; they aren't considered commands by your modem. If you type AT in data mode, for example, your computer will simply send the characters *A* and *T* to the other end of the line. To get your modem's attention back again, type +++, without a preceding AT and without pressing Enter. Your modem will respond with *OK*. Now you can enter any commands you wish. To return to data mode and talk to the other computer again, type ATO.

S*n* S stands for Store and denotes one of the Hayes registers. There are 16 of these, and although each is interesting in its own way, you'll probably use only two: S8 and S11. The value in S8 tells the modem the number of seconds to pause for a comma. ATS8=3 pauses for three seconds at every comma. S11 is a real sleeper. It controls dialing speed (in milliseconds). To make your modem dial like a demon, try ATS11=55 (smaller numbers make for faster dialing).

Z Resets the registers to their default values. If your modem starts misbehaving, ATZ is a gentle slap in its face.

After you've tried a few of these commands, you may want to look at your terminal program's configuration options. Most programs let you send a command string to the modem. Take advantage of this to make your modem louder or silent or to dial in a blur of speed.

You can also configure your modem by issuing commands directly from the DOS prompt or from a batch file. First, open a COM port with the MODE command; then send the commands to your modem with an ECHO statement. Here's a short batch file that tells your modem to dial the phone at warp factor 5.

```
MODE COM1:1200,n,8,1
ECHO ATS11=55 >COM1:
```

That's it. Modem power in a nutshell.

—CLIFTON KARNES

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HAYES JT FAX 4800 PORTABLE

Hayes, the standard-bearer for PC modem products, brings its considerable expertise to bear on the JT Fax 4800 Portable. I've evaluated several PC fax products over the last year, and the JT Portable is, without a doubt, the easiest to set up, configure, and operate. What's more, its portability lets you take your fax capability on the road.

Installing the JT Portable is simplicity itself. Connect the box to an open COM port using the standard serial cable, plug in your telephone line as directed, and plug the power supply into the wall. That takes care of the hardware. To install the software, insert the Program/Utility disk (one disk for 3½-inch drives, two disks for 5¼-inch drives) and type *Install*. The self-running installation and configuration program will have you ready to send your first fax (your warranty registration) within 15 minutes.

The JT Portable works best with ASCII text files; however, you can fax documents straight from your word processor using the JT's Application Capture option. If you configure your word processor to send its document to an Epson MX–compatible printer, the JT will capture the print job and route it to a receiving fax machine. You'll almost always be better off using Application Capture for sending a fax. The JT won't send graphics from any application, but it will convert its fax files from and to *PC Paintbrush* files (PCX) so that you can transmit and receive letterhead and signatures, for example.

As a receiver, the JT works extremely well. Faxes are captured and stored automatically and can be printed on plain paper (a great advantage over stand-alone machines using thermal paper). I experienced no problems printing a one-page fax on an HP LaserJet–compatible printer.

Installation: external
Slot/Bus Required: n/a
Fax Group Supported: 3
Other Requirements: 640K RAM
List Price: $199.00

HAYES MICROCOMPUTER PRODUCTS
5835 Peachtree Corners E
Norcross, GA 30092
(404) 449-8791

While the JT Portable has a lot to recommend it, there are a few disadvantages. One, the software is memory resident. You'll have to check for possible conflict with other TSRs. This also precludes the use of the JT Portable with such memory-manipulative software as *Windows*. Also, if you run into trouble (a bad connection, for example), it's difficult to regain control of your system for an exit or reboot. Finally, the JT is a fax system only—it doesn't double as a modem.

On the whole, the JT Portable offers flexibility as a trade for full stand-alone fax machine functionality. But it's a trade worth considering if you're in the market for a PC fax device. ▷

PETER SCISCO

Fax Facts

The sidebars "Fax Groupies," "The First Fax Machine," and "Xerox Fax Firsts" are from David Day's *Facsimile Facts & Figures, 1990/91*. The book is available for $69.95 plus $9.00 shipping and handling from the International Facsimile Association, 4023 Lakeview Drive, Lake Havasu City, Arizona 86403; (602) 453-5330.

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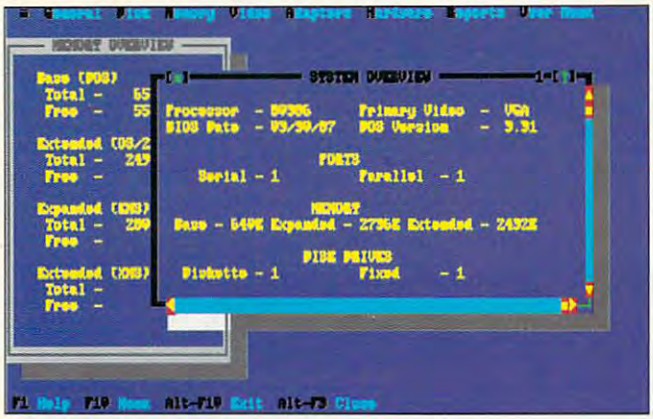

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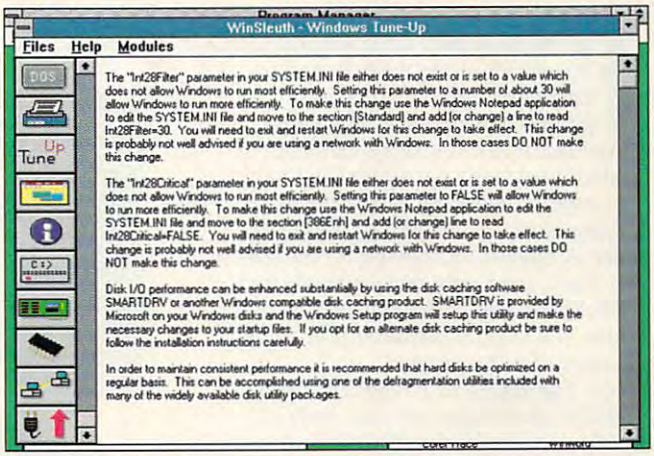
"WinSleuth should be dubbed 'Solutionware'"
Paul Bonner, PC Computing, January, 1991



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HAYES JT FAX 9600B

For the most part, a modem/fax board eliminates the bulk and bad paper associated with fax machines. As wonderful as they are, fax machines can take up valuable space; and many people dislike having to cope with loading paper, clearing paper jams, and handling flimsy paper. A modem/fax device, on the other hand, fits neatly and discreetly into an expansion slot on your PC and allows you to print documents on your choice of printer paper.

Installation: internal
Slot/Bus Required: 8-bit
Fax Group Supported: 3
Other Requirements: 640K RAM
List Price: $499.00

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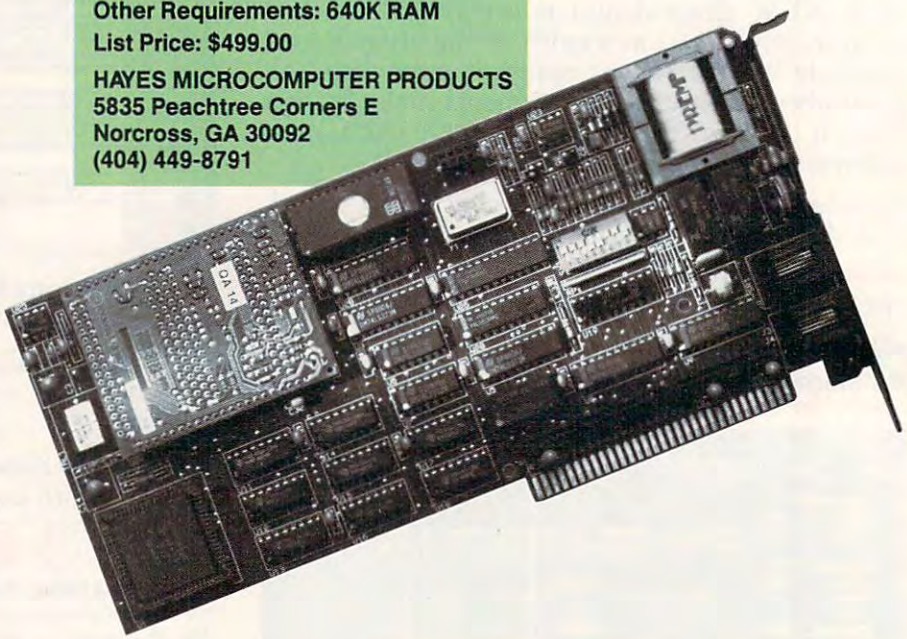


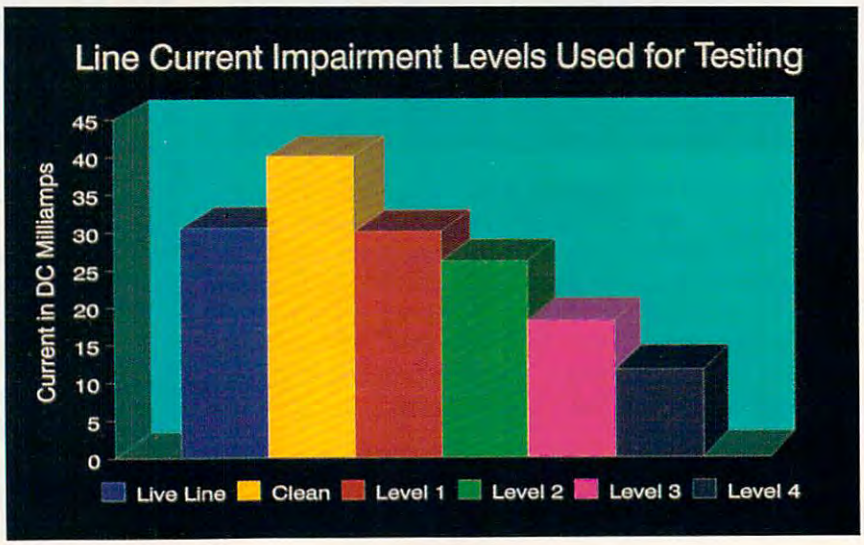
The Hayes JT Fax 9600B covers all the advantages (no bulk, endless software applications) and disadvantages (you have to buy a scanner to transmit copies of physical documents).

Essentially techno-shy, I found the Hayes JT Fax 9600B mercifully easy to install. Just uncover the expansion slots, press it in, and plug in a couple of phone wires. The only disadvantage that I discovered was the size of the modem attached to the fax board. On my IBM XT compatible, I found it necessary to leave the expansion slot open next to it to make room for its bulk.

The software included in the package made sending and receiving fax transmissions as easy as selecting from a series of clear options. It would've been nice to have seen a menu appear when the program came up rather than having to press a hot key, though offering a menu might nullify the advantage of leaving the program in the background for use at any time. Displaying and printing received faxes was no problem, and enlargements were amazingly crisp. The user's guide provided clear illustrations and instructions, though I found it skimpily indexed.

The Hayes JT Fax 9600B may not be quite as convenient in some respects as an actual fax machine, but it makes up for the minor inconveniences with its size and flexibility. ▷

EDDIE HUFFMAN



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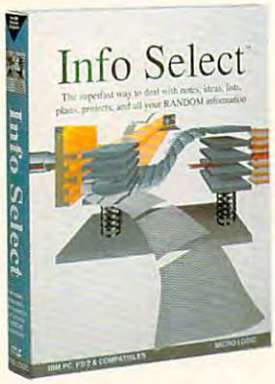

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INFO SELECT is easy to use - yet powerful.

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SATISFAXTION

For a friendly fax that won't take up room on your desk and for receiving faxes as images that can be stored and manipulated by your computer, you'd be hard-pressed to find something simpler to install or easier to use than SatisFAXtion.

The full-length 16-bit board is installed in a couple of minutes (although it's a 16-bit board, it will work in an 8-bit slot). It has no jumpers or switches to set. Once it's in, the only thing left to think about is the software.

You can send faxes from either *Windows* or DOS. For *Windows*-based transmission, the program supports *Faxit* (which isn't included, although you get a coupon for a free copy). There are two options for sending faxes from DOS. You can create a text file and then use the command COPY TEXTFILE LPT3 to send the fax (it invokes a pop-up program called *FaxPop*), or you can print the file from within the program (any program) to LPT3. LPT3 is the fax board; you can easily change the port to LPT1 for programs that can't print to alternative printer ports. LPT3, incidentally, emulates an Epson dot-matrix printer.

Keep up to 1000 fax numbers on file in your online telephone book for automatic dialing from the pop-up program. By using a feature called *grouping* in the telephone book and a special fax process called *polling*, you can automatically send up to 100 faxes, one to each of the numbers in a group. If your word processor allows you to change your printer setting from within the program, you could also print directly from your word processor to the fax line.

At first, the board fought with my mouse for dominance of the serial port, but by telling the installation program that I had no mouse (I lied), I was able to get the data-modem part of the board to cooperate.

The card is equipped with an input for an optional hand scanner that would enable you to fax directly from gray-scale images. Unfortunately, it has a proprietary connection, so only the Intel scanner can be plugged into it.

Installation: internal
Slot/Bus Required: 8-bit or 16-bit
Fax Group Supported: 3
Other Requirements: 640K RAM; MDA, CGA, EGA, VGA, or Hercules; hard disk; mouse recommended if used with *Windows*
List Price: $499.00 ($549.00 for microchannel)

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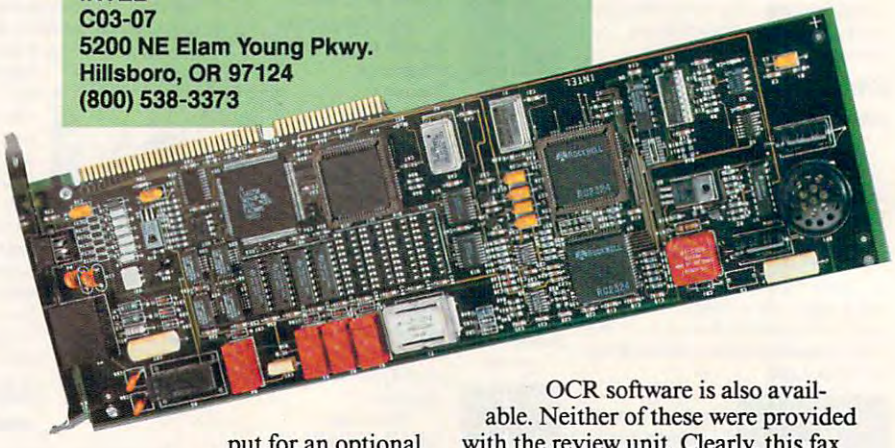

OCR software is also available. Neither of these were provided with the review unit. Clearly, this fax board from Intel has much to offer, including an abundance of useful features, superior ease of use and installation, and a very good manual.▷

ROBERT BIXBY

Fetch That Fax

It used to be easy to have Rover fetch your morning paper. Nowadays, he may have to learn to use a fax machine first. Fax devices have become so commonplace they're beginning to replace more conventional distribution channels.

An excellent example of this is *FAX TRACK Computers*, a computer news daily distributed by fax.

FAX TRACK works like this: Each day's computer news is condensed into one page of executive summaries covering hardware, software, company earnings, and other related topics and faxed to subscribers by 6:00 a.m. For more information on any topic, you can call a toll-free number and have a detailed story faxed back to you.

If you're traveling, give the company your hotel's fax number and receive *FAX TRACK* at your destination.

FAX TRACK Computers is available for $47.90 per month or $527.00 per year from Inlex, 4099 McEwen Road, Suite 350, Dallas, Texas 75244; (800) 800-3994. If you'd like to give *FAX TRACK* a try, a special five-day free trial is available.

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- Custom Pen Holder

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APPOINT

Memory Products

IBM PS/2 MEMORY

CAT. #	DESCRIPTION	NSI
30F5348	512KB Upgrade PS/2 30 286	44.00
30F5360	2MB Upgrade PS/2 30 286	128.00
6450372	2MB Memory Adapter 6450367	395.00
6450603	1MB SIMM PS/2 70-E61; 121	68.00
6450604	2MB SIMM PS/2 50Z-70	108.00
6450608	2MB SIMM PS/2 70 - A21	128.00
34F2933	4MB SIMM PS/2 55SX; 65SX	279.00
6450375	1MB Mem. BD PS/2 80-041	96.00
6450379	2MB Mem. BD PS/2 80 111-321	158.00

CAT. #	DESCRIPT.	NSI
6451060	4MB Mem.BD PS/2 80-A21;A31	298.00
6450605	2-8MB Xpand Mem. PS/2 70&80 w/2MB	348.00
34F3077	2-14MB Xpand BD. PS/2 70&80 w/2MB	388.00
6450609	2-14MB Xpand BD. PS/2 50-65SX w/2MB	388.00

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SIMM MODULES

	150	120	100	80	70	60
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256x9	17.00	19.00	21.00	24.00		
1MBx8			45.50	46.00	55.00	65.00
1MBx9			46.50	47.95	58.00	68.00
4MBx8				259.00	279.00	309.00
4MBx9				279.00	269.00	299.00

DRAM CHIPS

	150	120	100	80	70	60
64x1	.90	1.20	1.50			
64x4		2.00	2.15			
256x1	1.25	1.40	1.60	1.85		
256x4		5.00	5.25	5.60	6.25	7.50
1MBx1		4.75	5.00	5.35	6.00	7.00

COMPAQ MEMORY

CAT. #	DESCRIPTION	NSI
107331-001	512KB Upgrade Portable III	38.00
107332-001	2MB Upgrade Portable III	118.00
107651-001	1MB Module Portable 386	218.00
107653-001	4MB Xpand Mem. Portable 386	630.00
107654-001	4MB Mem. Xtension Portable 386	630.00
108069-001	1MB Xpand Memory DP386-16	288.00
108070-001	4MB Xpand Memory DP386-16	630.00
108071-001	1MB Memory Upgrade DP386-16	108.00
108072-001	4MB Memory Upgrade DP386-16	438.00
110235-001	1MB Memory BD Slt 286	162.00
110237-001	4MB Memory BD Slt 286	630.00
112534-001	4MB Module DP386S-16	298.00
113131-001	1MB Module DP386286E, 386 20-25E	96.00
113132-001	4MB Module DP2886E, 386 20-25E	228.00
113633-001	1MB Xpand Mem. DP386S-16	148.00

CAT. #	DESCRIPTION	NSI
113634-001	4MB Xpand Mem. DP386S-16	358.00
113644-001	1MB Xpand Mem. DP386 20E, 25E	148.00
113645-001	4MB Xpand Mem. DP386 20E, 25E	358.00
113646-001	1MB Module DP386S-16	110.00
115144-001	1MB Module DP386-33, 486-25, Syspro	158.00
116561-001	8MB Module 486-25, Syspro	899.00
116568-001	32MB Module DP486-25, Syspro	4,990.00
117077-001	512KB Mem. BD Portable LTE	119.00
117081-001	1MB Mem. BD Portable LTE 286	99.00
117081-002	2MB Memory BD Portable LTE 286	158.00
118688-001	1MB Module DP286N, 386N	90.00
118689-001	2MB Module DP386N, 386S-20	168.00
118690-001	4MB Module DP286N, 386N,	396.00

TOSHIBA MEMORY

CAT. #	DESCRIPTION	NSI
PC10-PA8304U	2MB Memory Card Portable T5200 Toshiba Destop T8500	168.00
PC12-PA8307U	2MB Memory Card Portable T3200SX	168.00
PC13-PA8306U	2MB Memory Card Portable T1200XE	168.00
PC14-PA8311U	1MB Memory Card Portable T1000SE-XE	218.00
PC15-PA8308U	2MB Memory Card Portable T3100SX	162.00

CAT. #	DESCRIPTION	NSI
PC15-PA8310U	4MB Memory Card Portable T3100SX	378.00
PC6-PA7137U	3MB Memory Card Portable T3200	228.00
PC7-PA8301U	2MB Memory Card Portable T5100	168.00
PC9-PA8340U	512K Memory Card Portable T3100E	120.00
PC9-PA8341U	2MB Memory Card Portable T3100E	168.00

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LASER PRINTER MEMORY

Cat. #		WORKS WITH	NSI
H33474B	1MB	HPLaser Jet IIP,III, IIID	99.95
H33475B	2MB	HPLaser Jet IIP,III, IIID	139.95
H33477B	4MB	HPLaser Jet IIP,III, IIID	214.95
H33443B	1MB	HPLaser Jet II & IID	99.95
H33444B	2MB	HPLaser Jet II & IID	139.95
H33445B	4MB	HPLaser Jet II & IID	214.95
1039136	1MB	IBM Laser 4019	139.00
1039137	2MB	IBM Laser 4019	185.00

Cat. #		WORKS WITH	NSI
1038675	3.5MB	IBM Laser 4019	229.00
M6005	1MB	Apple LaserWriter II/NTX	85.00
M6006	4MB	Apple LaserWriter II/NTX	319.00
S63-1300	1MB	Canon LBP-8II	119.00
S63-1880	2MB	Canon LBP-8II	189.00
N/A	4MB	Canon LBP-8II	269.00

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OKITEL 2400B PLUS PC MODEM

There are three questions I ask when I'm shopping for a modem card. Will it be easy to install, does it have all of the features I need, and will it perform over a reasonable period of time without failure? After putting this Okitel 2400B Plus through some paces, I can answer all three questions with a most definite *Yes.*

This modem occupies a full-sized expansion card. That tells me several things. Most important, it indicates that the design engineers didn't cut any corners to save money on production costs. It also means that the components won't overheat since there's plenty of space between them. And if repairs are ever necessary, a technician will have an easier time finding problems. Considering the quality engineering, I figure this modem will outlast most of the others that I've seen and used.

Installing a modem card can be frustrating, but the Okitel's documentation is clear and well illustrated. Knowing precisely where to look and what to do helped immensely because I had to change some jumpers on the modem card so that it wouldn't conflict with my other serial devices.

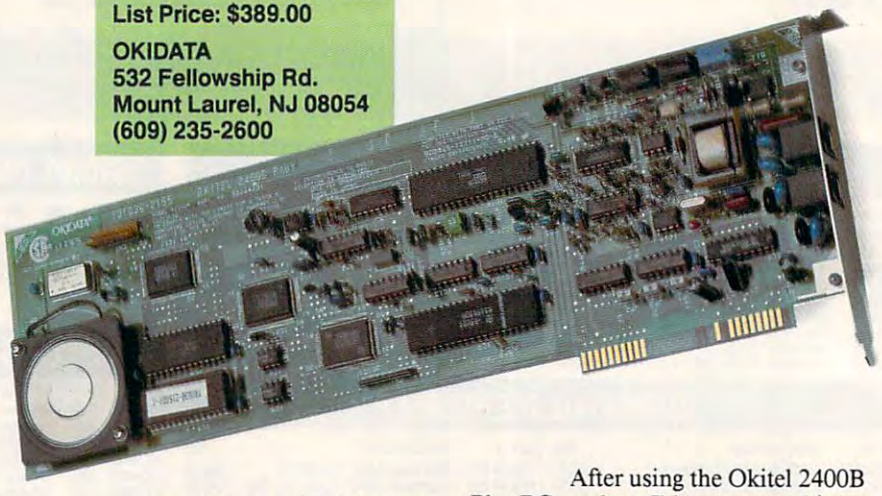
The default settings of my terminal program, *ProComm Plus,* didn't work. Here again, fixing these types of problems can be a hassle. But it wasn't. I read through the documentation, easily found the information that I needed, and set the *ProComm Plus* modem specifications. From then on, my telecommunicatons went smoothly.

And last but not least, this modem, being Hayes compatible, has all of the features I need. Not only did *ProComm* work fine, but so did other programs that I use, such as *Telix* and *Windows Terminal.*

The folks at Okidata were kind enough to provide telecommunications software. It's good enough to get started with, but you'll want to find something else if you want a full-featured program.

Installation: internal
Slot/Bus Required: 8-bit
Other Requirements: n/a
List Price: $389.00

OKIDATA
532 Fellowship Rd.
Mount Laurel, NJ 08054
(609) 235-2600



After using the Okitel 2400B Plus PC modem, I'd recommend it to anyone. It's a quality modem card that has excellent documentation and carries all of the features you need. ▷

RICHARD C. LEINECKER

The First Fax Machine

The first primitive facsimile machine was invented by Dr. Alexander Bain, a Scottish physicist, in 1842. This may come as a surprise to the many people who had only heard of facsimile during the fax explosion of the past five years.

Dr. Bain's early effort was developed even before the invention of the telephone by Alexander Graham Bell in 1876. It had a pendulum which created a brown stain as it swung across chemically treated paper.

It is interesting to note that both of these pioneers were of Scottish origin. Bell's U.S. Patent became the most valuable ever—and held by a foreigner! However, he did become an American citizen in 1882. Although Bell's life work, even apart from the telephone, is well documented up to his death in 1922, Alexander Bain's contribution to facsimile is little known. It is the author's sincere hope, that as the facsimile industry continues its meteorical rise, the work of its inventor, Dr. Alexander Bain, will not be forgotten.

