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SPREADSHEET ANALYSIS

Lotus 3 vs. 2.2:
Power or Speed—
You Can't Have Both

COMPUTERS

All the Speed You
Need? PC Labs
Tests 13 25-MHz
386 Machines

ALTERNATE INPUT

Mightier Than the
Mouse: 24 Digitizing
Tablets for
CADD and DTP

FREE UTILITY

Send Binary Files
Through E-mail
With DEBUGSCR

MAGAZINE

VOLUME 8 NUMBER 20 THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING NOVEMBER 28, 1989

Pick Your Word Processor

Word, WordPerfect, And DisplayWrite Dominate the Market

- Which Is Best?
- They Run Under OS/2—Does It Matter?
- How Good Are They At Desktop Publishing?
- Is There a Printer They Can't Handle?

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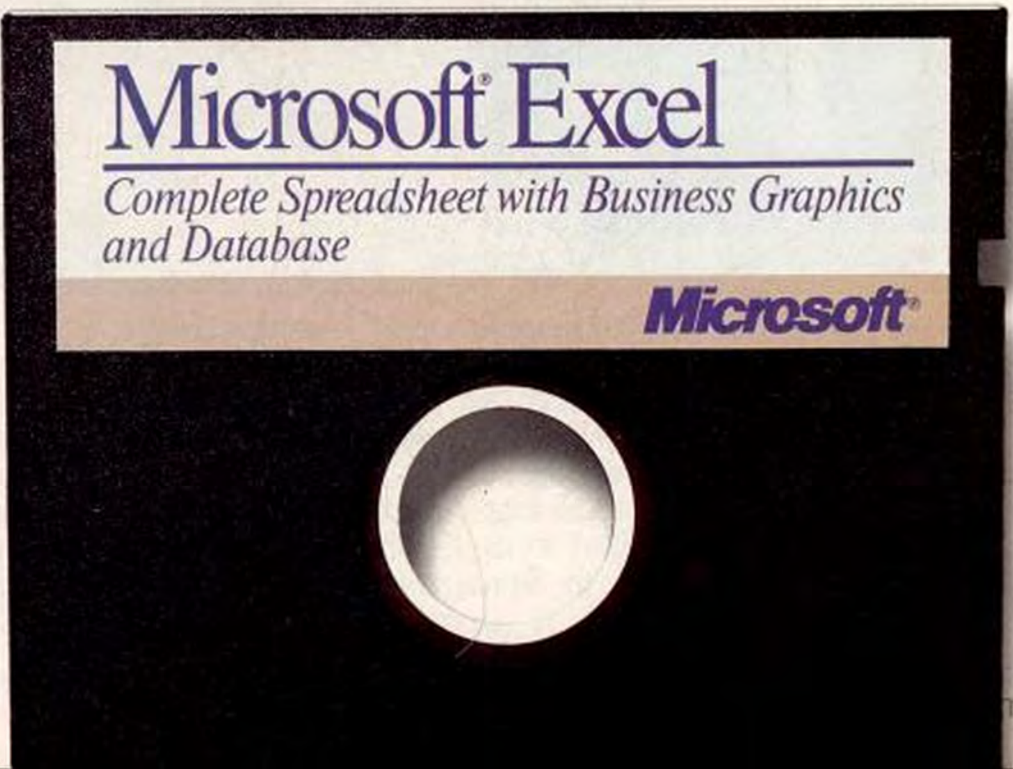
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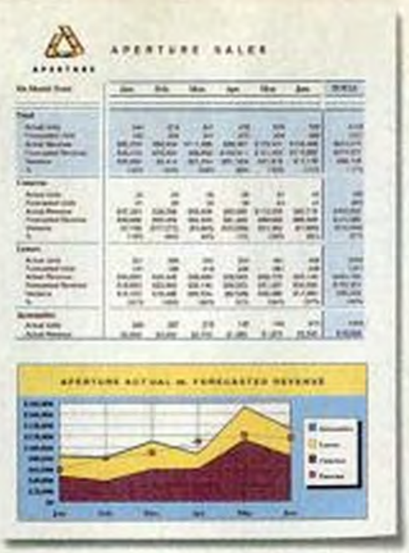

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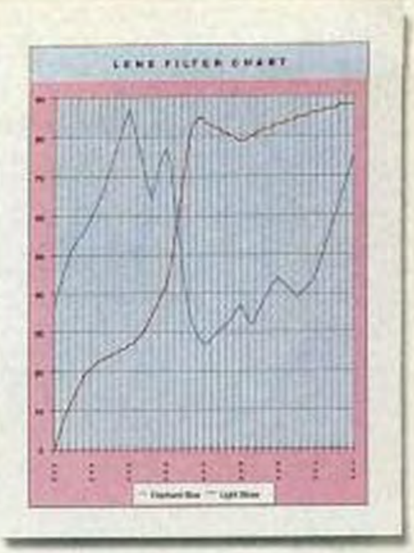

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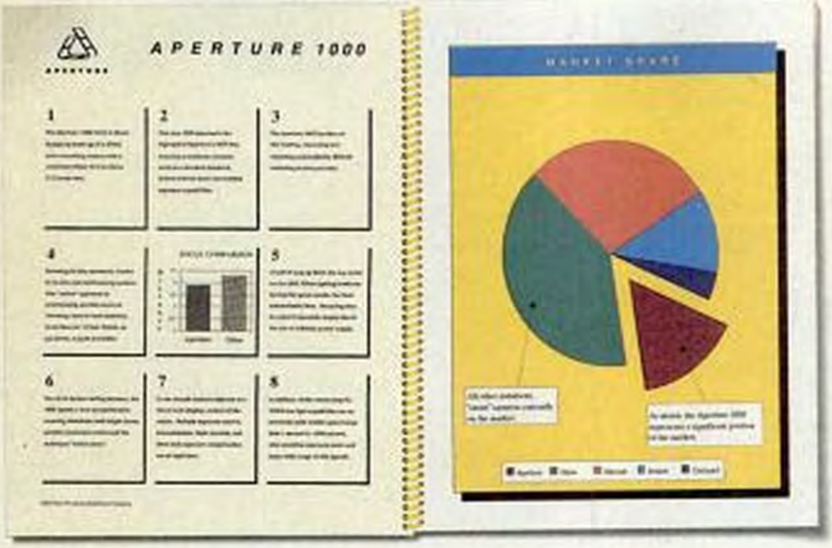

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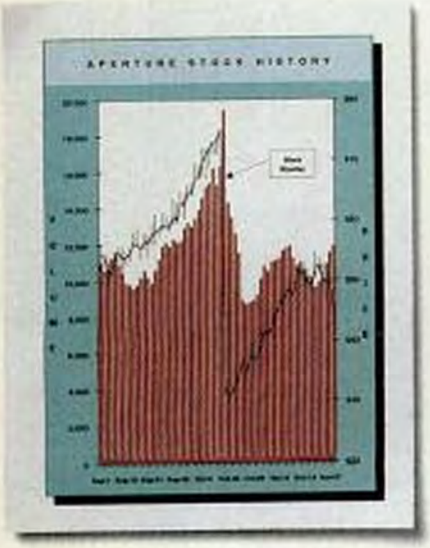

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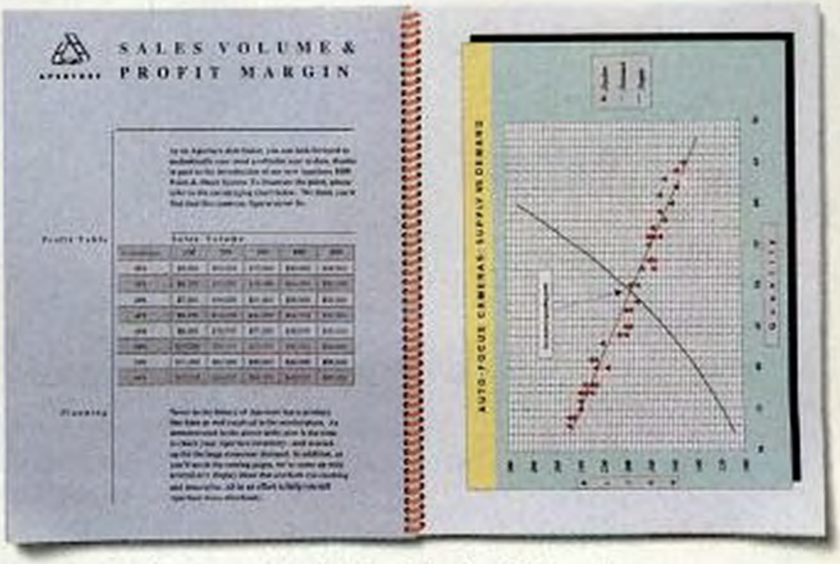

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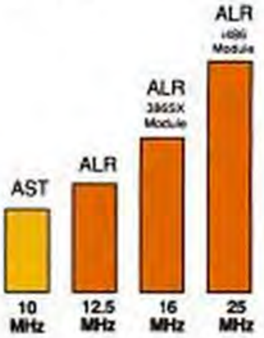

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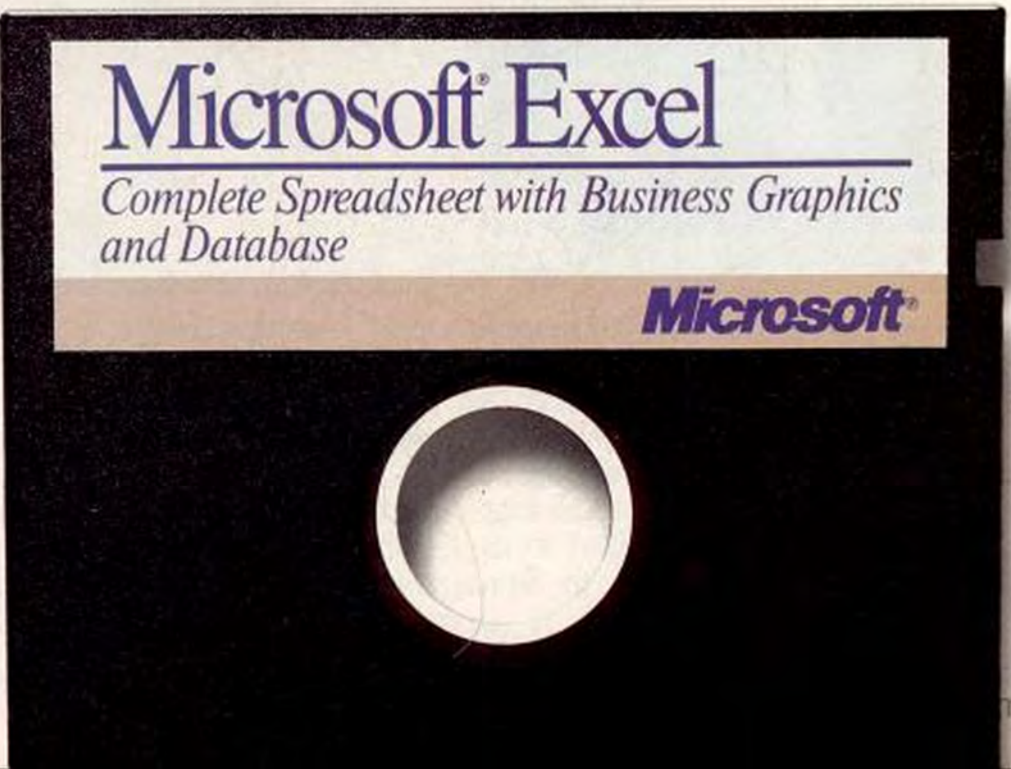
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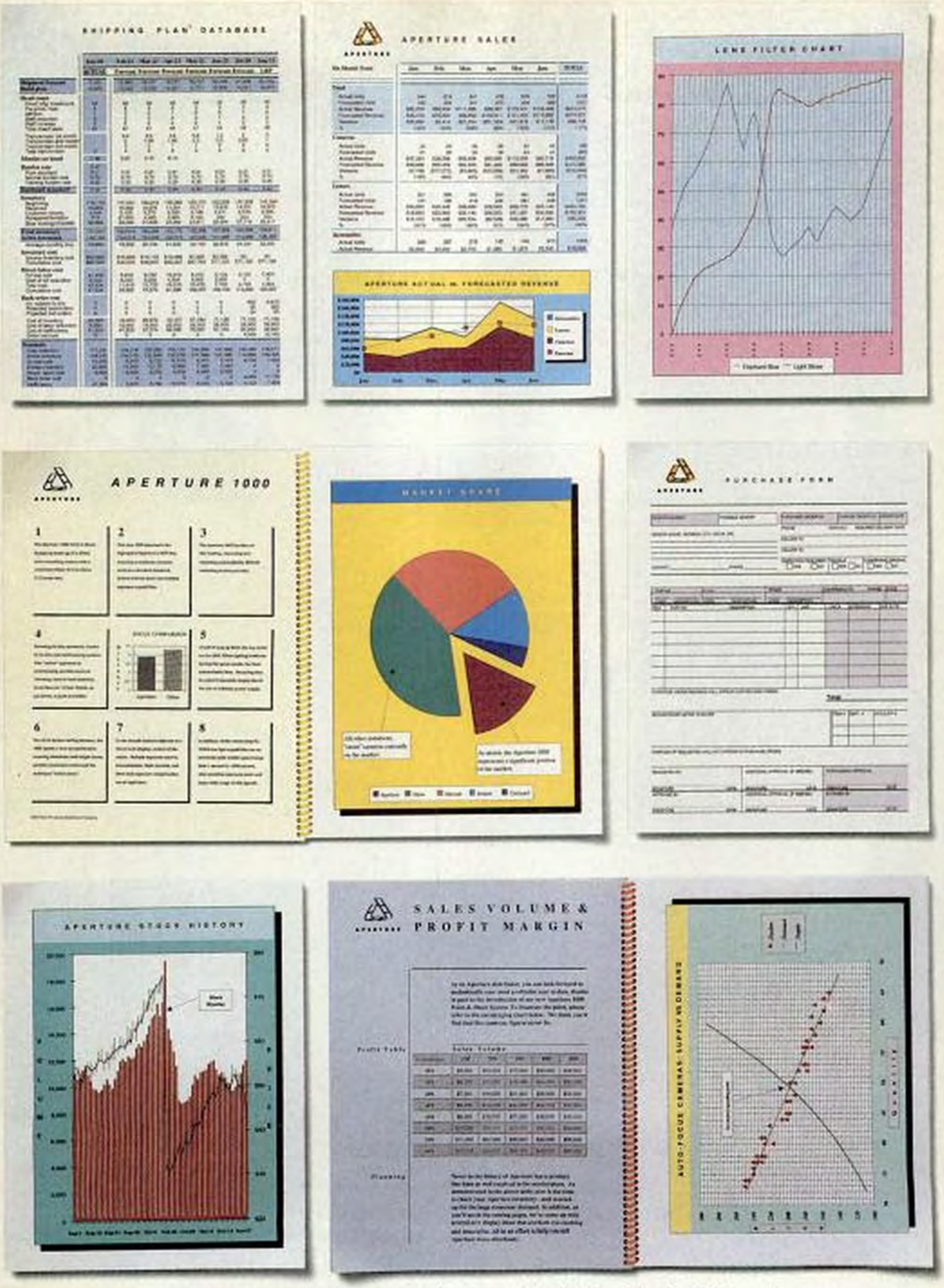
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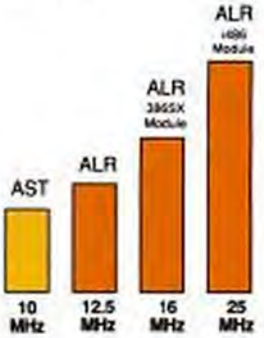

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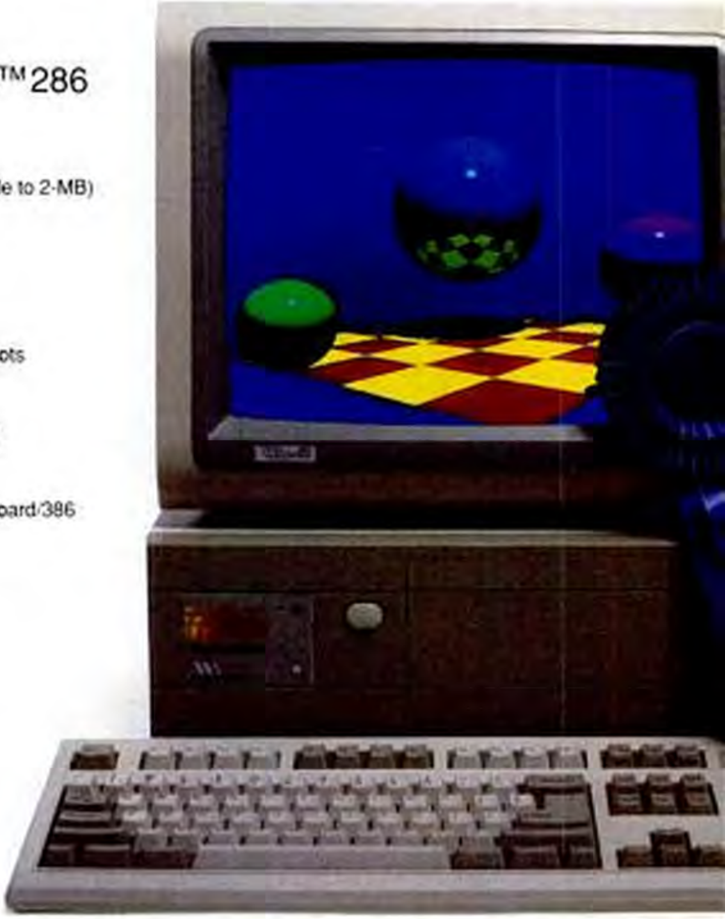

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Inside

In case you haven't noticed, we live in an electromagnetic world. In fact, if you could see all of the waves, rays, and fields that everyday appliances emit, you wouldn't see anything else.

Though few conclusions have been reached by biologists and physicists, alarms about the potential dangers of electromagnetic radiation are starting to ring more loudly. "Scientists Debate Health Hazards of Electromagnetic Fields" warned a recent *New York Times* headline. The gist of the advice given in the article by some worried experts: don't get too close to your coffee machine, think twice before you use your vacuum cleaner, throw away your electric blanket, and don't even ask about the power lines behind your house—you don't want to know.

Assistant editor Matthew J. Ross and staff writer Catherine D. Miller rate the office coffee machine Class A; this issue's computers rate Class B.

PHOTOGRAPHY: THOM O'CONNOR

PCs also generate large electric and magnetic fields—up to 3 meters across—whose effects are being debated. You may recall that when laptops first came onto the scene, airlines were reluctant to allow passengers to operate them aboard a plane, fearing that their radiation could interfere with navigation.

How did we know that the airlines were wrong? It's the Federal Communications Commission (FCC) that regulates the amount of radiation emission acceptable from a PC. After all, if your PC isn't adequately insulated, your neighbor's TV reception could suffer.

The FCC classifies PC boxes either as Class A, suitable for office use only, or as Class B, suitable for use anywhere. Unfortunately for computer manufacturers, the application and testing process for Class B certification can take up to 18 frustrating months.

Generally speaking, the achievement of Class B status indicates better overall engineering, and if you can buy a Class B machine, you should. All of IBM's and Compaq's machines, for example, are Class B. The 13 evaluations of 25-MHz 386 machines in this issue, supervised by assistant editor Matthew J. Ross and introduced by staff writer Catherine D. Miller, all feature models that have Class B certification.

Electromagnetic forces also figure into another section of this issue. Contributing editors Frank Bican and Winn L. Rosch evaluated 24 digitizing tablets, the vast majority of which use electromagnetic sensing as their modus operandi. In his introduction, Rosch explains the differences among *electromagnetic technology, resistive decoding*, and batlike *sonic triangulation*.

By the way, Rosch reports that when he's evaluating machines in his crowded home office, three or four are sometimes running simultaneously with their covers removed. In the Lab Notes section of a future issue, Rosch analyzes the potential hazards of electromagnetic radiation generated by PCs and peripherals and fills you in on ways to protect yourself.—**Donald P. Willmott** ■

PC Magazine: The Independent Guide to IBM-Standard Personal Computing. ISSN #0888-8507, is published biweekly except in July and August for $39.97 for one year (22 issues), $61.97 for two years, and $81.97 for three years. Additional postage $1.00 per copy or $22.00 per year for Canada and all other foreign countries. Ziff-Davis Publishing Co., a division of Ziff Communications Co., One Park Ave., New York, NY 10016. Second-class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to *PC Magazine*, P.O. Box 54093, Boulder, CO 80321-4093.

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TOP SPEED 254.76 mph
HIT ENTER TO ACCEPT
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Type of Laser Printer		QMS-PS 810 *turbo*	QMS-PS 820 *turbo*	Apple LW II NTX
Processing speed		20 MHz	20 MHz	16 MHz
Time to print (in minutes)	Graphics (1 pg)	0.23	0.23	0.54
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CIRCLE 259 ON READER SERVICE CARD

PC MAGAZINE® November 28, 1989

Volume 8 Number 20

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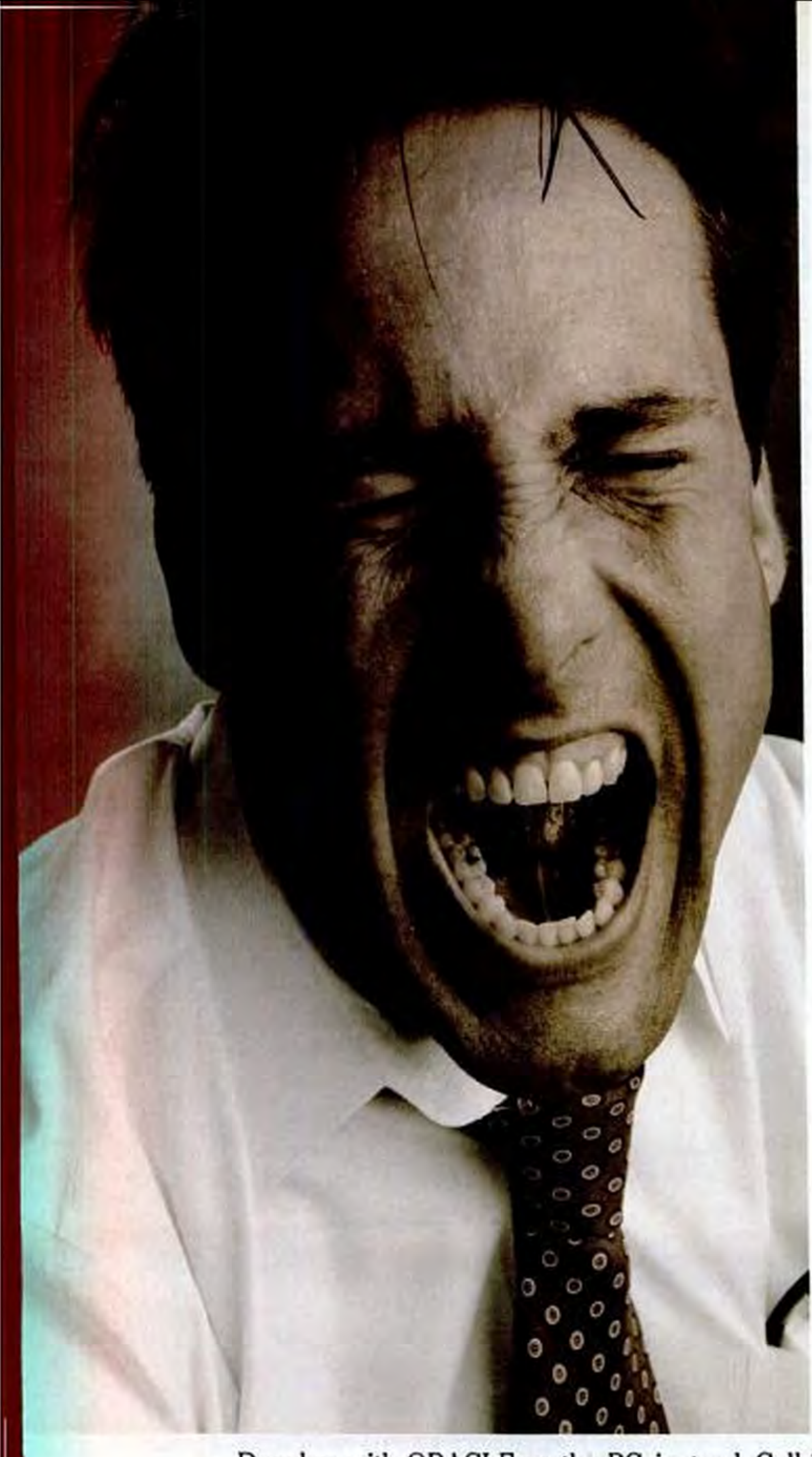

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72 MB HD (28 ms 1:1)	$1995	$2195	$2395
110 MB HD (15 ms 1:1)	$2295	$2495	$2695

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Austin 286/16 Includes:

- Harris 16 MHz 80286 Processor ■1MB RAM (optional 2 or 4MB)
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- Shadow RAM Caching (BIOS Caching) ■8K High Speed Hard Disk Cache
- Floppy Drive (3.5" 1.44MB or 5.25" 1.2MB) ■EMS LIMM 4.0 Support
- Enhanced 101 Keyboard ■IDE Hard Drive Controller Adapter
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72 MB HD (28 ms 1:1)	$2095	$2295	$2495
110 MB HD (15 ms 1:1)	$2395	$2595	$2795

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- Intel 80386 SX Processor ■1MB RAM (optional 2,4 or 8MB)
- IDE or ESDI Controller Card ■16-Bit VGA Display Adapter
- Shadow RAM Caching (BIOS Caching) ■6-16 Bit Slots and 2-16 Bit Slots
- Floppy Drive (3.5" 1.44 MB or 5.25" 1.2 MB) ■EMS LIMM 4.0 Support
- Enhanced 101 Keyboard ■2 Serial Ports & 1 Parallel Port
- Clock with Battery Backup ■80387/SX Math Co-Processor Socket
- American-Made MotherBoard ■Users & Technical Reference Manual
- Built-in Setup Program ■Fully DOS & OS/2 Compatible
- FREE 1 Year GE On-Site Service ■30 Day Satisfaction Guarantee

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Austin 386/SX Price Matrix with 1 MB of RAM

Choose Hard Drive	Choose Monitor & Video Adapter Card		
	Monochrome	VGA Color (640 × 480)	VGA Color (800 × 600)
40 MB HD (28 ms 1:1)	$1995	$2495	$2695
72 MB HD (28 ms 1:1)	$2295	$2795	$2995
110 MB HD (15 ms 1:1)	$2495	$2995	$3195
160 MB HD (18 ms ESDI)	$2795	$3295	$3495

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Austin 386/33 Includes:

- Intel 33 MHz 80386 Processor ■1MB RAM (optional 2,4,8 or 16MB)
- Intel 33 MHz 82385 Cache Controller ■55.2 MHz Performance Rating
- Direct Map 32K Static RAM Cache running at 25 Nano's
- IDE or ESDI Controller Card ■Shadow RAM Caching (BIOS Caching)
- 1-32 Bit High Speed Memory Slot, 5-16 Bit Slots and 2-8 Bit Slots
- Floppy Drive (3.5" 1.44 MB or 5.25" 1.2MB)
- Enhanced 101 Keyboard ■2 Serial Ports & 1 Parallel Port
- 80387 & Weitek Math Co-Processor Support ■Clock with Battery Backup
- American-Made MotherBoard ■Technical Reference Manual
- Built-in Setup Program ■Fully Unix & OS/2 Compatible
- FREE 1 Year GE On-Site Service ■30 Day Satisfaction Guarantee

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Austin 386/33 Cache Price Matrix with 1 MB of RAM

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110 MB HD (15 ms 1:1)	$4695	$5295	$5495
160 MB HD (18 ms ESDI)	$5095	$5595	$5795

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386·20

Austin 386/20 Includes:

- Intel 80386 20 MHz Processor ■1MB RAM (optional 2,4 or 8MB)
- 16-Bit VGA Display Adapter ■64K Static RAM Chache @ 35 Nano's
- 30 MHz Performance Rating ■1-32 Bit, 6-16 Bit, 1-8 Bit Slots
- Floppy Drive (3.5" 1.44 MB or 5.25" 1.2 MB) ■IDE or ESDI Controller
- Enhanced 101 Keyboard ■Serial Ports & 1 Parallel Port
- Clock with Battery Backup ■80387 Math Co-Processor Socket
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- Built-in Setup Program ■Fully Unix & OS/2 Compatible
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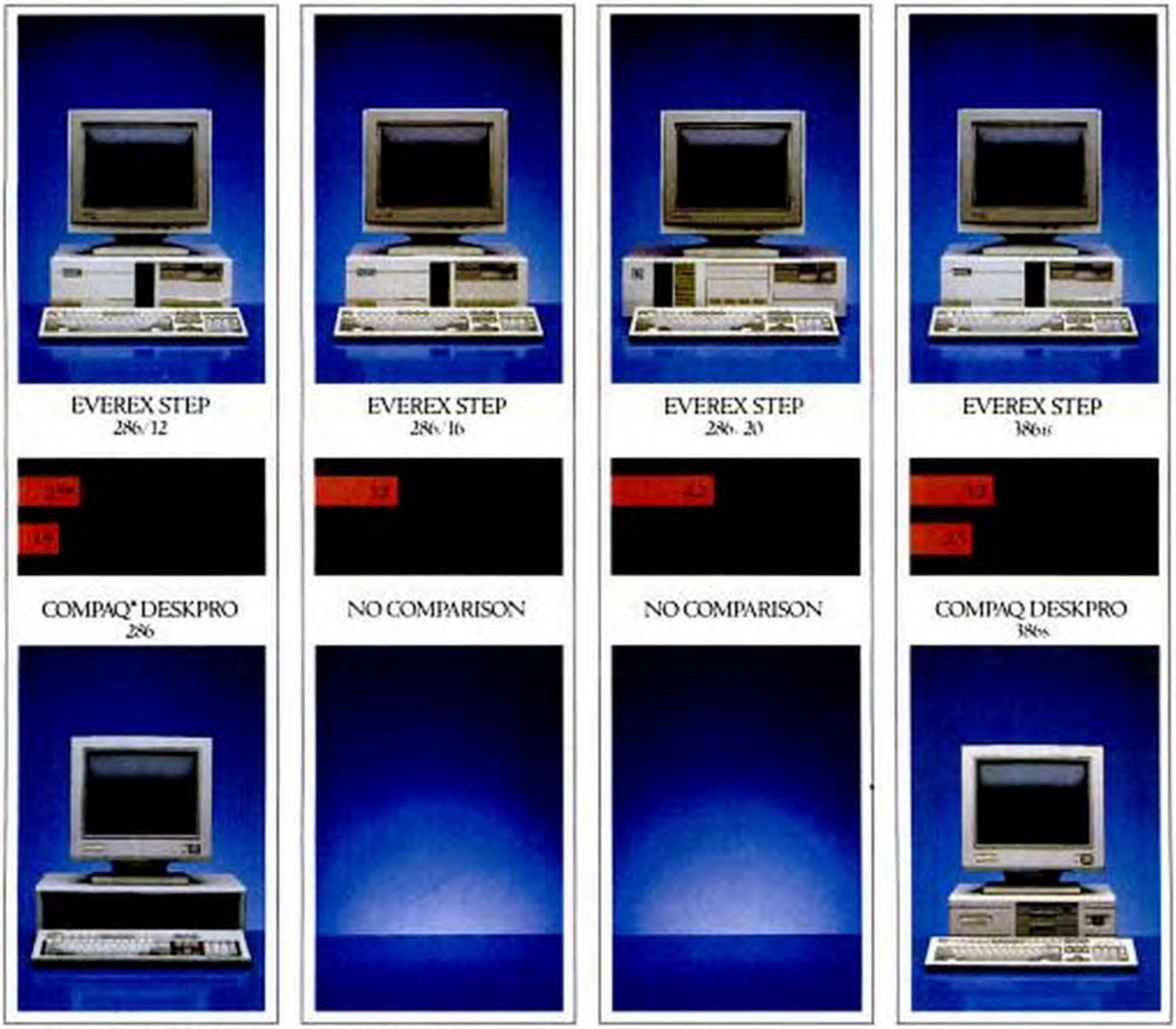
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286/12
EVEREX STEP
286/16
EVEREX STEP
286/20
EVEREX STEP
386/16
3.2
4.2
COMPAQ* DESKPRO
286
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NO COMPARISON
COMPAQ DESKPRO
386s

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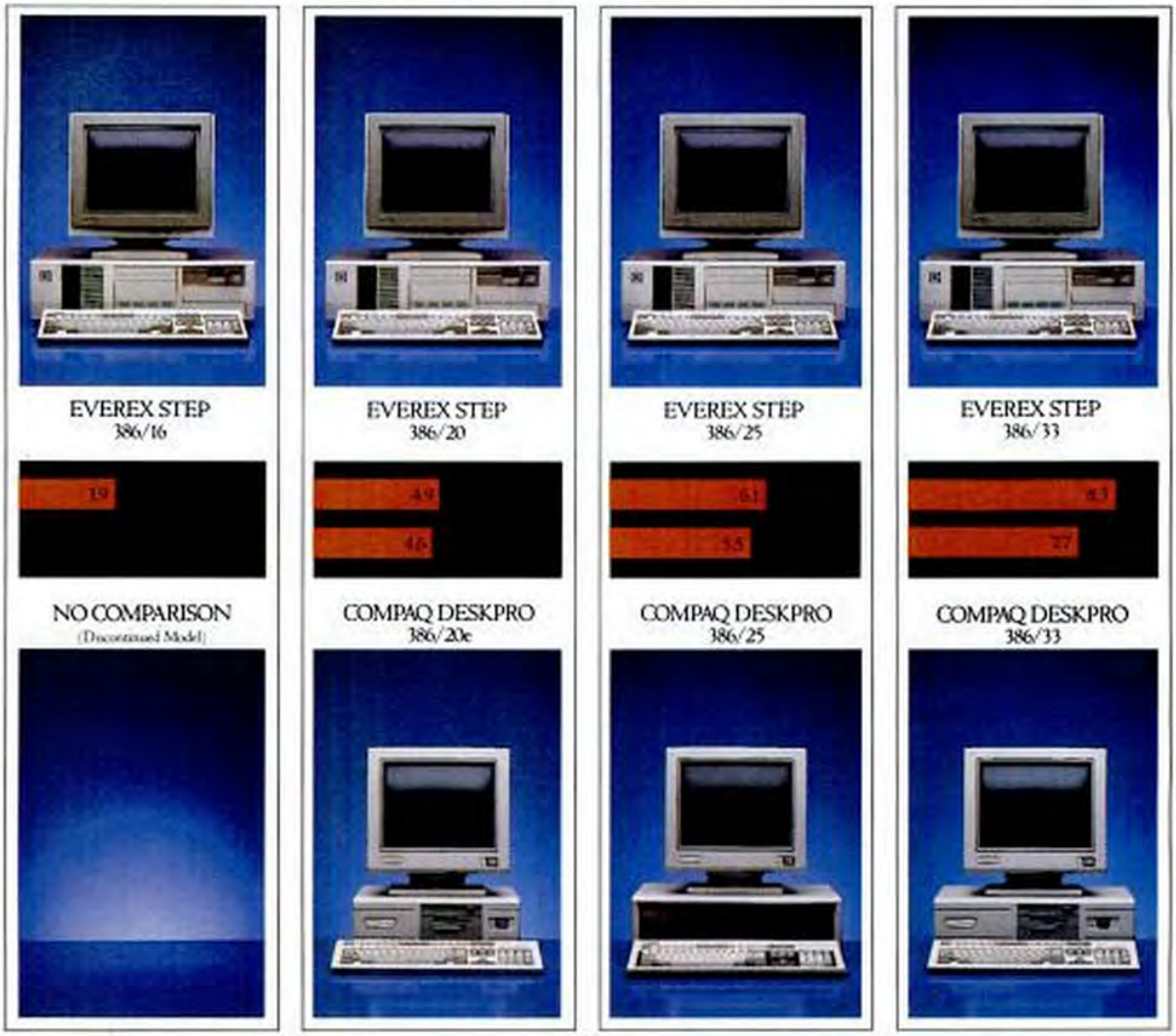
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386/16
39
NO COMPARISON
(Discontinued Model)
EVEREX STEP
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49
46
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CIRCLE 216 ON READER SERVICE CARD

Letters

STICKY GOOEYS

It has been with mounting horror that I have watched, over the years, the development and spread of graphical interfaces—not because I begrudge their use by those who seem to need or like them, but because their popularity might mean the end of command-line interfaces. Now, with the enthusiastic endorsement of your magazine ("The GUI: An Interface You Won't Outgrow," *PC Magazine*, September 12, 1989), I fear the doom of the command-line interface.

I am a fast touch-typist with an IQ above ambient. When I work at my computer, I want the display clear of anything except what I put there. Therefore: I hate menus; I hate mice; I hate icons; I hate borders, colors, flags, and whistles; I hate GUIs! That one should incur a performance penalty for using them is all the more intolerable.

The day that upgrading my hardware or software means being forced to use only a GUI is the day that I will cease to upgrade my PC and, if necessary, go back to using the university's mainframe.

Diana G. Matthiesen
Gainesville, Florida

PC MAGAZINE
GRAPHICAL:
The Better Interface

The graphical interface: Is a picture worth a thousand DOS prompts?

None of the articles or reviews in the September 12 issue on graphical interfaces mentioned a fact of critical importance to some PC users: graphical interfaces (GUIs) are virtually unusable by the blind.

Until recently, personal computers were an unalloyed blessing to the visually impaired. Braille and speech interfaces to spreadsheets, word processors, and communications packages allowed the visually impaired an unprecedented access to jobs, while electronic mail systems, publications on compact disk or on-line databases, and optical scanners combined with optical character recognition (OCR) software provided the means by which they could read written material that previously had to be braille-encoded or recorded verbally.

Widespread adoption of GUIs, however, could easily herald a return to the bad old days. Screen readers, either braille- or speech-based, do not interpret graphic characters, making icons essentially invisible. The screen clutter caused by multiple windows can also render screen readers useless.

Furthermore, OCR software does not offer a practical solution to these problems. As your reviewer noted, the GUIs themselves require a hefty hardware platform to provide adequate response time. Imagine the requirements to not only run the graphical interface but also translate its screens into a textual format, all within a reasonable time!

This situation has not escaped notice. Congress, in its 508 bill, prohibits the U.S. Government from purchasing computer technology that cannot be adapted to the needs of handicapped workers. A machine or application that is totally dependent on a graphical interface could not be legally purchased by any agency of the government.

GUIs unarguably provide a superior interface for many users. Developers, however, should remember to provide alternatives for those who want or need them.

Michael E. Darnell
Orlando, Florida

I know that graphical interfaces are the wave of the future and a wonderful development chock-full of promise, but I'll be damned if I'll call them "gooeys" or any other such foolishness. Please get someone to work right away on finding a more suitable term. Just not Dvorak.

You will let us know what you come up with, won't you?

Fredrick Earl Upchurch
Gastonia, North Carolina

NEVER SAY NEVER

I found your comment "*PC Magazine* will continue to cover the 286 market, but we won't award Editor's Choices because we can't recommend that you buy any of them" ("286s: No Frills, Few Thrills," *PC Magazine*, September 12, 1989) insulting and presumptuous.

As a reader, consumer, and user, my task is to balance my needs against my dollars. As computer journalists, your task is to provide reliable information about PCs. According to your magazine, 40 percent of PC buyers feel that a 286 is the machine of choice. Remember, customers are still buying 8086s and 8088s, happily sacrificing overrated PC power for dollars.

Please continue to select an Editor's Choice for each major category of equipment (XTs, 286s, 386s, and so on), and leave the buying to us.

William J. Klenke
Leavenworth, Kansas

"The best 286 computer you can buy is a 386SX"? Has one of the clone manufacturers finally gotten to you? No, I know: Intel must be putting the muscle on you to push the new chips. Your comparison of 21 286 computers in the September 12 issue had good data, but you seem to have made some pretty unfair assumptions.

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Letters

In the real world of mom-and-pop businesses, we can't get all excited over the hottest and slickest new chips. What we want is a reliable machine at a good price, with decent service and easy-to-use software. What you want us to do is give up our $1,299 price on a good 286 machine in favor of a $1,799 price on a computer that has *nothing* better to offer!

I know there are Fortune 500 companies out there that always buy the latest and greatest, no matter what the cost. But down here in the much larger small-business arena, we have to justify our automation costs or we don't eat.

David L. Morris
Dallas, Texas

HITTING THE STORES

After reading William Zachmann's bashing of computer retailers (William F. Zachmann, *PC Magazine*, September 12, 1989), I thought it was time to tell the dealer's side of the story.

I receive at least five calls a day from people asking for technical help with mail-order accessories or computers they've just purchased. I have at least three or four people a week stop in my store to get a good look and "hands-on feel" for a product they plan on buying mail-order.

Most manufacturers require dealers to have on-site service facilities and expensive training for technical and sales representatives. Eighty percent of my customers are business owners who have had little if any PC experience. My job is not only to sell them a system but, unlike mail-order outfits, to make that system productive. Or else personally face the music.

I can justify my higher prices: it's called overhead. Rent, payroll, merchandise flooring, taxes, interest, and advertising. I'm not getting rich, as Zachmann would like people to believe.

Computer stores still sell the vast majority of computers in this country and without them, the industry would wither away. Yes, there are plenty of "bad" computer stores out there, but there are also a lot of good ones—stores that will flourish because of good service.

David J. Raczka
Lockport, New York

A large "Congratulations!" for the editorials of Machrone, Seymour, Zachmann (again), and Manes in the September 12 issue. I am a recent computer buyer. I am also pursuing litigation against my "friendly" computer store for misrepresentation. It seems there is a motherboard in my system with "16 MHz" written all over it, being driven at 20 MHz. This is *after* the salesman and I discussed the sidebar entitled "Crystals, Components, and the Dangers of Speed" that appeared in your magazine ("The Controversy Continues: 286 vs. 386," *PC Magazine*, June 27, 1989) and he assured me that his store did not sell overoscillated computers. Right.

I hope computer store managers, owners, or whoever gives a damn about satisfaction (there *is* somebody, isn't there?) read your editorials and take heed. I also caution any would-be buyers not to take anything for granted. Check *everything* out. It should be worth a few hours of the salesperson's time for you to spend a few thousand dollars of *your* money at his or her establishment.

Small-business owners can't get all excited over the hottest and slickest new chips. We want a reliable machine at a good price.

Two thumbs up for *PC Magazine*.

Michael Ogden
Nashville, Tennessee

NOT QUITE DEAD-END USER

John Dvorak's latest diatribe (John C. Dvorak, *PC Magazine*, September 12, 1989) reminds me of the bully on the block looking to punch someone—anyone—in the nose.

This time John has "discovered" that a lot of users are using only 1.7 software packages. And if that wasn't bad enough, his mother-in-law has had to take any number of courses to learn *WordPerfect*. What is the lesson to be drawn from these two disparate facts? That the software companies have foisted complex pack-

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- **Advanced Chips & Technology NEAT Chip Set**
- 384K Shadow RAM Caching for BIOS
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- **65MB-22ms Fast Access Hard Drive**
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- Fully DOS, Unix, & OS/2 Compatible

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ages without standard interfaces on the helpless user community and said community has rebelled by refusing to buy dozens of new packages?

Come on, guy, get real. You've been in the PC business so long now you seem to have forgotten what the two most popular types of software packages (spreadsheets and word processing) supplanted: pencil-and-paper and the typewriter. If I were to use only *WordPerfect*, that would still be a vast improvement over the Selectric typewriter now gathering dust on my closet shelf.

Aside from *WordPerfect*, *Quicken* is the only other package I use with any frequency. A little over 1.7, I guess, but Dvorak would no doubt still classify me a Dead-End User. Well, I've got news for you, buddy; this is all I *want* from my PC. Sound shocking? Here's more: I wouldn't mind if *WordPerfect* were menu-oriented, but I was able to write, edit, and print a letter the first day I got the package using a relatively limited number of commands. I accomplished this amazing feat the old-fashioned way: I read just a few pages of the documentation.

Simply put, John, the number of packages used does not equate to package usefulness or customer satisfaction.

John T. McMahon
New York, New York

A MORE ATTRACTIVE PORT

The review of 14 data switches in your July 1989 issue ("Data Switches: A Low-Cost LAN Alternative") contains an error-filled review of our Systemizer Plus Connectivity Network. The most glaring and damaging error in your review: our price per port was repeated several times in the article as $399—which, on the average, is twice the cost of all the other products reviewed.

However, as your price per port was arrived at by dividing the retail price of each box by the number of serial or parallel ports it contains, a more careful analysis of our product would have revealed the existence of *two* DB-25 connection ports on the back of the Systemizer Plus. Since our suggested retail price is $399, dividing that by 2 yields a price per port of *$200*, which is on par with the majority of the boxes tested, and lower than the winners of your Editor's Choice award.

> **If I were to use only *WordPerfect*, that would still be a vast improvement over the Selectric typewriter now gathering dust on my closet shelf.**

Then factor in that ours are bidirectional I/O ports, that each can be set independently for serial or parallel operation, and that a separate third port is included for networking the Systemizers together, and further value is added per port.

Tim Wilde
President
Applied Creative Technology Inc.
Dallas, Texas

PC Magazine regrets the price-per-port error contained in the review of the Systemizer Plus Connectivity Network. We stand firm that the product, though meritorious, would not have been our Editor's Choice.

WANTED: A FEW GOOD UTILITIES

I would like to echo the sentiment expressed by A. Leyder (Letters, *PC Magazine*, September 12, 1989). I (and likely many other corporate readers) am faced with similar choices. I don't have time to type in these great utilities you offer, nor is my company willing to allow me a PC MagNet account. I know that $10 to $15 for an occasional utilities disk update would be no problem. Meanwhile, mark me as another "faithful but frustrated" reader.

James Eddy
Hartford, Connecticut

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- *Ports: 1 Serial, 1 Parallel*
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- *Clock Calendar w/Battery Backup*
- *Swan Setup & Utilities Diskette*

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- *GW BASIC/MS-DOS add $89*

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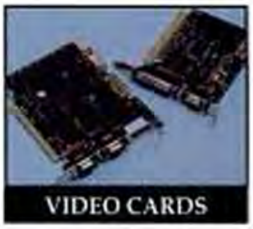