Dr. Bain's device was called the Electromechanical Recording Telegraph, and although today it may not be considered to have been a commercial success, little or no attempts were made to market the device at that time. —DAVID DAY

Facsimile Facts & Figures, 1990/91
International Facsimile Association

www.commodore.ca

TANDY FAXMATE

Fax communication is a fast and efficient variation on conventional information exchange. Trading the slow pace of mail or express delivery services for instantaneous worldwide communication, it offers good speed but poor-quality paper, few machine language barriers but some document-form limitations.

The Tandy FaxMate is an appropriately fast and efficient fax board that lets you send and receive facsimiles from your PC. Offering few frills, easy use, and mediocre onscreen reproduction, it simply gets the job done.

The FaxMate is easy to install: Remove your PC's cover, snap the fax board into a slot, and plug in a couple of phone cords. Its software is similarly easy to install and use, providing clear instructions and, for the most part, easily followed paths to any field, whether sending a fax or altering the current setup (I was caught off guard, though, when its automatic receive function kicked in unexpectedly).

With automatic setup of files for received faxes and steps that walk you through setting up a cover sheet and sending a document, the FaxMate does most of the hard work for you. It automatically redials if it gets a busy signal when sending, and it allows for automatic transmission to different machines during low-rate times.

Though designed to operate with the *DeskMate* software program, the fax board and accompanying software work fine on their own. The only substantial complaint I had was with onscreen reproduction of received documents. When the documents show up onscreen, they're illegibly reduced. And for all the software's zooming and half-sizing capabilities, making a document readable onscreen takes a lot of doing. However, the FaxMate readily prints clear, full-sized fax documents. And you enjoy the speed and convenience of working from your computer. ▷

EDDIE HUFFMAN

Installation: internal
Slot/Bus Required: 8-bit
Fax Group Supported: 3
Other Requirements: 640K RAM; hard disk with at least 3MB available; 3½- or 5¼-inch floppy disk drive; 80-column monitor with CGA, EGA, VGA, Tandy 16-color, Hercules, or compatible graphics; MS-DOS version 3.1 or higher
List Price: $249.95

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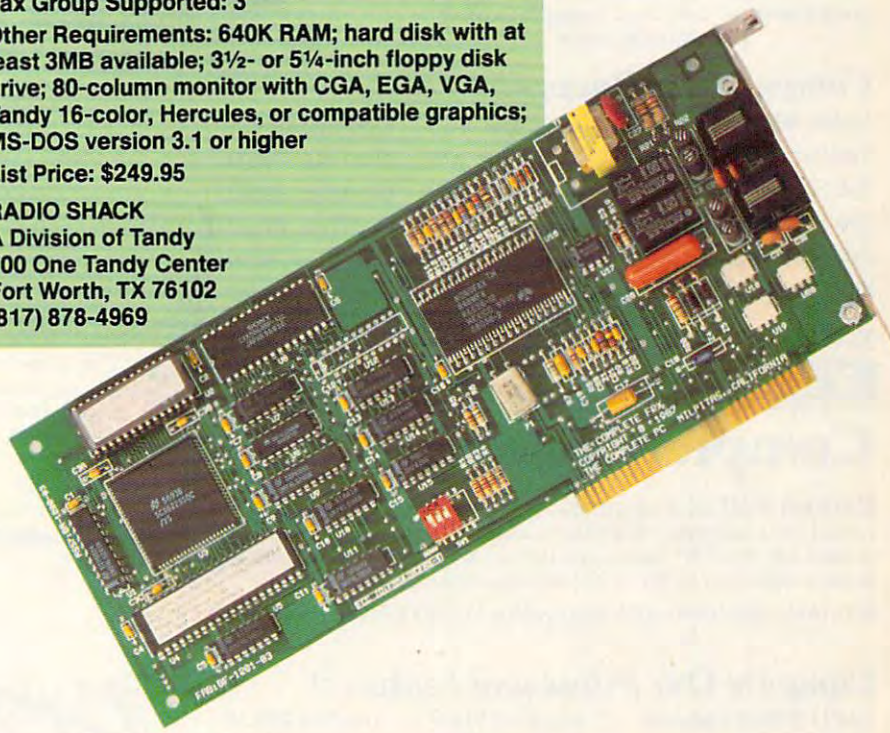

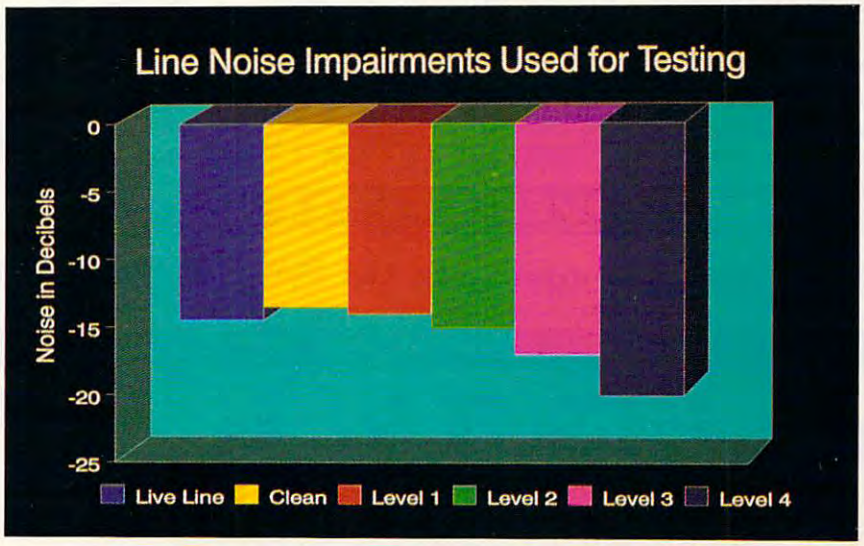

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WORLDPORT 2400 MODEM

The Touchbase Systems WorldPort Hayes-compatible modem is small—about the size of a pack of cigarettes—but topnotch. It attaches externally to the computer through the serial port and can be powered by a standard nine-volt battery, an AC adapter, or the computer itself. It connects to the phone line either through its modular phone jack or by means of an acoustic coupler.

The WorldPort cannot connect directly with some computers because it requires a 25-pin serial port. But an appropriate adapter cable, such as the DB9–DB25, will take care of that.

The modem gets its power directly from some computers, but not all. Using an alkaline battery as an alternative will maintain power for about six hours of continuous use. The unit also comes with an AC adapter. You switch the modem on and off using your communications software.

A phone jack on the modem's side connects directly to the telephone line running from your wall. There's only one jack on the modem, so to use your phone along with the modem, make sure the modem is either at the end of a daisychain or plugged into a Y-connector at the wall jack. An alternative to directly connecting the modem to the phone line is plugging it into an acoustic coupler using an adapter cable provided in the package.

The WorldPort worked well with each commercial or public-domain telecommunications program I tried at the modem's three speeds of 300, 1200, and 2400 bits per second. And, in case you lack such software, the unit comes with a powerful communications package—*Carbon Copy.*

The WorldPort is a very nice piece of equipment—easy to use, reliable, and well documented. The only thing preventing me from rushing out to buy one for myself is the whopping $359 price tag. Of course, you can expect the street price to be lower. ▷

BRUCE M. BOWDEN

Installation: external
Slot/Bus Required: n/a
Other Requirements: Any computer with an RS-232 port and the ability to accept the Hayes AT command set
List Price: $359.00

TOUCHBASE SYSTEMS
160 Laurel Ave.
Northport, NY 11768
(516) 261-0423

Bits, Baud, and CPS

Bits Per Second (bps). The number of data bits the modem is capable of transmitting each second.

Data Bits. The number of bits transmitted for each byte of data. Seven-bit characters usually represent the 128 standard ASCII characters; 8-bit characters can represent control characters and special token or graphics characters.

Baud Rate. The number of times per second a signal in a communications channel varies or changes states. This doesn't necessarily translate to bps.

Multiple-State Modulation. This method allows multiple bits to be sent with each baud.

Characters Per Second (cps). The number of characters transmitted by a modem in a second.

Medium- and high-speed modems use baud rates lower than their bps rates by employing multiple-state modulation. For example, 1200-bps modems that conform to the Bell 212A standard (which includes most 1200-bps modems used in the U.S.) operate at 300 baud and use a modulation technique called *phase modulation* that transmits four bits per baud.

—MICHAEL A. BANKS

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What We Tested

First of all, we tested the specific features and capabilities of this month's communications devices. While this kind of information routinely appears in advertisements and manuals, our tests allowed us to thoroughly check out these features and capabilities.

In addition, we ran a series of pass/fail tests to determine that each device did in fact function as the manufacturer indicated it would. Testing modems and fax units presents some interesting challenges. Because communications devices must, to a large extent, conform to industry standards in order to do what they do, a comparison of numerical benchmark results would not yield statistically significant information. Therefore, a pass/fail system was adopted, and each of the communications devices passed our rigorous tests.

Modem Testing

To test this month's modems, the lab used a 2400-baud Hayes-compatible external modem connected via the serial port to an IBM AT (6MHz). Using *ProComm Plus* communications software (parameters: 2400, N, 8, 1) and the SuperKermit file-transfer protocol, the lab sent and received the following test files:

File Name	*File Description*	*File Name*	*File Description*
SPALOGO. IMG	bitmap graphics	BUSY.EXE	executable program
SOFTWARE.TEX	ASCII text file	CAN.TIF	TIFF scanned-image file
WATERFAL.PCX	*PC Paintbrush* file	PRINTER.DOC	ASCII extended characters
MEMCHK.COM	command program	SAY.EXE	executable sound program
QT.COM	command program	VOICE.V3S	digital sound file
4000AS.TXT	ASCII alignment text file	WINDLOGO.GEM	GEM vector graphics file

The lab installed the test modem either externally or internally on an 80386 SX (16MHz). Additional hardware consisted of a TLS-3 line simulator, an FTS-80 modem/fax test set, and a proprietary multilevel line noise/signal impairment generator unit. All off-hook meter readings and test levels were calibrated and confirmed using a standard AT & T 2500 Touch-Tone telephone set. Test files were sent and received using "clean" simulator conditions, as well as impairment levels 1 through 4. These impairment levels mimic problematic line conditions you might encounter in your everyday electronic communications. The lab ran executable and program files at the end of each test cycle and compared file sizes. To confirm the integrity of the file transfer, the lab displayed text and graphics files.

Fax Testing

The lab used the manufacturer's proprietary software for all testing. For all fax-transmission testing, the lab used several test files (supported by the hardware/software):

File Name	*File Description*	*File Name*	*File Description*
SPALOGO.IMG	bitmap graphics	4000AS.TXT	ASCII alignment text file
SOFTWARE.TEX	ASCII text file	CAN.TIF	TIFF scanned-image file
WATERFAL.PCX	*PC Paintbrush* file	PRINTER.DOC	ASCII extended characters

Test files were sent and received using clean simulator conditions, as well as impairment levels 1 through 4—again, reflecting adverse line conditions you might encounter. Documents received from the tested fax devices were compared with laser-output samples of the original document files to judge quality of the transmission and visually confirm the integrity of the file transfer. The lab used the highest available baud rate for sending files from the test unit to the receiving fax unit, which supports 9600 baud in standard Group 3 mode.

For testing fax device units that can receive files, the lab used a nine-page set of laser-output samples with a cover sheet; both clean and impaired line conditions were used. The lab viewed received fax files on the video display between test cycles and generated laser-output specimens of the received files using the fax software's file-printing utilities and a 300-dpi HP-compatible laser printer.

—TOM BENFORD

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Installation: internal
Slot/Bus Required: 8-bit
Fax Group Supported: 3
Other Requirements: n/a
List Price: $169.00

ZOOM TELEPHONICS
207 South Street
Boston, MA 02111
(617) 423-1072
(800) 631-3116

To install the Zoom SendFax, all you have to do is decide which COM port it's going to use and set a jumper on the board. Then just slip it in any 8-bit expansion slot, and you're ready to go. (A slightly more expensive external version of the Zoom is also available.)

You'll be able to use the modem for two-way communication and the fax for sending faxes (but you won't be able to receive faxes with this Zoom board).

The modem portion of the Zoom/Modem HC2400S SendFax works flawlessly. It has full Hayes AT-command set compatibility (including support for all the standard Hayes registers), and it boasts a speaker with a tone that you'll find clearer than most.

For telecommunicating, you can either settle in with the *ProComm* communications software or use *ProComm* to download an even nicer communications program such as *Telix.*

For sending faxes, you can get your feet wet with the bundled *BitFax,* but it's no fun to use, and although you can combine graphics and text in your faxes, you may find the process cumbersome. You won't get many "oohs" and "ahs" for your documents' design at the other end of the telephone line.

There is other send-fax software, however, and the Zoom will work with any program that supports the Sierra chip set. If you're using *Microsoft Windows,* one excellent program is *WinFax* (Delrina Technology, 1945 Leslie Street, Toronto, Ontario, Canada M3B 2M3; 416-441-3676; $69). With it, you can send beautiful faxes, and doing so is about as easy as printing.

Do I recommend the Zoom SendFax? You bet I do. It has performed flawlessly, and even though I'm not enamored with the bundled software, you just can't beat the Zoom's price. ▷

CLIFTON KARNES

All Benchmark/Performance Testing is conducted by Computer Product Testing Services, Inc. (CPTS), an independent testing and evaluation laboratory based in Manasquan, New Jersey. Every effort has been made to ensure the accuracy and completeness of this data as of the date of testing. Performance may vary among samples.

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❑ **WordWhiz (1252)** A challenging word game that tests your vocabulary.

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❑ **Wunder Book (1269)** A collection of 5 colorful and fun games in English, Spanish, French, and German for children 3 to 10 years old. EGA or VGA

❑ **Animated Shapes (1264)** Teaches shapes and colors to pre-schoolers using animated graphics. 640K, EGA

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❑ **On Side (1506)** Prints your spreadsheets (or any file) sideways.

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❑ **Lotus Learning Sys. (1810,1811)** A complete package that makes it easy to learn Lotus 1-2-3. (2 disks) HD

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❑ **Paint Shop (1488)** An excellent graphics tool for desktop publishing. Supports BMP, GIF, IMG, MAC, PCX, and RLE formats.

❑ **Active Life (1472)** A powerful system for managing your active business and personal life.

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❑ **XVTDraw (1489)** A great drawing program that is in many ways better than the Windows Paintbrush program.

❑ **Screen Peace (1486)** A FANTASTIC screen saver with many beautiful and interesting variations.

❑ **Change Cursor Utility (1487)** Allows you to design your own arrow and hourglass cursors to use with Windows.

WORD PROCESSING

❑ **WP 5.0/5.1 Clip Art (1875,1876)** A large collection of clip art to add spice to your WP documents. (2 disks)

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❑ **Grab Plus/Laser Label (1883, 1884)** Takes addresses from a word processor and sends them to the printer. HD

APPLICATIONS

❑ **Trip Planner (1331)** A computerized road map. Computes best route. Very popular!

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❑ **Cash Control (1127)** Manage your bank accounts the fast and easy way with this great program. 320K

UTILITIES

❑ **Auto Menu (1409)** A professional hard disk menu system. Run any of your programs from a customized menu. HD

❑ **ViruScan (1440)** Make sure your computer is virus-free with this valuable utility. Highly recommended!

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❑ **Telix (1422)** The best telecommunications program available. HD

❑ **VGA Fonts (1442)** A collection of fun and interesting fonts to spice up your VGA screen display. VGA

❑ **Virus Central (1441)** A program that simplifies the use of ViruScan by providing a menu oriented environment. Requires ViruScan. 512K, CGA, HD

❑ **PC Pro (1443)** Combines a user menu, a file manager, an enhanced DOS prompt, and many new features into one environment. 384K, HD

GAMES

❑ **Double Blocks (1970)** A TERRIFIC Tetris clone for 1 or 2 players. Records top scores. You will love this!!

❑ **Video Poker/Ultima 21 (1945)** The BEST poker and blackjack games!

❑ **Pharaoh's Tomb (1974)** Face monsters and traps as you explore the pyramid. Your goal is to survive.

❑ **Bass Tour (1925)** Fish in your choice of lakes. Try to win the trophy.

❑ **ZZT (1921)** Test your problem solving ability and your arcade skills as you battle your way through 43 rooms.

❑ **Field General (1931)** Experience the excitement of a pro football game from a coach's point of view. CGA, HD

❑ **Insanity (1936)** Find your way out of this maze before going insane! CGA

❑ **The Monuments of Mars! (1920)** Many tough levels filled with puzzles, traps and creatures. 350K, CGA

❑ **Arctic Adventure (1982)** Contains 80 new levels of mind bending, finger twitching, arcade action. 350K, CGA

VGA GAMES

❑ **Shooting Gallery (1990)** Seven variations of a shooting range on your computer screen. VGA, mouse

❑ **VGA Sharks (1992)** Recover lost treasure in shark infested waters in this action arcade game. VGA

❑ **Beyond Columns (1997)** Beyond is like Tetris with a twist. VGA

❑ **VGA Jigsaw (1993)** Uses beautiful pictures to create puzzles for you to put back together. VGA

EGA GAMES

❑ **The Last Half of Darkness (1962)** Scary graphics and mysterious puzzles to challenge your mind. EGA, HD

❑ **Dark Ages (1964)** A brilliant arcade/adventure game with superb graphics and animation. 400K, EGA, 286 or faster machine.

❑ **Poker Slot (1989)** Plays just like the video poker machines you see in casinos. Great graphics! EGA, mouse

❑ **Commander Keen (1986)** One of the best games we have ever seen. Exceptional play and graphics. EGA

❑ **Double Link (1983)** A great Tetris style game that is sure to keep you challenged. EGA

IMPORTANT

CGA = Requires Color Computer
EGA = Requires EGA or VGA
HD = Requires Hard Drive
512K = Requires 512K RAM
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FAX AND MODEM CAPABILITIES

	Brooktrout Fax-Mail 96	The Complete FAX/Portable	Fremont Frecom Fax96	GVC Mini-FaxModem FMM-4824	Hayes JT Fax 4800 Portable	Hayes JT Fax 9600B	Intel SatisFAXtion	Okidata Okitel 2400B Plus PC Modem	Tandy FaxMate	Touchbase WorldPort 2400 Modem	Zoom/Modem HC2400S SendFax
Max Speed	9600	9600	9600	4800	4800	9600	9600	2400	4800	2400	4800
Min Fallback	2400	2400	2400	2400	300	300	300	300	2400	300	2400
Data Modem	O	O	O	●	O	●	●	●	O	●	●
Auto Fax/Modem Select	n/a	n/a	n/a	●	n/a	●	●	n/a	n/a	n/a	●
Fax Transmit	●	●	●	●	●	●	●	O	●	O	●
Fax Receive	●	●	●	O	●	●	●	O	●	O	O
Dithered/Gray Scale	O	●	O	O	●	●	●	n/a	●	n/a	●
Compressed Fonts	●	●	O	O	●	●	●	n/a	●	n/a	O
Max Modem Data Speed	n/a	n/a	n/a	2400	n/a	2400	4800	2400	n/a	2400	2400
AT Command Set	n/a	n/a	n/a	●	n/a	●	●	●	n/a	●	●
Background Operation Mode	●	●	●	●	O	●	●	O	●	O	●
Min Memory Requirement	62K	640K	41K	128K	640K	640K	640K	128K	384K	none	320K
Capture PrintScreen Output	●	O	O	●	●	●	●	n/a	●	n/a	O
Capture Screen to File	●	O	O	O	●	●	●	n/a	O	n/a	●
Capture Text Sent to Printer	●	●	●	●	●	●	●	n/a	●	n/a	●
Capture Graphics Sent to Printer	●	●	●	●	●	●	●	n/a	●	n/a	●
Direct Scanner Transmit	●	●	●	O	●	●	●	n/a	O	n/a	O
Direct Printer Text-File Transmit	●	●	●	●	●	●	●	n/a	O	n/a	●
Direct Printer Graphics-File Transmit	●	●	●	●	●	●	●	n/a	O	n/a	●
Max Pages Transmit/Receive	no limit	no limit	no limit	255	no limit	no limit	999	n/a	25	n/a	no limit
Adds Document Headers	●	●	O	●	●	●	●	n/a	●	n/a	●
Generates Letterhead	●	●	O	●	●	●	●	n/a	O	n/a	●
Generates Cover Sheet	O	●	●	●	●	●	●	n/a	●	n/a	●
Auto Answering	●	●	●	●	●	●	●	●	●	●	●
Auto Dialing	●	●	●	●	●	●	●	●	●	●	●
Auto Printing	●	●	O	n/a	●	●	●	n/a	●	n/a	n/a
Auto Speed/Rate	●	●	●	●	●	●	●	O	●	●	●
Performs Polling	●	●	O	n/a	O	O	●	n/a	●	n/a	O
Audible Speaker	O	O	●	●	●	●	●	●	O	●	●
Volume Control	n/a	n/a	●	●	O	●	O	●	n/a	●	●
Custom Fonts	●	O	●	●	O	O	●	n/a	O	n/a	O
File Conversions	ASCII, PCX, EPC	ASCII, PCX, TIF, CUT, MSP, Epson FX, Complete FAX	ASCII, PCX, TIF, FAX	ASCII, PCX, TIF, MAC	ASCII, PCX, FAX	ASCII, PCX, FAX	ASCII, PCX, DCX, Epson	n/a	ASCII, PCX, TIF, CUT, MSP, Epson FX	n/a	ASCII, PCX, TIF, IMG, PIX, *WordStar*, *WordPerfect*
Second Jack	●	●	●	●	●	●	●	●	●	O	●

●=yes O=no

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Interpreting the Grid Information

The grid information has been supplied by *COMPUTE*'s independent testing laboratory (Computer Product Testing Services) and should help you sort out the various capabilities of our Test Lab evaluation units.

Because much of the technology is new and unfamiliar, we have defined selected terms for you.

Max Speed. The maximum tested fax speed (in the case of fax units) or modem speed (in the case of modem-only units). The **Max Modem Data Speed** is the fastest modem speed for those devices with modem capabilities. This and all other speed listings are in bits per second (bps).

Min Fallback. The minimum speed to which a modem or fax will fall back—that is, slow down—to match speeds with another machine or to perform extra error correction in order to check and ensure data integrity.

Dithered/Gray Scale. A fax unit's ability to employ a technology called *dithering* to produce grays, not just black and white.

Compressed Fonts. A fax unit's own fonts, which allow it to create output more closely resembling the original document. These onboard fonts can also enhance the readability of a document.

Capture PrintScreen Output. A fax unit's ability to translate printer output into a transmittable image file. It simply dumps the screen to a file.

Direct Scanner Transmit. A fax unit's ability to send a scanned image directly, without creating a disk file.

Direct Printer Transmit. The capability to "print" directly to a fax board.

Polling. Unattended, automatic fax transmission and reception. A fax unit's ability, at a deferred time, to send out form letters to a predetermined set of fax numbers. It also allows you to leave documents in your transmit queue and have them transmitted in response to a faxed request. ⊡

Circle Reader Service Number 202

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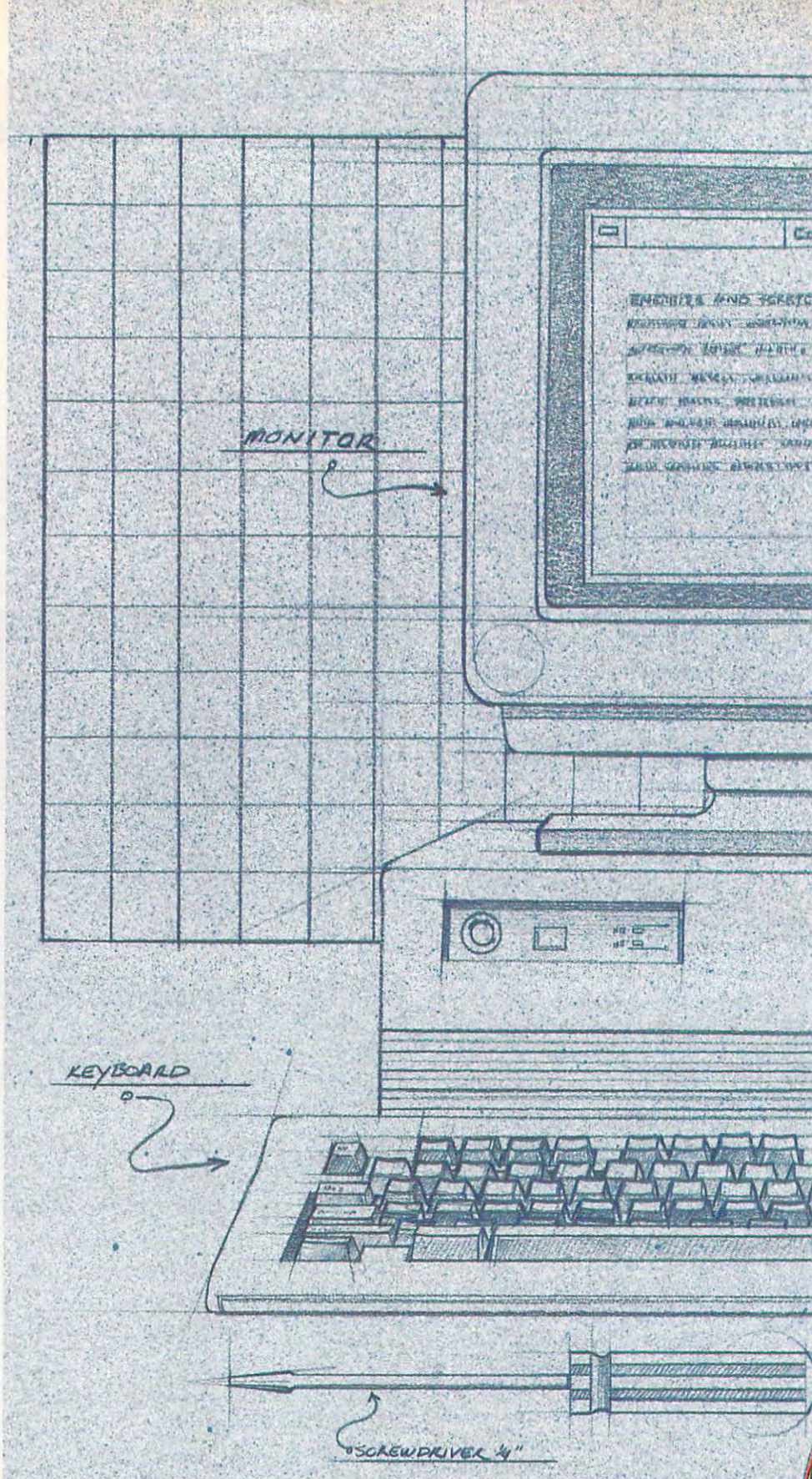
HOW TO INSTALL A HARD DRIVE

MARK MINASI



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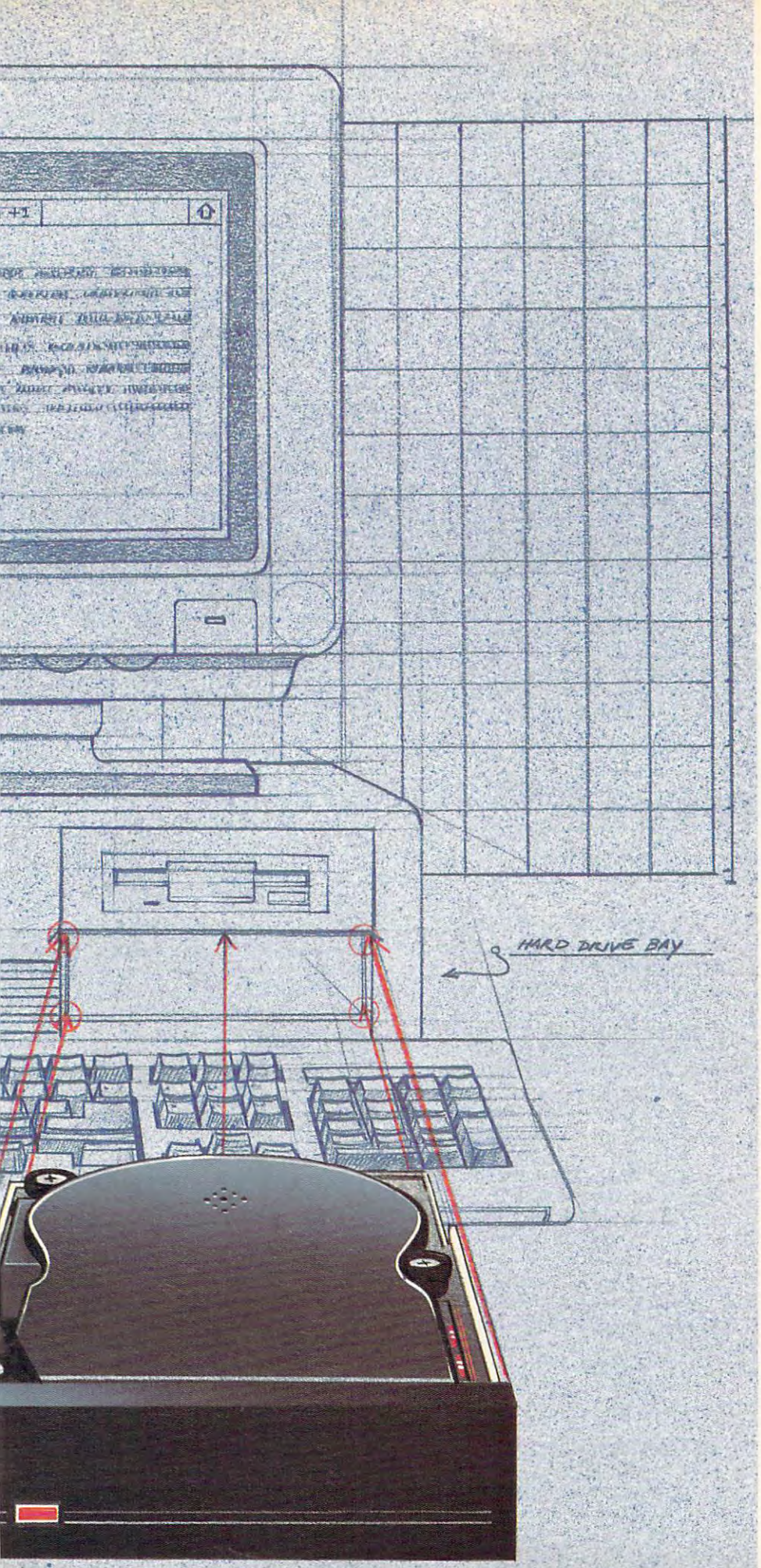


FOUR STEPS TO HARD DISK POWER

A couple of years ago, 20 megs seemed like a lot of storage. But nowadays *everything* burns up disk space at a furious rate. *Windows* 3.0 takes up 5 or more megabytes, *Lotus* several more—heck, even *Wing Commander*, a game with unbelievable graphics, can only manage those graphics by taking up 5 megs on your disk.

So it's time for an upgrade. You buy a larger disk and don't want to pay to have it installed. Here's how to put in your first hard drive or add a second hard drive. ▷

MICHAEL HILL

www.commodore.ca

One caveat before we go further. There is a wide variety of controllers, drives, and interfaces, so one article can't cover them all. What follows will tell you how to install *most* hard drives. Here are the basic steps to the process:

- Gather the information you'll need before you start.
- Configure the hard drive.
- Install the hard drive.
- Install the drive controller.

I'll also assume that you know that a drive system needs a hard drive, a circuit board called a *hard drive controller,* and cables. The controller has to be compatible with the hard drive, or this whole operation isn't going to work.

If you're not clear on how to buy a controller and drive, take a look at "How to Choose a Hard Disk" in the May 1991 issue.

Getting Ready

There are a few things you'll need to know about your drive later on, so let's get this information together before we go any further.

Find whatever documentation came with the drive, controller, and PC. You want to know the heads, cylinders, sectors per track, and write precompensation cylinder for your drive because the controller needs to know that data in order to support your drive. So get this from your vendor and write it down somewhere—you'll probably have use for it even after the drive is installed.

Most drives have a paper label pasted on them with a bad track table or error map. It describes exactly where the disk's surface has some kind of defect. I'm looking currently at a Seagate ST251-1, a popular 42MB drive. It has a white paper label atop it marked *Error Map.* The label looks like this:

Error Map 251/Serial # 26956413

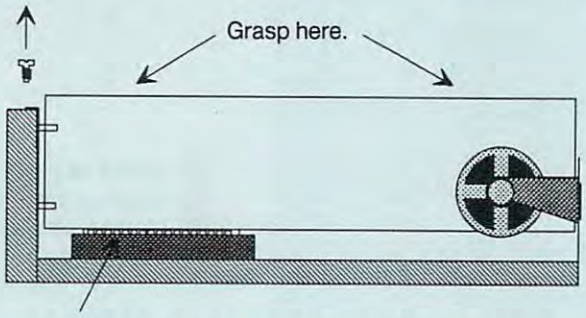
Cyl	Hd	BFI
137	3	2463
140	3	2463
141	3	2463
442	5	3722

The three columns are labeled *Cyl* (Cylinder), *Hd* (Head), and *BFI* (Bytes From Index). As the disk spins, there is an arbitrary starting point that is the index—*BFI* is the distance from this index. (Note an oddity of the table: It sees an error on head 3 for tracks 137, 140, and 141 at the same BFI. It seems highly likely that an error exists also on tracks 138 and 139. Personally, I'd treat head 3, BFI 2463 as bad for cylinders 138 and 139.)

The last suggestion for this installation phase is to collect documentation. There's no sense in tearing the computer apart only to realize that you never got the information on configuring the controller and that you won't get any further until you beg the company to send you that information. And besides, even if you convince the company to send it, you'll look strange lurking around the mailbox waiting for the mail carrier. (Actually, most controller vendors have 24-hour-a-day BBSs from which you can download your controller documentation and other information.)

Removing Circuit Boards

1. Remove any connectors (diagramming them first).
2. Remove the board's mounting screw.
3. Grasp the board along its top edge and rock it GENTLY up and out.
4. Avoid touching the edge connector once the board is out of its slot.



Opening the Computer

There's a good chance you'll have to get into your computer before going much further, since most AT-class machines (286-, 386SX-, 386-, and 486-based PCs) have their hard disk controller and hard disk cables already in the machine. Here are some tips on getting inside the machine with a minimum of trouble. Take your time, and write everything down.

Make a bootable DOS disk. If you don't have a bootable DOS floppy, make one now with everything on it that you'll need to boot the system. If you're replacing a hard disk, you probably always boot from the hard disk and don't have a bootable floppy handy. Make one, and make sure that it has the things you'll need for software preparation: SETUP if it's an AT machine, whatever low-level format program you'll be using, FDISK, and FORMAT.

Park your drive's heads. If you're removing an old hard disk, park it first. You should have a head-parking program around somewhere.

Turn the computer off, and remove the cover. Leave the PC plugged in, however, but be sure to provide antistatic protection, as I'll explain in a minute.

Be especially careful when removing the cover that you don't rip any ribbon cables on the edge of the cover. The ribbon cables for the floppies and hard drive often pop up as the cover is removed, making them easy prey for any sharp edges on the inside of the case.

Also, find an egg carton and use it to help you organize the screws that you take out of the computer. You can use the compartments in the carton to keep the different screws separated. You'll probably find two or three sizes of screws in your PC: large ones that secure the cover, small ones that secure the hard drive, and medium-sized ones that fasten everything else.

Ground yourself. Before you touch anything in the computer, touch the case of the power supply. (Don't know which is the power supply? It's the silver box with the fan in it and the power switch on the side. It's also got a label on it that says—sometimes in several languages—"If you open me, I'll kill you.")

Touching the power supply case drains away any static electricity that you might have built up. This only works if the power supply is plugged in.

Heed this warning: In 1989, I lived in The Condo from Hell for three months. It had the most static-attracting carpet I've ever seen in my life. I was working on a computer and absent-mindedly shuffled my feet on the carpet while trying to work out a problem. I reached over to remove a memory board from the system, and *zap!* A blue spark leapt about a centi-

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meter from my hand to the board. Killed two memory chips and probably weakened others.

Get in the habit of touching the power supply case. (No, you won't get electrocuted by touching the case of the power supply. Just don't open it up—*that* can kill you.)

Remove the hard drive. If you already have a hard drive, remove it and the controller. You can find the controller easily—just follow the ribbon cables from the back of the hard disk to a circuit board. That circuit board is the controller. It'll probably look like a pincushion, as it usually sports a 34-pin connector and two 20-pin connectors.

Before you do any of this, however, *please make good diagrams* so you can put things back the way you found them!

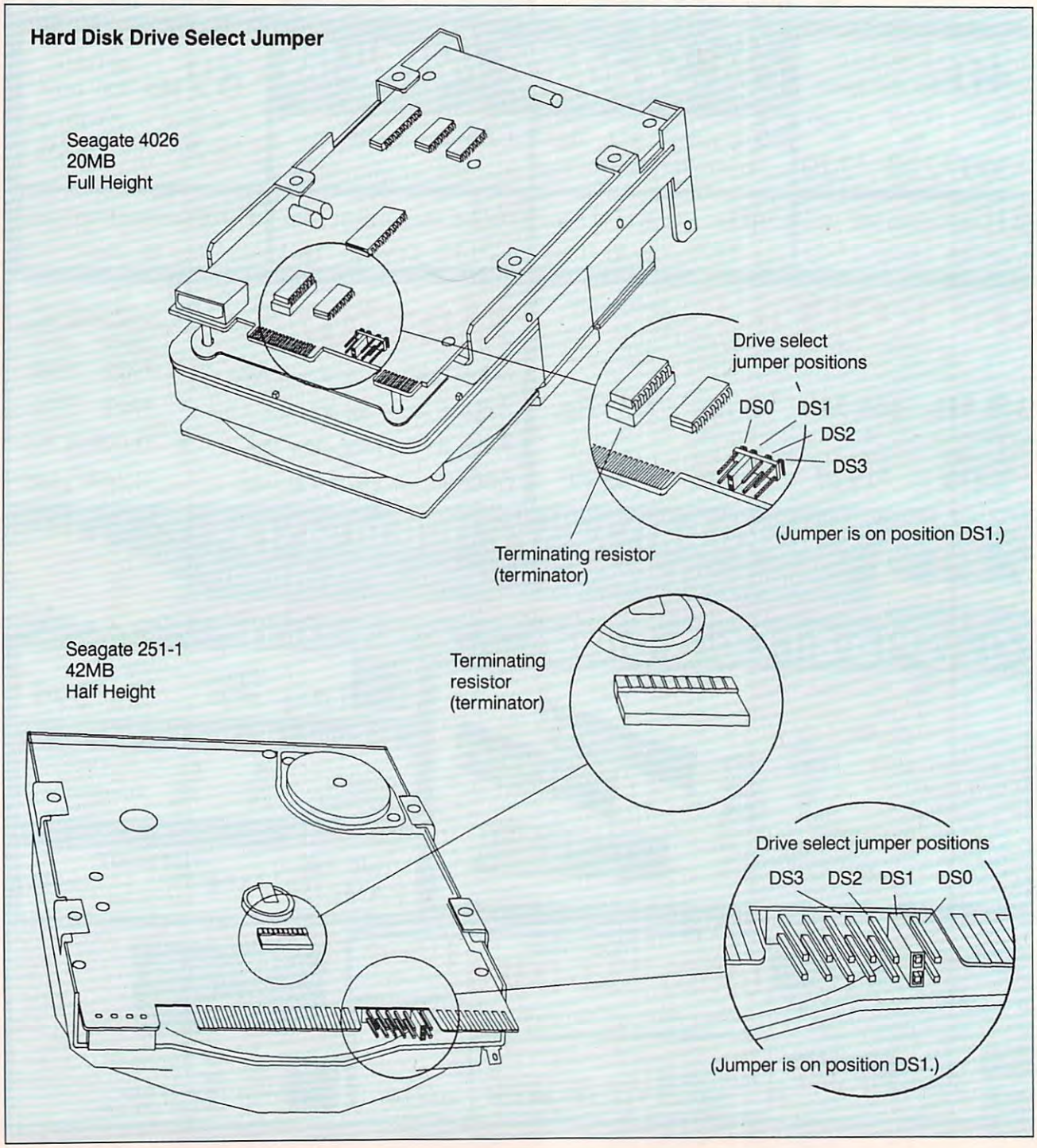
Circuit boards are held into the system with a single screw near the back of the PC. Remove the screw, and the board will come out. Rock the board gently back and forth to remove it from the system board. See the figure "Removing Circuit Boards."

Drives in XT-class systems are generally held in place with screws that bolt the drives right into the chassis. AT-class systems typically have rails fastened to the sides of the hard drives; the drives slide right into the AT chassis like drawers into desks. Metal tabs hold the drives in place.

If you ordered a hard drive with an installation kit for AT-class machines, the installation kit probably consisted of the plastic drive rails and screws to mount them on the drive.

Configuring the Drive

Next, you'll need to adjust two things on your hard drive: the terminator and the drive select jumper. If the drive is the only hard drive (floppies



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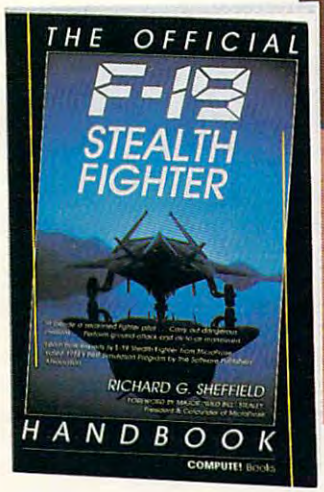

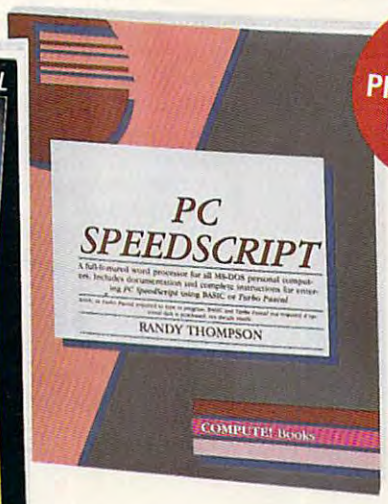

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don't count), you don't need to mess with the terminator.

The drive select jumper gives a drive an address as far as the controller is concerned: either address 0 or address 1. Ordinarily, your first hard drive (let's call it drive C) is addressed 0, and the second, if present, is addressed 1.

Let's call the second hard drive D, and ignore for the present that it's possible for a single drive to own more than one drive letter.

The drive is addressed by placing a jumper—a tiny plastic box (usually black, but I've seen white and blue) over two metal pins.

Drives generally have pins for drive addresses 0 through 5, but we only use addresses 0 and 1 in the PC business. There are a set of pins to jumper for address 0, another set for address 1, and so on.

The address your drive responds to is determined by where you put the jumper. There are two examples of drive select jumpers (and terminators, which we'll discuss presently) on "Hard Disk Drive Select Jumper." Just remember that the drive select jumper only goes on one address.

So we've said that the drive can have address 0 or 1. But which should it use? It depends on whether or not there's a twist in the cable. Your system probably uses two cables to connect the hard disk to the hard disk controller—a wider 34-wire cable and a skinnier 20-wire cable. The 34-wire cable carries the control signals; the 20-wire cable the data signals.

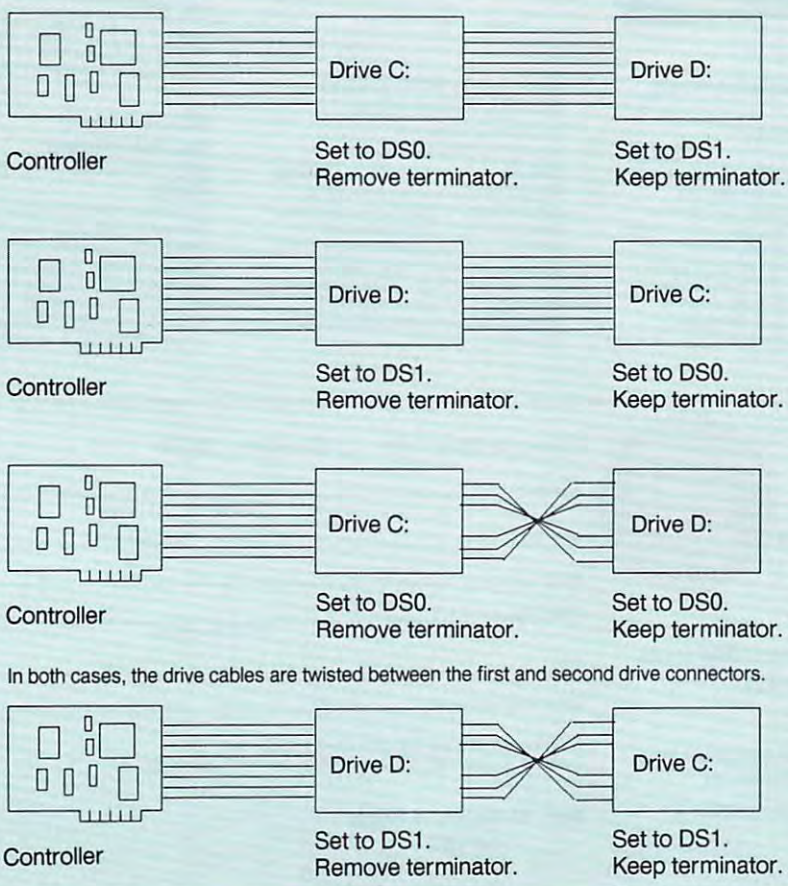
Take a look at the 34-wire cable. It should have a 34-wire connection on one side that attaches to the controller and a 34-wire connection on the other side that attaches to the drive. Is there *also* another 34-wire connection in the middle of the cable? If so, that is intended to support a second hard drive.

If you have the middle connector, look between the middle connector and the hard drive connector on the end. Is there a twist in the cable? Some cables are cut, twisted, and reconnected between lines 24 and 29 on the 34-wire hard disk cables. Knowing whether your cable is twisted or not determines how you set the drive select jumper.

If your cable isn't twisted, you set the drive select jumpers as I've already explained: Drive C is drive select 0, and D is drive select 1. On the other hand, if the cable has a cut and a twist, you set *both* drives to either drive select 0 or drive select 1, as you see in "Hard Disk Cabling."

Power Connector

Hard Disk Cabling



The Terminator

The last adjustment on the drive is the terminating resistor chip, or terminator.

You only need to mess with this if you're installing a second drive. The terminator is a group of resistors packaged in a chiplike housing. It will look like either a chip or half of a chip, and it can be any color, though it is generally *not* black so it will stand out from the rest of the board.

Limited space prevents a complete explanation of the terminator, but basically it's a resistor needed to complete a bus circuit. Drives connected to a controller are on a bus much like the bus that your PC has—the slots on the PC motherboard. Something's got to hold up one end of the bus (termed an *open collector bus*), and that's a resistor called the *pull-up* or *terminating resistor.*

The problem arises when the controller sees *two* drives with terminators—the circuit then ends up with *half* the resistance that it's designed for, and twice as much current runs through the controller and drive electronics. Result? You slowly cook the drive and controller.

So remove the terminator from the drive attached to the connector in the middle of the cable. Again, the arrangement is pictured in "Hard Disk Cabling." Look back to the figure "Hard Disk Drive Select Jumper," and you can see two examples of common hard drive terminators.

Installing the Drive

Now the drive's configured. Let's physically install it in the chassis.

The easiest way to install a drive is to insert it partway into the chassis and then attach the ribbon cables.

Stop at this point; don't get overanxious to screw in the drive. The dif-

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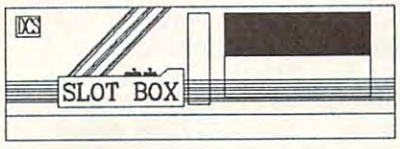

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ference between a good installation and a bad installation (as students in my PC troubleshooting classes hear over and over again) is how the cables are routed.

Now that the cables are attached to the drive, take a minute and figure out where to put them. They go from the drive to the controller, but there's nearly always some slack. Sloppy installers just stuff the cables into the case and then slap the cover on. This is a time bomb. The next time you take the cover off the PC, you'll end up catching the cables on something sharp, and you'll rip them. So take a minute and see if you can tuck them down out of the way.

Don't forget to provide power to the drive with the power connector. That's the white plastic connector with four wires running back to the power supply. You'll see several of these four-wire power connectors. They're pretty universal, and they'll connect to a floppy drive, hard disk, or tape drive. It doesn't matter which one you connect to the drive—they're all equal. There isn't a special one for A and one for C, or anything like that, so use whatever power connector is handy. If they're all in use, you'll need a Y splitter to convert one of the power connectors into two power connectors. Contact your hard disk dealer to buy a Y connector, if necessary.

Now secure the drive. As we saw before, with most systems you either bolt the drive directly to the chassis or secure it with metal tabs that keep it from sliding out of the box. See "Securing Hard Drives" for details.

Install the Hard Disk Controller

If the controller isn't already installed, put it in now. Installing the board is just the reverse of removing it; push the board's edge connector down into an expansion bus slot on the PC motherboard and then secure it with a screw on the board's back bracket.

A common question at this point is *My PC has five (or eight or three) expansion slots. Does it matter which slot I put the board in?* The answer is *Basically, no.* Some boards are 8-bit boards. They're identifiable because they have a single edge connector.