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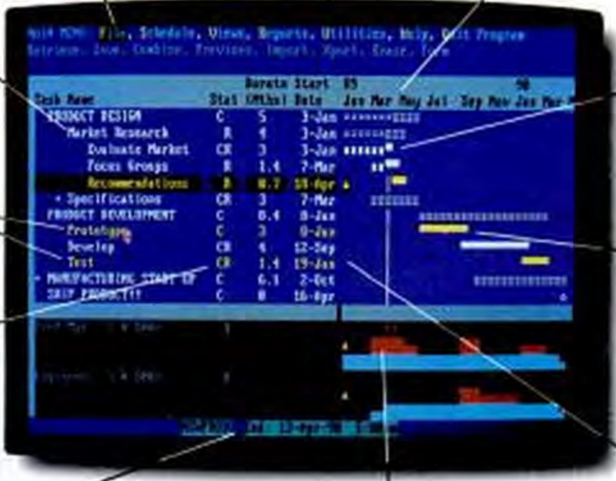

```
                                  Durata Start  85                          90
Task Name                    Stat (Mths) Date   Jan Mar May Jul  Sep Nov Jan Mar
 PRODUCT DESIGN               C     5     3-Jan
  Market Research             R     4     3-Jan
    Evaluate Market           CR    3     3-Jan
    Focus Groups              R     1.4   7-Mar
    Recommendations           R     0.7  18-Apr
  + Specifications            CR    3     7-Mar
 PRODUCT DEVELOPMENT          C     8.4   8-Jan
  Prototype                   C     3     8-Jan
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CIRCLE 249 ON READER SERVICE CARD

by Lori Grunin

Advisor

- **PARKING HEADS: Programs to park your hard disk drive's head.**
- **FROM APPEND TO XCOPY AND BEYOND: Starting a computer reference library.**

PARKING HEADS

I have often read that it's important to park the heads on your hard drive before you turn your machine off. How can I determine whether my hard drive parks its heads automatically? If it doesn't, where can I find a program or utility that will do it?

Felice Martinello
St. Catharines, Ontario
Canada

The conclusive way to find out if your hard drive auto-parks is to call the manufacturer and ask. Short of that, you can use rules of thumb: if your drive has a stepper motor head actuator (rather than a voice coil), it probably doesn't auto-park. Small drives and drives that cost significantly less than their same-size competition usually use stepper motors; all drives over 100MB use voice-coil technology. (You can find a complete discussion of actuators, as well as head parking, in *Upgrading and Repairing PCs*, cited in the response to the question following this one.)

Head-parking utilities tend to be drive-specific, so check the software that accompanied your drive to see whether the manufacturer included one. If the software lets you prepare your computer for moving (or words to that effect), that's your head parking. Similarly, some commercial disk utility software comes with head-parking programs as well.

There's an occasional debate over whether or not the heads need to be parked every time you turn off the computer's power or just when moving your system. The consensus seems to be that it can't hurt to park the heads, so you might as well do it before every power-down. Using a utility that's not meant for your drive—for instance, using the parker that came with your sister's ESDI CDC on your SCSI Seagate—might damage your data.

That said, there are quite a few public domain and shareware head-parking utilities floating around on PC MagNet and CompuServe that work on most drives. All good head-parking utilities give you the opportunity to change your mind and release the heads from their parked position before turning off the machine's power.

The following are all available in data library 1 of the IBMHW forum on CompuServe: SHUTDOWN, a $5 shareware program (filename: SHUTDO.ARC), works with up to eight drives; TIMEPARK, a public domain program (filename: TPARK1.ARC), will park the heads automatically when the drive hasn't been used for a user-specified period of time; HDPARK (filename: HDPARK.ARC), for which the voluntary contributions of $1 or more are donated to charity; and a public-domain parker designed specifically to operate with IBM PS/2 drives, PS2PARK (filename: PS2PRK.ARC).

You can also find a *PC Magazine* utility, PCPARK (filename: PCPARK.ARC), in data library 7 of the Utilities forum on PC MagNet (for downloading information, see the "By Modem" sidebar in the Utilities column of *PC Magazine*). For more information about the desirability of head parking or for the debug code to generate PCPARK, check out the PC Tutor column in the March 15, 1988, issue of *PC Magazine*.

FROM APPEND TO XCOPY AND BEYOND

I'm thinking of upgrading my IBM PC AT from PC-DOS 3.2 to DOS 3.3. Do I have to use PC-DOS 3.3, or may I use MS-DOS 3.3 (which I might get at a better discount) without causing any operating problems?

Also, judging from the many volumes I see in bookstores, there must be a better DOS book available than my IBM DOS manual. I would like one that gives a detailed description of all commands, as well as an explanation of the differences between MS-DOS and PC-DOS.

Gerhard Opel
Pukalani, Hawaii

Well, you *can* use MS-DOS 3.3 on your AT. Operating systems depend on BIOS compatibility, and "PC compatible" means (among other things) compatibility with IBM's BIOS. But you *can't* get MS-DOS at a better discount than PC-DOS; at least, not legally. Microsoft licenses MS-DOS to systems manufacturers, who either add little improvements, incorporate fixes to ensure 100 percent BIOS compatibility, or just sell it as is. The companies can sell MS-DOS only in conjunction with their systems. On the other hand, you can wander into any computer store and buy a copy of PC-DOS.

As for your other question, although at first glance there seems to be an overabundance of books on DOS cluttering up the shelves of your neighborhood bookstore, these can really be broken down into a few different categories: introductions, tips for power users, general reference books, and programmer's references. Of course, some of the books overlap in several of these areas, but they're still geared to specific audiences.

One of the most popular DOS books is Van Wolverton's *Running MS-DOS*, Fourth Edition ($22.95; ISBN 1-55615-186-1; Microsoft Press, 16011 NE 36th Way, Box 97017, Redmond, WA 98073; (206) 882-8080). It's a good book, but if you've been using DOS for a while, you might prefer something that is slightly more advanced; although Van Wolverton's book has the requisite detailed listing of commands, he spends quite a lot of time showing users the DOS ropes.

If you're a beginner, another book that

might meet your needs is Chris DeVoney's *MS-DOS User's Guide*, Third Edition ($22.95; ISBN 0-88022-349-9; Que Corp., 11711 N. College Ave., Carmel, IN 46032; (317) 573-2500). DeVoney's book comes shrink-wrapped with a quick-reference guide. Both books provide excellent introductions to DOS.

On a more advanced level there's *The Waite Group's MS-DOS Bible*, Third Edition, by Steven Simrin ($24.95; ISBN 0-672-22693-6; Howard W. Sams & Co., 4300 W. 62nd St., Indianapolis, IN 46268; (317) 298-5400), which is a true reference book—it's arranged so that you can easily find answers to questions instead of using the tutorial format others use.

The *MS-DOS Bible*'s step-by-step instructions are for would-be DOS programmers rather than DOS novices, and an appendix provides information on some undocumented MS-DOS interrupts and functions. In addition to providing a description and the syntax of each command, the book offers more in-depth information on such items as interrupts and functions, which can help you better understand any problems you may encounter with poorly behaved software.

At highest end of the complexity spectrum is the $65.95 *MS-DOS Encyclopedia*, put out by none other than Microsoft Press (ISBN 1-55615-174-8; see address above). This book not only gives detailed descriptions of the commands, but also lists and explains all the possible error messages you get with each command. Geared to programmers, however, it might be too advanced for your purposes.

If you're planning to customize your DOS environment, or if your PC refuses to wake up one morning, there are a few other reference books you might want to consider.

Under the category of power user guides, another one of Chris DeVoney's books, *MS-DOS Tips, Tricks, and Traps* ($22.95; ISBN 0-88022-376-6; Que Corp.; see address above), provides a plethora of helpful hints, organized in an easy-to-follow manner, without wasting space on meaningless graphics. Similarly, *PC Magazine*'s own *DOS Power Tools, Techniques, Tricks and Utilities* edited by Paul Somerson, offers hints and on-disk and in-print utilities ($44.95; ISBN 0-553-34526-5; Bantam Books, 666 Fifth Ave., New York, NY 10103; (212) 765-6500).

And since DOS won't run if you don't treat your hardware right, consider investing in Scott Mueller's *Upgrading and Repairing PCs* ($27.95; ISBN 0-88022-395-2; Que Corp.; see address above). In addition to being an excellent guide for troubleshooting hardware problems and offering advice to upgraders, Mueller provides aid to new-system buyers when they're making purchasing decisions.

I'm not trying to provide a definitive list of books you *must* have, and I've probably overlooked some people's favorites. But if you put a few of these books on your shelves, you should be able to handle almost any question or problem you encounter in the future.

ASK THE ADVISOR

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ZEOS 386/25 Desktop	2.29	8.37	0.33
ZEOS 386/33 Desktop	1.67	6.43	0.27
IBM PS/2 Model A	2.27	8.33	0.60
Compaq Deskpro 386/25	2.36	8.59	0.37

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CIRCLE 276 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

Autodesk Animator Brings Affordable Full-Screen Animation to the PC

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HANDS ON
by Luisa Simone

The future of PC-based desktop presentations has arrived. Though far from perfect, *Autodesk Animator* takes the standard PC "slide show," which usually consists of scripted transitions between static images, and makes it come alive with movement. The $299 program allows users to create the video presentations of tomorrow on the VGA systems of today, and in the process it may well become the paradigm for other bit-mapped graphics programs.

Traditional animation requires that you crunch out individual frames, each slightly different, and then link them together to create the illusion of movement. Although *Animator* gives you this option from within its Traces menu, the real power of its menu-based, interactive approach is that it lets you forget about the repetitive nature of animation and creatively paint with time.

Not even Einstein found it easy to explain that time is just the fourth dimension of our world, and though *Animator* labors to prove that any normal painting function can also be a time function, the concept is hard to grasp.

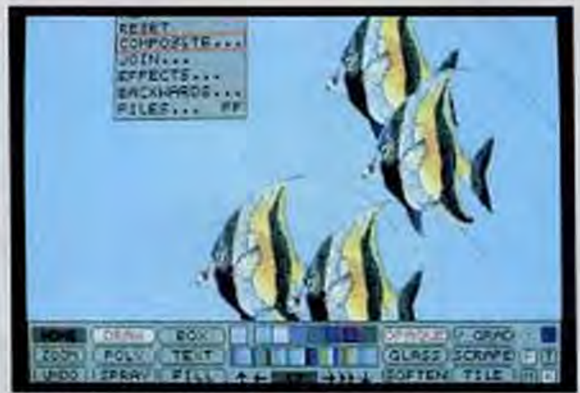
Time and movement are obviously related, and so the Optics menu in *Animator* is seemingly easy to understand. You can create abstract movement paths that guide the motion of entire animations or of individual objects (*cels*). Preset functions let you spin, rotate, and resize your images, but it is the advanced options, such as pathing, that release the open-ended potential of this product.

Using irregularly shaped spline or polygon tracks together with a clocked function (which records and then uses the changing velocity of your mouse movements to create a path that varies in speed as well as direction), the program allows you to move objects in an incredibly natural way; think of a fish swimming—slow, then fast, then slow again.

The same time concept can be applied to almost any function within the program. For example, if you invoke the tinting function of the Palette menu with the Time icon turned on, you can fade a picture to white. You can choose to apply the tint to one frame, a range of frames, or all the frames in your animation to simulate different durations. You can even opt to use a special effect with the tinting function; a ping-pong fade, for example, will fade the image to white and then reverse the whole operation, creating images that last for specific intervals.

Actually performing a ping-pong fade to white in a 64-frame animation sequence requires 4 menu operations and takes about 3 minutes, which clearly illustrates that it is harder to understand *Animator* than to use it. In part, the fault lies with the program's overly complicated and inconsistent use of terminology and menus.

For example, *Animator* refers to something as common as a gradient color range as a *cluster* that has been *ramped*. And what most people understand as shape interpolation (the gradual transformation of one object into another) *Animator* calls *tweening*, which, forgive me, sounds like something from Roger Rabbit's Toon Town.



Animator's drop-down menus augment its paintbox, by offering more-sophisticated animation functions.

Some of these terms were originally coined by developers for the Amiga, long known as a rich environment for animation development. But some attempt to translate the Amiga's lingua franca to a language common to PC-based programs would be welcome.

In addition, *Animator*'s menus are anything but SAA-compliant. The F1 key, for example, doesn't bring up the help menu. In fact, other than a brief description that pops up when you change tools or inks, there is no on-line help in *Animator*, a real handicap for beginners.

More serious are inconsistencies in the program's icon conventions and menu-versus-toolbox organization. For example, the Time icon is always in the right-hand corner of the dialog boxes—except when it isn't. And the Separator tool

CONTINUES ON PAGE 34

PHOTOGRAPHY: TOBE

Animator

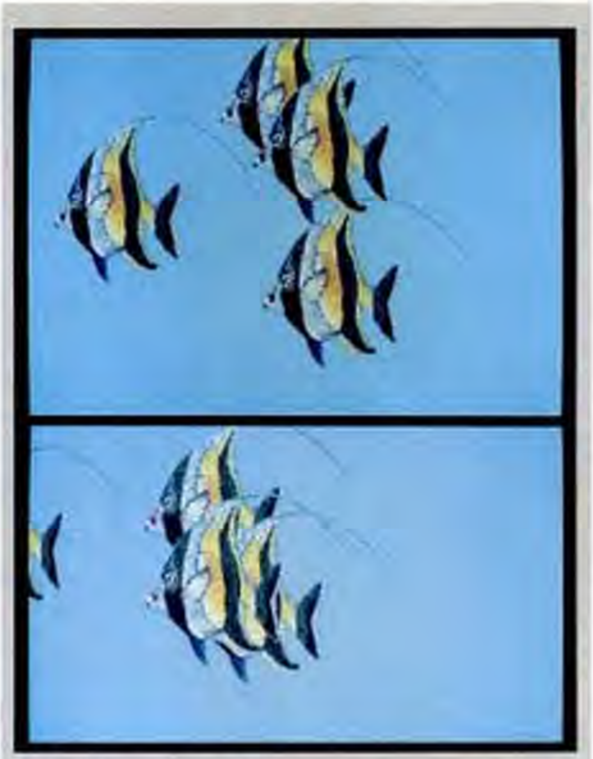
CONTINUED FROM PAGE 33

works slightly differently if you access it from the toolbox as opposed to the PIC menu. When invoked from the PIC menu, the Separator tool tries to replace the color you click on with the currently selected color throughout the frames in your animation (or, in other words, over time). The toolbox version, however, makes the change to only one frame. This would be forgivable if the other choices in the PIC menu also were associated with time functions, but they are not. So why not just have the Separator function work across frames when the Time icon is activated?

The main menus—Animator, Flic, Pic, Cel, Trace, Swap, and Extra—didn't always contain the functions I expected. Optics, which I would have associated with Traces (because they are two different ways to create movement), is only accessible from the Animator menu. Expect to spend one solid week diligently learning both *Animator*'s sophisticated concepts and its sometimes-confusing menus.

There are instances in which the menus are clear and concise. Composite and Join, which let you manipulate individual flics (or animated sequences) to create more-complex images and longer-running animations, respectively, are quite logically located on the Flic menu. And it takes almost no time to learn how to use the various memory buffers to your advantage. The cel buffer, which keeps an object in memory, is on the Cel menu, and the alternate work page, which can be used as a clipboard, is on the Swap menu.

The paint portion of the program deserves praise for making heavy-duty tools readily accessible. The 22 individual painting tools can be used in conjunction with 26 different inks (or surfaces) and 256 simultaneously displayed colors (from a palette of 262,000 hardware colors).



The simplest animation technique—motion across the x-y axis—is made more natural by *Animator*'s spline function. Each of the four fish can travel on a unique track.

Although only six tools, six inks, and a minipalette are displayed at any one time in the toolbox, right clicking on any of these objects brings up an appropriate dialog box from which you can pick substitutes.

But, again, the program begins to increase the complexity—and the number of options—at this point. Many of these tools have individual submenu options, like Dither and Tweening. And the palette manipulations are so elaborate that another complete menuing system is necessary to create color clusters for gradient fills, to sort colors by hue or brightness, or to compress a palette imported with a scanned image. This last function is especially useful if you want to combine two radically different palettes in order to use two scanned images in the same flic.

In the course of learning to use *Animator*, I managed to crash the program by losing my way in an endless loop of palette alterations. The underlying problem here is that *Animator* picks up its configuration information from the temporary working files that it stores in a subdirectory called \AAT, even if those files have been trashed. So once the program crashes—and even though the manual contains no explicit directions on this point—it is important to delete these bad files from the temporary directory. If you don't, *Animator* automatically loads with screen garbage and locks up.

Animator runs in only one video mode, VGA 320 by 200 with 256 simultaneous colors; this is wonderful if you work exclusively with scanned images, but it is inadequate if you want to paint an image from scratch. To its credit, *Animator* comes with a knockout conversion utility that translated high-resolution 640-by-480 .PCX files, like the fish in our screenshots, with no problems. Amiga animation files and Targa full-color continuous-tone images can also be converted to the appropriate .GIF format. The .GIF format is useful because of its stability and because so many public-domain images can be downloaded from CompuServe.

Animator does support LIM 4.0 expanded memory, but it is designed to utilize only 64K of EMS in order to run on the widest possible hardware platform—including, if you can believe it, 8-MHz 8086s. As a result, large and temporary files are swapped out to a fixed disk or a RAMdisk. In the long run, it is more efficient to use the utility program, *AAPlay*, to link smaller animation sequences together at playback time. Not only does this keep disk swapping to a minimum, but it gives users a nifty mechanism for bypassing the 4,000-frame limitation *Animator* imposes on any one sequence. In addition, *AAPlay* allows you to create runtime versions of your show.

By adding time elements to an exceptional two-dimensional graphics package, *Animator* increases the power of paint programs exponentially. Unfortunately, the level of complexity keeps right in step. *Animator* is fun to use and watch, but it ain't easy.

With the increased availability of VGA-to-NTSC conversion boards, you can even record your animations directly from your PC to your VCR. The possibilities are exciting. With some MIDI equipment, you might challenge MTV from the relatively modest location of your desktop. PCTV—the future is here. ■

PC MAGAZINE **FACT FILE**

Autodesk Animator
Autodesk Inc., 2320 Marinship Way, Sausalito, CA 94965; (800) 525-2763, (415) 332-2344.
List Price: $299.
Requires: 640K RAM, hard disk, 320 x 200 256-color VGA display, DOS 2.0 or later.
In Short: *Autodesk Animator's* low price, its ability to run on PCs at 8 MHz or faster, and its incredibly powerful toolset promise to revolutionize desktop presentations.

CIRCLE **446** ON READER SERVICE CARD

DeScribe, First PM Word Processor, Better at Undoing Than Doing

HANDS ON
by Edward Mendelson

The most spectacular feature of *DeScribe* isn't any of the things it can do. It's everything it can *undo*. DeScribe Inc.'s $595 WYSIWYG word processor and desktop publishing package for the Presentation Manager lets you change your mind about everything you've written and formatted during your current session.

If you want to recover a sentence that you deleted 2 hours ago, for example, simply choose Undo from the Edit menu and move a scroll bar to play back your session in reverse. You can revert to any prior state of format and text, or, when some long-abandoned text appears on-screen, you can cut it to the PM clipboard and insert it into the current state of the file. Nothing in the DOS world comes close.

DeScribe knows other tricks—not all of them based on OS/2—that most of its DOS counterparts will envy. It lets you run two search-and-replace strings simultaneously, and it lets you compile macros for increased speed. The speller and thesaurus include definitions.

Styles can be hierarchical, so that top-level styles will apply to a whole document while lower-level styles add additional details or modifications. Every other word processor makes you use a special code to insert a page number in a header or footer; *DeScribe*, however, lets you "format" a character as a page number, so that it will be incremented automatically on the following pages.

DeScribe lets you create text boxes with multicolumn text inside. It offers interactive word spacing, letter spacing, and kerning, and it gives you *Ventura Publisher*–like control over the number of hyphenated lines that can appear in a row.

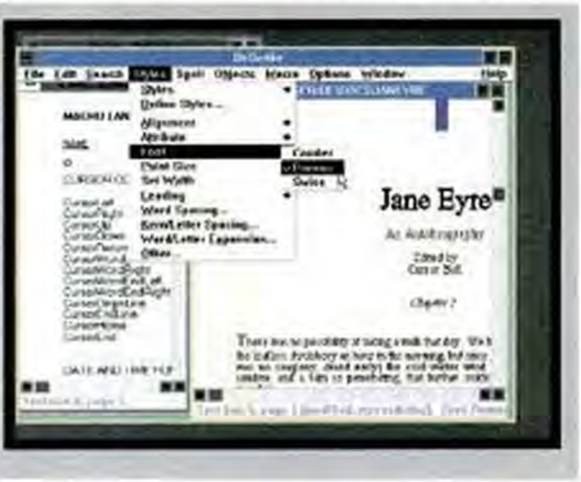
Like *Sprint*, *DeScribe* frequently saves a backup "snapshot" of your work to disk, and it automatically offers to use the backup when you open the program after a system crash. Like *WordPerfect*, *DeScribe* lets you assign different dictionaries to different areas of text. But unlike any other word processor, *DeScribe* lets you stretch or compress characters horizontally with printers that use scalable fonts.

Unfortunately, these impressive features are balanced by equally impressive limits. Amazingly, *DeScribe* doesn't have a command to jump to a specific page. It doesn't have an unambiguous page-break command, only an End of Section command that doesn't always end a page.

The program doesn't offer built-in superscripts or subscripts; instead, you have to write a macro that changes the leading and point size of the characters. You can't use superscripts for footnotes, because *DeScribe* doesn't create footnotes—or indexes, lists, or tables of contents.

You can import any text you want—as long as it's pure ASCII. No filters or conversion programs are provided. You can import graphics only via the Presentation Manager clipboard, and the only format supported is PM Metafile. Until the next version shows up, you'll have to buy another OS/2 application that can import or create Metafiles and use it to put the graphic in the clipboard.

Don't use *DeScribe* with anything slower than a 33-MHz machine. It's reasonably fast for a WYSIWYG program, but with a 16-MHz machine, you'll spend most of your time waiting for the screen to catch up with the keyboard. An upgrade for 386 machines costs $29.95—a needless annoyance, since a 286 is too slow for the program anyway.



DeScribe's Undo feature lets you replay an entire session. You can copy text from an earlier stage into the current version or revert to an earlier version.

Even on a 386, *DeScribe* could make better use than it does of OS/2's multithreading. Paginating and justifying a long document is a painfully slow process, and you can't do anything else while it occurs. To make matters worse, if you happen to click OK on some of the formatting menus—even if you've made no changes at all—*DeScribe* repaginates and justifies the whole file. This is the ideal program for anyone who needs to be forced to take a break from work.

The program's menu structure has its own frustrations. If you select Point Size from the Styles menu, a submenu offers only a limited group of sizes. If the size you want isn't listed, you have to go back to the Styles menu and select Other before you can enter the size.

Don't expect much help from *DeScribe*'s manual, which is organized according to the menus rather than by function and has an inadequate index. Nothing in the manual tells you that only Metafile graphics can be imported. The forbiddingly technical macro language is documented only in a 44-page file that you have to print by yourself. You get free tech support for 90 days, but after that, prepare to fork over $10 for the first 3 minutes and a dollar for each additional minute, or pay $95 for a year of single-user support or $1,100 for a year of corporate support.

If you absolutely need a Presentation Manager word processor, *DeScribe* is your only choice at the moment. If you can wait, hold off until early 1990, when you'll be able to choose between an improved version of *DeScribe* and a PM version of *WordPerfect*. ■

FACT FILE

DeScribe
DeScribe Inc., 4047 N. Freeway Blvd., Sacramento, CA 95834-9954; (916) 646-1111.
List Price: $595; 80386 upgrade kit, $29.95.
Requires: 3MB RAM (4MB recommended), 20MB hard disk (40MB recommended), OS 1.1 or higher; mouse recommended.
In Short: The first Presentation Manager word processor has a slick Undo feature and allows complex formats, but its word processing functions are limited and often inconvenient.

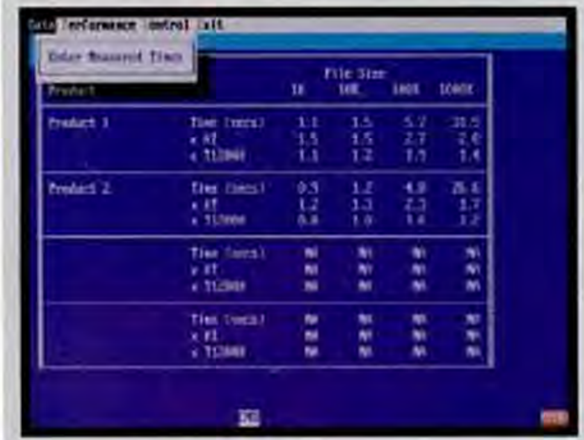
CIRCLE 443 ON READER SERVICE CARD

1-2-3 Macro Programmers Get Full-Featured Development Tool with Baler 5.0

HANDS ON
by Rock Miller

When *PC Magazine* last looked at spreadsheet compilers ("*1-2-3* by Any Other Name," December 22, 1987), *Baler* offered a subset of *Lotus 1-2-3*'s capabilities in a software package of interest mainly to programmers. With its $495 Version 5.0, the program has evolved into a full-featured developer's tool for anyone who feels comfortable working with *1-2-3* macros.

Like the old *Baler*, the new version turns a spreadsheet file into a standalone program that can be run independently of the spreadsheet program (in this case, *1-2-3*) that created it. This lets you distribute worksheets to those without a copy of *1-2-3*, saves some disk space, and, most important, protects your valuable formulas and macros from being stolen by snoops or wiped out by sausage-fingered users.



Baler, Version 5.0, lets you build standalone applications using the functions of *1-2-3*.

While the old *Baler* created QuickBASIC code that then had to be compiled, Version 5.0 generates an executable program directly. The compiled worksheet can be run as is, but if you want to modify it, you use CUSTOMIZ, *Baler*'s menu-driven customization utility, instead of splashing around in BASIC.

The new *Baler*, in fact, gives you far-reaching control over the appearance and operation of the finished worksheets. By default, the command and macro menus look like *1-2-3*'s, but you can change them into pull-down menus or even vertical-format pop-up menus (for macros). The BalerDraw module lets you dress up your worksheets with lines and boxes made up of the IBM Extended graphics set. New video options let you access the 43-line EGA and 50-line VGA modes from a menu. *Baler* even lets you build fully indexed, context-sensitive help systems.

Baler is intended to be a macro programmer's tool and thus assumes a fair amount of skill. Fully protecting your worksheets, for instance, requires mastery of *Baler*'s somewhat complicated security scheme. Although "baling" prevents others from seeing your formulas, a user can overwrite the formula cells unless you protect them. This design lets the user do "what-if" analyses by overriding the calculated value with a new one. But it also means that the cells can be unprotected from within the runtime module unless you use CUSTOMIZ to disable these menu entries.

Fortunately, this procedure is well documented, and you can save command-access settings for reuse in other worksheets. Indeed, if your worksheet makes extensive use of macro menus, you may prefer to lock all the *1-2-3* menus from keyboard access. But if you'd rather not deal with *1-2-3*'s protection features, you can use CUSTOMIZ to secure entire classes of cells (such as formula cells). Variable data can be stored in encrypted form to protect it or in .WK1-compatible form for interchange with *1-2-3* users or other applications.

Baler really comes into its own in combination with *1-2-3*'s macro language, which lets you use *1-2-3* to develop complex standalone applications. *Baler* supports most *1-2-3* 2.0 macro commands and functions, including the Graph and Data features. It also offers a number of extensions, that let you assign operations to function keys, restrict movement to within a certain range, and pop up help lines or otherwise customize the screen.

Be warned, however, that you may have to change some of your macro-programming methods. Since formulas are bound into the baled worksheet, you can't use macros that modify formula or macro cells. You also can't insert columns or rows within the bounds of the worksheet, though you can insert rows below the last line to add database records, for example. The manual has a thorough discussion of these pitfalls and offers suggestions on how to get around them.

PC MAGAZINE FACT FILE

Baler, Version 5.0
Baler Software Corp.,
Barrington Pointe, 2300 N.
Barrington Rd., 4th Floor,
Hoffman Estates, IL 60195;
(312) 490-5325.

List Price: $495 (includes single-user license for compiler and customization utility and unlimited runtime license).

Requires: 512K RAM (hard disk recommended), *Lotus 1-2-3* 2.01 or 2.2, DOS 2.1 or later.

In Short: This versatile and powerful spreadsheet compiler offers advanced features and excellent control over the appearance of the finished worksheet while protecting formulas and macros from alteration. With it, you can build standalone applications using *Lotus 1-2-3*'s macro language.

CIRCLE 408 ON READER SERVICE CARD

The documentation is short on examples, however, especially for advanced features like *Baler*'s "drill-down tables." These let you assign macros to individual cells, which are executed when you press Enter on that cell. The uses of drill-down tables are many, from customizing the movement of the cursor to implementing point-and-shoot operation. But you must write fairly complex macros to get this feature to work properly, and the manual and sample worksheet don't go nearly far enough toward explaining it clearly.

Baler compiles reasonably quickly, and it executes macros noticeably faster than *1-2-3* alone. But its recalc performance lags behind that of *1-2-3* 2.01. *Baler*'s minimal recalculation and math-coprocessor support, however, can boost its performance on calculation-intensive jobs. And its virtual memory system lets you use disk and extended memory as well as expanded memory to stretch the size of your workspace.

Always a good idea, *Baler* has matured into an excellent alternative to other application-development tools, especially where *1-2-3*'s macro language is well known and understood. If you program for others, *Baler*'s versatility makes it well worth the price. ■

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PacificPage Puts High-Quality PostScript In a Slow Cartridge

HANDS ON
by Edward Mendelson

If you're surprised to find a product that squeezes PostScript into a LaserJet cartridge, wait until you start using it. Pacific Data Products' $695 PacificPage cartridge has an even better surprise up its narrow plastic sleeve. Plugged into a 300-dot-per-inch LaserJet Series II, this cartridge produces pages that look strikingly better than those produced by any 300-dpi Adobe PostScript printer.

The brain of the cartridge is its PhoenixPage PostScript interpreter, a PostScript clone licensed from Phoenix Technologies. Most PostScript clones suffer from their inability to use Adobe's proprietary "hints," which improve font quality at resolutions below 600 dpi. But PhoenixPage incorporates Bitstream's new Quality Enhancement Module, which improves font quality through a set of "rules." Just as Adobe's hints work only with Adobe fonts, Bitstream's rules work only with Bitstream fonts like the ones included with the PhoenixPage interpreter.

Bitstream's rules tend to produce smoother curves at small sizes than Adobe's hints, and Bitstream's font designs are more subtle and less homogenized than Adobe's. The result is livelier and more readable text (although the type is still not as good as the best bitmapped LaserJet fonts), with graphics that match Adobe's.

To use the PacificPage cartridge, you'll need a Hewlett-Packard LaserJet Series II (the IID will be supported by a future version) with 2MB or 4MB of add-on memory. You'll also need a Type B personality, because this cartridge changes the LaserJet from quicksilver to molasses. In PC Labs' benchmark tests, the cartridge produced text at a mere 2 pages per minute, while the small test graphics files took a stupefying 16 minutes.

One alternative to the PacificPage is QMS's Adobe-licensed JetScript board, which plugs into your computer and connects to the printer via a video cable. The JetScript is the slowest of all PostScript boards, but in tests it printed text two and one-half times faster than the PacificPage—and graphics more than six times faster.

When you plug the PacificPage into a LaserJet, the printer is transformed into a PostScript printer. You can't use it as a LaserJet until you press some buttons on the front panel, issue a software command from DOS, or turn off the printer and remove the cartridge. You have to remove any add-in board that connects to the printer with a video cable. You can use the cartridge on a shared printer, but its slowness makes shared or network use impractical.

You can use up to four non-Adobe soft fonts at a time with the PacificPage, but if you want type quality equal to the 35 built-in fonts, you'll need to create soft fonts using Bitstream's *Fontware*, Version 3.0, and the advice in the next two paragraphs, which you won't get from PDP.

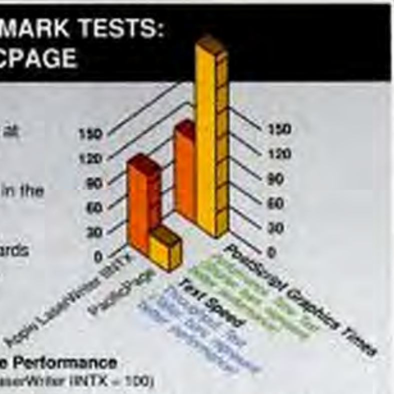
When generating PostScript fonts with *Fontware* for *Microsoft Windows*, choose "Alternative PostScript PDL printer (QEM)" as your output device. The resulting fonts will be compatible with the "rules" in Bitstream's Quality Enhancement Module. If you choose the AppleWriter or other PostScript printer, the fonts will print but will look coarse and won't be affected by the "rules."

Using *Fontware* for *WordPerfect* is more complicated. You use *WordPerfect*'s PTR program to modify WPRINT2.ALL, where you select the Apple LaserWriter definition; then you change the Soft Font Format Type from "Other" to "Alternative PostScript Device (Clone)." Now when you run *Fontware*, you automatically generate fonts compatible with the QEM. Service bureaus will have equivalent Bitstream fonts, so you can use the cartridge to proof pages destined for a Linotronic typesetter.

Adobe recently announced that it will make public its proprietary hints. When this happens, PDP will offer an optional upgrade to the PacificPage that will let it use Adobe soft fonts. By that time, you may be so pleased with Bitstream's fonts that you won't care. ■

BENCHMARK TESTS: PACIFICPAGE

Although twice as fast at producing text as the software PostScript interpreters we tested in the April 11, 1989, issue ("Post-Purchase PostScript: Add-in Boards for the HP LaserJet"), PacificPage outputs PostScript graphics much more slowly than software interpreters, add-in PostScript boards, and the Apple LaserWriter IINT and IINTX.

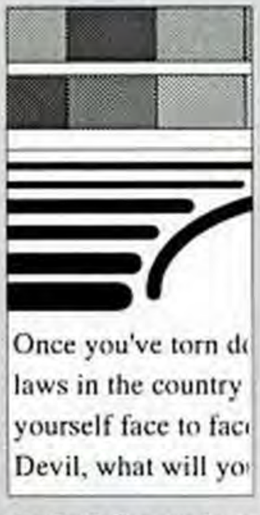


Relative Performance
(Apple LaserWriter IINTX = 100)

The **Text Speed** test prints a two-page single-spaced business letter: one copy for dot matrix printers, ten copies for laser printers. Print speed is measured in characters per second for dot matrix printers and in pages per minute for laser printers. Because the test document simulates a typical business letter with lots of white space, the speeds achieved by dot matrix printers are almost always much slower than their manufacturers' rated speeds, which are based on printing a single full line of characters.

The **PostScript Graphics Times** test clocks the processing speed of PostScript printers. It uses two large characters as a clipping area and draws a series of Bézier splines. The time reported is the number of seconds it takes to print a page.

	Throughput Test (Pages per minute)	Performance Time Test (Seconds)
	Text Speed	**PostScript Graphics Times**
Apple LaserWriter IINTX	6.80	436.00
PacificPage	2.10	963.00



Once you've torn d
laws in the country
yourself face to fac
Devil, what will yo

The PacificPage produces high-quality output.

FACT FILE

PacificPage
Pacific Data Products, 6404 Nancy Ridge Dr., San Diego, CA 92121; (619) 552-0880.
List Price: $695.
Requires: LaserJet Series II printer with at least 2MB of add-on RAM.
In Short: A plug-in PostScript cartridge for the LaserJet II, with extraordinarily high type quality at slow speeds.

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- IBM® Compatible

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- HDD/FDD Controller 1:1
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- Phoenix BIOS
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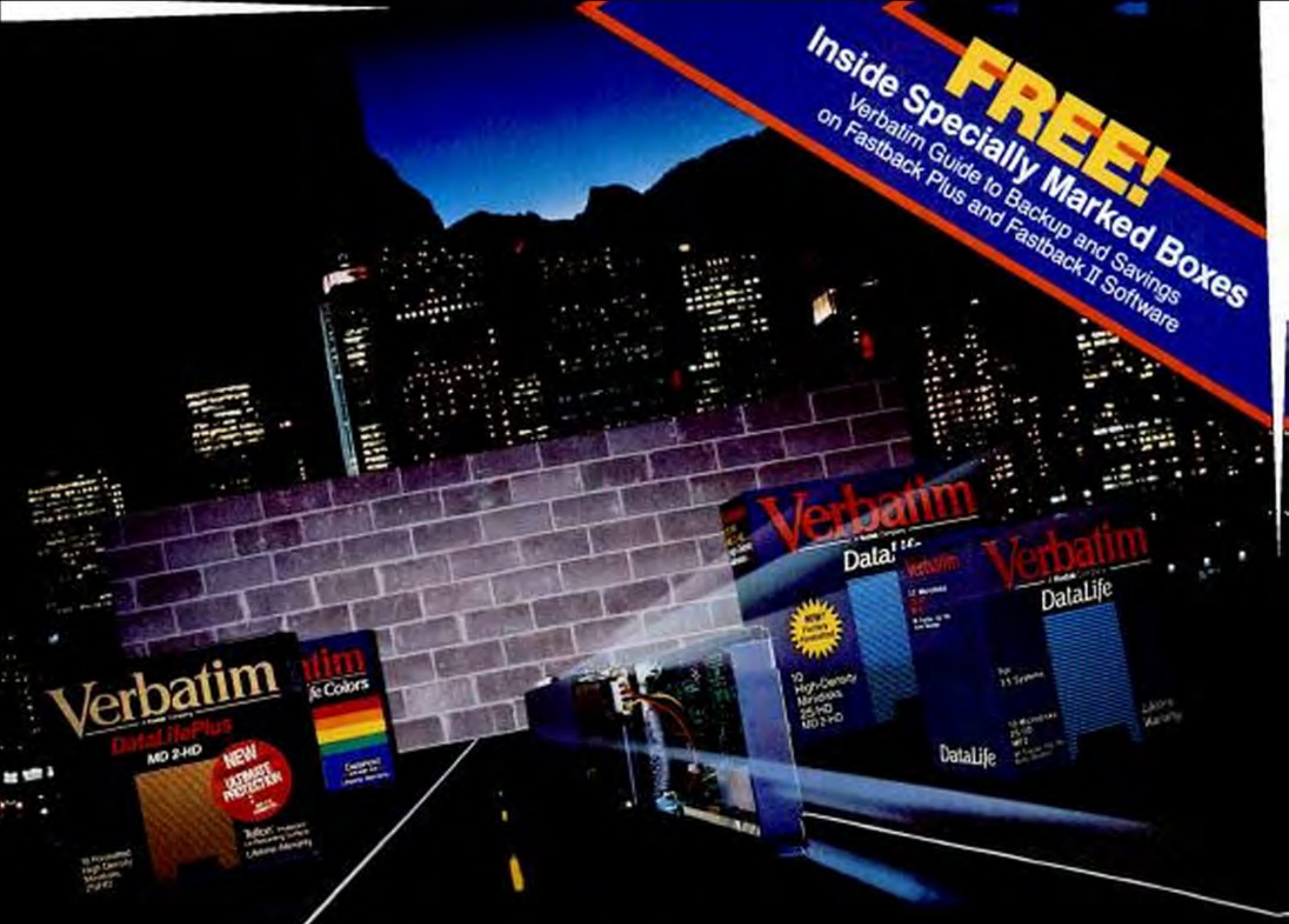
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CIRCLE 260 ON READER SERVICE CARD

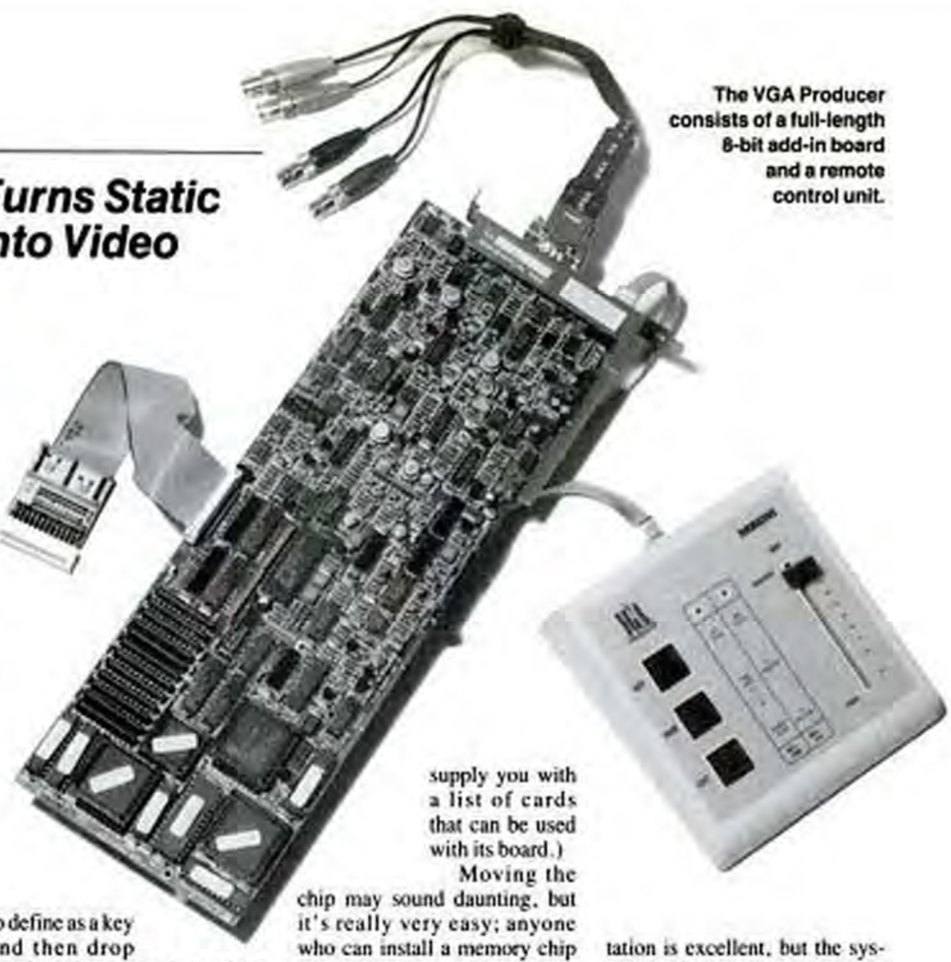
VGA Producer Turns Static VGA Graphics into Video

HANDS ON

by Alfred Poor

Not ready to shell out for high-end video-conversion equipment? For a comparatively modest investment of $1,695, Magni Systems' VGA Producer lets you combine VGA graphics with video, giving you many of the same capabilities as professional video-effects equipment that costs over ten times as much.

VGA Producer consists of a full-length 8-bit add-in board, which connects to VGA cards that have a 28-pin, socketed RAM DAC (not all do); and a remote control unit, which lets you control VGA Producer's effects features. The board encodes a VGA graphic into an NTSC composite video signal, and it can combine this signal with a second composite video signal coming from a VCR or camera. In addition to NTSC signals, the board can also handle Super VHS (S-VHS) video signals.



The VGA Producer consists of a full-length 8-bit add-in board and a remote control unit.

PHOTOGRAPH: THOM O'CONNOR

The remote control console that accompanies the board is what you use to achieve some fairly sophisticated effects; no special software is required. The three-button unit has a sliding control that, in its simplest use, lets the VGA graphic fade to the video image and back again. Pressing the appropriate buttons will let you perform cuts (i.e., switch instantly from one image to another) and automatic fades, in which you can control the time it takes for one image to fade into another. Automatic fades can range in length from a snappy half second to a glacial 10 seconds. You also can adjust the position of the VGA image within the screen, with separate adjustments for horizontal and vertical position. Two LEDs on the controller's panel indicate which programming mode has been selected.

These simple effects are just the start. You can select a color to define as a key and then drop out those keyed portions of the VGA image, letting the second video image show through the "holes" in the first image—the same technique that puts television reporters in front of weather maps.

The VGA Producer also lets you invert the effect, so that the keyed portion of the image remains and the rest of the VGA image drops out. All of this magic is made possible by VGA Producer's genlock capability, which allows it to synchronize the signals from two composite video sources.

INSTALLATION

Installing the board is a fairly straightforward task. VGA Producer requires that your VGA card have a socketed DAC (digital-to-analog converter), because you must be able to remove that chip and place it on a small circuit board; you then install the circuit board on your VGA card. (If you're not exactly sure whether your card has a socketed DAC, be sure to contact Magni Systems, which can supply you with a list of cards that can be used with its board.)

Moving the chip may sound daunting, but it's really very easy; anyone who can install a memory chip or a math coprocessor will have no difficulty with this step. You may have to exert a fair amount of pressure on the circuit board to properly seat the chip in the chip socket; be brave and push hard. A ribbon cable passes the video signal between the VGA Producer and your VGA board. Once you've plugged in the remote effects controller and your composite monitor, you're ready to roll. Your regular VGA monitor will perform exactly as it did before the installation.

If you do have a problem installing the VGA Producer, it may be because of its height and thickness. The board sticks up about three-quarters of an inch above the top of the end bracket, and it has a little card that juts out of its surface, making the whole unit more than five-eighths of an inch thick. Its width may make for a snug fit if you have thick cards in adjacent slots, and you'll probably want to make sure that your system unit is tall enough to house the board.

VGA Producer's documentation is excellent, but the system is so easy to use that you may well find yourself using all but the most sophisticated features just by following your instincts. In no time at all, you will be performing cuts, fades, and keys, combining your VGA images with other video pictures. ■

PC MAGAZINE FACT FILE

VGA Producer
Magni Systems Inc., 9500 SW Gemini Dr., Beaverton, OR 97005; (800) 624-6465, (503) 626-8400.
List Price: $1,695.
Requires: IBM PC AT or compatible; 8-bit, full-length slot; VGA card with socketed DAC chip.
In Short: An affordable alternative to high-end video-conversion hardware, this full-length add-in board turns VGA graphics into video. A supplied remote control unit adds special effects, like fades, border-control fills, and x-y positioning.

CIRCLE 435 ON READER SERVICE CARD

CarrierNET Builds LANs Without Cables

HANDS ON
by Kimberly Maxwell

With Carrier Current Technologies' CarrierNET set of peripheral-sharing utilities and AC power adapter ($199) and Excelltech's *ExcellNET* file-sharing and e-mail software (remarketed by Carrier Current at $79), you don't need local area network cabling to link your PCs. Instead, this combination lets you use existing power lines that run in a straight path between PCs to carry data, and the setup is more cost-effective than most dedicated network cabling schemes.

The CarrierNET system is able to accommodate up to 255 nodes on a power line up to a mile long. PCs can be located on different floors of a building, assuming that there are no electrical disruptions. Of course, as with any type of LAN, the more workstations on the system—or, in this case, power lines—the slower the response time.

Installing the CarrierNET hardware is simple. You attach one cable from the 1.5- by 3- by 5-inch (HWD) CarrierNET adapter to the power line and the other cable to your PC's serial port via a 25-pin connector. Each CarrierNET adapter contains a small radio transceiver that transmits over power lines. The transceiver employs carrier-sense-multiple-access (listen-before-transmit) protocols to share the radio channel.

After installing the CarrierNET hardware and software, you can then install the optional *ExcellNET* file-sharing and e-mail software. This merely involves answering several questions from a menu. The software uses DOS-like commands, but these must be prefaced with XL (as in XLCOPY), which tells the software to direct instructions through the CarrierNET port.

The CarrierNET system can accommodate up to 255 nodes on a power line up to a mile long.

ExcellNET's user manual is helpful in bringing you up to speed with the program. Unfortunately, there is no manual to walk you through the installation of CarrierNET, although the vendor does offer toll-free telephone assistance.

How does the CarrierNET system perform in a real-world setting? Like many people, we were skeptical of the ability of a power-line transmission system to operate in the presence of high electrical noise, so we did an informal noise test in addition to our performance tests. We plugged an old, noisy, sparking electric drill in the same socket as the CarrierNET module, ran the drill, and performed a file transfer.

Noise and ozone filled the air, and pulses saturated the power line, but the file-transfer time remained unaffected. Although our test was hardly comprehensive, we believe the CarrierNET's ability to communicate despite this much electrical noise is significant.

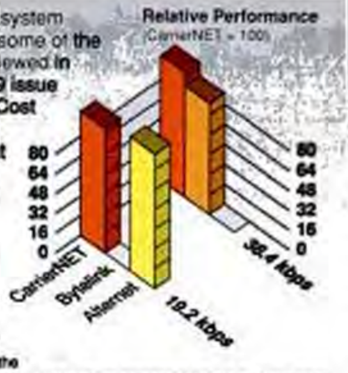
Since there is no direct cabling connecting PCs in the CarrierNET schema, the signaling speed is slower than that over wire, which can handle transmissions at 38.4 kilobits per second. In our performance tests, we recorded an average file-transfer throughput of slightly over 12 kbps for the CarrierNET system.

Currently, the *ExcellNET* software does not support virtual drives; this limits the usefulness of the system, because it cannot provide multiple simultaneous access to the same data files. But even in its present configuration, people who need peripheral-sharing, file-sharing, and e-mail capabilities will find the CarrierNET and *ExcellNET* combination valuable. With better software, the CarrierNET transmission system has a bright future. ■

PERFORMANCE TESTS: CARRIERNET

PC LABS

The CarrierNET system transfers data as fast as some of the fastest data switches reviewed in *PC Magazine*'s July 1989 issue ("Data Switches: A Low-Cost LAN Alternative"), but CarrierNET works without any wiring between the machines except the AC power line.



Taller bars represent better performance.

To test throughput times of the CarrierNET hardware and *ExcellNET* software, we moved a 50K data file that resists compression algorithms from the RAMdisk of one 12-MHz Dell System 200 to the RAMdisk of another. We timed the transfer several times to obtain an average.

Because some PCs cannot operate effectively at over 19.2 kilobits per second through their serial ports, we have provided test results for both 19.2- and 38.4-kbps signaling rates.

The data switch throughput times shown here are provided for comparison. These times were the best of their speed classes, although some data switches using 115.2-kbps signaling achieved faster throughput.

File Transfer Throughput (Kilobits per second)	Signaling Rate 19.2 kbps	Signaling Rate 38.4 kbps
CarrierNET	12.30	23.50
Bytelink	N/A	21.00
Alternet	13.30	N/A

N/A—Not applicable: the device could not be tested at this signaling rate.

FACT FILE

PC MAGAZINE

CarrierNET
Carrier Current Technologies Inc., Southern Pine Blvd., 9600 J, Charlotte, NC 28217; (800) 222-0377.
List Price: CarrierNET, $199; *ExcellNET*, $79.
Requires: RS-232 serial port for each connection, DOS 2.0 or later; 256K RAM recommended.
In Short: A cableless hardware/software combination that uses power lines to let networked PCs share printers, exchange files, and send electronic mail. Easy installation and good throughput mark CarrierNET as a sound bet for anyone who can't use standard network solutions.

CIRCLE 436 ON READER SERVICE CARD

PHOTOGRAPH: THOM O'CONNOR

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Hitachi CD-ROM drives retail ($995): Hitachi's second generation drives, the 1503 and the 3500, captured over 60% of the market with superior functionality and reliability. The third generation 3600 model (internal or stand-alone) released in September 1989 is Hitachi's powerhouse for the 1990's. Superior speed comes from a look-ahead cache and a linear pickup head motor. Powerful standard features include 8 drive daisy chaining, slim vertical or horizontal mounting, and full audio CD capabilities (accessible with CD Play Demo).

Microsoft Bookshelf (retail $295): An indispensable collection of writer's references for word processor users. This is the most popular CD-ROM title published. You get instant access to: **The World Almanac, Chicago Manual of Style, Bartlett's Familiar** Quotations, **Roget's II: Electronic Thesaurus, American Heritage Dictionary, Business Information Sources, The U.S. Zip Code Directory, Houghton Mifflin Spell Checker and Usage Alert** and more! All Microsoft CD-ROM's are RAM resident and include powerful cut and paste features for popular word processing packages.

Microsoft Stat Pack (retail $125): Now you have easy access to the abundance of statistics published by the Federal Government—census data, business statistics, agricultural surveys and much more, plus Microsoft Excel and Lotus 1-2-3 spreadsheet files for all tables. A must for marketers and planners.

Microsoft Small Business Consultant (retail $149): The most popular publications of the Small Business Administration and Deloitte, Haskins and Sells on running a small business. Answer tax, accounting, legal, personal, AND financing questions in an instant. A gold mine for businessmen, accountants, and consultants.

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PageMaker for OS/2: Another Reason to Use Presentation Manager

HANDS ON
by Edward Mendelson

With the arrival of the OS/2 version of *PageMaker*, all of the extravagant claims for the Presentation Manager are suddenly vindicated. Aldus Corp.'s Presentation Manager desktop publishing program doesn't do much that you can't do with the *Windows* version of *PageMaker*—it simply does it faster.

At virtually every point where *Windows* users must sit and stare at the hourglass icon, PM users barely have time to blink their eyes before moving on. The difference is so great that those accustomed to the delays in *PageMaker* for *Windows* may find themselves waiting for the hourglass icon to disappear—and then suddenly realize that it was never there at all. The PM version allows you to open multiple documents simultaneously and let one document reformat while you work on another.

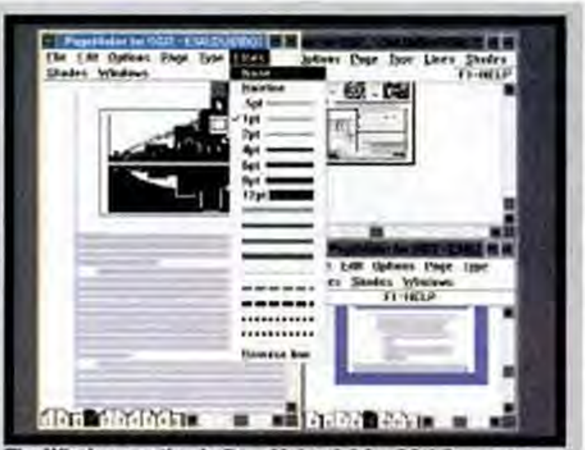
Even in a single document, printing, text importing, and text flow between columns and pages can all proceed in the background while you continue with your work in the foreground. Text loads and flows at about twice the speed of the *Windows* version; other functions show smaller but still-significant improvements. Screen redraw continues in the background also, so you can start work on one page before another takes shape on the screen.

The only significant change to the top-line menu is the addition of a Windows option, which allows you to switch from one document to another. In the DOS and Macintosh versions of *PageMaker*, you cannot create or open a document while another is on-screen. But if you click on Open or New in the PM version's File menu, the screen is instantly replaced by a second document—and a third and a fourth, up to OS/2's maximum of 16.

Each document looks like a separate session of *PageMaker*, even though you only have to load the program once. You can minimize each document to an icon or tile them across the screen. Any text and graphics that you cut or copy in one document can be pasted into any other with all formatting intact.

The OS/2 clipboard allows cutting and pasting of data between any PM applications. All of the import filters from the *Windows* version—and a few extras introduced after that version shipped—are included in the PM version, and files are fully compatible with the *Windows* and Mac versions.

The only restrictions imposed by the OS/2 version are the limits on output set by OS/2 itself. OS/2, Version 1.1, prints only to IBM dot matrix printers. Version 1.2 includes a limited PostScript driver and works with Epson dot matrix printers. Registered users of *PageMaker 3.0 for OS/2 Presentation Manager* will receive a free upgrade to 3.01, which will include a LaserJet driver. Until then, the best way to print ambitious files is probably through a service bureau. ■



The Windows option in *PageMaker 3.0 for OS/2 Presentation Manager* switches from one document to another.

List Price: *PageMaker 3.0 for OS/2 Presentation Manager*, $795; $95 for owners of the *Microsoft Windows* version. **Requires:** 6MB RAM; 40MB hard disk; OS/2 1.1 or later; EGA, VGA, or other high-resolution monitor and graphics adapter; mouse. Aldus Corp., 411 First Ave. South, Seattle, WA 98104-2871; (206) 622-5500.

CIRCLE 434 ON READER SERVICE CARD

MacroCalc: Not Your Typical, Clumsy On-Screen Calculator

HANDS ON
by Barry Simon

The calculator that comes with *Microsoft Windows* is a nice freebie, but it's inadequate for all but the simplest operations. For business and scientific calculations in the *Windows* environment, Anderson Consulting and Software's *MacroCalc* can be an invaluable tool.

In addition to offering standard mathematical functions, the $127 program features a full array of scientific operations, more than ten financial functions, unit conversion, simple statistics, date math, and procedures that make use of its macro language.

MacroCalc displays a graphical representation of a Hewlett-Packard-style pocket calculator; better yet, it even acts like one of these machines, allowing you to work in HP-style Reverse Polish Notation. But this program has a few tricks up its sleeve that take it beyond mere imitation.

First, *MacroCalc* is customizable. You can select from among 13 predefined key layouts, including Financial, Trigonometric, and Statistics, and can assign these formats or any you've created to 12 soft keys. If you are more comfortable using algebraic notation, a single keystroke will invoke an input box into which you can enter your calculations in conventional notation, even referring by letter to the five registers displayed on-screen.

In addition, *MacroCalc*'s tape system records your calculations in a way similar to the paper-tape printers included with some desktop calculators. You can save a tape to a file, restore it, and reuse it later on.

The program's strength comes from its flexible macro language. You can create macro files, which log a sequence of keystrokes, by simply selecting the Memorize command to begin the recording process. You also can create and edit macros with the program's built-in editor, MacroCalc Edit.

MacroCalc lets you use macros to define functions that should be evaluated, but macros also can serve as the bases for graphs and integration routines. You can paste *MacroCalc*-generated graphs into other *Windows* applications via the Clipboard. Several sample macros come with the program. ■

List Price: *MacroCalc*, Version 1.1, $127. **Requires:** *Microsoft Windows* 2.03 or later. Anderson Consulting and Software, P.O. Box 40, North Bonneville, WA 98639; (800) 733-9633.

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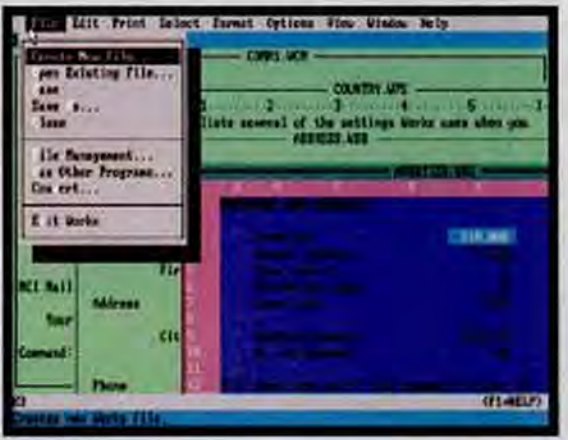
G-PCB11

Microsoft Works 2.0 Adds Windows-like Functionality

HANDS ON
by Jonathan Matzkin

While the debates about *Microsoft Windows* and the Presentation Manager raged, another Microsoft software package quietly established itself as the standard in low-end integrated software. Graphical environments may be the future of truly easy-to-use PCs, but *Microsoft Works* is here *now*.



Works 2.0 has MS-Windows-like context switching capabilities. You can switch to a window by clicking on it.

In one easily mastered package, Microsoft has combined the four most basic software tools: a word processor, a spreadsheet, a database, and a communications module. Version 2.0 ($149) builds on its predecessor's intelligent design and close integration of components.

Perhaps the most intriguing addition to *Works* is the ability to open up to eight simultaneous windows. You can start a report in the word processor, for instance, and then open a spreadsheet. The spreadsheet appears in a window that you can move or size in much the same way that *Windows* allows. Windows can overlap or completely obscure each other.

The windowing feature gives *Works* a modest form of context switching, which is *Windows'* biggest selling point. It's not multitasking, and it is limited to the built-in *Works* tools, but there is great value in the ability to move quickly from one application to another without having to close files. To switch from the current window to one that is partially obscured, you simply click on the desired window. It moves to the foreground and becomes active.

You use a pull-down menu to control the movement and sizing of windows; you can handle most of these functions with a mouse, as well. The Arrange All menu choice tiles your open windows so that all are visible and they don't overlap.

The Arrange All feature can make for a busy screen if you have lots of open files, but it's useful for getting a "global" view of your work. It also comes in handy when you lose a window behind several others and don't want to rearrange the whole screen to find it.

Another useful enhancement comes directly from *Word*, Microsoft's high-end word processor. Like *Word, Works* can be started either in straight character mode or in "character graphics" mode, which allows onscreen representation of attributes like boldface and italics. The pure character mode maximizes performance on older, slower machines, while the graphical enhancements give users access to WYSIWYG amenities not usually found in integrated packages.

All of these improvements seem to move *Works* toward the graphical future presaged by *Windows* and realized (one hopes) by the Presentation Manager. Other enhancements in *Works*, Version 2.0, are clearly designed to solidify the package's role as a self-contained environment. *Works*—or any other integrated package—is too confining for advanced PC users. But *Works* seeks to provide an all-encompassing solution for the lower-level user.

Toward that end, Version 2.0 allows you to launch DOS applications from within *Works*. That can mean simply shelling out to the DOS prompt, or it can involve running an external application. The typical *Works* user would have little need for external applications, but this feature provides the opportunity for some flexibility.

I easily configured *Works* to launch *XyWrite*, my preferred word processor, and *Procomm*, the communications package I use. With *XyWrite* called through *Works*, I was able to load four 19K text files and still have some memory left over.

Basic DOS services are now supported from within *Works*, as well; you can copy and format disks, for instance, without leaving the familiar pull-down menu environment.

Microsoft stumbles a bit when it comes to file conversion. With the wide assortment of word processors currently used in offices, this is an absolutely essential, and increasingly common, feature. *PFS:Professional Write*, from Software Publishing Corp., sets the standard at the low end with its truly transparent conversion of a variety of file formats.

As shipped, *Works* 2.0 doesn't offer built-in conversion to and from major word processor formats other than *Word*. The documentation includes an order form for the conversion utility—not much help if you need to convert a file on the spot.

Works 2.0 provides some of the functionality associated with *SideKick* and other desktop managers. You can pop up a calculator from within the *Works* applications, and an alarm clock displays a brief onscreen message at a user-specified time.

The enhancements in Version 2.0 also include support for extended memory, a 30,000-word thesaurus, and a limited style-sheet convention for each basic tool.

Good integrated software saves many users from the prolonged pain of learning separate applications. *Microsoft Works* lives up to this standard but also goes beyond it in offering truly useful and powerful tools. Only its lack of good file format conversion deserves serious criticism. At $149, *Works* is an outstanding value. That one outlay covers just about all the functionality that many users will need. One rarely sees that kind of value in software.

Ironically, in bringing *Windows*-like functionality down to this level, Microsoft may be poaching in its own potential market. But some *Microsoft Works* users might eventually make the transition up to *Windows* anyway. ■

FACT FILE

Microsoft Works
Microsoft Corp., 16011 NE 36th Way, Redmond, WA 988073-9717; (800) 426-9400.
List Price: $149.
Requires: 512K RAM, two disk drives, graphics adapter for charting, DOS 2.0 or later.
In Short: Microsoft's excellent integrated package gets even better by adding Microsoft *Windows*–like functionality. File conversion is a disappointment, however.

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Zeamon Breathes New Life into Typical DOS Commands

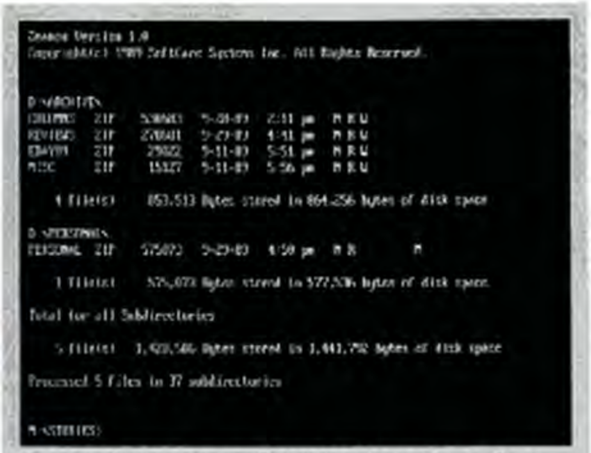
HANDS ON
by Rock Miller

For command-line junkies, *Zeamon* is a handy utility that extends the functionality of the most common DOS operations (COPY, DEL, and DIR) and adds a few that aren't in DOS (such as Move and Update). It runs under both DOS and OS/2 and costs $69.

Zeamon's virtue is consistency. All its commands use the same syntax, and all support the same extended wildcard specification, which lets you include and exclude files by building a filter made up of multiple wildcards. Thus, with *Zeamon*, you can accomplish in a single step tasks such as the following: copy all files except .TMP files, but including PRINT.TMP, in all subdirectories except \TEST. Further, *Zeamon* lets you use the asterisk wildcard at any place in the filename.

A wide range of command-line switches lets you copy from subdirectories and to screen files by date, size, archive bit, and other criteria. Together, these let you do things from the command line for which you would normally need a point-and-shoot-type DOS shell, such as deleting hidden files or moving entire subdirectory trees from one location to another.

Zeamon's advanced features help you handle more-complex jobs. You can put together lists of *Zeamon* commands and filters in a file, called a Speed Zeamon, which can then be used as a kind of command shorthand. *Zeamon*'s List command writes a list of filenames that match the filter criteria to standard output, which can in turn be redirected to a file for use by another application that accepts such lists or piped to another command. And Execute acts as an enhanced version of the DOS FOR command, giving you a direct way of applying repetitive operations (such as running EDLIN or DEBUG scripts) to multiple files.



***Zeamon* gives you many wildcard and formatting options on common DOS operations.**

Zeamon's flexibility does have its down side, in the form of picky syntax. You must be careful to type commands precisely by the book; the program doesn't always warn you if you make syntax errors. You'd be wise to follow the manual's advice to use the /C (Confirm) and /X (eXplain) switches until you're familiar with the program's quirks. *Zeamon* would also be improved by the ability to copy files from more than one directory and by support for more than one DOS error level.

Though most of *Zeamon*'s functions can be duplicated by judicious use of batch files and third-party utilities, who wants to bother? If you spend a lot of time at the C: prompt, *Zeamon* is a worthwhile acquisition. ■

List Price: *Zeamon*, $69.
Requires: 128K RAM, DOS 2.0 or later or OS/2 1.0 or later.
Softcare Systems Inc., 925 Clifton Ave., Clifton, NJ 07013; (201) 473-2002.

CIRCLE 444 ON READER SERVICE CARD

Winn Rosch Hardware Bible Offers Comprehensive Hands-On Advice

BOOK REVIEW
by Mitt Jones

While book publishers have been quick to cater to the masses willing to buy yet another book on *dBASE* or *WordPerfect*, the collection of PC-related offerings has long lacked a comprehensive guide to the PC hardware. *The Winn Rosch Hardware Bible*, written by one of *PC Magazine*'s most familiar and prolific contributing editors, fills the void nicely.

Comprising over 600 pages of hardware tutorial, the book is divided into 23 chapters, beginning with the motherboard and ending with tape drives. In between, you'll find chapters devoted to topics such as memory, coprocessors, the expansion bus, video adapters, modems, and hard disks, to name a few. CD-ROM and WORM drives are about the only items Rosch doesn't cover.

Rosch's mission seems to have been an ambitious one, akin to being all things to all people. For those who like to know why their hardware is the way it is, he often begins chapters with interesting accounts of the development and evolution of the component at hand.

For the more pragmatic among us, he sprinkles the book with how-to information. You'll learn, for example, how to replace your motherboard, your power supply, and just about anything else you'd care to remove. One chapter deals with system cases alone. Figures showing DIP-switch settings or part locations often accompany hands-on material.

Of course, no hardware bible would be complete without plenty of down-to-earth explanation, and Rosch devotes the majority of the book to explaining exactly what goes into a PC, what role the components play, and how they work.

The book also serves as a handy quick reference, providing tables on subjects such as hard disk types, Hayes modem S-registers, Epson printer escape sequences, and PC hardware interrupts.

If you've already gained a healthy knowledge of hardware through years of faithfully reading *PC Magazine*, you may be disappointed with the depth of information Rosch provides on some topics. Though by no means a shallow treatment, the book seems to stress breadth of coverage rather than depth. Rosch brings you up to speed on terminology and tells you what you need to know to make intelligent buying decisions. But with a few notable exceptions, he stops short of satiating the truly curious technophile.

Despite its few shortcomings, *The Winn Rosch Hardware Bible* is an impressive achievement and an invaluable source of information for anybody interested in the PC. If you're looking for a hardware primer and reference that is both comprehensive and comprehensible, nothing else comes close. ■

List Price: *The Winn Rosch Hardware Bible*, by Winn L. Rosch, ISBN 0-13-160979-3, $29.95. Brady Books, Simon & Schuster Inc., Gulf + Western Bldg., One Gulf + Western Plaza, New York, NY 10023; call (212) 373-8500 for the book's distributor, Prentice-Hall.

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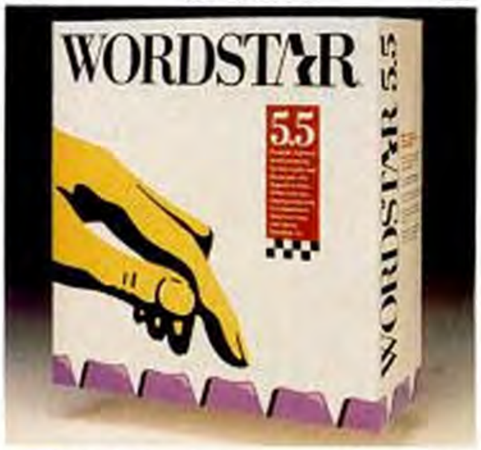

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CIRCLE 205 ON READER SERVICE CARD

by
Alan Cohen

New&Improved

News of Announced Products and Upgrades

Headlines in a Cartridge Fits Large Fonts into a Small Package

NEW

Boasting a total of 18 typefaces with proportional spacing, $399 Headlines in a Cartridge, from **Pacific Data Products**, includes italic Helvetica and Times Roman in 14-, 18-, 24-, and 30-point sizes, as well as bold Helvetica and Times Roman in 18-, 24-, 30-, 36-, and 48-point sizes. Since the cartridge plugs directly into your laser printer, no additional hard disk space or printer memory is required, and there is no need to download the typefaces.

Headlines in a Cartridge

Headlines in a Cartridge puts 18 large-size fonts on one sliver of silicon.

Furthermore, fonts can be printed in landscape orientation on printers (such as the HP LaserJet Series IID) equipped with an automatic font-rotation feature.

Printer drivers are included for *WordPerfect 5.0*, *Microsoft Word*, *Microsoft Windows*, *PageMaker*, *Microsoft Excel*, *WordStar 2000*, *Ventura Publisher*, *XyWrite III Plus*, and *DisplayWrite 4*.

List Price: Headlines in a Cartridge, $399. **Requires:** HP LaserJet Plus, LaserJet 500 Plus, or LaserJet Series II or IID; Canon LBP-8II; Olivetti PG-108 or PG-208; or compatible printer. Pacific Data Products, 6404 Nancy Ridge Dr., San Diego, CA 92121; (619) 552-0880.

CIRCLE 438 ON READER SERVICE CARD

HOT PROSPECT

PRIVATE EYE: A 12-INCH DISPLAY THAT YOU WEAR ON YOUR HEAD

The chief obstacle to shrinking the size of a laptop is the display; Private Eye, from **Reflection Technology**, allows laptop makers to bypass that difficulty altogether by removing the display from the system unit. The miniature monitor, about half an inch across, is basically an extension of the technology behind camcorder viewfinders. When held near the eye or worn on a headset, Private Eye displays what appears to be a 12-inch monitor floating 2 feet in front of you.

Drawing less than a half a watt of power, Private Eye has a resolution of 720 by 280. While Reflection Technology plans to work with other vendors to develop new products based on its system, Private Eye Starter Kits will be available at the beginning of the year to PC users who wish to access and experiment with the technology. Each kit includes an XT/AT-compatible, CGA-compatible Private Eye; a connecting cord; a headset; installation software; and a programmer's guide for Private Eye.

List Price: Private Eye Starter Kit, $495. Reflection Technology, 240 Bear Hill Rd., Waltham, MA 02154; (617) 890-5905.

CIRCLE 437 ON READER SERVICE CARD

Private Eye measures 1 by 1 by 3 inches and weighs all of 2 ounces.

Clarion Offers Two New Modules for Professional Developer

NEW

Clarion Software has enhanced the functionality of its *Clarion Professional Developer* package with the introduction of two new language extension modules (LEMs).

The $199 *Clarion ZIP Code Language Extension Module* provides developers with the means to create software applications that retrieve, check, and manipulate both specific ZIP codes and data referenced by the codes.

Included with the LEM is the current *ZIP-where* database from **Effective Data Solutions**. This file contains over 40,000 records, each containing geographic information relating to a particular ZIP code.

ZIP code records contain telephone area code, county name, state abbreviation, mileage grid coordinates, city name, time zone, and latitude and longitude for each ZIP code. The records may be accessed randomly or sequentially, either by ZIP code or by city name.

The *Clarion LEM Maker* (also $199) is a collection of tools that allows advanced programmers to create their own language extension modules from object modules written in **Borland International**'s *Turbo C*.

Clarion LEM Maker includes a special utility program that creates an assembly language interface between Clarion and *Turbo C* code; two sample LEMs and an extensive library of C functions are also provided.

List Price: *Clarion ZIP Code Language Extension Module*, $199; *Clarion LEM Maker*, $199. **Requires:** *Clarion Professional Developer; Clarion LEM Maker* also requires a Microsoft-compatible linker and a Microsoft MASM source-code-compatible assembler. Clarion Software, 150 E. Sample Rd., Pompano Beach, FL 33064; (305) 785-4555.

CIRCLE 439 ON READER SERVICE CARD

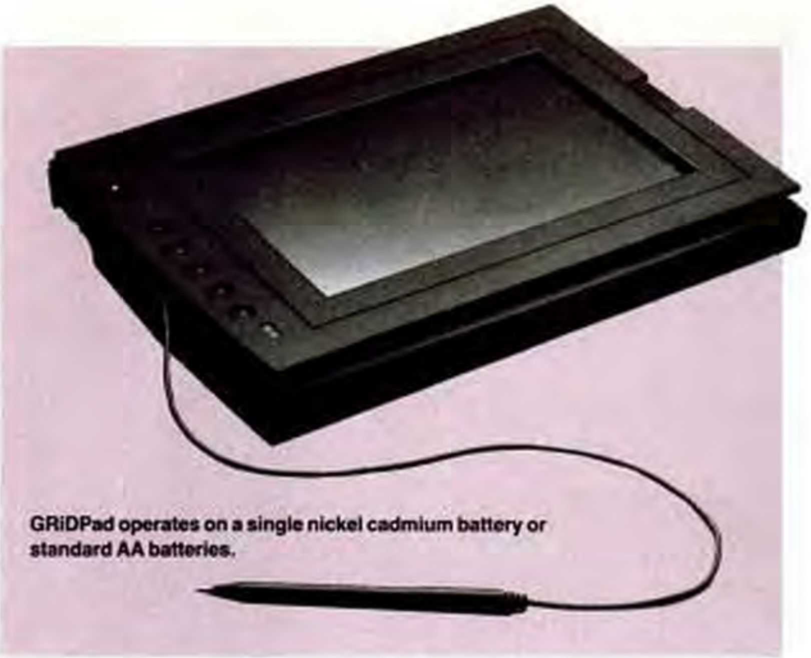
Portable GRiDPad Recognizes Printed Handwriting

NEW

At first glance, it looks like an overgrown Etch-a-Sketch; if you look a little bit closer, though, you'll see that **GRiD Systems Corp.**'s new GRiDPad is, in fact, a full-blown, 80C86-based, 10-MHz portable computer that can also recognize printed handwriting.

GRiDPad, designed primarily for PC users who need to gather and record data while out of the office, boasts a 10-inch, CGA-compatible, 640-by-400 display and weighs only 4.5 pounds.

Instead of actually entering information on a paper form, the GRiDPad user writes information directly onto the computer's screen using an electronic pen provided with the unit. (Data can alternatively be entered via a traditional XT-compatible keyboard—not provided with the unit—for those who'd rather type than write.) GRiDPad can capture and store written signatures as well as standard text and graphics.



GRiDPad operates on a single nickel cadmium battery or standard AA batteries.

The unit comes standard with 1MB RAM and can operate for between 4 and 8 hours on a single battery charge, according to the company. Two card slots accept removable 256K ($335) or 512K ($425) battery-backed RAM storage cards, and an optional 20MB external hard disk is also available. MS-DOS 3.3 and Traveling Software's *LapLink* are built into the computer's ROM.

List Price: GRiDPad, $2,370; 256K RAM card, $335; 512K RAM card, $425. GRiD Systems Corp., 47211 Lakeview Blvd., Fremont, CA 95327; (415) 656-4700.

CIRCLE 440 ON READER SERVICE CARD

IMPROVED

IBM PS/2 Series Enhancements—IBM has added three new models to the PS/2 series, each a reconfigured version of an existing PS/2. The new 20- and 25-MHz members of the Model 70 386 family—the 70 386-E61 ($5,795) and the 70 386-A61 ($8,395)—can be purchased with a 60MB hard disk with an average access time of 27 milliseconds. IBM's third new entry, the Model 30 286-E31 ($2,595), is a new edition of the Model 30 286, with a 30MB, 27-ms. hard disk. IBM has also increased the standard memory configuration on all versions of the Model 70 386 and the 30 286 from 1MB to 2MB. IBM Corp. (contact your nearest authorized IBM dealer); (800) IBM-2468.

The Quick View option of *The Norton Commander*, Version 3.0, lets you browse through the contents of the files on your hard disk.

***The Norton Commander*, Version 3.0**—The latest release of *The Norton Commander*, the popular DOS manager from Peter Norton Computing, features an expanded list of *file viewers*, which allow users to quickly view files in their native formats without having to load the specific applications. Version 3.0 of the *Commander* can view 22 common file formats, including those used by *Microsoft Word*, *WordPerfect*, and *PC Paintbrush*. New features include Commander Mail, which allows users to send and retrieve electronic messages and binary files via MCI Mail, and Commander Link, which gives users the ability to transfer files between any two PCs via a serial cable (available from the company for $29.95). Quick View, an enhancement to the DOS shell, enables a PC to display a directory of files on one side of its screen and the contents of a highlighted file on the other side. Once the desired file has been located in the directory, the program's Point and Shoot operation enables both data and application to be loaded with a single keystroke. Version 3.0 of *The Norton Commander* retails for $149. Current owners can obtain the upgrade for $49, plus $5 for shipping and handling. Peter Norton Computing Inc., Santa Monica, Calif.; (213) 319-2000.

***SeeMORE*, Version 2**—Personics Corp.'s enhanced version of its spreadsheet utility package, *SeeMORE*, gives users working in *Lotus 1-2-3*, Release 2.*x*, or *Symphony*, Version 1.*x* or 2, the ability to create an unlimited number of windows on-screen, allowing for easier manipulation of different segments of a worksheet. Windows can be tiled or overlapped, and attributes such as column widths, hidden columns, and insert and delete operations can be set independently for each window. Changes in one window will result in updates of all dependent windows and graphs, and a Restrict Ranges option is offered to limit cursor movement and insert and delete operations within the individual windows. Live graphs and horizontal rule lines can also be displayed

CONTINUES ON PAGE 56

BORLAND'S NEW SPREADSHEET

Lotus 1-2-3 3
Lotus 1-2-3 2.2
QUATTRO PRO

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Multipage consolidation		✓		✓
Keyboard and mouse support		✓		
Lotus 1-2-3 v 2.01 compatibility		✓	✓	✓
Spreadsheet Capacity (NSTL)**	640K RAM	11	8	NA
	1Mb RAM	18	12	5
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Clip art from PicturePaks by Marketing Graphics Inc. (MGI)/**NSTL (National Software Testing Labs) measured spreadsheet capacity by counting how many years of data could be added to a spreadsheet. Large numbers mean greater capacity. Performance for v 2.2 is with Allways attached. ***Based on suggested retail prices as of October, 1989.

"QUATTRO PRO seems to do the impossible: It maintains compatibility with 1-2-3; adds functionality that no version of 1-2-3 has and still runs large spreadsheets in 640K."

PC WEEK, *September 4, 1989*

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NEW

It can be considered one of the ultimate database features: linking pictures to textual information. To instantly have at your disposal not only a wealth of data on a certain subject, but also a good visual representation of that subject as well.

PixSure File Pictorial Database, from **Norick Data Systems**, is a source-code generator that lets you add high-resolution video pictures (captured from any NTSC signal source, such as a still video camera, camcorder, or television) to any .DBF format database. Using the *Clipper* compiler to generate code, *PixSure File* can either create a standalone database file or attach images to a preexisting *dBASE III+* file.

Images can be stored and viewed in a variety of sizes, from quarter-screens to full

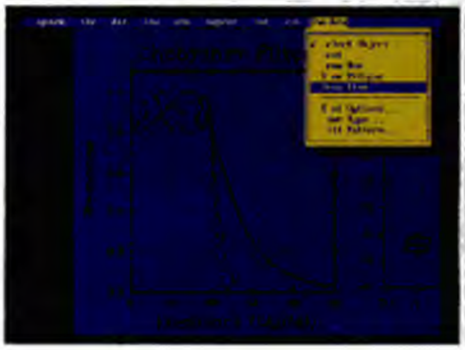
CONTINUES ON PAGE 59

IMPROVED

CONTINUED FROM PAGE 54

on-screen, and EGA- or VGA-equipped users can change the colors of more than a dozen screen elements. *SeeMORE*, Version 2, retails for $99.95. Current owners can obtain the upgrade for $25. Personics Corp., Maynard, Mass.; (508) 897-1575.

***Sigma-Plot*, Version 4.0**—Jandel Scientific has enhanced its scientific plotting software package, *Sigma-Plot*, and has integrated pull-down menus into its user interface. *Sigma-Plot*, Version 4.0, offers users a new set of specialized scales, including probit, logit, probability, and natural log; extended symbol choices; more specialized graph types, including stacked bar charts, box plots, quality control graphs, and pie charts; and greater flexibility with error bars. The package also features a data worksheet of up to 16,000 columns (expanded from 128); user-variable column widths to accommodate the required precision of data; new data-analysis operations, including t-tests; and a mathematical transform language that enables the user to enter and plot nearly any equation. Output options have also been enhanced and expanded: a greater number of fonts are provided, variable line thicknesses are possible for individual graphical elements, and line- and figure-drawing capabilities have been added. *Sigma-Plot*, Version 4.0, is available for $495. Contact the company for upgrade details. Jandel Scientific, Corte Madera, Calif.; (800) 874-1888, (415) 924-8640.



***Sigma-Plot*, Version 4.0, incorporates pull-down menus and has improved graphing capabilities in its user interface.**

Microsoft Mouse 400 Series—The Microsoft Mouse now boasts a resolution of 400 points per inch, up from 200 ppi. The new device, the Microsoft Mouse 400 Series, retains the design of its predecessor and houses all of its necessary electronics internally, thus doing away with the serial interface module. In addition, a new accelerator algorithm enables the on-screen cursor to move at a rate directly proportional to the velocity at which the mouse is traveling. As the user accelerates the mouse, the cursor will move a greater distance; conversely, as the mouse decelerates, the cursor will move a smaller distance. Through the Control Panel, any one of three predefined levels of acceleration can be selected, or the user can customize the mouse to his or her own rate of acceleration. Drivers for both OS/2 and DOS are included. The Microsoft Mouse 400 Series is available in two interface versions: bus and serial-PS/2. Prices are $150 bundled with *Microsoft Paintbrush* and $200 bundled with *Microsoft Windows/286*. Microsoft Corp., Redmond, Wash.; (206) 882-8080.

BORLAND'S PARADOX 3.0

PC MAGAZINE
EDITORS' CHOICE
September 26, 1989
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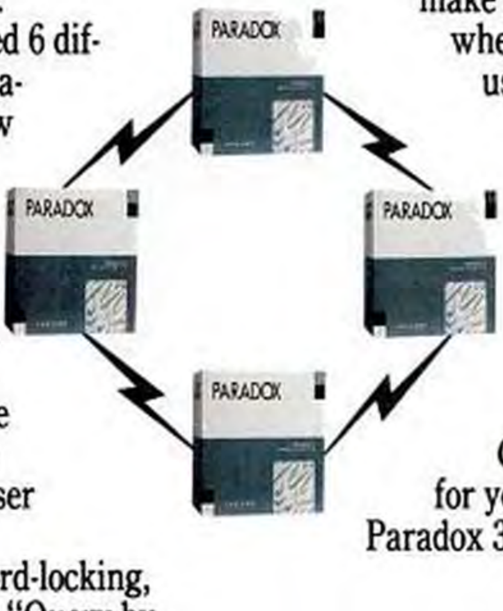

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Plus, you get unlimited scalable, rotatable fonts along with all of the PostScript special effects, including support for powerful grey scale generation, character path, complex clipping, arbitrary image scaling and rotation, and curve drawing with flatness control.

PreScript requires no expensive printer controller. No extra printer memory. No external drivers. No soft fonts or font cartridges. No hidden costs.

So make your LaserJet take off for pennies. Power up with PreScript: 13 fonts ($195); 35 fonts ($395); optional interface card ($195).

System requirements: 286 or 386 PC with 2 MB of extended memory; DOS 3.1 or higher; PreScript also works with the HP DeskJet and other HP-PCL compatible printers.

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Graphics
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CIRCLE 342 ON READER SERVICE CARD

PixSure File

CONTINUED FROM PAGE 56

screens. According to the company, over 3,200 full-screen images, or 8,300 quarter-screen images, can be stored on a 100MB hard disk.

Other features of *PixSure File* include mouse support for the program generator and all generated databases; pull-down menus; support for character, numeric, decimal, logical, and date fields; full support for indexing facilities; on-line help; label rotation and editing facilities; and support for .PCX-format files.

PixSure File supports both VGA and Targa16 graphics capture boards. According to the company, future releases of the package will have the ability to generate C, BASIC, Pascal, and standalone .EXE files.

List Price: *PixSure File Pictorial Database*, $995; with Jovian Logic graphics capture board, $1,495. **Requires:** IBM PC AT, PS/2, or compatible; 640K RAM; hard disk; 1MB EMS memory; Microsoft or compatible mouse; VGA or Targa16 graphics capture board (for software-only version); DOS 3.1 or later.
Norick Data Systems Inc., 5400 NW Grand, #450, Oklahoma City, OK 73112; (800) 521-EASY, (405) 947-7560.

CIRCLE 443 ON READER SERVICE CARD

Filter Packs Enhance GEM Applications' Import Capabilities

NEW

Users of many popular graphics packages, such as *Freelance*, *Harvard Graphics*, and *PC Paintbrush*, now have access to GEM-based applications that also speak their language.

Digital Research's collection of $15 *Filter Pack* programs allows users to convert .PIC, .PCX, .TIF, .DXF, and .CGM files to GEM format from the DOS command line. Each *Filter Pack* supports one file format and will work with any GEM application, including *Ventura Publisher*, *Draw Plus*, and *GEM Artline*. In the case of *GEM Desktop Publisher*, the newly supported files may be read directly into the application.

List Price: *Filter Pack*, $15 each. **Requires:** Any GEM-based application. Digital Research Inc., Box DRI, Monterey, CA 93942; (408) 649-3896.

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By an editorial study as published in the Sept. 18, 1989 issue of:

PC WEEK

SCOREBOARD

Attributes	American Power Model 450AT	Exide Powerware Personal 500	Para Systems Minuteman 300	Safe Power Safe 350	Toessng UPS-5150N
Length of time of power backup	9	8	10	7	8
Quality of documentation	8	8	9	8	8
Price relative to other power-protection units costing under $550	8	9	7	10	7
Presence of on-site indicator light	3	5	10	3	8
Ease of installation/configuration	10	10	10	10	10
Weighted Score	7.6	7.6	9.2	7.6	8.2

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CIRCLE 229 ON READER SERVICE CARD

FY '89
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1989
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Paste

Many utilities thrive only on misfortune. PC Tools provides first-rate accident insurance plus much more.

Our desktop manager is one of our most noteworthy features. It has a word processor, database, autodialer, telecommunications and much more. Including a calendar to help you keep appointments, print out to do lists, even graph your free time.

Find files and preview them in their native formats (including 1-2-3 and dBase) in a fraction of the time it formerly took. Hit LAUNCH and your application and associated data file are automatically loaded.

Our clipboard lets you cut information from your spreadsheet and paste it into your word processor (or any other application) without re-entering data or text.

A new visio

Accidents happen.

And when they do, nobody makes it easier to recover a deleted file or restore a hard disk than PC Tools Deluxe. But Central Point Software believes a utility product should do more than just protect you from misfortune. More than simply back up your hard disk, recover an inadvertently deleted file, or allow you to manage your files from a DOS shell.

Central Point's vision is that a utility product should enhance your productivity every moment you're at the keyboard. It should simplify the way you find, preview and load a 1-2-3 spreadsheet. Make it easy to combine the contents of one document into another. Even allow you to look up a client's address while you're in the middle of another application. Everyday tasks. Tasks that, without PC Tools Deluxe, are difficult to do and take far too much time.

But it's not just what PC Tools Deluxe does that makes it different. Its windowed environment makes doing these things (as well as all of its other functions) simple. The environment's movable, resizable win-

Express Lanes
OPEN

Our PC CACHE can accelerate disk intensive applications dramatically.

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Lost: 12 subdirectories, 350 DOC files, 221 WR1 files. Last seen in vicinity of 40 Meg. hard drive. Reward.

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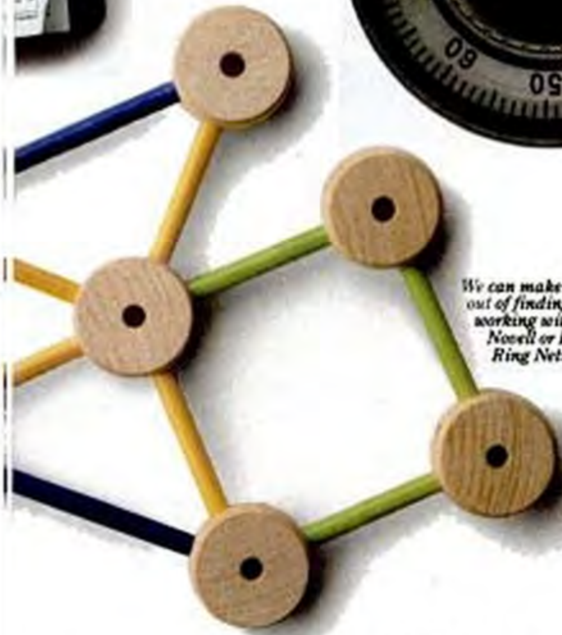

We can make child's play out of finding and working with files on Novell or IBM Token Ring Networks.

In the event your disk goes up in smoke, PC BACKUP makes sure you won't get burned. It's breathtakingly fast, reliable and extremely easy to use.

n of utilities.

dows, full mouse support, pull-down menus and context sensitive help make learning and using the product a breeze. And PC Tools Deluxe conforms to IBM's Systems Application Architecture (or SAA) standards so its look and feel is almost identical to all the other applications you'll see in the 90s.

PC Tools Deluxe. It has redefined what a utility product should be. Designed not only to protect you from misfortune, but to make using your computer as fast and easy as it should be. So, even if you never have had an accident in your entire life, you'll still benefit from PC Tools the very moment you start using it.

PC Tools Deluxe 5.5

Central Point Software INC

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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

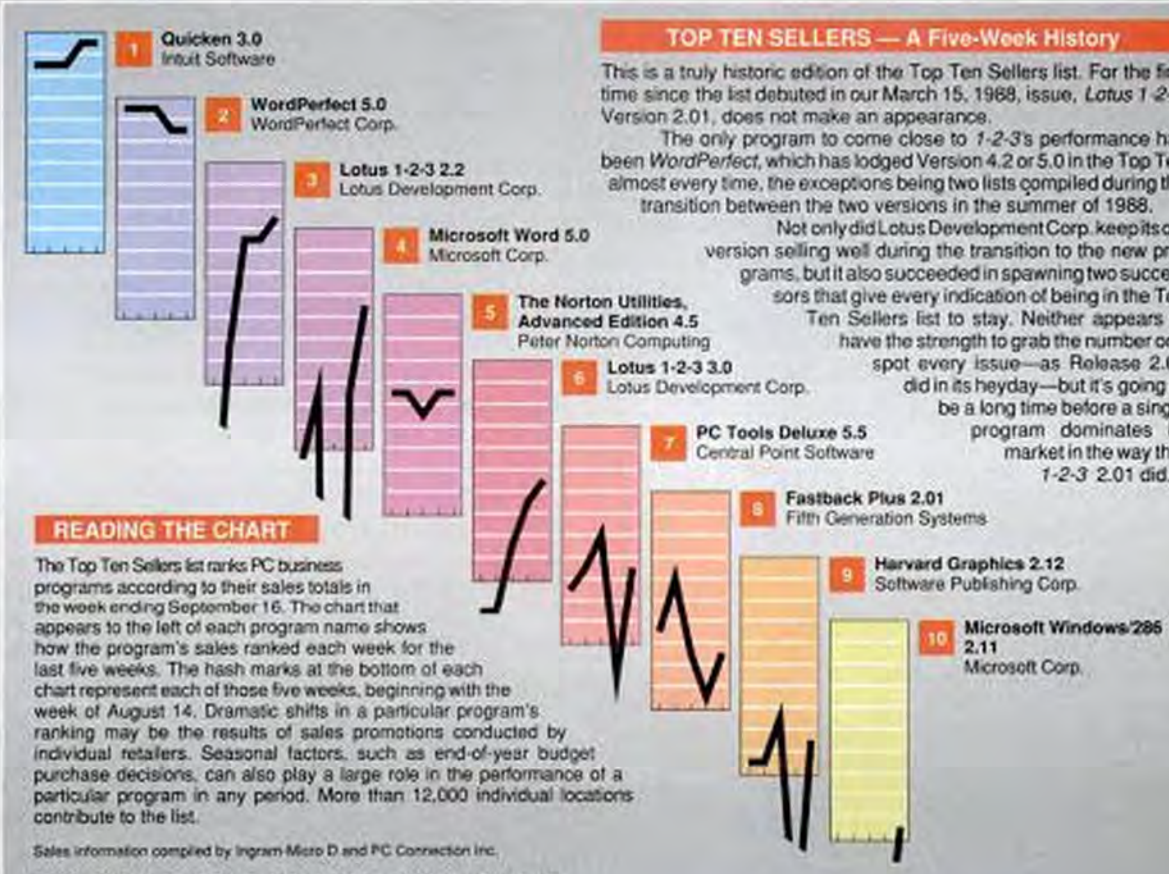
Microsoft and Apple Gang Up on Adobe; PostScript Specs Slip into the Open

Faced with the prospect of being trampled by two giants, John Warnock, president of Adobe Systems, appealed to the court of public opinion with a bold and risky move last month. After spending years building a proprietary standard for defining how to print typefaces and graphics on a wide range of output devices, Adobe will unveil the inner workings of PostScript early next year, according to Warnock.

Warnock is changing Adobe's successful (and highly profitable) course only under extreme duress, of course. He's faced with a Microsoft-Apple alliance that was formed for the sole purpose of wresting control over high-end laser printers away from Adobe's page description language (PDL), PostScript.

Not only have Microsoft and Apple been unhappy about paying royalties to Adobe for its technology, they also feel vulnerable: both companies would rather have their own programmers hammering away at PDL drivers instead of waiting for Adobe's people to get around to it. Smaller software publishers and printer makers have been grumbling about Adobe's high rates for some time, and clones of the language have been marketed with small success, but this is the first real challenge to Adobe's dominance since Apple's LaserWriter and Aldus Corp.'s *PageMaker* on the Mac started talking to each other through the PostScript interpreter—a

CONTINUES ON PAGE 64



TOP TEN SELLERS — A Five-Week History

This is a truly historic edition of the Top Ten Sellers list. For the first time since the list debuted in our March 15, 1988, issue, *Lotus 1-2-3, Version 2.01*, does not make an appearance.

The only program to come close to *1-2-3*'s performance has been *WordPerfect*, which has lodged Version 4.2 or 5.0 in the Top Ten almost every time, the exceptions being two lists compiled during the transition between the two versions in the summer of 1988.

Not only did Lotus Development Corp. keep its old version selling well during the transition to the new programs, but it also succeeded in spawning two successors that give every indication of being in the Top Ten Sellers list to stay. Neither appears to have the strength to grab the number one spot every issue—as Release 2.01 did in its heyday—but it's going to be a long time before a single program dominates its market in the way that *1-2-3* 2.01 did.

READING THE CHART

The Top Ten Sellers list ranks PC business programs according to their sales totals in the week ending September 16. The chart that appears to the left of each program name shows how the program's sales ranked each week for the last five weeks. The hash marks at the bottom of each chart represent each of those five weeks, beginning with the week of August 14. Dramatic shifts in a particular program's ranking may be the results of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Micro D and PC Connection Inc.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

Pipeline

CONTINUED FROM PAGE 63

rapport that created the concept of desktop publishing.

Of course, after Adobe takes the wraps off PostScript's inner workings next year, no one will have to depend on Adobe. Ironically, Microsoft says it's still going to stay its course with Apple rather than attempt to make peace with the language's creators.

Adobe will have to prove that it can make superior use of its own language in software drivers and printer ROM controllers to keep the company thriving. Early word is that the Microsoft-Apple emulation is several times faster than Adobe's, but a real product is many months away.

Apple's Change of Heart

Adobe's success with PostScript has been nothing short of breathtaking in the last couple of years; PC software, desktop laser printers, and top-of-the-line page-composition systems settled on PostScript as a common choice. HP's LaserJet-based PCL is the most popular way to print standard office documents today, but even among $2,000 laser printers, the future trend is toward PostScript on font cartridges. (Adobe-licensed PostScript cartridges should be available for less than $1,000 by the end of the year; PostScript clone cartridges are available for less right now.)

> **Early word is that the Microsoft-Apple emulation is several times faster than Adobe's.**

The company's hand was forced by the combination of Microsoft's unwillingness to pay royalties for the use of PostScript in OS/2 and Apple's change of heart. (Apple severed its long relationship with Adobe earlier this year for reasons that are still mysterious but that may have something to do with Adobe's budding relationship with Steve Jobs's NeXT project.)

In searching for its own font-printing technology, Microsoft had acquired a tiny company, Bauer Enterprises, that had cracked most of Adobe's secret font-hinting techniques (the algorithms that make best use of a printer's fixed number of dots in depicting smooth and precisely drawn characters).

A new way to control fonts has long been needed for OS/2 (see the June 13, 1989, Pipeline). It had seemed that Microsoft would create a new technique for displaying and printing both characters and graphics. Now, by emulating a successful standard, Microsoft is opening up a PDL clone market in the same way that Phoenix Systems broke IBM's PC BIOS wide open.

The one ingredient that both sides still must get from a third party is the typefaces. Adobe's typefaces are sold under license from Agfa-Compugraphic, Bitstream, and Linotronic; all three now say they'll cooperate with Microsoft and Apple while continuing their relationship with Adobe.

The prevalence of PostScript on PCs has helped these three companies gain royalties from the growth in desktop publishing, so they'll support any scheme that puts their typefaces on a greater number of printers.

At Least a Year Away

It's hard to say how long it will be before you're able to get true WYSIWYG PostScript-compatible fonts in PC applications because Microsoft doesn't expect to wrap the technology into OS/2 code until Version 2.0 at the earliest (OS/2 1.2 is just now being completed), but it's probably a year away.