Other boards are 16-bit boards. They have two edge connectors. A 16-bit board should go in a 16-bit slot, but an 8-bit board can go in either an 8- or a 16-bit slot.

Now hook up the cables from the hard drive. If you've got an AT system, the controller will probably be a combination floppy and hard disk controller, so be sure to hook up the cable for the floppy drives, too.

Introduce the Controller and the Drive

Seems only polite, hmmm?

The controller needs to know what kind of drive it's dealing with. On XT-style systems you give it that information during the first part of the software installation—a step called *low-level format,* so we won't worry about that here.

On AT systems, the system BIOS has a table of drive types built into it. Most clones know of 47 different hard drives. Why 47? Who knows? The earliest IBM ATs only knew of 14 drive types, and later ones knew 25. The last batch had 47 drive types. Cloners just copied IBM from that point on.

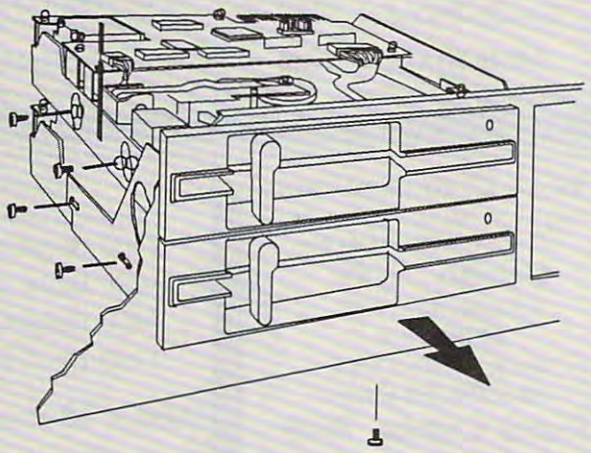
You just figure out which drive type most closely describes your hard disk—remember I told you to have heads, cylinders, number of sectors, and write precompensation handy?

For instance, I use a 60MB hard drive with 1024 cylinders, seven heads, 17 sectors per track, and no write precompensation. There isn't a drive type in my clone's ROM that matches that, but there's one that's close—977 cylinders, seven heads, 17 sectors per track, and no write precomp. That's drive type 18.

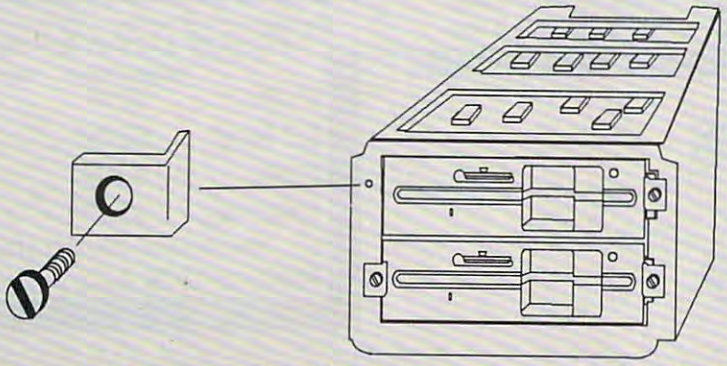
Once I figured that out, I ran my clone's SETUP program and told the system that I had drive type 18, and then I was ready to format the disk. I lost a little space, as I'm only using 977 of my 1024 cylinders, but that's not a big deal.

Well, that's how to do a hardware installation of most PC hard disks. Again, not every drive installation works as I've described, but this is the procedure for installing drives in most XT- and AT-class systems these days. Good luck and have fun—it's a great feeling to do a hard drive installation by yourself!

Securing Hard Drives



XT drives—both floppy and hard—are secured to the XT chassis directly.



In AT-style systems rails are placed on the drives so they can slide in and out of the chassis like drawers in a desk. Metal tabs keep the drives in place.

Mark Minasi is an owner of Moulton, Minasi, & Company, an Arlington, Virginia–based firm specializing in training technical and nontechnical users how to support, upgrade, and repair their PCs. He is also the author of COMPUTE's recently published *Maintaining, Upgrading, and Troubleshooting IBM PCs, Compatibles, and PS/2 Personal Computers*. Some of the illustrations used in this feature were done by Terry Keaton, an associate with Moulton, Minasi, & Company.

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MEET FAMOUS WRITERS ON YOUR PC

Most of us have stories of brushes with the famous and infamous—you may have shared an elevator with Jimmy Stewart or met Lewis Grizzard at a cocktail party, or perhaps your mother-in-law was Richard Nixon's nurse.

However, even if some of us have had the good fortune to meet admired celebrities once or twice in our lives, only a few of us will ever have the opportunity to hold a prolonged discussion with our favorite authors or chat about world events with well-known TV personalities.

Who are those lucky few who can join the in-crowd? If you own a modem, you're only a phone call away from schmoozing with the famous.

The global village prophesied by Marshall McLuhan is in its formative stages on the online networks. You can log on to CompuServe and send ultraconservative radio–talk show host Rush Limbaugh a letter about his latest show. Or log on to BIX and ask science fiction author Jerry Pournelle about his latest novel. During the Persian Gulf War, you could see military analyst Jim Dunnigan on network television explaining Saddam's latest moves. If you were online with GEnie, though, you could have asked him to elaborate on his short TV talk by posting a notice in the message base.

Of course, not everyone is hooked into the networks. Still, you're a lot more likely to be able to engage your favorite authors in a conversation if you run into them online than if you try to call them at home.

While you'll find an interesting assortment of famous (and perhaps infamous) personalities on the online networks, not everyone has moved into the global village yet. If you're into science fiction, though, you'll find that many people associated with that genre are available online. Perhaps because the field is intimately associated with high technology, the personalities associated with it aren't intimidated by online networks.

Whatever the reason, science fiction fans will find the online networks a paradise of information, tidbits, and gossip. The most active area I've encountered online is GEnie's Science Fiction RoundTable (SFRT). Pop into the message base (which is covered under GEnie's $4.95/month Star*Services flat fee), and you'll find an incredible wealth of messages from well-known writers, editors, reviewers, directors, special-effects experts, and occasionally even actors.

The SFRT is divided into 19 different categories, each concentrating on a specific aspect of the genre. Topics include novels, authors, films, science fiction TV shows, comics, conventions, fandom, science fact, writers' workshops, and an entire category devoted to Star Trek.

The Trek category, often the most active of the SFRT's topics, is a dream come true for fans of "Star Trek: The Next Generation." It's a great place for Trekkies to get together and discuss the show with each other, of course. However, they can also talk about the latest episodes with people like Mike Okuda and Ron Moore, who work on the show's computer displays and special effects. Or Chip Chalmers, who has directed a few episodes of the series. Or Brad Ferguson, Carmen Carter, Peter David, John Vornholt, Vonda McIntyre, and other Star Trek novelists. Even Wil (Wesley Crusher) Wheaton has been known to participate in the SFRT, although he's been absent lately due to the unfortunate death of his Macintosh.

Discussions range from the serious to the silly. In one topic, Brad Ferguson was discussing how unhappy he was with the major edits done to his most recent Star Trek novel and how he hopes people will be able to read his original version through the fan press. Reading on, I encountered a topic called *Carrot Juice, Earl Grey, Hot,* where a number of SFRT readers were writing a story about various Looney Tunes characters loose on the *Enterprise.* It features characters like Elmer Fudd as Wocutus of Borg. ("Wooney Tunes are iwwewevant. Pwepare to be assimuwated.")

Even if you're not a Trek fan, there's something here for you. You'll also find mainstream SF authors such as Lawrence Watt-Evans, Michael P. Kube-McDowell, Jerry Pournelle, Damon Knight, Mike Resnick, and David Bischoff online. Some folks, in the presence of such well-known names, will remain lurkers and read, but not join in, the discussions. Once you join in, you'll have a great time. These may be famous writers, but they're also regular folks.

There's also the infamous CAT 24, the Anything Goes category. Even if you're a devoted SF fan who reads fanzines (fan magazines) and attends conventions, you probably don't know what your favorite author thinks about subjects ranging from nuclear power and Operation Desert Storm to reincarnation and the opposite sex. In CAT 24, you'll find out.

This is just a taste of what you'll find in the SFRT. You'll find similar areas on BIX (SF), CompuServe (Science Fiction and Fantasy Forum), and People/Link (SF & F Club). So log on, beam up, and say hi.

Send comments and suggestions to DENNYA on BIX and GEnie, DENNY on Plink, or 75500,3602 on CIS. ⊡

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POINT & CLICK

CLIFTON KARNES

TWO POWER APPS THAT WON'T BREAK THE BANK

When most people think of *Windows,* they think of applications with superhigh price tags. It's certainly true that *Windows* has its share of $500-and-up programs, but there are many excellent software packages available for under $100. Here are two essential utilities, each priced below $100.

First, there's *Intermission* (ICOM Simulations, 648 South Wheeling Road, Wheeling, Illinois 60090; 708-520-4440; $49.95), a superb screen blanker you can set for a predetermined period or activate on demand by moving the mouse pointer to one of the screen's four corners (you choose which corner).

That's usually it for a screen blanker, but with *Intermission,* the fun is just beginning. While your screen is blanked, *Intermission* offers 34 animated displays, which the program can select at random.

These animated displays include Marine Screen (with multicolored fish that occasionally turn to look at you and also eat each other), Clock (an analog clock that slowly bounces around your screen), Dissolve (a pixel-by-pixel fade to black), Fireworks (with beautiful multicolored rockets), Flashlight (which illuminates a slowly moving circle), Kaleidoscope (just like the kid's toy), Puzzle (which turns your screen into an animated shuffle puzzle), Spaceflight (which moves you through space at warp factor 5), Mosaic (a quilt of elegant symmetrical designs), and Intermission (which is a lively display of pop bottles, popcorn, and candy).

Installing *Intermission* is simple. Just run the setup program and follow directions. You'll find the files INTERMISSION.EXE, SAVERDLL.DLL, and ANTSW.INI in your WINDOWS subdirectory, and the IMX animation files in a directory called SAVER. One additional file, ANTHOOK.386 may go in your SYSTEM subdirectory.

To configure *Intermission,* click on its icon, and get ready for the show.

The other essential *Windows* utility is *StraightLine* (First Genesis Software, 1000 Shelard Parkway, Suite 270, Minneapolis, Minnesota 55427; 612-544-4445; $99), a menu program and task manager. At $99, *StraightLine* may seem a little pricey, but it's worth every penny. It's unquestionably the fastest way to get from point A to point B in *Windows.*

StraightLine allows you to install *Windows* and DOS applications on a pop-up menu. From the menu, you can launch programs, switch to active programs, run programs not on the menu, or add new programs to the menu.

To set up *StraightLine,* simply run the program and choose Launch from the menu bar and Setup from the pull-down menu.

From Setup, you can browse through your files and install any EXE, COM, or BAT file. If there are documents associated with an executable file, you can attach these to it.

After installing your programs, click on Done to put *StraightLine* to work. To call *StraightLine,* press a special hot key or mouse click. The program provides several to choose from, or you can supply your own.

I've found that the right mouse button makes an excellent hot key, or more appropriately, hot *button.* Then you're only two clicks and a short mouse movement away from running any program on your system.

If you find a conflict with the right mouse button—*Paintbrush, Word for Windows, ToolBook, Turbo Pascal for Windows,* and several other programs use the right button—you can change it.

After you've installed *StraightLine,* simply press your hot key or button to call up the menu. You'll see a tiny window with a title bar and a menu bar that has just two selections on it: Launch and Active. If you chose a hot button, the window will appear right under your mouse pointer with the pointer directly over the Launch menu selection.

If you want to run a program, simply click your left button, drag to the *Windows* or DOS application you want to run, and then release the mouse button.

If you've associated documents with a program, you'll see a cascading menu with each installed document's name when you select the program from *StraightLine's* menu. Click on a document, and the associated program runs and loads the doc file.

From *StraightLine's* Active menu, you can switch to any active application much as you can from *Windows'* Task Manager, but *StraightLine* has some important enhancements.

For starters, there's a menu selection that allows you to minimize all your active programs. This is great if you have a large number of windows open and you need to get organized.

You can also press Control and click on any *Windows* application (including *Program Manager*) to close it.

Pressing Shift while clicking on a program will minimize it to an icon.

In short, *StraightLine* provides amazing control over your *Windows* environment. It's undoubtedly the most useful utility on my desktop. ⊡

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HARD DRIVE BUYER'S GUIDE

If you want to upgrade your PC, the first thing to consider is a faster, larger hard disk. To make shopping for your dream disk easier, we've compiled a list of more than 150 hard disks of 100MB or more, complete with their specifications and the address and telephone number of each manufacturer.

Use this list as a starting point to find the disks with the specs you want in the price range you can afford. While some of these drives aren't yet widely available to consumers, they do exist; shop around. The prices listed here are mail-order prices, and they may have dropped since press time.

How to Read the Chart

The drives in this chart are listed in alphabetical order by manufacturer (you'll find addresses and telephone numbers at the end of the chart). Each manufacturer's drives are then listed by capacity—the most important specification for most people.

Following capacity, you'll find the model number, the form factor (which is the diameter of the drive's disks), the exterior dimensions of the drive (so you can make sure it fits in the space you have), and the number of heads.

Next is the most important column in the chart after capacity: seek time. Seek time is a measure of a hard disk's speed, with smaller numbers meaning a faster disk. Just two years ago, 65 milliseconds was standard, but just look at the seek times for these drives. Most are less than 25ms, and some are *considerably* less than that.

The next column lists interface, which determines many of the drive's qualities (especially its speed and capacity) and the way the drive connects to your PC. Here's a brief explanation of each interface type.

AT (Advanced Technology) is the bus used in the IBM AT and compatibles. Drives designated with an *AT* by the manufacturer usually employ an IDE interface.

ESDI (Enhanced Small Device Interface) is an interface standard that puts some controller functions on the drive itself. ESDI allows for data transfers of 1MB–3MB per second and can be used for drives up to one gigabyte in size.

IDE (Integrated Drive Electronics), like SCSI (see below), is an interface design that puts the controller on the drive itself. IDE, however, offers lower performance.

MCA (MicroChannel Architecture) drives require a PS/2–style bus connection.

SCSI (Small Computer System Interface) is an interface standard that puts most of the controller functions on the drive itself. It offers transfer speeds of 1MB–4MB per second. SCSI also allows as many as seven additional devices to be daisychained. SCSI-2 is faster than SCSI but is fully compatible with the earlier standard.

The next column, Encoding, refers to the way data is stored on a disk. Almost all of the high-capacity drives listed here use RLL, for Run Length Limited, a system borrowed from the mainframe world that increases storage by 50–100 percent over previous encoding methods.

Under MTBF (Mean Time Between Failures), the numbers represent the hours of service you can expect from your drive. For most of these drives, the MTBF is 50,000 hours or more, which means that if you left your drive on 24 hours a day, it would last nearly six years. Most of us will be looking at 100-*gigabyte* drives by that time.

The last column lists price, and as mentioned above, these are mail-order prices, which may have dropped since press time.

Any column with *n/a* indicates that the information was not available at press time. ⊡

DAVID SEARS

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Manufacturer	Capacity in Megabytes	Model Name	Form Factor	Dimensions in Inches	Number of Heads	Seek Time in Milliseconds	Interface	Encoding	MTBF in Hours	Price
Conner	104.9	CP3100	3.5	1.625×4×5.75	8	25	SCSI	RLL	50,000	$469
	104.9	CP3104	3.5	1.625×4×5.75	8	25	AT	RLL	50,000	$449
	120	CP30104	3.5	1×5.75×4	4	19	AT	RLL	40,000	$569
	120	CP30100	3.5	1×5.75×4	4	19	SCSI	RLL	40,000	n/a
	120	CP30109	3.5	1×5.75×4	4	19	MCA	RLL	40,000	n/a
	212.6	CP3200F	3.5	1.625×4×5.75	8	16	SCSI	RLL	50,000	$779
	212.6	CP3204F	3.5	1.625×4×5.75	8	16	AT	RLL	50,000	$785
	212.6	CP3209F	3.5	1.625×4×5.75	8	16	MCA	RLL	50,000	n/a
	510	CP500	3.5	1.625×4×5.75	12	12	SCSI	RLL	100,000	n/a
	510	CP504	3.5	1.625×4×5.75	12	12	AT	RLL	100,000	n/a
Fujitsu	105	M616SA	3.5	1×4×5.75	4	20	SCSI	RLL	50,000	n/a
	105	M616T	3.5	1×4×5.75	2	20	PC/AT	RLL	50,000	n/a
	135.2	M2613T	3.5	1.625×4×5.75	6	20	AT	RLL	50,000	$515
	136.6	M2613SA	3.5	1.625×4×5.75	6	20	SCSI	RLL	50,000	$515
	180.3	M2614T	3.5	1.625×4×5.75	8	20	AT	RLL	50,000	n/a
	182.4	M2614SA	3,5	1.625×4×5.75	8	20	SCSI	RLL	50,000	$649
	235.2	M2621S	3.5	1.625×4×5.75	5	12	SCSI	RLL	50,000	n/a
	330.1	M2622S	3.5	1.625×4×5.75	7	12	SCSI	RLL	50,000	n/a
	366	M2261	5.25	3.3×5.7×8	8	16	ESDI/SCSI	RLL	200,000	$1,429
	425.1	M2623S	3.5	1.625×4×5.75	9	12	SCSI	RLL	200,000	n/a
	520.1	M2624S	3.5	1.625×4×5.75	11	12	SCSI	RLL	200,000	n/a
	688	M2263	5.25	3.3×5.7×8	15	14.5	ESDI/SCSI	RLL	200,000	$1,699
	1079	M2266	5.25	3.3×5.7×8	15	14.5	ESDI/SCSI	RLL	200,000	n/a
Kalok	105	KL3100	3.5	1.625×4×5.75	6	25	AT/IDE	RLL	50,000	n/a
Maxtor	130.4	7120	3.5	1×4×5.75	2	15	SCSI	RLL	150,000	n/a
	157.4	XT4170S	5.25	3.25×5.75×8.2	7	14	SCSI	RLL	150,000	$859
	157.93	XT4170E	5.25	3.25×5.75×8.2	7	14	ESDI	RLL	150,000	$849
	203.04	XT4230E	5.25	3.25×5.75×8.2	9	16	ESDI	RLL	150,000	$899
	213	LXT213	3.5	1.625×4×5.75	7	15	SCSI	RLL	150,000	$720
	337.58	XT4380S	5.25	3.25×5.75×8.2	15	16	SCSI	RLL	150,000	$1,249
	338.4	XT4380E	5.25	3.25×5.75×8.2	15	15	ESDI	RLL	150,000	$1,269
	340	LXT340	3.5	1.625×4×5.75	7	13	SCSI	RLL	150,000	$1,469
	360.31	XT8380S	5.25	3.25×5.75×8.2	8	14.5	SCSI	RLL	150,000	n/a
	360.97	XT8380E	5.25	3.25×5.75×8.2	8	14.5	ESDI	RLL	150,000	$1,249
	437	LXT437	3.5	1.625×4×5.75	9	12	SCSI	RLL	150,000	n/a
	535	LXT535	3.5	1.625×4×5.75	11	12	SCSI	RLL	150,000	n/a
	541.4	XT8610E	5.25	3.25×5.75×8.2	12	15.5	ESDI	RLL	150,000	n/a
	616.69	XT8702S	5.25	3.25×5.75×8.2	15	16.5	SCSI	RLL	150,000	$1,699
	675.58	XT8760S	5.25	3.25×5.75×8.2	15	16.5	SCSI	RLL	150,000	$1,895
	676.82	XT8760E	5.25	3.25×5.75×8.2	15	16.5	ESDI	RLL	150,000	$1,895
	694.7	XT8800E	5.25	3.25×5.75×8.2	15	16.5	ESDI	RLL	150,000	n/a
	696	P108E	5.25	3.25×5.75×8.2	15	13	ESDI	RLL	100,000	n/a
	696	P108S	5.25	3.25×5.75×8.2	9	12.5	SCSI-2	RLL	100,000	n/a
	1005	P112S	5.25	3.25×5.75×8.2	19	10.5	SCSI-2	RLL	100,000	n/a
	1027.7	PO12S	5.25	3.25×5.75×8.2	15	13	SCSI-2	RLL	100,000	n/a

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Manufacturer	Capacity in Megabytes	Model Name	Form Factor	Dimensions in Inches	Number of Heads	Seek Time in Milliseconds	Interface	Encoding	MTBF in Hours	Price
Maxtor	1051	P112E	5.25	3.25×5.75×8.2	15	13	ESDI	RLL	100,000	n/a
	1051	P116E	5.25	3.25×5.75×8.2	15	13	ESDI	RLL	100,000	n/a
	1160	P113E	5.25	3.25×5.75×8.2	15	13	ESDI	RLL	100,000	n/a
	1470	P117E	5.25	3.25×5.75×8.2	19	13	ESDI	RLL	100,000	n/a
	1470	P117S	5.25	3.25×5.75×8.2	19	13	SCSI-2	RLL	100,000	n/a
Micropolis	158	1674	5.25	3.25×5.75×8	7	16	SCSI	RLL	150,000	$959
	158	1674HS	5.25	3.25×5.75×8	7	3.9	SCSI	RLL	150,000	$959
	161	1654	5.25	3.25×5.75×8	7	16	ESDI	RLL	150,000	$899
	331	1578	5.25	3.25×5.75×8	15	16	SCSI	RLL	150,000	$1,445
	331	1578HS	5.25	3.25×5.75×8	15	3.9	SCSI	RLL	150,000	$1,445
	338	1558	5.25	3.25×5.75×8	15	19	ESDI	RLL	150,000	$1,249
	340	1684	5.25	3.25×5.75×8	7	15	SCSI	RLL	150,000	$1,395
	340	1684HS	5.25	3.25×5.75×8	7	3.9	SCSI	RLL	150,000	$1,395
	345	1664	5.25	3.25×5.75×8	7	15	ESDI	RLL	150,000	$1,295
	676	1568	5.25	3.25×5.75×8	15	16	ESDI	RLL	150,000	$1,829
	668	1588	5.25	3.25×5.75×8	15	16	SCSI-2	RLL	150,000	$1,895
	668	1588HS	5.25	3.25×5.75×8	15	3.9	SCSI	RLL	150,000	$1,819
	871	1538	5.25	3.25×5.75×8	15	14.5	ESDI	RLL	150,000	n/a
	1034	1598	5.25	3.25×5.75×8	15	14.5	SCSI-2	RLL	150,000	$2,689
	1034	1598HS	5.25	3.25×5.75×8	15	3.9	SCSI-2	RLL	150,000	$2,689
	1346	1518	5.25	3.25×5.75×8	15	14.5	ESDI	RLL	150,000	n/a
	1346	1528	5.25	3.25×5.75×8	15	14.5	SCSI-2	RLL	150,000	n/a
	1748	1548	5.25	3.25×5.75×8	15	14	SCSI-2	MZR	150,000	n/a
Microscience	107.3	7100	3.5	1.625×4×5.75	7	18	AT/IDE	RLL	60,000	n/a
	110.3	5100	3.5	1.625×4×5.75	7	18	ESDI	RLL	60,000	n/a
	120.4	710020	3.5	1.625×4×5.75	7	18	AT/IDE	RLL	60,000	n/a
	123.86	5100-20	3.5	1.625×4×5.75	7	18	ESDI	RLL	60,000	n/a
	201.38	7200	3.5	1.625×4×5.75	7	18	AT/IDE	RLL	60,000	n/a
	366	FH2414	3.5	3.25×5.75×8	8	14	ESDI	RLL	100,000	n/a
	366	FH3414	3.5	3.25×5.75×8	8	14	SCSI	RLL	100,000	n/a
	787.6	FH2777	3.5	3.25×5.75×8	15	14	ESDI	RLL	100,000	n/a
	787.6	FH3777	3.5	3.25×5.75×8	15	14	SCSI	RLL	100,000	n/a
	1062.2	FH21200	3.5	3.25×5.75×8	15	14	ESDI	RLL	100,000	n/a
	1062.2	FH31200	3.5	3.25×5.75×8	15	14	SCSI	RLL	100,000	n/a
Quantum	105	105S	3.5	1.625×4×5.75	6	19	SCSI	RLL	50,000	$539
	120	120S	3.5	1.625×4×5.75	3	15	SCSI	RLL	50,000	$689
	120	120AT	3.5	1.625×4×5.75	3	15	AT	RLL	50,000	n/a
	168	170S	3.5	1.625×4×5.75	4	15	SCSI	RLL	50,000	n/a
	168	170AT	3.5	1.625×4×5.75	4	15	AT	RLL	50,000	n/a
	210	210S	3.5	1.625×4×5.75	4	15	SCSI	RLL	50,000	n/a
	210	210AT	3.5	1.625×4×5.75	4	15	AT	RLL	50,000	n/a
	331	330AT	3.5	1.625×4×5.75	7	13	AT	RLL	75,000	n/a
	331	330S	3.5	1.625×4×5.75	7	13	SCSI	RLL	75,000	n/a
	425	425AT	3.5	1.625×4×5.75	9	13	AT-BUS	RLL	75,000	n/a
	425	425S	3.5	1.625×4×5.75	9	13	SCSI	RLL	75,000	n/a