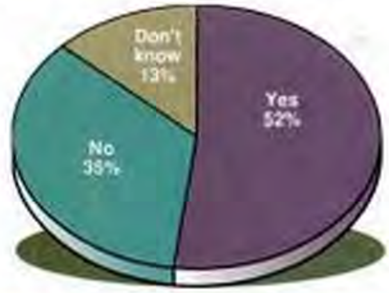
Since Microsoft expects that its implementation will be fully compatible with today's PostScript printers, these new developments only confirm the value of PostScript as the preeminent printing standard for today and for the future.

They also prove yet again the strength of an established standard in the PC market — and the frailty of standards ownership. ■

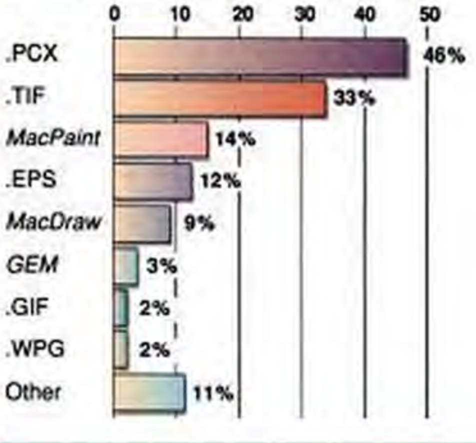
PC MagNet SURVEY

You can see the growing impact of PostScript in the results of this survey we recently took on PC MagNet. The popular .PCX and .TIF graphics file formats are being joined by Encapsulated PostScript (.EPS).

Is clip-art software used in your office?



In which formats do you store your clip art?



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- FoxPro gives you choices instead of limits: use a mouse or a keyboard; type commands or use the object-oriented interface; run in one window, or hundreds.
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System Requirements: *FoxPro operates in 512K RAM (640K recommended) with MS/PC-DOS 2.0 or greater and an 8086/8088, 80286 or 80386 microprocessor. For optimum performance, FoxPro takes complete advantage of any available EMS (expanded memory) or a math coprocessor.*

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CIRCLE 112 ON READER SERVICE CARD

Bill Machrone

However hot today's battles may be, rapid change ensures that they just won't matter in the end. And the end will come sooner than you think.

Fred Astaire was, for many, a living symbol of urbanity and civility. And his personal style wasn't far removed from his screen image. My favorite Astaire story has him in a bar when two patrons begin brawling. Astaire, ever the gentleman, saunters over to the combatants, places his hands on their shoulders, and says, "Come on, fellows, what will it all mean in a hundred years?" Both men angrily turned on Astaire for so trivializing their travail.

Astaire's role, and the fighters' anger, isn't all that different from the acrimony that results when people attempt to select appropriate technology from the vast array of choices the market offers. Today's platform wars are destined to become insignificant—not in a hundred years, but in ten years, or even five.

Any industry that, like the PC industry, regards a year of 15 percent expansion as slow is definitely in hypergrowth mode. Even zero growth would put about 7 million new machines into the market in 1990. And hypergrowth is accompanied by hyperchange, with replacement technology emerging as frequently as every 12 to 14 months. Unlike the artificial cycles created by Detroit, these are real changes—everything is getting faster, cheaper, and higher in capacity.

The PC is evolving from a handy and productive business tool to an agent of social change. And it's doing so at such a breathtaking rate that many of us are having difficulty keeping up with it. We must absorb the PC industry's phenomenal outpouring of technology or weather the guilt that comes from the knowledge that we're behind the technology curve.

SUSPICIOUS SUPERLATIVES

Prefixes such as *hyper-* and *mega-* tend to bring out the cynic in me. Yet I've signed on fully for hyperchange in the PC market. The user market is divided into three groups: the haves, the have-lesses, and the have-nots. At *PC Magazine*, we have positioned ourselves as a chronicler of the haves. This irritates the have-lesses because it forcefully reminds them that their systems are not only obsolescent but also overpriced.

One thing the haves and have-lesses can agree on is the pitiful plight of the have-nots. At today's prices, no business professional need be without a PC. Yet many still spread their arms and ask, "What do I need one for?" Some have-nots are technophobic. Others simply can't type. And still others are waiting for an application that has more bearing on their jobs, a view with some validity. For the last group, local area networks will deliver the message forcefully. These have-nots will be unable to participate in their workgroups, whether as workers or supervisors, unless they use PCs.

Not since the introduction of the automobile have there been such dislocations over a product. Yet we look back at those early days of automotive confusion with bemusement and a faint sense of superiority. After all, time was when directional signals were illegal, some argued for bells instead of horns, and early automotive enthusiasts were greeted far and wide with the cry "Get a horse!"

ILLUSTRATION: ROBERT PASTERNAK

Today, no one questions the role of the automobile in decentralizing America, whose overcrowded, manure-paved cities would otherwise have choked. Decentralization is necessary for growth, and rapid decentralization is necessary for hypergrowth. This magazine owes its existence to hypergrowth, and to its readers' insistence on knowing all of the alternatives that are available to them in their

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struggle to deal with change.

One of our most loyal and outspoken readers, Ken Ganshirt, works for one of the Canadian telephone giants. He's worked his way out from the highly citified mainframe shop to the urban minicomputer to the decidedly suburban and individualistic PC.

"We've always followed the technology up rather than the pricing down," says Ganshirt. "Senior management now expects us to stay with the current technology as soon as it is stable and at our price point (which we've pushed up a bit from the early days). This has served us well. When business users are ready to take advantage of the next levels of functionality available, the necessary platforms are there."

THROWAWAY SYSTEMS

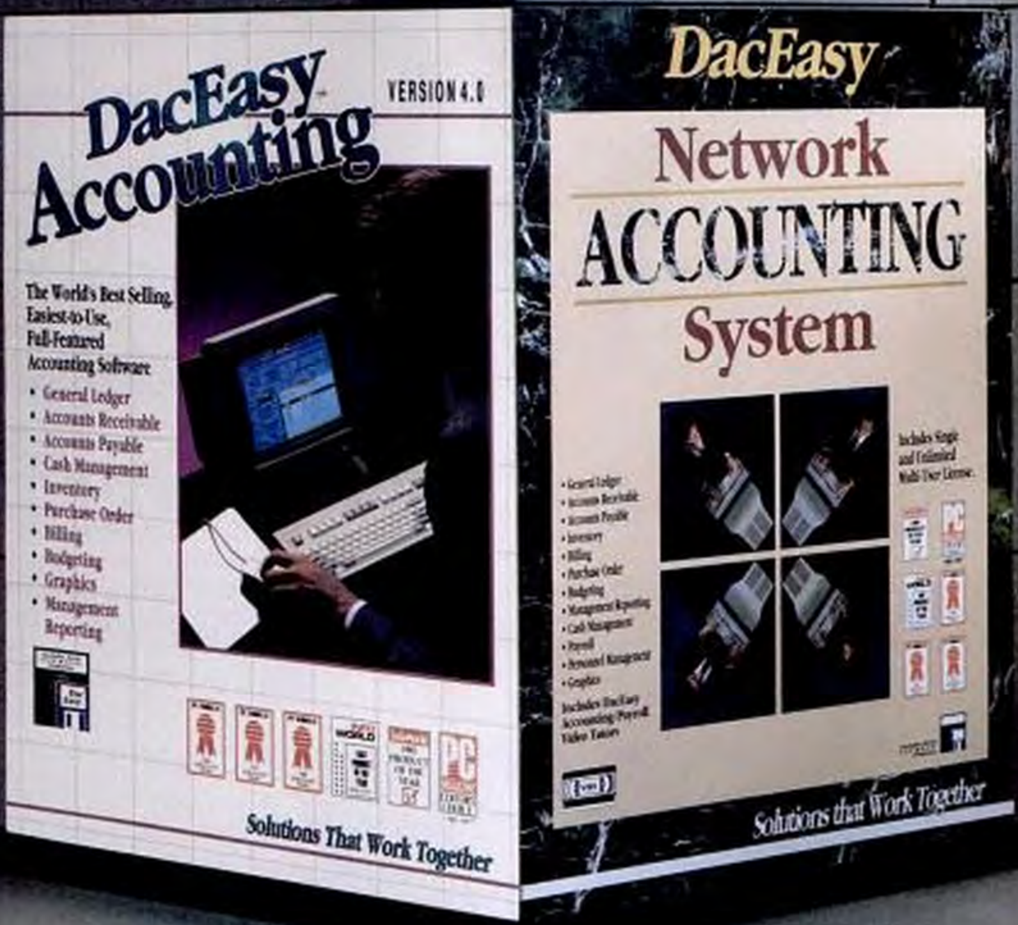
In some companies, this thinking has progressed to the point where PCs are regarded as consumable goods by the system builders. They design a system to accomplish a goal and to save money right now. They think of the PC not as capital equipment, but as an investment. They reap its financial benefits and then scrap it. They don't wait for standards; they capitalize on results.

Of course, "scrapping it" has a different meaning to the micro managers than to the accountants. Nobody's seen a PC go out in the trash yet. PCs get redeployed, perhaps half a dozen times. The forward thinkers don't worry about whose department is taking the depreciation or whether they've exhausted a given department's capital budget.

The key to success is balancing the needs of workgroups against the fiscal needs of the company. Micro managers are faced with an incredible array of choices, from cheap old technology to expensive new technology. They've got to balance what's installed against what's available against what's affordable.

PC Magazine will continue to do its part by concentrating on the leading-edge technologies. You don't need us to rehash old choices, and you don't need us to reconfirm the decisions you've already made. We'll continue, instead, to refine the comparative review, with the goal of making this magazine even more dense and information-rich. ■

The Cornerstone of Your Growing Business.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CIRCLE 194 ON READER SERVICE CARD

John C. Dvorak

Feeling a little lousy lately? Maybe it comes from "waiting till next year" for panaceas that never materialize.

It's called Presentation Manager Syndrome, PMS for short. It causes all sorts of problems for the afflicted. Nervousness, headaches, cramps, irritability. In short, PMS is the preannouncement or promise of something better than the bug-ridden product you are using. This promise is actually an excuse. The end user is the one who gets the headaches and cramps.

This isn't a new syndrome, though it seems to have climaxed during the recent two-year-long wait for Presentation Manager as the be-all, end-all, cure-all killer front end that will make OS/2 a knockout success.

It actually goes back to the days of CP/M and the S-100 bus. In the 1970s, when users had complaints, they were told not to worry, the new CP/M-Plus and the S-100 bus IEEE-696 standard would solve their problems. When CP/M-Plus finally came, the IBM PC was on its way to making history. By the time the S-100 bus was standardized, nobody cared.

Software vendors have always relied on such stalling tactics to string along the hapless user. The next bug fix is always "just around the corner." Recently, for instance, I had the unfortunate experience of trying to migrate to *Microsoft Windows/386*. I soon ran into one of those peculiar bugs that you always find in software whose target machine is actually a slew of machines, each of which is slightly different. My Everex 386 uses a Compaq video card, and I got a wacky configuration-error message after watching *Windows/386* work just fine for about a day. The factor that changed and made the error message appear was never discovered.

Anyway, I moan about this to an ex-Microsoft acquaintance, who decides to help me. He calls some of his *Windows* buddies at Microsoft to find out what's wrong. First off, we discover that some of the offending code was actually contributed by Compaq. "They screwed it up," I'm told. Microsoft, of course, is blameless. Then I'm told that Microsoft actually writes with the Compaq as the target machine. Interesting fact, I think to myself. Nevertheless, part of this code doesn't like the Compaq VGA card. What to do, what to do?

Finally, my friend gets off the phone and says, "Do you want me to tell you what you should really do? They say to wait for *Windows* 3.0. It solves all these problems." *Windows* 3.0? Slowly . . . step by step . . . inch by inch—PMS!

BAD MEMORIES

This wasn't my first experience with *Windows*-induced PMS. It reared its head when I complained about the ugliness of *Windows* and got a memo from Machrone, who said, "Are you sure you want to say these bad things? They'll be corrected in *Windows* 3.0!" Arrgh. Cramps. Nausea. I also got it when I griped about how *Windows* does such a poor job of running straight DOS applications. I was told, "*Windows* 3.0 will improve it!" That created gas, the shakes, and two pimples.

I don't want to sound like I'm picking on poor little rich Microsoft. Other sources of PMS are everywhere, the long waits for *dBASE IV* and *Lotus 1-2-3*, Release 3.0, being prime examples. The difference, though, is that these products were never talked up as ultimate fixes for some sort of bug or irritation. Instead, they are being sold as killer "makeovers."

ILLUSTRATION: KURT FUTTA

Now we all know what a makeover is like, right? Remember *Symphony*? It was rolled out as the ultimate killer app—better than *1-2-3*. And remember *Framework*? It was sold as the killer makeover that would supplant *dBASE*.

Meanwhile, my advice for those of you who get headaches from endless promises of wonderful future improvements: take two aspirin. And get some sleep. ■

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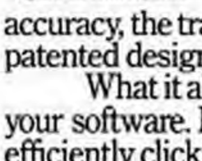
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John C.
Dvorak

Inside Track

While all the programmers in the world talk about C and Pascal and all their OOOPS or WHOOPS modifications, we forget the importance of BASIC—the language that launched the microcomputer revolution. It seems to have gotten lost in the shuffle, although Digital Research's DR-BASIC (whatever happened to that?) and Turbo Basic from Borland have made brief appearances.

The dominance of QuickBASIC, from Microsoft—perhaps one of the **greatest software packages** ever written—may actually have **ruined interest** in BASIC. After all, there is no longer any controversy or discussion on the subject of BASIC. Few observers have even noticed the lack of a BASIC for *Microsoft Windows*, despite the fact that *Windows* has been out for years.

The original Altair BASIC was written from scratch by Bill Gates and Paul Allen in less than a year. So one assumes that the **hordes** of Microsoft programmers could easily do BASIC for *Windows*, especially since they can use the already complete Microsoft BASIC code as a starting point. All that this says to me, therefore, is that *Windows* is **incredibly difficult to write for.** I mean, even Microsoft can't do it.

> "Should we format the diskettes all at once? OK, but only six fit in the slot at one time!" Gads!

Then again, the problem may lie elsewhere. It's obvious that all programs whose roots go back years and years are continuously modified until they turn into what's known as spaghetti code—**an undecipherable, convoluted mess.**

So it's amusing, but not surprising, to discover that Ethan Winer and his full-time staff of five can make a decent income supporting Microsoft QuickBASIC with add-ons, utilities, and improvements. **The talk of the programming community** is a replacement for the QuickBASIC library marketed by Winer's company, Crescent Software, of Stamford, Connecticut. It's called PDQ.

The company blurb says, "By removing the excessive hand-holding that QuickBASIC normally adds, PDQ programs can be nearly as small and fast as if they were written in assembly language. What makes most BASIC programs so large is the mandatory error checking that is present in the BASIC language library. By completely replacing that library, we are able to achieve extremely fast and small .EXE files—much smaller than C, and even competitive with assembly language."

PDQ also allows you to **turn any BASIC program into a TSR!** Fully executable .EXE files can be compiled down to as little as 690 bytes! If you think BASIC is dead, you'd better check out this $99 software package from Crescent. Phone them at (203) 846-2500. **Hot stuff,** for sure.

Software for the Rest of Us Dept.: Those of you who don't want to get too involved in BASIC or any kind of real programming but would like to **impress the boss** with a little compiled code once in a while should check out BATCOM. It's great. This nifty product will **take any DOS batch file** that you write and turn it into an executable file that runs up to **four times faster** than the old .BAT file. Developers who rely on dopey batch files for demos or installation programs might consider using this package to clean up their acts. It also keeps prying eyes out of your batch files.

BATCOM is from Whenham Software, 5 Burley Rd., Whenham, MA 01984; (508) 774-7036. It costs $59.95 and includes an extended batch language for those who want to get carried away. It also provides you with a bunch of **interesting** compiled utilities. If you write a batch program that won't compile properly, the company will gladly help you, too. This is definitely a fun product.

Crazy Mistakes Dept. Redux: I got a letter from Jeff Drew with more "Crazy Mistakes." I couldn't wait to run them in the next installment of Crazy Mistakes, so here they are: "John, I loved your articles on Crazy Mistakes—the crazy but true experiences in the computer business. I've got a couple for you. The latest rage is 386 CPUs in a tower configuration, right? Well, I know a guy whose German Shepherd mistook the office 'tower' for a hydrant and cost the guy a **small fortune** in repairs.

"Then there's the one about the guy who unplugged the cable and kept one end higher than the other end so that the current wouldn't run out. And how about waiting for solder to dry! Should we format the diskettes all at once? OK, but only six fit in the slot at one time! When I loaded all my programs into memory and turned the machine off, they were still there; how do I get them out? Not so funny: a $100-million bank says it last backed up about a month ago. And then there's the expert who says, 'I only keep programs on my hard disk; data files are for diskettes!' " Gads!

Old News Dept.: Has anyone wondered about the federal ruling nearly a year ago in the NEC-Intel lawsuit concerning microcode copyrights?

According to recently published reports, "U.S. District Judge William Gray also ruled in the same case that a Japanese manufacturer **legally copied** microchip designs from a U.S. company." Apparently, Intel failed to protect its copyright of the 8088's innards because of some legal technicality. I wonder exactly why AMD or some other chip maker hasn't **cloned the chip** and made it run at 25 MHz. Is anyone awake out there? ■

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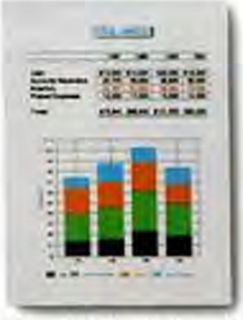

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With Monitor & Video Board	Mono	EGA	VGA
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- Shadow RAM for system & video BIOS relocation
- Supports EMS/LIM 4.0
- Supports 80287, 80387 and Weitek math coprocessors
- One 32-bit, five 16-bit & two 8-bit expansion slots
- 200W UL, CSA & TUV approved power supply (110/220V)
- ROM-based setup
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With Monitor & Video Board	Mono	EGA	VGA
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Jim Seymour

Market trends notwithstanding, the days of the 286 are numbered. And Intel's new low-power version of the 386SX will put the last nail in its coffin.

Today, there is no defensible reason for buying an 80286-based desktop PC for use in business. And by about this time next year, there will be no defensible reason for buying an 80286-based laptop PC for use in business, either.

Them's my premises. Now let's argue 'em.

First, let me acknowledge that my view appears to be out of sync with what the market says. In *PC Magazine*'s review of new 12-MHz 286s a couple of months ago ("286s: No Frills, Few Thrills," September 12, 1989), the market research graphs on page 160 showed that the popularity of 286 PCs is growing, not declining.

The Dataquest chart says that 39 percent of the 1988 market for corporate, education, and government PCs was claimed by 286s, with 386s and 386SX machines picking up only 9 percent. A second pie shows Computer Intelligence's forecast for 1989 sales to the same markets, in which 286 machines jump to 51 percent of the market, while 386s and 386SXs creep up only one point, from 9 percent to 10 percent.

It's always problematic to compare data from two different sources. But the trend is clear: sales of 286s are soaring, while sales of 386s are merely increasing nicely, thank you.

Beyond the data that says the market is voting the other way, there's a second, equally irrelevant argument against me: very little 386-specific software is available today.

That would be a Big Deal if we were buying PCs today for use *only* today, and maybe tomorrow and next week and next month. But the companies I work with buy PCs on a three- to five-year time horizon. They expect to be able to use their computers fully for three years—which means using them to run the important new software that comes out over that time. And then they expect to go through a couple of years of reevaluation and handing down, selling the machines off to employees for home use.

I can promise you that over the next three years, the hot software is going to demand 386 PCs. In some cases you'll be able to kludge through with a fast 286 and lots of memory. But memory is expensive, and no matter how quickly today's 1-megabit DRAMs give way to 2Mb and 4Mb parts, memory is *always* going to be expensive.

So why stick all that expensive memory in a crippled machine, driven by a brain-dead chip? Especially when that machine was only marginally less expensive than a 386 machine in the first place.

UNLEASHING THE POWER

The importance of 386 PCs is going to become even more evident early in 1990, when Microsoft ships *Windows* 3.0. On a 386 PC, its vastly superior memory management will finally pull *Windows* into the mainstream, fulfilling (if years late) the forecasts that we're on our way to a world of graphical user interfaces.

And by late next year, we should see the 386 version of OS/2 with Presentation Manager—a.k.a. "real OS/2." That will also have a big impact on the business-PC market.

Even if you don't succumb at first to the charms of a graphical interface, you'll benefit from the raw speed of these faster machines. Which is the other reason we should stop buying 286s and start buying 386s, *now*.

ILLUSTRATION: ROBERT PASTERNAK

I run only a couple of applications that directly exploit the advantages of the 386 chip. But my 386s run *386-to-the-Max*, a memory management utility, and the *Super PC-Kwik* disk cache. Always loaded at start-up from my AUTOEXEC.BAT file, those two utilities work together to create—only on a 386—a spec-

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tacularly fast, easy-to-manage workspace for *all* my DOS applications.

THE PRACTICAL 386 LAPTOP

I said that by this time next year, there won't be any good reason to buy a portable PC that doesn't have 386 power. The key here is Intel's low-power version of the 386SX chip.

Last April, Intel announced and shipped the first 386SX-LP, a special low-power version of the 386SX chip. It offers a new power-conservation mode—in effect, a "nap mode"—in which the chip is slowed down to 2 MHz, for power savings of up to 30 percent.

Equally important, the 386SX-LP is spec'd to run in environments with temperatures up to 100 degrees C., of critical importance in the tight, hot confines of a laptop case.

We haven't seen much use of that 386SX-LP power-conservation feature yet. But we will, beginning with machines that will make their debut at this fall's Comdex show.

But the real winner—you read it here first, folks—is going to be a new version of the 386SX-LP, which will go into production at Intel later this year.

By moving from the CMOS III process, which uses 1.5-micron-wide traces on the chip, to the new CMOS IV process, which uses incredibly fine 1-micron traces, Intel will be able to offer that 30 percent savings in power consumption while running the chip at its full rated speed of 16 MHz.

Intel has also promised a 20-MHz 386SX-LP for sometime next year. That's interesting, but not nearly so interesting or important as this new, truly-lower-power 386SX.

Attentive readers may complain that I'm singing a very different tune than I was as little as 15 months ago, when I wrote here that Harris's then-new 20-MHz 286s proved that the 286 design still had a lot of life left in it.

True—but again, irrelevant. Times change. After all, eight years ago, I was raving about the virtues of the 8088 chip.

The "386 imperative" isn't yet so strong that American business needs to retrofit or discard its existing fleet of 286 PCs—though that day is approaching. But it's clear that the time has come to stop buying new ones. ■

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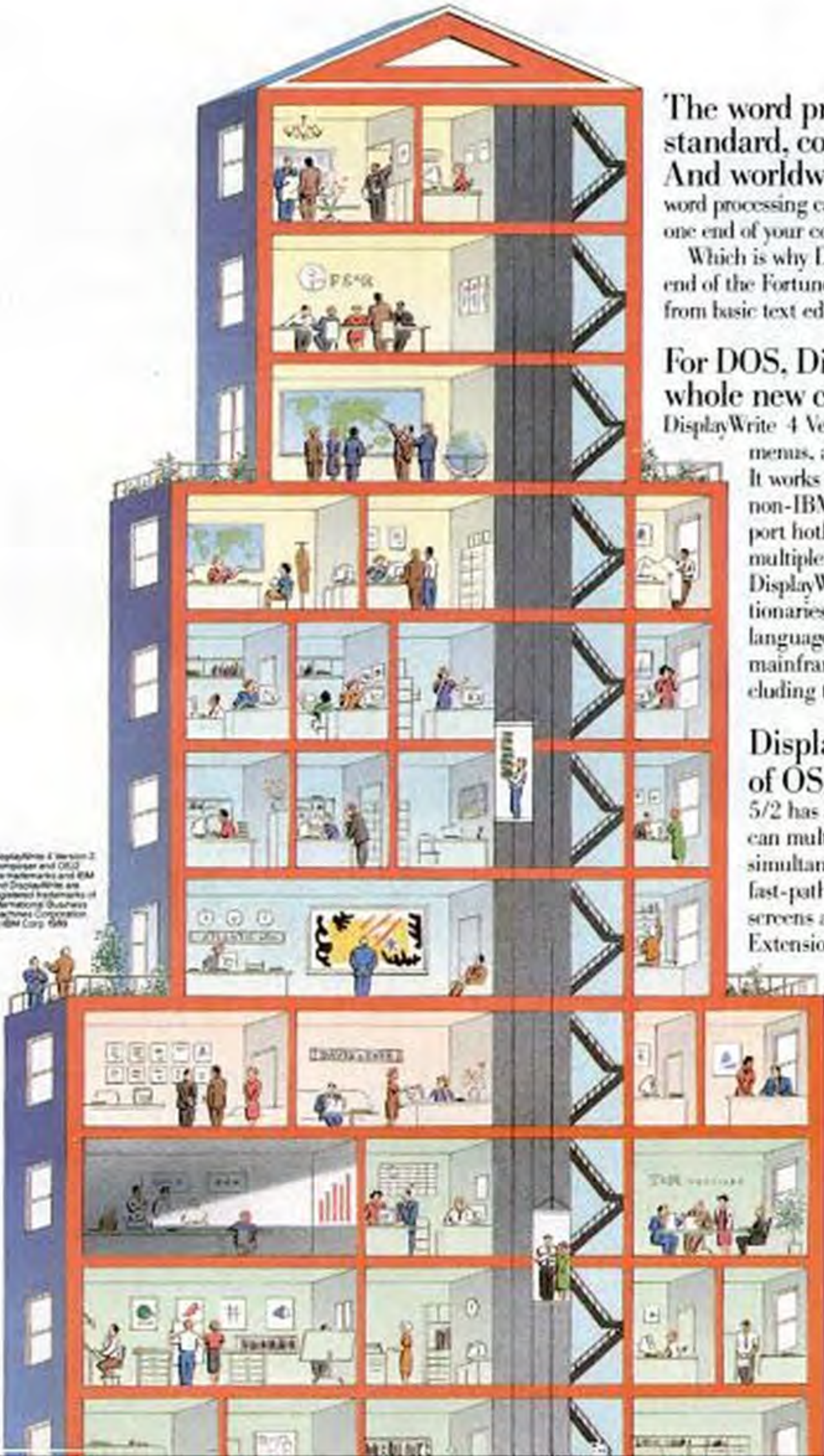

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William F. Zachmann

It's fashionable these days to run down OS/2's prospects. But for those with eyes to see, the big move is happening now.

To those who can read the signs in the computer industry the way Daniel Boone read the signs in the woods, it should be clear that the shift toward OS/2 is now under way. Those who can't spot a trend until it is writ large on the billboard of major market surveys, however, are having a hard time seeing what's going on.

There are lots of reasons why the city slickers of the industry, unable to find their way without a road map, aren't yet able to discern the shift in the weather. Mainly, though, it's because they're operating on false assumptions about what it takes to make the move to OS/2 worth doing.

Two months ago I noted in passing that there are two major requirements for OS/2 to get rolling (*PC Magazine*, September 26, 1989): first, it must reliably furnish all the capabilities already available from DOS; and second, it must offer enhanced capabilities sufficient to justify the added expense and effort required to use it.

Those who claim that significant use of OS/2 is still years away, that *Microsoft Windows* will dominate the market for the next several years, that programs like *DESQview* and *386-to-the-Max* will remain better alternatives for multitasking existing DOS programs, that the introduction of *Windows* 3.0 will make OS/2 unnecessary, or that Unix will take over the desktop arena are all off the trail. Their assumptions have led them astray.

The first misleading assumption is the myth of the "killer app." According to this view, simply doing what DOS already does doesn't justify the cost of the upgrade. People won't move to OS/2, it is assumed, until some spectacular new application that makes full use of OS/2's capabilities comes to market.

In fact, word processors and spreadsheet programs are the applications that real people spend most of their time using. Add database, graphics, and communications packages to the list and you've accounted for something like 90 percent of personal computer use.

These "big five" were the main applications of early CP/M computers. They are the main applications on IBM-compatible PCs and Apple Macintoshes today. And they will be the main applications on OS/2 computers tomorrow. We didn't need a brand new "killer app" to move from CP/M to MS-DOS, and we won't require one to move from DOS to OS/2.

For it isn't the ability to do brand-new types of applications but the ability to do the old types of applications better that will justify the switch to OS/2. The "killer apps" won't be entirely new types of applications at all. Instead, they will simply be better spreadsheet, word processing, communications, graphics, database, and utility programs, offering more power, more speed, and greater ease of use than their DOS counterparts.

A LITTLE HISTORY LESSON

Those with short memories and a distorted sense of history sometimes cite *Lotus 1-2-3* as the stimulant for the move from CP/M to DOS. In fact, the movement to DOS was well under way when *1-2-3* was announced. The program did bring about a better way of doing things in the already established category of electronic spreadsheets by making better use of the enhanced capabilities of DOS and the 8088. It was not, however, the reason that DOS became a success.

ILLUSTRATION: ROBERT PASTERNAK

Today *1-2-3*, Release 3, already offers an OS/2-capable spreadsheet, and other spreadsheet vendors will soon release their own OS/2-based products. OS/2 versions of existing word processing, communications, data-

William F. Zachmann

base, and graphics programs are also available today, with more competition on the way. And new programs in these categories—programs that make full use of OS/2's advanced capabilities—can't be far behind.

The city slickers also fall down in their assessment of the costs of moving to OS/2. They assume that thousands of dollars in added hardware and software will be required. What they fail to recognize, however, is that not everyone is starting out with a 10-MHz 286 system with only 1MB of RAM and 20- or 40MB of hard disk space.

If everyone had a 286 and wanted to move to OS/2 Extended Edition, the costs would be quite high. But many users already have 386 systems with 100MB of hard disk capacity and 4MB or more of memory. And the vast majority of OS/2 converts are heading for the Standard Edition, not the Extended Edition.

For this reason, the "DOS forever" scenario is *way* off base. A system that can really put *DESQview 386* or *Windows* 3.0 to work is perfectly capable of making effective use of OS/2 Standard Edition. In fact, it will be these power users who will most likely be the first to switch to OS/2. Not only do they already have systems that can run OS/2, but they also have demonstrated a clear interest in the capabilities that OS/2 can offer.

Similarly, the argument that *Windows* 3.0 muddies the waters and will slow the movement to OS/2 fails to withstand the test of reality. On the contrary, *Windows* 3.0 makes the transition from *Windows* to OS/2 easier. It will help accelerate the acceptance of both *Windows* and OS/2 by creating a smoother bridge from older, less-capable DOS systems.

Yet another set of wrong assumptions concerns OS/2's ability to run DOS applications in the compatibility box. Lots of people who have little or no direct experience with OS/2 like to refer to it as the "penalty box," evoking vague concerns about its stability.

In fact, as anyone can verify simply by using OS/2 for a little while, the compatibility box causes very few problems in running DOS programs, including communications programs. *None* of the many DOS applications I use regularly has had any problem running under OS/2.

If those who are still mired in the swamp would simply look about them, they would quickly realize that they are underestimating OS/2 today just as surely as they overestimated it two and a half years ago. They would also see clear signs that OS/2 is on the verge of acceptance—first among the leading-edge users and before long by a substantial number of ordinary users.

More and more decision makers are encouraging the shift to OS/2. What is still only a trickle will be a steady stream by spring, and by the end of next year OS/2 will be well on its way toward becoming the mainstream operating system for IBM-compatible PCs.

Despite what is said today by those whose foresight is as bad as their assumptions, the future lies with OS/2. And that future isn't as remote as it may seem. It's just around the bend. ■

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Wait State	0	0	0	0	0
Standard Memory	640K	1 MB	1 MB	1 MB	1 MB
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Cache Memory	–	–	–	32 K	32K
Co-Processor Slot	Yes	Yes	Yes	Yes	Yes
Expansion Slots (8 bit)	8	2	2	2	2
Expansion Slots (16 bit)	–	6	6	5	5
Expansion Slt (32 bit)	–	–	–	1	1
FD/HD Controller	W/HD	Yes	Yes	Yes	Yes
Device Bays	4	3	3	5	5
Serial Ports	1	2	2	2	2
Parallel Ports	1	1	1	1	1
Game Port	1	1	1	1	1
Clock/Calendar	Yes	Yes	Yes	Yes	Yes
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CIRCLE 247 ON READER SERVICE CARD

Stephen Manes

After years of working with keyboards and screens, we still have no true standard for moving the cursor. The latest candidate employs two all-but-forgotten devices: your thumbs.

Within our wildly fickle computer universe, a single century-old invention continues to be used more often than any mechanism developed in our high-tech age. Universal, indispensable, instantly recognizable, this brilliant device has withstood the test of time to become the single common feature of virtually every personal computer and terminal ever built—not to mention a host of other machines, mechanical and electronic. I refer, of course, to the spacebar.

No matter how much engineers transmute, permute, and pervert keyboards, the spacebar remains the sole constant. Function, cursor, and punctuation keys waltz all over the board and acquire new siblings. The Enter and Backspace keys grow and shrink like Alice in Wonderland. International conventions and speed-typing proselytizers waving the Dvorak banner make even the alphabet meander.

But though the good old spacebar may vary a mite in height and girth, it always ends up right where you want it, your willing slave, under your thumb. We take the spacebar so much for granted that nobody even bothers to label it. Space, as Sun Ra says, is the place.

The spacebar's endurance is quite a tribute to whoever—my references are mute on this point—came up with it. The typewriter was patented in 1868 and first marketed in 1874. The first citation for the term *space key* in the Oxford English Dictionary is from 1875: the sentence fragment "By holding the space key [of a type-writer] down while an 'I' and 'S' are struck"—to produce, I suspect, the mark of the Yankee dollar.

1888 marked the first literary step up to the *bar*: "In front of the four banks of keys there is a narrow strip of wood which is called the 'space-bar'." From this we can draw two conclusions: first, a dozen years were all it took for the spacebar to become commonplace, and second, savvy merchandisers missed their opportunity to license "Spacebar Centennial" souvenirs.

The typewriter spacebar—we must remind those striplings who stare at typewriters and wonder where the Escape key is—simply moved the carriage along one space, thereby serving the function not only of spacing but also of a computer keyboard's Right Arrow key. The backspace key, necessarily "nondestructive," was the old-fashioned equivalent of the Left Arrow; not until the invention of the correcting Selectric could a single key both backspace and munch. To this day, users who switch from typewriters to word processors must wean themselves from the habit of navigating the screen by spacing and backspacing.

A QUIVER OF ARROWS

Given the importance of cursor navigation, the pace of computer development, and the number of years that have passed since the introduction of terminals, one would surmise that cursor movement would by now have a spacebar of its own—a simple, intuitive, consistent, standardized interface. No such luck.

We're still dodging a quiver of arrows and a chain of supplementary keys that wander around from keyboard to keyboard, not to mention a plethora of "alternate input devices," from the multibutton key-mouse to the preternaturally weird Felix pointing device. Even the once-mandatory Macintosh mouse is reportedly slated to be destabilized by the advent of a trackball on Apple's portable Mac.

ILLUSTRATION: ROBERT PASTERNAK

Which brings us to the Isopoint key, newest entry in the cursor-movement sweepstakes. What seems to separate this device from all the rest is the same thing that made the spacebar what it is today: utter simplicity.

Stephen Manes

Just below the spacebar, for easy access by either thumb, sits the Isopoint key—a horizontal roller somewhat thinner than a drinking straw, exposed in a little cradle. Slide the roller left or right or thumb it up and down, and the cursor follows along. For a mouselike "click," push the roller down and let it go; hold the roller down while moving it for a classic "drag." Optional extra thumb switches on each side of the roller emulate mouse buttons two and three.

MIGRATORY RODENT

And that's it. The Isopoint key's use of the otherwise idle thumb seems ergonomically inspired. The key is always in the same handy place—unlike the migratory, drop-prone rodent that might better be termed a lemming. The Isopoint key leaves your hands in the main typing arena—unlike virtually every alternative, including most arrow keys. You can add the unit to an existing keyboard, but it makes more sense as an integral part of a keyboard's design—a particular plus for laptop machines in the dawn of the Graphical User Interface.

Drawbacks do spring to mind. Unlike a mouse or trackball, the Isopoint roller lacks "infinite" horizontal travel, relying instead on a spring-loaded switch to sense that you want to push the cursor beyond screen's edge. But even with mice, handling screen boundaries is really a problem of software rather than hardware.

The Isopoint key is probably not the device of choice for graphics; artists will probably miss the grand sweep of elbow and wrist. But for daily tasks—moving the cursor, picking menus, and the like—the device seems a real boon. Today, the hardware works with standard mouse drivers; someday, software conventions such as those used with today's arrow keys—say, Ctrl-Isopoint to speed things up, Alt-Isopoint to slow them down—could make the product even more useful.

Craig Culver, the Isopoint's inventor (Culver Research, 201 Ware Rd., Woodside, CA 94062), says he dreamed up the product when the Macintosh came out five years ago; it's since gone through roughly 50 iterations and three patents. He's been licensing it on a nonexclusive basis to various companies—the first licensee was Hewlett-Packard—but significant mechanical and electronic complications lurk behind the device's elegant facade.

At this writing, keyboard maker Alps Electric seems most committed to the product and poised to be the first manufacturer out with it. A manufacturer of mice and trackballs, Alps knows how to produce the complex optical encoders critical to the Isopoint key. At Spring Comdex, the firm showed prototypes of an add-on Isopoint key as well as machines with Isopoints built in. Result: machines with Alps-made Isopoints should hit the stores by the time these words see ink.

I don't want to overhype this thing; I've fooled around only with prototypes, and reactions among astute friends who've tried it vary from ecstasy to grunting. There is a long, dippy history of innovations that didn't quite make it, and this one could well end up just another footnote. But the Isopoint key seems different. With thumbs-up from users and a lot of luck, Culver might just earn the fame and fortune that apparently eluded the guy who invented the spacebar. ■

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EDITOR'S PICK

☆ ☆ ☆ ☆

TOP CHOICE

"...among brand-name systems, the HeadStart III is an uncommonly good buy."

HOME OFFICE COMPUTING, AUGUST, 1989

"I'd definitely recommend this machine to anyone who's considering an AT-class compatible."

COMPUTE'S PC MAGAZINE, SEPTEMBER, 1989

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INFOWORLD
AUGUST, 1989

"The HeadStart III is about as close to a no-hassle PC as I've seen."

LOS ANGELES TIMES, NOVEMBER 24, 1988

"If it sounds like we're raving about this machine we are."

COMPUTER BUYERS GUIDE, 1989

PC WORLD
BEST BUY

"...It's hard to imagine a better choice."

PC WORLD, JUNE, 1989

"Using a HeadStart III is almost as easy as plugging it in."

COMPUTER WORLD MAGAZINE, MAY, 1989

Publish-It!
Splash!

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SPEED: 12MHz/8 Switchable
BIOS: Award
BUILT IN RAM: 1 Megabyte
EXPANDABLE TO: 3 megabytes
POWER SUPPLY: 145 watts 110/220 switchable
KEYBOARD: 101 key PS/2 compatible
GRAPHICS: VGA Autosync
FLOPPY DRIVES: one 5.25" 1.2 megabyte, one 3.5" 1.44 megabyte
HARD DRIVE: 32.1 megabyte, 28 milliseconds, 1:1 interleave
BUILT IN INTERFACES: Parallel, 2 RS232 serial, mouse, joystick
EXPANSION SLOTS: 3 available
MOUSE: Standard
SOFTWARE: DOS 3.3, GW Basic, HeadStart Advanced Environment, Floppy Driver, Framework II, 3-D Graphics, ATI and Computer•Ease Tutorial Software, XTree hard disk manager, Publish-it! Chessmaster 2000, Splash!, VGA paint program, Bookmark, plus Twist and Shout.

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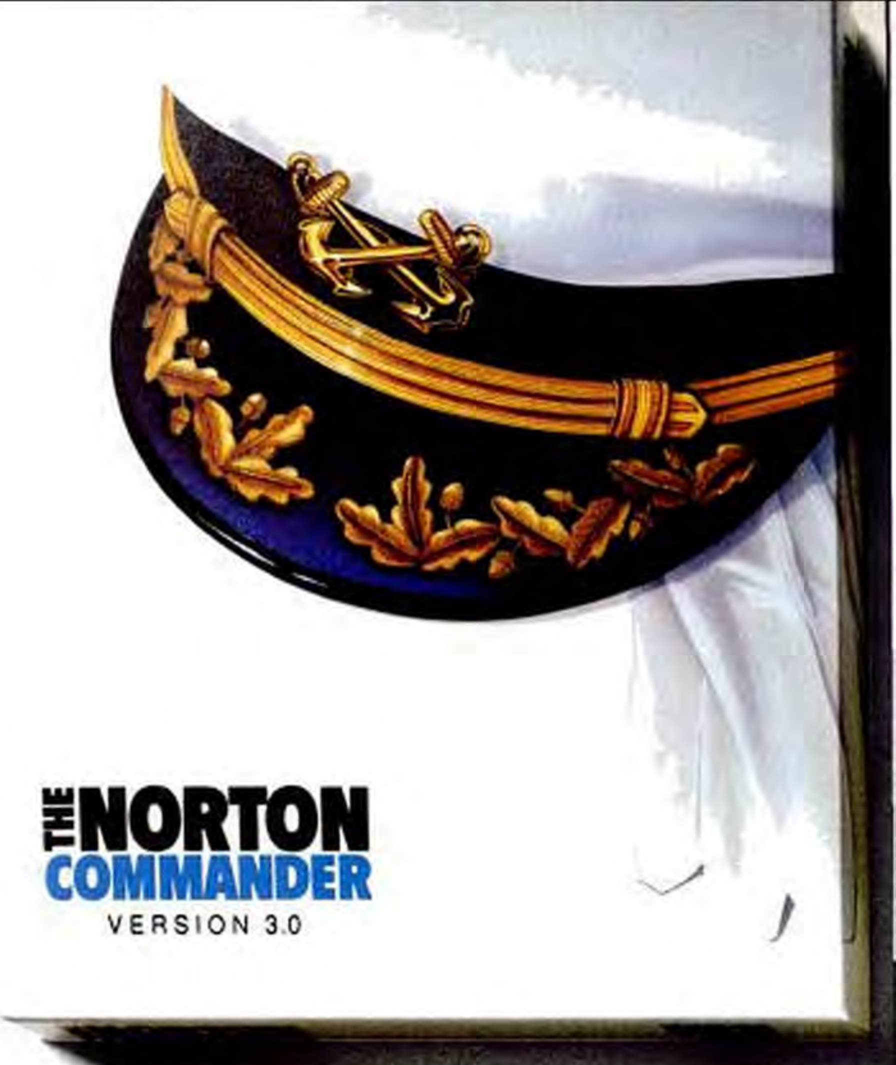

In your wildest dreams, if you could do absolutely anything you wanted with your data files, what would you do?

You'd organize them, of course.

Manage them, too.

From time to time you'd probably need to look for them.

But most of the time, you'd just want to look *at* them—or through them—instantly.

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Well, stop dreaming. Because the new Norton Commander* has arrived and it's better than anything else you can use to deal deftly with DOS.

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Which is pretty remarkable, considering that *InfoWorld* called the original version "tops in its class…a new level of convenience for MS/DOS users."

They called Version 2.0 "a near-perfect DOS shell…the market's best…recommended for all DOS users, regardless of expertise."

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Now you don't have to.

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InfoWorld thought the world of Version 2.0. The new Norton Commander is even better—and even easier to learn and use.

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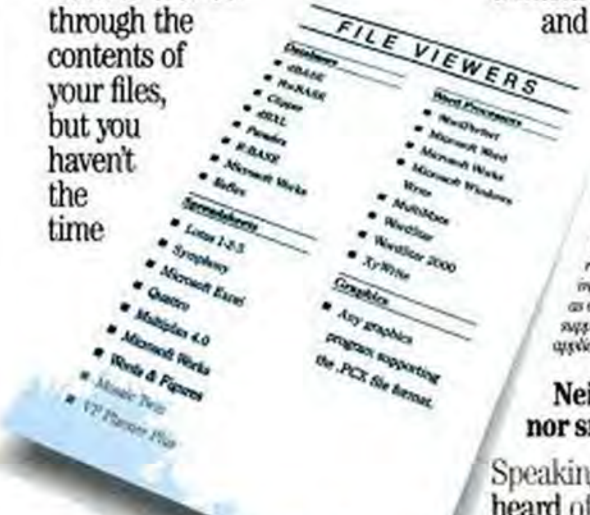
Your wish is our Commander.

Yet it's flexible enough to adjust totally to your particular style of working—even get out of your way entirely when you don't need to see it.

But since it can do so many things for you, you'll probably be seeing a lot of it.

Like those times when you want to browse through the contents of your files, but you haven't the time—or the patience—to load and run the applications that created the files in the first place.



FILE VIEWERS

Databases
- dBASE
- FoxBASE
- Clipper
- dBXL
- Paradox
- R:BASE
- Microsoft Works
- Reflex

Spreadsheets
- Lotus 1-2-3
- Symphony
- Microsoft Excel
- Quattro
- Multiplan 4.0
- Microsoft Works
- Words & Figures
- Mosaic Twin
- VP Planner Plus

Word Processors
- WordPerfect
- Microsoft Word
- Microsoft Works
- Microsoft Windows Write
- MultiMate
- WordStar
- WordStar 2000
- XyWrite

Graphics
- Any graphics program supporting the .PCX file format.

Want to see a look in your files without running the application? With our ingenious File Viewers, your data is as close as a keystroke. Version 3.0 supports most leading business applications.

Thanks to our ingenious File Viewers, all you have to do now is point to the filename and shoot.

Presto. You're eyeballing your data.

Fire again and you've launched the application.

In fact, a couple of keystrokes—or mousestrokes, if you prefer—is all it takes to perform the full range of file management functions.

Or, for that matter, to call up a tree view of your directories, a list of your last 15 commands, or a menu of your favorite programs and routines.

What could be easier? Faster? More efficient?

Certainly nothing we've heard of.

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Speaking of things you haven't heard of before, imagine using a DOS manager to automatically send and receive messages via MCI® Mail.

Dream on, right?

Wrong. Our new Commander Mail™ lets you instantly exchange files, faxes, telexes and E-Mail with any MCI Mail subscriber—in Milwaukee, in Outer Mongolia, even in Marketing. Without having to laboriously load and run one of those tiresome communications programs.

Who knows, you may actually get some mileage out of your modem for a change.

The new Norton Commander speaks laptop, too. It adapts to your LCD display automatically. And our new Commander Link makes it easy to transfer files between two systems.

You'll definitely get more mileage out of your laptop PC. Because the Norton Commander adapts to your laptop's LCD display characteristics.

And our new Commander Link™ lets you transfer files from desktop to laptop—and back—quickly and easily.*

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And order us around.

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Microsoft Word 5.0
WordPerfect 5.0
IBM Display Write 5/2 Composer

Two Aces and a King

The Big Three Word Processors Raise the Ante

by Edward Mendelson

IBM DisplayWrite 5/2, Microsoft Word 5.0, and WordPerfect 5.0 sit at the top of the word processing heap—and justifiably so. Which one's right for you? In order to decide, you'll need to review their individual strengths and weaknesses carefully.

Think twice about your choice of a word processor, because no other kind of software is so intimately connected to the way you think about everything else.

If you work at a computer, a word processor is the primary means by which you communicate your thoughts. A word processor is the medium with which you create everything, from a quick memo about the company picnic to a multivolume book that incorporates chapters written by a dozen coworkers and draws on charts, images, spreadsheets, and information culled from giant databases. Word processing software has matured to the point where the best programs let you produce documents at both ends of the spectrum—and everywhere in between—with an ease that was unimaginable a few years ago.

It isn't hard to create a program that can produce both a simple memo and an elaborately complicated book. The hard

ILLUSTRATION: DAVID ANSON RUSSO

part is adding all the features that make it possible for a dozen people on a network to produce a book over a period of months or years without making you work a week when you merely want to write and print a memo. The best of today's full-featured word processors are designed to let you do simple work in an uncomplicated and undemanding environment while keeping a complex maze of functions accessible—and easily navigable—for anyone who wants to explore them.

Almost two years ago, in the February 29, 1988, issue of *PC Magazine*, we tested 55 word processors. Since then, the market has remained remarkably stable, with few significant newcomers making a name for themselves and few major contenders dropping out of the competition. The major word processors are still character-based, although the market leaders now all include a noneditable graphics page preview and can import or even edit graphics to varying degrees.

Graphics-mode word processing, once essentially limited to the primitive functions of Microsoft's *Windows Write*, has begun to come into its own. At the low end of the scale, Samna's *Amí*, running under *Windows*, and, in far more ambitious ways, *IBM Interleaf Publisher* both make graphics-mode word processing a reality. *Amí Professional* and *Microsoft Word for Windows*—the unannounced product that must be the worst-kept secret in Microsoft's history—will occupy the middle ground when they become available.

Now, *PC Magazine* takes a long look at the latest versions of the three market leaders (in revenue): *WordPerfect 5.0* and *Microsoft Word 5.0*, which run under DOS or OS/2 and were Editor's Choices in 1988, and the OS/2-only *DisplayWrite 5/2 Composer*. We also take a brief look at the other programs that earned the Editor's Choice rating in 1988 (see the sidebar "Beyond the Big Guys"). *WordPerfect* holds a decisive lead in the market, with sales of 140,000 copies a month. Second-place *Microsoft Word* is campaigning aggressively to narrow the gap, and *DisplayWrite* maintains its market share through the loyalties of offices that will buy anything as long as the box has big blue letters reading "IBM."

All three programs belong in the category of full-featured word processors, as contrasted with smaller "executive" word processors like Symantec's *Q&A Write* and Software Publishing's *Professional Write*, which are designed mostly for brief reports and mailing-list applications. Executive word processors have a wide audience, but the market as a whole has decided it prefers the power of full-featured programs, even if most users never need anything more than they can find in executive programs.

No full-featured program can hope to be taken seriously today unless it includes programmable merges and macros, remappable keyboards, sorting and math functions, a speller and thesaurus, hyphenation, footnotes and endnotes, outlining, automatic cross-referencing, multilevel tables of contents and indexes, document summaries, snaking and side-by-side columns, and file-management functions within the program itself. *WordPerfect* and *Microsoft Word* contain all of these features, implemented to varying degrees; *DisplayWrite* has most of them.

Word processing software has matured to the point where the best programs let you produce documents at both ends of the spectrum—from a quick memo to a multivolume book—with an ease that was unimaginable a few years ago.

PHOTO FINISH

A few years ago, speed was a reason to choose one word processor over another. Today, most full-featured programs race to a photo finish, and the difference between them hardly matters. In the PC Labs benchmark tests, *Microsoft Word* and *WordPerfect* performed almost identically at speeds approaching the championship speeds of *XyWrite* and *Nota Bene*. It no longer makes sense to let the benchmark timings make your decision for you. Now the subtleties of style and functionality of a word processor matter infinitely more than its raw speed.

A full-featured word processor is like a language or a culture. In a few hours you can learn the few phrases needed to ask the way to the train station or reserve a hotel room. It takes longer to become fluent in the idioms and familiar with the local customs. You can't compare word processors the way the splashy ads do: by counting up a list of features and counting the keystrokes needed to perform a half-dozen functions. An advanced word processor is a complex environment that can't be understood by glancing at a few tourist attractions. The one that is best for you is the one you can imagine living in for years to come.

Word processing users often believe that the program they happen to prefer is the only one that conforms to the way human beings think—like the apocryphal Frenchman who said that the advantage of the French language is that the words come in the order in which you think them. Sometimes this belief turns into fanaticism. When you meet someone who tells you that *Microsoft Word* (or *WordPerfect*) is ideal and that *WordPerfect* (or *Microsoft Word*) is junk, you have met a word processing fanatic. He probably is not dangerous, but if you value your safety, you will smile politely, agree with everything he says, and get out of the room as quickly as possible.

The idiom of most word processors (including *WordPerfect* and *DisplayWrite*) consists of codes that turn formatting on and off. When you want to change the left margin to 2 inches, you insert a left-margin code. Formatting codes are like gateways. On one side of the gate, one set of conditions apply; on the other side of the gate, another set applies. When you want to modify the format of a block of text, you insert a gate at the start of the block and another gate afterward.

Other programs (including *Microsoft Word*) tend to think in terms of areas of text to which formatting is applied like a coat of paint. If you want to change the left margin to 2 inches, you define the block that you want changed and tell the program to apply the new formatting. You won't find a format code at the start or end of the block, because all formatting information is stored invisibly at the end of the file as pointers to different areas of the text. Neither method is inherently superior, al-

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For the features section of this issue, the associate editor was Donald P. Willmott and the PC Labs project leader was Pamela J. Milland.

though the gated method, for better or worse, lets you tinker more directly with the layout of your files.

HOW TO LOOK AT A PAGE

Other cultural differences include the ways in which programs think about pages. *Microsoft Word* joins *DisplayWrite* in defining the margins as the outline of the main body of text while pushing headers, footers, and page numbering into the blank area beyond the margin. *WordPerfect*, in contrast, treats the margins as the limits of the printed page, and takes away space from the body text when you add a header or footer. Again, neither method is superior. The first is preferable if you always want the main text to hold the same shape; the second is preferable if you want to know exactly what the limits of the printed page will be, and it tends to allow for more precise and predictable layouts.

Like a language or local customs, the interface of each of these programs bears vestiges of its archaic past. *WordPerfect*, *Microsoft Word*, and *DisplayWrite* would all look very different if their authors could redesign them from the start. All include illogical or nonstandard key assignments. Neither *WordPerfect* nor *Microsoft Word* uses the otherwise standard F1 key to bring up a help menu. *DisplayWrite* uses F1 for help but doesn't conform to IBM's SAA interface. Don't try to persuade devotees of *Microsoft Word*'s alphabetical menus to like *WordPerfect*'s function keys, although the two interfaces are rapidly converging in style. *Microsoft Word* now makes extensive use of the function keys, while the forthcoming *WordPerfect* 5.1 will include optional pull-down menus. *Microsoft Word* has always been designed for a mouse; *DisplayWrite* now has limited mouse support; and *WordPerfect* 5.1 will make full use of the rodent.

You use a word processor to communicate. When choosing a program, consider how easy it is to communicate your program's files to other programs and different kinds of computers. You can buy third-party packages that convert word processor files from one format to another, but an advanced word processor should come with its own conversion facilities. *Microsoft Word*, *DisplayWrite*, and the new *WordPerfect* 5.1 can import comma-delimited files from a database and part or all of a standard spreadsheet file without conversion. *Microsoft Word*, soon to be followed by *WordPerfect* 5.1, can link a document to a spreadsheet and update the document after the spreadsheet data changes. Full two-way hot links between documents and spreadsheets are still over the horizon but getting closer.

DESKTOP PUBLISHING

Word processors also need to communicate with the desktop publishing programs that import the word processor's files. If you choose a word processor whose files aren't understood by Aldus's *PageMaker* and Xerox's *Ventura Publisher*, you'll need to use tedious and inadequate conversion programs if you want to see your text appear in desktop-published glory. *PageMaker* and *Ventura* can directly import the major word processing formats, although it usually takes their vendors a few months to develop filters that handle all the new features in a new release of a word processing package.

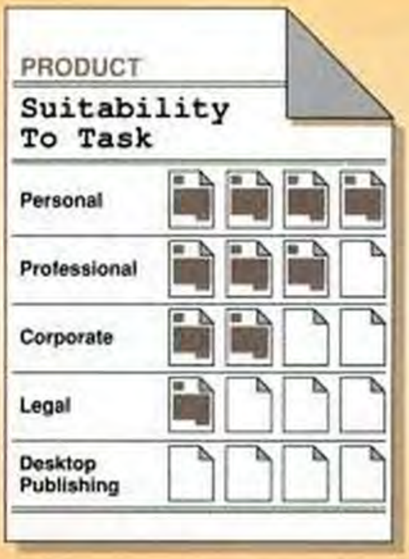
For the first few months after *WordPerfect* 5.0 appeared, *PageMaker* was unable to import its files except in *WordPerfect*

SUITABILITY TO TASK

PC Magazine assesses a word processing program's suitability in five arenas—Personal, Professional, Corporate, Legal, and Desktop Publishing—and assigns it a point value for each one. These subjective ratings, on a scale from 0 to 4, are presented along with each review and translate as follows: 0—lacks feature or is not at all suited; 1—poorly suited; 2—some capability; 3—well suited; 4—ideal for the task.

A **Personal** word processor should be very easy to learn and use; it is best suited for short documents, letters, and memos. Important features include context-sensitive help, simple menus, and clear documentation. Users include students, home users, executives, and other professionals who write short documents.

A **Professional** word processor is more full-featured. It should be able to handle long documents with extensive page formatting including complex headers, footers, and indexing. Printer control and dictionary support are both important, and likely users include professional and technical writers, academics, and those working in the publishing industry.



Corporate word processors should easily handle short documents, letters, and repetitive memos that are produced often, and should offer mail-merge. Document summaries (including author, revisor, and keywords) and envelope printing are musts. Parallel versions running on IBM and DEC mainframes and minis or Unix systems are a plus. Note that not all users within corporations are corporate users.

Legal refers to the program's ability to handle the special functions required by lawyers and law offices, including line numbering, redlining and revision marking, compilation of tables of authorities, file comparison, and password protection.

Word processors with **Desktop Publishing** features must be able to handle multiple columns of text and to import common graphics files (.PCX, .CGM, TIFF) as well as *1-2-3* and *Excel* spreadsheet data. They should also be capable front ends and partners for *PageMaker* and *Ventura Publisher*.

To receive a rating of 4, the product should contain all the features users expect now (based on competitive products) or will find on similar products in the near future (a DTP rating of 4 indicates a superior word processor, not a word processor equal to *PageMaker* or *Ventura Publisher*).

4.2 format, which made *Word* a better choice if you were using it to send files into DTP. Then Aldus issued a spiffy *WordPerfect* 5.0 filter, and the two packages were equal. Now *Word* 5.0 has appeared, and *PageMaker* won't be able to import its new features until Aldus prepares a new filter. If you choose one program over another merely because your desktop publishing program has a more up-to-date filter for it, you may find the situation reversed in a few months.

Today's word processors need to communicate effectively on a network. All three of these programs can include nonprinting comments by different members of a workgroup. All support revision tracking using redlining and strikeout; *WordPerfect* has a built-in document-comparison function. *WordPerfect* and *Microsoft Word* let you create and print "frame" documents that include part or all of other documents created separately.

The best word processors let you recover easily from false moves. *Microsoft Word* has a flexible Undo command. *WordPerfect* lets you restore three deletions. OS/2 word processors will be even more forgiving: DeScribe Inc.'s *DeScribe* lets you play back an entire session to find any text you want to recover.

Word processors must evolve in order to survive. Five years ago, *WordStar* and *MultiMate* led the market. *WordStar* had the advantage of speed and its familiarity as a holdover from the CP/M era. *MultiMate* was the best of the programs that emulated the Wang dedicated word processors that took over the nation's offices in the 1970s. At the end of the 1980s, word processors based on CP/M and Wang models seem as awkward as beached whales. Recent versions of *WordStar* and *MultiMate* have belatedly added features in an attempt to stage a comeback, but few users show any interest in switching to these programs from any others.

Today's most successful word processors, *WordPerfect* and *Microsoft Word*, were first conceived almost 10 years ago. Will new versions of these programs continue to dominate the DOS and OS/2 market in the 1990s, when graphic user interfaces begin to supplant the character-based screens of the 1980s? Someone somewhere has begun to imagine the word processor best adapted to the new operating systems and platforms of the next decade. WordPerfect Corp., Microsoft, and IBM all hope that that person is working for them right now.

DisplayWrite 5/2 Composer

The bulky package of IBM's $695 *DisplayWrite 5/2 Composer* contains two completely separate OS/2 applications: *DisplayWrite 5/2* itself and the new *Composer Extension*. The first of these—let's simply call it *5/2*—is a character-mode word processor that evolved from IBM's standalone Displaywriters of a couple of decades ago and the DOS versions of *DisplayWrite*. *5/2* is a dinosaur, but an advanced dinosaur, and the latest version has features that looked impressive when rival packages added them in 1985. It even has some new features that look impressive today. *Composer*, in contrast, is an up-to-date, bright-looking, graphics-mode, quasi-desktop publishing program. It can read *5/2* files and has a keyboard interface that resembles that of *5/2*, but the resemblance stops there.

The difference isn't limited to such odd contrasts as the presence of mouse support in the text-mode *5/2* and its complete absence in the graphics-mode *Composer*, where you have to use the arrow keys to push the cursor because the mouse driver wasn't ready on time. The difference is one of culture. *5/2* is a pure IBM product, while *Composer* is the work of a company called Beyond Words. If *Composer* looks familiar to you on-screen, that may be because you've seen pictures of another program built around the same engine, IMSI's *PagePerfect*, an underwhelming DTP package introduced last year.

DISPLAYWRITE 5/2 COMPOSER

Suitability To Task

Personal	■	■	□	□
Professional	■	■	■	□
Corporate	■	■	■	□
Legal	■	■	■	□
Desktop Publishing*	■	■	■	□

*With the addition of the *Composer Extension* module.

The story of the two programs in *DisplayWrite 5/2 Composer* is a human interest story as much as a software story. It's the story of the users who struggle with the two programs, the support technicians who are bewildered by them, and the programmers who fight internecine battles within IBM over the issues of interface and design.

Above all, *DisplayWrite 5/2 Composer* is the story of its users. They typically work in offices where no one ever got fired for buying IBM. *5/2* does have advanced and clever features, like columns automatically balanced in length so that the last column on a page isn't shorter than the others, and mail-merge with variables. But *5/2* is so tied to its past that its speller still contains the name of the old standalone Displaywriter but not the name of the *DisplayWrite* program.

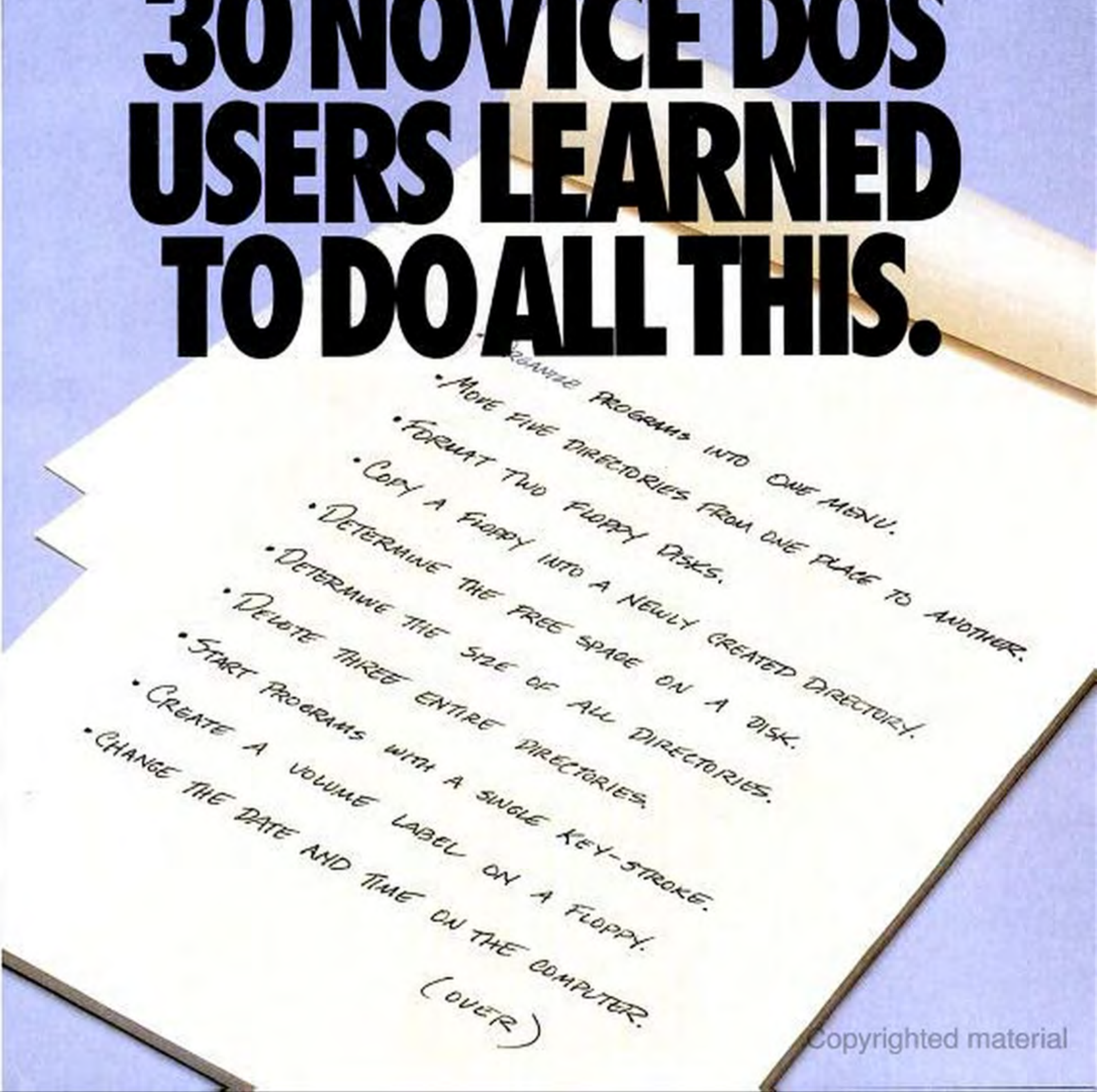
TYPEWRITER METAPHOR

The old Displaywriter was designed around a typewriter metaphor, and the latest version hasn't forgotten this. You still can't see the bottom of one page and top of the next on the same screen, and the left and right arrow keys won't even take you back to the previous line or forward to the next. (The right arrow takes you into the right margin and beyond, although you return to the page as soon as you start typing.)

If you add text to existing pages, you have to choose Repagination from a menu and wait while *5/2* calculates the new page breaks. By entering some carriage returns at the bottom of a page, I got *5/2* so confused that even after repaginating, it told me the cursor was at line 137 on page 2, and then locked up the computer when I tried to repaginate a second time in order to sort out the problem.

Despite OS/2's multitasking, *5/2* won't let you print the document on-screen. If you forget to repaginate before printing, *5/2* sometimes spews out blank pages at the end of the print job, apparently endlessly. If you stop it by turning off the computer, *5/2* will tell you that the file is "in use" when you try to edit it later. You have to use *5/2's* Recover command and then delete a couple of backup files before you can do anything with the file again. *DisplayWrite* is the only major application that includes a command to Recover files that it mangled all by itself.

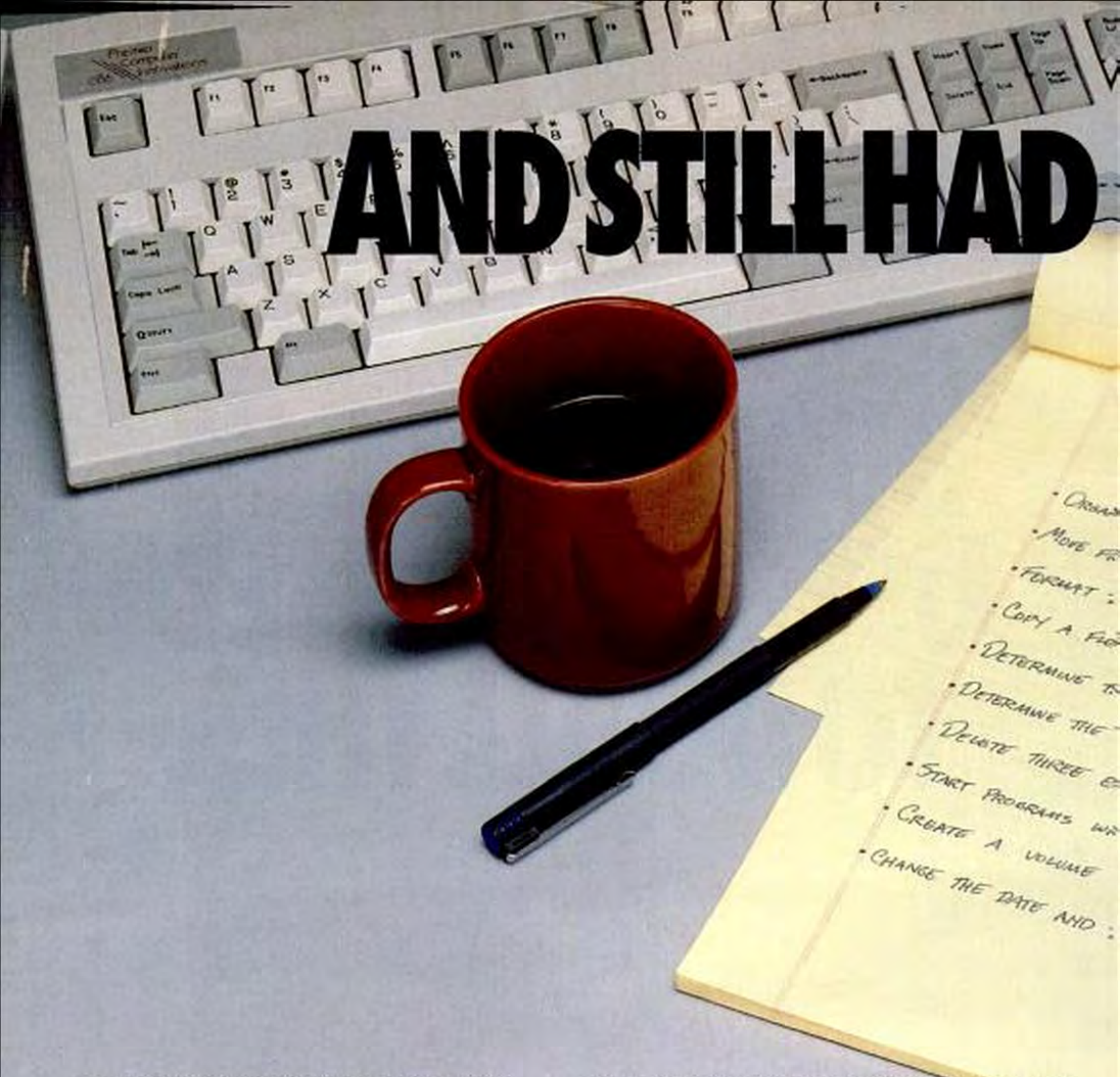
DURING ONE LUNCH HOUR 30 NOVICE DOS USERS LEARNED TO DO ALL THIS.



- RGANIZE PROGRAMS INTO ONE MENU.
- MOVE FIVE DIRECTORIES FROM ONE PLACE TO ANOTHER.
- FORMAT TWO FLOPPY DISKS.
- COPY A FLOPPY INTO A NEWLY CREATED DIRECTORY.
- DETERMINE THE FREE SPACE ON A DISK.
- DETERMINE THE SIZE OF ALL DIRECTORIES.
- DELETE THREE ENTIRE DIRECTORIES.
- START PROGRAMS WITH A SINGLE KEY-STROKE.
- CREATE A VOLUME LABEL ON A FLOPPY.
- CHANGE THE DATE AND TIME ON THE COMPUTER.

(OVER)

AND STILL HAD


• ORGAN
• MOVE FR
• FORMAT :
• COPY A FLO
• DETERMINE T
• DETERMINE THE
• DELETE THREE E
• START PROGRAMS WI
• CREATE A VOLUME
• CHANGE THE DATE AND :

THE ONLY DOS THEY HAD TO KNOW WAS A: INSTALL

The 30 novice PC users installed DOS Partner,™ EasySoft's new integrated shell and file management program, reviewed the documentation, and within minutes, were performing tasks that typically require weeks or months of DOS training and experience.

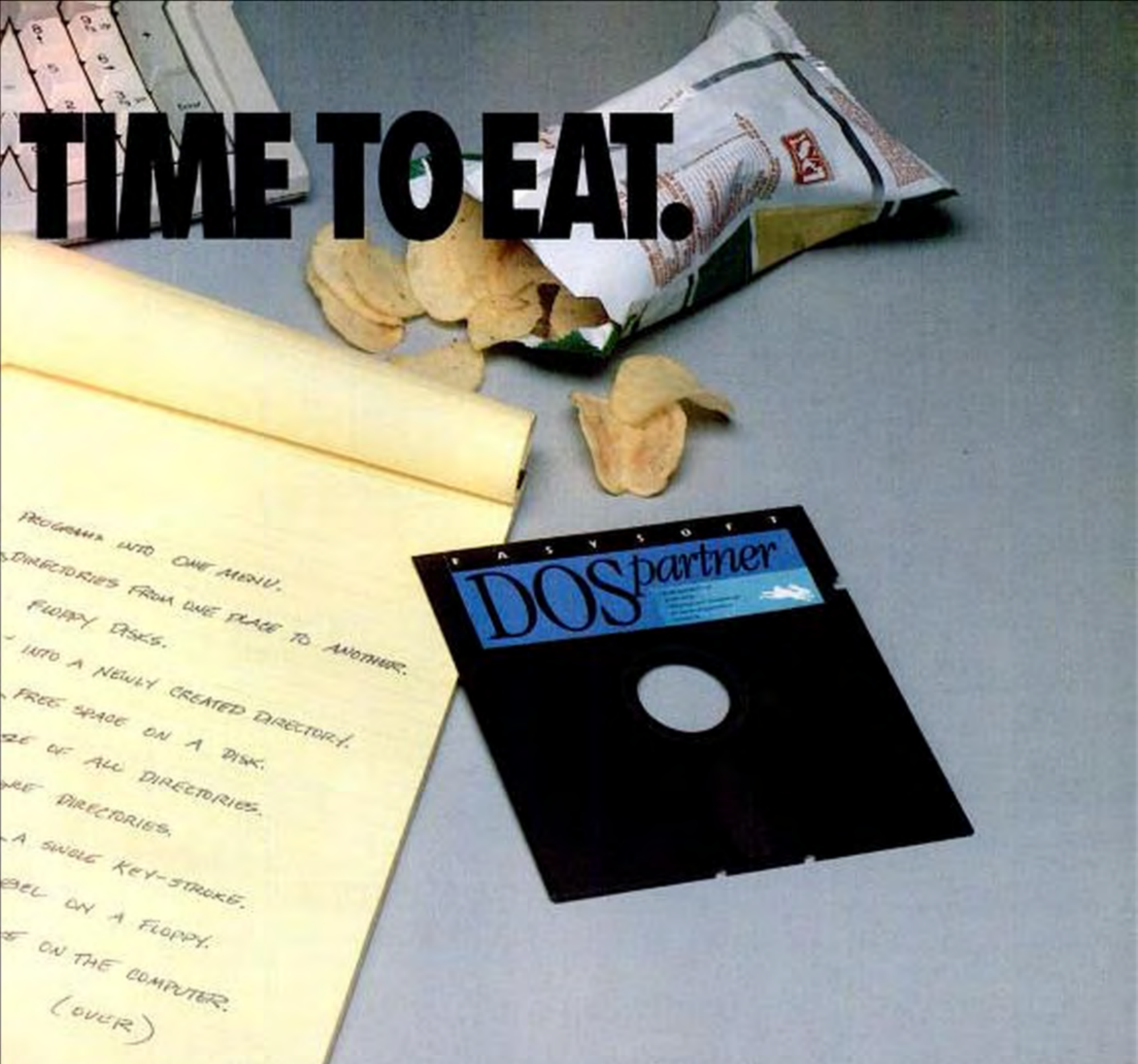
Tasks like moving an entire directory, with multiple subdirectories, from one hard drive to another. Using only DOS, the task of moving this directory took an experienced programmer nine minutes. It took novice users an average of only 30 seconds to move the same directory with DOS Partner.

DOS PARTNER MAKES DOS INVISIBLE

DOS Partner
DOS

DOS Partner is not like shells that still require you to know DOS. It allows you to ignore DOS altogether. DOS Partner manages all your files, directories and applications. And it provides you with other functions unavailable in DOS. You can even delete entire directories, with associated subdirectories and files still in them.

TIME TO EAT.


PROGRAMS INTO ONE MENU.
DIRECTORIES FROM ONE PLACE TO ANOTHER.
FLOPPY DISKS.
INTO A NEWLY CREATED DIRECTORY.
FREE SPACE ON A DISK.
ZE OF ALL DIRECTORIES.
RE DIRECTORIES.
A SINGLE KEY-STROKE.
BEL ON A FLOPPY.
E ON THE COMPUTER.
(OVER)
EASYSOFT
DOSpartner

You and your PC speak plain English to each other. So you never run into dead ends, bad command messages or syntax errors. DOS Partner shows you all your options on the screen. If you want to move, copy or delete a directory or a file, you simply move your cursor to the English command and press enter. It's that simple.

DOS PARTNER CAN ELIMINATE DOS TRAINING

If your company is like most, it's spending $300.00 in support and training for every $100.00 it spends on software and hardware.

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5/2 supports many non-IBM dot matrix and laser printers but doesn't understand them very well. Until you change the defaults, it thinks your laser printer uses fanfold paper.

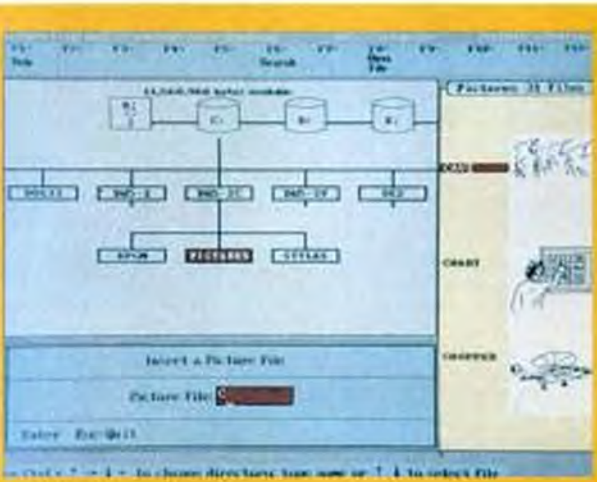
Although both *5/2* and *Composer* require OS/2, Version 1.1, neither uses Presentation Manager, neither runs in a text window, and neither conforms to the SAA standard. Sources within IBM explain that *5/2*'s keyboard was modified to match the tentative SAA standard that IBM planned some years ago—until the SAA designers changed the rules, a change that caused much consternation among the *DisplayWrite* designers.

When *5/2* appears on-screen, you see a menu asking if you want to create, revise, or print a file. After making your choice, you reach a screen whose top two lines are a status display that tell you whether you are creating or revising a file, the name of the file, the cursor position, and other format information. Below this is a one-line menu of six function keys, and then a ruler line. The menu is highly selective. It gives you access to basic editing functions only, and you'll need to memorize which ones are listed under "F5=Functions" and which are under "F7=Instructions."

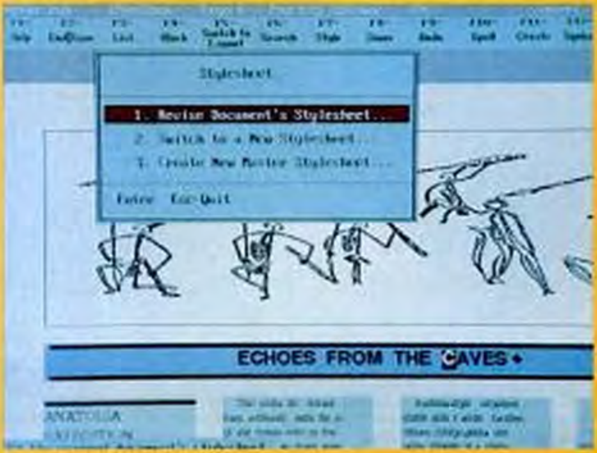
You can safely guess that some advanced functions are on the Control state of the keys listed on the menu, but you'll need a keyboard chart and a help menu to find most keys. Some of the keyboard assignments seem chaotic. F1 is the Help key, but Alt-5 brings up a list of key assignments. Alt-8 deletes to the end of the line, but Alt-7 does nothing. If you want to indent a paragraph, don't try Ctrl-I, which also does nothing; use Ctrl-T instead. Is Print on Ctrl-F12 or Alt-4? Actually, it's on both. Is cursor line drawing on F11 or Alt-1? It, too, is on both. You can press Ctrl-A to open a *XyWrite*-like command line that can save you a lot of menu-hopping, although some functions are available only via the menus.

WINNING FEATURES

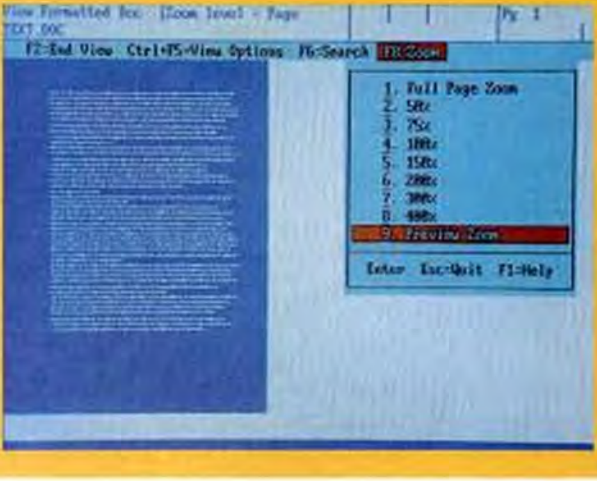
Among the better features of *5/2* are split-screen editing, hidden text, a notepad for storing blocks of text, tables of contents and indexes, centering on any point on a line, and a flexible footnote function that allows you to gather a group of notes on a single page or store notes in a footnote library to reuse in different files. Even the best of the features is clumsily implemented. For example, the new graphics page preview, which has multiple zoom levels,


Insert a Picture File
Picture File:
Enter Esc=Quit
CHART

DisplayWrite 5/2 Composer offers several pictures (in a proprietary format) for insertion into documents. They are explained in the upper-left-hand corner of the screen and are previewed along the right.


Stylesheet
1. Revise Document's Stylesheet...
2. Switch to a New Stylesheet...
3. Create New Master Stylesheet...
Enter Esc=Quit
ECHOES FROM THE CAVES

Fifty style sheets, all of which can be modified, are included in the *DisplayWrite 5/2 Composer* package. This four-column layout includes a picture loaded from the picture library.


View Formatted Doc [Zoom level - Page
TEXT.DOC
F2=End View Ctrl+F5=View Options F6=Search F8=Zoom
1. Full Page Zoom
2. 50%
3. 75%
4. 100%
5. 150%
6. 200%
7. 300%
8. 400%
9. Preview Zoom
Enter Esc=Quit F1=Help

Features new to the basic *DisplayWrite 5/2* package are Zoom and Preview. In the full-page preview zoom, text is illegible but the view accurately depicts what the layout of the paper page will look like.

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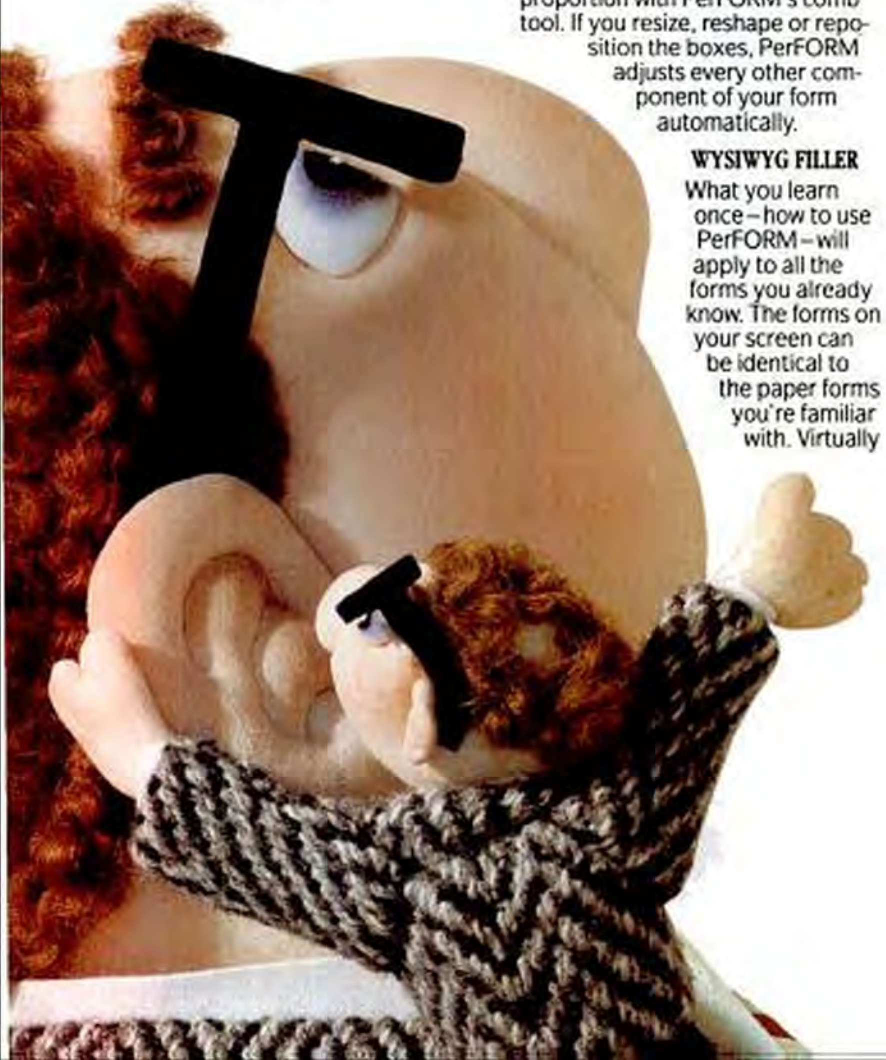

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PerFORM

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*Manufacturer's suggested list price

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CIRCLE 250 ON READER SERVICE CARD

often gets confused at the top zoom level and displays the same text simultaneously in two sizes, one overlapping the other.

If your printer supports them, *5/2* lets you print and display about 400 characters above the standard ASCII set by choosing one of four supplied extended character sets and then typing an Alt-letter combination from a chart in the manual. Only a fraction of the 400 characters are included in the four default character sets, and you can edit one of four duplicate sets if you want to use any of the other characters.

Choosing a typeface is even more complicated. *5/2*'s font menu makes you choose a font by number. If you want to choose a font that comes in a variety of different heights, like the Helvetica available with many laser printers, all *5/2* tells you is to make your choice among fonts numbered from 4,096 to 61,439. Can't remember that Helvetica Italic is font number 34,231? IBM explains that it's easy to find out: just use OS/2's multitasking functions to open another *DisplayWrite* session and print the text file that lists the fonts available in your printer. Every other advanced word processor lets you choose fonts by name from a menu.

The manual says you can include graphics in *5/2* files but omits the awkward fact that you can't actually insert them via *5/2* unless they've already been converted into IBM's RFT format. You can, however, bring in .WK1 and .DBF files with reasonable ease.

COMPOSER EXTENSION

When you turn to the *Composer Extension*, you're in another world. The function keys are similar to those in *5/2*, but the

PC MAGAZINE FACT FILE

***DisplayWrite* 5/2 Composer**
IBM Corp., contact your authorized IBM dealer.
List Price: *DisplayWrite 5/2*, $495; *Composer Extension*, $200; upgrade from earlier versions, $95.
Requires: 3MB RAM, EGA or VGA, OS/2 1.1 or later. 20MB of hard disk space recommended.
In Short: *DisplayWrite 5/2 Composer* is a character-based, page-oriented word processor with some impressive features but an awkward and confusing interface. The *Composer Extension* part is a limited desktop publishing package that uses embarrassingly crude fonts and has no mouse support.

CIRCLE 396 ON READER SERVICE CARD

PC MAGAZINE WORD PROCESSORS: SUMMARY OF FEATURES

(Products listed in ascending price order)

	PC Microsoft Word 5.0 $450	PC WordPerfect 5.0 $495	DisplayWrite 5/2 Composer $695
TEXT FORMATTING FEATURES			
Both 10 and 12 cpi available	■	■	■
Proportional spacing	■	■	■
Adjustable letter spacing	❑	■	■
Adjustable left and right margins	■	■	■
Fractional line spacing	■	■	■
Spacing adjusts to font height	■	■	■
Double underline	■	■	■
Superscripts/subscripts	■	■	■
Insert mode and replace mode	■	■	■
Strikethrough	■	■	■
Small capitals	■	■	❑
Nonprinting comments	■	■	■
Adjustable top and bottom margins	■	■	■
Maximum page length (inches)	22	18	45.5
Variable page length within document	■	■	■
Vertical centering	■	■	❑
Tabs can be entered anywhere	■	■	■
Tabs move when left margin changes	■	❑	■
Conditional page breaks	■	■	❑
Paragraphs can be linked (together on one page)	■	❑	❑
Unbreakable blocks	■	■	❑
Widow/orphan control	■	■	■
Automatic page numbering	■	■	■
Automatic resetting of page numbers	■	■	❑
COMMAND STRATEGY			
Command line	❑	❑	■
Full-screen menus	■	■	■
Lotus-style menus	■	❑	❑
Menus can be bypassed from keyboard	■	❑	■
Permanent defaults can be changed	■	■	■
Temporary defaults can be set	■	❑	■
SCREEN DISPLAYS			
Screen displays ruler line	■	■	■
Ruler line can be suppressed	■	■	❑
Margin positions are graphically displayed	■	■	■
Page breaks are shown while typing	■	■	■
Paragraph markers can be displayed continuously	■	■	❑
Format codes can be displayed	■	■	■
TEXT ENTRY AND EDITING			
Undelete capability	■	■	■
Multiple undelete levels	❑	■ (3)	❑

PC—Editor's Choice ■—Yes ❑—No

	Microsoft Word 5.0 $450	WordPerfect 5.0 $495	DisplayWrite 5/2 Composer $695
Mouse-controllable cursor	■	❑	■
Word block	■	❑	❑
Line block	■	❑	❑
Sentence block	■	■	❑
Paragraph block	■	■	❑
Column block	❑	❑	❑
Page block	❑	■	❑
Block can be extended	■	■	❑
Reformats automatically after block move	■	■	❑
Copies or moves to another window	■	■	■
Saves reformat parameters to a file	■	❑	■
Appends block to an existing file	❑	■	❑
Search-and-replace			
Works forward and backward	■	■	■
Verifies replace	■	■	■
Searches within other files	■	■	❑
Performs case-sensitive search	■	❑	■
Preserves case when replacing	■	■	■
Can recognize string as a complete word	■	❑	■
Uses wildcards	■	■	❑
Search-and-replace for format codes or settings	■	■	■
Search-and-replace for text attributes (underline, italic, bold)	■	❑	■
Text windows	■	■	■
Number of windows	8	2	2
Split-screen windows	■	■	■
Full-screen windows	■	■	❑
PRINTING			
Number of printers supported	275	450	60
PostScript printers supported	■	■	■
Queues documents for printing	■	■	■
Can change print queue	■	■	■
Prints block	❑	■	❑
Prints continuous range of pages	■	■	■
Prints discontinuous range of pages	■	■	■
Prints current page (without requiring page number)	❑	■	■
Automatic envelope formatting and printing	■	■	■
Landscape mode	■	■	■
FILE HANDLING			
Maximum file size	8.3MB	Unlimited	2.4MB
Creates .BAK file	■	■	■
Makes backup during save and resume	■	■	■

CONTINUES

WYSIWYG screen with graphics and bitmapped fonts in multiple sizes and styles tells you that you've moved from the Kansas of word processing into the Oz of desktop publishing. It's a nice place to visit, but you wouldn't want to live there.

It's nice to visit because you can get kerning, leading, dropped or enlarged capitals, hyphenation control, and other DTP wonders. Unlike in DOS DTP programs, you can split the screen between two documents. But you won't want to live there for dozens of reasons. First of all, the transportation is primitive. Instead of using a mouse, you have to use the Ctrl-Arrow keys to move the cursor long distances, the Shift-Arrow keys for small distances, and the unshifted Arrow keys for distances in between. If you press an Alt-Arrow key, the program will merely beep at you—something it does all too often.

You can import graphics files as long as you choose one of the sample files included with the program, a TIFF file, a Lotus .PIC file, or one of IBM's own graphics formats. *Composer* also directly supports IBM scanners. If you have any .PCX files, you'll have to leave them at the door. You can flow text around rectangular graphics but not around irregular graphics.

Composer's Styles menu shows you exactly what your text will look like, down to the jagged-looking fonts you see onscreen. With any non-PostScript printer, including the HP LaserJet, *Composer* doesn't use the fonts that come with the printer, but only its own graphics fonts licensed from AGFA Compugraphic. *Composer*'s versions of these fonts are coarse and can make a laser printer look like a dot matrix. Even though the fonts are graphic, you can't scale them at print time. If you don't want to use the fonts generated at installation, you have to load a Font Librarian program that generates new screen and printer fonts and then use those. The package comes with versions of Times, Helvetica, and Courier.

Composer will use the Times, Helvetica, and Courier fonts in PostScript printers, but only in sizes that match *Composer*'s screen fonts. You can't use any of the other fonts that come with almost all PostScript printers today. Don't get the idea that you can use *Composer* to proof PostScript files that you later send out to a service bureau. Incredibly, *Composer* doesn't let you print to disk.

To help you find your way around these two programs IBM now offers toll-free tech support, though we found its usefulness spotty at best. One technician read passages from the *5/2* manual in answer to a question about *Composer* and then gave me answers that were simply wrong. *DisplayWrite*'s two-volume looseleaf manuals are written in IBMese, a language in which elementary concepts are explained in vast detail while complex ones are left sketchy and incomprehensible.

If you work in an all-IBM office that uses OS/2, you're going to use *DisplayWrite 5/2 Composer*, and you can accomplish a lot with it if you're patient enough to navigate its menus and generous enough to ignore its quirks. But if you want convenience and ease from your word processor, move to an office that uses *WordPerfect* or *Microsoft Word*.

Microsoft Word 5.0

Microsoft Word is Microsoft's $450 quick-change artist. If you don't like the way it looks when you install it, you can make it look like a completely different program. Do you want to remove the double-bordered frame that surrounds the text window? Do you want to display a ruler line? Or remove the two-line menu, with its alphabetical list of commands? Or display nonprinting characters like paragraph marks and tabs? Or assign screen colors to any style of text or any element of the display? Or, with a graphics adapter, display italics and superscripts, or put 35, 43, or 60 lines on-screen? Or display text with true line-breaks that scroll off the right edge of the screen, instead of breaking the

MICROSOFT WORD 5.0

Suitability To Task

Personal	■	■	☐	☐
Professional	■	■	■	■
Corporate	■	■	■	■
Legal	■	■	■	■
Desktop Publishing	■	■	■	■

PC WORD PROCESSORS: SUMMARY OF FEATURES

(Products listed in ascending price order)

	PC Microsoft Word 5.0 $450	PC WordPerfect 5.0 $495	DisplayWrite 5/2 Composer $695
Performs backup at timed intervals	■	■	■
Temporarily goes to OS/2	■	■	■
Includes file management functions	■	■	■
Can search disk for a filename	❑	❑	❑
File import/export			
DCA	■/■	■/■	■/■
Microsoft Word	■/■	■/❑	❑/❑
MultiMate	❑/❑	■/■	❑/❑
WordPerfect	❑/❑	■/■	❑/❑
WordStar	❑/❑	■/■	❑/❑
Lotus 1-2-3	■/❑	■/❑	■/❑
SPELLING CHECKER AND HYPHENATION			
Spelling checker			
Number of words in dictionary	130,000	130,000	100,000
Maximum number of user dictionaries	1	1	3
Spell-checks defined block	■	■	❑
Legal spelling checker	■	❑	■
Medical spelling checker	■	❑	■
Hyphenation			
Based on algorithm or dictionary	Algorithm	Both	Dictionary
Inserts soft hyphens	■	■	■
Allows entering soft hyphens from keyboard	■	■	■
Readjusts to additions and deletions	■	■	■
MANUSCRIPT PREPARATION			
Footnotes and endnotes	■	■	■
Different fonts	■	■	■
Automatic numbering	■	■	■
Multilevel table of contents	■	■	■
Multilevel indexing capability	■	■	■
Cross-referencing	■	■	❑
DESKTOP PUBLISHING FEATURES			
Snaking columns	■	■	■
Single and snaking columns on same page	■	■	■
Maximum number of columns	22	24	12
Full justification and microjustification	■	■	■
Side-by-side columns	■	■	■
Maximum number of columns	Unlimited	24	12
Unmatched column widths available	■	■	■
Column widths defined by moving cursor	❑	❑	■

PC—Editor's Choice ■—Yes ❑—No

WORD PROCESSING

THREE MARKET LEADERS

	Microsoft Word 5.0 $450	WordPerfect 5.0 $495	DisplayWrite 5/2 Composer $695
Adjustable gutter widths	■	■	■
Single column automatically restored	■	■	■
Line drawing using cursor	■	■	■
Line drawing using menu	■	■	■
Expandable box around text	■	■	■
Graphics files imported	.EPS, HPGL, .PCX, .PIC, .TIF	.CGM, *Dr. Halo*, .DXP, .EPS, HPGL, .IMG, *MacPaint*, .MSP, .PCK, .PCX, .PIC	GOCA, IOCA, .PIC, .TIF
Text flowing around graphics	■	■	■
Page preview	■	■	■
Full-page portrait monitor supported	■	■	☐
Zoom image	☐	■	■
Imports directly from PageMaker	☐	■	■
Imports directly from Ventura Publisher	☐	■	■
Exports directly to PageMaker	■	■	☐
Exports directly to Ventura Publisher	■	■	☐
NUMERIC FEATURES			
Arithmetic operations within document	■	■	■
Keyboard calculations	■	■	☐
Pop-up calculator	☐	■	☐
MACROS			
Number of macros	Unlimited	Unlimited	Unlimited
Programmable macros (using "if/then")	■	■	☐
HELP, DOCUMENTATION, AND ERROR HANDLING			
Context-sensitive on-line help	■	☐	■
Adjustable help levels	☐	☐	☐
Documentation			
Keyboard templates	■	■	■
Tutorial	■	■	☐
Indexed reference manual	■	■	■
Error messages			
Explain error	■	■	■
Explain remedy	☐	■	☐
Alert user when abandoning, aborting, or quitting an altered file	■	■	■
TECHNICAL SUPPORT			
Free support	■	■	■
Toll-free telephone number	☐	■	■

ENDS

lines for convenience at the edge of the screen? Or display the coded abbreviations of paragraph formats to the left of the paragraphs themselves? Or collapse or expand a document created using *Word's* built-in outliner? You can do all this and more with a few keystrokes or mouse twitches.

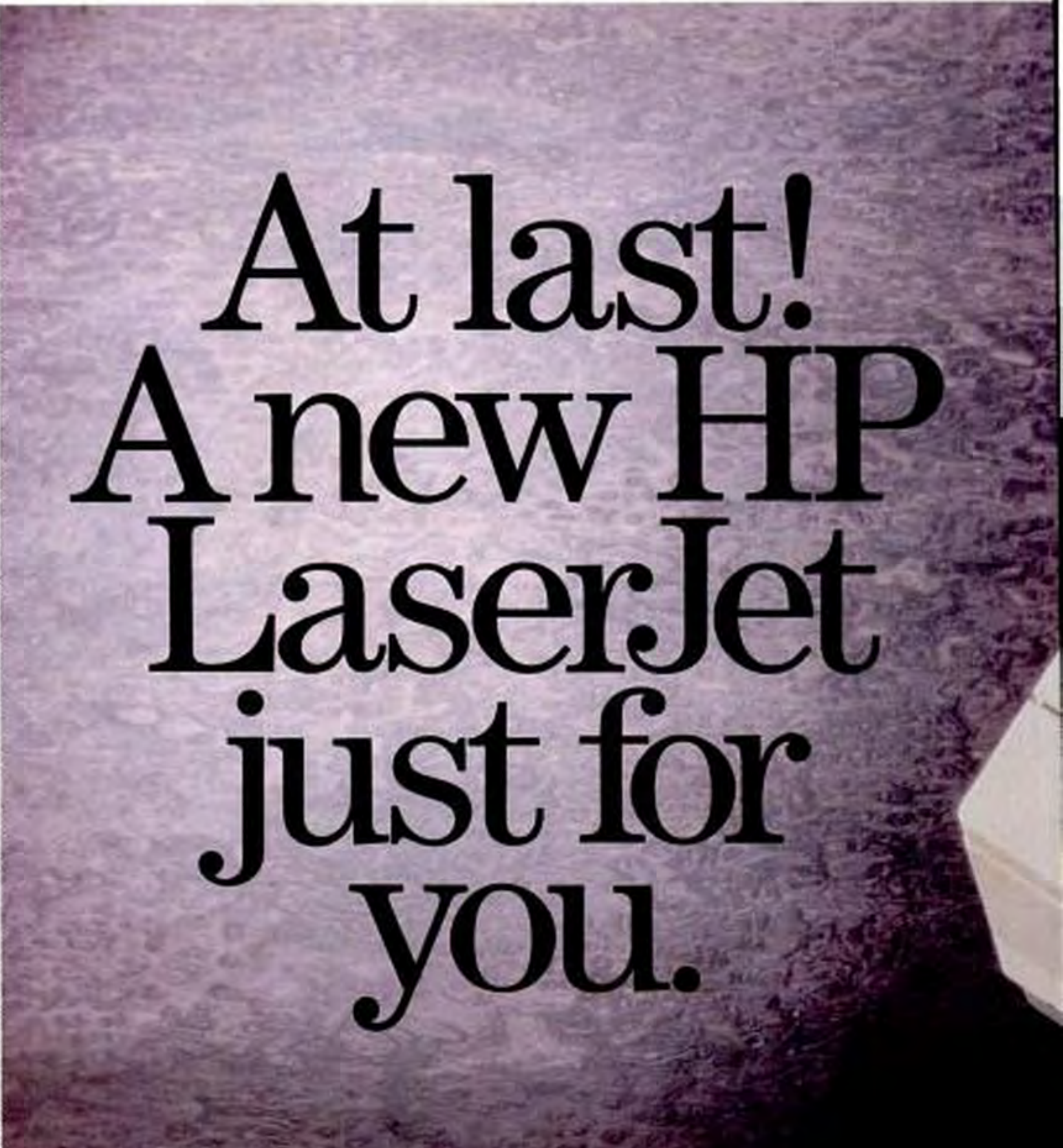
Microsoft Word is just as adept at making quick changes in text as it is in changing the screen. Any word processing program can transform the format of a page by using stylesheets of the kind pioneered by *Word* itself in 1983. But *Word* makes it easy to transform *anything* on a page, even if you didn't bother to set up a stylesheet first. A format search-and-replace function lets you change any text from 12-point bold-underline Courier to 10-point italic Times Roman in seconds. A single command lets you alter any paragraph with a one-inch first line indentation to a half-inch indentation without searching for each paragraph in the file.

You can decide at any time whether or not to print or display "hidden" text, and you can change your mind again afterward. With stylesheets, you can apply highly elaborate formatting to a paragraph simply by putting the cursor anywhere in the paragraph and typing the Alt key and one or two letter keys. Even without stylesheets, you only need to press an Alt-letter key to apply common formats.

Besides making quick changes, *Word* also saves and prints quickly and lets you move quickly around a file. It can now paginate on the fly, and when you jump from the top to the bottom of a file, automatic pagination doesn't slow you down. *Word* paginates in the background, so a page break will sometimes appear onscreen after the text in which it occurs. Unfortunately, *Word* is too quick to abandon deleted text: it has only one-level undeletes, compared with *WordPerfect*'s three and *Nota Bene*'s five. But *Word* now has automatic timed backup, so you can recover text deleted 20 minutes ago.

MAKING TEXT LOOK GOOD

No word processor approaches the ease with which *Word* lets you format text, both directly through formatting commands and automatically through stylesheets. Some of *Word*'s formatting functions can be duplicated in other programs only through tedious and unreliable macro programming. For example, if you format a paragraph to be preceded by a one-line space, *Word* knows enough to omit the extra space when the paragraph comes at the top of the



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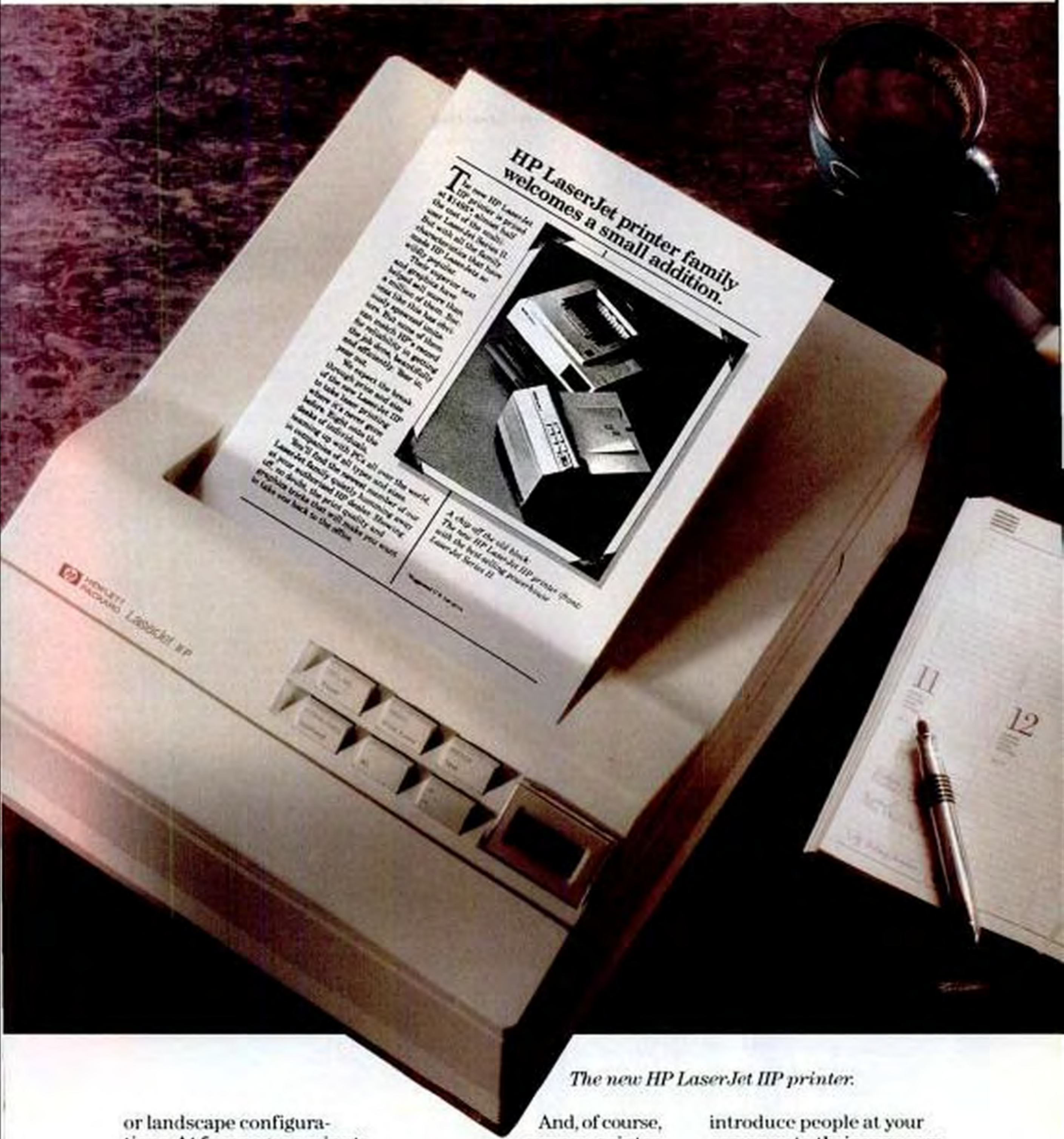
At only $1495,* it's got your name on it.

The HP LaserJet printer family has expanded— in a small way.

The new HP LaserJet IIP (as in Personal) fits right on your desk. And, with a price almost half of the multi-user LaserJet Series II,* into most budgets.

Its simple front panel gives you easy, push-button control over the menu, the 14 internal fonts, form feed and other functions. It handles four different paper sizes: letter, legal, executive and A4, as well as envelopes. In portrait

*Suggested U.S. list prices:
LaserJet IIP $1495;
LaserJet Series II $2695.
Dealer prices vary.



HP LaserJet printer family welcomes a small addition.

A chip off the old block. The new HP LaserJet IIP printer (front) with the best-selling powerhouse LaserJet Series II.

The new HP LaserJet IIP printer.

or landscape configurations. At four pages a minute. From one or two paper bins (the second is optional).

The 512K standard memory is upgradable to 4.5 Mbytes for more complex graphics and publishing programs.

And, of course, our new printer is compatible with the HP LaserJet Series II and virtually all popular PC software.

So call **1-800-752-0900, Ext. 277J** for your nearest authorized HP dealer. Then introduce people at your company to their very own HP LaserJets.

There is a better way.

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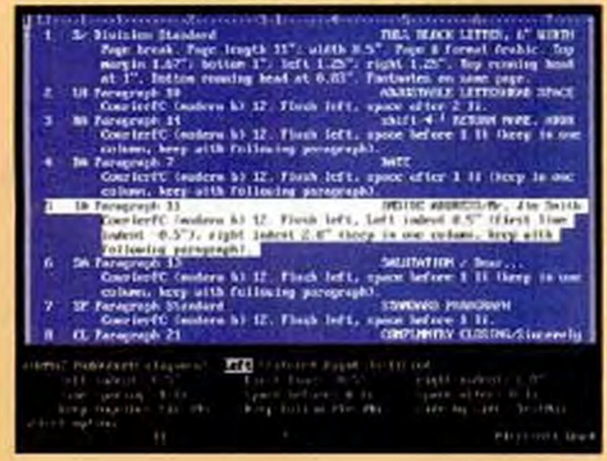
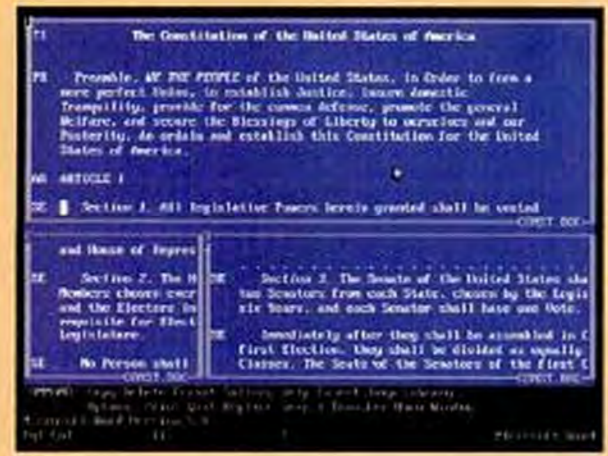
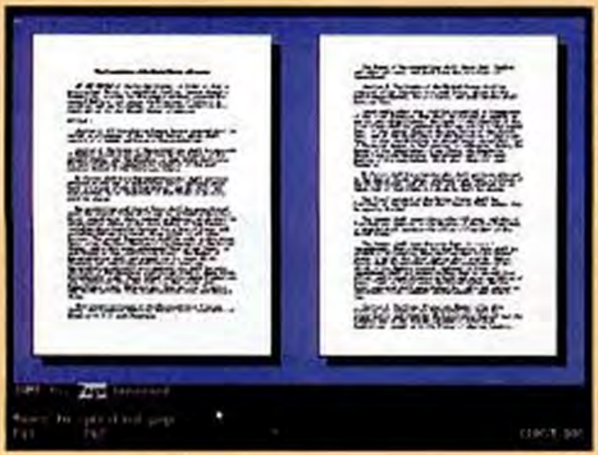


Microsoft Word's style sheets are displayed and edited in a screen accessed from the Gallery menu. Formatting for any paragraph can be described in comprehensible English.



Microsoft Word can display different parts of the same document in up to eight windows at once. The letters next to the paragraphs represent style codes.



Microsoft Word's page-preview screen presents almost-readable text, but the image can't be enlarged to reveal fine detail.

page. *Word* can automatically keep a heading and text together by forcing the last lines of one paragraph to print on the same page as the first lines of the next.

You can put boxes around text simply by moving the cursor into a paragraph or highlighting a block and pressing a few keys. You can position a paragraph on a page and make other text flow around it, although *Word* sometimes gets confused by the resulting narrow columns and prints two paragraphs on top of each other.

When *Word*'s original authors rethought the whole concept of formatting text for a printer, they got it almost entirely right. They divided formatting into character formats (type styles, text attributes like italic), paragraph formats (indents, line-spacing, space before and after), and "division" formats (margins and columns). There's nothing wrong with the concept of divisions, except that *Word* takes them too seriously. A single chapter or report can have multiple divisions, but *Word* insists on assigning the number 1 to the first footnote in each and forces you to renumber the notes in any later division by hand.

For all its skill at basic formatting, *Word* doesn't equal the subtlety and precision with which *WordPerfect* controls a printer. *Word* doesn't let you adjust letterspacing and word spacing anywhere in a document, doesn't support kerning, and offers a limited number of widths for borders and lines. *Word* comes with printer drivers that sometimes include more fonts and cartridges than the printer can hold at any one time; if you don't use a utility program to modify the drivers, *Word*'s font menu often lets you choose fonts that you don't actually have, with disastrous results on the printed page. *Word* supports more than 275 printers, roughly half the coverage of *WordPerfect*.

To print a nonstandard foreign or technical character, you have to figure out for yourself whether your fonts support it and then remember which ASCII character you should type to the screen in order to get the completely different character that you want at the printer.

BRINGING IN GRAPHICS

Word imports most standard graphics formats and lets you resize images and position them in relation either to the text or to a specific location on the page. Text can flow around rectangular but not irregular graphics. A screen-capture utility lets you rotate images 90 degrees. Graphics themselves are not included in a *Word* file, only

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PERFORMANCE TESTS: THREE MAJOR WORD PROCESSORS

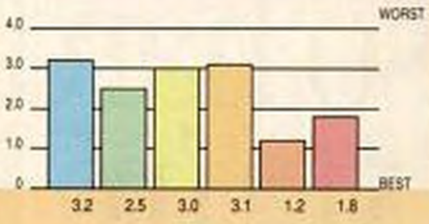
All three of these popular, high-end word processors perform well on our tests. The speed differences are slight except in isolated cases. Clearly, when you want to decide among these competitors, feature sets are a far more important consideration than relative speed.

For this set of performance tests, PC Labs tested under both OS/2 and DOS. *DisplayWrite* is represented by its highest DOS version (Version 4.2) and its OS/2 version (5/2). Our test equipment was an IBM PS/2 Model 70-A21 running at 25 MHz with a 120MB hard disk and 4MB RAM. A Hewlett-Packard LaserJet Series II was used for printing. A 50,000-byte ASCII file was used for testing, and all timing was done with a stopwatch.

Program Load

Elapsed Time (seconds)

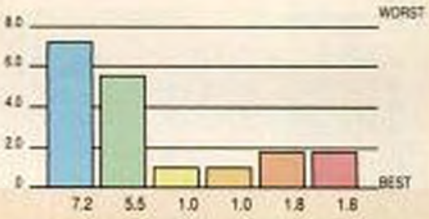
The **Program Load** test times how long it takes to load the word processing program from the hard disk, from the moment the Enter key is pressed at the command line (with no parameters active) to the moment that keystrokes can be entered in the program.



Import File

Elapsed Time (seconds)

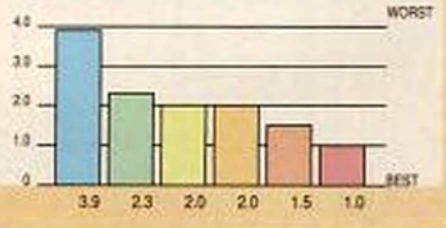
The **Import File** test measures the time required to bring in the test file from the hard disk and have the word processing software convert it to the package's native format. Timing starts when the key is pressed to begin the import and ends when the file is on the screen.



Save and Continue Edit

Elapsed Time (seconds)

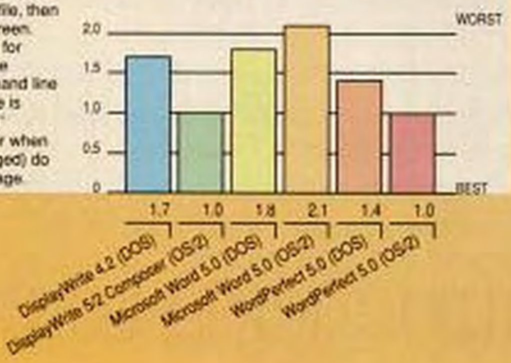
In the **Save and Continue Edit** test, the file is saved to the hard disk while it is being edited. Timing starts at the moment the command to save is executed and ends when keyboard control is regained.



Save and Blank Screen

Elapsed Time (seconds)

The **Save and Blank Screen** test adds a space to the beginning of the file, then saves the file and blanks the screen. Timing starts with the keystroke for saving the file and ends once the screen is cleared and the command line or menu is displayed. The space is added to make sure that "smart" programs (which can save faster when they detect that a file is unchanged) do not have a performance advantage.



CONTINUES

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Others claim to put over 150 fonts on a single cartridge, but their shortcuts can boggle your software drivers and leave you unable to perform simple operations. SuperSet drivers allow you to interface more easily with WordPerfect, PageMaker, MicroSoft Word, and Windows, Wordstar 2000, Lotus 1-2-3, dBase III, DisplayWrite, MultiMate Advantage II, Ventura Publisher and other popular programs.

Crisp, clean, HP-equivalent font families from Tms Rmn to Helv, presentation graphics to bar codes. Backed by JetWare's reputation for quality and consistency. After all, we're the only company that offers the complete family of HP font cartridges and soft fonts from A to Z. Plus a five-year warranty.

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an instruction to include the graphic at print time. TIFF files are noticeably degraded in printing, even at *Word*'s highest resolution. *Word* now offers a graphic page preview, but it displays only a miniature image with barely readable text and can't zoom in for a more detailed view.

It isn't hard to learn the basics of *Word*. The paperback manuals are clear and sensibly arranged by topic. The on-screen menu gives quick access to essential functions, and anything you don't find under the obvious places is likely to be found among the miscellaneous functions gathered under Library. Tutorial files are linked to context-sensitive help, so you can get a quick, focused lesson exactly when you need it.

Word's menus, which you reach by pressing the Esc key, are mildly inconsistent in design. In the higher levels of each branch in the menu tree, you can choose options quickly by pressing letter keys, but at the lowest level you have to use the tab or arrow keys to move around the different fields in the menu—and then you can use letter keys again to choose among the options in each field. If you use a mouse exclusively, you won't notice the inconsistency, but you'll get your work done more slowly. You can exit most submenus by pressing Esc, but some make you press E for Exit. To rename a file you use the Transfer Rename menu, but to copy or delete the same file, you need to jump over to the Library Document-Retrieval menu.