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Manufacturer	Capacity in Megabytes	Model Name	Form Factor	Dimensions in Inches	Number of Heads	Seek Time in Milliseconds	Interface	Encoding	MTBF in Hours	Price
Quantum	105	LPS105AT	3.5	1×4×5.75	4	17	AT-BUS	RLL	60,000	n/a
	105	LPS105S	3.5	1×4×5.75	4	17	SCSI	RLL	60,000	n/a
Rodime	112.5	3139AP	3.5	1.625×4×5.75	5	18	AT	RLL	100,000	$499
	112.5	3139S	3.5	1.625×4×5.75	5	17.5	SCSI	RLL	100,000	n/a
	121.99	3151A	3.5	1×4×5.75	4	18	AT	RLL	50,000	$599
	210	3259S	3.5	1.625×4×5.75	9	17.5	SCSI	RLL	100,000	n/a
	213	3259AP	3.5	1.625×4×5.75	9	18	AT	RLL	100,000	$799
	331	3331S	3.5	1.625×4×5.75	7	12	SCSI	RLL	100,000	n/a
	426	3426S	3.5	1.625×4×5.75	9	12	SCSI	RLL	100,000	n/a
	540	3540S	3.5	n/a	9	12	SCSI	RLL	100,000	n/a
Seagate	106.9	ST3120A	3.5	1×4.02×5.77	3	16	AT	RLL/ZBR	150,000	n/a
	107	ST2125AV	5.25	1.625×5.75×8	2	18	SCSI	ZBR	100,000	n/a
	107	ST2125N	5.25	1.625×5.75×8	2	18	SCSI	ZBR	100,000	$735
	107	ST2125NM	5.25	1.625×5.75×8	2	18	SCSI	ZBR	100,000	n/a
	113.4	ST1133N	3.5	1.625×4×5.75	5	15	SCSI	RLL	150,000	n/a
	126	ST3144N	3.5	1×4.02×5.77	3	16	SCSI	RLL/ZBR	150,000	n/a
	128.4	ST1150R	3.5	1.625×4×5.75	9	15	ST506	RLL	150,000	n/a
	130	ST3144A	3.5	1×4.02×5.77	3	16	AT	RLL/ZBR	150,000	n/a
	130.7	ST1144A	3.5	1.63×4.02×5.77	7	19	AT	ZBR	150,000	$439
	155	ST4182N	5.25	3.25×5.75×8	9	16.5	SCSI	RLL	100,000	$799
	155	ST4182NM	5.25	3.25×5.75×8	9	16.5	SCSI	RLL	100,000	n/a
	158.8	ST1186N	3.5	1.625×4×5.75	7	15	SCSI	RLL	150,000	n/a
	160	ST2182E	5.25	1.625×5.75×8	3	16	ESDI	RLL	100,000	$929
	160	ST4182E	5.25	3.25×5.75×8	9	16.5	ESDI	RLL	100,000	$799
	163.8	ST1186A	3.5	1.625×4×5.75	7	15	AT	RLL	150,000	n/a
	171.9	ST1201N	3.5	1.625×4×5.75	9	15	SCSI	RLL	150,000	n/a
	177.5	ST1201A	3.5	1.625×4×5.75	9	15	AT	RLL	150,000	$699
	177.8	ST1201E	3.5	1.625×4×5.75	9	15	ESDI	RLL	150,000	$899
	183	ST2209N	5.25	1.625×5.75×8	3	18	SCSI	ZBR	100,000	$939
	183	ST2209NM	5.25	1.625×5.75×8	3	18	SCSI	ZBR	100,000	n/a
	183	ST2209NV	5.25	1.625×5.75×8	3	18	SCSI	ZBR	100,000	n/a
	204.2	ST1239N	3.5	1.625×4×5.75	9	15	SCSI	RLL	150,000	$775
	210.7	ST1239A	3.5	1.625×4×5.75	9	15	AT	RLL	150,000	$859
	241	ST2774A	5.25	1.625×5.75×8	5	16	AT	RLL	100,000	n/a
	307	ST4350N	5.25	3.25×5.75×8	9	16.5	SCSI	ZBR	100,000	$1,249
	307	ST4350NM	5.25	3.25×5.75×8	9	17.5	SCSI	ZBR	100,000	n/a
	337	ST2383N	5.25	1.625×5.75×8	7	14	SCSI	ZBR	100,000	$1,289
	337	ST2383NM	5.25	1.625×5.75×8	7	14	SCSI	ZBR	100,000	n/a
	338	ST2383A	5.25	1.625×5.75×8	7	16	AT	RLL	100,000	$1,295
	338	ST2383E	5.25	1.625×5.75×8	7	16	ESDI	RLL	100,000	$1,289
	338	ST4383E	5.25	3.25×5.75×8	13	18	ESDI	RLL	100,000	$1,295
	338	ST4384E	5.25	3.25×5.75×8	15	14.5	ESDI	RLL	100,000	$1,359
	357	ST4385N	5.25	3.25×5.75×8	15	10.7	SCSI	ZBR	100,000	$1,499
	357	ST4385NM	5.25	3.25×5.75×8	15	10.7	SCSI	ZBR	100,000	n/a
	357	ST4385NV	5.25	3.25×5.75×8	15	10.7	SCSI	ZBR	100,000	n/a

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Manufacturer	Capacity in Megabytes	Model Name	Form Factor	Dimensions in Inches	Number of Heads	Seek Time in Milliseconds	Interface	Encoding	MTBF in Hours	Price
Seagate	380	ST4442E	5.25	3.25×5.75×8	15	16.5	ESDI	RLL	100,000	$1,469
	442	ST2502N	5.25	1.625×5.75×8	7	16	SCSI	ZBR	100,000	$1,749
	442	ST2502NM	5.25	1.625×5.75×8	7	16	SCSI	ZBR	100,000	n/a
	442	ST2502NV	5.25	1.625×5.75×8	7	16	SCSI	ZBR	100,000	n/a
	462	ST1480A	3.5	1.625×4×5.75	9	14	AT	ZBR	150,000	n/a
	613	ST4702N	5.25	3.25×5.75×8	15	16.5	SCSI	ZBR	100,000	$1,795
	613	ST4702NM	5.25	3.25×5.75×8	15	16.5	SCSI	ZBR	100,000	n/a
	676	ST4766E	5.25	3.25×5.75×8	15	15.5	ESDI	RLL	150,000	$1,895
	676	ST4766N	5.25	3.25×5.75×8	15	15.5	SCSI	RLL	150,000	$1,995
	676	ST4766NM	5.25	3.25×5.75×8	15	15.5	SCSI	RLL	150,000	$1,995
	676	ST4766NV	5.25	3.25×5.75×8	15	15.5	SCSI	RLL	150,000	n/a
	676	ST4767E	5.25	3.25×5.75×8	15	11.9	ESDI	RLL	150,000	n/a
	676	ST4767N	5.25	3.25×5.75×8	15	11.9	SCSI-2	RLL	150,000	$2,179
	676	ST4767NM	5.25	3.25×5.75×8	15	11.9	SCSI-2	RLL	150,000	n/a
	676	ST4767NV	5.25	3.25×5.75×8	15	11.9	SCSI-2	RLL	150,000	n/a
	691	ST4769E	5.25	3.25×5.75×8	15	12.9	ESDI	RLL	150,000	n/a
	1050	ST41200N	5.25	3.25×5.75×8	15	15	SCSI	ZBR	150,000	$2,695
	1050	ST41200NM	5.25	3.25×5.75×8	15	15	SCSI	ZBR	150,000	n/a
	1050	ST41200NV	5.25	3.25×5.75×8	15	15	SCSI	ZBR	150,000	n/a
	1352	ST41520N	5.25	3.25×5.75×9.9	1	11.5	SCSI-2	ZBR	150,000	n/a
	1352	ST41600N	5.25	3.25×5.75×8	1	11.5	SCSI-2	ZBR	150,000	n/a
	1420	ST41650N	5.25	3.25×5.75×8	15	15	SCSI-2	ZBR	150,000	n/a
	1420	ST41650ND	5.25	3.25×5.75×8	15	15	SCSI-2	ZBR	150,000	n/a
	2100	ST42400N	5.25	3.25×5.75×8	1	11	SCSI-2	ZBR	150,000	n/a
Teac America	105.02	SD-3105	3.5	1×4×5.75	4	19	AT/SCSI	RLL	30,000	n/a
Toshiba	106	MK234FB	3.5	1.625×4×5.75	7	25	SCSI	RLL	30,000	n/a
	107	MK234FC	3.5	1.625×4×5.75	n/a	16	AT	RLL	30,000	$479
	107	MK1034FC	3.5	1×4×5.75	4	16	AT	RLL	40,000	n/a
	675	MK350FB	5.25	3.25×5.75×8	15	16	ESDI/SCSI	RLL	30,000	n/a
	765	MK350FA	5.25	3.25×5.75×8	15	16	ESDI	RLL	30,000	n/a
Western Digital	209.8	WDSP4200	3.5	1.625×4×5.75	8	16	SCSI	RLL	86,587	n/a
	212	WDAP4200	3.5	1.625×4×5.75	8	16	AT/SCSI	RLL	50,000	$775
	320	WDSC8320	3.5	1.625×4×5.75	15	12.5	SCSI	RLL	150,000	n/a
	400	WDSC8400	3.5	1.625×4×5.75	14	11.5	SCSI	RLL	150,000	n/a

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PROGRAMMING POWER

TOM CAMPBELL

I've seen so much hype the last few years that I've been skeptical of some innovations that were actually worthwhile. If you're the same way, you might be wondering whether you should learn C++.

This month I'll try to illustrate why C++ lives up to all its publicity. I think it's well worth your time to learn, and I'll show you some of its new features. I'll finish by explaining when you *shouldn't* use C++.

What's New?

C++ is a highly compatible superset of ANSI C. In fact, many of ANSI C's features came from C++, which itself is now the subject of an ANSI standardization effort. Void, const, and function prototypes are three such examples.

Void lets you create generic pointers, a cleaner and semantically more acceptable solution than using char *, and it lets you create functions that don't return a value—just like a procedure in Pascal.

Const tags variables so that optimizers won't remove them improperly. Function prototypes, like the FORWARD of Pascal or the DECLARE of *QuickBASIC*, assure that functions use the correct type and number of parameters. Optional in C, they're required in C++.

Object Lessons

The most important additions to standard C are object orientation and operator overloading. Objects are like structures that can include functions; more important, their traits can be inherited by other objects.

Objects are difficult to design and can't be hacked quickly (because bad object design can ruin a program long before you know it), but they make program maintenance an order of magnitude easier.

I don't believe, as many do, that objects alone speed development time, although I believe that a beginner taught correct C++ would make far fewer mistakes than a beginner taught C.

But objects do speed maintenance time, because you can combine them with operator overloading to make your code conform more closely to what it's actually doing.

Operator overloading means that most operators, such as +, >>, and ==, can be redefined to operate on user-defined data types. For example, FORTRAN can deal with complex numbers, but C can't.

In C, you'd create a structure called *complex* and a number of functions to operate on them—multiply, divide, and so on. To add two complex numbers, you'd create a function called add( ), and invoke it like this:

```
complex c1, c2;
...
add(c1, c2);
```

In C++, you can add complex numbers to the repetoire of + and do this:

```
complex c1, c2;
...
// The plus operator now works on
   complex numbers.
// Note that single-line comments can
   start with "//"
// and don't need to be terminated.
c1 = c1 + c2;
```

The cout class, which works much more like BASIC's PRINT than C's printf( ), uses the << operator. Objects plus operator overloading mean that you can create, say, a records-and-fields object called *Datum*, and then inherit its qualities in a CustomerRecord object, overload the << operator for displaying records, and wind up with this code:

```
CustomerRecord NewRecord;
...
cout << "New customer: \n" <<
   CustomerRecord;
```

If this is hard to understand, translate it to C. Imagine being able to do this in C:

```
CustomerRecord NewRecord;
...
printf("New customer: \n %z",
   CustomerRecord);
```

where %z is an imaginary print specification for values of type CustomerRecord, which could contain numeric, text, or binary values.

Avoiding the Routine

One of my favorite additions to C is call by reference—like Pascal's VAR or QuickBASIC's parenthesized SUB parameters. It makes program maintenance a zillion times easier by eliminating the need for those pesky indirection operators.

Here's a trivial example that squares a number. Note that it changes the value of *a* without making you call the routine with &a and without requiring tons of *a indirections within the function. This single-handedly removes one of C's most difficult-to-learn and worst-conceived traits.

```
#include <iostream.h>
// The & gives C call by reference.
void Square(int &Value)
{
  // Just square it. The "&" lets this
```


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```
  look more natural.
  Value = Value * Value;
}

void main( )
{
  // Request a number.
  cout << "Enter an integer. ";
  // Allocate a variable for it.
  int a;
  // Get it from the keyboard.
  cin >> a;
  // Square it. Notice no "&".
  Square(a);
  // Display its value.
  cout << "Squared, it's " << a;
}
```

I/O in the Stream

If you're a C programmer, you probably use the line *#include <stdio.h>* routinely, not even thinking twice. When you program in C++, you have to think twice.

Stdio.h has been superseded by iostream.h, which supplements the concepts of standard input and standard output considerably, refining greatly the concept of streams that began with C. (Note here that you can easily distinguish current from outdated texts by their use of stream.h, the predecessor to iostream used in C++ before version 2.)

Iostream.h is as great an improvement on stdio.h as C's elegant file I/O was on everything that preceded it. In fact, some of it is actually as powerful as . . . BASIC.

I've often complained that C, with the advantage of a decade's hindsight, made you jump through hoops just to print common values. C++ goes BASIC one better by offering all the flexibility of PRINT and PRINT USING with the ability to customize their behavior completely.

Here's an example. The user is prompted for an integer. After it's been entered at the keyboard, the value is displayed in both decimal and hex, embedded in a message.

```
#include <iostream.h>
void main( )
{
  cout << "Please enter an integer. ";
  // Note declaration occurring after
    executable code.
  int Num;
  // Accept the number from the
    keyboard.
  cin >> Num;
  // Display it in decimal and hex.
  cout << "That number is " << Num
    << " decimal, and " << hex <<
    Num << " hex.";
}
```

Notice how Num is declared right where it's needed, whereas C requires declarations to appear before executable code. More interesting is hex, which is called a *manipulator.*

Manipulators affect the behavior of a stream. In this case, the default appearance of numbers in decimal form is neatly overidden, and the numbers are displayed as hex values instead.

Built-in manipulators include dec and oct; setw, which sets a default width for output values; fill, which lets you set the fill character (which is normally a space); setprecision, which determines the precision to which floating-point numbers are displayed; and others. Manipulators give you even greater power than PRINT USING with the bonus that you can alter the preset behavior of streams.

Getting an A++

If you're looking for books that teach C++, here's how to shop effectively. Try to get some sense from the book jacket that the author has been programming in C++ for a few years and didn't learn it just to write the book.

Make sure the book is for version 2.0 or 2.1 and not for earlier versions. Make sure it covers at least the following topics: operator overloading, function overloading, memory management (including new, delete, _new_ handler, and set_new_handler), the this pointer, references, inheritance and multiple inheritance, and the iostream class. All of these are medium- or advanced-level topics, but they form a kernel of knowledge no C++ programmer should be without.

I can vouch for a couple of entries in this already-crowded market.

Teach Yourself . . . C++ by Al Stevens (MIS Press, P.O. Box 30135, Salt Lake City, Utah 84139; 800-247-3912; $29.95) is well written, fairly free of typos, and obviously written by a C++ stud.

Another surprisingly good treatise is the Borland C++ tutorial (*Borland C++*, Borland International, 1800 Green Hills Road, Scotts Valley, California 95066-0001; 408-438-8400; $495), a near book-length introduction that does an excellent job of covering the fundamentals. Both come with the example code on disk, and both require that you be reasonably familiar with C before starting.

When to Avoid C++

Now it's time to gaze at the dark side of the force—when to avoid C++. First, plan for your next several projects to take much longer to code than they would in C.

Designing maintainable, extensible classes takes a very long time. So does learning *when* to apply new programming paradigms. Just knowing the features of C++ doesn't mean you know when to put them to work. However, maintaining your code will be a lot easier.

Second, bear in mind that moving your code to non-PC systems may be impossible. C++ has not been in widespread use for long. That means you may end up paying to beta test for the next implementation you use—without volunteering.

It's difficult enough to find ANSI C implementations on some systems; many administrators don't even know what C++ is.

Third and last, note that C++ isn't as standardized as ANSI C. While the ANSI C standard library must be included for an implementation to call itself ANSI, C++ is too new for that.

Each implementation of C++ tends to come with a library that includes linked lists, bags, queues, collections, and trees. But none of these is required, so plan to do a lot of wheel-inventing for the time being.

While I've tried to get across some of the best features of C++, I've barely scratched the surface.

If you want to find a good job programming in C, or if you have a big project coming up and are deciding on an implementation language, you should use C++.

It makes software easier to maintain (if the maintainer knows C++!), makes your code look more like your algorithms (finally—your code can match a line of pseudocode like "Print value," where value isn't a scalar type), and knowing it makes you a more desirable employment prospect. ⊡

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TIPS & TOOLS

HINTS AND TIPS FROM OUR READERS

In the February issue of *COMPUTE,* Caroline Hanlon stressed the importance of saving your system setup in case of later problems. She suggested writing the system setup information on a 3 × 5 card. This is fine, but there is a better method of saving your system setup information.

Below are two BASIC programs that save and restore the system setup information. To run the save program, type BASIC or GWBASIC SAVECMOS. When you run SAVE CMOS.BAS, the system setup information is saved to a file called CMOS.RAM. Since you won't be able to boot from your hard drive if the system setup is trashed, you should copy the programs, the CMOS.RAM file, and BASIC to a floppy disk formatted with the /s option to make the disk bootable. To restore the system information, boot from the floppy, and enter BASIC or GWBASIC RESTCMOS.

SAVECMOS.BAS

```
10 DEFINT A-Z:DIM CMOS(63)
20 FOR I=1 TO 63:OUT 112,I
30 CMOS(I) = NP(113):NEXT I
40 OPEN "CMOS.RAM" FOR
   OUTPUT AS #1
50 FOR I = 1 TO 63:WRITE #1,
   CMOS(I)
60 NEXT I
70 CLOSE #1:SYSTEM
```

RESTCMOS.BAS

```
10 DEFINT A-Z:DIM CMOS(63)
20 OPEN "CMOS.RAM" FOR INPUT
   AS #1
30 FOR I=1 TO 63:INPUT #1, CMOS(I)
40 NEXT I:CLOSE #1
50 FOR I = 1 TO 63:OUT 112, I
60 OUT 113, CMOS(I):NEXT I
70 SYSTEM
```

You'll need to enter your setup to correct the date and time information, but all the other information should be correct. If you use DOS 3.3 or higher, use the DATE and TIME commands instead of running setup. These commands change the date and time in CMOS for you.

Vincent O'Connor
Babbitt, MN

Cheap Format

I've recently discovered a way to low-level format my hard drive without buying an expensive low-level formatting program. Owners of IBM PS/2s can use this undocumented tool.

Make a backup of your hard drive. Insert the IBM Personal System/2 Reference disk in drive A and turn on the computer. When the menu appears, press Ctrl-A. You'll see the undocumented advanced menu. Here you can either run an advanced and more rigorous check of your computer or low-level format the hard drive.

Jason Shultz
Harrison, AR

Windows 3.0 Swapfile

Windows 3.0 running in 386 enhanced mode can make use of virtual memory, a process whereby *Windows* can handle a *memory full* condition by swapping data temporarily out to disk. If you want to run 3MB worth of programs but only have 2.5MB of RAM free, no problem. *Windows* in the 386 enhanced mode can send .5MB to disk temporarily, using the disk as if it were memory. This is a good bargain because disk space is less expensive than RAM, but its Achilles heel is speed. It can be quite slow.

One way to speed up virtual memory is to preallocate space on disk as a permanent file for this swapping process. That way, you save the file setup and breakdown time, and the file can be contiguous, making access faster.

That's what the *Windows* program SWAPFILE does; it sizes and allocates a permanent swapfile. It's discussed in the back of the *Windows* manual, so most people have never created a swapfile, even if they're running *Windows* on a 386.

SWAPFILE.EXE is located in the C:\WINDOWS\SYSTEM subdirectory. You'll only run the program once, in order to create the file. When you do run SWAPFILE, it must be run under *Windows* in real mode, so run it from the command line.

```
WIN /r C:\WINDOWS\SYSTEM
   \SWAPFILE.EXE
```

Follow the prompts. It's worth taking the few minutes to create a swap file. You'll see the improvement in performance when running memory-hungry programs.

Mark Minasi
Arlington, VA

Dump *dBase IV* Logo

For *dBase IV* developers and users, if you are sick of seeing the *dBase IV* logo every time you run the program, add the /T toggle switch to the command line. DBA /T will eliminate the *dBase* logo.

Jim Reece
Tucson, AZ

Shrinking a BASIC EXE

Here are some notes on how to trim down and speed up your compiled BASIC programs. These are all brute-force but often highly effective techniques that don't require a huge amount of brainpower.

Avoid ON statements and background music. Any ON statement slows down the program significantly because its condition must be checked after each statement executes. On the other hand, ON statements provide unparalleled ease of use and predate event-driven languages by a decade.

Use DEFINT and integer variables. By default, BASIC uses real numbers for its variables—numbers with an exponent and decimal point. If you can keep your calculations to integer values, they'll speed up immensely. This really shows up in games, where moving objects around the screen and figuring out their locations represent a huge investment of computer time.

Use *PowerBASIC*'s smart linking. *PowerBASIC* lets you trim out great chunks of your program with its smart

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linking. This lets you jettison the parts of the runtime library your program doesn't use, giving you the option to remove things like communications code, screen drivers for graphics, and so on. This can cut a 50K program in half.

Some speed-up tricks that work with GW-BASIC won't work at all in the compiled versions. Taking out REMs won't help because they never make it into the compiled version anyway, but they do cost in interpreted BASIC. Putting often-used GOTO labels at the top of the program will speed up a GW-BASIC program because any GOTO causes the interpreter to rewind the program and search line numbers starting from the very first one. On the other hand, any GOTO, regardless of its location, compiles to a single machine instruction in compiled BASIC, and the target location doesn't matter. Finally, reducing the lengths of variable names—a useful and speed-improving trick in GW-BASIC—means nothing in compiled BASIC because the variable names are converted to addresses and thrown out at compile time. Like REM statements, they cease to be an issue when compiled.

Tom Campbell
Irvine, CA

Large File Copy

Have you ever come across a file too large to fit on a single floppy disk? Sometimes even compressing a file doesn't help, especially database files. There's a way to split a file and place the parts on separate floppies. Later the file can be restored to the original file. DOS provides this easy solution if you don't have a program that's specifically written to handle the problem. You can use the DOS BACKUP command by entering the following:

BACKUP *source drive: \path \ filename destination drive: \path*

Follow the instructions displayed on the screen. When you're ready to reassemble your file, use the DOS RESTORE command.

RESTORE *destination drive: source drive:*

Both BACKUP and RESTORE are external DOS commands. This means that the files BACKUP.EXE and RESTORE.EXE must be available to the system at execution time. The files must be located in the current directory, in a directory listed in your PATH statement in your AUTOEXEC.BAT file, or on a disk in the current drive. Be careful using this method between different computers, though. Some files that have been backed up with one version of DOS refuse to be restored under another version of DOS. Try it out with an unimportant file first.

Andy Lin
West Hills, CA

Batch Shortcut

I've created a batch file that allows me to change to any directory on my hard drive with a minimum of keystrokes. I also included the DIR command so that when I change to a directory, a directory listing of specified files is displayed. This command line parameter is optional. The batch filename is G.BAT, and the syntax for its use is as follows:

G *directory abbreviation* [*file spec*]

```
ECHO OFF
IF " " == "%1" GOTO HELP
IF L == %1 GOTO LOTUS
IF l == %1 GOTO LOTUS
IF W == %1 GOTO WP
IF w == %1 GOTO WP
IF D == %1 GOTO DBASE
IF d == %1 GOTO DBASE
:HELP
ECHO You must enter a directory abbreviation.
ECHO Syntax: G directory abbreviation [file spec]
GOTO END
:LOTUS
C:
CD \LOTUS
GOTO DIRECTORY
:WP
C:
CD \WORD
GOTO DIRECTORY
:DBASE
C:
CD \DBASE
:DIRECTORY
IF " " == "%2" GOTO END
DIR /P %2
:END
```

You should change the batch file to match the directories on your hard drive. Using a batch file such as this one can save lots of environment space, especially if your hard drive is filled with a lot of directories. You don't have to list the directories in this file in your PATH statement.

John Norris
Pasadena, TX

Mouse Hot Seat

If your optical mouse doesn't work properly sometimes and your computer is located in a sunny room, the problem may be direct sunlight falling on the mouse.

Optical mice keep track of movement by shining an LED at a receptor through a notched disk that moves when the mouse is moved. Other sources of light can confuse the sensor into thinking that the mouse isn't moving at all because the light isn't interrupted, a condition which the mouse interprets as movement.

In ambient light, the mouse's cover is usually enough to prevent unwanted light from reaching the sensor, but direct sunlight can be strong enough to shine through the case, particularly if it's white plastic. (I have experienced this problem with a mouse manufactured by Kraft, which has been perfect otherwise.)

The obvious solution is to move your mouse out of the sun or hold the mouse so your hand completely covers it. If you like your computer where it is and like the way you hold your mouse, it's a simple matter to remove the mouse cover and either cover the inside with electrical tape or paint the inside black. It shouldn't be necessary to completely cover the inside with tape or paint—just a little darkening over the ball should do the trick.

It may be something to try if you have a mouse which seems to work perfectly at night but poorly during the brightest parts of the day.

Michael Stowe
Yellow Springs, OH

If you have an interesting tip that you think would help other PC users, send it along with your name, address, and Social Security number to COMPUTE's PC Hot Tips, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. For each tip we publish, we'll pay you $25–$50 and send you a COMPUTE's PC LCD clock radio while supplies last. ⊡

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PC DISK UPDATE

JOYCE SIDES

For those of you who couldn't read the documentation file for *ASIC* (February 1991) from *CMOS*, install *ASIC* and then use *TurboTYPE* (located on the April disk as T.EXE) to read the documentation file. Enter T *drive:\path*\ASIC .DOC at the DOS prompt to read the file. Make sure T.EXE is on the disk in the current drive or directory when you run the program.

CMOS Windows?

We've been tossing around the idea here at *COMPUTE* of enhancing *CMOS (COMPUTE's Menu Operating System)*. We'd like to know what you think about a *Windows* 3.0 version.

The program would still work on nongraphics systems, but there would be a version that would have the look and feel of *Windows* graphics with buttons and scroll bars. Drop us a line to let us know what you think.

Off Track

If you get the error message *Advanced feature unavailable in line no line in module DSKTRK 45 at address 0654:44DC* when you run *DISKTRAK* (December 1990), you probably have an early version of DOS that's incompatible with the program. *DISKTRAK* works with DOS versions 3.0 or higher. If you get this message, you'll want to check the DOS version you're using. To do this, enter VER command at the DOS prompt.

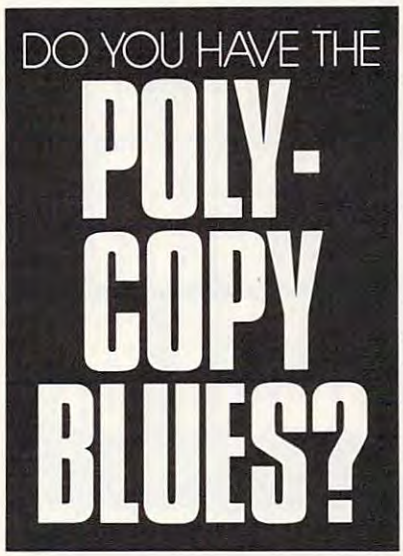
On Track

The author of *DISKTRAK*, Birk Binnard, has a new version of the program. The version published on the December 1990 *COMPUTE's PC Disk* was version 4.50. The new version is 5.10 and can be downloaded from CompuServe in area 6 of the IBM Utilities forum. The filename is DSKTRK51.ZIP.

If you don't have a CompuServe account, send a formatted disk plus $0.50 for postage in a reusable disk mailer, and Mr. Binnard will send you a shareware copy of the new version.

If you've already registered the program, send $5 to cover the cost of the disk, disk mailer, and postage. If you haven't registered but would like to, send $15 to register the program and receive the new version. Send your order to Peninsula Software, 28510 Blythewood Drive, Palos Verdes, California 90274.

The new version of *DISKTRAK* includes PATH support, a Restore function, enhanced comment editing, new printer controls, increased window size for Delete and Restore functions, and bug corrections.



Poly-no-*Copy*

After I received phone calls from several readers about a problem with *PolyCopy* (February 1991), I called Joseph Albanese, the author of the program. Some users complained of getting the message *Drive A not supported* when they ran the program.

Mr. Albanese said that he was aware of problems with *PolyCopy* running on the PS/2 Model 50z, the PS/2 Model 70/25 MHz, and also DTK machines.

He's working on the solution. If you've had trouble with the program, please contact Mr. Albanese and give him any pertinent information about your computer system such as the type and brand of computer, the version of DOS, and BIOS. Send inquiries to Joseph M. Albanese, P.O. Box 1157, Bassett, Virginia 24055. You can also contact him through his BBS at (703) 666-9535.

Mis-*CALC*-ulation

COMPUTECalc (February 1991) may not work on some Tandy computers. The program works in DOS 3.0 or higher, not on DOS 2.1 or higher as stated in the magazine and in *CMOS*.

The program may also not work with any mouse that is not 100-percent Microsoft compatible, such as a Genius mouse. However, you can still use the keyboard with the calculator, or you can install the mouse in Microsoft-compatible mode by pressing both mouse buttons when the computer boots. A Microsoft message should appear when the mouse driver loads.

Unfortunately, the Genius mouse isn't completely Microsoft compatible, so even this trick may not work, but it's certainly worth a try.

Sweet Memory

Sometimes the Run option is offered in *CMOS* for a program, but when you run it, you get a beep and an error message that says *Out of Memory*.

If this happens to you, exit the menu to DOS and rerun *CMOS*. Some programs don't release memory after they've run, so when the program returns to *CMOS* and you try to run another program, the memory isn't available.

You can install the program and run it from DOS without problems.

PATHs to Ponder

Make sure that you change the PATH to the correct directory when you run *AC Hunter* (February 1991). The PATH option is displayed on the opening menu when you first run the program. If you run it from drive A, enter A:\ when the program prompts you for the correct PATH. ⊡

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TONY ROBERTS

TUNE UP YOUR BOOT UP WITH CONFIG.SYS

A properly tuned CONFIG.SYS helps your system run smoothly. With CONFIG.SYS out of balance, however, you'll waste memory in the best case, or have trouble running some programs in the worst case.

Many users avoid CONFIG.SYS except when directed by software installation procedures to make some change, usually to the BUFFERS or FILES commands. These suggestions are designed to ensure that the new software works properly under the heaviest imaginable load. If you don't push your software to its absolute limit, you may be able to scale back these settings.

Although the memory you can save by judiciously refining CONFIG .SYS commands amounts to only a few thousand bytes, this is sometimes enough to allow the coexistence of memory-resident utilities and programs that otherwise seem incompatible.

The FILES command specifies the maximum number of files that can be open at any one time. Although it may appear that very few files are open, there's more going on than meets the eye. If you start your word processing program with a batch file, for example, the batch file is open, the word processing program is open, the file you are editing is open, and other auxiliary files such as printer drivers or spelling dictionaries may be open.

DOS uses 64 bytes of memory to track the status of each open file. It sets aside this block of memory based on the FILES statement in CONFIG .SYS. If you specify FILES=20, DOS reserves 1280 bytes regardless of how many files are actually open.

If the FILES allocation is too small, DOS alerts you with a *Too many files open* message when it runs out of slots in which to track files.

To find the optimum setting for FILES, gradually reduce the number of files specified in CONFIG.SYS and then run your usual software until you encounter errors. Then raise the FILES setting a little so you can operate error free.

BUFFERS, at 512 bytes each, are much more memory-hungry than FILES. A buffer is a block of memory used in the exchange of information between programs and disks.

When data is needed from the disk, a disk sector is read, and the information is placed in a buffer where the program can access it. Although the program often requires fewer bytes than the entire 512 bytes the sector holds, the extra information is kept in the buffer in case the program asks for it later.

When the application makes its next request for disk access, the buffers are checked to see if the appropriate data is there. If so, the data can be accessed immediately without requiring a slow disk-read operation.

The most recently read disk data is kept in the buffers, and once all buffers are full, the oldest data is discarded to make way for new information.

When too few buffers are specified in CONFIG.SYS, the system will be slowed by extra disk accesses. If too many buffers are allocated, the system loses time churning through them before going to the disk.

Finding the proper number of BUFFERS is largely a matter of feel. With too few buffers open, your machine will perform sluggishly, but you may not need as many buffers as some software instructions suggest. This is especially true if you use disk caching.

A disk cache is a more sophisticated buffering system that manages a much larger amount of memory, often extended or expanded memory. Some disk caches work in conventional memory.

In addition to storing sectors already requested by the application program, caches commonly perform look-ahead buffering. In this scheme, the cache reads the requested sector plus the next few sectors on the assumption that those sectors will be sought soon.

Caching programs also make intelligent decisions about what data to keep in memory. A well-executed cache not only keeps the most recently accessed information but also the most frequently used.

One other bit of tuning that helps speed up disk access is the FASTOPEN command that came into being with DOS 3.3.

FASTOPEN creates a directory cache that speeds up DOS's file-opening operations. The command, which is usually executed in the AUTOEXEC.BAT file, has a slightly different syntax in DOS 3.3 and DOS 4.01.

In DOS 3.3, FASTOPEN C:=100 sets up a 100-entry directory cache for disk drive C. In DOS 4.01, FASTOPEN C:=(100,) accomplishes the same result. FASTOPEN only works with hard disks.

Whenever a file opening is requested, DOS searches the directory path until it locates that file. If FASTOPEN is running, the file's location on the disk is recorded in the FASTOPEN cache. If a subsequent request for that file is made, DOS can quickly look up its location in the FASTOPEN cache rather than having to read through all the files in all the directories on the directory path. ⊡

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HARDWARE CLINIC

MARK MINASI

WHAT TO DO WHEN THE LIGHTS GO OUT

Last month, I talked about power protection and some lower-cost power-protection devices. This month, I'll finish the topic with a discussion of battery-backup devices.

In addition to protection from short power irregularities, you may need backup power. I've lived in a number of places in the northeastern United States where summer lightning storms will kill the power for just a second—enough to erase your memory and make the digital clocks blink. Unlike the devices I discussed last month, no transformer or MOV (Metal Oxide Varistor) can help you here. You need something that has a built-in battery, something with enough power to carry you through until the juice comes back on, or at least with enough power to allow you to gracefully exit your applications and shut off your computer. To that end, there are two kinds of devices in this category: SPSs (Standby Power Supplies) and UPSs (Uninterruptible Power Supplies). Both use batteries, but there's a fundamental difference between the ways they use them.

Not to Worry?

"Hang on a minute," I hear you cry. "Who needs a UPS? Isn't that overkill?" Actually, I'd say *No.*

Here's the bad news: Electrical power is getting worse in the United States. Nobody wants a power plant in his or her backyard, coal-burning plants cause acid rain, nukes scare just about everybody, and wind/tide/geothermal/you-name-it alternative sources of energy aren't really going anywhere. We're not building new sources of electricity, but we're continuing to create new drains on the country's power network. Power demand continues to grow, while electrical generation capacity grows much more slowly. The net result is that we're going to see more brownouts, blackouts, spikes, and surges throughout the 1990s.

The good news? Uh . . . there isn't any. The world is changing. Expect power in our country to take on a distinctly Third World look. (How do I know? I was a senior economist with a national laboratory working for the United States Department of Energy for several years in the early 1980s.) From your PC's point of view, electrical power is like air—it soon dies without it, and dirty power makes it sick. That could mean permanent hardware damage, data loss, or momentary misreads.

This all seems strange and counterintuitive because power in the 1980s was fairly clean and reliable, leading to the common wisdom that you just plug your PC into the wall and it'll go. Also, most household appliances are fairly robust about the kind of power they'll accept: Plug a toaster in just about anywhere, and it works fine. A new consensus will develop by the mid 1990s that everyone needs power protection.

UPS and Downs

Your backup options are standby power supplies (SPSs) and uninterruptible power supplies (UPSs). They use fundamentally different approaches to solving power problems. SPSs charge the batteries while watching the current level. (See Figure 1.) While utility power is normal, the SPS is fairly irrelevant, letting spikes, surges, and low voltage pass right through to your PC. A few SPSs have MOVs—the kamikaze components in surge protectors that I discussed last month—but, in general, they do nothing except when the power disappears altogether.

If the power drops, the SPS activates itself and supplies power until its batteries run down. (See Figure 2.) Note well that a *fast* power switch must occur here, and it's important to find out what the switching time is. Four ms or under is fine. In my experience, 14 ms isn't fast enough.

A UPS constantly runs power from the line current to a battery, then from the battery to the PC. (See Figure 3.) This is superior to an SPS because there's no switching time involved. Also, this means that any surges affect the battery-charging mechanism, not the computer. A UPS is, then, a surge suppressor as well.

A UPS or SPS has to convert the battery's DC current to the AC current that your PC requires. AC is supposed to look like a sine wave. Cheaper UPS and SPS models produce square waves. (See Figure 4.) Square waves are bad because they include high-frequency noise which can hamper your computer's operation. Worse, some peripherals (printers in particular) can't handle square-wave AC; their power supplies burn up. So, when examining UPSs, ask whether they use square wave or sine wave.

A sine-wave UPS is the only way to really eliminate most power problems. The reason everyone doesn't have one is cost; a good one costs over $1,000, like the excellent Minuteman systems from Para Systems (sine-wave MM500/1 UPS—$1,399, AT300 SPS—$339; 1455 LeMay Drive, Carrollton, Texas 75007; 800-238-7272).

Plan B

A decent compromise can be found in a fast (4 ms) square-wave SPS. I know I said square waves are bad for your peripherals, but consider this: How often will the SPS actually be providing power? Not very often—remember that it only supplies power when the line voltage drops out, which is probably not a common occurrence. ▷

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The brief minute or two each month of square-wave power that your peripherals end up getting won't kill them. And you'll save a pile of money over a UPS.

On the other hand, remember that a UPS is always online and so must produce sine-wave output, but UPSs have the benefit of providing surge protection by breaking down and reassembling the power. SPSs don't provide this protection; you still have to worry about surge protection when you buy an SPS, but not if you buy a UPS. So make the choice that your budget allows.

Or you might buy a unique product, called the InnerSource, from PC Power and Cooling Systems (31510 Mountain Way, Bonsall, California 92003; 619-723-9513). The InnerSource replaces your current power supply with a combination power supply and UPS. It's a nifty device—it takes no more space than the power supply that's already in your PC and provides 10 to 15 minutes of backup power. (It also includes a connector to power your monitor.) You get low-voltage protection, surge and spike protection, and blackout insurance—all for $395. This isn't a bad deal (as I said last month, a decent power conditioner would cost $200, and this does a lot more). And while this sounds like a unique idea, every single battery-powered laptop incorporates a similar system—so I suppose you could buy only laptops as a means of combatting power problems. To summarize:

- If it's an SPS, it must switch in 4 ms or less.
- If it's an SPS, square-wave output is acceptable.
- If it's a UPS, it *must* have sine-wave output.

Power of Misinformation

Shopping for a UPS can be a real education—not in power-protection devices, but in misinformation. You'd think Saddam Hussein's public-relations minister wrote some of the UPS brochures I've seen. One story in particular really highlights what I mean.

A few years ago, a power-protection company—I won't mention any names—ran some full-page ads claiming to have *the* answer to low-cost power protection: a $200–$300 UPS.

Figure 1: SPS in charging mode

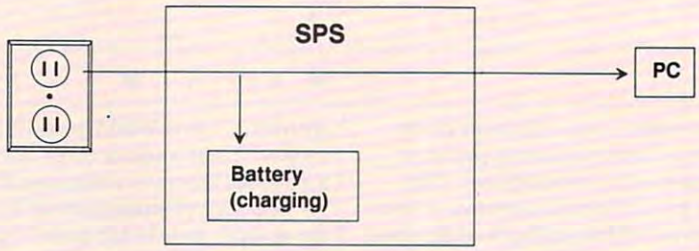


Figure 2: SPS in discharging mode

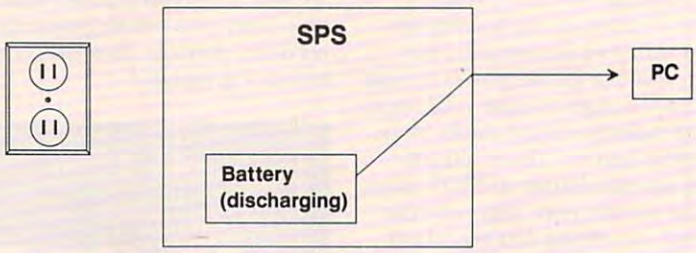


Figure 3: UPS operation

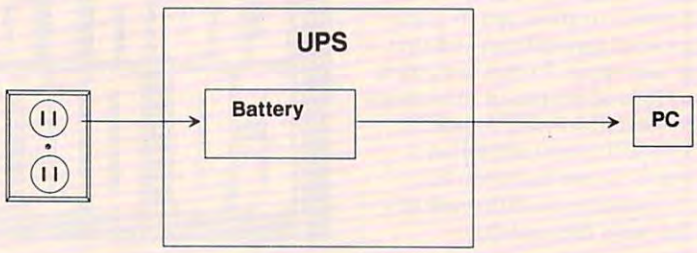
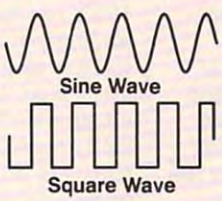


Figure 4: AC waveforms



Wow, I thought, and called them up to find out more. I was directed to a regional distributor, who took my call and did his best to answer my questions.

"This sounds like a terrific deal on a UPS," I said. "Does it produce sine-wave output or square-wave output?"

"I'm afraid the information I have doesn't include the answer to your question," the distributor's technical manager replied. He didn't have the answers to a lot of other questions, so I started smelling a rat.

So I ventured, "How about the switching time? What's the switching time?"

He perked up, pleased to have the answer to a question. "Four milliseconds," he proudly answered. I replied that he wasn't selling a UPS, but an SPS. His answer? "Oh, you mean it's not an online UPS. Yeah, that's true. It's not an online UPS." I've heard similar dodges from vendors since that conversation, so be careful when examining power-backup products. ⊡

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STALKING THE PERFECT WINDOWS CAPTURE PROGRAM

ROBERT BIXBY

If you want to write a how-to guide for using a *Windows* program or if you're creating a presentation based on a *Windows* program, you'll need to make screen captures of *Windows* 3.0 screens. There are several ways to capture text and graphics on your PC, but *Windows* 3.0 presents a bit of a challenge. It's different enough from earlier versions that the *Windows* capture program you used in the past probably won't work with 3.0.

Microsoft was generous enough to provide a built-in capture system to suit your needs some of the time. This method is similar to the Shift–Command–3 combination on the Macintosh, which saves the current screen as a *MacPaint* file—although the *Windows* version isn't nearly as convenient as the Mac's.

Pressing PrintScreen while *Windows* is running saves the entire screen to the Clipboard. (To capture only the currently active window, press Alt–PrintScreen.) You can then paste the graphic into *Paintbrush* and save it as a BMP or PCX file.

This means that each time you capture a screen, you'll have to call up *Paintbrush* to deal with it, which isn't a very efficient process and will tire you out if you're making more than two or three screen dumps. Furthermore, the *Paintbrush* canvas is slightly short. It isn't tall enough to paste the entire *Windows* 3.0 screen, and you'll always end up chopping about a quarter of an inch off the bottom.

In my search for the perfect *Windows* screen capture, I discovered *Hijaak* (Inset Systems, 71 Commerce Drive, Brookfield, Connecticut 06804-3405; 800-828-8088; $199) and *Collage Plus* (Inner Media, 60 Plain Road, Hollis, New Hampshire 03049; 800-962-2949; $129), both recently released with *Windows* 3.0–friendly capture programs. *Hijaak* is primarily a graphics conversion program that's just what you need for converting Macintosh and Amiga graphics to PC format or for transferring images among PC programs. It includes a simple program for capturing screens.

I got my start capturing *Windows* screens while editing a book on *Adobe Illustrator* for the PC. The program I used then was *HotShot Graphics* (SymSoft, 924 Incline Way, Call Box 5, Incline Village, Nevada 89450; 702-832-4300; $249). To signal the *Windows* portion of the program to capture a screen, I pressed two keys. The graphic was then captured and saved to disk in the *HotShot* native format, HSG, which could then be converted to TIF or PCX. *HotShot* would even autoincrement the filename, so I'd wind up with a list of easily managed files like GRAB001.HSG, GRAB002.HSG, and so forth.

One problem I had with *HotShot* was that when it converted its native format to TIF, it was incompatible with most other programs. In order to use its output with most other programs, I had to convert it to either PCX or IMG format.

Hijaak follows a similar convention, grabbing the file at a keypress and saving it in a native format, IGF, which can then be converted to PCX or another format at the end of the session. Not only is the screen capture a convenient feature of the program, but *Hijaak* is also the best solution if you find yourself converting files frequently. It offers both a conversion environment and a quick and easy command line converter. Unfortunately, *Hijaak* lacks an autoincrementing feature. It pauses in the screen-capture process to give you the chance to enter a filename before the screen is saved to disk.

I was even more impressed with *Collage Plus.* Rather than simply hiding in the background, this program's *Windows* 3.0 capture program features an onscreen window that disappears momentarily as the screen is captured. *Collage Plus* also offers a series of options for the capture file, including color, monochrome, and dithered grays. If you choose grays, you're given the option of a fine, medium, or coarse dither, and a slide bar for indicating whether you want a lighter or darker picture. These options won my heart.

Collage Plus even provides a chart in the manual to help you decide which screen-capture format should work best for your particular application (certain dithering schemes work better for scaling operations than others).