Whenever you can fill in a menu field with an item from a list, *Word* lets you press F1 to see the available choices. If the choices are a list of files, the screen gives you convenient access to other drives and directories, although *Word* inconveniently refuses to display the date or size of the files listed. *Word*'s keyboard uses all states of the function keys. Some keys give you access to functions like cursor line-drawing, which you can't reach from the menu at all. Other keys are shortcuts to an arbitrary selection of options normally available from the menu; in its ads, Microsoft uses these shortcuts to claim that *Word* needs fewer keystrokes than *WordPerfect*, but the shortcuts cover only a small number of *Word*'s many options.

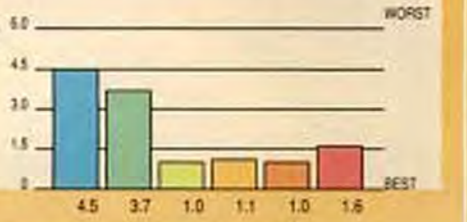
With a mouse you can use scroll bars in the border of the text window to roam around a document without moving the cursor that represents the text-entry point. Using either the mouse or a menu, you can split the screen into up to eight windows, including a footnote window that automat-

PERFORMANCE TESTS: THREE MAJOR WORD PROCESSORS

Global Search-and-Replace

Elapsed Time (seconds)

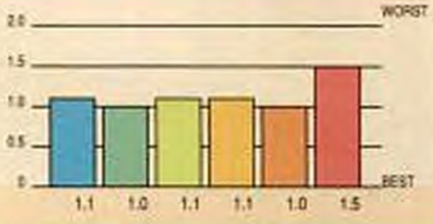
The **Global Search-and-Replace** test performs an automatic search-and-replace to locate 100 occurrences of a word in the test document and replace each occurrence with another word. Timing begins on execution of the search and ends with the last replacement.



Search for Middle

Elapsed Time (seconds)

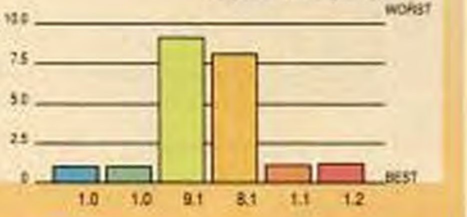
The **Search for Middle** test marks the middle of the document with the string "This is the Middle of the File," then searches for the string from the top of the file. Timing begins with execution of the search and ends when the string is located.



Regain Keyboard Control After Print Command

Elapsed Time (seconds)

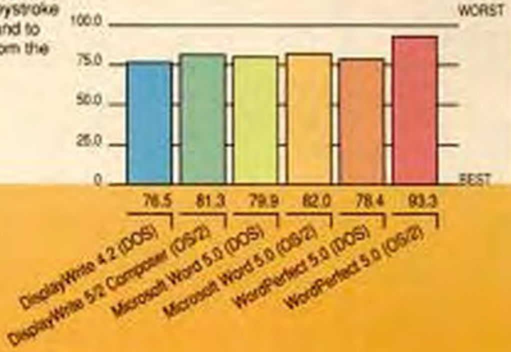
In the **Regain Keyboard Control After Print Command** test, the file is printed, and the delay is timed from the keystroke that executes the print command to the moment when control of the keyboard is regained.



Time To Complete Printing

Elapsed Time (seconds)

The **Time to Complete Printing** test measures the time from the keystroke that executes the print command to the ejection of the last page from the printer.



CONTINUES

ically displays the notes linked to the text that appears in another window.

STYLESHEETS

The one steep cliff in the learning curve is the point where you start to learn stylesheets. *Word* makes the climb easier by letting you first apply format to text and get an idea of how the new format looks, and only then record the formatting to a stylesheet—although you can still save steps by typing formatting commands directly into a stylesheet.

Most *Word* users probably never touch stylesheets and manage very well without them. But if you use proportional type or any moderately fancy layouts, you will only waste time by not modifying at least the default stylesheet. Unless you modify the stylesheet, *Word* defaults to typewriter-style six lines per inch, and you'll have to change the line spacing by hand to the "Auto" setting. *WordPerfect*, in contrast, automatically adjusts line spacing to match any font you choose.

Unlike most other word processors, *Word*'s mail-merge and macro functions use virtually the same straightforward programming language. Programmed macros, keystroke-recorded macros, and boilerplate text are all stored in *Word*'s "glossary" files—either in the default glossary or the glossaries for special uses—and boilerplate text can be associated with styles. Macros can be invoked from key combinations and can run DOS commands. The powerful merge functions let you vary the text included in a document depending on whether certain fields have numbers greater or lesser than numbers you specify or contain place-names or any other text.

FACT FILE

EDITOR'S CHOICE

Microsoft Word, Version 5.0
Microsoft Corp., 16011 N.E. 36th Way, Box 97017, Redmond, WA 98073; (206) 882-8080.
List Price: $450; upgrade from earlier versions, $75.
Requires: 384K RAM, (hard disk and mouse recommended; graphics card required for page preview), DOS 2.0 or OS/2 1.0 or later.
In Short: *Microsoft Word* 5.0 is impressively fast and glitters with features. Formatting is extremely quick and convenient, and advanced programmable macros and merges are easy to perform. *Word* uses the mouse more extensively and imaginatively than any other word processor.

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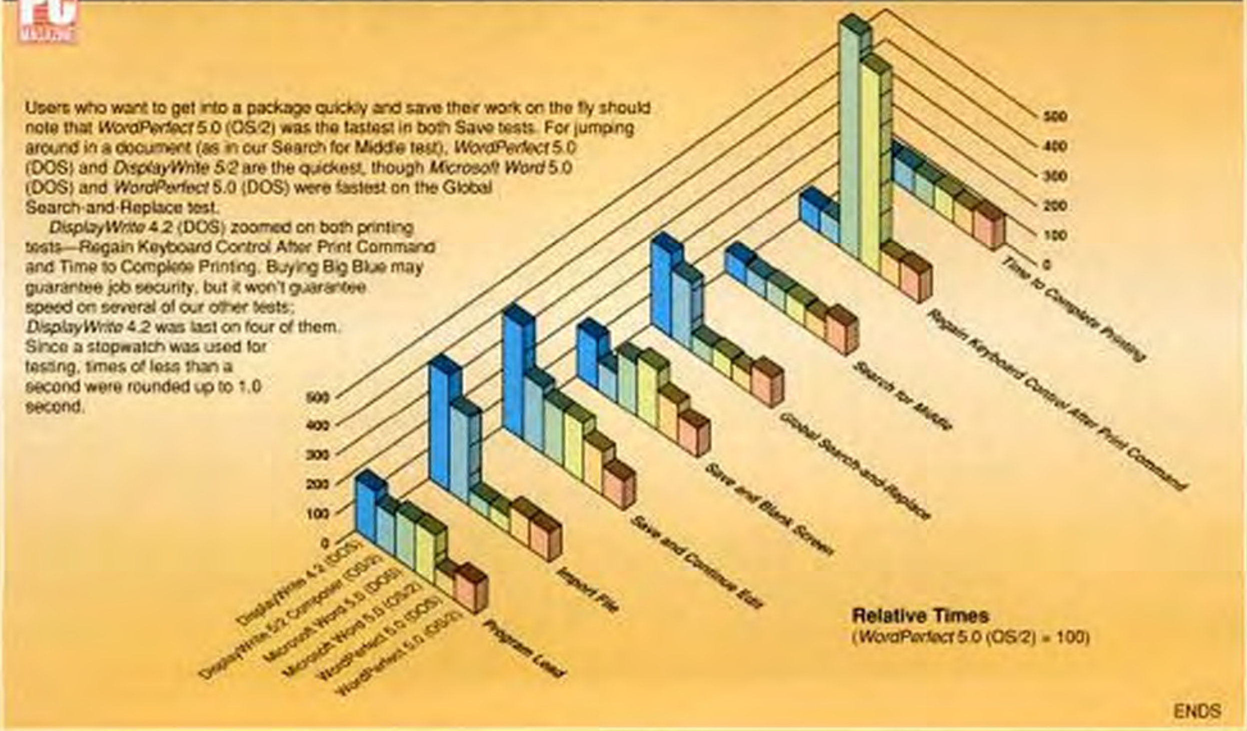
Word's speller is now integrated into the rest of the program and can flag minor errors in capitalization and punctuation. Although, as with any speller, you can add words to a user dictionary, *Word* can't display added words among its suggested alternatives when it finds a misspelling. *Word* incorporates the industry-standard *WordFinder* thesaurus. The hyphenation function uses an algorithm and can't be supplemented by a dictionary as in *WordPerfect*.

Word's document retrieval feature lets you locate files by searching for text in summary screens or the files themselves. You can link *Word* documents to spreadsheets of up to 32K, but you must give an explicit command to update the link after altering data in the worksheet. You can also link a document to part or all of other *Word* documents in the same way.

Within a single document, you can create automatic cross-references as well as an index and a table of contents. Both cross-references and links between documents economically make use of *Word*'s new bookmark feature, which lets you jump to a named region of any file without

WORD PROCESSOR PERFORMANCE TESTS: COMPOSITE VIEW



Users who want to get into a package quickly and save their work on the fly should note that *WordPerfect* 5.0 (OS/2) was the fastest in both Save tests. For jumping around in a document (as in our Search for Middle test), *WordPerfect* 5.0 (DOS) and *DisplayWrite 5/2* are the quickest, though *Microsoft Word* 5.0 (DOS) and *WordPerfect* 5.0 (DOS) were fastest on the Global Search-and-Replace test.

DisplayWrite 4.2 (DOS) zoomed on both printing tests—Regain Keyboard Control After Print Command and Time to Complete Printing. Buying Big Blue may guarantee job security, but it won't guarantee speed on several of our other tests; *DisplayWrite* 4.2 was last on four of them. Since a stopwatch was used for testing, times of less than a second were rounded up to 1.0 second.

Relative Times
(*WordPerfect* 5.0 (OS/2) = 100)

ENDS

making you search for specific text.

If you want to exchange *Word* documents with users of other software, you'll have to either buy a conversion program or hope that the other software comes with a conversion program of its own. *Word* can export files in ASCII format and Microsoft's Rich Text Format (for exchange with *Word* for the Macintosh), and it comes with a utility to convert files into IBM's DCA format. Beyond that, you're on your own.

TECHNICAL SUPPORT

Microsoft's technical support staff is knowledgeable and polite, as they should be when answering calls that you have to pay for. Unfortunately, tech support wasn't able to offer fast fixes for the many incompatibilities between the first release of *Word* and many combinations of VGA adapters and hardware, including problems with some all-IBM machines.

Microsoft ships only one version of *Word*, which you can install for DOS,

BEYOND THE BIG GUYS: The Best of the Other Word Processors

by Edward Mendelson

PC Magazine's editors winnowed the 55 packages tested in our word processing blockbuster (February 29, 1988) down to five Editor's Choices: *Nota Bene* 2.0, *Q&A Write*, *Microsoft Word* 4.0, *WordPerfect* 4.2, and *XyWrite III Plus*. The story on *Word* 5.0 and *WordPerfect* 5.0 is updated in the accompanying evaluations. What's the latest news on the others?

The best package for manipulating text remains Dragonfly Software's $495 *Nota Bene* 3.0, with a major upgrade to 4.0 due around this fall. *Nota Bene* began as a word processor for academics and has grown into a matchless instrument for creating, modifying, and formatting all forms of text. Its keyboard is densely but logically organized and includes conveniences like keys that scroll two windows simultaneously, a smart quotation mark key that automatically senses whether to insert an opening or closing quotation mark character, and one-keystroke transpositions of words, sentences, and paragraphs. It remembers the last ten search and replace strings and has a five-level undelete buffer. *Nota Bene* offers a richly customizable system of collapsible outlines, footnotes, tables, and cross-references, and its built-in textbase lets you access megabytes of files in seconds. A $165 add-on bibliography program automates repeated references for legal and academic work.

Nota Bene gets its jackrabbit speed from a souped-up version of the *XyWrite* engine but adds scores of functions that *XyWrite* itself doesn't have. All of its hundreds of functions are available from Lotus-style menus, but advanced users can jump to a smart command line that lets you cycle through earlier commands to save retyping. If you don't need graphics capabilities, you may find that *Nota Bene* surpasses both *Word* and *WordPerfect* in its powers as a text processor.

Symantec's $199 *Q&A Write* remains a smooth performer in the executive class. The original character-mode version is still available, while a new version, *DeskMate Q&A Write* (also $199), comes with a runtime version of Tandy's *DeskMate* graphic interface. Both versions use clear and logical menus. The built-in database, with up to 1,000 records, lives up to expectations raised by the high-powered *Q&A* database package. The *Q&A* package is weak in formatting features, but the new *DeskMate* version imports some graphic formats and includes a graphic page preview.

For expert users, XyQuest's *XyWrite III Plus* remains almost identical to the version reviewed last year—still the lean, command-driven speed demon favored by hard-bitten journalists. For timid beginners, the *A La Carte* menus shipped with recent copies of the program make the program's interface more inviting. A major upgrade is rumored for late this year or early next.

During the past two years at least one other program has ascended into the heights reached by 1988's Editor's Choices. Software Publishing's *Professional Write*, now in Version 2.1, equals or betters *DeskMate Q&A Write* in its formatting, graphics, and database functions and manages to be even easier to learn and use. Printer and font support is especially strong. Neither of these executive word processors has footnote features, but if limited disk space and budget make you hesitate to choose a full-featured package, *Q&A Write* or *Professional Write* offer surprisingly effective alternatives.

One other contender, *Lotus Manuscript* 2.1, is prominent for its equation editor and large-scale outlining, despite a totally non-WYSIWYG editing screen. But the new *WordPerfect* 5.1 will have even better equation support, and *Word* 5.0 offers outlining with greater convenience and flexibility. ■

FACT FILE

***Lotus Manuscript*, Version 2.1**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $495. **Requires:** 512K RAM, hard disk, DOS 2.0 or later. Graphics adapter required for Document Preview.

CIRCLE **399** ON READER SERVICE CARD

***Nota Bene*, Version 3.0**
Dragonfly Software, 285 West Broadway, #600, New York, NY 10013; (212) 334-0445.
List Price: $495; bibliography program, $165; special language supplements, $125 ($195 for package that can access all five languages at once). **Requires:** 512K RAM, hard disk recommended, DOS 2.0 or later.

CIRCLE **400** ON READER SERVICE CARD

***Professional Write*, Version 2.1**
Software Publishing Corp., P.O. Box 7210, 1901 Landings Dr., Mountain View, CA 94039; (415) 962-8910.
List Price: $229. **Requires:** 512K RAM, hard disk recommended, DOS 2.0 or later.

CIRCLE **401** ON READER SERVICE CARD

Q&A Write
Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; (408) 253-9600.
List Price: $199; *DeskMate Q&A Write*, $199. **Requires:** 384K RAM (512K recommended; *DeskMate* version requires graphics adapter), two disk drives (hard disk recommended), DOS 2.0 or later.

CIRCLE **402** ON READER SERVICE CARD

XyWrite III Plus
XyQuest Inc., 44 Manning Rd., Billerica, MA 01821; (508) 671-0888.
List Price: $445. **Requires:** 384K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.

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HP LaserJet IIP Compatible

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Spending a lot of time, effort and money fooling around with downloadable soft fonts? Don't give up. Just plug in Pacific Data Products' *Headlines in a Cartridge*™.

Immediately, you gain access to 18 high-quality Helv and Tms Rmn style fonts. And they come in the most widely used display sizes—14, 18, 24, 30, 36, and 48 points. In bold or italic styles. No other font cartridge can match these point sizes.

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Keep your hands where they belong.

Odd as it may seem, the mere act of lifting your hands to poke among the function keys on your keyboard can slow you down as you write. It may not seem like much each time, but multiply the time lost in drafting a report or even a letter, and it adds up. A lot.

That's why our newest release, WORDSTAR 5.5®, can help you work faster. A powerful,full-featured word processing package, WORDSTAR 5.5 is the only leading word processing software program designed to help you keep your hands where they belong – on the home row – and work faster.

You don't type by touch? WORDSTAR 5.5 is the first word processing program to incorporate the IBM Systems Applications Architecture™ (SAA) "pull down" menus. So you can find the functions you want by a simple "point and shoot." Using the "pull down" menus also helps you learn WORDSTAR 5.5 quickly and easily.

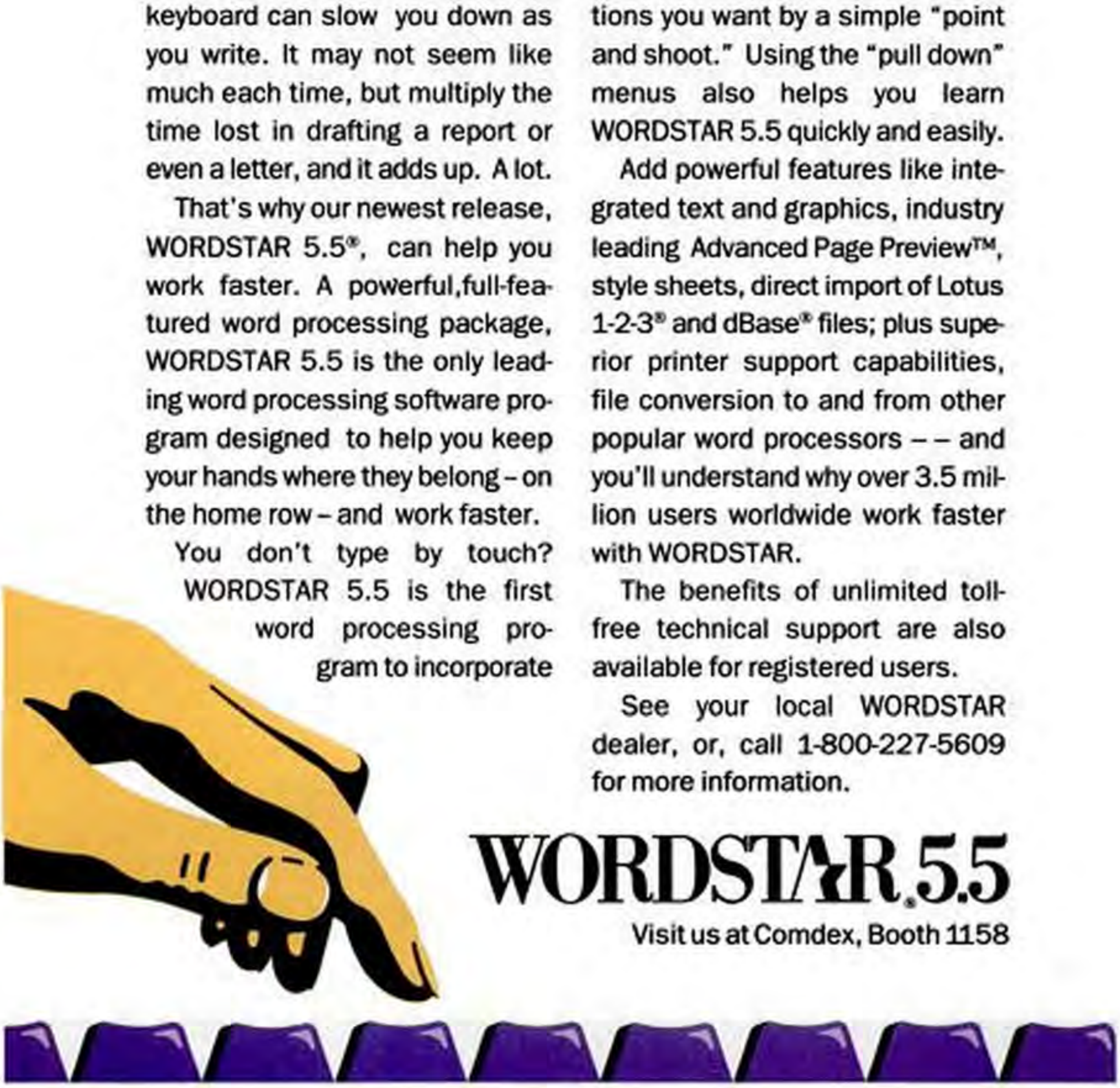
Add powerful features like integrated text and graphics, industry leading Advanced Page Preview™, style sheets, direct import of Lotus 1-2-3® and dBase® files; plus superior printer support capabilities, file conversion to and from other popular word processors – – and you'll understand why over 3.5 million users worldwide work faster with WORDSTAR.

The benefits of unlimited toll-free technical support are also available for registered users.

See your local WORDSTAR dealer, or, call 1-800-227-5609 for more information.

WORDSTAR® 5.5

Visit us at Comdex, Booth 1158



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CIRCLE 264 ON READER SERVICE CARD

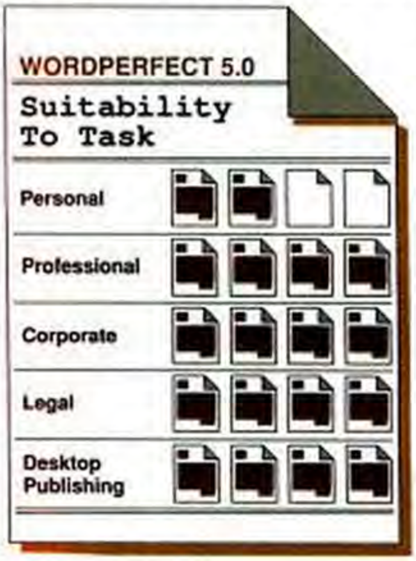
OS/2, or a network. When running under OS/2, *Word* is functionally the same as when running under DOS except for some arcane limits on mouse functions. Running *Word* under OS/2 also eliminates the bottlenecks that often make *Word* frantically flash a message to save your file when you perform memory-intensive tasks.

Word has no rival in ease of formatting, and its outliner is the best in any word processor. Its ability to edit different parts of the same file in different windows on the same screen is indispensable. Although its printer control is strong, it no longer leads the industry, and its foreign-language and scientific support is limited. But if *Word*'s manifold and impressive strengths correspond to your needs, you will find it one of the most convenient and powerful programs on the market.

WordPerfect 5.0

Nothing could be emptier and more simple than *WordPerfect*'s editing screen, with a laconic status line in the lower-right corner and acres of blank space to write in. And nothing could be more plentiful and elaborate than the gigantic network of features hidden beneath.

That combination of simplicity and power makes *WordPerfect* the $495 colossus of word processors, a giant both in its range of functions as well as in its share of the market. WordPerfect Corp.'s powerhouse can be found on every variety of system from the Apple II and the Macintosh to the Amiga, Atari, VAX, IBM 370, and on to OS/2 and Unix machines.



WORDPERFECT 5.0

Suitability To Task

Personal	■	■	□	□
Professional	■	■	■	■
Corporate	■	■	■	■
Legal	■	■	■	■
Desktop Publishing	■	■	■	■

WordPerfect serves the whole spectrum of users while serving the whole spectrum of computers. Beginners can create and print a file after learning to use two or three function keys. More-advanced users learn other function keys that lead to modest-looking one-line menus; only in the submenus one more level down does *WordPerfect*'s enormous range of options and functions finally become apparent. (Version 5.1, due to appear by the time you read this, will have mouse support and optional pull-down menus that let you forget the function keys altogether.)

WordPerfect serves corporate and academic users by being the most communicative of word processors. It lets you share files with minimum effort and maximum compatibility. If you create a document with fonts and layouts tailored to your PostScript typesetter, you can hand the file to a colleague with a 9-pin dot matrix printer, and his copy of the program will automatically produce the best possible approximation of the original. You need give your colleague only one file because *WordPerfect* documents are self-sufficient enough to carry their stylesheets and graphics with them.

WordPerfect is highly hospitable to files created by other software. Built into the program is a smart ASCII import that optionally strips excess carriage returns. A conversion program imports and exports documents in DCA, *WordStar*, *MultiMate*, and other formats, and imports but does not export *Word* 4.0 files. Version 5.1 will add links to spreadsheets and automatically update the links whenever you load the *WordPerfect* file; 5.1 will also read virtually any database file.

INTEGRATED FUNCTIONS

All of *WordPerfect*'s functions are integrated, so that if, for example, you choose another printer driver, all related options change automatically—the printer port, the default type style and size, the sizes of superscripts and headings, even the paper size. *WordPerfect* does the tedious work of reformatting and leaves you to get on with the work of thinking and writing.

No other word processor approaches *WordPerfect*'s virtuosic control over more than 450 printers. You can make fine adjustments in the average spacing between letters and words. You can designate one page in a file as printed letterhead, another as standard letter paper, another as an envelope—and each prints in the correct orientation, using paper taken from the correct slot on the printer. *WordPerfect*'s printer drivers are full-fledged programs with variables and branching, rather than mere lists of data, yet a supplied printer-definition program lets you modify or create drivers using simple menus. (The manual for the printer-definition program costs an extra $19.95.)

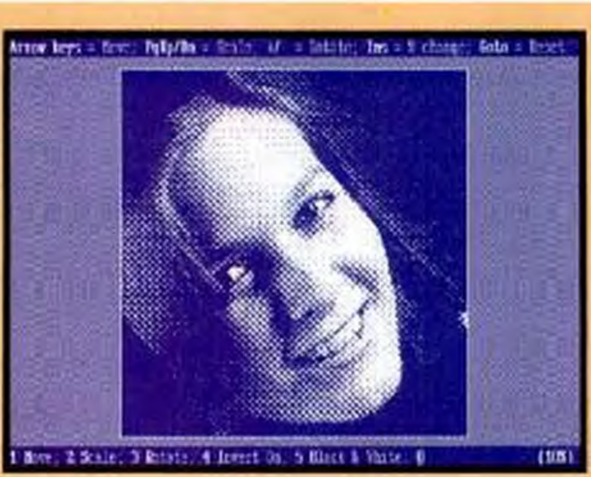
In its handling of foreign and technical characters, *WordPerfect* is rivaled only by *Nota Bene*. You can enter 1,700 characters, including Greek, Hebrew, Cyrillic, and Japanese, from the keyboard using a "compose" key that inserts an "é" when you type an "e" and an apostrophe or inserts less-common characters when you enter numerical codes for the 15 character sets listed in the manual. If you don't like typing 4,23 to enter the copyright symbol, you can automate it with a macro.

WordPerfect handles pictures with the same aplomb it brings to type. You can rotate, size, stretch, or crop an image, and position it at any point on a page or insert it into a line of text like a character.

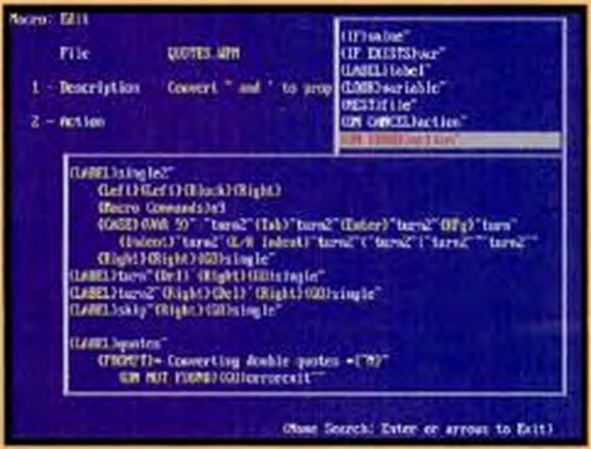
A text screen attached to an EGA, VGA, or Hercules card can display 512 different characters, and all 1,700 can appear on the graphic page preview, which zooms in to 200 percent magnification. You won't get nasty surprises when you try to print special characters, because the graphic preview displays a character only if your printer's fonts can print it. In Version 5.1, if your fonts don't include the character you need, *WordPerfect* will print it by generating it as a graphic—a spectacular convenience for foreign-language work, matched by 5.1's new feature that can display and print any equation as a graphic.

WordPerfect handles pictures with the

WordPerfect's unique graphics-editing screen lets you rotate and resize images or move them within a frame. You can't modify individual pixels, but you can do anything else to manipulate the image.



WordPerfect lets you edit recorded macros or create programmed macros using a macro-editing screen. The menu at the upper right lets you enter programming commands into a macro.


Macro: Edit

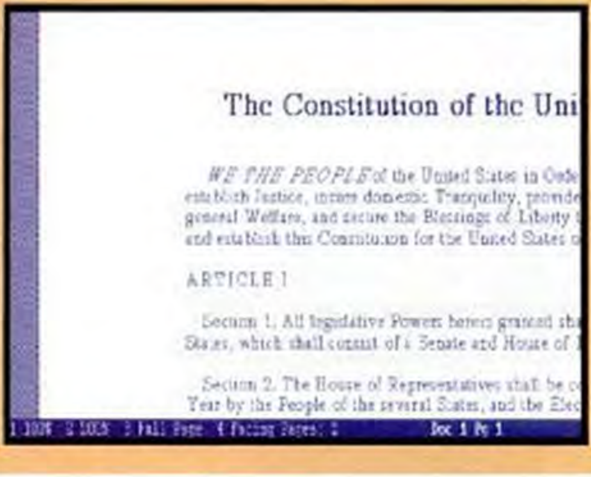
File QUOTES.WPM

1 - Description Convert " and ' to prop

2 - Action

(Name Search: Enter or arrows to Exit)

WordPerfect's page preview zooms to fine details of layout. Notice the wide spacing in the all-capitals text, a typographic effect achieved with *WordPerfect*'s advanced printer controls.


The Constitution of the Uni

WE THE PEOPLE of the United States in Orde
establish Justice, insure domestic Tranquility, provide
general Welfare, and secure the Blessings of Liberty
and establish this Constitution for the United States o

ARTICLE I

Section 1. All legislative Powers herein granted sha
States, which shall consist of a Senate and House of

Section 2. The House of Representatives shall be co
Year by the People of the several States, and the Elec

same aplomb it brings to type. You can rotate, size, stretch, or crop an image, and position it at any point on a page or insert it into a line of text like a character. *WordPerfect* uses measurements as small as 0.00083 of an inch, so you can specify the width and location of graphics lines and boxes to the limit of a printer's ability.

WordPerfect lets you put a box around text using any style or shading you like. In Version 5.0 this function is powerful but clumsy because you can't see boxed text on the normal editing screen; in 5.1, boxes, tables, and side-by-side columns will be produced effortlessly by moving the cursor around an ingenious table editor.

WordPerfect's footnotes offer a combination of great power and minor inconvenience.

TEXT FORMATTING

You can apply virtually any formatting to text in a *WordPerfect* document, although sometimes you have to use roundabout methods. You can't specify paragraph formats as straightforwardly as in other programs. You have to insert an unintuitive code if you want headers or footnotes to print in the font you choose. For a hanging indent you press the Indent key to indent the paragraph, then press the Margin Release key to move the first line back to the margin. (Margin Release key? On a word processor?) These indent codes move the cursor to a tab stop, which means that your paragraph formats will change in ways you may not like when you reset your tabs. At the start of a hanging-indented paragraph, the cursor jumps bewilderingly forward and back on screen as it moves through the format codes. To edit such paragraphs safely, you have to split the screen between the normal editing window and a window that lets you tinker directly with the codes.

WordPerfect's styles let you incorporate text and format codes into a kind of supercode whose content changes when you change stylesheets. The effects are more elaborate than *Word*'s styles, but less convenient to apply because you choose styles from a menu and have to write macros if you want to apply them with only one or

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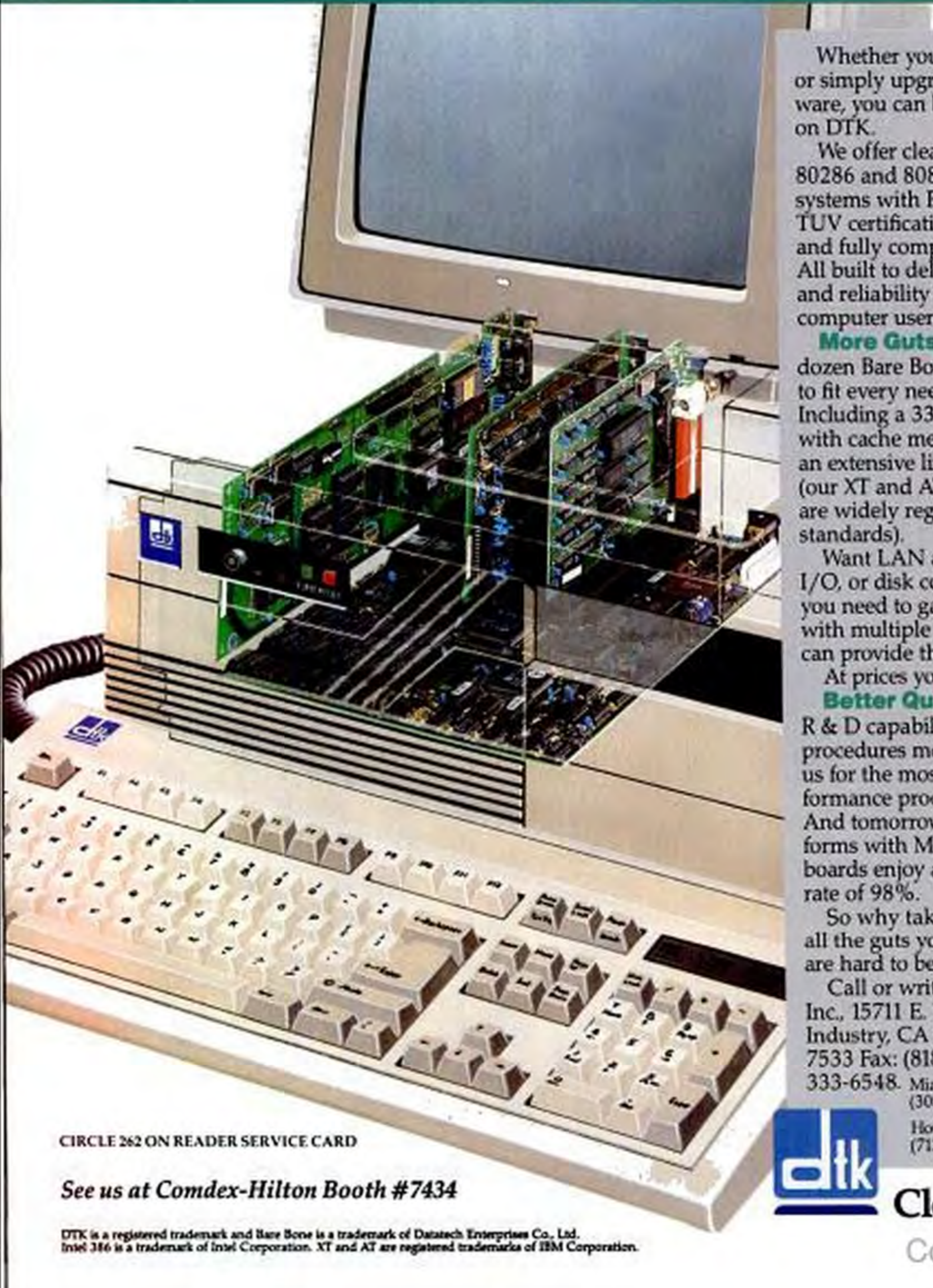

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MAN LOSES HAIR WAITING FOR DOS

Anytown, USA—The unidentified victim was apparently among the millions of people who still think that DOS Backup and Copy commands are a safe and convenient way to back up their valuable hard disk data.

It is not known whether the shocking loss was a result of natural aging while DOS made the backup, or whether the victim pulled his hair out in frustration after discovering that a minor disk error had rendered his entire backup set useless.

According to reliable sources, the tragedy could have been averted if the man had been using **FASTBACK PLUS,** the world's fastest and most reliable backup software.

A special commission has been appointed to study ways in which the public can be made aware that **FASTBACK PLUS'** *Advanced Error Correction, easy-to-use menu, flexible file and directory selection, automated backup options* and other features allow even beginners to make fast, foolproof backups.

Public knowledge of these facts could ease the widespread stress and trauma that result from using DOS commands to back up hard disk data.

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two keys. If you don't use styles, you have to write macros to make global format changes in a file. *WordPerfect* has no direct way of transforming all underlined text to italic, and more-complex changes require elaborate macro programming.

WordPerfect's footnotes offer a combination of great power and minor inconvenience. You can have footnotes and endnotes in the same file, and you can reference them with letters, numbers, or symbols. But you can't edit a footnote on the same screen with the main text, and to make a search or replace operation extend into footnotes, you have to remember to press Home before the Search key. Footnote numbering can be restarted at any number and isn't disrupted by formatting changes as it can be in *Word*. Automatic cross-referencing links notes, tables, pages, and graphics. One reason *WordPerfect* is popular in law offices is its built-in support for the special abbreviations and formats used in legal citations. *WordPerfect* does create outlines but can not collapse them so that only the higher levels are visible.

WordPerfect's speller lacks a whole-word option but lets you remove or add words from the main dictionary so that they appear among the alternatives for misspelled words. You can insert codes in a document that make *WordPerfect* switch to another dictionary when it reaches that code—an ideal feature for files that use more than one language.

One reason *WordPerfect* is popular in law offices is its built-in support for special abbreviations and formats used in legal citations.

KEYBOARD INTERFACE

WordPerfect's keyboard interface generally puts related functions on different states of the same key, but some assignments seem capricious: the speller, for example, is on Ctrl-F2, the thesaurus is on Alt-F1. Block moves and copies require excess keystrokes. To reach the beginning of the text in a file you press "Home Home Up"; but you press Home three times, then Up, to reach the beginning of the codes in the file. Although you normally complete a command by typing a string and pressing Enter, with the Search key you type the search string and then press the Search key again. This lets you search for carriage returns without entering the special codes required by other programs, but it's an inconsistency that can waste more time than it saves.

PC MAGAZINE **FACT FILE**

EDITOR'S CHOICE

WordPerfect, Version 5.0
WordPerfect Corp., 1555 North Technology Way, Orem, UT 84057; (801) 225-5000.

List Price: $495; upgrade from earlier versions, $75; network version: $695 for the server, $150 for each station; OS/2 version: $549; developer's toolkit, $40.

Requires: 384K RAM (512K and hard disk recommended), DOS 2.0 or later.

In Short: Now the market leader, *WordPerfect* 5.0 has the greatest depth and range of features, as well as the most exact control over the printer, of any word processor. Its graphics capabilities bring it close to the powers of desktop publishing programs. Versions for other computer platforms make it uniquely suitable for corporate use.

CIRCLE 398 ON READER SERVICE CARD

WordPerfect lets you create macros by recording keystrokes or using a built-in macro editor that includes variables, branching, and even lets you create menus that replace the ones designed by WordPerfect. A sample macro supplied on the disks makes a calculator pop up on the editing screen. Mail-merge in 5.0 doesn't directly support variables, but 5.1's revamped mail-merge will be fully programmable.

You get only two windows for editing files, but you can view a third file from the directory screen. That same directory screen supports extensive file management as well as word and document searches, including searches in document summaries. If you use the $129 *WordPerfect Library*—with its intelligent DOS shell, calculator, calendar, small database, macro editor, and other utilities—you can capture text from the screen and transfer it to any application. *WordPerfect Office*, a $495 package for use on networks ($150 for each extra station), expands on *Library* to

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EDITOR'S CHOICE

- **Microsoft Word**
- **WordPerfect**

Chances are you already use either *WordPerfect* or *Microsoft Word*. If so, there's no compelling reason to switch. There's also no strong reason to switch if you use any of the Editor's Choices from our word processing blockbuster of 1988. At that time, we gave the nod to five programs: *Nota Bene*, *Word*, *WordPerfect*, and *XyWrite* among high-end programs, plus *Q&A Write* among professional programs. Two others have made enormous strides in recent months, *Lotus Manuscript* in the high-tech arena and *Professional Write* in the executive suite. If you use any of these programs and are satisfied with their features, stay with what you've got.

If you use almost anything else, it's probably time to start over, and you won't regret choosing either *Word* or *WordPerfect*. The market has tilted decisively toward *WordPerfect*, and for the majority of users, the market has made an excellent choice.

WordPerfect has the greatest depth and range of features, the fullest control over the printer, and the best technical support in the industry. Corporate users can install versions of *WordPerfect* on platforms ranging from Unix and DEC machines through the IBM 370 and the Mac. *WordPerfect* has the full resources of a dynamic corporation behind it; it has the best features and support now and the most promise for the future. Version 5.1, due around the time you read this, improves the awkward spots in the keyboard interface.

Microsoft Word shines in the ease with which it lets you apply and alter formatting. Its stylesheets require some initial effort in learning but let you construct complex and repeatable page formats with a few keystrokes. Its collapsible outlines make large files manageable and convenient. *Word* was always strong in printer support, but *WordPerfect* has set a new standard that *Word* hasn't tried to approach.

Word 5.0 is smoother and more powerful than earlier versions, but its growth has slowed, and Microsoft seems to be turning its energies away from DOS-based *Word* and on to the forthcoming *Word for Windows*, scheduled to arrive late this year or early next. *Word for Windows* may open the era of serious WYSIWYG word processing. When that happens, all the honors will suddenly be up for grabs again.

include e-mail and scheduling.

A "master document" feature in Version 5.0 lets you incorporate other files as "subdocuments" that can be edited and modified separately and then printed as a single large file with continuous pagination, cross-referencing, and footnotes. *WordPerfect* can compare a file on-screen with a file on-disk and automatically redline or strike through any changes or rearrangements. Nonprinting comments added to files can be converted to printable text but, unlike *Word*'s invisible text, they can't be reconverted automatically into comments.

A refreshingly intelligent installation program checks out your system to make sure *WordPerfect* will work correctly from the start. Once inside *WordPerfect* itself, the help system is extensive enough to let you ignore the manual until you need to work with complex functions like merging, sorting, and math. In Version 5.0, the help system makes you consult an on-screen index if you don't know which key has the function you need help with; the help in 5.1 will be context sensitive.

Version 5.0's looseleaf manual is arranged alphabetically rather than logically and doesn't document all features; 5.1 will be better documented. A disk-based tutorial gets your feet wet in the program's basic techniques, and a 400-page workbook takes you into the program's depths. If all else fails, you can get fast and usually knowledgeable advice by calling a toll-free number. *WordPerfect*'s customer support is by far the best in the industry.

***WordPerfect* is the industry standard and also the flagship of a company dedicated to maintaining its dominance. Its control of the printed page makes other word processors look crude by comparison.**

Minor updates of *WordPerfect* appear every six weeks to two months and cost $10 or more, depending on the number of disks involved. You can even order a subscription and use one copy to update an entire office. These updates include minor bug-fixes as well as improved features and new options on the menus. *WordPerfect* 5.0's first release, for example, didn't support landscape graphics on the LaserJet and didn't include kerning tables; later updates have both.

A $549 OS/2 version of *WordPerfect* 5.0 has the same features as the DOS version except that it displays a session number on the status line if you open multiple copies of the program. A Presentation Manager version is due in 1990, with a *Windows* version a distinct possibility soon after.

WordPerfect is the industry standard and also the flagship of a company dedicated to maintaining its dominance. *WordPerfect*'s control over the printed page makes all other word processors look crude by comparison, and it combines unequaled power with an interface that makes basic functions simple. The program's main weakness lies in the fact that some of its most powerful functions, including those that format a page, are more awkward to use than they need to be. But *WordPerfect* is the word processor that individual and corporate users can buy with the utmost confidence that it will meet their needs both now and in the future. ■

Edward Mendelson is a contributing editor of PC Magazine.

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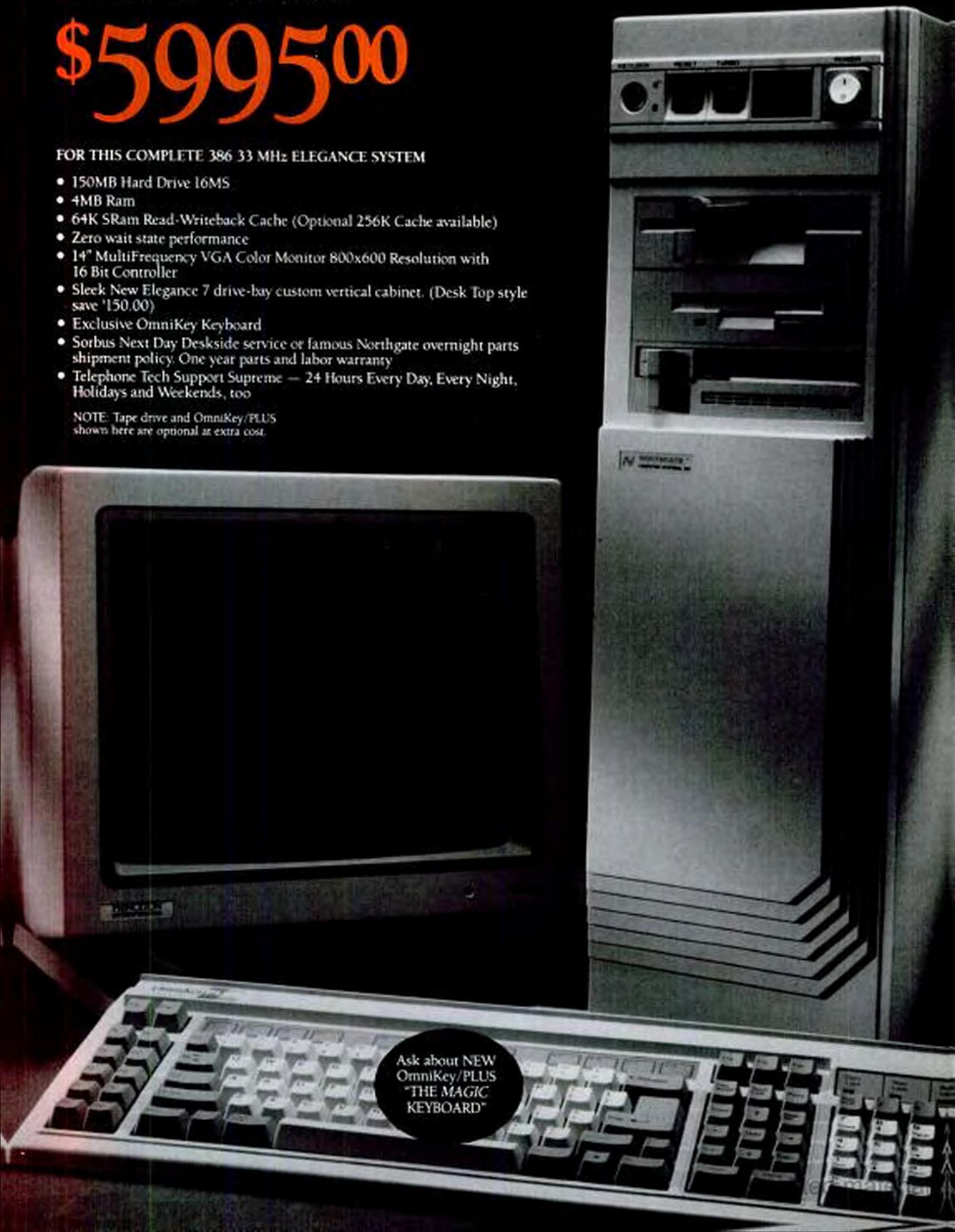

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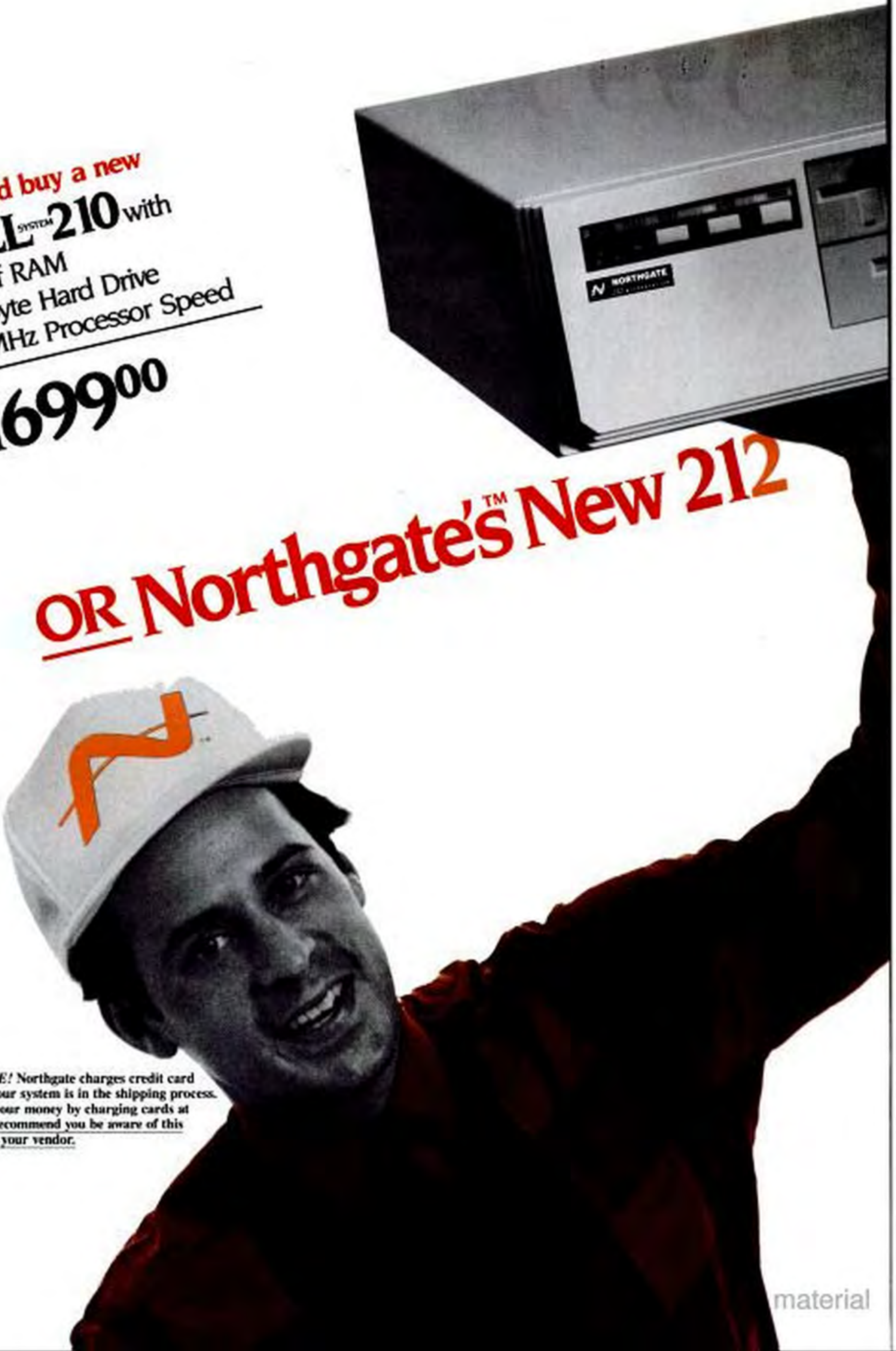

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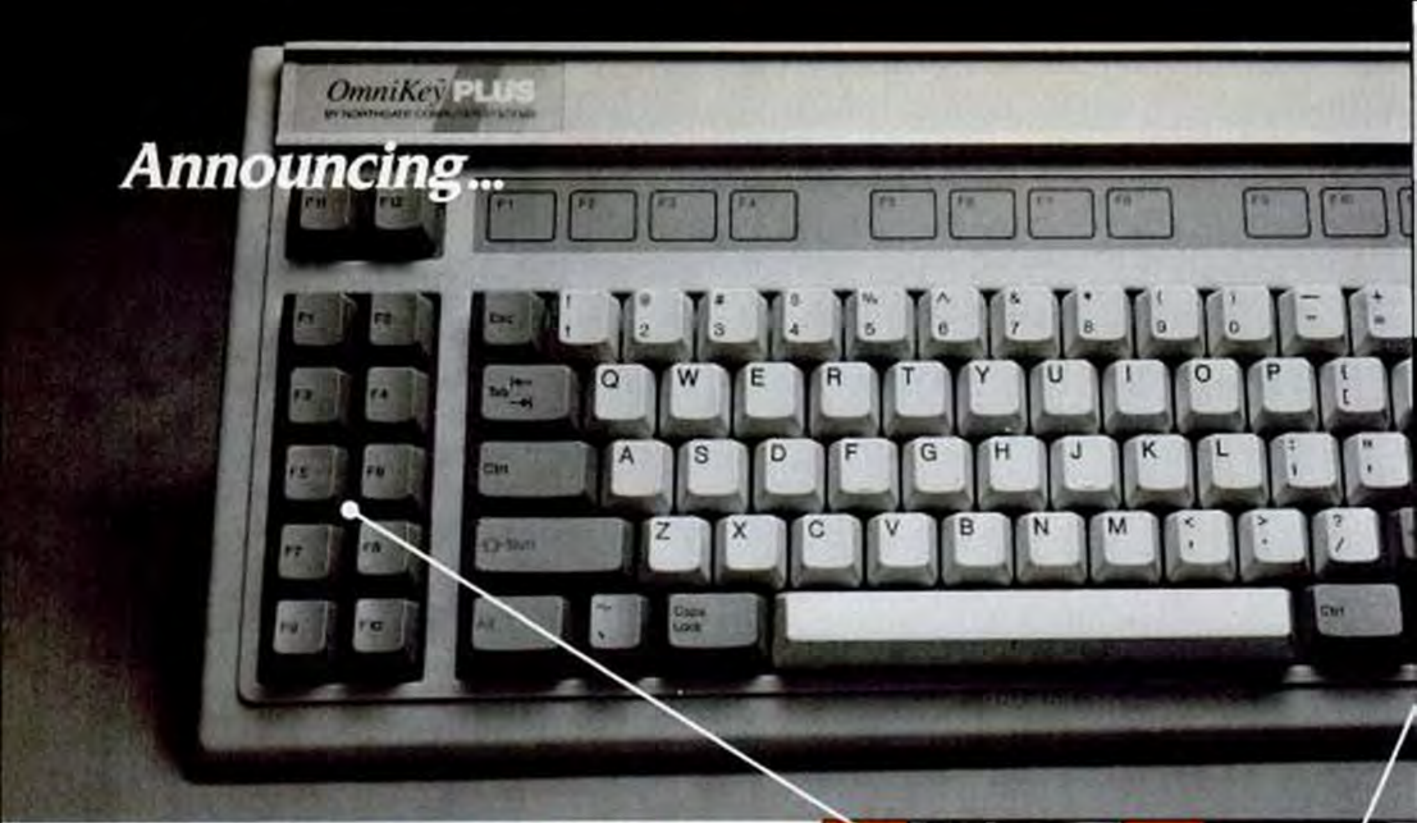

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Company ____________________

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Computer Brand & Type ____________________

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- [ ] **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- [ ] **INDIVIDUAL CREDIT.** Complete sections "a" and "b" only.

Please complete all appropriate sections, providing at least two year's residence and employment history. This will enable your application to be processed as quickly as possible. If you are self employed, please be sure to complete section "D".

Applicants must be 18 years of age or older.

a. Your Personal Information

Requested Line of Credit $ ______

Your Name: First Initial Last **Date of Birth:** Mo Day Yr **Social Security Number:**
Present Address Street Apt. # City State Zip **Home Phone** ( ) -
Date of Residence: Month Year **Monthly Payment:** $ Buy ☐ Rent ☐ Other ☐
Previous Address: **Dates of Residence:** From To
Your Employer: (If self employed, see rear panel.) **Date of Employment:** Mo Yr **Position:** **Monthly Income:** Gross $ Net $
Employer's Address: Street City State **Business Phone:** ( ) -
Previous Employer: **Address:** **Dates of Employment:** From To
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation. **Other Income:** I have received since (Date) Monthly Income Gross $ Net $
Name and Address of Nearest Relative Not Living With You: Relationship

b. Credit Information

include joint applicant's information, if joint account requested

Bank Account: Bank Name Address ☐ Checking ☐ Savings
Bank Account: ☐ Checking ☐ Savings

	Payment	Balance
Bank Loan Reference:		
Bank Card Reference: VISA Mastercard		
Other Credit Card Reference		
Other Credit References: Account No. Expires		

Driver's License No. State Expires

c. Joint Applicant's Personal Information

If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract.

Joint Applicant's Name: First Initial Last **Date of Birth:** Mo Day Yr **Social Security Number:**
Address Street Apt. # City State Zip **Date of Residence:** Mo Yr **Home Phone** ( ) -
Employer: **Date of Employment:** Mo Yr **Position:** **Monthly Income:** Gross $ Net $
Employer's Address: Street City State **Business Phone:** ( ) -

d. Self-Employed Information

Complete this section only if you are self employed

Business Name		Proprietorship Corporation Partnership
Business Address		Business Telephone ( )
Description of Business	Your Position	In Business Since
Your annual income from business	Business' annual income (gross) (net)	

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25-MHz 386s

Eclipsed but Still Shining

33MHz
25MHz

For only a fraction more than 20-MHz PCs, 25-MHz 386s offer speed at prices that are relative bargains. PC Labs tests 13 new machines with stringent Class B credentials.

by Catherine D. Miller

The 25-MHz 386 chip was never expected to reign as the PC speed king for long. The 486 was more than just a rumor, and news of the impending introduction of the 33-MHz 386 eclipsed the 25-MHz 386 while it was still in its infancy. Less than a year after introducing the 25-MHz 386 in April 1988, Intel shipped the 33-MHz processor, and the 25-MHz 386 was relegated to the midrange of high performance. Yet the 25-MHz 386 still offers incredible performance for the price, and this price/performance value should only get better.

So many processor choices have made the PC market more than a little confusing. Intel's 32-bit processor lineup already includes the hybrid 16-MHz 386SX, and the 16-, 20-, 25-, and 33-MHz 386. Early next year Intel will ship the 20-MHz 386SX, and the 25-MHz 486 will replace the 33-MHz 386 as the state-of-the-art 32-bit processor.

Meanwhile, the fact that 286-based machines are still selling so well indicates how price-sensitive the market is. Intel's price structure will have a profound effect in determining which processors will survive the inevitable pruning of future PC choices. As of the fourth quarter of 1989, Intel lists the 16-, 20-, and 25-MHz 386 processors at $173, $184, and $192, respec-

ILLUSTRATION: FRANK RILEY

tively (quantity 1,000); the 33-MHz 386 is priced at $278. The 25-MHz chip has experienced the biggest drop in price over the year, amounting to more than half of its original first quarter 1989 price of $425. Factor in the 386SX selling at $80, and the upcoming 20-MHz SX chip, and the 16- and 20-MHz 386's survival is in doubt. But the 25-MHz 386 processor should remain secure. Since a 25-MHz 386 offers a 25 percent performance increase over a 20-MHz processor and costs only 4 percent more for the chip, its continued success seems assured.

ATTAINING HIGHER PERFORMANCE

Each of the 13 machines that we reviewed uses a minimum 32K high-speed static RAM (SRAM) cache to help the slower system memory keep up with the 25-MHz processor for near-zero-wait-state performance. Most of the units use the Intel 82385 cache controller. HiTech, Micro Labs, PC Craft, Unisys, and Wyse, however, have their own proprietary cache designs, while TeleVideo uses the Austek 38152 cache controller.

PC manufacturers enhance the designs of their systems to improve performance. Among the machines tested, HiTech, Tandon, and CSS don't offer the ability to use shadow RAM, which can speed up BIOS and video access. Only TeleVideo doesn't give you control over whether shadow RAM is implemented.

Control over speedup techniques such as shadow RAM and RAM caching allows you the flexibility to use software such as *Lotus 1-2-3*, Release 3.0, which needs the 384K RAM where shadowed ROM resides in RAM, and also expansion boards that wouldn't function properly if their memory addresses were cached. (See "Potent Medicine, Strong Side Effects" by Contributing Editor Winn L. Rosch for an overview of the pluses and minuses of PC speed-up techniques.)

These 25-MHz machines have the power to handle calculation-intensive applications such as CADD, desktop publishing, statistical analysis, and graphics. But do they have what it takes to perform the duties of a file server? To be an effective server, you need more from your PC than just fast performance. The PC's cabinet must be large enough to hold two hard disks and a tape drive. You'll need as much as 7MB RAM to run a powerful operating system such as *NetWare/386* with several hard disks, a tower case, three serial and two parallel ports, an empty slot for your network adapter card, and if you use Ethernet with its difficult T-connectors, and easy access to the back of the cabinet so you can attach the cables. Of the computers reviewed here, only the ACMA 386/25 Business System, the PC Craft 3500/25C, and the Tele 386-25 had all of these features, making them elegible for use as file servers.

OUT ON THE STREET: What PCs Really Cost

by Susan L. Hayes

Anyone familiar with the personal computer industry knows better than to pay a manufacturer's suggested list price. Discounts are everywhere, but the question remains: how low can prices go?

Posing as a brand-specifier looking for a good deal, *PC Magazine* chose seven 25-MHz 386 computers and questioned several national chains, such as ComputerLand and Businessland, as well as metropolitan dealers and direct-marketing companies to find the greatest discounts off list. Choosing comparable PCs from Compaq, Everex, IBM, Tandy, and Zenith, plus the direct-marketing Dell and CompuAdd, we found that the gap between the list price of a Compaq Deskpro 386/25 and the price of a mail-order CompuAdd 386/25 narrows down from $7,235 to about $3,500 as you shop around. There's more: IBM's PS/2 Model 70-A21 can sell for as low as $8,100—the same price as a Dell System 325. What's the catch?

NEVER PAY LIST PRICE AGAIN

We based our comparisons on similarly configured machines that had 4MB RAM, at least a 100MB hard disk, VGA adapter, and monitor. Compaq's DeskPro 386/25 with a 110MB hard disk lists for $13,694. We found that 25 percent off list is the norm when buying through a dealer, with one New York dealer quoting $9,500, 30 percent off Compaq's list price. To cut costs further, we found that several dealers suggested putting a Paradise VGA card in the machine instead of Compaq's own for an additional $300 savings.

IBM's PS/2 Model 70-A21 with a fixed 120MB hard disk, lists for $11,113. IBM's standard corporate discount is 25 percent, but most dealers seemed willing to offer a similar break on single machines, with prices ranging from $8,000 to $8,300. However, nothing's guaranteed: our worst case was $9,550, a paltry 14 percent off list.

Everex, a company increasingly compared with Compaq and IBM in terms of speed and quality, offers comparable prices as well. With a 150MB hard disk, the Step 386/25 lists for $11,124. Everex said that dealers routinely slash an incredible 38 percent off list. Expect 25 percent. A similar discount proved true for Zenith's Z-386/25 as well. Listing for $12,096 with a 150MB hard disk, Zenith is sold through authorized dealers nationwide at an average street price of $9,072.

The Tandy 4025LX with a 170MB SCSI hard disk lists for $9,278. Radio Shack dealers regularly discount Tandy systems by about 10 to 15 percent. Tandy offers significant discounts to corporate accounts buying in quantity.

Street prices can be unpredictable, though, with prices quoted over the phone often reflecting more the mood of the salesperson than the dealer's standard discount. But one comforting aspect in the search for the ultimate street price is that discounts nationwide usually fall within established boundaries of 20 to 30 percent off the suggested list price. Because the prices of identical systems vary only slightly among dealers in New York, Dallas, or Chicago, it's not necessary to canvass the entire country for fear of not landing that big bargain.

LESS DISORDER IN MAIL-ORDER

Early in its evolution, mail-order buying was fraught with disasters. Luckily this has changed, and the process has advantages, such as avoiding sales tax on out-of-state purchases. Further-

THE SELECTION PROCESS

PC Magazine used several criteria in selecting the computers for this review. Since we had already looked at 25-MHz systems twice this year, we decided not to include the 25-MHz 386s reviewed in either the February 14, 1989, or May 30, 1989, issues. The machines reviewed for this issue must have been available by mid-July. We requested complete VGA systems with 4MB RAM, a 100MB or larger hard disk, and processor RAM cache of 32K or greater.

We then selected the 25-MHz systems that had received FCC Class B approval or had submitted the required paperwork well before our July 15 deadline. Why Class B? All PCs generate radio frequency (RF) emissions that can interfere with other electronic devices designed to receive RF communications. The Federal Communications Commission has prescribed two sets of guidelines to reduce the amount of emissions from PCs. Class B machines are more strictly regulated and emit less interference. The less stringent Class A is typically known as the office-equipment standard, since PCs given this rating are not to be used in the home. Class A is not monitored by the FCC: manufacturers are honor-bound to determine that their PCs comply with Class A standards.

Receiving an FCC Class B rating is a time-consuming and costly process. The manufacturer must submit a unit for inspection to the FCC along with documents, photos, and technical specifications for all of the system's components. Class B certification indicates that the machine produces RF emission levels low enough not to interfere with TVs and radios found in the home.

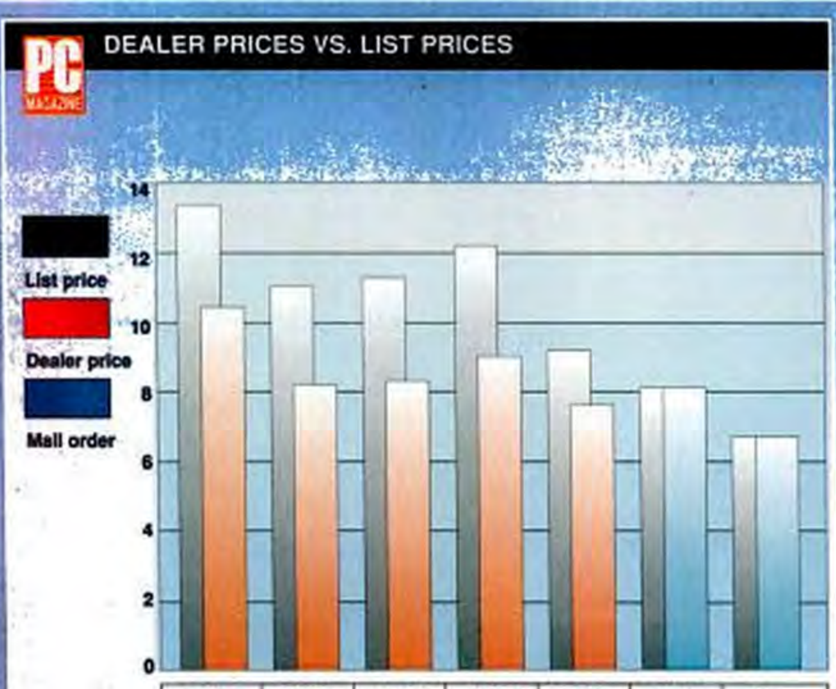
Yet FCC Class B ratings are also important for PCs that reside in offices. Walkie-talkies, cellular phones, and the telephone microwave system on the roof of your office rely on RF reception. As processor speeds increase, so do RF emissions. In general, PC systems complying with Class B guidelines have better electronic design techniques, including adequate grounding and cable shielding, cleaner motherboard design, and more-sophisticated engineering.

All other things being equal, when you have a choice between otherwise equivalent Class A and Class B machines, you should choose Class B.

PERFORMANCE AND PRICE

While the differences in performances on the PC Labs benchmark tests among the machines reviewed here are important, they should not be the sole basis for making a purchasing decision. All the machines performed within the range expected for this class, with no single machine exceeding or falling short of the mark.

Three of the systems reviewed feature backplanes with the processor on a 32-bit


DEALER PRICES VS. LIST PRICES

	Compaq Deskpro 386/25	IBM PS/2 Model 70-A21	Everex Step 386/25	Zenith Z-386/25	Tandy 4025LX	Dell System 325	CompuAdd 386/25
	$13,694 $10,271	$11,113 $8,113	$11,124 $8,343	$12,096 $9,072	$9,278 $7,686	$8,100 $8,100	$6,459 $6,459
Discount off list price	25%	25%	25%	25%	15%	Mail order	Mail order

more, most companies offer a 30-day money-back guarantee.

An alternative to buying from dealers is the thriving industry of reselling big-name machines through the mail; companies that do so include Bulldog and Arlington Computer Products. Prices for Compaq and IBM—both for single units and small bulk orders of approximately 20 machines—hover around a 30 percent discount. Everex and Zenith systems are much harder to find through mail-order resellers.

With all of the discrepancies among local and national dealers, you might wonder if any machine sells for list price. Yes, Virginia, list equals the selling price at direct-marketing companies like Dell and CompuAdd. A CompuAdd 386/25 with a 150MB hard disk lists for $6,459 and sells for $6,459. Compare this with the IBM Model 70 A-21's average price of $7,800 from mail-order resellers, and the gap between the two products is less than $1,500—quite a difference from the $4,500 rift between list prices.

Buying a computer "on the street" takes some time and energy, but you can save yourself big bucks in the long run. You'd better shop around. ■

expansion card. The AST Premium 386/25, Tele 386-25, and the WYSEsystem 386 Model 3225 all feature this design. By replacing the processor card with one more powerful, a 25-MHz 486 for example, you could upgrade the system without abandoning the box. Only AST has announced plans to ship a 486 upgrade card: for $3,695 and the return of the processor card, you'll be able to purchase the FASTboard 486/25.

List prices for the standard VGA configurations of the machines we tested started at a low of $2,950 for the HiTech SAM 3001/386-25 with 4MB RAM, an 85MB hard drive, a VGA card, VGA monitor, and DOS 4.01. The highest list price of the group, $15,141, was for the dealer-distributed and heavily discounted Unisys PW^2 800/25A workstation, equipped with 6MB RAM, a 140MB hard drive, VGA monitor, and DOS 4.01. But if you're cost-conscious, looking at list prices won't give you an accurate idea of what you'll really pay (see the sidebar "Out on the Street: What PCs Really Cost" on street prices). To give you some basis for comparison, we've indicated the distribution channels used by each manufacturer to market its products.

ACMA COMPUTERS INC.

ACMA 386/25 Business System

by Bruce Brown

Personal computers are usually surprisingly reliable, even with all the stories about hard disk drives failing whenever they're loaded with crucial, non-backed-up data. For all the claims of hardware reliability, however, astute purchasers, especially people buying high-performance computers, look for all the vendor support and backing they can get in case of hardware problems. ACMA Computers of Fremont, California, has blended an attractive combination of a 45-day money-back guarantee, unlimited toll-free telephone support, and a two-year system warranty. By going an extra measure or two to demonstrate a willingness to support users and keep satisfied customers, ACMA is putting its policies where its mouth is.

ACMA's entry in the 386 25-MHz world is the ACMA 386/25 Business System. The standard unit is a desktop model, but the test unit came with a vertical (tower) case, measuring 7.25 by 24.5 by 16.75 inches (HWD). The tower model has room for six half-height drives stacked vertically, all of which can have removable media. The $1,895 base model includes 1MB RAM with a 64K RAM cache; your choice of a 1.2MB or 1.44MB floppy disk drive; one parallel, two serial, and one game port; an MFM 1:1 interleave combination floppy/hard disk controller, and a selection of utility software.

ACMA 386/25 Business System
ACMA packs 4MB RAM, a 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, 80387-25 coprocessor, and a 375-watt power supply into the tower case of its 386/25 Business System. Add a NEC MultiSync 3D monitor and a two-year warranty for just $5,995.

ACMA specified a price of $3,595 for our standard configuration system, which consists of 4MB RAM, a 120MB RLL hard disk drive, VGA monitor, and MS-DOS 4.01. For the tower unit tested, including 4MB of RAM, both 1.2MB and 1.44MB floppy disk drives, an extra-power 375-watt power supply, a Toshiba 150MB SCSI hard disk drive with drive controller upgrade, an 25-MHz 80387 math coprocessor, a 16-bit ATI VGA Wonder Board, and a NEC MultiSync 3A, the price was still a decent $5,995.

The ACMA machine uses a Micronics motherboard, the Chips and Technologies 386 chipset, and a Phoenix BIOS. This combination, along with the 35-nanosecond 64K RAM cache and 80-ns. system RAM, helped the ACMA to score very

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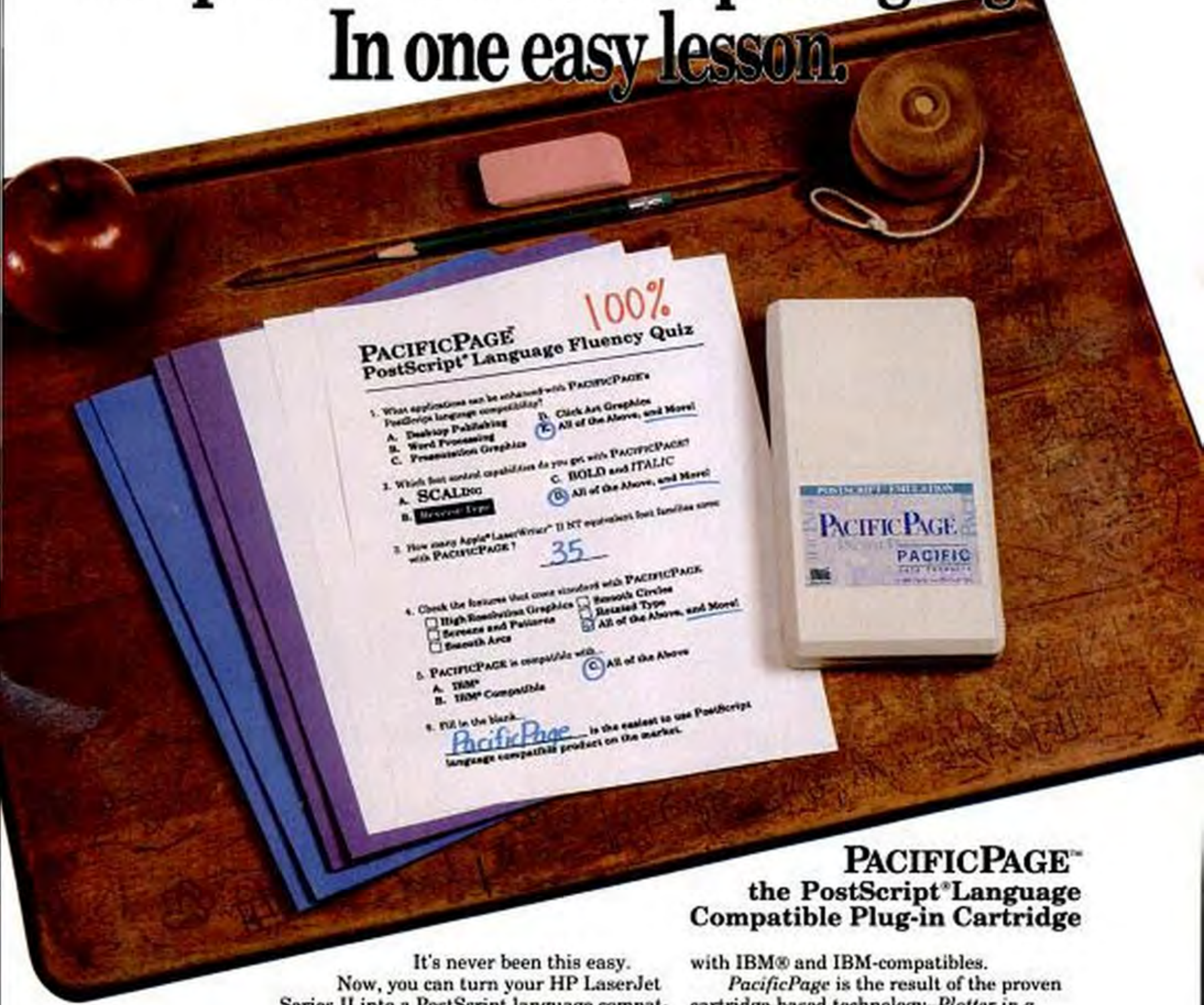

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CIRCLE 158 ON READER SERVICE CARD

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well in the processor-determined benchmark tests, the Conventional Memory test, and in the DOS File Access (Large and Small records) tests. ACMA's video test scores are also good. Processor speed is 25 MHz but can also be reduced to 6 or 8 MHz if necessary. At each of the three processor speeds, the ACMA expansion bus clips along at a safe 8.33 MHz.

The ACMA motherboard can hold a total of 8MB in DIP-style chips, with the single 32-bit expansion slot capable of handling another 8MB on a 32-bit memory card. The Micronics motherboard uses memory interleaving and has a user-selectable video and ROM BIOS shadowing capability. The memory cache is not expandable; all versions of the machine come with 64K of 35-ns. static RAM, run by an Intel 82385 controller chip. The expansion slots include the single 32-bit slot and five 16-bit slots.

The ACMA's standard power supply is 200 watts, though the five-lead 375-watt unit on our test model is a wise upgrade if you're going to load up with drives and memory. The vertical case also has plenty of space on the inside, so even with a full house of drives, boards, and memory there is still enough room for adequate ventilation.

ACMA includes a Maxi-Switch 101-key keyboard, which is 18.25 inches wide by 8.25 inches deep and has a 72-inch cable connected to the center rear.

ACMA sells computers by mail order and through a direct sales staff. All ACMA machines come with a reassuring 45-day no-questions-asked money-back guarantee with no return fee. There is also toll-free technical support, as well as a two-year warranty, the first year covering both parts and labor and the second year covering labor only. The extra year is an unusual but welcome feature, since computer labor fees often start at about $65 per hour with a 2-hour minimum.

In all the ACMA 386/25 is a good combination of performance, fine components, good expansion possibilities and better-than-average warranty and support policies—all at a reasonable price. If you're looking to buy a computer by mail order but still want a company that will stand behind what it sells, the ACMA 386/25 is a good bet.

FACT FILE

ACMA 386/25 Business System
ACMA Computers Inc., 117 Fourier Ave., Fremont, CA 94539; (800) 666-8898, (415) 438-4400
List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, utility software, $1,895; with the tower unit, 4MB RAM, 120MB hard disk, VGA monitor, and DOS 4.01, $3,595; as tested with 4MB RAM, 150MB hard drive, 1.2MB and 1.44MB floppy drives, NEC MultiSync 3D monitor, 80387-25 math coprocessor, 375-watt power supply, $5,995.
In Short: The ACMA 386/25 is a good deal, offering a combination of performance, expansion possibilities, better-than-average warranty, and reasonable prices. This is an impressive machine.

CIRCLE 545 ON READER SERVICE CARD

AMAX ENGINEERING CO.

Amax PC/386-25

by Bruce Brown

There's a lot to be said for straightforward competence in microcomputers. Especially when you get to relatively fast machines like 25-MHz 386-based computers, which just a year ago were the fastest on the market, finding a competent machine with proven components is reassuring. The Amax PC/386-25 from Amax Engineering has all the markings of a solid workhorse machine, with no outlandishly fast speeds in any one area but with no questionable design components or tricks, either.

The Amax machine is sold only through dealers and value-added resellers (VARs). Amax sells a base unit with everything but video components for $3,400. The base system includes 1MB of RAM with a 32K RAM cache; either a 1.2MB or 1.44MB floppy disk drive and a 40MB hard disk (not enough if you're going places with a 25-MHz machine, but at least a start); one parallel, one game, and two serial ports; and various utility software. A machine with 4MB of RAM, a 32K RAM cache, a 150MB SCSI hard disk drive, an 80387-25 math coprocessor, 8-bit VGA card and monitor, and DOS 4.01 lists for $5,455. Our test system, which had a 16-bit Western Digital VGA card with a NEC MultiSync 3D monitor plus a larger, 64K RAM cache, costs $6,750—an attractive price for the components included.

The Amax system unit is a desktop box measuring 6.5 by 21 by 16.75 inches (HWD). The case can handle five half-height drives, three of which can use removable media. It looks like a fairly standard AT-style case with lights for power, hard disk access, and turbo operation, as well as a reset button and keylock all located on the front. The supplied keyboard is an enhanced Maxi-Switch unit with a 72-inch cable; the standard power supply delivers 220 watts and comes with four device leads.

The PC/386-25 scored well on all of the benchmark tests, a fine showing in a very fast field. While it can't claim to be one of the fastest boxes, it is certainly a 25-MHz 386 machine, judging by performance scores alone. If you look inside the box, you'll see the standard Intel 80386 25-MHz chip run by a 50.00-MHz clock crystal on a Micronics motherboard bearing the standard Chips and Technologies 386 chip set and a Phoenix BIOS. There is a socket for either an 80387-25 math coprocessor or a Weitek chip, but not both.

The processor can run at 6, 8, or 25 MHz, with the expansion bus staying at a constant 8.33 MHz no matter what the processor speed. There are eight expansion slots; one 32-bit, five 16-bit, and two 8-bit. Our test machine had separate floppy and hard disk controllers because of the SCSI hard disk upgrade; this setup wasted an expansion slot unnecessarily. If you need all the expansion slots, specify a combination SCSI drive controller.

Amax PC/386-25
Amax opts for dependable performance and compatibility rather than speed. With 4MB RAM, a 150MB hard disk, VGA monitor, 80387-25 coprocessor, and DOS, the PC/386-25 lists for $5,455.

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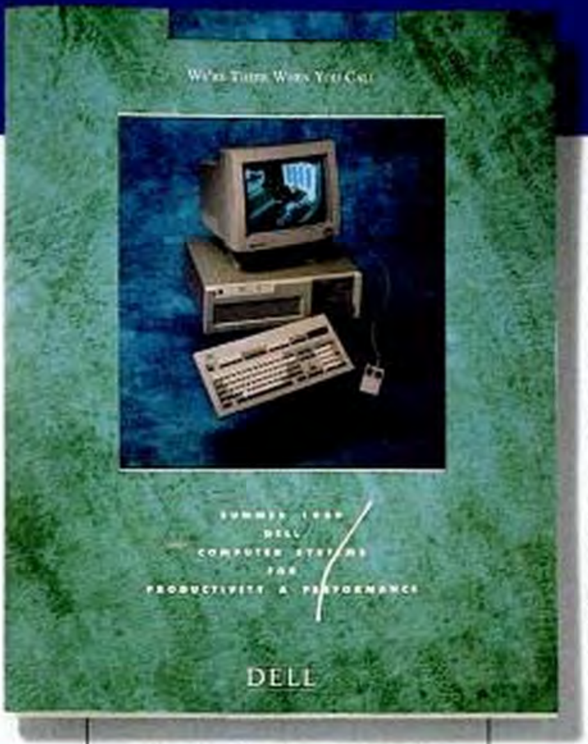

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CIRCLE 532 ON READER SERVICE CARD

25-MHz 386-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

The following commentary analyzes some of the terms in this table of features. The phrases in bold type are listed in the same order as in the left-hand column of the table.

Basic configuration This price represents the most stripped-down machine the vendor will sell, typically including 1MB RAM, one floppy disk drive, and serial and parallel ports.

Hard disk options The number of different hard disks the vendor offers for a machine is often indicative of how much customizing is available.

Standard configuration For the sake of price comparisons, our "standard" configuration normally includes 4MB RAM, a hard disk of at least 100MB, one high-density floppy disk drive, a VGA monitor, at least one parallel and one serial port, DOS, and a keyboard. Because the "standard" packages cited here may differ from this configuration, the price of each system is followed by the size of the hard disk and any other departures from our specification.

Tested configuration The specifications of the evaluation units depend on what configuration each manufacturer has sent us (based on our guidelines).

Bus clock speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 MHz.

Disk controller manufacturer and type Disk encoding techniques currently include RLL (Run Length Limited) and the older MFM (Modified Frequency Modulation) scheme. All data is encoded onto and read from your hard disk as a series of polarity-reversing bits representing ones and zeros. Nine such bits would be needed to store 12 bits of data in MFM format, and only six polarity changes are required with RLL format; thus, MFM takes more space than RLL but provides a more stable environment and is more commonly used. ST-506 technology, for instance, uses the MFM encoding scheme.

Two other common data transfer interfaces are SCSI (Small Computer System Interface) and ESDI (Enhanced Small Device Interface). Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers.

The BIOS version and date may affect PC Labs' benchmark test results. Those purchasing the same machine with a different BIOS version are likely to encounter some variations in performance.

Memory chip type Kb and Mb refer to kilobits and megabits, respectively.

Chip packaging Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs. The Dual In-line Package (DIP) is the traditional buglike computer chip sprouting 8, 14, 24, or even 40 or more metal legs (evenly divided between right and left sides).

BASIC CONFIGURATION	SAM 3001/386-25	ACMA 386/25 Business System	CSS Select 386-25	Micro Labs 386/25	Proteus 386-MX25	Tandon 386/25
List price	$1,595	$1,895	$2,800	$2,995	$2,995	$3,051
Basic configuration includes	2MB RAM, 1.2MB floppy disk drive, tower case	1MB RAM, 1.2MB or 1.44MB floppy disk drive; 2 serial, 1 parallel, and 1 game port; utility software	1MB RAM, 1.2MB floppy disk drive, 2 serial and 1 parallel port	1MB RAM, 40MB hard disk, 1.2MB floppy disk drive, 1 serial and 1 parallel port	1MB RAM, 1.2MB or 1.44MB floppy disk drive, 2 serial and 2 parallel ports, diagnostics and utility software	1MB RAM, 1.2MB floppy disk drive, 2 serial and 2 parallel ports, DOS 3.3, GW-BASIC, *Microsoft Windows* 2.03
Drive bays	6 half-height	6 half-height	5 half-height	5 half-height	5 half-height	5 half-height
OS/2 available	☐	☐	☐	☐	☐	☐
Hard disk options (MB)	43, 65, 85, 120	40, 65, 72, 80, 110, 120, 150, 300	80, 106, 182, 383	40, 65, 71, 80, 120, 145, 300	40, 45, 80, 150, 340, 700	110, 330
Slots	One 32-bit, five 16-bit, one 8-bit	One 32-bit, five 16-bit	Two 32-bit, four 16-bit, two 8-bit	One 32-bit, six 16-bit, one 8-bit	One 32-bit, six 16-bit, one 8-bit	One 32-bit, five 16-bit, two 8-bit
Slots free with hard and floppy disk drives, video, two serial and one parallel port installed	4	5	5	5	5	4
Power supply (watts)	220	200	200	200	200	190
Keyboard cable length (inches)	72	72	72	80	72	80
STANDARD CONFIGURATION						
Price of VGA system with 4MB RAM, hard disk, DOS	$3,250 (120MB hard disk)	$3,595 (120MB hard disk)	$5,590 (106MB hard disk)	$4,695 (120MB hard disk)	$5,222 (150MB hard disk)	$7,099 (5MB RAM, 330MB hard disk)
80387 coprocessor	$495	$525	$525	$575	$561	Unavailable
TESTED CONFIGURATION						
List price	$3,250	$5,995	$5,700	$5,590	$5,225	$5,955
Tested configuration includes	4MB RAM, 120MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, DOS 4.01	4MB RAM, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, NEC MultiSync 3D monitor, 80387-25, DOS 4.01, GW-BASIC, 375-watt power supply, tower case	4MB RAM, 89MB hard disk, 1.2MB floppy disk drive, VGA adapter, 80387-25	4MB RAM, 145MB hard disk, 1.2MB floppy disk drive, VGA monitor, DOS 4.01	2MB RAM, 150MB hard disk, 1.2MB floppy disk drive, NEC MultiSync 3D monitor	1MB RAM, 330MB hard disk, 1.2MB floppy disk drive, 30MB Personal Data Pac, DOS 3.3

■—Yes ☐—No

N/A—Not applicable: the product does not have this feature.

Single In-line Packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. Single In-line Memory Modules (SIMMs), on the other hand, are individual logic devices that are installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement duplicates the integrated structure of a SIP but allows for the possibility of replacing an individual memory component if necessary.

RAM chips RAM chips come in two basic types: static and dynamic. Static RAM chips (SRAMs) are faster and more efficient but costlier. Dynamic RAM chips (DRAMs) cost less and are more common, but the tradeoff is in slower processing and operation.

Interleaved memory CPU speed is usually faster than memory speed. Interleaved memory increases processing speed by splitting the memory into two or more portions. The CPU then sends information to a section at a time, allowing one section to process while another receives data.

Shadow RAM Shadow RAM is a technology that loads system BIOS and/or video BIOS directly into fast RAM on boot-up of the computer, offering enhanced performance speed at the cost of 384K of memory in the first 1MB of system RAM.

Disk cache software Some companies provide software to facilitate data retrieval from the hard disk. This software speeds overall system performance by anticipating what data the processor will need next.

Maximum 32-bit RAM Many computer manufacturers have designed their own 32-bit slots for memory expansion cards. The availability of such slots is especially important for a growing number of memory-intensive applications.

Processor RAM cache A processor RAM cache acts as a bridge between the CPU and the slower main memory. The cache is comprised of a small bundle (typically 32K to 128K) of fast SRAM chips. The cache controller is designed to predict and retrieve the data the CPU is likely to require next, thus preventing wait states. There are two varieties of controllers: discrete-logic chips (designed by the individual manufacturers) and third-party VLSI chips like the Intel 82385.

FCC certification class Two classes of FCC (Federal Communications Commission) approval may be given to computers: Class A and Class B. These classes concern levels of radio-frequency interference. With Class A approval, a computer may be operated in a business locale. The tougher Class B rating allows home use as well, where computers are likely to be placed near radios and television sets.

Certification tests must be performed by private testing companies. The passing results are then sent to the FCC for final certification, a process that can take several months.

Amex PC/386-25	Mitac MPC-4000F	PC Craft 3500/25C	AST Premium 386/25	Tele 386-25	Unisys PW^2 800/25A	WYSEsystem 386 Model 3225
$3,400	$5,195	$5,569	$5,695	$5,995	$7,315	$7,599
1MB RAM, 40MB hard disk, 1.2MB or 1.44MB floppy disk drive; 2 serial, 1 parallel, and 1 game port; utility software	1MB RAM, 1.44MB floppy disk drive, 2 serial and 1 parallel port, DOS 4.01	4MB RAM	2MB RAM, 1.2MB floppy disk drive, 2 serial and 1 parallel port, utilities, DOS 3.3	4MB RAM, 1.2MB floppy disk drive, 2 serial and 1 parallel port, DOS 3.3	2MB RAM (no keyboard)	4MB RAM, 1.2MB floppy disk drive, 2 serial and 1 parallel port, DOS 3.3
5 half-height	6 half-height	8 half-height, 1 full-height	5 half-height	6 half-height	5 half-height	5 half-height
☐	☐	☐	OS/2 1.1 ($325)	☐	OS/2 1.1 ($352)	OS/2 1.1 ($340)
20, 40, 80, 120, 150, 156	40, 100	60, 150, 330, 768	90, 150, 320	150	80, 140, 320	150, 300
One 32-bit, five 16-bit, two 8-bit	One 32-bit, seven 16-bit	Three 32-bit, five 16-bit, one 8-bit	Three 32-bit, three 16-bit, one 8-bit	Ten 16-bit, two 8-bit	Two 32-bit, five 16-bit, one 8-bit	Eight 16-bit, three 8-bit
3	6	4	4	8	6	5
220	220	250	220	240	220	220
72	90	72	110	72	82	90
$5,455 (150MB hard disk, 80387-25)	$8,937 (106MB hard disk)	$9,240 (150MB hard disk)	$10,039 (150MB hard disk)	$9,009 (150MB hard disk)	$12,466 (2MB RAM, 146MB hard disk)	$11,173 (150MB hard disk, 150MB tape backup)
Not separately priced	Unavailable	$550	Unavailable	Unavailable	$1,895	Unavailable
$6,750	$9,052	$10,415	$9,239	$9,009	$12,466	$11,173
4MB RAM, 156MB hard disk, 1.2MB floppy disk drive, NEC MultiSync 3D monitor, 80387-25, DOS 4.01	4MB RAM, 106MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, DOS 4.01	150MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-25, DOS 4.01	2MB RAM, 150MB hard disk, 1.2MB floppy disk, VGA monitor, DOS 3.3	4MB RAM, 150MB hard disk, 1.2MB floppy disk drive, VGA monitor, DOS 3.3	2MB RAM, 146MB hard disk, 1.44MB floppy disk drive, VGA monitor, DOS 4.01	4MB RAM, 150MB hard disk, 150MB tape backup, 1.2MB floppy disk drive, VGA monitor, DOS 3.3

CONTINUES

25-MHz 386-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

	SAM 3001/386-25	ACMA 386/25 Business System	CSS Select 386-25	Micro Labs 386/25	Proteus 386-MX25	Tandon 386/25
TESTED CONFIGURATION						
Microprocessor clock speeds (MHz)	8/25	6/8/25	8/25	8/25	8/25	8/25
Wait states	0	0	0	0	0	0
Bus clock speeds (MHz)	8	8.33	8	8.33	8	8.33
Disk controller manufacturer and type	DTC (MFM/RLL)	Western Digital (SCSI)	Adaptec (ESDI)	Western Digital (ESDI)	Western Digital (ESDI)	Adaptec (MFM/RLL)
Number of drives handled by controller	4	4	4	4	4	4
BIOS version and date	Phoenix BIOS Plus, Version 1.10 00 (January 1988)	Phoenix BIOS Plus, Version 1.10 10 (January 1988)	Award BIOS, Version 3.03 NFS (September 1987)	AMI BIOS, Version DAMI 3067 (September 1988)	AMI BIOS, Version 386-C&T (December 1988)	Tandon BIOS, Version 305-3.15 (May 1989)
System board manufacturer	FlashCom	Micronics	CSS	AMI	Proteus	Micronics
386 chip set manufacturer	Chips and Technologies	Chips and Technologies	VLSI	Chips and Technologies	Chips and Technologies	Chips and Technologies
MEMORY SPECIFICATIONS						
Memory chip type	1Mb	1Mb	1Mb	1Mb	1Mb	256Kb, 1Mb
Chip packaging	SIMM	DIP	DIP	DIP	DIP	DIP
Memory chip speed (nanoseconds)	80	80	100	80	100	80
RAM chips	DRAM	DRAM	DRAM	DRAM	DRAM	DRAM
Interleaved memory	☐	■	☐	☐	☐	■
Shadow RAM	☐	■	☐	■	■	☐
Shadowing can be turned off	N/A	■	N/A	■	■	N/A
Disk cache software	☐	■	☐	☐	☐	☐
Maximum 32-bit RAM	16MB	16MB	16MB	16MB	16MB	16MB
Maximum RAM on motherboard	8MB	8MB	8MB	4MB	4MB	N/A
Maximum total system RAM	16MB	16MB	16MB	16MB	16MB	16MB
PROCESSOR RAM CACHE						
Cache size:						
Minimum	64K	64K	32K	64K	32K	64K
Maximum	64K	64K	64K	64K	32K	64K
Installed	64K	64K	32K	64K	32K	64K
Cache memory speed (nanoseconds)	35	35	20	25	25	35
Cache controller	Discrete logic	Intel 82385	Intel 82385	Discrete logic	Intel 82385	Intel 82385
OTHER						
Warranty	1 year	2 years	1 year	1 year	15 months on-site	1 year
FCC certification class	B	B	B (pending)	B	B (pending)	B
Password security	☐	☐	☐	☐	☐	■

■—Yes ☐—No

N/A—Not applicable: the product does not have this feature.

Amax PC/386-25	Mitac MPC-4000F	PC Craft 3500/25C	AST Premium 386-25	Tele 386-25	Unisys PW^2 800-25A	WYSEsystem 386
6/8/25	16/20/25	8/25	4.77/8/25	16/25	8/25	8/25
0	0	0	0	0	0	0
8.33	8.33	8	8	8	8	8
Future Domain (SCSI)	Connor Peripherals (ST-506/MFM)	Western Digital (ESDI)	Western Digital (ESDI)	Western Digital (ESDI)	Adaptec (SCSI)	Western Digital (ESDI)
4	4	4	5	4	4	4
Phoenix BIOS Plus, Version 1.10 10 (January 1988)	Phoenix BIOS; Version 3.07 (June 1989)	Award BIOS, Version N:Y3.04e (June 1988)	AST BIOS, Version 1.20 (March 1989)	Televideo BIOS, Version 1.03 (July 1989)	Phoenix BIOS Plus, Version 1.10 04.C1A (January 1988)	Phoenix BIOS, Version 3.06 (February 1989)
Micronics	Mitac	Mylex	AST	Televideo	Intel	Wyse
Chips and Technologies	Chips and Technologies	Chips and Technologies	AST	Chips and Technologies	Intel	Wyse
1Mb	1Mb	1Mb	1Mb	1Mb	256Kb, 1Mb	1Mb
DIP	SIP	SIMM	SIMM	SIMM	SIMM	SIMM
85	80	80	100	100	80	100
DRAM	DRAM	DRAM	DRAM	DRAM	DRAM	DRAM
■	■	■	☐	☐	☐	■
■	■	■	■	■	■	■
■	■	■	■	☐	■	■
☐	☐	☐	■	☐	☐	■
16MB	24MB	32MB	36MB	16MB	18MB	16MB
N/A	8MB	N/A	4MB	N/A	2MB	N/A
16MB	24MB	32MB	36MB	16MB	18MB	16MB
32K	32K	64K	32K	32K	64K	64K
64K	32K	128K	32K	32K	64K	64K
64K	32K	64K	32K	32K	64K	64K
35	30	25	25	25	35	25
Intel 82385	Intel 82385	Discrete logic	Intel 82385	Austek 38152	Discrete logic	Wyse
1 year	1 year on-site	1 year; 4 months on-site	1 year	1 year on-site	1 year	1 year
B (pending)	B (pending)	B (pending)	B	B	B	B
☐	■	☐	■	☐	☐	■

ENDS

BENCHMARK TESTS: 25-MHz 386-BASED PCs

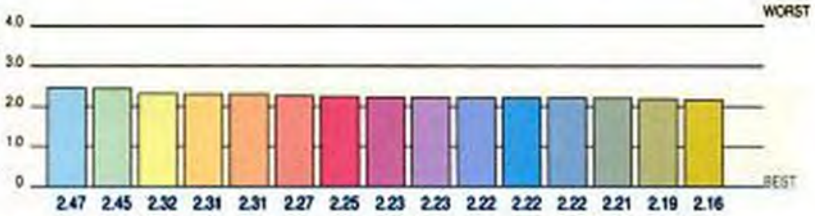
Pan United's Micro Labs 386/25 captured a first-place finish on our Conventional Memory test and on two video benchmark tests (including one tied score). It also performed well on the processor tests but was surpassed by the CSS Select 386/25, which runs its 25-MHz processor at 26.6 MHz.

PROCESSOR AND MEMORY BENCHMARK TESTS

80386 Instruction Mix

Elapsed Time (seconds)

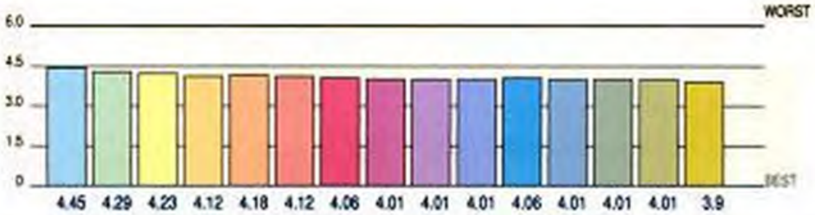
The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



Floating-Point Calculation Without Coprocessor

Elapsed Time (seconds)

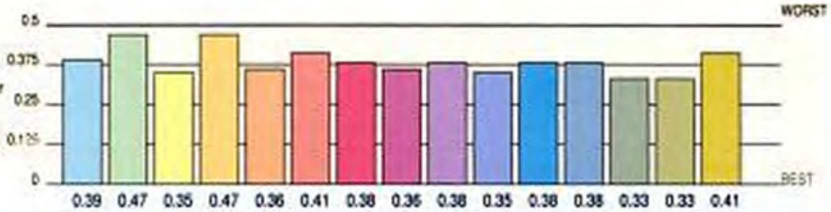
The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory

Elapsed Time (seconds)

The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.

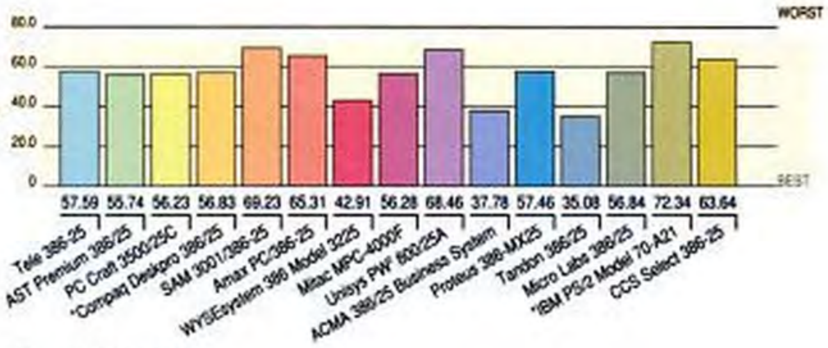


DISK BENCHMARK TESTS

DOS File Access (Small Records)

Elapsed Time (seconds)

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



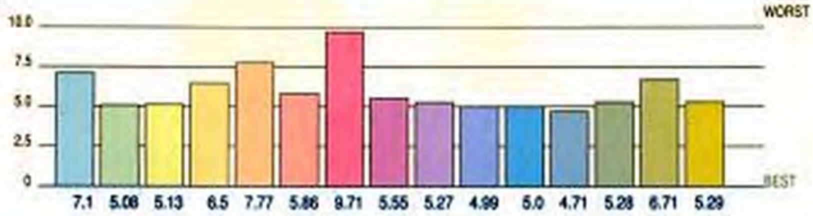
* Reported for comparison.

BENCHMARK TESTS: 25-MHz 386-BASED PCs

DOS File Access (Large Records)

Elapsed Time (seconds)

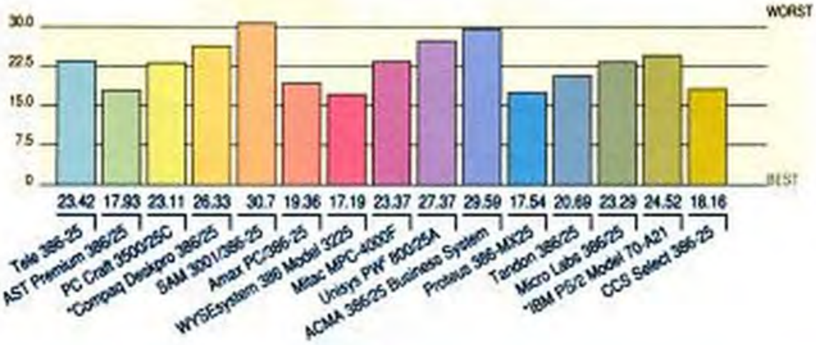
The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



BIOS Disk Seek

Elapsed Time (milliseconds)

The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.



PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

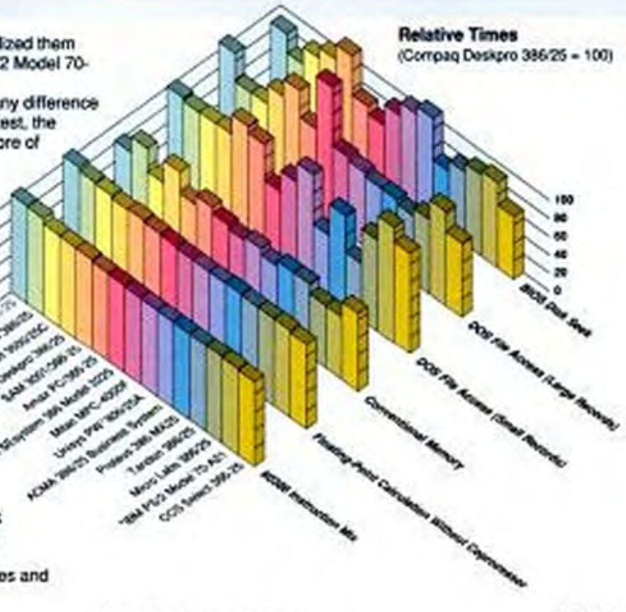
PC Labs tested thirteen computers in the 25-MHz 80386 class and normalized them against the popular Compaq Deskpro 386/25. Test results for the IBM PS/2 Model 70-A21 are also reported for comparison.

You'll have to look closely at our processor and memory tests to see any difference among the contenders in this lineup. In fact, on the 80386 Instruction Mix test, the leader—the CCS Select 386-25—shaved only about 13 percent off the score of the slowest computer, the Tele 386-25. You might notice a difference in some processor-intensive tasks, but at this clock speed, flying is flying.

The Floating-Point Calculation test had very similar results, with the same two computers (CSS Select 386-25 and Tele 386-25) in first and last place, respectively. This margin is attributable to the faster overall system speed of the CSS unit, which pushes its Intel processor to run at 26.6 MHz.

The fastest performer in our roundup on the Conventional Memory test, Pan United's Micro Labs 386/25, tied the IBM PS/2 Model 70-A21. The Micro Labs 386/25 comes with 80-nanosecond DRAM chips, plus a 64K RAM cache with a proprietary cache controller rated at 25 ns. Note that each of the computers has an on-board RAM cache of at least 32K, evidence of manufacturer response to buyers' demands for faster and better memory.

The fastest scores on the DOS File Access tests for both small and large records were achieved by the Tandon 386/25. A faster bus speed and a 330MB Maxtor drive contribute to this success story. The WYSEsystem 386 Model 3225 captured first place on the BIOS Disk Seek test; a fast ESDI interface is used on the 150MB CDC drive we tested. I/O bottlenecks can become a noticeable problem, especially on this class of computers, but the units tested reflect the current solutions: faster interfaces and on-board caching.


Relative Times
(Compaq Deskpro 386/25 = 100)

* Reported for comparison.

CONTINUES

We're In A Perfect Position To Offer You 386 Performance On A 286 Budget.

FEATURE	IBM* PS/2 MOD 50Z	IBM* PS/2 MOD 55SX	TELEVIDEO TELE386SX*	COMPAQ* DESKPRO 286e	COMPAQ DESKPRO 386S*
CPU	80286	80386SX*	80386SX	80286	80386SX
Speed	10 MHz	16 MHz	16 MHz	12 MHz	16 MHz
Wait State	0	0	0	1	0
Std Memory	1 MB	2 MB	1 MB	1 MB	1 MB
32-Bit Software Compatible	NO	YES	YES	NO	YES
On-Board Video	VGA	VGA	VGA	VGA	VGA
Monitor	OPTION	OPTION	OPTION	OPTION	OPTION
Fixed Disk	30 MB	30 MB	OPTION	OPTION	OPTION
Price	$3250	$3850	$2339	$2699	$3299

Note: Information on this chart is based on published materials.

The comparison above will clearly help you and your customers chart a course through a sea of PCs.

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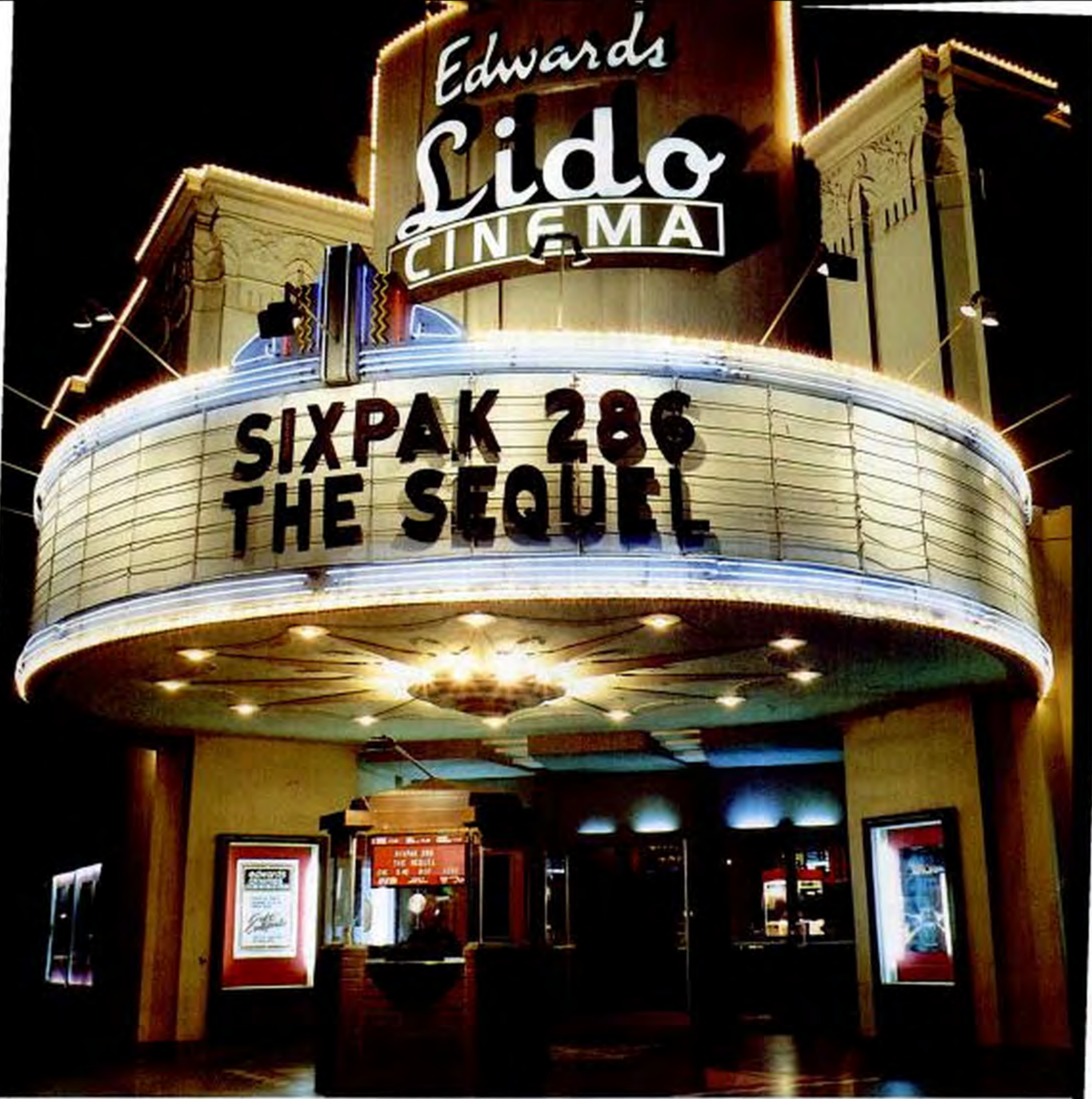
CIRCLE 227 ON READER SERVICE CARD



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But that's not all.

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"SixPak 286 is a hit. Its low-profile design and switchless installation are flawless."

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CIRCLE 166 ON READER SERVICE CARD

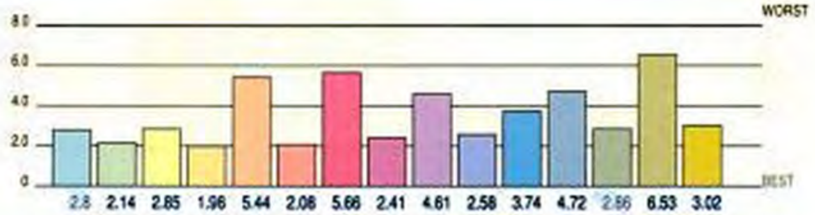
BENCHMARK TESTS: 25-MHz 386-BASED PCs

VIDEO BENCHMARK TESTS

Direct to Screen

Elapsed Time (seconds)

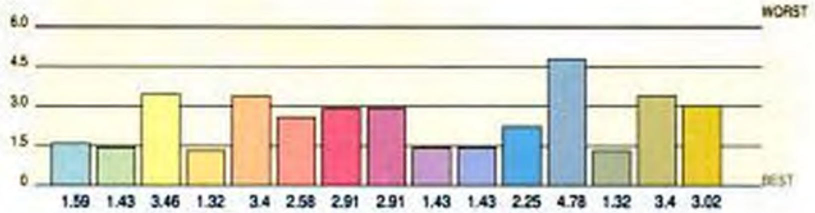
The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



Video BIOS Routine with Scrolling

Elapsed Time (seconds)

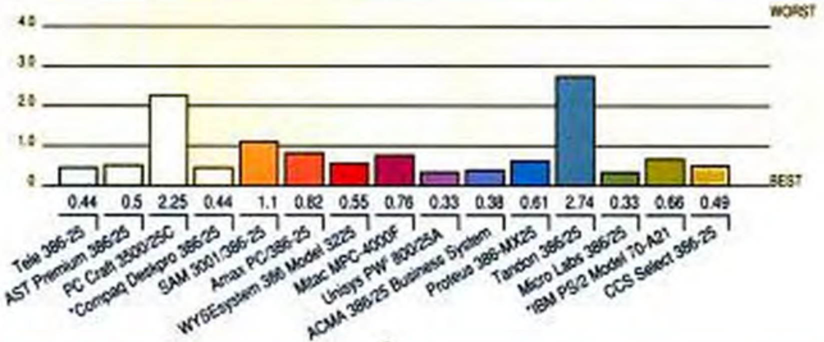
The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.



Video BIOS Routine Without Scrolling

Elapsed Time (seconds)

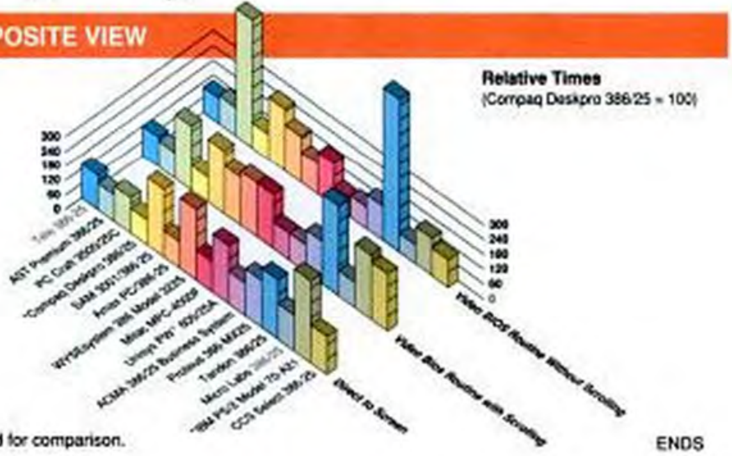
The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.



VIDEO BENCHMARK TESTS: COMPOSITE VIEW

Not all VGA cards are created equal, as we see from PC Labs' video benchmark tests, where the slowest machines took anywhere from about three to eight times as long as the fastest. 8-bit cards will really slow you down here, as demonstrated by the Tandon 386/25.

Now to look at the winning end of the scale: On our Direct to Screen test, the Amax PC/386-25 with its 16-bit VGA card was surpassed only by our reference standard, the Compaq Deskpro 386/25. The Micro Labs 386/25 also used 16-bit VGA cards, winning top honors both on Video BIOS with Scrolling and on Video BIOS Without Scrolling, where its score was tied by the Unisys PW² 800/25A.



* Reported for comparison.

ENDS

FACT FILE

Amax PC/386-25
Amax Engineering Co. 47315 Mission Falls Ct., Fremont, CA 94539; (800) 888-AMAX, (415) 651-8886.
List Price: With 1MB RAM, 40MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, utility software, $3,400; with 4MB RAM, 150MB hard disk, VGA monitor, 80387-25 coprocessor, DOS 4.01, $5,455; with 156MB hard drive, Orchid ProDesigner 16-bit VGA card, NEC MultiSync 3D monitor, 80387-25 coprocessor, $6,750.
In Short: The Amax PC/386-25 is available through dealers and VARs only. With only three open slots in the standard configuration it lacks a bit of expansion space, but it's a fine machine with good performance.

CIRCLE **603** ON READER SERVICE CARD

The Amax motherboard doesn't hold any memory itself: all memory is on cards, with a maximum of 8MB per card. Memory chips on the test machine were 85-nanosecond 1MB DIP chips. The Micronics board design uses both memory interleaving and shadow RAM for video and ROM BIOS, the latter two capable of being disabled by the user setup program. The Amax RAM cache has an Intel 82385 controller with 35-ns. static RAM chips.

Since Amax machines are sold by dealers or value-added resellers, (VARs); these form your first line of support. Amax machines come with a one-year parts and labor warranty; a second-year service contract is available for 15 percent of the original system purchase price.

Amax Engineering builds proficient machines with standard, quality components. While there may be nothing here to holler about because of especially fast speed or trickier-than-usual technology, simple competence should speak eloquently for itself.

AMERICAN MITAC CORP.

Mitac MPC-4000F

by Catherine D. Miller

American Mitac's 25-MHz 386 offering, the Mitac MPC-4000F, is housed in a modified tower case that is designed to sit either on your desk or on the floor. At 16.75 by 9 by 19 inches (HWD) when standing, it's shorter and wider than most tower systems but narrower and higher than standard AT-size desktops. However you look at it, with its five half-height and one 3.5-inch drive bays, it's roomy.

The basic configuration of the Mitac MPC-4000F carries a list price of $5,195. You get 1MB of 80-nanosecond RAM in 256K SIMM packaging, a 30-ns. 32K static RAM cache controlled by the Intel 82385-25 cache controller, a 1.44MB 3.5-inch floppy disk drive, a 220-watt power supply, one parallel and two serial ports, a 101-key keyboard, and DOS 4.01.

The MPC-4000F's somewhat boxy-looking case has several special features. The back panel features a 25-pin parallel and two 9-pin serial ports, along with a keyboard connector. The front panel has another keyboard connector at its base and a row of indicator lights for power, hard disk access, and microprocessor speed, plus a well-protected power switch along the top. Four of the six drive bays are accessible from the front of the system, and Mitac includes its own 101-key keyboard with the PC.

Mitac builds its own system board, which lies along the right side of the unit. Two floppy disk drives can be controlled directly from the board, so the basic system doesn't include a disk controller card. The Chips and Technologies chipset supports the processor's functions, and an Intel 82385-25 cache controller handles 32K of 30-ns. static RAM. The board cannot accept more chips to make a larger cache. The Mitac MPC-4000F uses a Phoenix BIOS, which lets you choose if you want to shadow video and ROM BIOS in RAM. Microprocessor speeds are software switchable to 16, 20, or 25 MHz, yet the bus always runs at 8.33 MHz.

FACT FILE

Mitac MPC-4000F
American Mitac Corp., 410 E. Plumeria Dr., San Jose, CA 95134; (800) 648-2287, (408) 432-1160.
List Price: With 1MB RAM, 1.44MB 3.5-inch floppy disk drive, DOS 4.01, $5,195; with 4MB RAM, 105MB hard disk, VGA monitor, $8,937; with 1.2MB 5.25-inch floppy disk drive, $9,052.
In Short: With emphasis on expandability, six full-length expansion slots remain free in a fully configured Mitac MPC-4000F. Its modified tower case can be placed horizontally on a desktop or vertically on the floor, and it can handle six storage devices.

CIRCLE **604** ON READER SERVICE CARD

PC LABS 25MHz

Mitac MPC-4000F
The MPC-4000F fits six drive bays and eight slots into a modified case that can be used as either a desktop or a tower. American Mitac's 25-MHz offering sells for $9,052 with 4MB RAM, 105MB hard disk, VGA monitor, and two high-density floppy disk drives.

Two sets of SIP sockets lie under the power supply. Each set holds four 256-kilobit or 1-megabit (Mb) SIP memory blocks for a maximum 8MB RAM on the motherboard. Although SIPs in the same set must be of the same chip size, you can use both 256-kilobit and 1Mb memory blocks together, each in its own set. The unit as tested used 80-ns. 1Mb chips to make four 1MB blocks, with the second set empty.

The Mitac MPC-4000F supports 24MB of 32-bit page-interleaved system RAM: 8MB on the motherboard and an additional 16MB on a 32-bit memory board. No DIP switches need to be set if the system's memory configuration is changed, but you must run the Setup program to set the extended memory size.

Our $9,052 evaluation unit included 4MB RAM, a 1.2MB 5.25-inch floppy disk drive, a 105MB hard disk and a ST-506/MFM controller card from Connor Peripherals, the Paradise 16-bit PVGA Plus VGA card, and the Tatung VGA monitor.

Performance on PC Labs benchmark tests was strong for this class of machine on processor, memory, and video tests. Showings on the disk benchmark tests were lower but still competitive.

The manual accompanying the Mitac MPC-4000F does an excellent job of showing how the system can be expanded.

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PC MAGAZINE
EDITOR'S CHOICE
Data World 386-20
May 30, 1989

"Dataworld's Data 386-20 and Data 386-25 stand out in the 20 and 25 MHz catagories for speed and quality construction." (May 30, 1989)

PC MAGAZINE
EDITOR'S CHOICE
Data World Data 386-25
May 30, 1989

"The Dataworld Data 386-20 minitower and Data 386 full-size tower are good values and first-rate performers from an up-and-coming mail order firm…"

PC MAGAZINE
EDITOR'S CHOICE
Data World Data 386-16
February 28, 1989

"The Dataworld offers a 16-bit video system with a top-quality NEC MultisyncII monitor and an exceptionally fast disk-drive controller for an impressive combination of value and performance…from a vendor with an increasing reputation for quality." 16 MHz system. (Feb. 28, 1989)

PC MAGAZINE
EDITOR'S CHOICE
Data World Portacomp II
October 11, 1988

"The Portacomp II is a value leader with fast memory, a fast drive controller and a terrific keyboard…Marvelously cheap powerful alternative…outperformed the other 286's. (Oct. 11, 1988)

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80386SX-16 Intel

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- 80387SX coprocessor socket
- EMS 4.0 software drivers.
- Expansion slots: 4 16-bit and 2 8-bit slots.
- 1.2 or 1.44MB diskette drive.
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- NEC Multisync 3D monitor.
- Additional options listed under 80386-25 system.
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It also guides you through all the steps necessary to get the system up and going. The standard suite of utilities and setup included with the Phoenix BIOS are described in an appendix. Although the manual is written simply enough for beginners to understand, it also includes solid technical information about the system.

American Mitac uses several distribution channels to get its products to market. Major distributors such as Micro American, dealers, and value-added resellers (VARs) carry the Mitac line of computers. While the company offers a 1-year parts and labor warranty, on-site and extended warranties are available through TRW.

Although it may be more expensive than some of the other systems reviewed here, the Mitac MPC-4000F is a well-constructed and well-integrated system offering plenty of room for expansion. Either as a desktop or a floor-standing tower, the Mitac MPC-4000F is a flexible system that deserves a closer look.

AST RESEARCH INC.

AST Premium 386/25

by Catherine D. Miller

AST Research has designed the AST Premium 386/25 with an eye toward the future. Based on a modular design, the CPU, some system RAM, the cache controller, cache memory, and sockets for Weitek 3167 and Intel 80387-25 coprocessors reside on a 32-bit processor card. The system board, containing the ROM BIOS, I/O ports, and seven expansion slots, supports AST's i486 upgrade card called the FASTboard 486/25. This means you can buy a 386 today and upgrade to a 486 tomorrow without losing your entire investment.

Housed in a 6.25- by 19.25- by 16.5-inch desktop case, the AST Premium 386/25 comes standard with 2MB of 100-nanosecond RAM in SIMM packaging, a 25-ns, 32K static RAM cache controlled by the Intel 82385 chip, a 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, a 220-watt power supply, a 101-key keyboard, DOS 3.3, GW-BASIC, and AST utilities for $5,695. The system board has three 32-bit slots (one of which is occupied by the processor card), three 16-bit slots, and one 8-bit slot.

Three of the system's five half-height drive bays are accessible from the front. The front panel includes a reset button and indicator lights for microprocessor speed and hard disk access. The microprocessor speed is software switchable from 25 MHz to 8 and 4.77 MHz, and the expansion bus runs at 8 MHz.

A floppy disk drive controller, built into the system board, handles three floppy disk drives. Although the basic system has neither hard disk nor hard disk controller, an AT adapter interface on the system board supports hard disks with AT-embedded controllers.

The AST Premium 386/25 supports a maximum of 36MB 32-bit RAM, with the CPU card holding only 4MB RAM. Additional memory expansion cards, each with a 16MB RAM capacity, are available and can be installed in the two remaining 32-bit slots to bring the total system memory up to 36MB. The list price for one of these

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cards with 1MB of RAM is $899.

The AST Premium 386/25 is unique while maintaining complete compatibility with current standards. Many components, including the system board, BIOS, processor card, and keyboard, are designed by AST. Engineered around AST's AT-compatible SMARTslot architecture, three expansion slots—two 32-bit and one 16-bit—have extra pins to accept boards created for the SMARTslot. AST's SMARTslot architecture was an attempt to share some of the processor's work with processors on other boards. However, at this point, no SMARTslot boards have been planned by AST or announced by third-party vendors, and AST plans to follow the EISA multimaster bus standard rather than attempting to create a standard of its own.

Although you might expect to see an increase in performance due to the utilization of this arbitrated multimaster bus, quite the opposite turned out to be the case. While competitive, the AST Premium 386/25's performance times on PC Labs processor and memory benchmark tests were often slower than those of most 25-MHz systems we tested here, finishing last in the Conventional Memory test.

PC LABS
25MHz

AST Premium 386/25
With its CPU on a card, the AST Premium 386/25 is ready for AST's FASTboard 486/25, making upgrades easy. The unit as tested has 4MB RAM, 150MB hard disk, a 1.2MB floppy disk drive, VGA monitor, and DOS for $10,039.

The AST keyboard is of the 101-key variety, with the 12 function keys arrayed across the top. The $9,239 review unit also included the AST VGA Plus 16-bit VGA card and monitor, Western Digital's ESDI controller supporting two hard disks, and a CDC full-height 150MB hard disk drive. The performance times of the AST evaluation unit on our disk and video benchmark tests were better than those of most of the 25-MHz 386 units reviewed in this article.

AST utility software grants you infinite control over the way your system is set up. Other programs included in the utility software are disk caching, expanded memory manager (supporting EMS 4.0), print spooler, and RAMdisk programs. The manuals accompanying the AST Premium 386/25 are well written and well organized. The system manual clearly describes the technical specifications of the system, as well as how to configure it for your needs. The AST Utility Software manual describes what the various AST utilities do and how to use them.

AST relies on a six-spoke distribution network. Its machines are sold through major chains, independent VARs and

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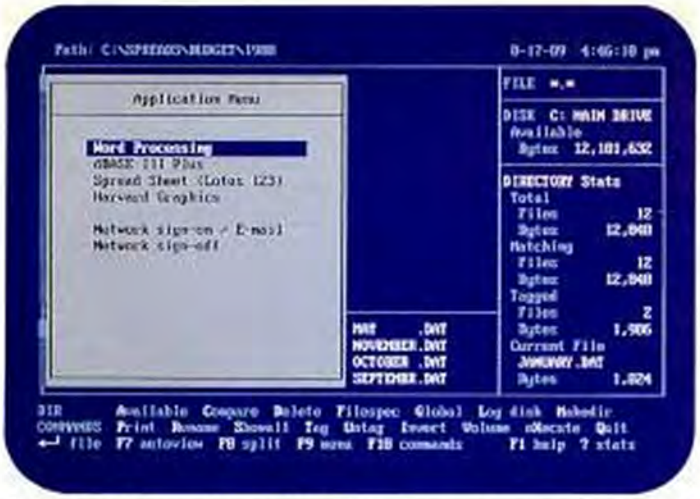
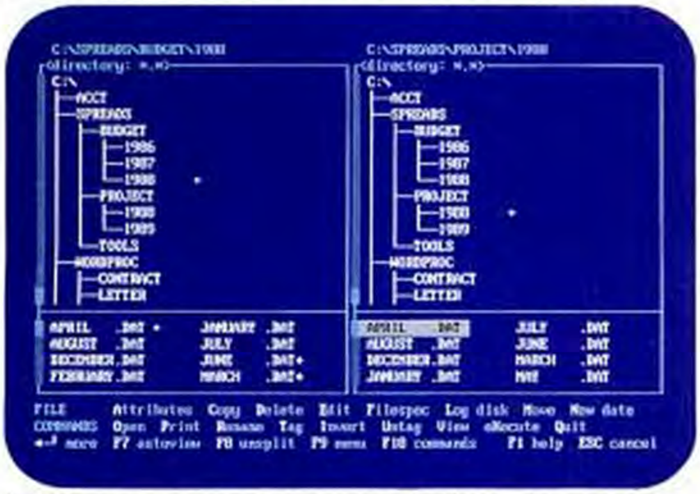
CIRCLE 331 ON READER SERVICE CARD



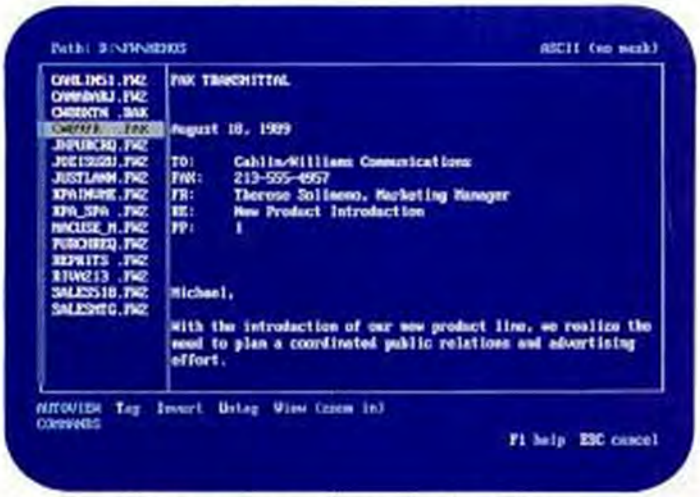
```
Path: C:\SPREADS\BUDGET\1988                                8-17-89  4:46:10 pm
                                                      FILE  *.*
           Application Menu                           DISK  C: MAIN DRIVE
                                                       Available
  Word Processing                                       Bytes  12,181,632
  dBASE III Plus                                      DIRECTORY Stats
  Spread Sheet (Lotus 123)                             Total
  Harvard Graphics                                      Files          12
                                                        Bytes      12,048
  Network sign-on / E-mail                             Matching
  Network sign-off                                      Files          12
                                                        Bytes      12,048
                                                       Tagged
                                                        Files           2
                                        MAY     .DAT    Bytes       1,906
                                        NOVEMBER.DAT   Current File
                                        OCTOBER .DAT    JANUARY.DAT
                                        SEPTEMBER.DAT   Bytes       1,024
DIR       Available  Compare  Delete  Filespec  Global  Log disk  Makedir
COMMANDS  Print  Rename  Showall  Tag  Untag  Invert  Volume  eXecute  Quit
↵ file  F7 autoview  F8 split  F9 menu  F10 commands      F1 help  ? stats
```

Application Menu—*Just point 'n shoot to run any application or commonly used procedure. MIS managers can easily create customized user environments.*