But the best news about *Collage Plus* is that it provides a countdown. The countdown feature means you can set it to snap a picture up to 99 seconds after the command is given. Usually only five to ten seconds are required to call up the dialog box you want to illustrate, but the long pause adds immeasurably to the program's flexibility.

Collage Plus will even capture in the format you prefer, whether it's PCX, TIF, or the BMP format used by *Windows* itself, which eliminates the extra step of converting files to the format you want. *Collage Plus* also autoincrements for you, so there's virtually nothing to do with the screen capture once you've requested it.

The screen-capture utility also lets you "flip" the image or reverse colors. There's an option that will let you capture the active window rather than the whole screen, and it can display an indicator that will show you how much of the screen has been captured. ⊡

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FAST FORWARD

DAVID ENGLISH

I recently attended a seminar on the future of computing at a software conference, and no one on the panel was willing to define the term *multimedia.* As with other squishy phrases *(user-friendly, ergonomically designed, all natural),* most of us have a general idea of what we're talking about when we use the terms—but don't ask us to be too precise. When the phrase *desktop publishing* was introduced in 1984, it was squishy. But as actual products flooded the market, we were able to separate the practical uses from the industry hype.

In the case of multimedia, the confusion is compounded by the fact that it isn't a market or a single application, but a group of six related technologies that have become affordable at the same time.

Three of these six technologies are extensions of past PC advances—high-resolution graphics (VGA or better), an affordable device for realistic sound (the Sound Blaster and similar sound cards), and a standard graphical user interface (*Windows* 3.0). The three other technologies are relatively new to the PC world—faster and less expensive CD-ROM players, full-motion video, and sophisticated, yet easy-to-use, authoring systems for multimedia applications.

Joined together, these six technologies form the foundation for what we know as multimedia. You don't even need all six to qualify—just about any combination of three or more will do. Let's take a brief look at these technologies and see how each has evolved.

Over the last few years, VGA has become the de facto video-card standard, especially its two high-resolution modes—320 × 200 with 256 colors, and 640 × 480 with 16 colors. In addition, *Windows* makes it easy for software companies to support even higher-resolution modes. A card manufacturer can write a single driver that will work with any present or future *Windows* program. This allows multimedia developers to use photographic-quality images in their applications and maintain a high degree of compatibility over the various high-resolution modes. We've come a long way on our journey from four-color CGA to the 16.7 million colors of the new 24-bit cards.

Sound has undergone an equally dramatic transformation. While many programs still rely on simple PC beeps, Microsoft has established a sound-card standard with *Multimedia Windows,* which allows any *Windows* application to play real sounds through your PC. As with video cards, sound-card manufacturers need to write only one driver in order to support all *Windows* programs, and software developers only have to deal with a single sound-card standard.

WHEN IT COMES TO LANGUAGE, IT'S ALL **SQUISHY TECH**

All of these high-resolution images and real sounds take up a lot of disk space—too much even for a hard drive. Enter CD-ROM, which can store as much as 650 megabytes on a disc. While the current crop of CD-ROM players are faster than ever, Microsoft has set an even higher standard (150K per second) for *Multimedia Windows.* These units are able to maintain their higher speeds by using a buffer to hold frequently read information. A year ago, CD-ROM players were $800–$1,000. Today, you can buy them for as little as $400.

The main reason Microsoft insisted that CD-ROM players be so fast is full-motion video. With a speedy CD-ROM player, a PC can spool images off of a CD-ROM disc fast enough to display a video sequence in a small window without any flicker (or a video in a full-screen window with only a little flicker). A multimedia program could display a person in a small window explaining the action in another window. As long as the windows aren't too large, a 150K per second CD-ROM player can handle them. All-talking, all-moving pictures (and animation) may soon be appearing on a PC near you.

Multimedia applications are only as good as the development tools that create them. Fortunately, we're seeing a bumper crop of reasonably priced authoring systems (most under *Windows*) that are both powerful and easy to use. The majority of these programs use the *HyperCard* model, allowing you to associate visual objects with programming code and literally move those objects into place with your mouse.

At this time, it looks as though the common platform for all of these technologies will be *Multimedia Windows.* With *Multimedia Windows,* you can link various applications together. For example, you could have one program grab an animation from a CD-ROM disc so that a second program could use it in a multimedia presentation. At the same time, a third program could grab the CD-ROM's MIDI data so that a fourth program (in this case, a MIDI sequencer program) could feed the musical data to a sound card and a MIDI synthesizer.

Because *Multimedia Windows* has the necessary programming hooks and standards for these technologies, it will ultimately be the means for making multimedia less squishy. Look for a steady stream of products over the next twelve months that will define what multimedia is and what it will become in the future. ⊡

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WORKPLACE

DANIEL JANAL

Do your clients know what you do and how long it takes? If they don't, they might think that you're ripping them off. And that's a message you certainly don't want to send.

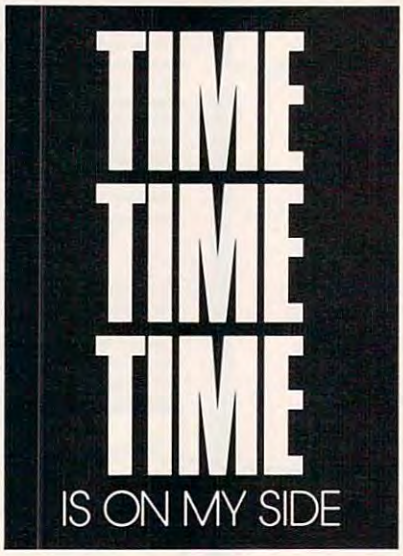
It's important for any business, at home or downtown, to keep accurate track of the time spent on projects. For me, that means looking at my watch at the beginning and end of each project and recording the time in my diary. However, when I forget to make entries (and this does happen), I must rely on estimates. Then, at the end of each month, I face another problem—adding the figures. If you've ever tried to add one hour and 25 minutes to three hours and 50 minutes, you know what I mean. Do that 20 times a month, and you'll be mired in a tedious process that can be fraught with errors.

Timeslips, a leading time-billing program, bolsters its attractiveness by claiming that 25 percent of the average person's time is not billed properly. I recently decided to take the program up on its challenge, figuring that if I won, my income would increase and my clients would get more detailed reports.

Timeslips is easy to set up. The program asks for standard logistical data, such as your name, billing rate, and activity (consulting, writing, phone calls) and your clients' names, addresses, and billing rates, among other items. This information is used to create time slips, invoices, and labels. Ten easy minutes later, I was ready to track time. My only complaint is that I wanted to use my current client number codes, which range from 30 to 60. *Timeslips* insists that all client codes be entered sequentially, beginning with 1. My solution was to enter *x* in the first 29 fields.

I began by creating a time slip for writing this article and then starting the stopwatch. The program displayed the time not only as seconds, but as dollars and cents. The effect of seeing money accumulate on the screen is mesmerizing. Time really is money. Then, to my dismay, I realized the first ten minutes of preparation time were not billed. But, because the *Timeslips* program lets you enter time from the keyboard, I was able to quickly remedy this problem. This feature comes in handy for services performed outside the office.

To create a time slip, type your name or employee number, client name or number, and activity. The *Timeslips* program automatically inserts the correct billing rates. You can type a description of the activity you're about to perform, such as *write article, proofread manuscript,* or *send*



invoice. Then select the billing options, such as Bill by Client or Charge a Flat Rate. Activate the stopwatch, and time is credited to your account.

Timeslips can operate as a TSR, which is great for client-based companies. For example, say you're working on a project for one client when a second client calls. With the TSR function, you can stop the time slip on the first client and create a new slip for the second client in just a few seconds. I used *Timeslips* with *WordPerfect* in a 640K environment with no problems, but that didn't leave room for any other TSRs. I also used it as a stand-alone program in order to free some memory and was pleased with its performance.

But while the billing process is simple and effective, I found the reporting process cumbersome. Fortunately, *Timeslips* gives you so many selections that you can create virtually any kind of report or invoice you need. The program uses onscreen prompts and help, but I still needed to refer to the manual quite often. Obviously, as with any other software program or hardware system, you should spend some time with the manual to get yourself acquainted with the product. That way, you'll have some idea of what to expect.

I called the technical support department (on my dime, as the company doesn't have toll-free support) and held the phone for eight minutes and 23 seconds, according to my *Timeslips* time slip, which displayed my lost productivity and earnings on the screen, second by second, dollar by dollar. (Those who live by the time slip die by the time slip.) On the plus side, the technician was friendly and answered my question with ease.

Another feature that I liked, and which saved me money, was the program's ability to track expenses. I sometimes forget to charge clients for postage and copying. Because this feature is so easy to use, there is no excuse for letting nickels and dimes fall through the cracks.

By keeping accurate track of your time, a time-tracking and billing program like *Timeslips* enables you to better serve your clients by allowing you to prepare detailed invoices that are both informative and accurate. For workers in an extended office setting—those telecommuters who are becoming an ever-increasing part of the modern American work force—*Timeslips* can offer the means to track work so that they can meet their employers' desire for accurate record-keeping.

Put time on your side. And take back all those hours that have been slipping through your fingers. You'll be surprised by how they add up. ⊡

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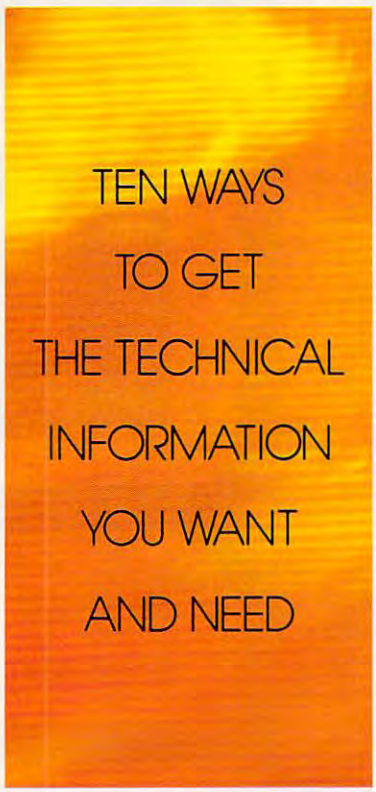
TECH KNOWLEDGE



ROSALIND RESNICK
AND
SUSIE ARCHER

In business, time is money. For most business people who depend on computers for their livelihood, few things are more maddening than waiting on hold for a computer-company technician. Few things, that is, except having the technician come on the line talking in some weird computer lingo and offering "assistance" that is impossible to comprehend.

Getting technical support for your home office doesn't have to boost your blood pressure. Although few hardware or software warranties guarantee much beyond the right to return or repair a product if it turns out to be defective, computer companies value your business and are usually willing to talk you through your problem over the phone. The store where you made your purchase, on the other hand, rarely offers more than a limited refund or exchange.

Keeping this in mind, here are ten time-tested ways to help you get the technical information you require—and turn a potentially frustrating experience into a fruitful one. When you learn the language computer technicians talk, you'll get more out of your calls to technical support. And once you master the basics of troubleshooting your own computer problems, you'll rarely need to ask for technical support again. And that's the biggest time saver of all.

1 An Ounce of Prevention

When you buy a program or a piece of equipment, you enter a relationship with the manufacturer. Start your relationship off right by sending in the registration and warranty cards enclosed with your purchase. Telephone support is offered by almost every manufacturer, but the staffer fielding the call may ask you to identify yourself before directing your call to a technician. If you're not in the company's database as a registered user (or if you don't have your registration number readily available), you may get the cold shoulder. You'll also miss out on any notices, newsletters, or other product information designed to keep you abreast of changes.

You should also consider buying a one-year maintenance contract on your computer hardware—but only if it costs less than ten percent of the product's purchase price and you feel reasonably certain that the company will survive the life of the contract. On-site contracts normally don't cost much more than a standard contract; some companies throw them in free as part of a package deal. An on-site contract will let you stay at home by your phone during business hours while a technician comes to you. It can save taking a morning off to lug your machine to the computer store.

2 Read the Directions

No matter how user-friendly your computer claims to be and no matter how many pull-down menus your software possesses, it's still a good idea to read your user manual carefully before throwing in the towel and calling the company for help. If you have time or patience for nothing else, make sure that you study

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the chapter that tells you how to set up your computer and install your software. Make sure that you have followed directions to the letter and that you are using the equipment specified.

If a problem pops up, check the troubleshooting guide in the back of the manual for common problems and frequently asked questions (you may want to look in a local bookstore for the books listed in the tech books section). Remember that few technical support lines are toll-free, and, for most home computer users, Silicon Valley is a long-distance call.

3 Reach Out and Ask Someone

Unless you're a seasoned computer user, there's probably a limit to what you can do on your own. There comes a time when it's best to pick up the phone and call for help. Demand assistance right away if your computer won't start or your program freezes up on the screen and you have to reboot or exit your application unexpectedly.

Call, too, if you find yourself having to repeat a particular task or keystroke sequence again and again. It could be that a new device driver has been introduced that better supports your printer or modem or a software guru has come up with a keystroke-saving macro that will save you time and aggravation. Or your software may have been updated to correct a problem while the package you bought was sitting on the shelf.

A technician can let you know whether you have the latest version. Even if there isn't a fix for your problem, phone calls are what spur companies to make improvements.

4 Be a Do-It-Yourselfer

Ultimately, the best source of product support is you, the home user. If your manual provides more confusion than help, log on to an online database or bulletin board and look for answers there. Microsoft, Tandy, IBM, and other hardware and software manufacturers provide no-cost bulletin boards, called *forums* on CompuServe and *roundtables* on GEnie, where the company's technical staffers are assigned to read users' questions and leave detailed answers.

It's a good idea to browse through these forums before sending in your question; chances are your problem is not unique. Another nice thing about forums is that you can leave and receive messages at any time of day or night. Remember that though there is no extra charge for many of these forums, use of CompuServe itself is neither free nor inexpensive.

It also pays to know your limits. Whenever a problem occurs, it's wise to back up your data on a floppy disk using the DOS BACKUP command. Often a support technician can repair or restore a damaged file if you haven't tried to fix it yourself first. This backup file can also help the technician diagnose an obscure error. The smartest thing, of course, is to back up your system on a regular basis. That way, your programs and data can be salvaged in case of a hard disk crash—the home computer user's darkest nightmare.

5 Know the Lingo

Reaching out for help won't do you much good if you don't speak the same language as the technician on the other end. We're not suggesting you dash out and take a crash course in C, but knowing a little bit about the hardware can make your interaction with a technician much smoother.

Familiarize yourself with the following, and you'll be on your way:

- Memory-resident programs (also known as *terminate and stay resident* or *TSR programs*), the most popular being *Sidekick* and *PC-Tools'* PCSHELL, reside in your computer's random access memory, enabling your system to call up or enhance other applications. Some may even load automatically every time you turn on your machine. They make it possible for you to call up a program with a keypress or speed up your system in some way, but they may also be memory hogs and sometimes prevent other programs from running. If you have problems, a technician may suggest that you remove all TSRs from your AUTOEXEC.BAT and reboot.
- If your screen freezes up, you may have to warm boot your computer by holding down the Ctrl-Alt-Del keys or cold boot it by pressing reset or turning your computer off and and then on again.
- The CHKDSK command tells the technician how much disk and free memory space you have available.
- You'll also need to know the contents of your AUTOEXEC.BAT and CONFIG.SYS files. To view these files, type CD \ to enter the root directory; then enter TYPE AUTOEXEC .BAT. You can repeat these steps for the CONFIG.SYS file. If either file scrolls off the screen before you can read it, use Ctrl-S to pause and Ctrl-Q to resume the scrolling. You can also send a screenful of information to your printer by pressing the PRINTSCREEN key. The CONFIG.SYS file sometimes contains a command to load a memory manager. Often these managers have names like QEMM.SYS or EMM.SYS. These memory managers give access to RAM beyond the conventional 640K. Technical support people will need to know whether you have one of these memory managers running because they sometimes are the source of conflicts that prevent programs from operating properly. You might try deleting these commands or putting REM ahead of them and rebooting. If your memory manager is the problem, that could clear it up.
- The setup is a part of memory that contains important information on what peripherals are attached to your computer. PCs and XTs have this information coded by setting switches on the motherboard, but ATs and more advanced machines store this information in a CMOS RAM that is maintained by battery power. If your AT fails to boot properly, it could be because the CMOS battery has run down. Therefore, you should always know what is contained in your setup. Different machines use different methods to reach the setup, but the two most common ways are by pressing Ctrl-Alt-Esc or by pressing Del while the machine is booting. Don't change the settings except under the supervision of a technician, but you should take the time to write down all of the setup information and keep the record close to your computer. Then if your setup fails,

Tech Books

Here is a selection of favorite PC books packed with maintenance and troubleshooting information.

The Hardware Bible
Winn Rosch
ISBN 0-13-160979-3
500 pages
$29.95
Brady Books

Maintaining, Upgrading, and Troubleshooting IBM PCs, Compatibles, and PS/2 Personal Computers
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you can reenter the information and be back to work in minutes.

- A technician may ask you to identify your DOS version, your BIOS type, and your graphics display. You can easily determine your DOS version simply by typing VER at the DOS prompt. The BIOS (Basic Input/Output System) type and display type (usually Hercules, CGA, EGA, or VGA) flash on your screen when you boot your computer. Some common BIOSs are AMI (American Megatrends) and Phoenix.

6 Work the System

It's easier and faster to get help if you know what it's like for the technicians on the other end. On any given day, the peak volume period for help-desk calls is from 9:00 a.m. to 2:00 p.m. EST (most software companies are on the West Coast and there is a three-hour time difference between the Eastern and Pacific time zones).

Many companies hold support staff meetings on Monday morning in order to compare notes on problems. Generally, you can get faster, more personal service if you avoid peak periods and call when the support staff is most likely to be available.

It's also important to know who will be answering your call. At a small company, the person on the other end of the line may be a programmer or software developer, while at a large organization, it may be a receptionist who will take the basic information and route your call to someone else. At a midsize company, you are likely to land a generalist with good people skills who has enough expertise to ask the key questions and diagnose your problem. A specialist may be called in, but it's usually the call-taker's job to get the answers you need.

Generally, computer technicians will record their discussion with you on a trouble ticket or problem report and assign it a level of priority. Priority Level 1, for example, will usually get you an answer in a couple of hours. Priority Level 2 will generate a response within a day. Be honest about your urgency. You don't want to earn a reputation for crying wolf.

7 Put It in Writing

It's a good idea to keep a detailed call-history journal in case you can't resolve your problem in one phone call and must explain your problem again to someone else. Your log should include the date and time of your call, the problem symptoms, the phone number and extension you called, the person who took the call, and the diagnosis and any troubleshooting steps required.

8 Clean Out Your AUTOEXEC

A support technician will frequently fix your problem by giving you instructions on how to alter your system files or copy certain types of files or device drivers into certain subdirectories. That's why it's important to know how to access the AUTOEXEC.BAT file that automatically loads programs into your computer's memory at boot-up every time you turn on your machine. If too many memory-resident programs are being loaded in automatically, you may not have room to run other programs that require at least 512K of RAM. A support technician can help you edit your AUTOEXEC.BAT file using a text editor or the EDLIN program that edits ASCII files. Normally, RAM space can be freed up by inserting the letters REM in front of any command that loads in a driver or TSR.

9 ReCONFIGure Your SYStem

Common problems such as system freeze-ups and insufficient memory can often be solved by letting the technician edit your CONFIG.SYS file. This file usually contains the statements BUFFERS = X and FILES = X. The CONFIG.SYS file also lets you add device drivers to your system that can control a modem, a mouse, or an optical scanner.

The more buffers you tell DOS to use, the more data it can store in memory. The greater the number of files you set, the more tasks your system can perform simultaneously. To solve your immediate problems and help your computer run more efficiently, set the buffers statement somewhere between 10 and 25 and the files statement at no less than 20.

10 Take It to the Top