```
 C:\SPREADS\BUDGET\1988                C:\SPREADS\PROJECT\1988
┌<directory: *.*>──────────────────┐  ┌<directory: *.*>──────────────────┐
 C:\                                    C:\
 ├─ACCT                                 ├─ACCT
 ├─SPREADS                              ├─SPREADS
 │  ├─BUDGET                            │  ├─BUDGET
 │  │  ├─1986                           │  │  ├─1986
 │  │  ├─1987                           │  │  ├─1987
 │  │  └─1988        *                  │  │  └─1988
 │  ├─PROJECT                           │  ├─PROJECT
 │  │  ├─1988                           │  │  ├─1988       *
 │  │  └─1989                           │  │  └─1989
 │  └─TOOLS                             │  └─TOOLS
 ├─WORDPROC                             ├─WORDPROC
 │  ├─CONTRACT                          │  ├─CONTRACT
 │  └─LETTER                            │  └─LETTER
 APRIL   .DAT *   JANUARY .DAT          APRIL   .DAT      JULY    .DAT
 AUGUST  .DAT     JULY    .DAT          AUGUST  .DAT      JUNE    .DAT
 DECEMBER.DAT     JUNE    .DAT*         DECEMBER.DAT      MARCH   .DAT
 FEBRUARY.DAT     MARCH   .DAT*         JANUARY .DAT      MAY     .DAT
FILE      Attributes  Copy  Delete  Edit  Filespec  Log disk  Move  New date
COMMANDS  Open  Print  Rename  Tag  Invert  Untag  View  eXecute  Quit
↵ more  F7 autoview  F8 unsplit  F9 menu  F10 commands    F1 help  ESC cancel
```

Split Windows—*Simultaneously view, compare and manipulate two separate directories or drives, and quickly locate files.*