Captain Kangaroo notwithstanding, the three magic words are not *please, thank you,* and *you're welcome,* but *please, thank you,* and *may I speak to your supervisor.* If you can't get the help you need from the support technician, ask to speak with someone further up the chain of command. This person, typically called the support manager, will probably be able to steer you to a technician who can better help resolve your problem.

If a problem recurs, try to remember whether you've installed any additional hardware or software since your last call or if you've recently entered a large amount of data on your hard disk. Even if the answer is yes, don't be shy about calling back for more help. Don't assume that you'll get the same technician on the line. This is where your call-history journal can come in handy. In addition, problems labeled by a technician as chronic normally get higher priority.

If you're still not satisfied, it may be time to write a letter to the company's president or ask for a refund. After all, time is money, and you've got to know where to draw the line.

Tech Support Is Only Human

Above all, remember that the person at the other end of the line is a human being who must deal with dozens of dissatisfied users at all levels of expertise. If you are patient and cooperative—and if you've done your homework—he or she can be much more helpful to you. ⊡

How to Get Help Online

If you're on GEnie or CompuServe, you're only a phone call away from some of the best technical assistance available, directly from your software company. Here are the shortcut ways to contact some of the software heavy hitters. Some of the hardware roundtables and forums are not directly supported by the companies involved, but they are a way to contact fellow users of the equipment to obtain information.

Company	GEnie	CompuServe
Microsoft	MICROSOFT	GO MSOFT
Software Publishing		GO SPC
Lotus		GO LOTUS
WordPerfect	WP	GO WPSG
Ashton-Tate	ASHTONTATE	GO ASHFORUM
WordStar International		GO WORDSTAR
Symantec		GO SYMANTEC
Borland	BORLAND	GO BORLAND
Hayes	HAYES	GO HAYES
IBM	IBMPC	GO IBMNET
Macintosh	MAC	GO MAUG
Amiga	AMIGA	GO AMIGA
Commodore	COMMODORE	GO CBMNET

To see a complete listing of the software or hardware forums on CompuServe, type GO SOFTWARE or GO HARDWARE. A larger computer-related area containing all of the above forums and more can be reached by typing GO COMPUTERS.

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STEVEN ANZOVIN

WHY PC CAN'T READ

Hal 9000 could do it. So could the Terminator, not to mention the Robot in *Lost in Space.* These Hollywood computers could read, use a phone book, and even read lips. In the real world, we also want our computers to understand what we write and say and to return enlightening responses. Unfortunately, they don't understand a word.

That's what computing newcomer Daniel Lombardo, curator of the Emily Dickinson Collection in the poet's hometown, Amherst, found out when he tried the popular grammar-checking program *Grammatik IV* (Reference Software International, 330 Townsend Street, Suite 123, San Francisco, California 94107; 800-872-9933, 415-541-0222). Danny was writing an article about Dickinson on his new PC, which he ran through *Grammatik's* battery of grammar, style, mechanics, and spelling analyzers.

Like other grammar and style checkers, *Grammatik* offers suggestions for improving text based on rules developed by academic writing experts. The program's internal rules couldn't cope with Dickinson's writing, however. About Dickinson's poem on a hummingbird—

A Route of Evanescence
With a revolving Wheel—
A Resonance of Emerald—
A Rush of Cochineal—
And every Blossom on the Bush
Adjusts its tumbled Head—
The mail from Tunis, probably,
An easy Morning's Ride—

Grammatik said, *This may be an incomplete sentence. Long sentences can be difficult to understand. Consider revising so that no more than one complete thought is expressed in each sentence.*

The use of *in case* in a line from one of Dickinson's letters, "I found abundance of candy in my stocking, which I do not think had the anticipated effect upon my disposition, in case it was to sweeten it," prompted this response: *Hackneyed, Cliche, or Trite . . . Avoid cliches, they distract the reader and weaken your message. Cliches are a symptom of lazy writing.*

As Danny remarked sarcastically, "After 30 years, the great critic Thomas Wentworth Higgins was still bewildered by Emily's writing. *Grammatik* got right to the point in a microsecond. She was lazy."

Grammatik is actually one of the better programs of its kind on the market and can be a real help to expository writers—not poets—trying to learn their craft. Reference Software doesn't claim *Grammatik* will make a computer "understand" your writing any more than a paint program can critique your artwork.

Danny's experience points to a more general problem in what's called *natural language processing,* the yet-to-be-achieved ability of computers to understand everyday language. Computers work by rules, called *algorithms,* and many theorists of artificial intelligence think the human brain works much the same way. In this view, the only important difference between brains and computers is in the brain's greater complexity and adaptability. Make computers more complex, faster, and better able to learn, and natural language processing should follow—you merely need to feed in the right language rules. The same rules *Grammatik* now uses to analyze a poem are the primitive precursors of a system that may someday allow computers to read natural human language.

But research shows that reading isn't as simple as it appears; it requires a knowledge of how the world works, not just the rules of language. Some experts estimate that an ordinary, common-sense understanding of the world may actually require a knowledge base of as many as 10 million instantly accessible rules of thumb. But because language evolves over time and varies in usage with each writer and speaker, it may not be possible to define all the rules.

To get a sense of the difficulties involved in natural language processing, first remember what it was like to learn how to read in grammar school. Now imagine attempting the same complex task having lived your life in a featureless box with no speaking ability and having the innate language capabilities of a gnat. A daunting prospect.

Clever programming can yield software that gives the appearance of language understanding. MS-DOS seems to "know" what you mean when you type *dir,* and that's what misleads computing neophytes. Also, it doesn't help that movie robots all talk fluently, only occasionally stumbling over human colloquialisms. However, most researchers in the field of natural language processing are just beginning to admit that devising a real-world program capable of understanding text, including poetry, on a human level is probably decades away from happening.

So why can't PC read? Because we don't know how we do it ourselves, and until we know better, our computers will be unable, in Dickinson's words, to "expound the skies." ⊡

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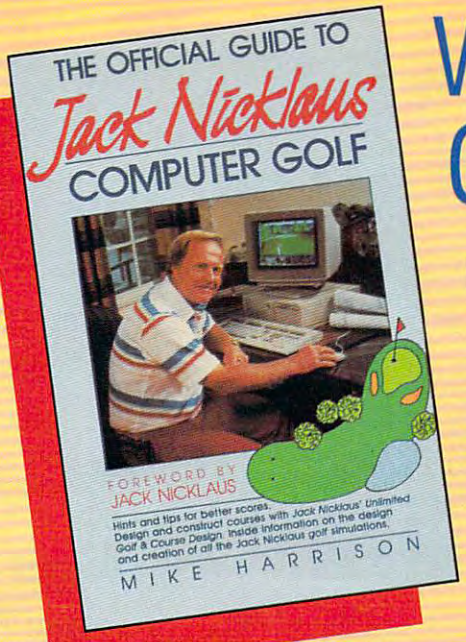

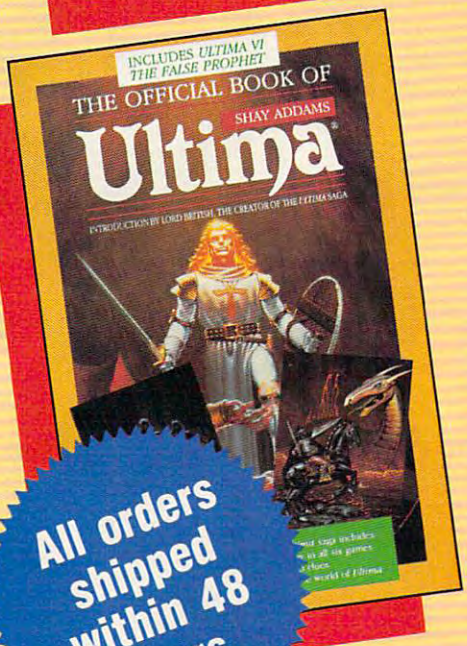

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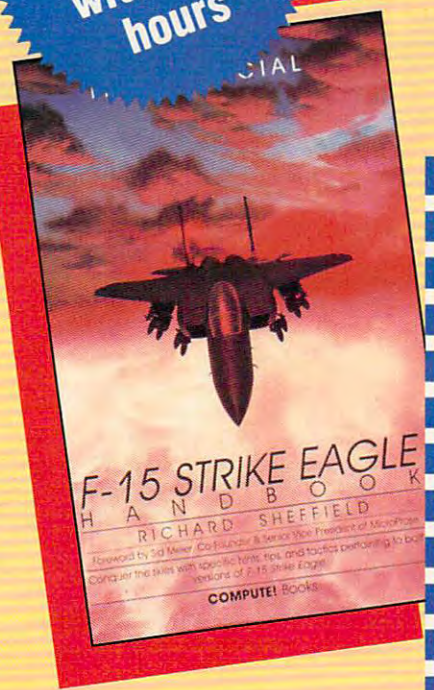

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Scientists call robots that do this kind of work *smart*. In this case the word *smart* has far less to do with common sense than with computerized intelligence used to make high-level decisions. Long the darling of science fiction writers and movie producers, robots have traditionally been portrayed as intelligent machines performing work too dangerous or too dull for humans. Despite these decades-old prophecies, however, totally independent robots still exist only in fiction and the minds of visionaries. ▷

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One realist, Dr. Reinhold C. Mann, director of the Oak Ridge National Laboratory's Intelligent Systems Section, believes that continued advances toward creating autonomous robots require much more exploration of the ways a machine's mind is trained: "We have not yet solved the learning problem. We still need to achieve a more humanlike performance from robots." Mann believes one way to solve the learning problem is to find a way for an older generation of robots to teach the younger generation.

In addition to the formidable technical obstacles of creating a practical machine intelligence, emotional issues also impede progress. Many people hold to the once widely popular Hollywood concept that robots, in league with malevolent computers, could destroy the world, enslave humanity, or produce widespread unemployment as machines replace humans. Paul Klarer, robotics software engineer for Sandia Laboratory, disputes that concept. "We need to get the word out that robots are designed to help. They will not take away their jobs, but they will keep people out of the line of fire," says Klarer.

Since robots are, after all, merely expendable machines and will never possess a sense of self-preservation, they can be used to spare humans from performing society's dirtiest, most dangerous work. Each of the robots shown in the accompanying photographs exists for just that reason—to keep people out of harm's way.

▲ **Built on an All-Terrain Vehicle (ATV) chassis, Sandia's Fire Ant qualifies as a *smart assassin.* A human operator guides it to its assigned position by remote control. Parked and armed, it waits for an enemy vehicle to pass. The onboard Motorola 6805 8-bit processor analyzes incoming sensor data to detect the target and initiate the fire-control sequence. When locked onto the target, the Fire Ant launches its six-inch armor-piercing slug at 6600 feet per second.**

◀ **This is the result of the Fire Ant's attack. The Fire Ant's copper-jacketed slug devastated this M-47 tank. Because of such awesome firepower, some researchers resist allowing autonomous military robots the freedom to initiate a fire sequence. Supporters of robot technology claim that future armed robots incorporating built-in safeguards will provide strategic support for front-line troops with total dependability. Even under human control, robots already have a place on the battlefield. The U.S. Army requested more than 1000 Fire Ants for urgent delivery to Saudi Arabia at the start of Desert Storm (ironically, Sandia declined, saying it could not comply with the request on short notice).▷**

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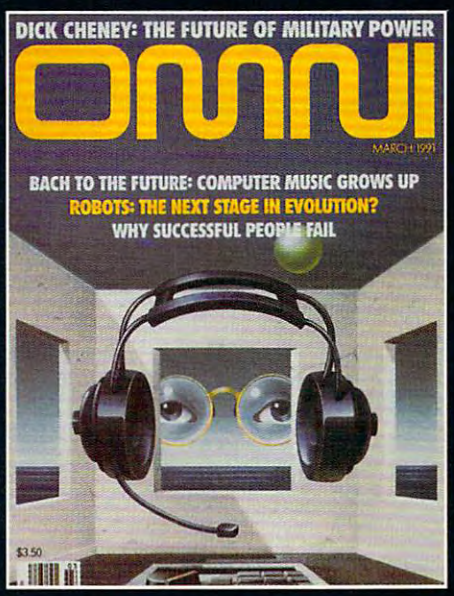

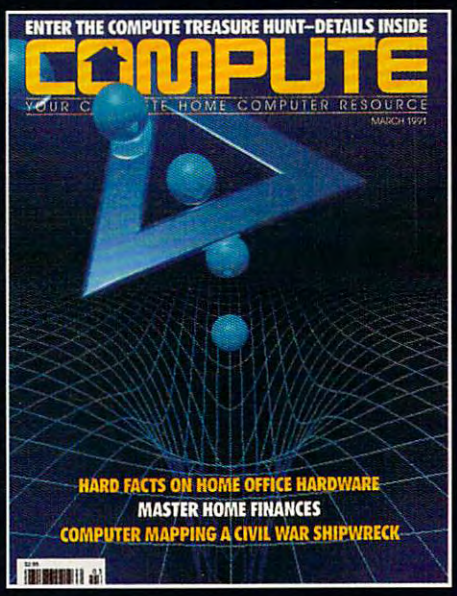

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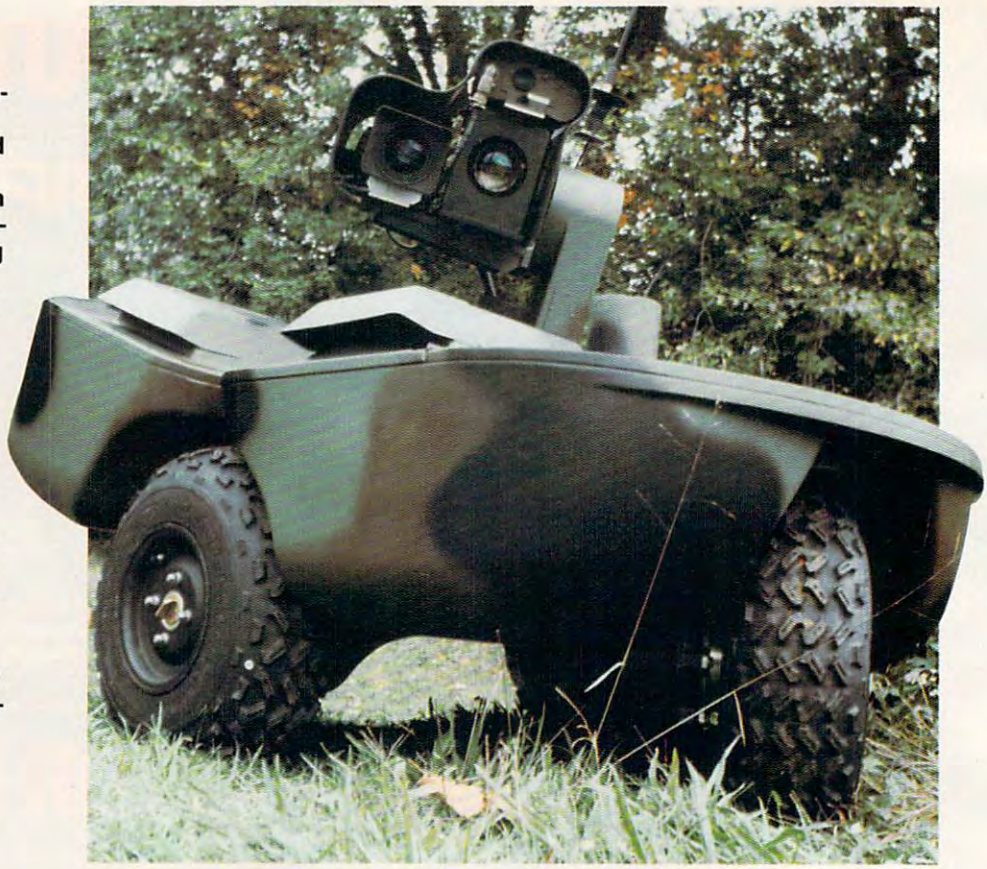
▶ Primarily designed for military use, TMAPs (Tactical Multipurpose Automated Platforms) may see service as reconnaissance vehicles or as smart, mobile launchers of laser-guided Hellfire missiles. Like the Fire Ant, TMAPs remain under human guidance and use on-board computers and sensors for gathering and processing target-acquisition data. Grumman's version of the TMAP relies on Motorola's 6805 processors to control its propulsion system and process incoming sensor data. An Intel 80386 central processing unit provides high-level intelligence for path-planning and obstacle-avoidance sequences.

At the current development rate of machine intelligence, some cautious researchers predict that 20 years may pass before advanced TMAP hunter/killer robots can operate without human supervision. Even the development of fail-safe logic circuits may not convince some experts to grant armed robots battlefield independence. Why? Because there are thorny ethical questions about the fact that military robots lack compassion (and might even violate the Geneva Convention), not to mention the frightening possibility of the robot initiating friendly fire.



◀ Even when stripped of their firepower, mobile robots still keep humans out of harm's way. Mounted on a Honda ATV chassis, Sandia's Telemanaged Mobile Security Stations (THOMAS) patrols remote, potentially dangerous sites to detect intruders. Sitting atop a telescoping ten-foot-tall mast, THOMAS's onboard computer processes realtime data it receives from its sensor array. The computer compares the incoming data against known alarm conditions, factors in climatic conditions, and then decides whether to radio an alarm back to a monitored central command post. THOMAS uses high-discrimination infrared sensors and radar to detect intruders. The next generation of THOMASes, already under development, will operate autonomously and contain neural networks for acquiring and evaluating data. ▷

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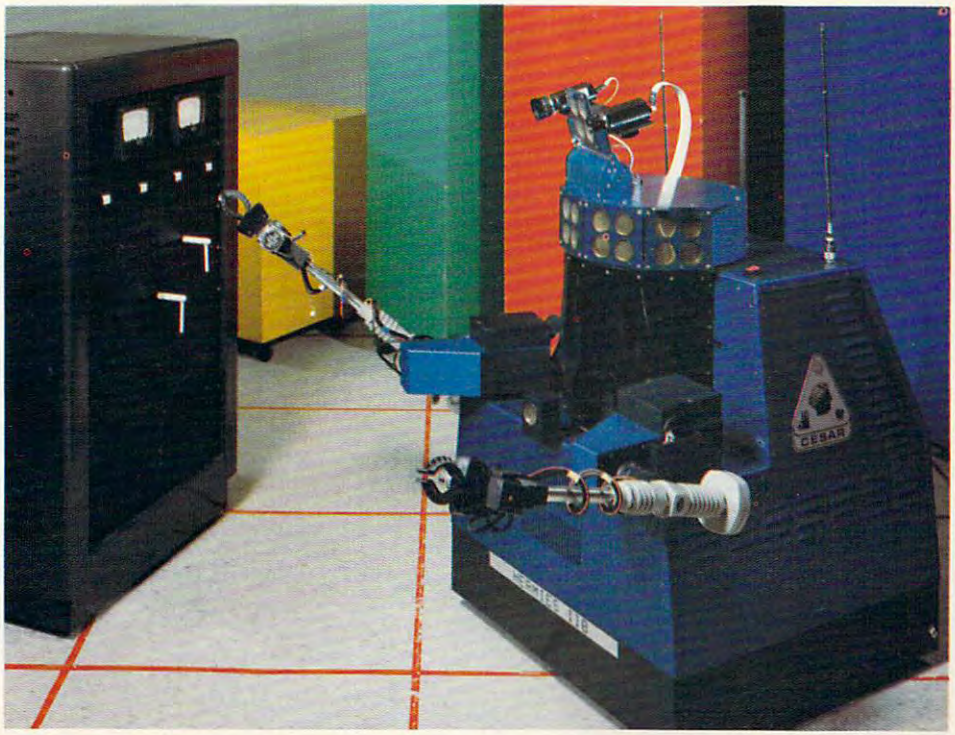
▶ In this time-sequenced photo, a robot built by Oak Ridge Laboratory uses a vacuum attachment to clean up a simulated chemical spill. Employing machine vision to locate and map the spill, the HERMIES III (Hostile Environment Robotics Machine Intelligence Experimental Series) employs three paralleled Motorola 68020 processors, one Intel 80286, and 16 Hypercube nodes for realtime image analysis and decision making.

Operating independently of human guidance, HERMIES uses a laser ranging camera plus multiple sonar sensors to navigate through an unknown area containing fixed and moving objects. Machine intelligence is supplied by a LISP-based artificial intelligence program supporting CLIPS, a public domain expert-system shell developed by NASA which controls high-level navigating decisions. The next generation HERMIES IV robot will incorporate VLSI fuzzy logic hardware to overcome the inherent rigidity of present-day rule-based programming.

HERMIES' ability to operate in hazardous areas and make independent decisions can free its operators from dangerous duty.



◀ Seen here at the controls is the HERMIES IIB, a smaller, earlier version of the independent, versatile robot. It receives instructions from a single Intel 80286 plus an NCUBE 16-node Hypercube computer (operating at 16 MIPS). Using its dexterous lightweight arms, this HERMIES IIB learned the sequences (including reading panel-mounted analog meters) required to shut down equipment that is malfunctioning and initiate an alarm-control sequence. Like its big brother, the HERMIES III, the IIB can use its on-board computational power to operate autonomously. The human overseer, located in a control room at a safe distance, is continuously apprised of the IIB's location and progress via an RS-232 wireless modem. ▷

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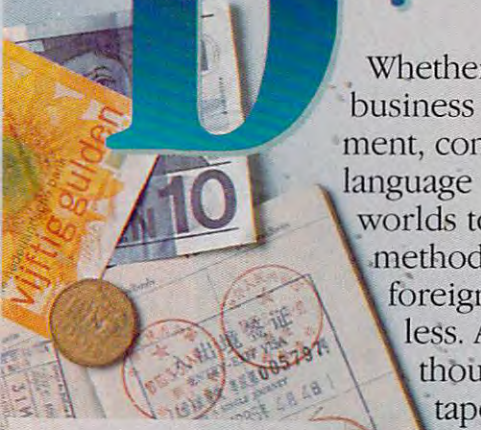

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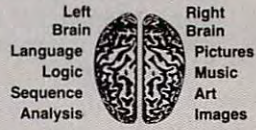
> "American managers with language skills open more doors."
> *Wall Street Journal Editorial*
> July 25, 1988



> "(the superlearning method is) fascinating . . . the results are extraordinary."
> Prof. Lawrence Hall
> Harvard University

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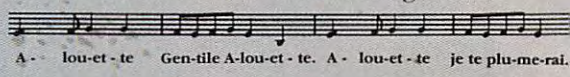

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> "American ignorance of other tongues has been hurting American business executives in their competition for (overseas) markets."
> *The New York Times*
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You, Robot

They're becoming more common all the time. How do humans react to robots in everyday life?

Meeting a nine-foot-tall robot at a company bash can be intimidating. But it's nearly impossible not to like the bucket of bolts when it dons a bow tie and admits in a soft voice that parties make it nervous.

Logan Enterprises, a Greensboro, North Carolina, entertainment company, designs, builds, and operates nine-foot-tall robots for corporate events. The robots, which are actually intricate machine costumes with a human operator inside, are a melding of man and machine.

Creating interaction between humans and robots is the job of Logan inventors David Rawlins, David Hall, and Dan Hall. They have discovered that people respond positively to robots that project familiar human characteristics.

"If people see the humanness in the robot, they tend to react better," says David Hall. "For example, the robot can offer to shake hands, or it can give a compliment: 'That's a lovely sweater you're wearing.'"

Logan's hulking robots consistently win over children at Disney World in Florida, Hall says. "We'll go up to a kid wearing a Mickey Mouse hat and say 'I know you; you're Mickey Mouse.' The robot, which projects childlike innocence, easily makes a friend."

Incredibly, children show little fear of the Logan robots. "Eighty percent of the children come up and shake hands," Hall says. "They want to know how it's built and how it moves. Every kid has a robot in his world. Robots let people bring in their own imagination."

Logan's inventors have experimented extensively with body language, voice pitch, color (red eyes appear menacing, while blue ones come off as friendly), and accessories (from bow ties to sunglasses to jams) to unlock the human heart.

But personalizing the robot can go too far.

"There is a fine line, knowing the limitations of being human for the robot," Hall says. "You don't want to get too close to being human, as in androids, because that scares people."

Most humans would probably feel threatened by an industrial robot that can work three shifts without a coffee break—bow tie or no bow tie. But robots can do more than entertain at parties, build cars, patrol secure areas, and blast tanks to kingdom come. They can also occupy barstools.

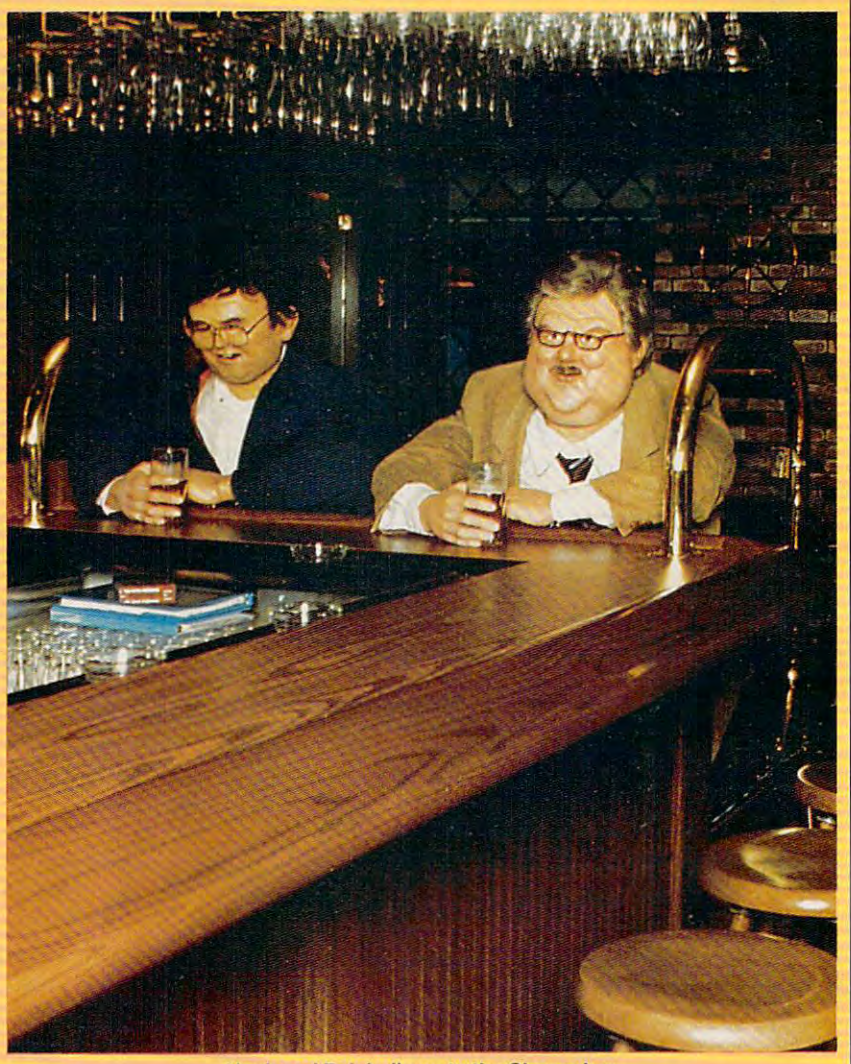
Host International, a division of Marriott, is cashing in on two trends—the attractive features of robots and the most popular program on television, "Cheers." Host operates airport concessions across the country. Now it's planning to open Cheers bars in 46 airports. Two have already opened, in the Detroit Metro and Minneapolis-St. Paul International airports. The bars are more than sawdust and brass, though. They feature mechanical drinking buddies permanently stationed at the end of the bar, like their human counterparts on "Cheers," Norm and Cliffy. Actually, because the actors who portray Norm and Clif refused to give permission to use their likenesses, the two robots look more like Laurel and Hardy. The two trade wisecracks and banter while cradling beers in their hands.

The robots— known as Hank Gifford, who sells hardware, and Bob Johnson, who sells insurance—currently vegetate in the Minneapolis-St. Paul location to celebrate its opening. New robots are being built to take their place in Detroit.

Advanced Animation, a Vermont company in the robot business for 30 years, created the dipsomaniacal robots. A representative of Host International stated that the public's response to the two robots has been "overwhelmingly positive." Far from the mundane, regular guys they portray, Hank and Bob have become celebrities, written about in newspapers from New York to Los Angeles, as well as in the Detroit and Minneapolis-St. Paul papers.

As a good example to the traveling public, Bob and Hank never actually take a drink from their glasses. Their robotic arms don't work. Only their upper bodies and faces are animated. ⊡

—SHERRY ROBERTS



Hank and Bob belly up to the Cheers bar.

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WHAT YOU GET WITH THE NET

Most computer users don't have modems. Why? Probably because most people haven't had a good reason to get one. Who would they send messages to? Why not just pick up the phone and call?

But all that's starting to change. More and more people are finding the "good enough" reason to buy a modem is an online service like Prodigy, CompuServe, Delphi, or GEnie. There's something exhilarating about getting on an electronic information service and finding yourself in public conversation with people whose books or columns you've read or whose views you find fascinating.

I've been online (off and on) for years. For instance, I uploaded this column by modem, and my book *Ender's Game,* published back in 1984, was the first novel I know of that was published electronically *first* (on Delphi).

The rest of my family never even tried to log on until recently. Up to now, they just looked over my shoulder as I fumbled through Delphi and CompuServe. They added comments like, "Cool, I guess," or "What in the world are you doing?" or "That is so confusing." Then they walked away.

Until Prodigy. I tried it out to take part in an electronic conference with a Illinois college class, but the service was so interesting, I hung around awhile. And I like a lot of what I've seen.

The Prodigy concept is simple. Instead of using your own communications program and turning your computer into a dumb terminal with the mainframe a thousand miles away, Prodigy is loaded as a program in *your* computer, and most of the routine tasks are handled right there in your home. Only when you absolutely need to upload or download something from Prodigy do you access the main system. And when you do, the Prodigy program handles that automatically.

This means each person signed on to Prodigy uses only a fraction of the mainframe processing time needed to accomplish the same tasks on another online service. That lets Prodigy charge you a flat rate instead of a fee for each minute of connect time. Paying by the minute encourages you to get off as fast as you can, but a flat monthly fee encourages you to play around with the system, to explore its possibilities. (There's a surcharge of 25 cents per message for every message you send above 30 in any given month.)

Another Prodigy innovation is its humane interface, which is far less intimidating than the mostly blank screen you get from Delphi and CompuServe. To their credit, some of the other services have been making progress. *CompuServe Information Manager (CIM)* and GEnie's *Aladdin* automate many online tasks. *CIM* even has mouse support and pull-down menus for the IBM version. *Aladdin* is a keyboard-driven program, but it makes managing GEnie RoundTables and software libraries a breeze. Just set up your *Aladdin* program with the areas you visit most, and move to your favorite places with the touch of a finger.

But when my 12-year-old saw me dinking around with Prodigy, he didn't just walk away. He sat down, and in a few minutes, I had him signed on with his own membership (each household gets *six* memberships for the same fee). He was off and running.

Prodigy offers games online, but they're simpleminded—nothing to write home about. You can shop and browse through online catalogs, although my orders arrive much faster through telephone shopping than by means of Prodigy. On the other hand, I don't have to spend an hour on hold, and most companies are a pleasure to deal with.

But Prodigy's main attraction—and the best entertainment—comes from other users. The conversations and messages on the club bulletin boards are a great way to strike up some friendships. Best of all, from my point of view, there are lots and lots of *kids* online.

So not only did my computer-literate son, Geoffrey, take to Prodigy at once; so did my ten-year-old daughter, Emily. She cheerfully hooks up and carries on her own conversations with long-distance friends.

But there are drawbacks. You can't upload or download long files, and the message-length limitation, though lately improved, is still pretty severe. I've found, though, that the forced brevity of the messages helps me. On Prodigy it takes only a couple of minutes to read and answer letters from my fiction readers—so I actually complete my online correspondence. That doesn't happen very often with the U.S. Mail!

Of course, you can do all this—and a lot more—with GEnie, CompuServe, Delphi, or America Online. But can you do it as easily as you can on Prodigy? And will your less-than-expert family members feel as comfortable exploring these other services on their own? Not a chance!

Is Prodigy worth buying the modem for? You'll have to answer that yourself. But when I see my kids typing away, corresponding with people all around the country on an incredibly wide range of subjects, I can tell you *my* answer. Prodigy has made my kids use the computer for something besides homework and games, and it's made their world a little larger, too. Prodigy claims that 700,000 households are signed on to its system. I'm glad mine is one of them! ⊡

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