```
Path: D:\FAXWORKS                                            ASCII (no mask)
 CAHLIN51.FAX   FAX TRANSMITTAL
 CAMBDARJ.FAX
 CHRRKTN .BAK
 CHRFFR  .FAX   August 18, 1989
 JHPURCRQ.FAX
 JOEISUBU.FAX   TO:     Cahlin/Williams Communications
 JUSTLAMM.FAX   FAX:    213-555-4957
 XPAIMARK.FAX   FR:     Therese Solimeno, Marketing Manager
 XPA_SPA .FAX   RE:     New Product Introduction
 MACUSE_M.FAX   PP:     1
 PURCHREQ.FAX
 REPRITS .FAX
 RTW213  .FAX
 SALES510.FAX   Michael,
 SALESMTG.FAX
                With the introduction of our new product line, we realize the
                need to plan a coordinated public relations and advertising
                effort.

AUTOVIEW  Tag  Invert  Untag  View (zoom in)
COMMANDS
                                                      F1 help  ESC cancel
```

AutoView—*Save time and guess-work by scrolling through file contents from the directory or file window.*

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CIRCLE 199 ON READER SERVICE CARD

FACT FILE

AST Premium 386/25
AST Research Inc., 2121 Alton Ave., Irvine, CA 92714; (714) 863-1333.
List Price: With 2MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 3.3, $5,695; with 150MB hard disk, VGA monitor, $9,239; with 4MB RAM, $10,039.
In Short: Featuring a CPU on a card, the AST Premium 386-25 offers an easy upgrade path to the 486. Nice touches include a useful suite of utilities, built-in ports, and a floppy disk controller handling three floppy disk drives built into the system board.
CIRCLE 546 ON READER SERVICE CARD

VADs, OEMs, major distributors, international distributors and governmental sales. The company offers a one-year parts and labor warranty, with service available directly from AST even if you buy your system through another distribution channel.

The AST Premium 386/25 distinguishes itself as a reasonable performer for this class of machine. Its fine craftsmanship and many extras make the AST Premium a unified system rather than just a collection of high-quality parts.

CSS LABORATORIES INC.

CSS Select 386-25

by Bruce Brown

The CSS Laboratories' 25-MHz machine breaks the rules, but just by a little. The system clock crystal in this otherwise standard-looking box is clearly marked at 53.2160 MHz. Since the system speed is attained by dividing the crystal speed in half, that means that the CSS 386/25 isn't a 25-MHz machine at all, but rather a 26.6-MHz machine. Many argue that pushing a crystal beyond the processor manufacturer's specification is a good way to get faster performance at a slight price, while others stipulate that any crystal speed over specifications increases the possibility of motherboard component breakdown over time. Pushing the processor an extra 1.6 MHz, less than 10 percent, doesn't seem like much of a threat, but it does account for the CSS's slight performance edge on the processor-determined benchmark speed tests.

CSS Laboratories is an Irvine, California company that designs its own mother-

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CIRCLE 200 ON READER SERVICE CARD

boards. This one is called the *CSS Mother Superior 386/25-Cache*. The base unit lists for $2,800 and includes 1MB RAM, a 1.2MB floppy disk drive, plus two serial and one parallel port. *PC Magazine*'s standard configuration machine with 4MB RAM, a 106MB hard disk, VGA controller, and NEC Multisync 2A monitor costs $5,500. CSS prefers to unbundle DOS and math processors, specifying the prices separately at $90 for DOS 3.3 and an 80387-25 coprocessor at $575. According to CSS, the company doesn't sell DOS 4.01 because most of their buyers (they sell only to dealers and VARs) feel that DOS 4.01 has too many bugs at this time. If you want DOS 4.01, you'll have to get it separately from your dealer.

The test unit in the standard 6.5- by 21.25- by 16.5-inch AT-style case lists for $5,700, including 4MB RAM, an 89MB ESDI hard disk, a 16-bit VGA card and an 80387-25 coprocessor but no monitor. The front of the case has keylock and reset buttons, as well as lights for power on, hard disk access, and turbo mode. Also included is a Honeywell keyboard with a minimal 72-inch cable.

Due most likely to the slightly faster crystal, the CSS machine was slightly faster on the 80386 Instruction Mix and Floating-Point benchmark tests. The rest of the PC Labs test results for the Select 386-25 were within the normal range for 25-MHz 386 machines, with solid disk performance and reasonable video scores.

FACT FILE

CSS Select 386-25
CSS Laboratories Inc., 1641 McGaw Ave., Irvine, CA 92714; (714) 852-8161.
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, $2,800; with 4MB RAM, 106MB hard disk, and NEC MultiSync 2A monitor, $5,500; as tested with 4MB RAM, 89MB hard disk, 1.2MB floppy disk drive, VGA adapter and no monitor, 80387-25 coprocessor, $5,700; DOS 3.3, $90.
In Short: Despite a slightly faster than specified system clock crystal, which accounts for its slight edge in processor-based tests, the CSS Select 386-25 is a respectable computer with moderate expansion possibilities and pricing. Sold only through dealers and VARs.

CIRCLE 547 ON READER SERVICE CARD

CSS Select 386-25
In its quest for speed, the $5,500 CSS Select 386-25 uses a faster crystal that yielded 26.6-MHz system performance, plus 20-ns. chips in its 32K cache. With 4MB RAM, 106MB hard disk, and VGA, it is the fastest machine in this roundup.

With CSS's own motherboard you get a discrete set of chips to control the processor and Award's 386 Modular BIOS. The system can run at either 8 or 25 MHz with the expansion bus running always at a straight 8 MHz. Additionally there are eight expansion slots: two 8-bit, four 16-bit, and two 32-bit.

The Select 386-25 can hold up to 8MB of DIP DRAM chips on the motherboard itself, with 100-nanosecond chips in the test unit. Extra memory on cards can increase memory to the system maximum of 16MB. RAM cache on the CSS board consists of 32K run by an Intel 82385 controller. The 20-ns. chips are the fastest we found in this roundup, and they certainly help system performance.

Inside the case, there is enough room for six half-height drives, three of which can have exposed fronts for removable media. The Select 386-25's 200-watt power supply is plenty sufficient for the number of drives and the amount of memory the system can hold.

CSS machines come with a one year parts and labor warranty, fulfilled by the dealer. At the time of testing, CSS was negotiating for an optional Intel on-site service contract, but the deal wasn't set, nor was pricing available at that time.

If your dealer sells CSS machines, consider whether you want the slight threat to reliability for the minor gain in speed. If you choose to be safe, the dealer should have no problem getting this machine with a 50.00-MHz crystal and keeping you nested within prescribed standards, although you will lose some performance.

HITECH INTERNATIONAL INC.

SAM 3001/386-25

by Bruce Brown

If you want a 25-MHz 386 machine at the lowest cost, don't need much support, and are willing to live with slight system aberrations, read on. HiTech International is looking for buyers who care about price more than anything else. If you fit the category, do they have a deal for you!

HiTech's SAM 3001 in its 25-MHz variety uses a little-known Flashcom motherboard with the more common Chips and Technologies 386 chip set and de facto standard Phoenix BIOS. The base unit, with 2MB of RAM, a 1.2MB floppy disk drive, 220-watt power supply, keyboard, and no software costs just $1,595. This system is in a vertical case that measures 24.5 by 7.5 by 17 inches (HWD) and holds six half height drive bays all available for removable storage media devices.

If you want a more fully configured system, a SAM 3001 with 4MB of RAM, an 120MB hard drive, both 1.2 and 1.44MB floppy disk drives, Samsung VGA monitor, and DOS 4.01 costs $3,250. An Intel 80387-25 math coprocessor is available separately for only $495. The unit ships with a compact Nan Tan

PC 25MHz
LABS

SAM 3001/386-25
With limited support and potential system problems, there is only one reason to consider the SAM 3001/386-25 by HiTech: its amazing price. This PC is only $3,250 with 4MB RAM, a 120MB hard disk, VGA monitor, and DOS.

keyboard, 18 inches wide and just 6.75 inches deep, with a marginally acceptable 72-inch cable.

The VGA card used in the SAM 3001 machines is a DEI board manufactured by Trident; it didn't help much with video speeds on PC Labs benchmark testing, keeping the SAM 3001's scores in the lower part of the pack. The other scores were all acceptable for this class of computer.

The SAM 3001 purportedly works at both 8 and 25 MHz. We had no problems at 25 MHz (which, after all, is the speed you buy this machine for) but with the system slowed to 8MHz it wasn't able to run programs or access data on the hard drive. I was able to get a directory reading but could do nothing else with the C: drive when running at 8 MHz. HiTech International is aware of this problem and says it's being worked on, promising no particular date.

FACT FILE

SAM 3001/386-25
HiTech International Inc., 712 Charcot Ave., San Jose, CA 95131; (408) 435-8827.
List Price: With 2MB RAM, 1.2MB 5.25-inch floppy disk drive, tower case, $1,595; with 4MB RAM, 120MB hard disk, both 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, DOS 4.01, $3,250. 80387-25 math coprocessor $495.
In Short: If you want to take the risk of low support and possible motherboard incompatibility for the cheapest price, look closely at the SAM 3001/386-25. If you need security, look elsewhere.

CIRCLE **546** ON READER SERVICE CARD

The expansion bus runs at a straight 8 MHz whatever the processor speed. There is one 8-bit, five 16-bit, and one 32-bit slot, with the last reserved for memory expansion beyond the motherboard's 8MB limit. The SAM uses 80-nanosecond 1-megabit SIMM chips and has a 64K RAM cache with 35-ns. static RAM cache memory chips. The memory cache doesn't use a specific controller chip such as the Intel 82385 or the Austek; rather, cache control is handled by discrete logic chips on the motherboard. The SAM design does not use memory interleaving or RAM shadowing of video or ROM BIOS.

The SAM 3001 has reset and turbo buttons, plus a turbo light on the front of the case. Only the reset button works. Certainly HiTech is trying to save money by using

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CIRCLE 200 ON READER SERVICE CARD

the same cases, but even with HiTech's good deals customers spend four-digit amounts and should get functional controls.

HiTech International sells all of their systems directly, the emphasis being on price. There is a one year warranty on the system but only 90 days on hard disk drives. HiTech uses Seagate drives, and according to HiTech Seagate charges a $35 service fee for warranty work. HiTech also doesn't pay to ship warranty-repaired systems back to you: you pay both ways.

The HiTech SAM 3001/386-25 is a functional 25-MHz machine at a rock-bottom price. If little support, a less-than-comprehensive warranty, and a nonfunctional turbo switch and light don't bother you, then this machine may be just the deal you're looking for. If you want hand-holding and a dealer's gentle support, you probably didn't read this far anyway.

PAN UNITED CORP.

Micro Labs 386/25

by Bruce Brown

Pan United's Micro Labs 386/25 is a straight, good deal in a mail-order 25-MHz 80386 personal computer. Of course you want more details than that, but the first take on this machine is that it's a solid box with standard components sold at a reasonable price by a mail-order company that's been selling PC/AT/386 clones for several years.

The Micro Labs 386/25 comes in a desktop case that measures 6.5 by 21 by 16.75 inches (HWD). It includes an AMI motherboard, Chips and Technologies 386 chip set, and AMI BIOS. The base unit, for $2,995, includes 1MB RAM with a 64K cache, a 1.2MB 5.25-inch floppy disk drive, a 40MB 28-millisecond hard disk, one parallel and one serial port.

PC Magazine's standard test configuration, with 4MB RAM, 120MB hard disk, a VGA monitor and DOS, costs $4,600. Pan United actually prices DOS separately, selling DOS 4.01 as a $95 option. The company also sells an Intel 80387-25 math coprocessor for $575. The test system, with a 145MB Micropolis ESDI hard disk, a Video Seven Fast Write 16-bit VGA card, and Tatung VGA monitor (but no DOS) lists for $5,495.

Pan United's performance on the PC Labs benchmark tests showed better-than-average video performance overall. Video performance was arguably the best in the roundup; disk performance was solid; and the processor scores put the Micro Labs 386/25 in second place behind the CSS Select pushed to 26.6 MHz.

A CLOSER LOOK

The Micro Labs 386/25 runs at either 8 MHz or 25 MHz. The turbo light on the front of the system unit works, though the turbo button doesn't. You can set system speed via the keyboard with a Ctrl-Alt-Plus or - Minus key combination. The expansion bus runs at 8 MHz when the computer itself is at 8 MHz or at 8.33 MHz when the system is running at full tilt at 25 MHz. There are 8 slots in all: six 16-bit slots, one 8-bit slot, and one 32-bit slot.

The system board holds a maximum 4MB RAM. The as-tested unit came with 80-nanosecond DIP chips. Other memory, up to the 32-bit system maximum of 16MB, has to go on a memory card. The RAM cache uses discrete logic chips to run the standard 64K of 25-ns. static RAM cache memory chips.

The Micro Labs' case can hold five half-height drives, three of which accept removable media. The standard 200-watt power supply has four power leads, so if you plan to use five separate drives, you need to get a power splitter—a minor aggravation. The front of the case has a reset switch and a keylock in addition to the nonfunctional turbo button.

PC LABS
25MHz

Micro Labs 386/25
Pan United's Micro Labs 386/25 offers solid mail-order value, quality component parts, and reasonable support at a fair price. A system with 4MB, 120MB hard disk, VGA monitor, DOS, and a 30-day guarantee is $4,695.

The standard keyboard is a Chicony model that measures 19.25 inches wide and 8.25 inches deep. This keyboard has a clicky feel and an 80-inch cable that attaches to the right rear of the keyboard. The 101-key design has a large L-shaped Enter key and small backslash and backspace keys.

FACT FILE

Micro Labs 386/25
Pan United Corp., 1967 Route 27, #12, Edison, NJ 08817; (800) 433-3006, (201) 985-8009.
List Price: With 1MB RAM, 40MB hard disk, 1.2MB 5.25 floppy disk drive, $2,995; with 4MB RAM, 120MB hard disk, VGA monitor, $4,600; with 145MB hard disk, $5,495. 80387-25 math coprocessor, $575; DOS 3.3 or 4.01, $95.
In Short: For brand-name components, good performance, and moderate expansion room from a mail-order 386 computer, look at the Micro Labs 386/25 from Pan United. If you order one and don't like what you get, you have 30 days in which to return it for your money back, no questions asked.

CIRCLE **549** ON READER SERVICE CARD

Pan United sells through dealers and by mail-order, with about half of their sales through each. To augment the one year parts and labor warranty, the company uses mirror shipping—the standard practice among mail-order vendors, in which the vendor pays to ship an in-warranty repaired machine back to you in the same manner that you shipped it in for service. Pan United also offers a 30-day money-back guarantee with no restocking fee.

No surprises, no incredible thrills or frills: Pan United's Micro Labs 386/25 is a solid deal in a mail-order machine. Sounds good to me.

PC CRAFT INC.

PC Craft 3500/25C

by Bruce Brown

If you're looking for a 25-MHz computer to stuff full of drives, ports, and memory, look no further. The PC Craft 3500/25C is pricey, but it can take up to 32MB of memory and has space for eight half-height and one full-height drive. The system comes in a spacious vertical case with top-exiting cables and a locking system that lets you set this baby up to run undisturbed by anyone, including busybodies who might accidentally try to reboot the machine when nobody's looking.

The 3500/25C tower unit measures a full 24.5 by 9 by 23 inches. The base unit, starting with 4MB of RAM and a 64K cache, costs $5,569, a sizable chunk of change. But for a file server dedicated to network applications, tucked neatly away in a back room with your company's applications and data, case size and price aren't an issue.

Although the as-tested unit has 4MB RAM, a 150MB hard disk, both 1.44 and 1.2MB floppy disk drives, VGA, a Maxi-Switch 101-key keyboard, and an 80387-25 math chip for a total suggested list of $10,415, it is not a speed demon. The video speeds on PC Labs benchmark tests were slow, but otherwise the remaining scores were all in the normal range for a 25-MHz 386.

ON THE MOTHERBOARD

The PC Craft's expansion bus runs at a constant 8 MHz, with system speed user-

PC Craft 3500/25C
At the high end of the price spectrum and having what it takes to be a file server, the PC Craft 3500/25C packs 4MB RAM, a 150MB hard disk, two floppy disk drives, VGA, an 80387-25 coprocessor, and DOS into its spacious case for $10,415.

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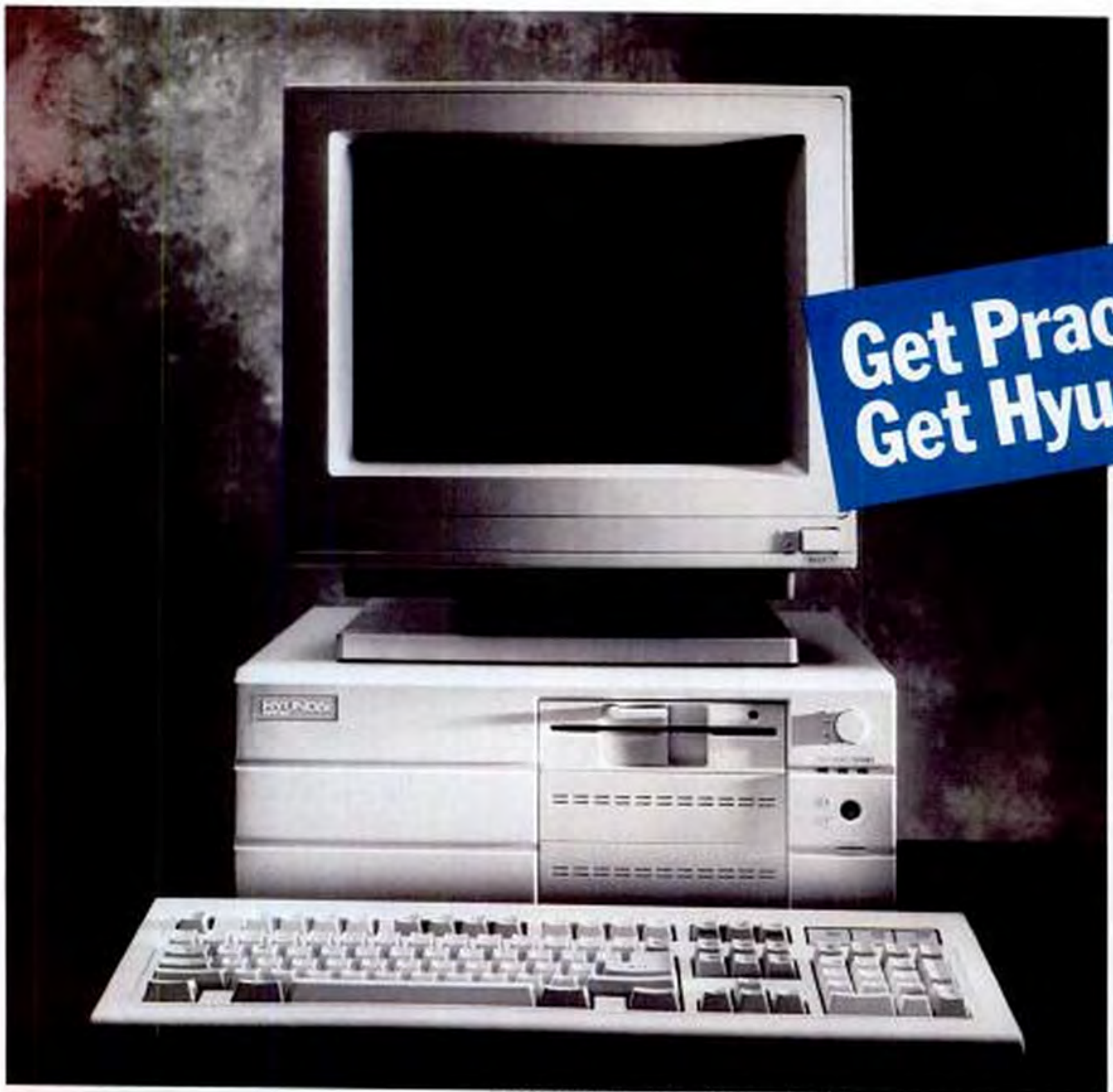
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CIRCLE 525 ON READER SERVICE CARD

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selectable at 8 or 25 MHz. Inside there are five 16-bit slots, three 32-bit slots, and one 8-bit slot. The standard power supply is a 250-watt unit with two fans and an unusual heat sensor that speeds up the fans as the temperature inside the system unit increases. For a box with the size and capacity of the PC Craft the larger power supply and extra cooling make sense and are obviously one reason why the computer costs a bit more.

The system uses a Mylex motherboard with a Chips and Technologies 386 chip set and Award 386 modular BIOS. Fully loaded, the PC Craft can handle 32MB of 32-bit RAM. All memory fits on memory cards in SIMM chips; none on the motherboard. The memory on the test machine was rated at 80 nanoseconds, with 25-ns. static RAM chips on the standard 64K RAM cache controlled by discrete circuitry. This motherboard uses memory interleaving as well as RAM shadowing of both video and ROM BIOS (both of which you can disable).

On the outside, the front panel has indicator lights for disk access, turbo speed, power on, and keyboard disabling. Behind the front panel, which really swings out like a door, is a rocker switch that disables the keyboard to protect the system against accident or malicious rebooting, or some such friendly touch your network doesn't need.

The PC Craft 3500/25C is sold only through value-added resellers (VARs) and

FACT FILE

PC Craft 3500/25C
PC Craft Inc., 640 Puente St., Brea, CA 92621; (800) 733-6666, (714) 256-5000.
List Price: With 4MB RAM, $5,569; with 1.2MB 5.25-inch floppy disk drive, 150MB hard disk, VGA monitor, 80387-25, DOS 4.01, $9,240; with 150MB ESDI hard disk, 1.2MB 3.5-inch and 1.44MB 5.25-inch floppy disk drives, 80387-25 coprocessor, $10,415.
In Short: If you need to stuff a lot into your 386, look to the PC Craft 3500/25C, which has room for eight half-height and one full-height drive, plus up to 32MB of RAM. A big box at a hefty price.

CIRCLE 550 ON READER SERVICE CARD

POTENT MEDICINE, STRONG SIDE EFFECTS: The Pros and Cons of 386 Performance Enhancements

by Winn L. Rosch

Coaxing the most performance possible from a computer requires more than just cranking up the clock crystal to 33 MHz and letting a 386 microprocessor run wild. PC makers must brew together an amalgam of technologies to match the speed abilities of system components. Like steroids, these electronic miracle drugs can have powerful results—and equally profound side effects. Here's a guide to the most effective power prescriptions:

Dynamic and static RAM Most memory chips used in today's PCs are classified as *dynamic random-access memory*, or DRAM. They store data as tiny charges in memory cells. Because these charges drain away, DRAM must be refreshed constantly, which imposes delays between accesses so that the charges can build up and stabilize (typically from 60 to 150 nanoseconds). Since *static RAM* chips do not need to be refreshed, they can be accessed as quickly as their circuits can handle signals: every 15, 25, or 35 nanoseconds. While SRAM is faster, it's prohibitively expensive and usually reserved for small memory caches where speed is more important than cost.

(Reducing) wait states The easiest way to match a fast, 33-MHz microprocessor to slower DRAM chips is by adding wait states—that is, periods when the microprocessor stops dead to let the slower RAM chips catch up. Wait states reduce memory cost but impose a big penalty in performance: an 80386 memory access requires two clock cycles (one to specify an address, one to read or write it), and a wait state stretches that to three, slowing the system by one-third. Some operations, including cache misses and frequent read/write operations, may require 20 or more wait states.

Interleaved memory The cheapest technique for minimizing wait states is to interleave memory. Interleaving divides the total RAM of a system into two or four banks that are accessed alternately. When one bank is being refreshed, the other can be accessed without wait states. While interleaving can cut wait states by 50 to 75 percent, it also makes memory expansion more difficult because two or four identical banks of additional memory must be added at a time.

Paged memory Special paged memory chips are designed to allow back-to-back accesses without wait states within blocks of memory addresses called pages. Paged memory can cut wait states by 80 percent. Tradeoffs: accesses to memory outside the last-used page impose wait states, and more importantly, paged memory chips are more expensive and can be difficult to find when you want to add memory to your system.

Processor RAM caching A small block (typically 32 to 128K) of fast SRAM is connected to the processor and uses a special cache controller, such as Intel's 82385 chip, to move data from slow main memory into the cache, anticipating what information the processor will require next. When the controller is right, accesses to the cache impose no wait states. The penalty for caching is more complicated circuitry, added expense for controller and SRAM, and additional wait states on cache misses.

Shadow RAM The slowest memory is ROM, yet it holds the code that controls your PC's video display, hard disk, and keyboard. Copying the ROM BIOS code into faster RAM and using the 80386's memory-mapping ability to fool programs into using the RAM copy speeds up these I/O functions. Called shadow RAM because the code in RAM follows the ROM code, the tradeoff of this technique is its appropri-

ILLUSTRATION: NORM BENDELL

PC Craft's direct sales force. The standard warranty is for one-year parts and labor coverage and includes a four-month on-site service contract for the crucial system break-in period. Extended on-site and depot (you take it to a service center) service contracts are available for 12 percent and 8 percent of the system list price per year of the contract.

The PC Craft unit is the most capacious of those reviewed in this issue. Truly this machine isn't intended for single users unless they happen to be very, very busy. It's designed for use as a dedicated DOS file server or for Unix applications. With its many nice touches for heavy use, the PC Craft computer is a great choice for multiuser applications.

PROTEUS TECHNOLOGY CORP.

Proteus 386-MX25

by Bruce Brown

You may not have heard of Proteus Technology yet, but if they keep on doing what they've done so far, you will be. The Proteus 386 25-MHz PC reviewed here offers a good combination of components, performance, and vendor support, including 15 months of on-site service for machines located at either business or home locations. Proteus positions itself as a service-oriented company, a good move in an industry where users often feel abandoned after they buy a machine.

The Proteus 386-MX25 features a straightforward 386 design using Proteus's own motherboard, the Chips and Technologies 386 chips set, and an AMI BIOS. The base unit, priced at $2,995, includes 1MB RAM with 32K of 25-nanosecond cache memory and an Intel 82385 cache controller, either a 1.2- or 1.44MB floppy disk drive, two serial and two parallel ports, diagnostic and utility software.

PC Magazine's standard configuration system with 4MB of RAM, a 150MB hard disk, 16-bit VGA card, Mitsubishi Diamond Scan monitor, and DOS 4.01 lists for $5,783. The as-tested unit has 2MB RAM, a 150MB drive, an 8-bit VGA card

ation of up to 384K of RAM that certain applications, including *Lotus 1-2-3*, Release 3.0, require to run properly.

Extended and expanded memory 80386 systems can address memory beyond their first megabyte as extended or, with driver software, as expanded (EMS or LIM 4.0) memory. The 80386 operates optimally when using extended memory. If EMS memory is simulated from extended memory using software such as Quarterdeck's *QEMM-386*, expanded memory performance nearly equals that of extended memory. But using an EMS board in an expansion slot or an old EMS driver designed for 80286 computers will impose severe speed penalties.

Bus speed While 80386 machines now run at 33 MHz, most have expansion buses limited to 16-bit width and 8-MHz operation. The low speed and narrow width lead to at least an eightfold slowdown for any information traversing the expansion bus, including video and hard disk data. Speeding up the bus trims the slowdown but sacrifices compatibility; many expansion boards fail at higher speeds. The new 32-bit proprietary buses—for instance, Micro Channel and EISA—will require new expansion boards to take advantage of the wider data path.

16-bit integrated video Most video adapters still use 8-bit interfaces, slowing displays to one-fourth that of the 32-bit 80386. Widening the interface to 16 bits can double the speed of screen updates. Expansion bus overhead imposes additional performance limits, so integrating the display circuitry onto the system board gives additional speed increases. Drawbacks: integrated video circuitry frustrates upgrade possibilities because you must bypass system board video circuitry to use it; hence, you will end up paying for video that you are not using.

Hardware disk caching Finding data on a hard disk is significantly slower than locating it in memory because of mechanical delays imposed by the disk drive. A hardware disk cache adds fast memory to the disk controller to store the data to be needed next by the computer, which then can be retrieved at memory rather than disk speed. While hardware caching is the best way to speed up any disk, it's also among the most expensive, adding nearly $1,000 to the price of the disk controller. Some software applications also suffer compatibility problems with the disk caching controller.

Software disk caching By using your system's existing RAM as a cache with a software disk caching program, you can speed up your hard disk performance. Relatively inexpensive and quite effective, software caches suffer from their strength. They sap both memory and power from their hosts: RAM used for caching can't be used by programs, and cache overhead slows system processing.

Math coprocessor The 80386 chip is not optimized for mathematics. A math coprocessor (sometimes called a floating-point or numeric coprocessor) can significantly speed up programs requiring heavy-duty math, such as statistical, engineering, and graphics software. But math coprocessors are expensive ($500 to $600 for a 33-MHz 80387), and they work only with software specifically written to take advantage of them in machines designed to accommodate them. Another drawback is that the Intel 80387 and the Weitek 3167 are neither code- nor pin-compatible with one another. Moreover, a math coprocessor won't speed up normal business math (addition and subtraction) at all. ■

Winn L. Rosch is a contributing editor of PC Magazine.

Proteus 386-MX25
Proteus combines 15-month on-site support, toll-free technical help, and extended service contracts with solid 386 performance to make its 386-MX25 a solid value. The system sells for $5,783 with 4MB RAM, a 150MB hard disk, a Mitsubishi VGA monitor, an 80387-25 coprocessor, and DOS.

and NEC MultiSync 3D monitor for a total price of $5,225 with DOS.

The system is a desktop unit measuring 6.5 by 21.25 by 16.5 inches with room for five half-height drives. Three drive bays are accessible at the front of the case. The 200-watt power supply is sufficient for five drives and can also handle the eight expansion slots—a complement of one 8-bit, six 16-bit, and one 32-bit slot, all of which run at 8 MHz.

The processor runs at either 8 or 25 MHz. Up to 4MB RAM fits on the motherboard, with an additional 12MB on an optional memory card in the 32-bit slot. The DIP-style memory chips are rated at 100 ns. Proteus's motherboard doesn't use memory interleaving but allows you to shadow RAM for both video and ROM BIOS if you choose.

The Proteus 386-MX25 scored well on our benchmark tests, with strong results on the processor and memory tests. The other PC Labs test results were within the normal range for 25-MHz 386 machines.

In addition to the normal keylock, reset button, and power, turbo, and hard disk drive access lights, there are also a speaker on/off switch and a red, two-character LED status and error-condition display. The Proteus keyboard is a private label enhanced unit with a 72-inch cable.

Proteus has several end-user-oriented policies, including a 30-day money-back guarantee, toll-free technical support, and the 15-month on-site service contract. Additional extended service contracts are available at the time of purchase. Adding in the solid 25-MHz performance, the Proteus 386-MX25 is an attractive machine that should appeal to both business and private users.

FACT FILE

Proteus 386-MX25
Proteus Technology Corp., 75 Kingsland Ave., Clifton, NJ 07014; (800) 782-8387.
List Price: With 1MB RAM, 1.2MB 3.5-inch or 1.44MB 5.25-inch floppy disk drive, diagnostics and utility software, $2,995; with 2MB RAM, 150MB hard disk, and NEC MultiSync 3D monitor, $5,225; with 4MB RAM, 150MB hard drive, Mitsubishi VGA monitor, 80387-25 coprocessor, and DOS 4.01, $5,783.
In Short: Proteus Technology sells its 386-MX25 both through dealers and through a direct sales force. The 386-MX25 offers a combination of good parts, good prices, and good performance, along with a 15-month warranty that offers free on-site service.

CIRCLE **601** ON READER SERVICE CARD

TANDON CORP.

Tandon 386/25

by Bruce Brown

Tandon Corp. makes and sells computers that are most known for Tandon's drive technology: Tandon's Personal Data Pac system, which consists of removable hard disk drives in 30- and 40MB cartridges that ease data transport, security, and backup and are available in internal and external versions to work as main or ancillary storage for Tandon computer systems.

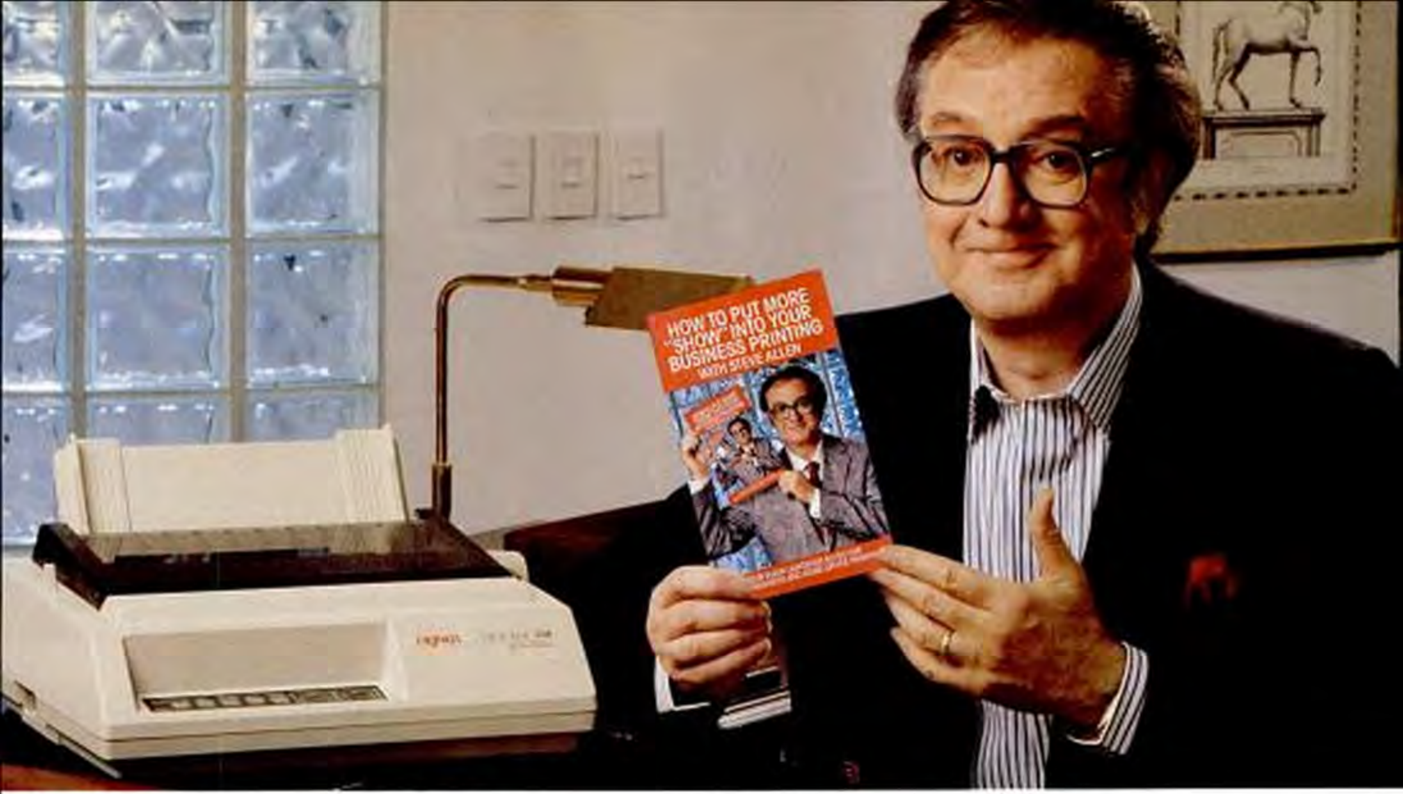
The Tandon 386/25 is a 25-MHz personal computer in a desktop configuration. The case measures 6.5 by 21.25 by 16.5 inches, a standard size for desktop AT-style machines. The base unit, with 1MB RAM, a 1.2MB 5.25-inch floppy disk drive, one serial port, one parallel port, MS-DOS 3.3, GW-BASIC, and *Microsoft Windows* 2.03 lists for $3,051, complete with a 101-key keyboard that's 19 inches long, 8.25 inches deep, and has an 80-inch cable.

The Model 386/25, configured with 5MB RAM and a 330MB Maxtor hard disk, 8-bit VGA video card and VGA monitor, costs $7,099. The as-tested unit is $5,955 with just 1MB of memory, the 330MB drive, VGA, an external In-PAC Receptacle and 30MB Personal Data Pac, plus the three software packages. Tandon doesn't sell math coprocessors; however their authorized dealers will be happy to sell you one.

The Tandon uses a Micronics motherboard capable of running at either 8 or 25 MHz. In each case the expansion bus runs at 8.33 MHz, powering the two 8-bit, five 16-bit, and one 32-bit slot. The Micronics motherboard uses the Chips and Technologies 386 chip set and Tandon's own BIOS, which in the power-on sequence pauses to allow you to specify the boot drive.

Tandon 386/25
Tandon's 386/25 combines 25-MHz performance with its Personal Data Pac removable data subsystem for fast and flexible performance. A 5MB RAM, 330MB hard disk, VGA system with DOS, and the Data Pac sells for $7,099.

One of the principal advantages of the Tandon Personal Data Pac system is that you can have different operating systems on your hard disk and on a Data Pac and then specify which one you want when you start the system. This kind of setup has many different possibilities for creative use; for example, running Unix on your hard disk but keeping DOS on a Personal Data Pac for your special DOS-only applications or files.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HOT BENCHMARK PERFORMANCE

The Tandon is no slouch, either. The 386/25 proved to be the third fastest of the 13 machines reviewed here on the PC Labs processor and memory benchmark tests. Video scores were poor due to an 8-bit card, so get a 16-bit adapter instead. Hard disk performance had first-place finishes in two of the three tests.

You can use either 256-kilobit or 1-megabit memory chips on the memory board, with a possible system total of 16MB on the board. No memory is installed on the motherboard itself. The chips installed on the test unit were rated at 80 nanoseconds. The Intel 82385 cache controller manages the 64K of 35-ns. cache memory chips, making the processor scores even more impressive since many of the other machines reviewed here opted for 25-ns. cache memory chips.

The basic system box is designed to hold five half-height drives, using a 190-watt power supply with four device leads. The 330MB Maxtor drive is a full-height device, as is the internal In-PAC Receptacle. The as-tested unit's external In-PAC Receptacle is attached by cable to a card inside the computer. The cable carries both the power and the drive controller commands for the Data Pac device.

The Tandon case is attractive with a recessed reset button and lights for power on, hard disk access, and to indicate either 8- or 25-MHz operation. The only unusual touch is a bright blue strip along the top-front edge of the computer that adds a little color to the case.

Tandon has a standard one-year parts and labor warranty but no provisions for

FACT FILE

Tandon 386/25
Tandon Corp., 609 Science Dr., Moorpark, CA 93021; (800) 378-3000, (805) 378-6010.
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 3.3, GW-BASIC, and Microsoft Windows 2.03, $3,051; with 1MB RAM, 330MB hard disk, external In-PAC Receptacle, and 30MB Personal Data Pac, $5,955; with 5MB RAM, 330MB hard disk, and VGA monitor, $7,099.
In Short: The best thing about the Tandon 386/25 is its easy marriage with the Tandon Personal Data Pac system—removable 30MB hard drives that offer data security and portability. Otherwise, the Tandon 386 offering is a competent, no-frills machine sold only through dealers.

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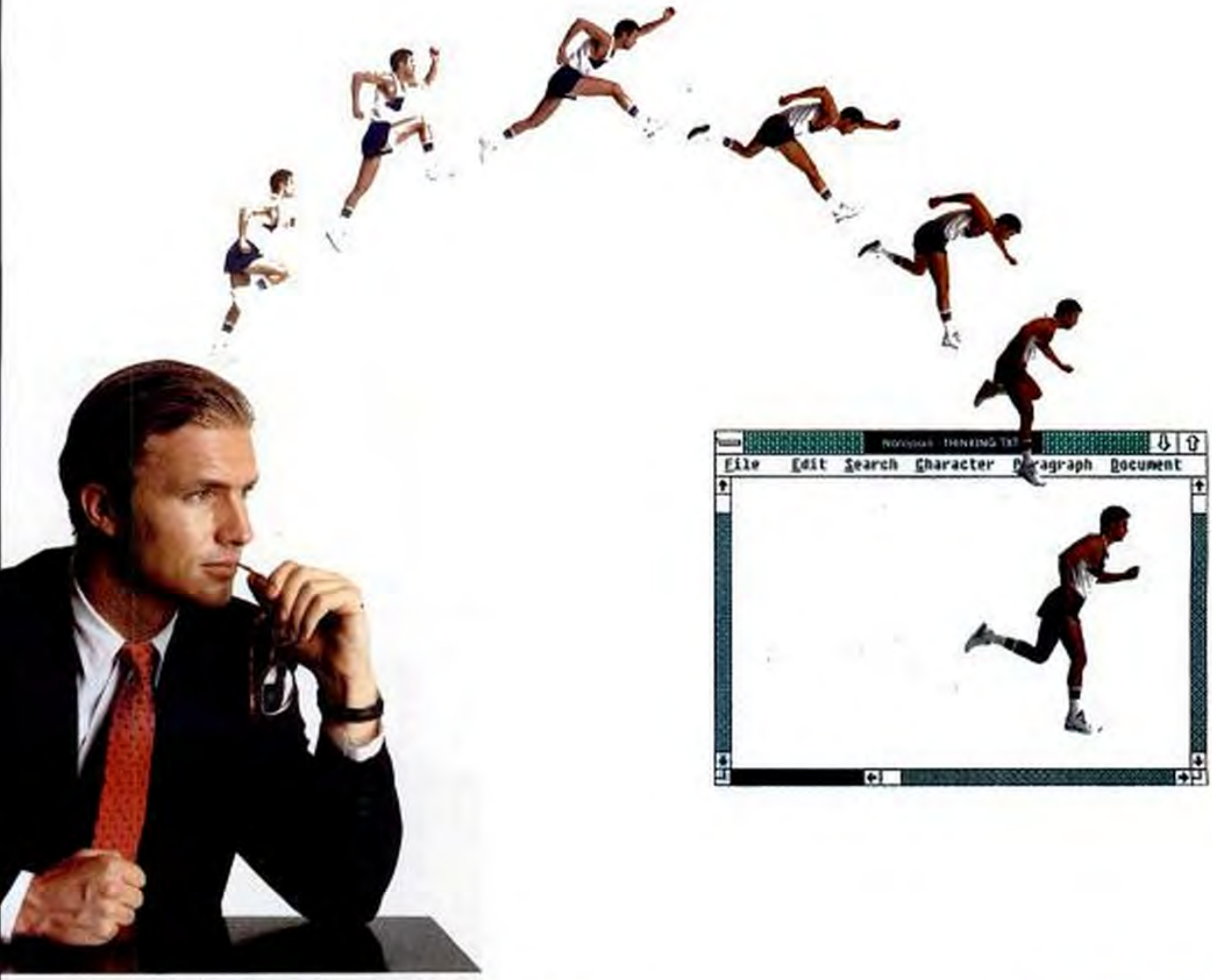

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on-site service or extended warranties. Tandon's dealer network handles these needs.

The best thing about the Tandon 25-MHz 386 machine is the Personal Data Pac system. There are other types of removable, bootable storage media, such as Bernoulli cartridges, but the Tandon design, with new lower prices, is an attractive configuration for good data security, especially if you want to maintain more than one operating system on the same computer. Factor in fine 25-MHz 386 performance, and the Tandon 386/25 is an attractive machine.

TELEVIDEO SYSTEMS INC.

Tele 386-25

by Catherine D. Miller

Using a modular design, for its desktop-model Tele 386-25, TeleVideo Systems manages to cram 12 slots and six half-height drive bays in the 6- by 20.75- by 16.25-inch (HWD) case. Although four of the 12 slots are needed for the CPU, memory, video, and controller cards, the remaining eight slots leave plenty of room for expansion. And the modular design makes the system easier to service if you should have problems.

Tele 386-25
The Tele 386-25 features a backplane 12-slot design, with CPU and memory on separate cards and eight open slots for expansion. Configured with 4MB RAM, a 150MB hard disk, VGA, and DOS, TeleVideo's 25-MHz PC sells for $9,009.

Bearing a list price of $5,995, the basic configuration includes 4MB of 100-nanosecond SIMM-type DRAM; Austek's 38152-25 cache controller with a 25-ns. 32K static RAM cache; Western Digital's 1007 5.25-inch floppy/hard disk controller card; a 1.2MB 5.25-inch floppy disk drive; a 240-watt power supply; one parallel and two serial ports; a solid Fujitsu 101-key keyboard and DOS 3.3. Our $9,009 evaluation unit added a 150MB ESDI hard disk from Micropolis, TeleVideo's own 16-bit VGA card based on the Trident TVGA 8800CS controller chip, and a Samsung VGA monitor.

> **Despite unremarkable scores, the Tele 386-25 offers solid 25-MHz performance.**

WHAT'S OUTSIDE

Four of the six drive bays accept removable media. A reset button and indicator lights for power and hard disk access reside on the front panel. The back panel includes a 9-pin serial port and the keyboard connector. The power switch is located on the rear right side of the case.

Inside, starting at the left side of the machine, the 12-slot backplane runs along the back of the system, with the last four slots running into the first of two banks of drive bays. If you put storage devices in these bays, you'll reduce the length of these four slots so that they'll accept half-length cards only. Wisely, this is the area in which the two 8-bit slots reside.

The CPU and memory boards are installed in the first two 16-bit slots. The CPU board includes the 80386-25 processor, a socket for either the Intel 80387-25 or Weitek coprocessors, the BIOS chips, the Austek cache controller, and a 32K static RAM cache. The processor runs at both 25 and 16 MHz; at 16 MHz the cache is automatically turned off, while the expansion bus operates at 8 MHz. TeleVideo uses its own BIOS for this system, which features a minimal setup procedure. Both shadow video and shadow BIOS RAM are featured, but you cannot disable them.

A 25-pin parallel and a 9-pin serial port are built into the memory board. The memory board has four banks of four SIMM sockets, supporting a total of 16MB of 100-ns. DRAM, in either 256-kilobit or 1-megabit SIMM units.

The CPU and memory boards are connected together in several ways. First of all, they are joined by a two-part 32-bit connector, giving all 16MB RAM a 32-bit data bus. Second, the boards are connected by machine screws. Since the CPU board is on the outside, the boards don't need to be disconnected from one another to add a coprocessor, but adding memory is not suggested for the faint-hearted.

The Tele 386-25 managed to turn in the slowest times of the machines reviewed here on PC Labs two-processor benchmark tests. Its performance on our memory, disk, and video benchmark tests fell into the middle of the pack. TeleVideo's unique system design doesn't seem to have increased performance for this class of machine. The margin separating the PC reviewed here, though, is not critical. Even with its unremarkable test scores, the Tele 386-25 offers solid 25-MHz performance.

The manual accompanying the Tele 386-25 is adequate, although incomplete in parts, and with some incorrect information, particularly concerning upgrading memory. TeleVideo representatives are correcting these errors. The manual does include some good advice on positioning expansion boards within the system, especially important in a box with so many expansion slots.

TeleVideo distributes the Tele 386-25 through distributors and VARs, which discount the list price. A generous warranty

FACT FILE

Tele 386-25
TeleVideo Systems Inc., 550 E. Brokaw Rd., P.O. Box 49048, San Jose, CA 95161-9048; (408) 954-8333.
List Price: With 4MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 3.3, $5,995; with 150MB hard disk, VGA monitor, $9,009.
In Short: TeleVideo Systems' highly expandable Tele 386-25 features six half-height drive bays and 12 expansion slots. Although eight slots are free in a fully configured system, only four of these are full length. A generous warranty supplies one year of on-site support.

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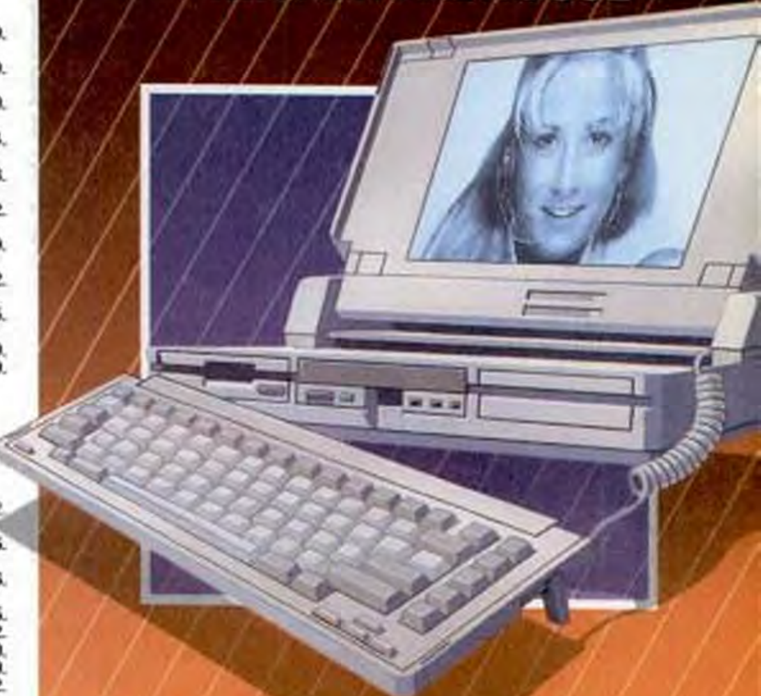

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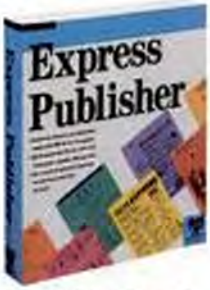

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includes one year of parts and labor plus one year of on-site support. The Tele 386-25 includes some innovative design features, even if it's benchmark performances were uninspiring. But what makes this system worth considering is its expandability and its support policy.

UNISYS CORP.

Unisys PW^2 800/25A

by Bruce Brown

Unisys's 25-MHz 80386-based computer has a look that can be called "high corporate" and a price to match. This classy-looking combination desktop and vertical case gives up no performance or expansion edge to the less expensive brands, but it doesn't do much to justify the PW^2's high cost, either.

The base model PW^2 costs $7,315 with 2MB RAM and a 64K RAM cache. That's all you get for your money: there's no floppy disk drive, certainly no hard disk or video, no interface ports, no software, and not even a keyboard. A configuration with 2MB of RAM, 1.44MB floppy disk drive, 140MB hard disk, a Video Seven 16-bit VGA card and Unisys VGA monitor, two serial ports and one parallel port, a 101-key keyboard with an 82-inch cable, and DOS 4.01 costs $12,466. If you want an Intel 80387-25 math coprocessor with a Unisys machine, it will cost you an extra $1,895, roughly the same as IBM and Compaq but at least three times the price charged by most of the vendors whose machines are reviewed in this issue.

Unisys PW^2 800/25A
The Unisys PW^2 800/25A is corporate machine with an elegant combination tower/desktop case and a Fortune 500 price. With 2MB RAM, 146MB hard disk, 1.44MB floppy disk drive, VGA, and DOS, the system costs $12,466.

The Unisys PW^2 800/25A uses an Intel motherboard and 386 chip set with a Phoenix BIOS. The dual-speed 8- and 25-MHz system clock includes the slower speed for booting recalcitrant software, but otherwise the machine is intended to run at full speed. The expansion bus powers one 8-bit, five 16-bit, and two 32-bit slots at a steady 8 MHz.

The Unisys box measures 6.75 inches high (or 9.5 inches wide with the stabilizing feet when vertical) by 21.5 inches wide and 18.75 inches deep. The combination stand and integrated system foot is a beautifully designed piece that fits snugly on one side of the system case. The front of the case has a slight curve that adds to the system's design appeal, as does the FCC B sticker on the back of the case.

The Unisys did well on our benchmark tests, with good video speed scores combined with reasonable disk, processor, and memory performance. It doesn't justify its price by yielding the highest performance, but it surely holds its own.

The Unisys motherboard can hold up to 2MB RAM, using SIMMs. The installed chips were rated at a fast 60 nanoseconds, which partly explains the higher overall system cost. A memory board in the 32-bit slot can take up to an additional 16MB, raising the system potential to 18MB of 32-bit memory. The memory cache is fixed at 64K of 35-ns. memory chips, with cache management accomplished by discrete chips integrated into the motherboard.

There's room for five half height drives in the Unisys case, three of which can use removable storage media. The standard 220-watt power supply is ample for the system's expansion possibilities.

Don't expect to buy Unisys computers through the mail or at your local discount computer store. Unisys sells through dealers and via a direct sales force, targeting a clearly defined market: big business. Corporate buyers who use Unisys mainframes and workstations or buy from full-service vendors are the intended market, and also the only ones likely to be willing to pay the relatively high price for this machine; but look for discounts. A one-year parts and labor warranty is standard, with warranty extensions and on-site service available by negotiated contract.

FACT FILE

Unisys PW^2 800/25A
Unisys Corp., P.O. Box 500, Blue Bell, PA 19424; (800) 547-8362, (215) 542-2240.
List Price: With 2MB RAM, no keyboard, $7,315; with 2MB RAM, 146MB hard disk, 1.44MB 3.5-inch floppy disk drive, VGA monitor, and DOS 4.01, $12,466. 80387-25 coprocessor, $1,895.
In Short: The Unisys PW^2 386 machine is a good-looking machine made by a large company; it is sold directly to corporate accounts and through select dealers. An expensive alternative but a good performer.

CIRCLE **606** ON READER SERVICE CARD

The Unisys 386 25-MHz computer comes in an attractive package and performs well. Unfortunately, the base unit costs more than IBM or Compaq and is less well known, so it's easy to see the difficulty that Unisys has in gaining ground in the personal computer market.

WYSE TECHNOLOGY

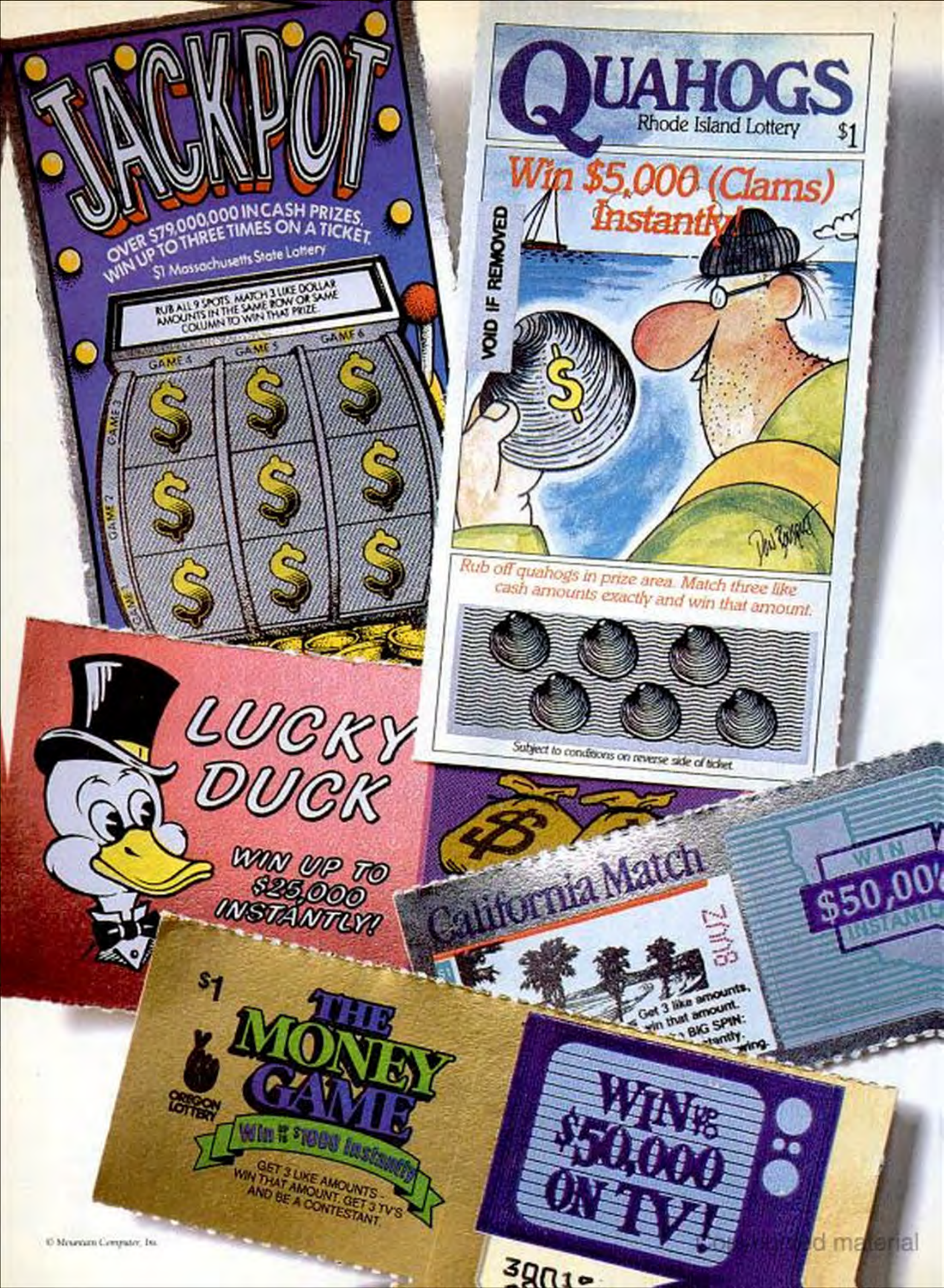
WYSEsystem 386 Model 3225

by Catherine D. Miller

Wyse Technology continues its tradition of modular system architecture with the 25-MHz WYSEsystem 386 Model 3225. Because it's designed around a CPU on a board, many of the machine's components are engineered by Wyse Technology to ensure an integrated system unit. Although Wyse has not yet announced a 486 upgrade board, that seems to be the logic at work behind the Model 3225.

The basic system, which carries a list price of $7,599, includes 4MB of 100-nanosecond RAM, a 25-ns. 64K cache, a Western Digital ESDI hard/floppy disk controller, a 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, a 220-watt power supply, a 101-key keyboard, and DOS 3.3.

The stylish light-gray 5.25- by 21- by 17.25-inch (HWD) desktop case houses five half-height drive bays, four of which are accessible from the front of the system.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CIRCLE 186 ON READER SERVICE CARD

A removable cover slides over the drive bays when they're not in use. A diagonal LCD panel displays the date or time, and the processor speed, which can be set to 8 or 25 MHz with a button located directly below the LCD screen.

Inside you'll find eight 16-bit and three 8-bit slots, but by the time the system is configured with a video adapter, disk controller, and I/O ports, only five slots are left open. The processor, system memory and cache memory each reside on separate boards occupying three 16-bit slots. A 32-bit top-plane, which is held in place with a clamp and cover plate screws, connects the three boards so that the system operates with a 32-bit bus. The bus operates at a constant 8 MHz. Directions for the removal of these three units and the removal of the top plane are placed on the inside cover of the system, along with the jumper and switch settings for the CPU board and memory board, as well as other system specifications.

WYSEsystem 386 Model 3225
The WYSEsystem 386 Model 3225 features a backplane design with the CPU on a card for 486 upgrades. With 4MB RAM, 150MB hard disk and tape drives, a 1.2MB floppy disk drive, VGA, and DOS, $11,173.

Ten of the eleven expansion slots on the backplane are located along the rear of the computer, so boards are installed in the conventional vertical manner. The controller board resides in a space-saving eleventh slot, which is located horizontally next to the drive bays so as not to crowd the system.

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FACT FILE

WYSEsystem 386 Model 3225
Wyse Technology, 3471 North First St., San Jose, CA 95134; (800) GET-WYSE, (408) 473-1200.
List Price: With 4MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 3.3, $7,599; with 150MB hard disk drive, 150MB tape drive, and VGA monitor, $11,173.
In Short: The WYSEsystem 386 Model 3225 comes in a stylish light grey desktop case with room for five half-height storage devices. Three of the 11 expansion slots are occupied with the CPU, cache, and memory cards. Both hard disk options include tape backup drives.
CIRCLE 607 ON READER SERVICE CARD

CPU ON A CARD

In addition to incorporating Intel's 80386-25 processor, the CPU board includes a socket for the Intel 80387-25 coprocessor. Phoenix ROM BIOS chips supply the standard setup and utilities associated with this BIOS, including shadow video and BIOS RAM and password protection.

The CPU memory card features four banks of SIMMs that can contain 16MB of 32-bit memory available with all four banks full. A socket and support circuitry for the Weitek 3167 coprocessor is located on the cache memory board. A 64K direct-mapped posted write cache composed of 25-ns. chips is standard and cannot be increased. Wyse controls this cache with chips of its own design.

In addition to the basics, our $11,173 evaluation unit included CDC's 150MB hard disk drive, a 150MB streaming tape drive from Archive, Wyse's 8-bit VGA board, and Wyse's VGA monitor. Wyse doesn't offer a hard disk drive independently of the tape drive; you must buy both if you buy your hard disk from Wyse. While I won't dispute the importance of backup, you should be able to choose the method that best suits your needs.

The WYSEsystem turned in a competitive performance on the PC Labs benchmark tests, doing especially well on the small-record DOS File Access and BIOS Disk Seek tests. The Model 3225's sluggish performance on our video benchmark tests (last place in the Direct to Screen test) is attributable in part to the 8-bit VGA board installed in our evaluation unit.

The manual accompanying the WYSEsystem 386 Model 3225 is adequate for most purposes, although it is a little sparse when it comes to describing the system's setup procedures and utilities. Wyse Technology distributes the Model 3225 through distributors and larger VARs that will set up the system and offer service and support. Wyse offers a one-year parts and labor warranty, with an optional on-site service policy also available.

Wyse offers a high-quality system with some unique design features. Although it commands a higher price than many 25-MHz 386 systems, it's a solid performer and well supported. Give it a look. ■

Catherine D. Miller is a staff writer at PC Magazine. *Bruce Brown, a frequent contributor to* PC Magazine, *is a computer consultant based in Simsbury, Connecticut.*

EDITOR'S CHOICE

All the PCs reviewed in this issue are competent performers, with benchmark results well within the expected range for their class. None of these 25-MHz machines will let you down, but none measure up to the three Editor's Choice winners from *PC Magazine*'s May 30, 1989 386 blockbuster. For this reason, we aren't awarding an Editor's Choice to any of the PCs in this roundup. Our favorites remain the three Editor's Choice machines from DataWorld, IBM, and Northgate.

The 13 machines reviewed here represent the third group of 25-MHz 386 PCs that *PC Magazine* has evaluated this year. In those ten months, 25 MHz machines haven't gotten any slower, yet they've slipped from being the fastest PCs around to the second fastest and now, with the advent of the 486, to third. Already we're beginning to see the beginning of commodity marketing for 386-25s.

We looked at nine machines in our February 14, 1989 issue, and the Dell System 325 emerged as *PC Magazine*'s first 25-MHz Editor's Choice. The System 325 currently lists for $6,899 with 1 MB RAM, a 150MB hard disk, Super VGA (800 by 600 resolution), and DOS.

Twenty-five 25-MHz PCs were evaluated in our comprehensive May 30, 1989 round up. By then time had caught up with the Dell, and although it remains a well-constructed, reliable PC, it was no longer among the fastest 25-MHz 386s. The 25-MHz Editor's Choices selected in May, and the ones that we consider still the best 25-MHz 386s, are the DataWorld Data 386-25, which comes with 1MB RAM, 140MB hard disk, Super VGA, and DOS for $5,435, and the Northgate Elegance 386/25, which costs $5,124 with 1MB RAM, 150MB hard disk, Super VGA, and DOS. Also winning the Editor's Choice was the IBM Micro Channel PS/2 Model 70-A21. Although the A21 experienced some system board failures, IBM has corrected this problem, and we still consider it an Editor's Choice PC. The IBM lists for $11,113 with 4MB RAM, a 120MB hard disk, and a VGA monitor. Note the IBM includes more memory, and since it is sold through dealers, you should be able to negotiate a 20 to 30 percent discount.

Among PCs reviewed this issue, our favorite (though not Editor's Choice) is the ACMA 386/25 Business System. The ACMA stands out for its performance (consistently finishing third or better out of 13 machines), good expansion possibilities, 45-day money-back guarantee, and a two-year warranty. Its $3,595 price tag for 4MB RAM, 120MB hard disk, VGA, and DOS, makes it an attractive choice.

The Micro Labs 386/25 from Pan United Corp. is a good value offering fast performance. It sells for $4,600 with 4MB RAM, a 120MB hard disk, VGA monitor, and DOS, and uses brand name components.

If you're hungering for expansion capability, take a look at the PC Craft 3500/25C. This tower unit accommodates one full-height and eight half-height drives but costs $9,240 with VGA and a 150MB hard disk. The Mitac, Unisys, and Wyse entries also charged premium prices for solid yet unexceptional performance.

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Drive Video	1 Floppy	2 Floppy	40MB-45MS	66MB-25MS
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VGA/Mono	$824	$899	$1104	$1254
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PC BRAND 286/12 $799

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12 MHz Clock, Zero Wait Operation,
Norton SI 15.3 •Landmark™ Speed 15.1MHz
512K, 1.2MB or 1.44MB Drive, 101- Keyboard

Standard System Features:

- 80286-12 Processor Operating at 12MHz with Zero Wait States delivering 15.1MHz Effective Throughput
- 512K RAM expandable to 4MB on the System board using 256K or 1MB 100ns RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
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- Enhanced 101-key AT Style Keyboard
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- Real Time Clock/Calendar with 5 Year Battery
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- Mini Size Tower Case®

Standard Pre-Built Configurations:

286/12 With 512K, Hard Disk Drive, Monitor & Video Card				
Drives Video	40MB-45MS 1:1 RLL	66MB-25MS 1:1 RLL	71MB-18MS 1:1 MFM	110MB-25MS 1:1 RLL
Mono	$1207	$1432	$1572	$1672
VGA/Mono	$1402	$1627	$1767	$1867
EGA	$1547	$1772	$1912	$2012
VGA/16Bit	$1637	$1862	$2002	$2102

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Norton SI 23.0 • Landmark™ 26.7MHz
512K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- 80286 Processor Operating at 20MHz w/Zero Wait States in interleave mode delivering 27MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB 100ns RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM, and PCNET compatibility
- Built-in System Board LIM 4.0 EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- Mini Size Tower ® Case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable

Standard Pre-Built Configurations:

286/20 w/512K, Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB 45MS 1:1RLL	66MB 25MS 1:1 RLL	71MB 18MS 1:1 MFM	110MB 25MS 1:1 RLL	150 17MS 1:1 ESDI	320 16MS 1:1 ESDI
Mono	$1407	$1632	$1737	$1862	$2357	$2817
VGA/Mono	$1602	$1827	$1932	$2057	$2552	$3012
EGA	$1747	$1972	$2077	$2202	$2697	$3157
VGA/16Bit	$1837	$2062	$2167	$2292	$2787	$3247

PC BRAND 386/SX-16 $1099

PC BRAND, Inc.

16 MHz Clock, Zero Wait Operation
Norton SI 18.7 • Landmark™ 18.3MHz
512K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- 80386SX Processor Operating at 16MHz delivering 18MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB 80ns RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387SX Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM, and PCNET compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case with 5 Disk Drive bays (Shown with optional Mini Size Tower ® Case)

Options:

- Mini Size Tower ® Case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable

Standard Pre-Built Configurations:

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Drives / Video	40MB 45MS 1:1RLL	66MB 25MS 1:1 RLL	71MB 18MS 1:1 MFM	110MB 28MS 1:1 RLL	150 17MS 1:1 ESDI	320 16MS 1:1 ESDI
Mono	$1507	$1732	$1837	$1962	$2457	$2917
VGA/Mono	$1702	$1927	$2032	$2157	$2652	$3112
EGA	$1847	$2072	$2177	$2302	$2797	$3257
VGA/16Bit	$1937	$2162	$2267	$2392	$2887	$3347

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Norton SI 23.0 • Landmark Speed 26.1MHz
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Standard System Features:

- True 20MHZ Intel 80386-20 CPU Operating with Zero Wait States delivering up to 26.1MHz Effective Throughput
- 1024K RAM standard expandable to 16MB using 256K and/or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
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- Custom configurations w/Name Brand peripherals of your choice
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Standard Pre-Built Configurations:

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Mono	$1995	$2095	$2220	$2330	$2860	$3305
VGA/Mono	$2170	$2270	$2395	$2505	$3035	$3480
EGA	$2280	$2380	$2505	$2615	$3145	$3590
VGA/16Bit	$2370	$2470	$2595	$2705	$3235	$3680

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Norton SI 31.6 • Landmark Speed 43.5 w/Cache
1024K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- Intel 80386 Processor Operating at 25MHz with Zero Wait States in interleave mode delivering 34 to 44 MHz Effective Throughput
- 1024K RAM standard expandable to 16MB using 256K and/or 1MB RAM
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- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller, 977.6 KB/SEC Caching Controller w/ESDI Configurations
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- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287, 80387 or Weitek Co-Processor Support
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- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case with 5 Disk Drive bays (Full size case w/cache)

Options:

- 32KB or 64KB Cache Processor • Weitek Co-processor • Tower ® Case
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable

Standard Pre-Built Configurations:

386/25 With Hard Disk Drive, Monitor & Video Card						
Drives Video	40MB-45MS 1:1 MFM	66MB-25MS 1:1 RLL	71MB-18MS 1:1 MFM	110MB-25MS 1:1 RLL	150-17MS 1:1 ESDI	320-16MS 1:1 ESDI
Mono	$2182	$2332	$2462	$2592	$3162	$3412
VGA/Mono	$2387	$2537	$2667	$2797	$3367	$3617
EGA	$2502	$2652	$2782	$2912	$3482	$3732
VGA/16Bit	$2577	$2727	$2857	$2987	$3557	$3807

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- Intel 82385-33 Cache Processor with 32K 25NS Static RAM Standard, Field Upgradable to 64K
- 1024K RAM Standard Expandable to 16MB
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive Controller, 977.6 KB/SEC Caching Controller w/ESDI Configurations
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387 or Weitek Co-Processor support
- Phoenix BIOS With Full MS/DOS, 0S/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- 8 Slot motherboard design
- Full size case with 5 Disk Drive bays (Shown with Optional Full Size Tower ® Case)

Options:

- Custom configurations w/Name Brand peripherals of your choice
- Weitek Co-Processor • Tower ® Case • Factory Ram Upgrades

Standard Pre-Built Configurations:

386/33 With Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB-45MS 1:1 MFM	66MB-25MS 1:1 RLL	71MB-28MS 1:1 MFM	110MB-25MS 1:1RLL	150MB-17MS 1:1ESDI	320MB-16MS 1:1 ESDI
Mono	$3259	$3454	$3554	$3679	$4124	$4634
VGA/Mono	$3454	$3649	$3749	$3874	$4319	$4829
EGA	$3599	$3794	$3894	$4019	$4464	$4974
VGA/16Bit	$3689	$3884	$3984	$4109	$4554	$5064

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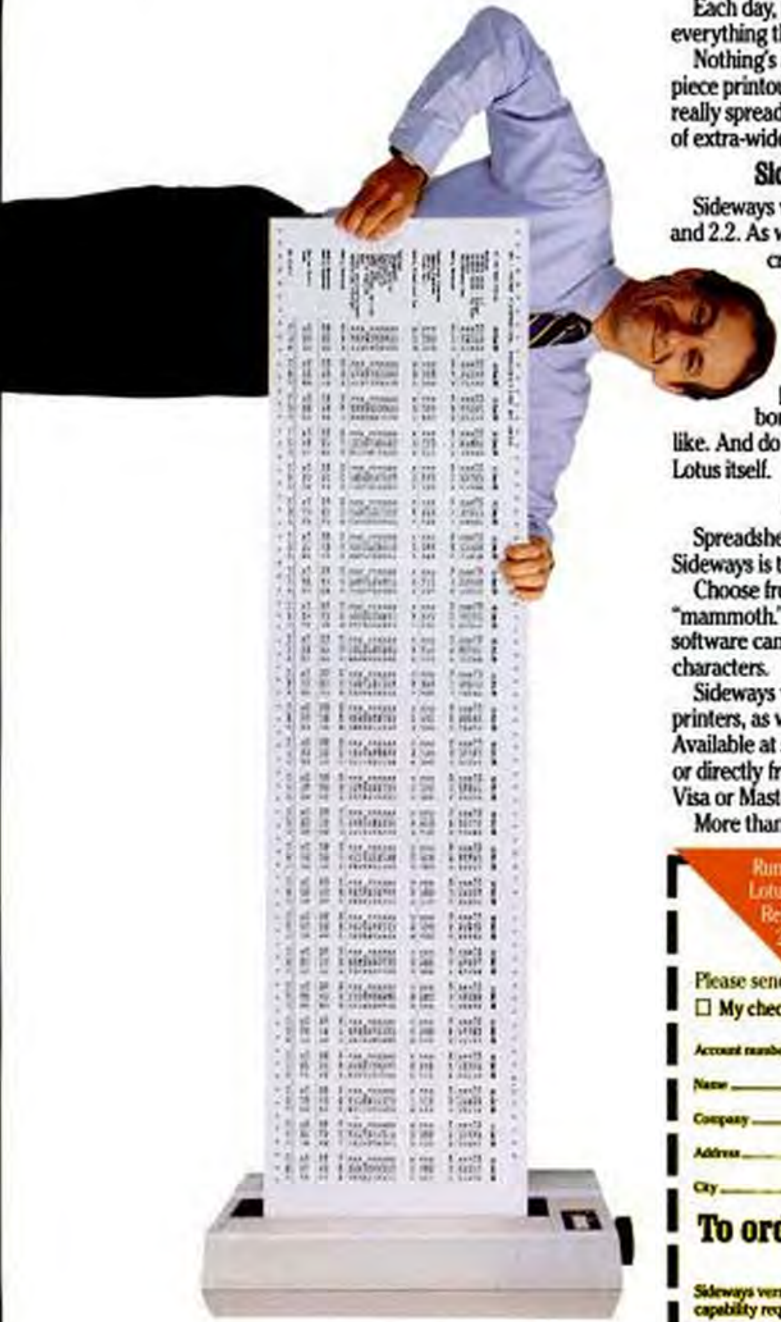

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Just Enough, Just in Time

The two new versions of Lotus 1-2-3 have a wealth of new features that millions of users have been awaiting impatiently. Are they good enough to win back those who have found the same features elsewhere?

by M. David Stone

You've heard all about *Microsoft Excel*, and *Quattro Pro*, and *SuperCalc 5*, but you've stayed with *Lotus 1-2-3* 2.01 because you know its menus by heart and the program does what you need it to do—more or less. But now that Lotus has delivered not one but two new releases, the question becomes not just whether to upgrade, but which one to upgrade to: Release 2.2 or Release 3.0. Microsoft Corp., Borland International, and Computer Associates International would say "neither!" and satisfied users of their spreadsheets would agree.

Lotus Development Corp.'s two new releases, which both list for $495, have clearly differing hardware requirements. Release 3 needs a 286 or 386 processor, a hard disk, and 1MB of memory (3MB for OS/2 operation), while Release 2.2 can run on a dual floppy system with an 8088 and as little as 320K. Lotus would have you base your upgrade decision strictly on the hardware you have or intend to buy, but it has confused the issue by making the two releases just different enough to make the decision a little more difficult than that. The versions share some new commands, but each has features the other lacks.

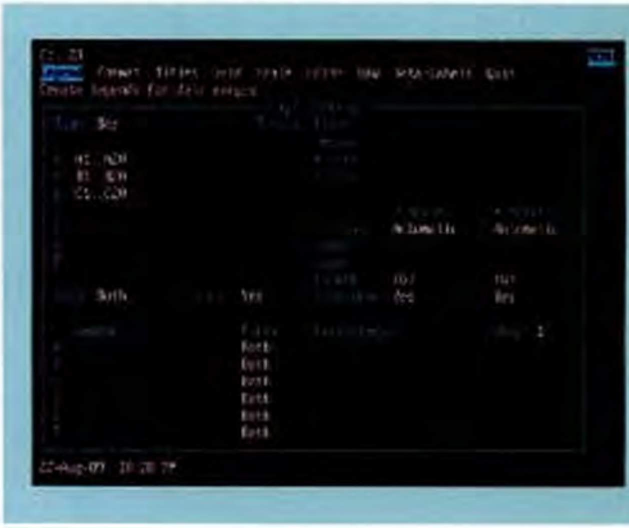
Release 3 offers 3-D worksheets (a stack of connected worksheets in the same file), links to external databases, and the ability to see a graph and worksheet simultaneously. Release 2.2 offers none of the above—the penalty for being able to run in 640K or less. But 2.2 is not simply a subset of Release 3. Most notably, 2.2 comes bundled with *Allways*, an add-in that can produce output every bit as attractive as anything you've seen from *Excel*. *Allways* provides shading, boxes, and up to eight fonts per worksheet, yielding far more professional-looking output than Release 3 can produce.

You'll also find a handful of menu choices in Release 2.2 (for add-ins and macro learn mode) that you won't get in Release 3, and 2.2 provides setting sheets—a feature that gives you an overall view of relevant settings for a given function. For example, when you are working in the Graph menus, the setting sheet lets you see all of your graph settings at once.

Moving from 2.01 to either 2.2 or 3.0 feels comfortable, like discovering new sides to an old friend's personality. But moving between 2.2 and 3.0 has a *Twilight Zone* feel to it, as if you've slipped into another dimension.

Some of the differences between the two upgrades are temporary. According to Lotus, future versions of Release 3 will incorporate setting sheets and the add-in menu choices that are already in 2.2.

Lotus says that the only reason for leaving the add-in choice off the Release 3 main menu is that there aren't any add-ins for this product yet (it claims that 2.2 will work with most add-ins designed for 2.01). Release 3's new programming means that add-ins have to be rewritten from scratch. Until add-ins for Release 3



Setting sheets in 1-2-3, Release 2.2, like the Graph setting sheet shown here, make it easier to navigate the menus. You can see what you've already done and make changes within context. There's no need to waste time on trial and error.

RELEASE 3's MEMORY MUDDLE

by M. David Stone

Lotus 1-2-3, Release 3, requires a minimum of 1MB RAM for DOS—640K conventional and 384K extended. But does it really need all that memory? And does that big requirement mean that you can't load your network software or favorite TSR?

No, it doesn't, and no, it doesn't. The RAM requirement is more complicated than the simple 1MB that Lotus states. In fact, there are complications with both the extended memory and the conventional memory.

Extended memory first: On the one hand, many computers with 1MB of RAM are already using all or part of the 384K extended memory for shadow RAM. This helps speed up the computer's operation but may prevent Release 3 from running. On the other hand, 386-based PS/2 systems and Compaq systems also use shadow RAM, but Lotus worked with IBM and Compaq to ensure that there would be no conflicts. In general, the more extended memory your computer uses for shadow RAM, the more likely you are to have a problem, particularly if the system can't be configured to turn off the shadow RAM. (You can always sidestep the problem by adding more extended memory.)

The requirement for conventional memory is even less clear. The Lotus manual states that if you don't have enough memory available, "part of *1-2-3* is stored in overlays on the hard disk." The implication is that Release 3 doesn't need all that memory after all. This turns out to be true.

We ran Release 3 in a *DESQview* window set to 480K. Even then, the Worksheet Status screen showed 226K free. The program also ran without problems in the 480K window with *SideKick* loaded first.

Beyond *DESQview*, Release 3 worked fine with *Lotus Express*, with only 273K of conventional memory available after loading the memory-hungry comm program. With *Express* loaded, the program wouldn't let me use the /System command to shell out to DOS. Instead, it responded that there was not enough memory available.

Lotus was not able to come up with firm figures for the memory Release 3 minimally needs; the figure changes, depending on your DOS version, which screen drivers and printer drivers are installed in Release 3, and how many drivers are installed.

According to Lotus, Release 3 loads as much as possible into extended memory first. If you have enough extended memory (750K), Release 3 will load all but 30K into that. With extended memory filled, the program then loads the rest into conventional memory. In the real world, you'll simply have to try the program with your favorite TSRs and see if they work. But if you plan to create large spreadsheets, you'd better have some expanded memory (up to 32MB addressable) or additional extended memory (up to 15MB addressable) as well. ■

from scratch. Until add-ins for Release 3 arrive and Lotus incorporates the menu choice, the add-in manager is available through Alt-F10, just as in 2.01. To maintain consistency, 2.2 can also bring it up with Alt-F10.

Lotus has also announced that *Allways* for Release 3 will be available "at a nominal cost," with details to follow when beta testing begins. Once Release 3.*x* matches the few advantages that 2.2 currently has, it will offer a true superset of 2.2 features. It makes sense, then, to consider the two programs together, since 2.2 offers some hints as to what 3.*x* will become.

FACT FILE

Lotus Development
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Lotus 1-2-3, Release 2.2
List Price: $495; upgrade from earlier versions, free for packages purchased since September 6, 1988, $150 otherwise.
Requires: 320K RAM, two disk drives (512K RAM and a hard disk required for *Allways*), DOS 2.0 or later.
In Short: The speedy, low-overhead upgrade solution for 8088 machines. Some spreadsheet linking available, but not the 3-D power of Release 3. The inclusion of the *Allways* graphing/printing add-in increases the hardware requirements but adds excellent output capability.

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Lotus 1-2-3, Release 3.0
List Price: $495; upgrade from earlier versions, free for packages purcased since September 6, 1988, $150 otherwise.
Requires: 80286 or 80386 processor, 1MB RAM (3MB for OS/2), hard disk, DOS 3.0 or later.
In Short: Its wealth of new features fills more than 640K, but users with the right hardware who have been waiting for 3-D spreadsheets and multiple file linking won't mind. There's a speed/power trade-off to contend with, but overall, the improvements are welcome and long overdue.

CIRCLE **544** ON READER SERVICE CARD

VALUABLE CONNECTIONS

The most significant new features in the releases are linking (in both versions) and 3-D (in Release 3 only). Both linking and 3-D are sure to change the way you design spreadsheets, since they let you spread your models over several connected worksheets.

There is an important distinction between linking and three-dimensionality. To link worksheets, you only have to be able to read the contents of cells from one worksheet into arbitrary cells of another, a feature that you'll find in both 2.2 and 3—and in the program I had eight years ago on my CP/M computer, for that matter. For three-dimensionality, you also need the ability to extend ranges through a stack of worksheets, just as you can extend them horizontally and vertically on a single worksheet.

Even 2.2's meager ability to link worksheets opens new possibilities. With linking, it's a trivial matter to build a simple accounting system: Start with a template for income and expenses and create a worksheet for each account as needed. Then build a chart of accounts worksheet that links to each income or expense sheet and reads the current totals.

If the total for each expense sheet is in cell D100, for example, the link formulas in the chart of accounts would take the form

```
+<<EXPENSE1.WK1>>D100
```

The double angle brackets indicate that EXPENSE1.WK1 is a filename. If you wish, you can also include a complete path and drive letter.

Each time you load the chart of accounts sheet, it will update the linked formulas from disk. If you're on a network and think someone may have changed one of the source sheets, you can update the figures manually with the /File Admin Link-refresh command.

In 2.01 you could use the /File Combine Copy command along with macros to get much the same effect, but you'd have to work at it. Linking lets you consolidate information easily—which means you are more likely to take advantage of it.

Linking in Release 3 works almost the same way it does in 2.2, with one exception and many enhancements. The exception is that Release 3 does not automatically update data from disk when you load a file.

There is at least one reason for leaving out the automatic update. One of the key features in Release 3 is the ability to load multiple files. If you've already loaded a source worksheet and modified it, you obviously don't want the linking formulas to read the out-of-date data still on disk.

Release 3's solution is to read data automatically only when the source worksheet is in memory. The program will even update link formulas as you make changes in the source file. It will not read the data from disk unless told to with the /File Admin Link-refresh command, and then it will sensibly ignore the data from disk if it differs from data in the same worksheet in memory.

Alas, this is one difference that is clearly in 2.2's favor. Lotus was no doubt trying to cut down file-loading times in Release 3, but it would be better to take the extra time to make sure you're working with the most-current data. As it is, you can use an auto-executing macro in files with link formulas to run the /File Admin Link-refresh command after loading.

> **Features like linking (available in both versions) and 3-D (in Release 3) are sure to change the way you design spreadsheets; they let you spread your models over several connected worksheets.**

Of course, Release 3 can link to .WK1 and .WKS files as well as to the program's native .WK3 format. This makes consolidation easy, even when the worksheets are created with other versions of *1-2-3* or compatible programs. (Release 2.2, which uses the .WK1 format, can link to .WK1 or .WKS files, but not to .WK3 files.)

One notable feature in Release 3's linking is the ability to include @ functions and ranges in the link formula. For example, you can create a formula such as

```
@sum<<JANEXP.WK3>>ITEMTOTS
```

This will look at the JANEXP file, find the range ITEMTOTS, and return the sum of the entire range. To do the same thing in 2.2, you have to create an extra formula in the JANEXP worksheet to total the amount, then read the total from there. Clearly, that's a less elegant approach than entering one formula in Release 3.

LINKED VS. 3-D WORKSHEETS

The distinction between three-dimensionality and linking is one that is important enough to repeat: three-dimensionality refers to the ability to extend ranges through a stack of worksheets in a single file. Linking does not.

It doesn't make much sense to define a named range by extending it through multiple files. The next time you load the files, you can load them in a different order. On the other hand, if the worksheets are all part of one file, you will automatically have them in the same order every time, so having a range in the third dimension becomes meaningful.

Some programs eliminate confusion between linked and 3-D worksheets by offering only one choice. *Excel*, for example, uses a different file for each worksheet. The only trouble with having both options in Release 3 is that they seem so similar that you may have trouble sorting out the differences. The benefit is that once you understand the differences, you can

SEYMOUR ON SPREADSHEETS: Do Lotus's New Releases Succeed?

by Jim Seymour

It just *seemed* like forever. From its formal announcement in April 1987, at the first *Lotus Week* celebration in Boston—at the peak of Lotus's power, when it seemed the company could do no wrong—till *Lotus 1-2-3*, Release 3, was shipped in July 1989 didn't really take all that long, as software products go: 26 months.

But since the last major release, 2.0, had appeared in September 1985, we had thought 3.0 would arrive long before the Summer of '89. And the combination of our expectations, based on working with previous Lotus spreadsheet programs, and the hype Lotus brought to the party during those 26 months, meant that we were all expecting something pretty spectacular in Release 3.0. With every delay over those two years, those expectations got cranked a bit higher: anything that takes *that* long must be pretty incredible, right?

Even Lotus's announcement in March of this year that we'd be seeing not one but two new *1-2-3*s and a third one sometime next year hardly dampened the passions.

OK, so Lotus found it couldn't pack all the goodies it had built into 3.0 into 640K and had to turn to a DOS extender so that the program could use extended memory. Upgrading system memory is a Good Thing; this is the era of megamemory, right?

OK, so rewriting 3.0 in the C language, rather than the fast, tight assembler code of earlier versions meant 3.0 might not be so fast as we were used to. C'mon: Speed isn't really *that* important, is it?

OK, 3.0 can't turn out good-looking printed worksheets the way you can with 2.01 and the bundled *Allways* add-in from Funk Software. So what? Attractive printouts aren't all *that* important, are they?

We ran out of OKs when *1-2-3*, Release 3, actually shipped.

INHERITING THE MANTLE

Is *1-2-3* 3.0 a great spreadsheet program? Of course: with the exception of the spreadsheet built into Lotus's forlorn *Jazz* for the Macintosh, Lotus has never shipped a spreadsheet program that wasn't a great piece of software. Even *Symphony*, with its warty interface, confusing design, and sorry word processing had within it from the first a state-of-the-art spreadsheet . . . which was just another way of saying a *Lotus* spreadsheet.

And that's the problem: It's hard to call *1-2-3* 3.0 a *state-of-the-art* spreadsheet, perfectly nice though it is.

Fairness time: There are lots of swell things in *1-2-3* 3.0. There's 3-D, for example: you can build stacks of either same-format worksheets (a "multiple-sheet file," in Lotus-ese), or varying-format worksheets ("linked files"), then produce cover sheets, or "roll-ups," which gather and summarize the detail from all those underlying sheets.

And you can have a *1-2-3* 3.0 graph on-screen, in a "HotView" window, right along with a few of the rows and columns of the worksheet itself.

And the database features have been improved, by the addition of powerful multitable file capabilities. You can also snatch data relatively easily from external database files; Lotus includes a *dBASE III* driver, and we'll surely see others from the DBMS vendors and third-party software companies.

And there's a learn mode for creating macros, a few obscure new @ functions, better recalculation algorithms, a long-overdue search-and-replace function, and real support for LANs.

STAND AND DELIVER

But, but, but . . . all those OKs start piling up: Were we really going in the right direction when we had to keep dropping desirable features, from 640K operation to good-looking printouts to decent-quality graphs to the kind of blazing speed we've always associated with Lotus spreadsheet programs?

In return we got new functionality in 3.0, but too often the new goodies are less useful than they at first seem. Lotus's addition of 3-D capability is a perfect example. While *1-2-3* 3.0 gives users access to both kinds of 3-D spreadsheets—multiple-sheet files of same-format worksheets and linked files of dissimilar sheets—Lotus did a lot better job with the former than the latter.

Creating multiple-sheet files in 3.0 is direct and simple. A new command, /Worksheet Window Perspective, spreads up to three of those separate sheets across your screen at once and makes jumping from one to another easy. And a related /Worksheet Window Group command lets you format cells and ranges three-dimensionally, to keep those worksheets formatted the same way.

But building the second kind of 3-D worksheet, which is richer and more complex—the linked-files flavor—is less convenient. You'll find yourself slipping and sliding around as you try to navigate through related worksheets, looking for the cells you want to link.

use whichever approach is most appropriate. Multiple linked files are a good choice for data that comes from multiple sources, while 3-D spreadsheets are a fine choice for files that are completely under your control.

If you can keep the two concepts separate, you shouldn't have much trouble working with either format (Jim Seymour has a decidedly negative reaction to Release 3's handling of multiple linked files, however. See "Seymour on Spreadsheets: Do Lotus's New Releases Succeed?"). The key is to consider multiple files in memory as nothing more than a shortcut. It saves you from having to clear one file from memory before you can work on the next, but it offers little else. When you use the /Worksheet Window Perspective command to see three worksheets at once or Ctrl-PgUp and Ctrl-PgDn to move through the worksheets on-screen, it may look ex-

This isn't all Lotus's fault: *Microsoft Excel* shows how much help it is to have a graphical environment when you're working in three dimensions. Maybe Lotus will deliver state-of-the-art 3-D worksheet capabilities when the *next* version of *1-2-3*, the graphically oriented *1-2-3/G* for OS/2 with Presentation Manager, ships sometime next year.

HARD CHOICES

No program exists in a vacuum. We judge software by how it compares with other programs of the same type. And *1-2-3* 3.0 isn't so hot when you stack it up against the competition—including Lotus's own competition for 3.0.

Microsoft Excel, though in need of an upgrade (reportedly coming this fall), already delivers a richer set of tools, superior functionality and output, and the benefits of working in a graphical environment. *Excel*'s speed roughly matches *1-2-3* 3.0's, except for the time required to load the program and save files, where its *Windows* overhead drags *Excel* down.

Borland's new *Quattro Pro* 2.0, which should be shipping about the time you read this, offers some of *Excel*'s advantages. For example, it can have up to 32 files open at once in 3-D work, each file in its own window—in the character-oriented environment of plain-vanilla DOS. Navigation and linking are also easier than in *1-2-3* 3.0, and with comparable or better speed.

Finally, for many people both the hoary *1-2-3* 2.01 and Lotus's new Release 2.2 are better choices than Release 3.0. Certainly *1-2-3* 2.2 is a nice upgrade from 2.01, though it gives up a little in raw performance. Among other things, you forgo 3.0's 3-D features, enhanced database, and access to megamemory—2.2 allows just one worksheet of 256 columns by 8,192 rows in memory, while 3.0 can (theoretically) manage 256 worksheets at once, each of that size. But you get the smarter recalculation, search-and-replace, learn-mode macros, and much of the rest of *1-2-3* 3.0.

More importantly, you get the superior output of *Allways*, as well as access to the whole range of existing *1-2-3* add-ins.

Still, *1-2-3* 2.01 users have to ask how much those new features of 2.2 are worth. For many, doing nothing for now may be the right answer.

DIMINISHED EXPECTATIONS

What happened with *1-2-3* 3.0 is a window into the future of the PC software market. Because our first encounters with PCs brought revolutionary changes in how we work, many of us expect each new release of our favorite software to effect that same kind of leap, the kind of whack on the side of the head we got the first time we loaded *1-2-3* 1.0, or *dBASE II*, or even, God save me, *WordStar*.

But PC software has become an evolutionary, not revolutionary, business. In a world of incremental improvements, tensions between the vendor's ability to deliver steady improvements and our expectations of soaring innovation are inevitable.

Lotus 1-2-3, Release 3.0—and maybe, our expectations—is the first victim of that conflict. ■

Jim Seymour is a contributing editor of PC Magazine.

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the worksheets on-screen, it may look exactly the same as when you have multiple worksheets in the same file. In fact, it may use some of the same commands, and the feature may even allow the same maximum of 256 worksheets to reside in memory at once. But it's a completely different situation.

Release 3 provides a few aids to make linking easier. If you want to link a cell in one worksheet to a cell in another, you don't have to type the formula. You can move to the cell the formula will go in, type +, then use cursor movement keys to move to the worksheet and cell you want to link to. Hit Return, and Release 3 will enter the link formula—including drive, path, filename, and cell. If you want to, you can follow much the same strategy to define an @ function and range.

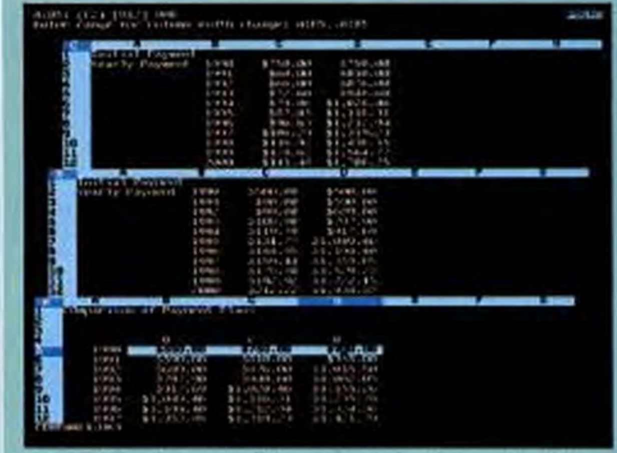
All this is straightforward. Indeed, it's a natural extension of the point-and-shoot strategy of 2.01. However, you can't do much more with multiple linked files. You can't copy data to more than one file at a time, because Release 3 won't let you define a multifile range. If you want 3-D features, you have to put all your worksheets in one file.

3-D WORKSHEETS

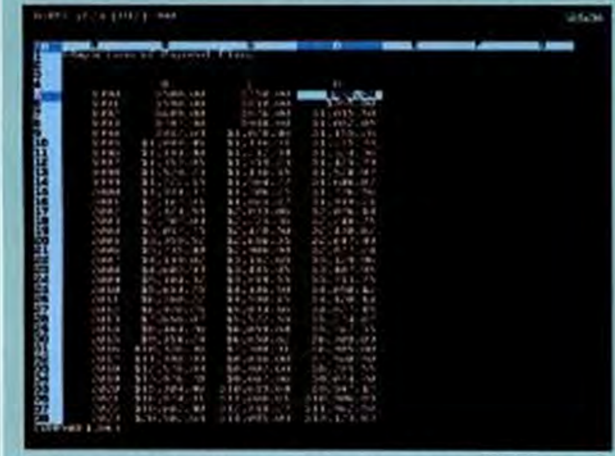
When you load Release 3, the screen is essentially the same as in 2.01 or 2.2, although the characters look different on a graphics monitor since they are created as bitmapped graphics. There are, however, two differences to spot on the screen: an A sits at the top-left corner of the worksheet, and the current cell indicator reads A:A1, rather than A1.

The first A indicates that you are on the first worksheet in the file. To create additional worksheets, you use the /Worksheet Insert Sheet command, designate whether

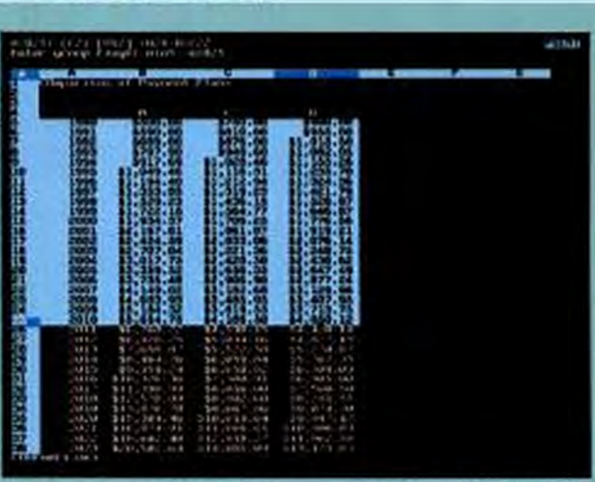
TAKING ADVANTAGE OF RELEASE 3's NEW FEATURES



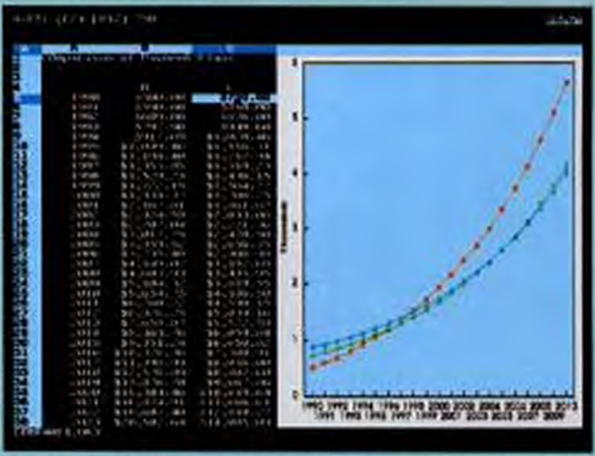
1. This 3-D model compares three schedules to determine when the most expensive initial payment schedule becomes the least expensive for out-of-pocket expenses. Sheet A is the consolidation sheet. Sheets B and C are two of the three payment schedules. Sheet D is not visible.



2. Here, we've cleared the three-window view in preparation for creating a graph of the payment schedule model. The cursor position tells Release 3 where to position the left edge of the graph.



3. Release 3's new /Graph Group command will let you define the x-axis and data ranges for a graph all in one step. Note that in all these screens, the display is set for EGA's 43-line mode so that as much data as possible can be displayed on the screen at one time.

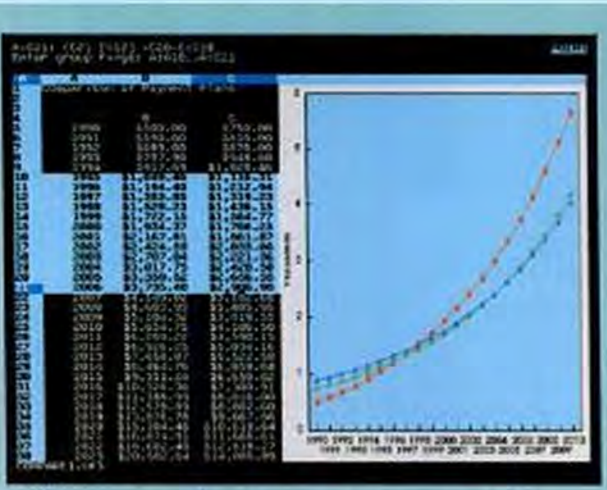


4. With the graph defined, issue the /Worksheet Window Graph command to show your graph with the worksheet. This graph is too small to show the points where the out-of-pocket costs become less expensive.

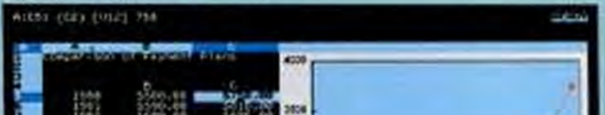
to insert before or after the current sheet, and enter the number of sheets to insert. If you want to see more than one worksheet, enter the /Worksheet Window Perspective command, and *1-2-3* will show you three worksheets on-screen.

Once you create the additional worksheets, you can treat them as simple extensions of the top worksheet. Suppose you want to see sales broken down by month, product, and region. Simply enter the products on Worksheet A in column A, the regions in row 1, and the appropriate formulas to total the figures. Then copy the entire range of entries to all the other worksheets in the stack so that you can enter one month's figures into each worksheet.

To copy, you use the /Copy command as usual. When *1-2-3* asks for the range to copy to, move to the upper-left-hand corner of the range you're copying from, tack down the cursor with a period, then move through the spreadsheets with Ctrl-PgUp or End Ctrl-PgUp to go to the last worksheet in the file. When you reach the last worksheet, tap Return, and *1-2-3* will copy the text and formulas. Note that this is a simple extension of the commands you al-



5. With the graph still showing on-screen, you can go back to the /Graph menus and redefine the graph; in this case the graph now shows a shorter period of time.



6. After you redefine the graph, Release 3 redraws it. Now you can see that the schedule that is least expensive to begin with becomes the most expensive one in 1998, while the schedule that is the most expensive at the start yields the lowest out-of-pocket costs starting in 2005.

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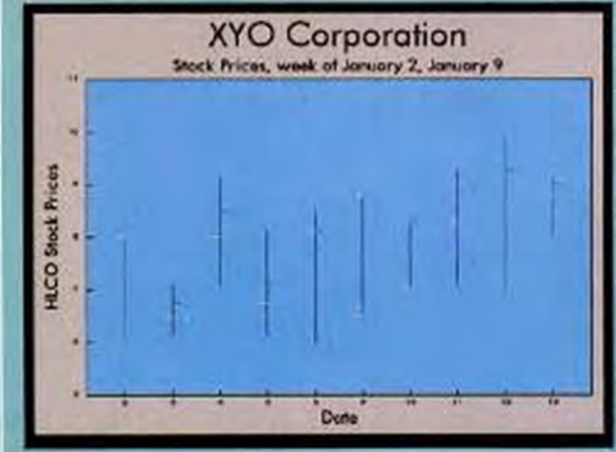
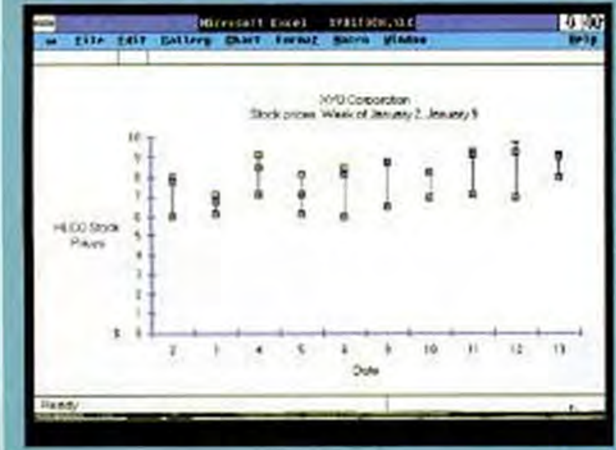
1-2-3 VS. TWO GRAPHING CHAMPIONS

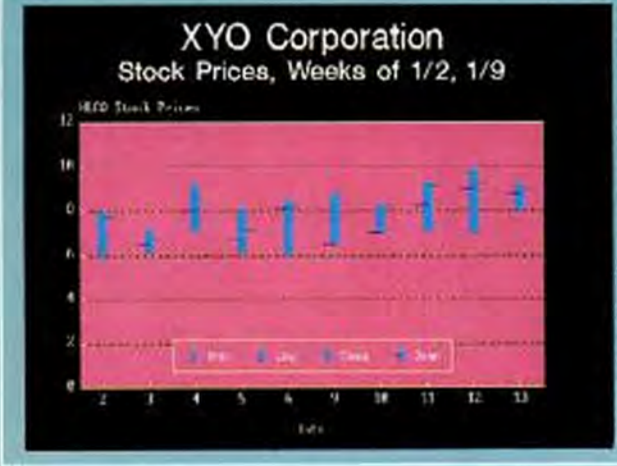
One of Release 3's best new features is its enhanced graphics. To demonstrate what's possible in Release 3.0 and what you'd get with the same data and design in *Microsoft Excel* and *Harvard Graphics*, we created imaginary stock prices for a two-week period for the bogus XYO Corp. Stock fluctuations were represented in high-low-close-open (HLCO) graphs.



Lotus 1-2-3 users can finally display high-low-close-open graphs in Release 3. (Users of *Lotus Signal*, the stock-quote-importation program, know that earlier versions of *1-2-3* and Release 2.2 do not allow this.) Note the color and font-sizing touches. This is the only HLCO design in *1-2-3*.



Microsoft Excel 2.10 uses a graph design similar to Lotus's to create HLCO graphs. The big difference is that with *Excel* you get many more customization features, including color, font, text, and pattern manipulation.



You can show HLCO numbers three ways with *Harvard Graphics*: as *error bars*, as bars with horizontal lines for open and close values, and as an *area chart*, with data displayed in a range. This graph uses the bar method. *Harvard Graphics* allows customization of the bars' sizes, orientation, and fills.

tures are just as straightforward.

One feature worth special mention is the /Worksheet Global Group command. With the Group feature turned on (as indicated by the word *GROUP* at the bottom of the screen), most changes you make to one worksheet in a file will apply to all of them. This includes changes in column width and insertions or deletions of rows and columns. The Group feature saves you from having to define a 3-D range for each command. If you need to format the sheets independently, you simply toggle the Group feature off.

GOOD-LOOKING GRAPHICS

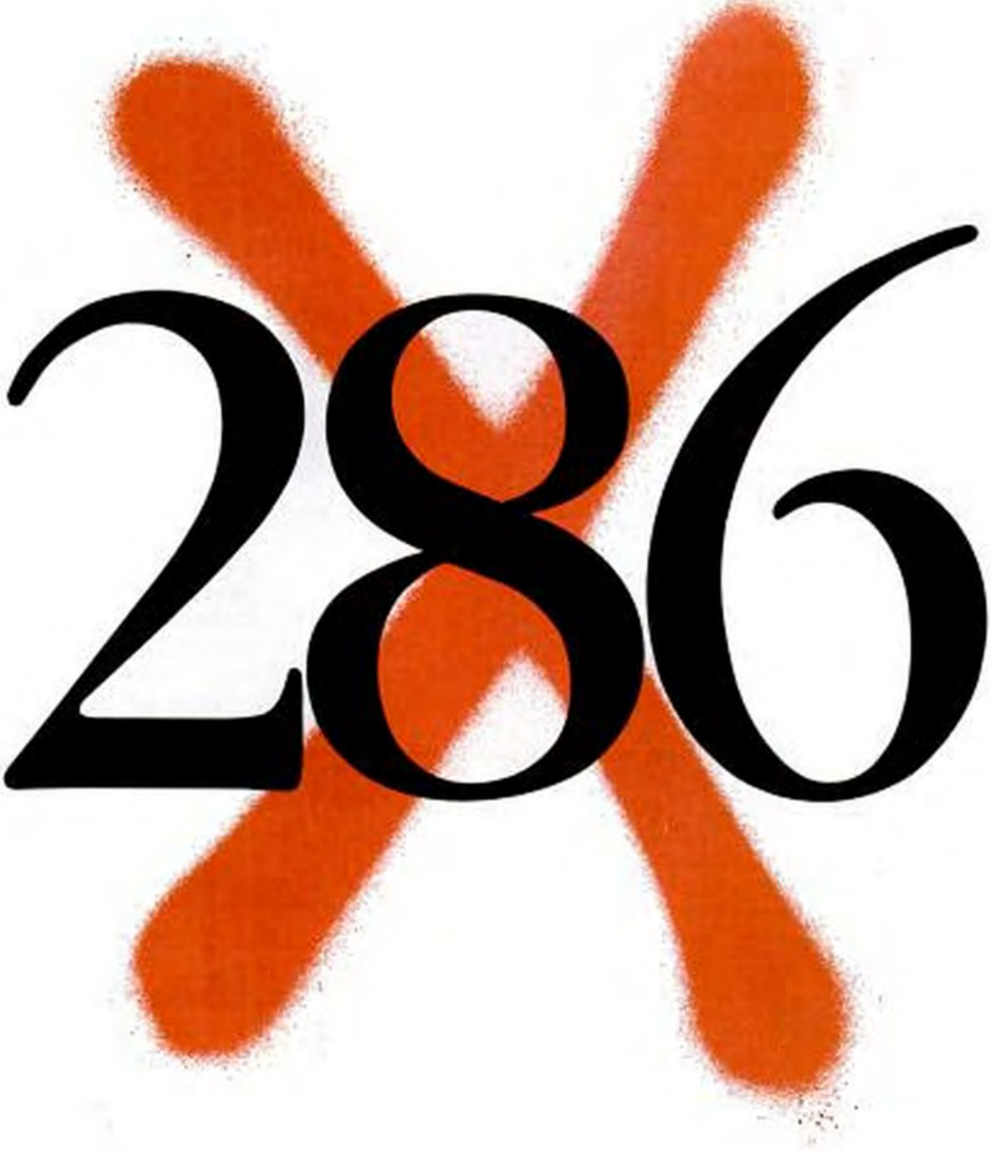
Complaints about *1-2-3*'s graphics probably began as soon as there was another program to compare it with. The good news is that Lotus has made real improvements in its graphics in both new releases.

Release 2.2 still has the familiar PrintGraph, but Release 3 has gotten rid of it. To print a graph in Release 3, you use /Print Printer Image to designate the graph, then print with the /Print Printer Go command. Choices for controlling color, font, cross-hatching, and other features are in the Graph menus, under /Graph Options Advanced. Other controls—for graph size, rotation, and density—are in the Print menu, under /Print Printer Options Advanced Image.

Release 2.2 has taken a step away from PrintGraph, thanks to the inclusion of *Allways*. To print a graph with *Allways*, you create a .PIC file, as you do with PrintGraph. You then go to *Allways* and use the /Graph Add command to choose the .PIC file and position the graph on the spreadsheet. Positioning the graph is much like creating a range, so you automatically control graph size and aspect ratio when you define the position. You can then designate a print range that either includes the graph or doesn't.

A nice touch with *Allways* is that you can print the spreadsheet and graph with one command. You can also attach several graphs to one spreadsheet and print them all on the same page. The only way to print graphs and text on the same page with Release 3 is to print the text first, then the graph, adjusting the size and position of the graph to fit on the page.

Mechanics of printing aside, both new releases offer improvements in the look of the graph. For example, instead of crowding the *x*-axis by keeping all the labels in one line, both 2.2 and 3 will automatically create two lines if needed and alternate the



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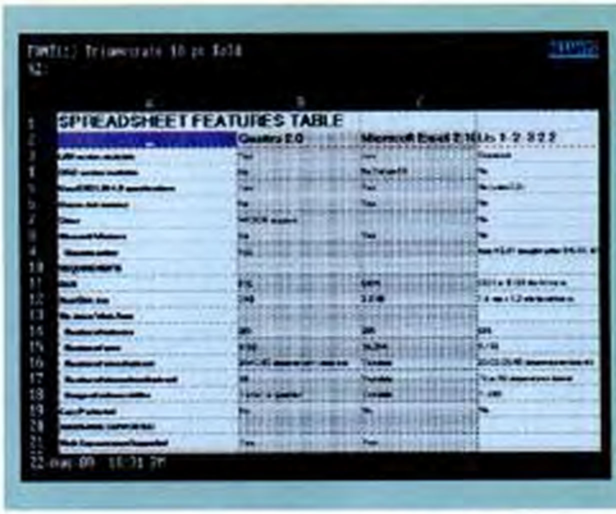
text between them (though 3 does a better job of this). Similarly, whereas 2.01 will crowd a bar graph by butting the left- and rightmost bars against the frame, 2.2 and 3 both leave space between the bars and the frame. The net result of these changes adds up to far-better-looking graphs, both on-screen and on paper.

Other graphics features in Release 3 include new graph types, such as hi-lo-close-open, area, and mixed. One last feature is the /Worksheet Window Graph command, which will show you a graph on-screen along with your worksheet. This lets you change numbers in the worksheet or adjust settings for the graph and watch the effect on the graph. The feature is just as impressive to watch in *1-2-3* as it is in *Excel*. You cannot see multiple worksheets and the graph at the same time, but you can page through your worksheets with the graph showing, and make any changes you like.



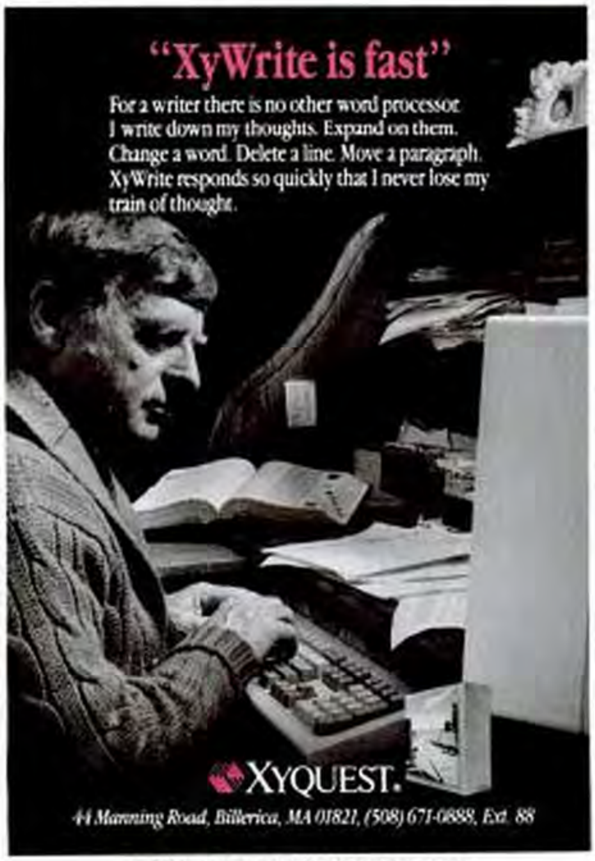
Allways provides a reasonably WYSIWYG environment to let you see what your output is going to look like. *Allways* can provide shading, a grid, and different-size fonts, producing output that is a match for any other spreadsheet program you've seen.

DATABASE FEATURES

Release 2.2 has no database features beyond what you find in 2.01, but Release 3's database features have been pumped up to the point where you'll want to take a close look—especially if you've decided that *1-2-3* is too weak to be taken seriously as a database program.

Among other new features is the ability to create queries that combine data from two or more tables. The mechanics are much like any other query, except that you first create a "join" formula that establishes an equivalence between the keys in two tables—for example, +ZIP=ZIPCODE, where ZIP and ZIPCODE are each in a different table. You then enter both table ranges in /Data Query Input by separating the ranges with commas. Release 3 combines data from both tables when you use the Extract command.

This join feature gives Release 3 some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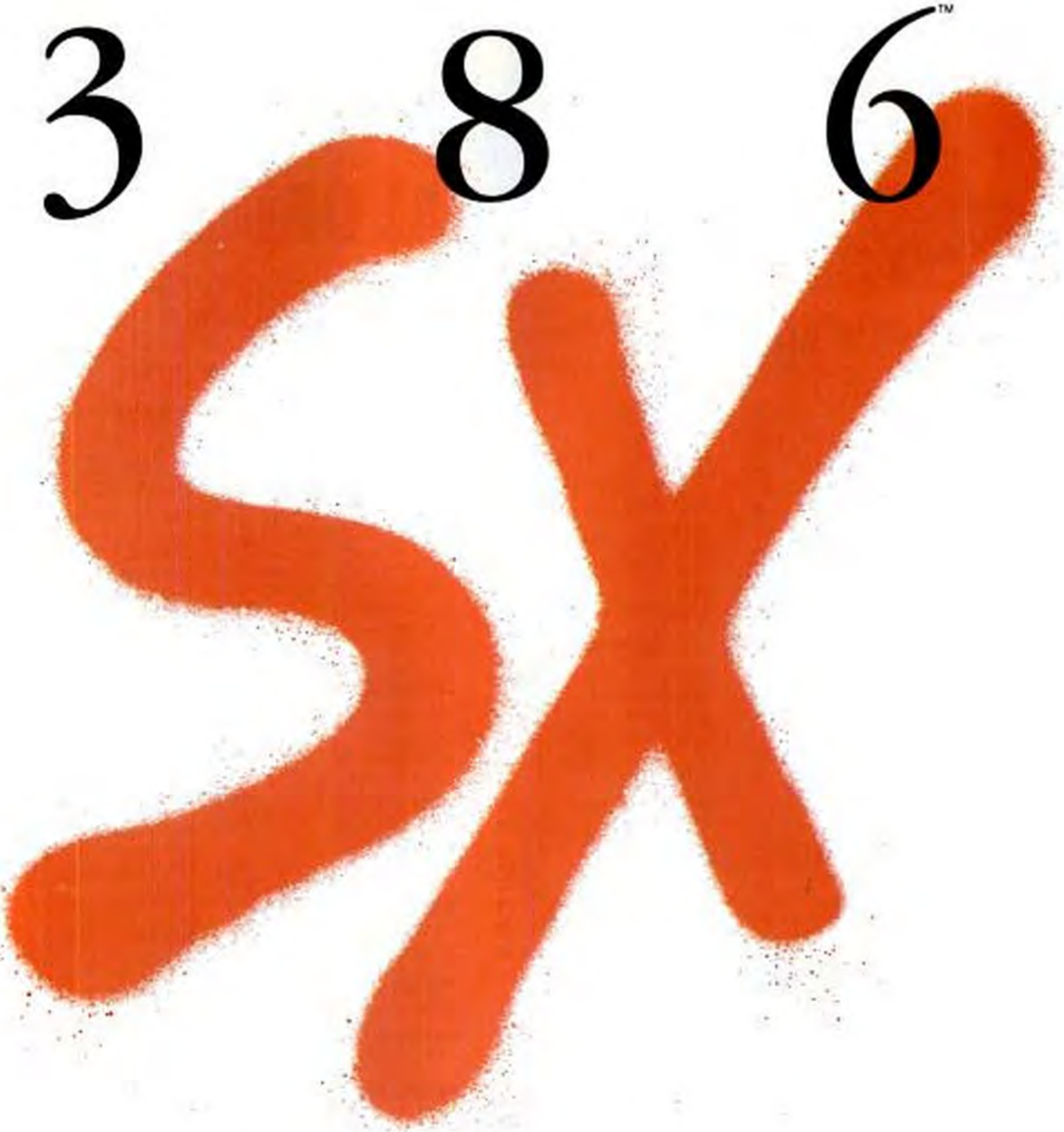

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A DIVISION OF AZ COMPUTER CORPORATION OF AMERICA 2727 W. GLENDALE AVE. PHOENIX, AZ 85051 noteworthy relational database capabilities, but even more interesting are the new Data External commands. Although poor instructions in the manual guarantee it will take you some time to figure out how all this works, once you do, you'll be able to retrieve data from external database files and write data to existing files or create new ones. As shipped, Release 3 comes with a driver for *dBASE III* and *dBASE III Plus* files. Other drivers will be coming shortly—though Lotus has not yet decided on the means of distribution.

Other new database features in Release 3 include the ability to sort on up to 255 keys and create calculated fields in the output range. There are also new macro commands that let you create data-entry forms.

If you've been using *1-2-3* as your database manager, you'll find that Release 3 will let you do a lot more. If you haven't been using the database functions, you'll find enough new features to make them worth trying now.

FINALLY, AN UNDO

One last notable new feature is Undo. In both releases, you can turn Undo on and off with /Worksheet Global Default Other Undo Enable or Disable. You undo a change with Alt-F4. However, there is an important difference between the two releases. Undo in 2.2 is a toggle, meaning you can undo an undo. Undo in Release 3 is not as versatile.

The difference makes the 2.2 version of Undo a little more forgiving than Release 3's. Both releases treat any series of commands between an initial slash and the return to ready mode as a single operation. This means, for example, that you can go to the /Data menu, set up a query complete with ranges for input, criteria, and output, extract some data, escape back to Ready mode, hit Undo, and wipe out your range settings when all you really wanted to do was to undo the extraction. In 2.2, you can salvage your work by hitting Alt-F4 again, to undo the undo. In Release 3, you can't.

Release 3 tries to save you from this sort of mistake by asking you to confirm the undo before it actually proceeds.

Fortunately, even though you can't use Undo to toggle back to the previous state, Release 3 has a feature that can give you much the same effect—at least in some circumstances. Curiously, the manual doesn't mention it when discussing the Undo feature, but Release 3 includes a memory buffer that will automatically record your keystrokes at all times. In fact,

THE NEW LOTUS 1-2-3s: SUMMARY OF FEATURES

	Lotus 1-2-3, Release 2.2	Lotus 1-2-3, Release 3.0	Microsoft Excel, Version 2.10	Quattro Pro
GENERAL FEATURES	$495	$495	$495	$495
LAN version available	■	■	■	■
OS/2 version available	☐	■	■	☐
Uses LIM EMS 4.0	☐	■	■	■
Uses extended memory	☐	■	■	☐
Maximum number of columns	256	256	256	256
Maximum number of rows	8,192	8,192	16,384	8,192
Usual number of rows displayed	20	20	Variable	20
Number of characters displayed	82	82	Variable	80
Maximum column width (characters)	240	240	Variable	Unlimited
Supports 8087 coprocessor	■	☐	■	■
Supports 80287 coprocessor	■	■	■	■
Supports 80387 coprocessor	■	■	■	■
Supports mouse	☐	☐	■	■
Includes mouse drivers	☐	☐	■	☐
Supports full-page monitors	☐	☐	■	☐
Auto-sensing (detects systems, printers, and so on)	☐	■ (graphics display only)	■	■
FILE FORMATS IMPORTED/EXPORTED				
.DBF	■	■	■	■
.DIF	■	■	■	■
Multiplan	■	■	■	■
.PRN	■	■	■	■
Symphony	■	■	■	■
.TXT	■	■	■	■
VisiCalc	■	☐	■	☐
.WKS	■	■	■	■
.WK1	■	■	■	■
GENERAL FEATURES				
Undelete	■	■	■	■
Pointing for copying and moving	■	■	■	■
Row hiding	☐	☐	■	■
Column hiding	■	■	■	■
Cell hiding	■	■	■	■
Vertical titles	■	■	■	■
Horizontal titles	■	■	■	■
Numbers formatted as labels	■	■	■	■
High-order ASCII characters (128–255) displayed	■	■	☐	■
Extract function (saves partial spreadsheet)	■	■	■	■
Warning against file overwrite	■	■	■	■
Automatic backup (.BAK files)	■	■	☐	☐
User-customizable backup interval	☐	☐	■	☐
Auto-save can be disabled	☐	☐	■	☐
User-customizable file extensions	■	■	■	■
Nonalphanumeric symbols in filenames	■	■	■	■

■—Yes ☐—No

	Lotus 1-2-3, Release 2.2	Lotus 1-2-3, Release 3.0	Microsoft Excel, Version 2.10	Quattro Pro
Formulas displayed in worksheets	■	■	■	☐
Cut-and-paste	☐	☐	■	■
Programmable hotkeys for shortcuts	☐	☐	■	■
Protect capability				
Rows	☐	☐	■	■
Columns	☐	☐	■	■
Cells	■	■	■	■
Macros	☐	☐	■	■
Formulas	☐	☐	■	■
MENUS				
Custom menus	■	■	■	■
Menus accessible via macros	■	■	■	■
Lotus-style slash and tree menus	■	■	☐	■
Pull-down menus	☐	☐	☐	■
First-letter-sensitive menus	■	■	■	■
ON-SCREEN DISPLAYS				
CapsLock toggle indicator	■	■	■	■
ScrollLock toggle indicator	■	■	■	■
NumLock toggle indicator	■	■	■	■
Insert/overstrike toggle indicator	■	■	■	■
Other	Undo	Group, zoom	None	None
Constant display of date	Optional	Optional	☐	■
Constant display of time	Optional	Optional	☐	■
User can set screen colors	☐	☐	■	■
Maximum number of splits on one screen	2	2	14	64
User can format split screens independently	☐	☐	■	☐
User can scroll screens independently	■	■	■	■
RECALCULATION				
Row	■	■	☐	■
Column	■	■	☐	■
Natural	■	■	■	■
Logical	☐	☐	☐	■
Manual	■	■	■	■
Automatic	■	■	■	■
Background	☐	■	■	■
Intelligent	■	■	■	■
FUNCTIONS/OPERATIONS				
Math (including trigonometry)	17	17	22	19
Logic	9	8	6	8
Date and time	11	13	12	12
Statistics	7	10	14	10
Number of logical and arithmetic operators	17	17	5	20

CONTINUES

you can't even turn the buffer off.

If you accidentally undo more than you meant to in Release 3, you can often recover your work by entering Alt-F2 to bring up the Record menu and picking Playback.

Playback is just what it sounds like—it plays back your keystrokes so you don't have to type them again. Even better, it lets you edit the buffer and select which keystrokes to play back. It's meant as a kind of ad hoc macro feature. But if you undo more than you meant to, you can use Playback to reenter your keystrokes. What's more, you can edit the buffer to correct whatever mistake you were trying to undo in the first place.

One extra that goes with the Undo toggle in 2.2 is that it also extends the spreadsheet's natural what-if capability. You can enter a change in your worksheet, undo it, and then toggle back and forth between the two states, without having to reenter any numbers. Similarly, you can load a second worksheet and use Undo to toggle back and forth between the two worksheets to compare them. This is no match for the 256 worksheets you can have in memory in Release 3, but it's still a nice touch.

BUT WAIT, THERE'S MORE

Releases 2.2 and 3.0 offer a laundry list of other new features. Both new versions know about networks and both provide controls—called reservations—that keep two users from changing the same file at the same time so that one user doesn't overwrite the changes made by the other. In addition, Lotus has announced network server versions for both releases; they should be available this fall. Prices for the network version of Release 3 are $695 for the server and $395 for a node license; Release 2.2's prices are $100 less.

There are also any number of small changes in both releases that add extra polish here and there. Both versions have screen drivers that will let you take advantage of options such as the 43-line mode of an EGA adapter. Release 3 will even let you install for two modes—25 lines and 43 lines on an EGA—and switch modes from within the program.

Other small but time-saving changes in both programs include the ability to define all the data ranges for a graph with one /Graph Group command and the ability to set the width of any number of adjacent columns with one /Worksheet Column Column-range command. Still more important is a Learn mode for macros in both versions. As with the Undo feature, Learn

THE NEW LOTUS 1-2-3s: SUMMARY OF FEATURES

	Lotus 1-2-3, Release 2.2	Lotus 1-2-3, Release 3.0	Microsoft Excel, Version 2.10	Quattro Pro
MACROS				
Auto-load macros	■	■	■	■
Learn mode for macros	■	■	■	■
Macro libraries provided by vendor	❏	❏	■	■
User-written macros can reside in worksheet or library	■	■	■	■
Macro menu	■	■	■	■
Macro branching	■	■	■	■
Looping macros	■	■	■	■
Conditional goto's	■	■	■	■
Imports working Lotus 1-2-3 macros	■	■	■	■
Imports other macros	❏	❏	❏	❏
DATABASE FEATURES				
Database can be larger than spreadsheet	❏	■	■	■
Database resides partly on-disk	❏	Optionally	■	■
Number of simultaneous sort keys	2	255	3	5
Data record search by arithmetic criteria	■	■	■	■
Data record search by logical criteria	■	■	■	■
Database entry screen	❏	■	■	■
Multidimensional database	❏	■	❏	❏
Maximum number of levels	N/A	256	N/A	N/A
3-D SPREADSHEETS				
3-D spreadsheet linking	❏	■	■	■
Number of levels	N/A	256	Unlimited	64
GRAPHS				
Graph types available	Bar, line, pie, stacked-bar, *x,y*	Area, bar, HLCO, line, pie, stacked-bar, *x,y*	Area, bar, column, HLCO, line, pie, scatter, combination	Area, bar, column, HLCO, line, pie, rotated-bar, stacked-bar, text-only

■—Yes ❏—No N/A—Not applicable: product does not have this feature.

works differently in the two releases, but it serves the same purpose.

If you use macros often, you'll also appreciate the ability to create macro libraries; this lets you use the macros in more than one worksheet without having to reenter them in each one. Release 3 lets you put macros in their own file that you can load with any other file. Release 2.2 provides a macro library manager as a bundled add-in. Both programs break the 26-macro barrier by letting you assign a macro name of up to 15 characters; you can also assign up to 26 macros to Alt keys.

A particularly welcome change in Release 3 is that when you clear an error message, the program no longer dumps you back to Ready mode, forcing you to retype an entire command. Release 2.2 still has this annoyance.

Given all the new features, the Lotus menu structure is getting awfully old and creaky. There are now so many choices in so many different menu branches that it's hard to keep track of them all—particularly in Release 3, which has well over 200 new entries on its menus. In addition, too many menu choices use the same word to

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	Lotus 1-2-3, Release 2.2	Lotus 1-2-3, Release 3	Microsoft Excel, Version 2.10	Quattro Pro
PRINTING FEATURES				
Controls color on-screen as well as in printing	■	■	■	■
Sizes fonts on-screen as well as in printing	■	■	■	■
Shows font styles on-screen as well as in printing	■	■	■	■
User can print directly from screen	☐	■	■	■
Landscape printing	■ (with *Allways*)	■	■	■
Box and shade output	■ (with *Allways*)	☐	■	■
Multifont output	■ (with *Allways*)	☐	■	■
PostScript printing	■ (with *Allways*)	■	■	■
Maximum characters in setup string	39	512	Unlimited	40
Number of printers supported	84 (70 with *Allways*)	38	136	130
Customizable print drivers	☐	☐	■	☐
HELP AND DOCUMENTATION				
Context-sensitive on-line help	■	■	■	■
Troubleshooting guide	■	■	■	■
Quick-start booklet	■	■	■	■
Keyboard template	■	■	■	■
Reference card	■	■	■	■
Toll-free telephone support	■	■	☐	☐
Tutorial program	☐	☐	■	■
Command table	■	■	■	■
THIRD-PARTY SOFTWARE				
SideKick	■	■	☐	■
Sideways	■	☐	■ (built-in)	■ (built-in)
SQZ	■	☐	☐	■

ENDS

mean different things at different places in the menus. The setting sheets in 2.2 are a step in the right direction, but the menu structure really needs to be revamped.

FIRST-CLASS SUPPORT

Lotus should be congratulated for starting up the Lotus PROMPT HotLine, a 24-hour, seven-day, toll-free support number. I tried the hotline at various hours; not surprisingly, it tended to be busiest during business hours. But being able to call and get help at 3 p.m. on a Saturday afternoon is a feature that would be nice to see become an industry standard. Both releases come with an initial six months of free hot-line support.

If you're a *DeskMate* user, you should know that in August, Lotus made another move to increase market share by announcing, with Tandy, the *Lotus Spreadsheet for DeskMate*. Based on the technology of *1-2-3* 2.01, it makes use of the graphical user interface of Tandy's *DeskMate* environment. The program's feature set offers most of *1-2-3*'s functionality, but does not support macros, add-ins, or expanded memory. Worksheet files are

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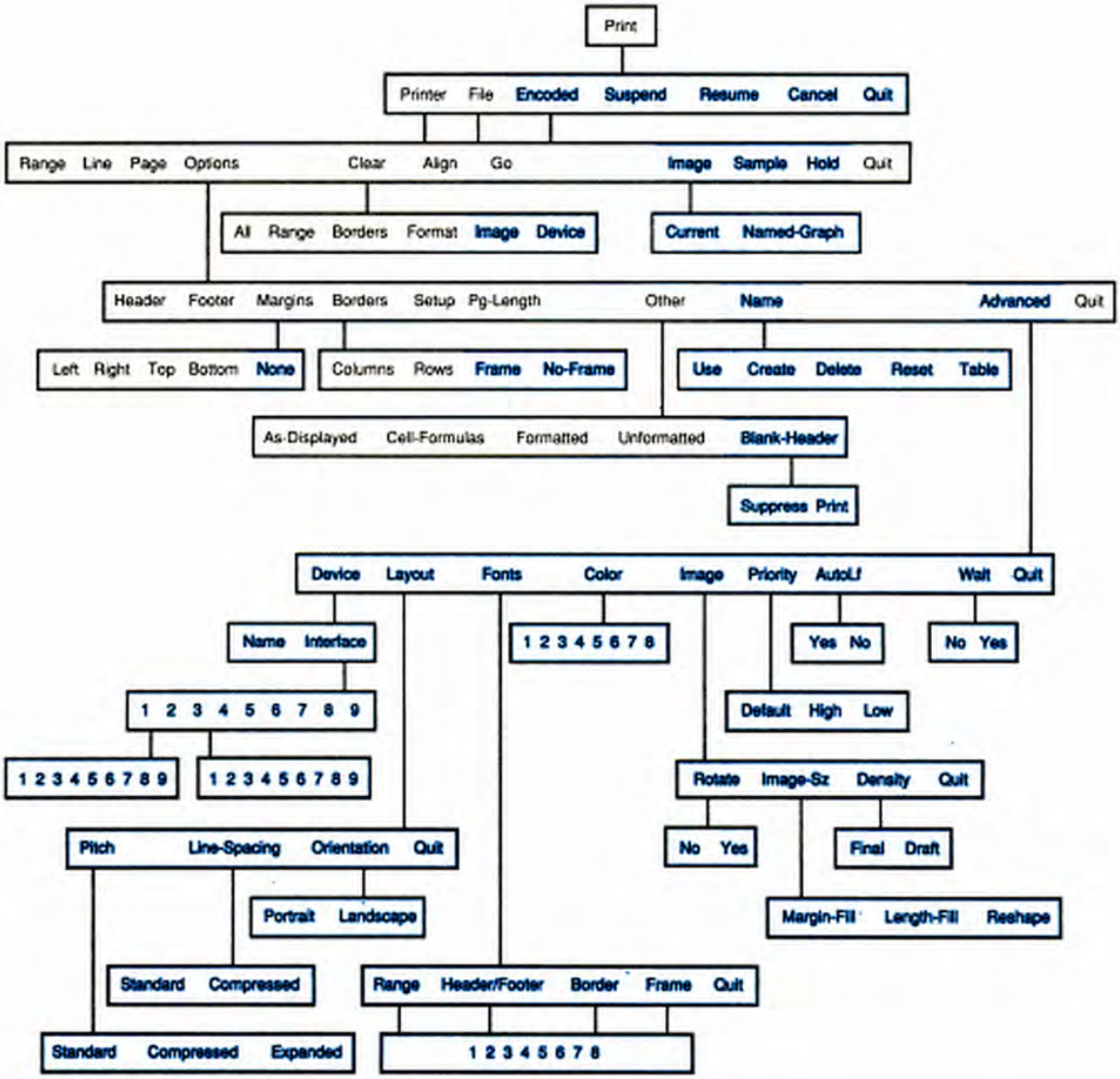
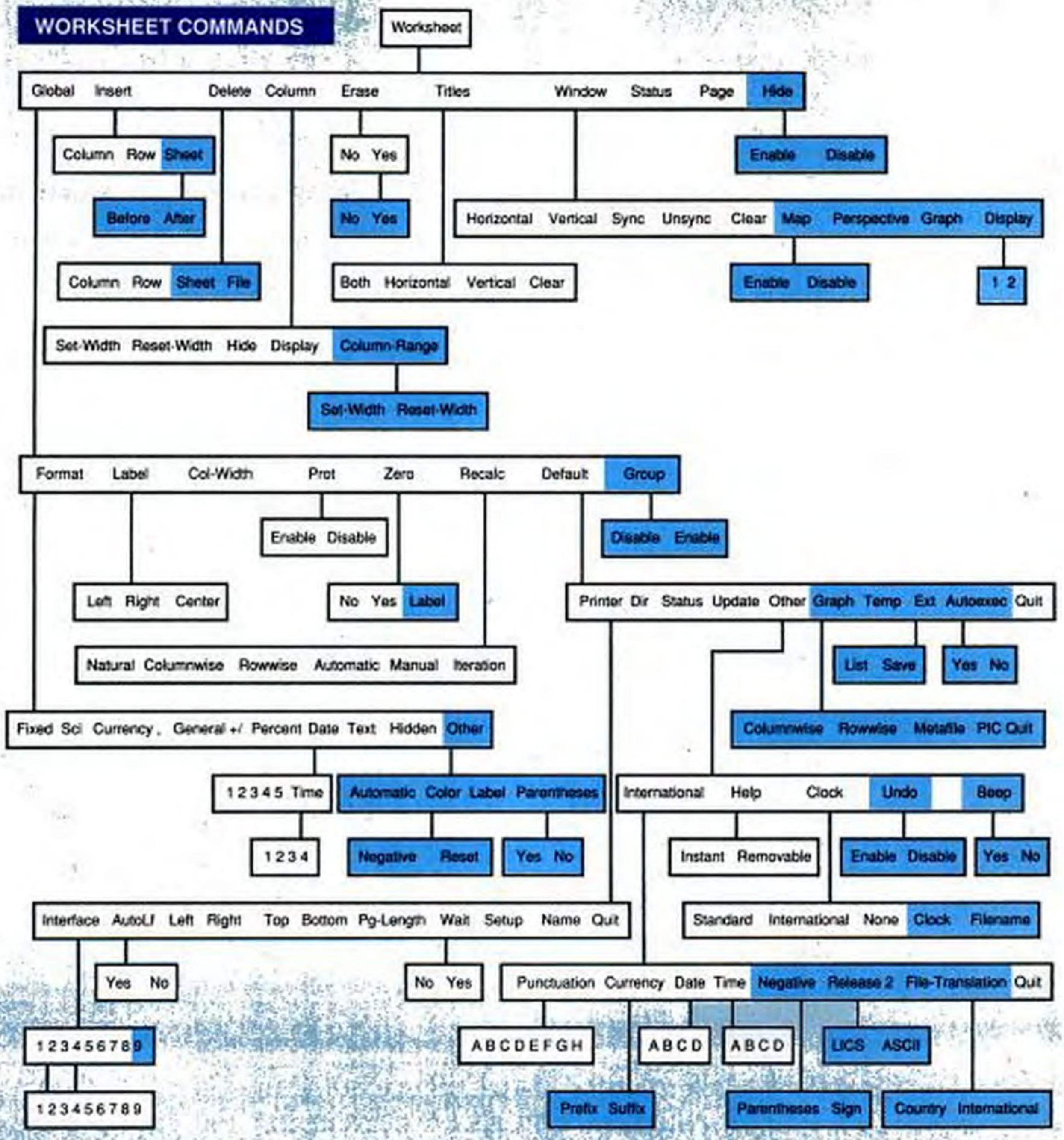
WHERE TO FIND RELEASE 3'S NEW FEATURES

Many new features of *Lotus 1-2-3,* Release 3, are located under the Worksheet and Print headings of the main menu. You'll find the new multiple-spreadsheet commands under Worksheet, and the Print menu offers the package's improved output design.

These menu trees show all of the commands under the Worksheet and Print headings. Commands new to Release 3 are highlighted.

PRINT COMMANDS

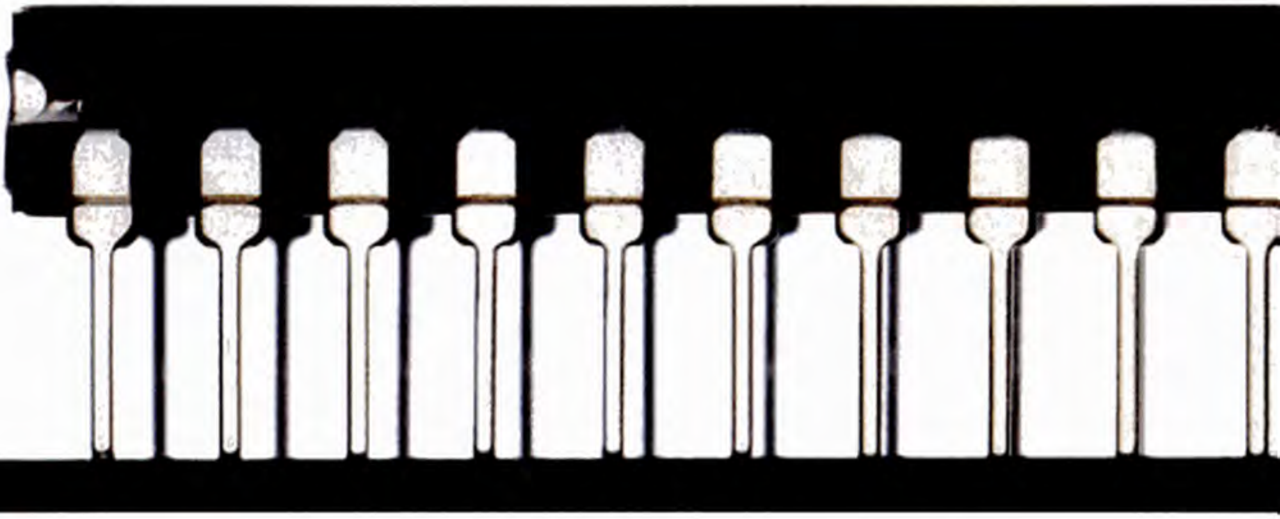

Print
Printer File Encoded Suspend Resume Cancel Quit
Range Line Page Options Clear Align Go Image Sample Hold Quit
All Range Borders Format Image Device
Current Named-Graph
Header Footer Margins Borders Setup Pg-Length Other Name Advanced Quit
Left Right Top Bottom None
Columns Rows Frame No-Frame
Use Create Delete Reset Table
As-Displayed Cell-Formulas Formatted Unformatted Blank-Header
Suppress Print
Device Layout Fonts Color Image Priority AutoLf Wait Quit
Name Interface
1 2 3 4 5 6 7 8
Yes No
No Yes
1 2 3 4 5 6 7 8 9
Default High Low
1 2 3 4 5 6 7 8 9
1 2 3 4 5 6 7 8 9
Rotate Image-Sz Density Quit
Pitch Line-Spacing Orientation Quit
No Yes
Final Draft
Portrait Landscape
Margin-Fill Length-Fill Reshape
Standard Compressed
Range Header/Footer Border Frame Quit
Standard Compressed Expanded
1 2 3 4 5 6 7 8



WORKSHEET COMMANDS

Worksheet
Global Insert Delete Column Erase Titles Window Status Page Hide
Column Row Sheet
Before After
Column Row Sheet File
No Yes
No Yes
Both Horizontal Vertical Clear
Enable Disable
Horizontal Vertical Sync Unsync Clear Map Perspective Graph Display
Enable Disable
1 2
Set-Width Reset-Width Hide Display Column-Range
Set-Width Reset-Width
Format Label Col-Width Prot Zero Recalc Default Group
Enable Disable
Disable Enable
Left Right Center
No Yes Label
Printer Dir Status Update Other Graph Temp Ext Autoexec Quit
Natural Columnwise Rowwise Automatic Manual Iteration
List Save
Yes No
Columnwise Rowwise Metafile PIC Quit
Fixed Sci Currency , General +/- Percent Date Text Hidden Other
1 2 3 4 5 Time
Automatic Color Label Parentheses
1 2 3 4
Negative Reset
Yes No
International Help Clock Undo Beep
Instant Removable
Enable Disable
Yes No
Standard International None Clock Filename
Interface AutoLf Left Right Top Bottom Pg-Length Wait Setup Name Quit
Yes No
No Yes
Punctuation Currency Date Time Negative Release 2 File-Translation Quit
1 2 3 4 5 6 7 8 9
1 2 3 4 5 6 7 8 9
A B C D E F G H
A B C D
A B C D
LICS ASCII
Prefix Suffix
Parentheses Sign
Country International

WE HAVE WAYS TO MAKE YOU SCREAM.



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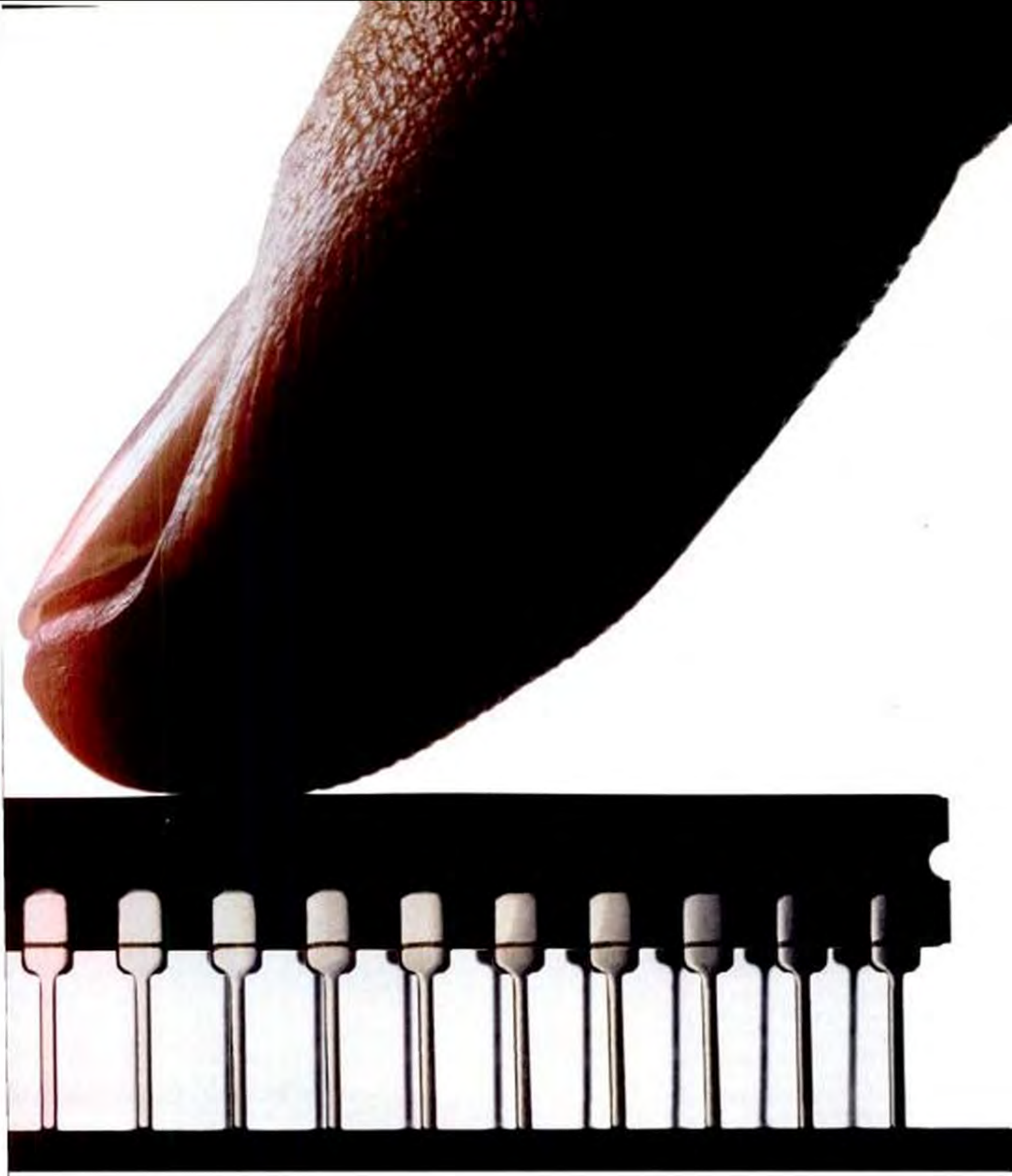

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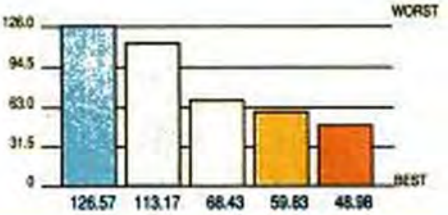
PC LABS PERFORMANCE TESTS: THE NEW LOTUS 1-2-3s

***Lotus 1-2-3,* Release 2.2, is slower than the Release 2.01 package you're probably using today. *Lotus 1-2-3,* Release 3, is slower still. That's the price you pay for the two upgrades' impressive array of new features.**

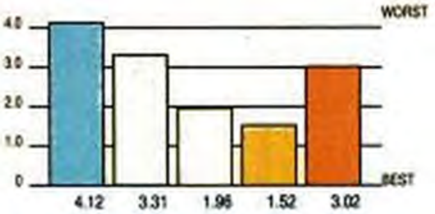
Mathematical Worksheet Recalculation — Elapsed Time (seconds)

Mathematical Worksheet Recalculation reports the time taken to calculate a *Lotus 1-2-3* 2.01 worksheet with 1,950 mathematical functions and 494 text cells. Lower times indicate more-efficient implementation of standard spreadsheet functions.



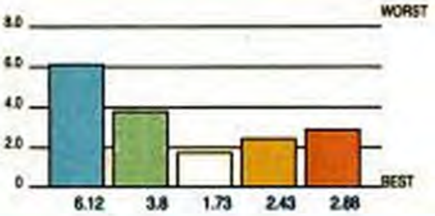
Loan Recalculation — Elapsed Time (seconds)

The **Loan Recalculation** test worksheet calculates the monthly payment and displays the amortization schedule for a ten-year mortgage based on any given loan principal. This test is a typical spreadsheet application.



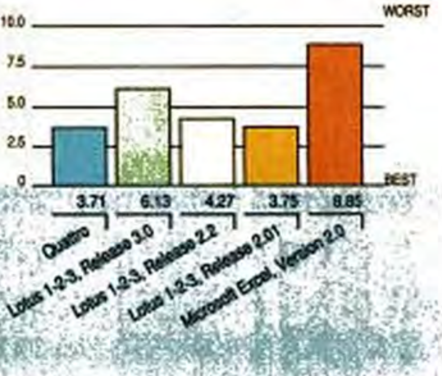
Internal Rate of Return Recalculation — Elapsed Time (seconds)

Internal Rate of Return Recalculation tests the Net Present Value and Internal Rate of Return functions. These computation-intensive formulas indicate the efficiency of a program's calculation and Internal Rate of Return algorithms.

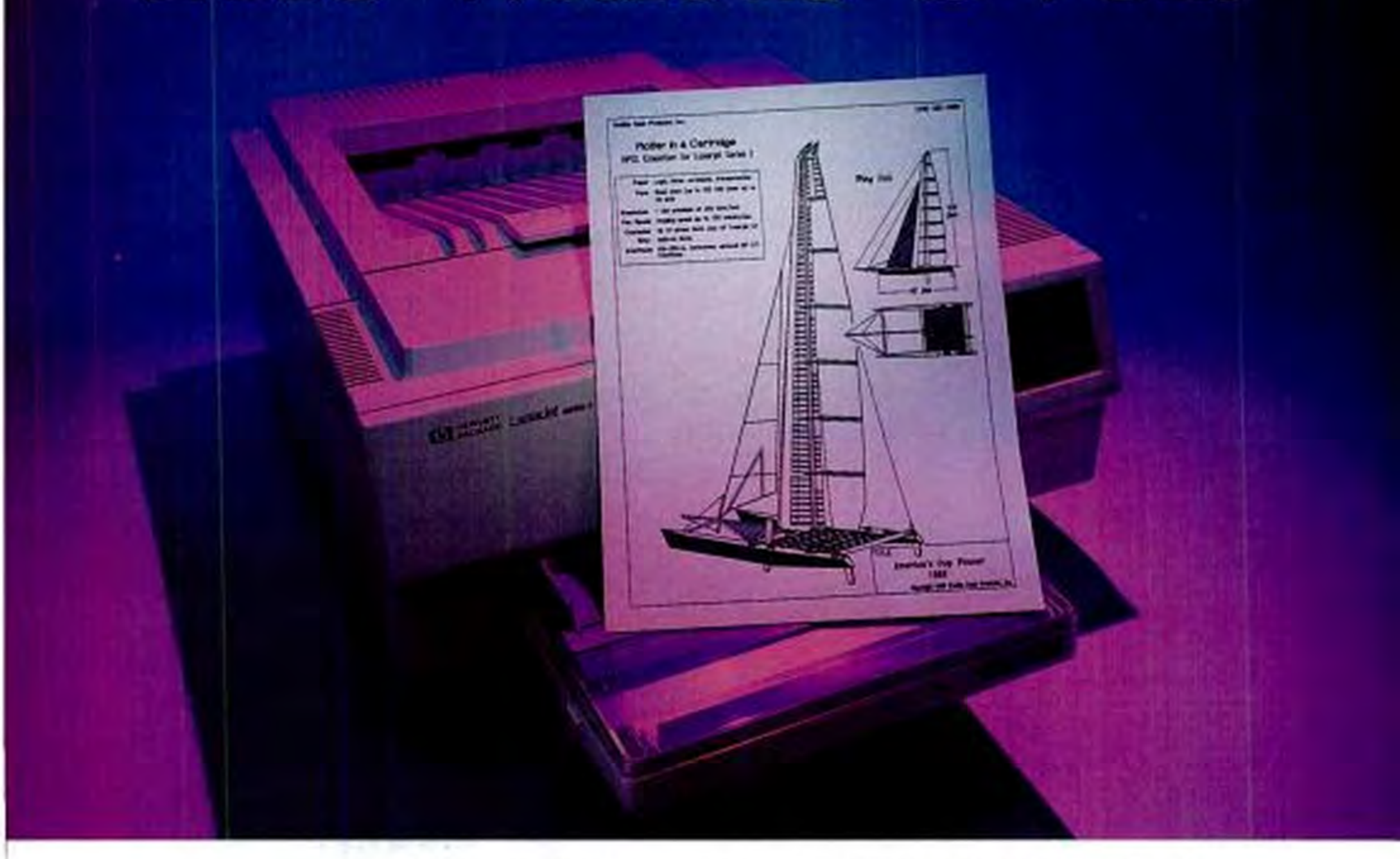


Save to Disk — Elapsed Time (seconds)

The **Save to Disk** test measures how long it takes the spreadsheet program to save the Mathematical Worksheet Recalculation test file to disk, using the product's native file format.



The Wait is Over.



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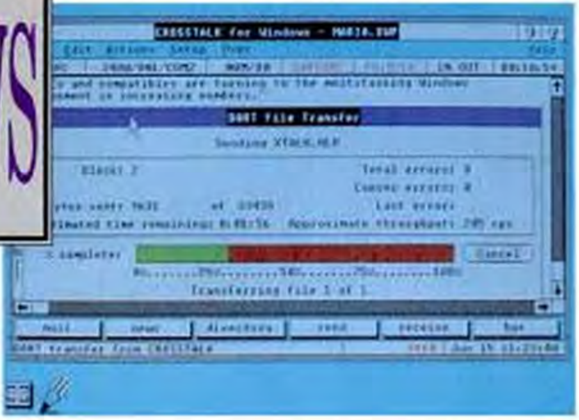

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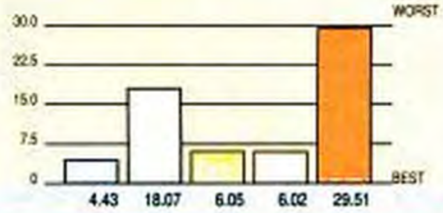
CIRCLE 278 ON READER SERVICE CARD

PERFORMANCE TESTS: THE NEW LOTUS 1-2-3s

Load from Disk

Elapsed Time (seconds)

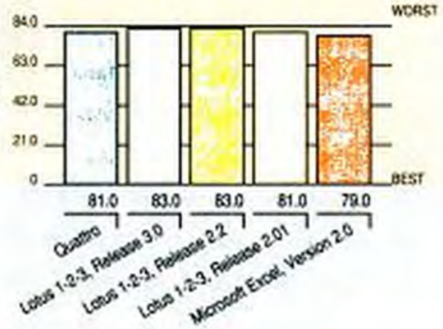
The **Load from Disk** test measures how long it takes the spreadsheet program to read the Mathematical Worksheet Recalculation test file from disk, using the product's native file format.



Disk Space

File Size (kilobytes)

Disk Space reports the size of the Mathematical Worksheet Recalculation file when the spreadsheet program saves it to disk in the program's native file format. A smaller number here is better, leaving room for more or bigger files on the same disk.



PERFORMANCE TESTS: COMPOSITE VIEW

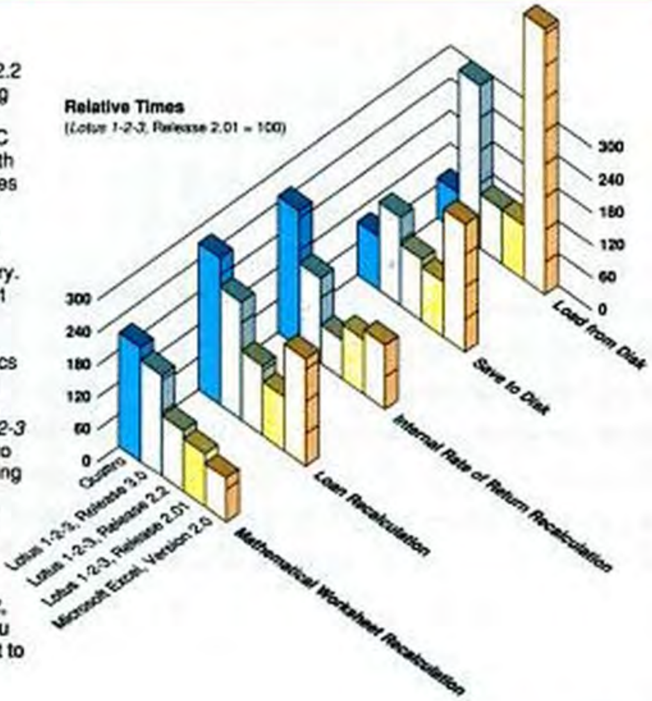
Will you sacrifice speed if you upgrade to *Lotus 1-2-3*, Release 2.2 or Release 3.0? The answer depends on what you've been using thus far.

PC Labs tested *Lotus 1-2-3* 2.2 and 3.0 on an 8-MHz IBM PC AT running DOS 3.3 and equipped with a 30MB hard disk, a math coprocessor, and 1MB of extended memory (Release 3.0 requires at least 384K extended memory). The results were compared against the performance of *Lotus 1-2-3* 2.01, Borland's *Quattro*, and *Microsoft Excel*, all of which we had previously tested (*PC Magazine*, November 15, 1988) using 640K conventional memory.

These packages offer various kinds of automatic or intelligent recalculation features. We restricted our tests to manual recalculation. You'll certainly see slower recalculations with Release 3.0 than with 2.01 or 2.2, but *Quattro* is slower on recalcs than any other package tested. *Excel* is fastest on straight math calculations, coming in third on the other two recalculation tests.

When you're saving to disk, you may notice a lag in *Lotus 1-2-3* 3.0 compared with 2.01 and 2.2, but you'll take even more time to save *Excel* files. Likewise, *Excel* trailed behind all others in loading from disk (we used a Lotus .WK1 file in testing, so *Excel*'s overhead shows up here). *Quattro* is fastest both in saving and in loading a file from disk. Among the three versions of *Lotus 1-2-3*, 2.01 remains the fastest at loading a file, performing significantly better than Release 3.0.

The moral is: If you're going to upgrade to Release 3.0 or 2.2, do it for the new features, not for any speed improvements. If you do a lot of recalculations, don't do them manually, and do expect to see some sluggishness.

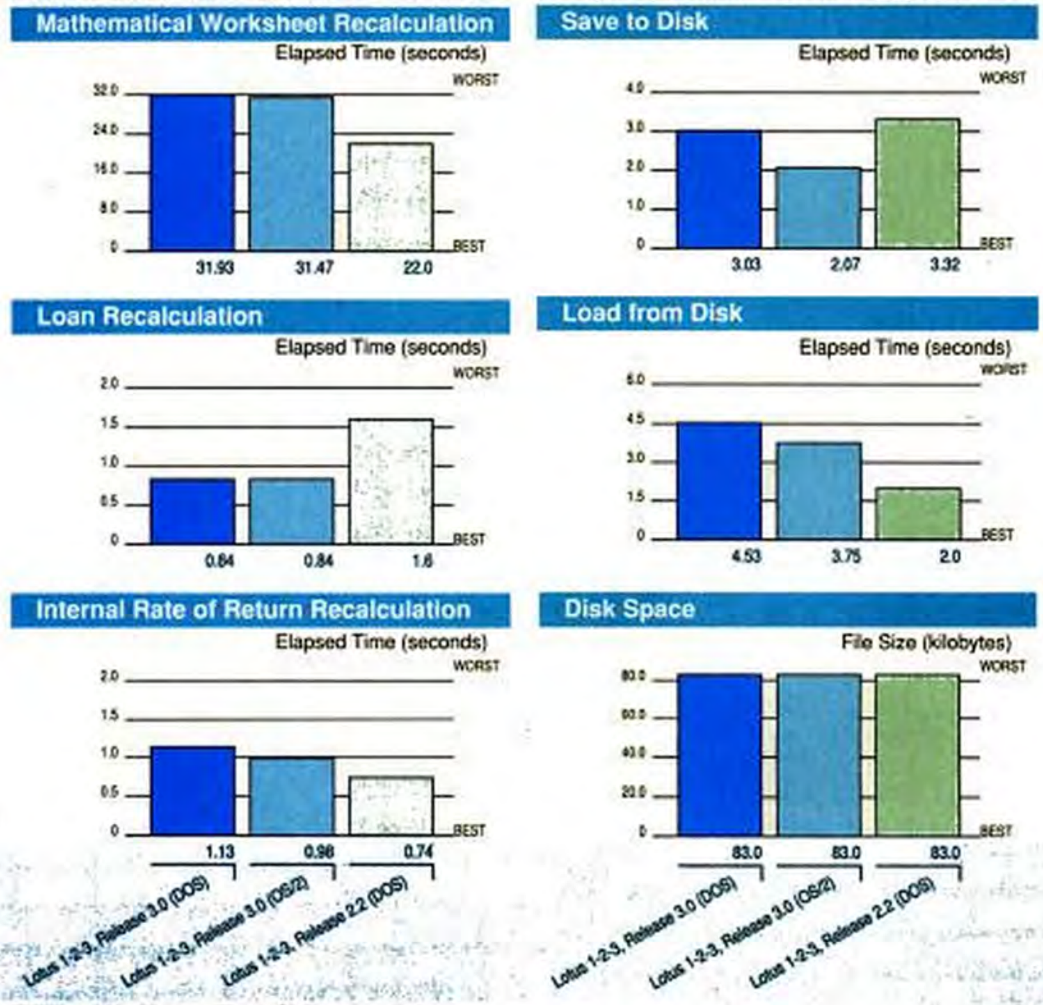


CONTINUES

PERFORMANCE TESTS: THE NEW LOTUS 1-2-3s ON A COMPAQ DESKPRO 386/25

Most users of Release 3.0 won't be satisfied running it on slow hardware, which might explain why Lotus has publicized high-end hardware requirements. With this in mind, PC Labs retested Release 3.0, along with Release 2.2, on a Compaq Deskpro 386/25 under DOS. We also tested Release 3.0 under OS/2.

These tests confirmed two important points: Release 3.0 does run under OS/2, and indeed you will see much faster processing on a 386. Just be sure that your 386 has a large enough hard disk if you're using OS/2; we needed almost twice the space that we needed when running under DOS.



saved in .WK1 format. *Lotus Spreadsheet for DeskMate*, which will have a list price of $219.95, is due to ship sometime before the end of the year.

When it comes to 2.2 and Release 3, Lotus's upgrade policies are extremely reasonable. If you bought 2.01 on or after September 6, 1988, upgrading to either 2.2 or 3 is free until the end of 1989. After that, the upgrade price will be $150. If you bought a version of *1-2-3* previous to the September date, the upgrade to either 2.2 or 3 is $150. If you bought *Allways* separately, the upgrade to 2.2 is $90.

All in all, the upgrade is worth the price. The question is which one to buy. If you don't have the hardware to run Release 3, the choice is easy: 2.2. If you have the hardware already and you want OS/2 capability, go with Release 3. Short of these factors, you may have a problem deciding.

Ultimately, as Lotus points out, the two releases are built around different design philosophies. Release 2.2 is about speed and small size and being able to run on an 8088. Release 3 is about power, features, taking full advantage of your hardware, and being able to run on different hardware platforms (eventually). Either way, the revisions are welcome and overdue. The people at Lotus know better than anyone else that options in the spreadsheet marketplace have never been better. The two new releases of *1-2-3* represent Lotus's attempt to keep its 5 million users loyal, and it's likely that because of the easy, inexpensive upgrade path, a majority of them will remain Lotus loyalists. ■

M. David Stone is a contributing editor of PC Magazine.

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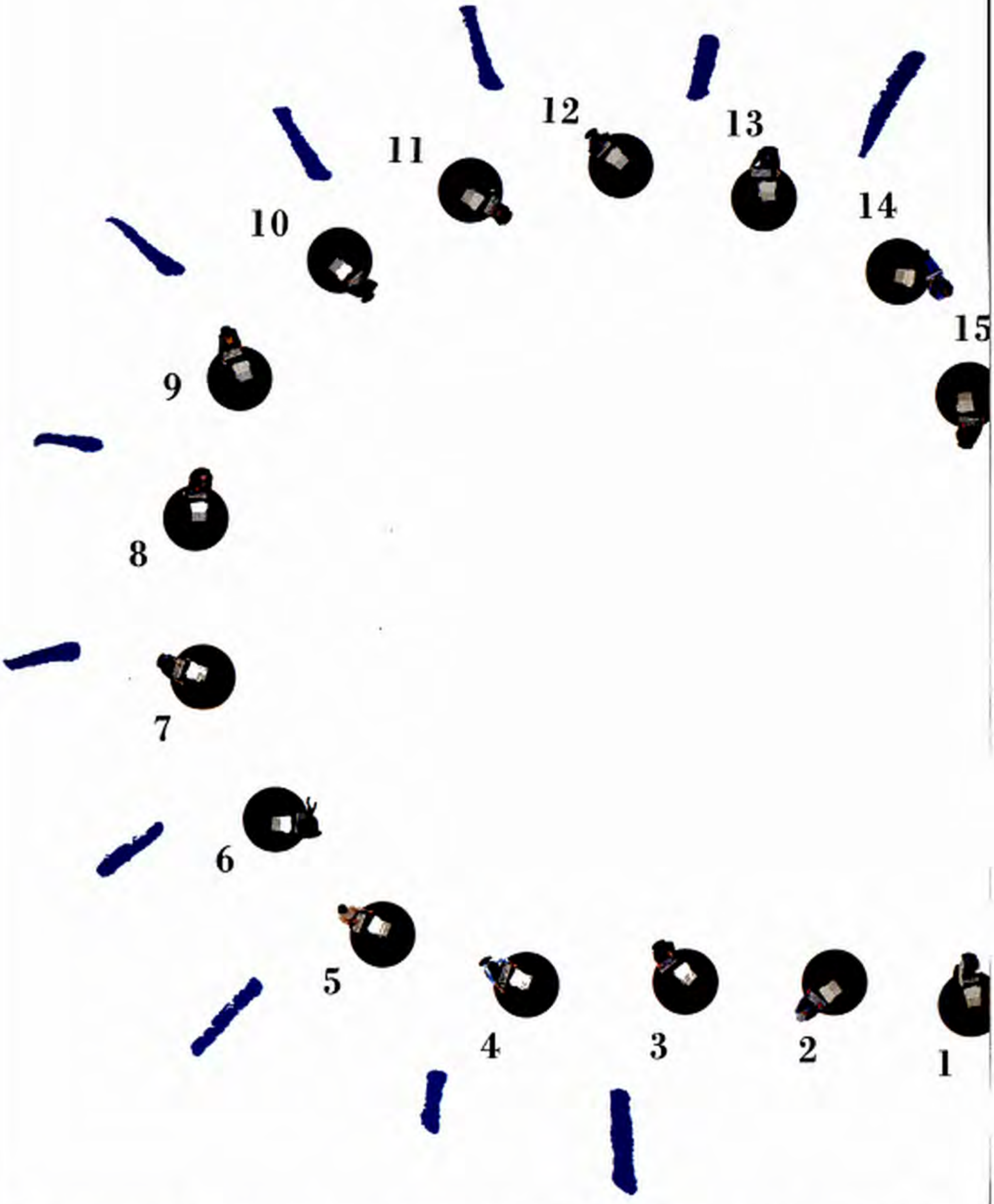

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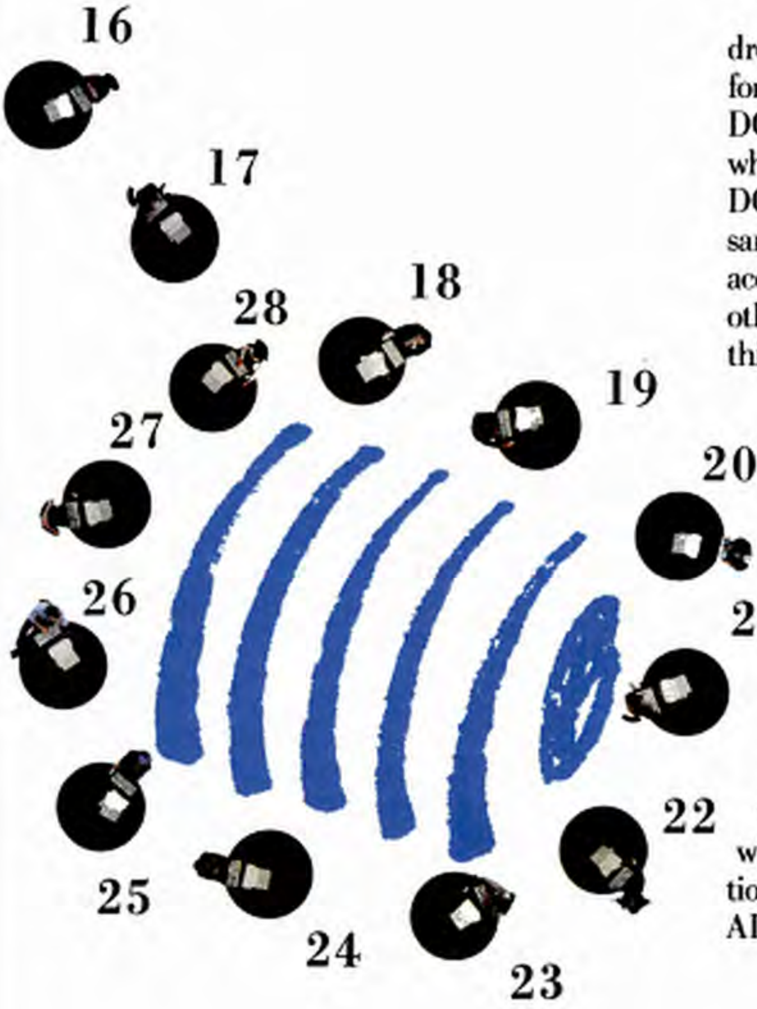

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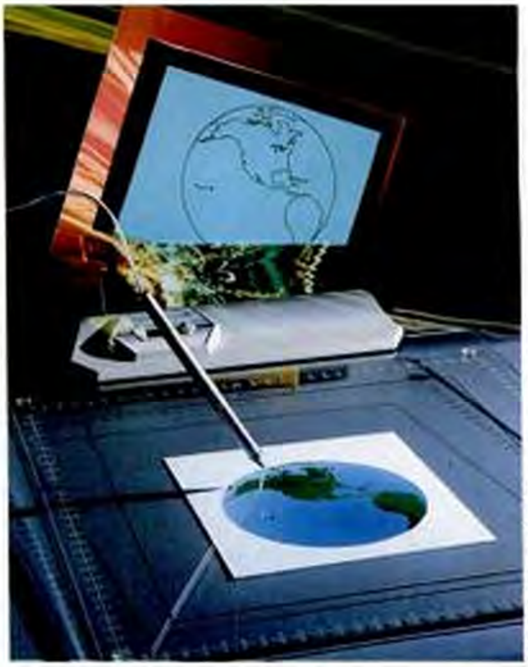


PHOTOGRAPHY: JOHN WILKES

Digitizing Tablets

Pointing the Way to Easier Input

Technological advances have made digitizing tablets an increasingly attractive alternate input option—and not just for CAD users. PC Labs evaluates 24 models from 15 manufacturers.

by Winn L. Rosch

Sorry, Miss Manners. Pointing may be impolite, but it sure is efficient. Whether you want to locate a person in a crowd or a dot on a blueprint, pointing to it can save a lot of talking or typing.

That's the whole point of digitizing tablets. Put a pen or cursor in your hand, and just by pointing you can quickly and accurately create or trace drawings, blueprints, or original art. And despite Miss Manners's admonitions, pointing is the most natural way of expressing yourself. A digitizing tablet is as familiar and easy to master as a pen and paper.

Digitizing tablet is an amazingly straightforward term. The term *digitizing* refers to the process of converting positions on a plane (Cartesian *x*- and *y*-coordinates) into digital values that can be used by applications like CAD, illustration, and paint programs. A *tablet* is the physical embodiment of the device and is also its metaphor. It resembles the classic paper drawing tablet, a flat surface upon which you can sketch.

Underneath its surface, however, the digitizing tablet is a complex electronic miracle that can pinpoint a specific location with an accuracy as fine as .001 inch.

BEYOND THE MOUSE

Tablets are distinguished from mice in two ways. In its native mode of operation, the tablet indicates absolute locations—that is, you point to a particular location on the tablet. Later, by putting the tablet's pen or cursor back in the same location, you return to the same on-screen point. In effect, the point is logically fixed to its location on the tablet.

A mouse is a relative pointing device. It indicates distances between locations rather than absolute locations. If you roll a mouse across a pad, lift it up, and move it back to its original location, it usually won't indicate the same on-screen point.

Your preference depends on how you work. If you draw while watching the screen, relative locations may be all you need. If you want to trace an existing drawing, however, absolute positioning is a must. You need to make the on-screen (and in-file) digital image an exact representation of the paper artwork. Tape a blueprint to a tablet and you can transfer every one of its lines into your drafting program.

The absolute/relative distinction between tablets and mice is blurring. Most of today's tablets include mouse drivers that allow them to emulate some type of mouse (Microsoft's is the most popular emulation). Equipped with an emulation, the tablet becomes more versatile than the mouse, because it can deliver both absolute and relative positioning.

Tablets also differ from mice in the way you use them. Typically, tablets give you a choice of using a pen (or stylus) or a cursor (sometimes called a *puck*). A pen makes using a tablet almost indistinguishable from ordinary drawing. In fact, you can draw on paper with an inked pen as you digitize information for your applications. Only the pen's cable will remind you that you're connected to your computer. An increasing number of tablets even eliminate the need for this umbilical.

On the other hand, you manipulate a tablet cursor the same way you do a mouse. A cursor is a hand-size pointing device with 1 to 16 buttons on top and a reticle with cross hairs that allows you to indicate exactly a particular point that you want to digitize. Compared with mice,

ALTERNATE INPUT: A WEALTH OF OPTIONS

MICE

Price: $80 to $180

Mice continue to proliferate in the workplace, and as graphical user interfaces arrive, even more mice will be sold. They are by far the most widely supported of input devices. Mouse technology ranges from mechanized balls and rollers to optical photosensors; however, the technology behind a mouse doesn't make much difference in its functionality.

Companies are now trying to outperform each other in resolution; 200 to 300 dots per inch is the average range. The higher the resolution, the smaller the work space needed to move the mouse around. Some mice now require an area of just 1 by 2 inches.

A variation on the mouse theme is the ALPS Isopoint, a rolling bar that can move your cursor in any direction, built into the base of a keyboard. The Isopoint could become a big success on laptops, especially if graphical user interfaces start appearing on them.

Advantages:

Inexpensive

Most widely supported alternate input devices

Familiar to most PC users

The higher the resolution, the smaller the necessary work space

Disadvantages:

Low resolution compared with that of tablets

The higher the resolution, the faster the scroll, which makes pinpointing an area difficult

DIGITIZING TABLETS

Price: $429 to $2,000 or more

Tablets generally resemble a sketch pad upon which you can draw with a pen or a mouselike cursor. Some tablets offer primitive character recognition to let you input data by writing it on the tablet, but their tested accuracy is less than optimal. Models with cordless pointing devices (by Kurta and Wacom) give you great freedom in drawing.

Primarily found on the desks of artists and CAD users, tablets can also be used by anyone who wants to save keystrokes by having all of an application's commands laid out in one place. Templates for *PageMaker, Microsoft Windows* and other menu-intensive applications are leading this trend.

Tablets range in dimension from book size all the way up to drafting-table size. Prices increase proportionally, and the largest models are usually found in architectural and engineering firms, not in the possession of graphic artists.

Advantages:

Extremely high resolution (1,000 dots per inch and more)

The ability to unnest menus, putting the entire menu tree under your control

Disadvantages:

Relatively expensive, especially when they are used primarily as menu timesavers

The higher the resolution, the larger the footprint

Not as widely supported by software as mice, making usefulness questionable for some applications cursors are more accurate and less comfortable to use. They are generally gripped with your fingers extended as if you were picking up some kind of insect that threatened to crawl up your leg. In general, cursor designs could use some rethinking.

DISTINGUISHING DIGITIZERS

While this sampling—some 24 tablets—may seem diverse, it represents only a slice of the tablet market. Current products range from those the size of paperback books to full drafting tables. They differ in the accuracy and resolution they deliver and in the speed at which they transmit information. At heart, they use a variety of technologies to determine the coordinates of their pointing devices. And the pointing devices themselves have their own spectrum of differences.

Size is perhaps the least important dimension of digitizing tablets. Many manufacturers offer tablets identical in features except for the drawing area. A product line may embrace a range from 12-by-12 to 36-by-48 inches or more. How much space you need depends on the application you plan to use, the images you wish to digitize, and how much you can spend. To bring this survey down to size, PC Labs sampled products that were as close as possible to two standard sizes, the popular and inexpensive 12- by 12-inch tablets and 12- by 18-inch models. Larger-size tablets in a manufacturer's line can generally be judged by their standard-size kin.

One interesting product not quite ready in time for evaluation is the Personal Writer 10SL, a new arrival from the Macintosh arena. The Personal Writer includes a 2.5-inch-wide miniature keyboard and screen right on the tablet's face, and since it can emulate your keyboard and handle pull-down menus, it is compatible with any program that runs under DOS, *GEM*, or *Microsoft Windows*. The Personal Writer can also record and store hundreds of macros for any application.

Another model, the Personal Writer 15SL, offers handwriting recognition that can convert your scrawl into plain, bold, or italic type in any point size. The Personal Writers are available in a range of sizes from 12-by-12 to 42-by-60 inches. Prices start at $799. Contact Personal Writer, 1900 Avenue of the Stars, #2870, Los Angeles, CA 90067; (213) 556-1001.

THE SIZE QUESTION

Bigger means more precise, because tablet precision is measured by the number of

TRACK-BALLS

Price: $95 to $169

A trackball looks very much like a cue ball set into a base. It lets you input data in either two or three dimensions and move the cursor around the screen very quickly. Unlike a mouse, a trackball doesn't run out of desk space or need to be repositioned.

Logitech's new $149 TrackMan combines a small right-thumb-operated trackball with three mouse-style buttons to provide the best of both technologies.

Advantages:

Small footprint

Use mouse emulators, so have wide support

Disadvantages:

Unfamiliar to majority of PC users

Relatively low resolution

TOUCH SCREENS

Price: $230 to $995

Touch screens let you touch a menu selection with your finger to activate a function. Most screens use one of two technologies: either your finger interrupts infrared light beams crisscrossing the screen surface, or it closes an on-screen circuit. Touch screens are excellent for public information services and for training purposes in any number of applications. The leading manufacturer is Hewlett-Packard.

Advantages:

Good training tools

In many cases, resolution is completely dependent on the pointing device (a pen will have greater accuracy than a finger)

Disadvantages:

Environment-sensitive

The tendency to lose their sensitivity as screen coatings wear off

Touching the screen becomes tiring at a PC set up with the screen at eye level

Fingerprints can cloud the screen and create glare

LIGHT PENS

Price: $145 to $200

Light pens can be used like touch screens, allowing you to point to a function on the screen. You can also use them like tablet pens and actually draw on the screen. All light pens plug into the graphics adapter and send electron beams to the adapter to pinpoint the pen's location.

Advantages:

Flexible, can be used either as touch screens or tablet pens

Good training tools

Disadvantages:

Not widely supported by software

As with touch screens, you must lift your arm to the screen

Most light pens also have a cord to contend with

To get pixel-point resolution, you must include special adapter cards

HOW DIGITIZING TABLETS WORK

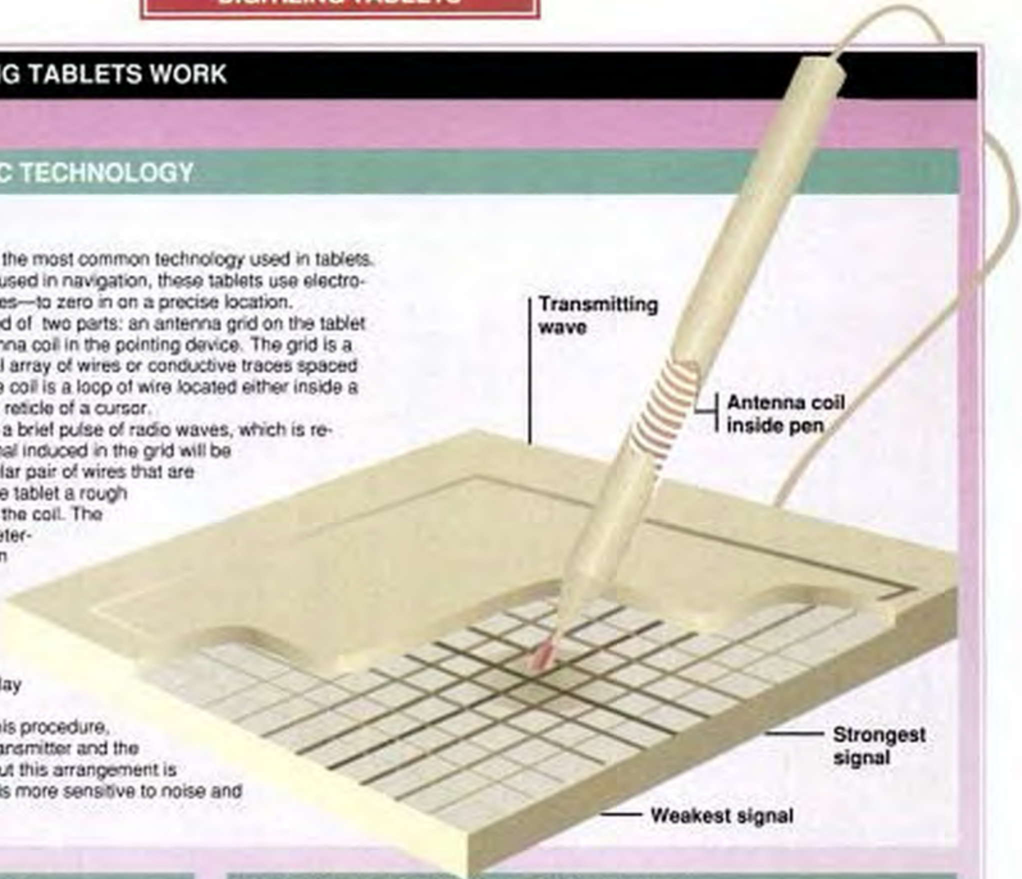
ELECTROMAGNETIC TECHNOLOGY

Electromagnetic sensing is the most common technology used in tablets. Like radio direction finders used in navigation, these tablets use electromagnetic fields—radio waves—to zero in on a precise location.

The system is comprised of two parts: an antenna grid on the tablet and a complementary antenna coil in the pointing device. The grid is a screenlike, two-dimensional array of wires or conductive traces spaced from .1 to .5 inch apart. The coil is a loop of wire located either inside a pen or visibly encircling the reticle of a cursor.

Typically, the coil emits a brief pulse of radio waves, which is received by the grid. The signal induced in the grid will be strongest in the perpendicular pair of wires that are closest to the coil, giving the tablet a rough indication of the location of the coil. The fine position of the coil is determined by the delay between the transmission and reception of its signal. If the coil is directly over a grid trace, the delay is minimal; if it's midway between two traces, the delay stretches to its maximum.

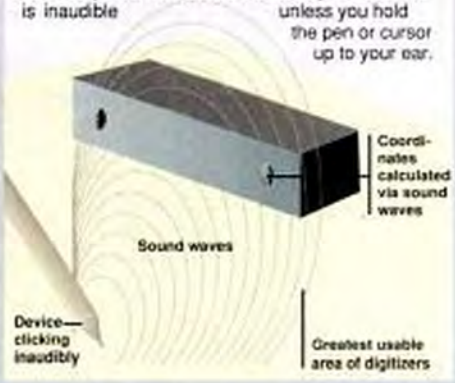
Some tablets reverse this procedure, using the tablet grid as a transmitter and the pointer coil as a receiver, but this arrangement is more difficult to shield and is more sensitive to noise and interference.



SONIC TECHNOLOGY

The technology of Science Accessories' Grafbar GP-7 Mark II could be described as triangulated bat echolocation. The system's pointing devices emit a sharp click (like bats do). A pair of separated microphones—bat ears—listen for the noise, filtering out all sounds except those in the range from 65 to 75 kHz. The distance from pointing device to microphone is easily calculated using the speed of sound, and through triangulation the *x*- and *y*-coordinates of the pointing device's position can be determined.

Science Accessories' cursors use piezoelectric elements to generate the sonic signals; the pens use spark gaps. Both are triggered by a 600-volt pulse. The sound emitted by the devices is inaudible unless you hold the pen or cursor up to your ear.

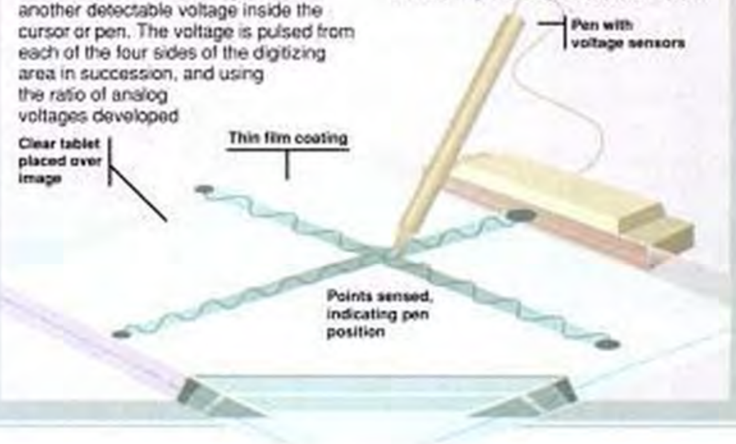

Coordinates calculated via sound waves
Sound waves
Device—clicking inaudibly
Greatest usable area of digitizers

RESISTIVE DECODING TECHNOLOGY

Resistive decoding technology substitutes a thin film coating in place of the wire grid used in more-conventional tablets. Although the indium-tin oxide coating is hidden inside the opaque tablets, it's vital to the clear ones—the compound is almost completely transparent itself. Look through a Scriptel RDT-series tablet and all you can see is a faint pattern that seems as if it were inside the glass.

The resistive decoding system works by creating a voltage gradient across the film. This voltage induces another detectable voltage inside the cursor or pen. The voltage is pulsed from each of the four sides of the digitizing area in succession, and using the ratio of analog voltages developed from each pulse inside the pointing device, the system detects the location of the pointing device. The analog ratios are converted to digital form and are then processed by a patented error-correction circuit to compensate for nonlinearities in the system.

The resistive decoding system promises the same resolution and accuracy as most conventional electromagnetic tablets—1,000 points per inch with a 0.01-inch accuracy. The maximum drawing speed of the system is limited by the electronics of the pad.


Pen with voltage sensors
Clear tablet placed over image
Thin film coating
Points sensed, indicating pen position

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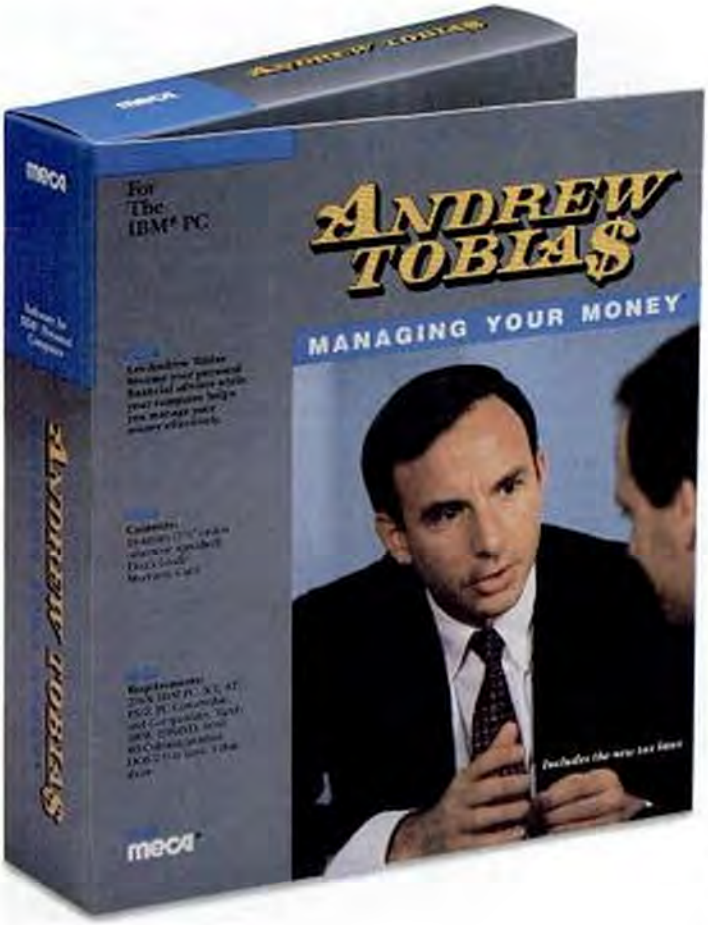

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lines that can be resolved within an inch. A 48-inch tablet will resolve four times as many points as a similar 12-inch one. The bigger tablet will also be more tiring to use—you may have to stretch across the whole surface to draw. Then again, applications often allow you to set the size of the digitizing area. You can do your coarse drawing on a small section of the tablet and use the entire tablet for detail work.

The useful space on a tablet varies with several outside factors. Both the application you run and the tablet driver you use control how much of the surface is put to work. For example, *AutoCAD* provides a TABLET CFG command that allows you to shrink the tablet space actually devoted to screen manipulation and to define portions of the tablet as menu areas. To give a general indication of the integration of each tablet with typical application programs, PC Labs measured the default tablet area devoted to *AutoCAD* drawing (as opposed to menu activation) before configuration.

If you're drawing freehand, speed may be the most important digitization issue to you. A tablet must be fast enough to follow the quickest motions of your hand. The points-per-second figures are a general indication of the speed at which a device relays coordinates to the applications with which it communicates. However, this speed is dependent on the communications rate of the connection between tablet and host (you'll want to use the fastest data rate possible—serial speeds of 9,600 bits per second or quicker).

The speed that is reported by the manufacturer of a tablet does not always accurately represent the performance you really get, so PC Labs tested drawing speed under actual-use conditions—drawing lines and boxes as rapidly as possible in *AutoCAD*—and also evaluated performance subjectively.

Two factors are important for determining whether you can use a given tablet at all: software and emulations. The software that comes with a tablet may include specific drivers to allow the tablet to work with specific applications. Mouse support usually takes the form of a driver. Many applications already have built-in support for tablets. With these programs, it's important that the tablet you choose works like one that your favorite applications know. Most tablets can emulate one or another of the more popular data formats used by digitizing tablets—for instance, that of the Summagraphics MM Digitizer Series tablets. Make sure that the tablet you choose emulates something your software supports.

> **If you're drawing freehand, speed may be the most important issue to you. A tablet must be fast enough to follow the quickest motions of your hand.**

POINTING DEVICES

The pointing devices that accompany digitizing tablets are myriad. From a usefulness and versatility standpoint, however, the most important distinguishing characteristic we found was cordlessness. Most pointing devices must be tethered to the tablet by a cable that is used to communicate position information to the tablet electronics. Two tablets reviewed here—Kurta and Wacom products—have cordless devices. In testing, this proved a great convenience. Not only was there no cable to tangle, snarl, and resist our drawing efforts, but cordless operation also allowed us to switch between using a pen and a cursor instantly.

Of course, cordlessness can be a problem, too. Cordless pens and cursors can be misplaced—accidentally or otherwise—just as quickly as Bic pens. Not that a cord will prevent a thief from liberating the pointing device (and at prices up to $250, the prospect may be tempting), but the cord does serve as a reminder not to put the pen in your pocket and stroll off. The cord can also prevent an expensive pen from dropping to the floor and being trod upon.

The shape and feel of a cursor or pen is the most subjective feature of any tablet. In general, a pen feels like a bloated ballpoint, not unlike the typical technical pen. The cursor is a hunk of plastic that provides a place for buttons. The number of buttons you need on a cursor depends mostly on how many your favored application supports; a 16-button cursor will mean that you might rarely have to go back to your keyboard to select functions, but you'll probably have to squint at the cursor to figure out which button does what.

Pens differ in the number of buttons they offer, too. In general, all pens give at least one switch that's activated by pressing down on the point, the tip-switch. A second button (and sometimes a third) on the side of the pen near the tip may also be available. How worthwhile additional buttons are depends on the software you use.

Sometimes pens are distinguished from styli in that the latter don't contain ink supplies. With few exceptions (notably the ZedPEN), pens can be equipped with dummy inkless cartridges to make them into styli. Pen-shaped pointing devices are uniformly described as pens in this article.

A new kind of pen, the pressure pen, is rapidly becoming popular. Instead of merely indicating on or off, the pressure pen sends out a digital value corresponding to the force applied to the pen tip. This force can then be used by an application to indicate the width, weight, or color of a line drawn in that application, a feature particularly useful in freehand sketching. Pressure pens vary in the range of forces they can detect and the number of pressure levels they can digitize (typically from 64 to 256).

All in all, you'll find more variety among tablets than among just about any other kind of input peripheral that you can connect to your computer. Which one is best for you depends not only on the quality of the product, but on your preferences and applications as well. Here, in alphabetical order by company name, are evaluations of 24 models.

ALTEK CORP.

Datatab ACT1212

by Frank Bican

As a manufacturer of digitizing systems for over 18 years, ALTEK has been a leading supplier of tablets to military and government agencies. Given that such a time span in any computer-related industry is epic, you might expect old-world craftsmanship. Indeed, the Datatab ACT1212 gives you that—perhaps a bit more of it than you want to deal with.

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5439 Beaumont Center Blvd. • Suite 1050 • Tampa, FL 33634 boards, ALTEK's model is built out of such earthy commodities as oak and steel. The end result is a mixed blessing of surprisingly detailed workmanship and just plain antiquity.

The tablet itself is built around a mitered oak framework covered on top and bottom with Formica veneers, and the edges display their woodgrain for all the world to see. Handsome, perhaps, but this construction would appear to be an invitation to dimensional instability in environments with fluctuating humidity.

Buried within is the gridwork that provides this electromagnetic tablet with accuracy to within 0.003 inch—higher than you could ever be expected to match with a hand-held pen or cursor, of which several are available.

The work space itself is far larger than the active area, measuring a generous 25.2 by 19.2 inches. If you have a huge desktop, you'll relish the added space for pens, cursors, and rulers. For many, though, the ACT1212 may devour too much real estate for its capabilities.

The working surface of the ACT1212 resembles a Formica countertop, with nothing to clutter it but a logo in the upper-right corner. There is no indication of the boundaries of the active area, which measures 19.3 by 13.4 inches (judging by the cursor's proximity LEDs), far larger than the manufacturer's claim of 12 by 12 inches. As with most of the other tablets, though, this one's default workspace, when used with *AutoCAD*, measures a smaller 8.5 by 10 inches.

ALTEK's Datatab ACT1212 represents 18 years of digitizing experience and, at $1,310, you pay for it. All its pointing devices are extra-cost options. The Datatab's resolution and accuracy are superior, but the interface and price may make you think twice.

FACT FILE

Datatab ACT1212
ALTEK Corp., 12210 Plum Orchard Dr., Silver Spring, MD 20904; (301) 572-2555.
List Price: Tablet, $1,310; controller, $575; pen, $120; 2-button cursor, $145; 4-button cursor, $290; 16-button cursor, $360.
Requires: Serial port.
In Short: It may have a workspace larger than advertised and oak and steel craftsmanship, but its cantankerous setup procedure, abysmal documentation, and high price make this littlest ALTEK hard to recommend.

CIRCLE **404** ON READER SERVICE CARD

Although a stylus (which can double as a ballpoint pen) is available, more useful are the three available cursors (2-, 4-, and 16-button). Each is precisely machined out of optically clear plastic, with a generous 1.5-inch cross-hair reticle.

Built around a Z88 microprocessor, the tablet's controller board is mounted in a 1-inch-deep steel box that is attached to the bottom of the tablet. Around the perimeter of the box are connectors for the serial-port cable, tablet cable, power supply, and pointing device.

Setting up the ACT1212 at PC Labs proved to be a rather frustrating experience. If the factory DIP switch settings don't work (they didn't for us), you'll have to hunt around for a Phillips screwdriver to remove the bottom panel from the controller box. Next, open the manual and discover just how unclear documentation can be. Finally, call ALTEK's technical support; they'll help you configure it.

But that's just the start. There is a five-selection soft-key menu that must be mounted just outside the lower-left corner of the active area. For this, the manual recommends attaching a terminal and marking the 0,0 *x*- and *y*-coordinates. If you don't have a terminal readily available, you can use one of the cursors and mark off the active area, which is indicated by the cursor's proximity LED. Once the proper area is located, remove the backing from the paper label and mount it on the board. Given this product's list price of around $2,000, you would expect the manufacturer to measure the active area and mount the label for you.

Testing with *AutoCAD* revealed less-than-perfect performance. Coordinate output was quite slow, resulting in a jumpy on-screen image, and button clicks were commonly missed if the cursor or pen was moving quickly. The ALTEK tablet was one of the few that exhibited signs of external interference. With the pen resting on the tablet, the image jumped around noticeably, perhaps affected by another tablet set up some 6 feet away.

All that hand craftsmanship translates into high costs, and considering that a minimal configuration (tablet, controller, and pen) will cost $2,005, the ACT1212 is overpriced in relation to its equally capable competitors.

CALCOMP

DrawingBoard 2300 Model 23120 CalComp 2500 Series Model 25120

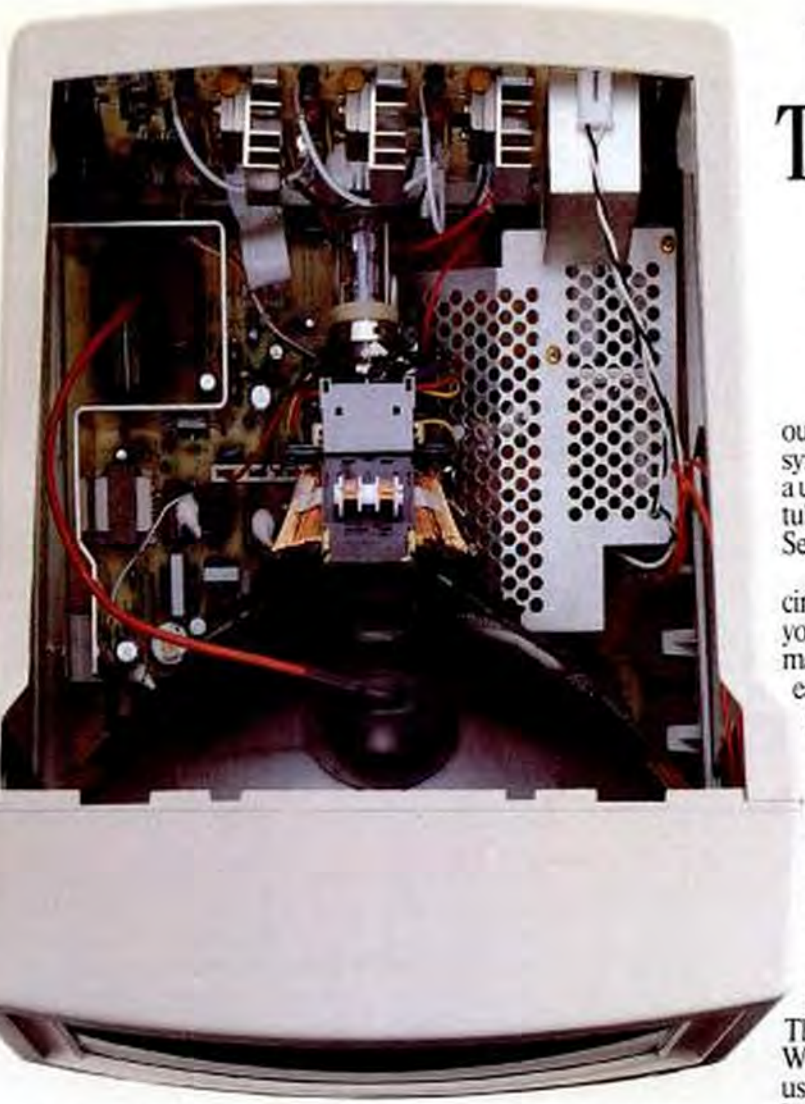
by Winn L. Rosch

CalComp's DrawingBoard 2300 and 2500 Series tablets are a picture of evolution in progress. The 2500 Series is the early step, the former quintessence of development suddenly overshadowed by an even more promising cousin, the DrawingBoard 2300.

Although CalComp has been known as a supplier of PC peripherals for about as long as there have been PCs, these tablets hark back further—to 1971, the year Talos Systems was formed. That company introduced its first electrostatic tablet in 1974 and became part of CalComp in 1980.

In the current product line, the DrawingBoard 2300 and the 2500 Series are distinguished as low-priced, high-performance models, respectively. But the drawbacks of the 2300 line are so scant as to make it a top choice PC tablet; the 2500s, on the other hand, are archaic curiosities.

While functionally similar and sharing the same pointing devices, the two tablets are aesthetically, ergonomically, and operationally distinct. The 2500 incorporates a number of good ideas that are fine-tuned in the 2300. Two 2500 models are available, the $915 Model 25120 with a 12- by 12-inch digitizing area, and the $1,275 Model 25180 with a 12- by 18-inch digitizing



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area. The 2300 series comes in three sizes, the 12- by 12-inch 23120 for $595; the 12- by 18-inch 23180 for $1,095; and the 18- by 24- inch 23240 for $2,495. We looked at the 12- by 12-inch models of each line.

The DrawingBoard 2300 Model 23120 proved to have its own elegance. It's hardly more than a flat square measuring 15 inches wide by 16 inches long; its wedge shape tapers up from half an inch to an inch and a half high, bottom to top. Its actual active area proved generous, measuring 12.25 by 12.25 inches. Beyond that, the 23120 adds a few refinements to tablet design.

It has pivoting retractable feet, allowing you to adjust the angle between its work surface and your desk by about 15 degrees. A transparent vinyl cover sheet is provided to protect and hold down templates or drawings you might want to trace. Attached by snaps, it covers not only the drawing area but also an inactive bottom inch and a half of the tablet. A small trough at the top of the pad provides a convenient resting place for the CalComp pen. An LED located to the right of the trough indicates a number of system operation and setup functions. Overall, it's lightweight (about 4 pounds) and solid.

Setup controls are integrated into the 2300's digitizing functions so that communications parameters can be set without switches. Instead, you need only point the cursor at a menu area above the active digitizing area. The menu is part of the plastic cover of the tablet. Changes are made in a straightforward fashion—putting the cursor cross hairs (or pen-tip) over a designated menu area causes the LED indicator to glow, signalling "on." Each function is toggled on or off by pressing down on a cursor button or pen tip. There is one default set of parameters, and two others can be stored in and retrieved from nonvolatile memory.

2500 SERIES

The 2500 Series bears only a family resemblance to the 2300. The 12- by 12-inch Model 25120 is thicker and heavier (about 7.5 pounds) than the 23120. Moreover, it uses a different setup arrangement and features a darker gray highlight to distinguish its active digitizing area, which was exactly the advertised size. The 25120 tablet itself is a basic wedge, 14.75 inches wide by 15.75 inches long, tapering down from 2.5 to 0.6 inches. A 4.25-inch inset about an inch deep near the middle of either side provides a convenient grip for picking up the tablet. The top of the tablet is plastic; the base plate is aluminum. This is a sturdy product, for heavy-duty use.

CalComp's DrawingBoard 2300 (bottom) and 2500 Series (top) offer high performance but opposite growth-potential. At $915, the 2500 is a solid performer but a technological dead end; the 2300 ($595) is newer, sleeker, and provides room for growth.

The operating parameters of the 25120 are set through a menu at the top of the digitizing area, as with the 23120, but the legends identifying the functions of individual areas are screened onto the tablet itself. Functionally, they differ in that they're arranged logically into five banks that must be individually set using a complex but easy-to-learn configuration ritual. Again, they will likely need to be set only once—the values set are stored in nonvolatile memory.

While the price of the 23120 includes its power supply, a serial cable with a 9-pin adapter for ATs, and your choice of a pen and 4-button cursor or a 16-button cursor, the 25120 comes without a pointing device but with a serial cable ending in your choice of a 25-pin or 9-pin D-shell connector. The 9-to-25-pin adapter of the 23120 proved a mixed blessing—the one provided with the evaluation unit had nuts on the end of the securing screws, preventing its proper insertion.

The CalComp pen, $92 if purchased separately, resembles a fat ballpoint almost half an inch in diameter at its widest. For a better grip, the last inch and a half of the tapering semiconical tip is fluted. It is easy to hold and manipulate. Its tip twists off so that you can replace the 3.25-inch cartridge with a foreshortened conventional ballpoint cartridge. Only a tip-switch was available on the pen delivered with the evaluation system, although units with side switches are also available from CalComp. The DrawingBoard 2300 is also compatible with an optional $595 pressure pen that distinguishes 256 levels of force on the pen tip, using an external processor in an auxiliary box.

The CalComp cursor is basically a rectangular lump (0.6 by 2.25 by 3.75 inches (HWD)) with a 1.5-inch extension for the triangular paddle and its cross-hair reticle. Instead of being centered, the reticle sight is offset to the left, and the cross hairs form an X rather than the more usual +.

Two styles of 4-button cursors are available. We tested one with the chiclet pushbuttons arranged in a straight line; another cursor puts them in a diamond pattern. Either costs $218. A 16-button cursor is also available at a cost of $275. The bottoms of the CalComp cursors are simply made from slippery plastic (akin to Derlin or Teflon), with three raised pads to reduce friction.

The 2500 uses basically the same pointing devices as the 2300, with the exception of different connectors and cable lengths. While the 2300 uses DIN connectors at the ends of its 42-inch pointing device cables, the 51-inch 2500 Series pointing-device cables terminate in 15-pin D-shells.

As to proximity range, the 23120

FACT FILE

CalComp, 2411 W. La Palma Ave., Anaheim, CA 92801; (800) CAL-COMP, (714) 821-2000.

DrawingBoard 2300 Model 23120
List Price: With pen and 4-button cursor, or 16-button cursor, $595.
Requires: Serial port.
In Short: A state-of-the-art, lightweight electromagnetic tablet with good resolution and moderately low accuracy (0.025 inch). The DrawingBoard 2300 includes retractable feet and vinyl overlay for templates.

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2500 Series Model 25120
List Price: $915.
Requires: Serial port.
In Short: A heavyweight electromagnetic tablet with a sophisticated binary setup system that features good resolution (1,278 lines per inch) and moderate accuracy.

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3314	☐Typing Tutor IV 1.0	33.
	Softlogic Solutions ... NCP	
3546	☐Disk Optimizer 4.01	45.
3542	☐Software Carousel 3.01	55.
	Software Publishing ... NCP	
3495	⊡Professional Plan 1.02	59.
3499	☐PFS:First Publisher 2.1	79.
4342	⊡PFS:First Graphics 1.0	89.
3478	⊡PFS:First Choice 3.02	105.
3496	⊡Professional Write 2.11	139.
3493	⊡Professional File 2.01	189.
3482	⊡Harvard Graphics 2.12	299.
4669	⊡Harvard Graphics Access. Pk 1.0	299.
4284	⊡Harvard Project Manager 3.0	439.

Intuit ... NCP

⊡*Quicken 3.0*–Bring your personal or small business finances under control with Quicken. This easy-to-use program works just like your paper check book. Automate check writing, financial reporting, and more .... $39.

	Spinnaker ... NCP	
4441	☐Resume Kit 1.29	25.
4446	☐8-in-1 2.0	39.
4444	⊡Splash 1.0	59.
	Symantec ... NCP	
3427	⊡Q & A Write 1.01	129.
3412	⊡Grandview 1.0	189.
3425	☐Q & A 3.0	219.
3431	☐Timeline 3.0	369.
	T/Maker ... NCP	
5540	⊞ClickArt Business Images	45.
4185	⊞Scrapbook+ 1.0	85.
	TOPS ... NCP	
3724	⊞NetPrint 2.0 *(share printers)*	119.
3726	⊞TOPS 2.1	115.
3725	TOPS Repeater *(network extender)*	129.
3720	*Flashcard 2.1 (AppleTalk network card, 1 year warranty)*	159.
	Traveling Software ... NCP	
4190	Battery Watch 2.0 *(3½" only)*	35.
3729	⊡LapLink Mac 2.0 *(Mac-PC transfer)*	79.
5179	⊡LapLink III	85.
4891	⊡ViewLink 1.0	95.
3727	⊡DeskLink 2.21	99.
	True BASIC, Inc. ... NCP	
3561	⊡True BASIC 2.1	52.

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Or to illustrate

Volkswriter ... NCP
▣ *Volkswriter 4 with Correct Grammar*–Makes professional word processing simple. The first and only word processor with a fully integrated grammar corrector....... $109.

	Vericomp ... NCP	
3765	⊡SoftBytes 2.0	35.
	Volkswriter ... NCP	
5046	▣Volkswriter 4 *(w/Correct Grammar)*	109.
	WordPerfect Corp. ... NCP	
3799	⊡WordPerfect Library 2.0	75.
3804	☐WordPerfect 5.1	265.
3805	▣WordPerfect Network 5.1	389.
3806	Additonal Network Stations 5.1	89.
	WordStar USA ... NCP	
2825	☐WordStar Prof. Release 5.5	229.
5000	☐*Upgrade to Release 5.5*	89.
	Xerox ... NCP	
4539	⊡Professional Extensions 1.0	399.
3812	☐Ventura Publisher 2.0	call
	XTREE Co. ... NCP	
4512	⊡XTREE Pro 1.1	69.
	XYQUEST ... NCP	
4393	☐XyWrite III Plus 3.55	229.

RECREATIONAL/EDUCATIONAL

	Broderbund ... CP	
1413	☐Where/World Carmen Sandiego?	25.
1414	☐Where/USA Carmen Sandiego?	25.
1417	☐Where/Europe Carmen Sandiego?	29.
5701	☐Where/Time Carmen Sandiego?	32.
4948	▣JetFighter *(by Velocity)*	35.
	Electronic Arts ... CP	
5798	☐Ferrari Formula I	29.
5806	☐F-16	35.
5805	⊡Starfleet II	45.
5803	☐Battle of Britain	45.
5804	⊡Deluxe Paint II *(Enhanced)*	89.
	Microprose ... CP	
4454	☐F-19 Stealth Fighter	39.
2725	☐F-15 Strike Eagle	22.
	Microsoft ... NCP	
2858	☐Flight Simulator 4.0 *All New*	39.
	Mindscape ... CP	
4897	☐Gauntlet	29.
4695	▣Balance of Power 1990	33.
	Parlor Software ... CP	
3159	☐Bridge Parlor 2.3	49.

	Sierra On-Line ... CP	
3405	⊡Thexder	$24.
4752	⊡Gold Rush	25.
4455	⊡Leisure Suit Larry II	33.
4345	⊡King's Quest IV *(512k version)*	33.
5695	⊡Manhunter: San Francisco	33.
4456	⊡Police Quest II	33.
3404	⊡Space Quest II	33.
5106	⊡Space Quest III	36.
	Spectrum Holobyte ... NCP	
3467	⊡Tetris *(addicting mind teaser)*	24.
4283	⊡Falcon/AT *(F-16 simulation)*	32.
5187	⊡VETTE!	32.
	Stone & Assoc. ... NCP	
3436	▣Memory Master *(ages 2-6)*	22.
3435	⊡My Letters,Numbers,Words *(2-6)*	22.
5231	⊡Phonics Plus	22.
3439	☐2nd Math *(ages 7-16)*	27.
	Sublogic ... NCP	
4653	☐Up Periscope	25.
3335	☐Jet *(requires CGA or EGA)*	33.
	True BASIC, Inc. ... NCP	
3559	⊡Algebra 3 with Workbook	39.
3590	⊡Pre-Calculus with Workbook	39.

Electronic Arts ... CP
☐*Lakers vs. Celtics*–Play 5-on-5. You control NBA players with all stars and teams .. $35.
☐*Madden Football*–With over 160 different plays, includes 11 man teams, injuries, time outs, and weather .... $35.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

	AST Research ... 2 years	
1223	I/O Mini 2 C/S/P	89.
1302	SixPakPlus 64k C/S/P	129.
4107	RAMpage Plus 286 512k	419.
4105	RAMpage Plus MicroChannel 512k	469.
	Brother International ... 1 year	
5787	HL-8e Laser Printer	1899.
5788	HL-8Ps PostScript Laser Printer	call
5786	Toner/Drum Kit	99.
	Central Point ... 1 year	
5042	Copy II PC Deluxe Option Board	115.

	Compucable ... 2 years	
1604	2-Position switch box	$25.
1605	3-Position switch box	35.
	Cuesta ... 1 year	
1608	Datasaver 400 Watt *(power backup)*	429.
	Curtis ... lifetime	
1681	Curtis Clip CC-1	6.
1686	Disk Holder DB-1	8.
1718	3½" Disk Holder DB-2	8.
1704	Printer Stand PS-1	18.
1713	Filtered SafeStrip SPF-3	24.
1694	Emerald SP-2	36.
1707	Ruby SPF-2 *(6 outlets; EMI/RFI filtered; 6 ft cord)*	55.
1708	Ruby-Plus SPF-2 Plus *(w/FAX & modem protection)*	65.
	DacEasy ... 1 year	
	ACCELERATORS	
3211	Breakthru 286-8 *(8 MHz)*	225.
3210	Breakthru 286-12 *(12 MHz)*	349.
	Epson ... 1 year	
	We are an authorized Epson Service Center.	
1906	FX-850 *(80 col., 264 cps, 9 pin)*	call
1904	FX-1050 *(136 col., 264 cps, 9 pin)*	call
5183	LQ-510 *(80 col., 180 cps, 24 pin)*	349.
1930	LQ-850 *(80 col., 264 cps, 24 pin)*	call
4117	LQ-950 *(110 col., 220 cps, 24 pin)*	call
1917	LQ-1050 *(136 col., 264 cps, 24 pin)*	call
4116	LQ-2550 *(136 col., 333 cps, 24 pin)*	call
5184	LX-810 *(80 col., 180 cps, 9 pin)*	199.
1052	Printer-to-IBM cable *(6 feet)*	15.
	We carry a full line of Epson accessories and ribbons. Call us with your needs.	
	5th Generation ... 1 year	
3952	Logical Connection 512k	529.
4921	Logical Connection 1 Meg	659.
	Hayes ... 2 years	
2304	Smartmodem 1200	289.
2305	Smartmodem 1200B *(w/Smartcom II)*	289.
2306	Smartmodem 1200B *(hardware only)*	259.
2307	Smartmodem 2400	429.
2308	Smartmodem 2400B *(w/Smartcom II)*	429.
2309	Smartmodem 2400B *(hardware only)*	399.

Samna ... NCP
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	Hercules ... 2 years	
2318	Graphics Card Plus............	$189.
5120	VGA Card....................	189.
	Intel ... 5 years	
4696	2400B Internal Modem..........	159.
2352	2400B Internal Modem 2 *(for PS/2)*	249.
5119	2400 Baud External Modem.....	179.
2346	Inboard 386/PC w/1 Meg.......	599.
4646	Inboard 386/PC Piggyback 4 Meg	1249.
2339	Inboard 386/AT *(req. inst. kit)*....	859.
2338	Inboard 386/AT Installation Kit....	139.
4266	Above Board Plus 512k.........	419.
4267	Above Board Plus I/O 512k......	449.
5336	Above Board Plus 8 2 Meg......	699.
5342	Above Board Plus 8 I/O 2 Meg ...	739.
4272	Above Board 2 Plus 512k.......	469.
4339	Above Board Plus Piggyback *w/2 Meg (upgrades to 6 Meg)*.....	call
4275	Connection Coprocessor.......	769.
4857	Visual Edge *(improve the output of your HP Laserjet II)*............	449.
	MATH COPROCESSORS	
2374	8087-2 *(for 8 MHz 8088 CPU's)*...	129.
2368	80287 *(for 6 MHz 80286 CPU's)*...	135.
2370	80287-8 *(for 8 MHz 80286 CPU's)*.	199.
2369	80287-10 *(for PS/2 Models 50 & 60)*	229.
4750	80387SX *(for 80386SX CPU's)*....	309.
2371	80387 *(for 16 MHz 80386 CPU's)*..	349.
2372	80387-20 *(for 20 MHz 80386 CPU's)*	399.
4121	80387-25 *(for 25 MHz 80386 CPU's)*	499.

HARVARD GRAPHICS

Software Publishing ... NCP
☒*Harvard Graphics 2.12*–Be "free and easy" with the industry's best-selling presentation graphics package. Now with a coupon for free drawing accessory (normally $149 List). Graphically the best choice........ **$299.**

	Kensington Microware ... 1 year	
2581	Masterpiece...................	94.
2582	Masterpiece Plus..............	109.
4972	PowerTree 10..................	19.
4973	PowerTree 20..................	27.
4974	PowerTree 50..................	54.
5697	Expert Mouse *(Trackball for PS/2)*.	115.
	Key tronic ... 3 years	
2537	101 Keyboard..................	99.
4518	101 Plus Keyboard.............	99.
	Kraft ... 5 years	
5800	3 button Thunder Joystick........	29.
5813	ThunderStick w/new game adapter	55.
4292	3 button Joystick w/game adapter .	45.

The Intel
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Intel ... 5 years
Inboard 386/PC–Boost your PC performance. A 16Mhz 80386 processor and 1Mb RAM allows you to handle today's most advanced applications, including Lotus 1-2-3 Release 3. 30 day money back guarantee....... $599.

5801	New Game Adapter *(2 game ports)*.	27.
5802	Trackball.....................	69.
	Logitech ... limited lifetime	
5464	Series 2 Mouse *(C9 for PS/2's)*....	65.
4388	ClearCase Mouse *(serial only)*.....	65.
5151	HiREZ Mouse *(C9)*..............	85.
5152	Mouse w/Paint Show *(C9)*.........	99.
4297	ScanMan Plus *(hand scanner)*....	185.
	Magnavox ... 2 years	
4758	13" CGA Monitor *(8CM515)*......	269.
4760	13" Hi-Res Monitor *(9CM053)*....	369.
4761	13" VGA Monitor *(9CM062)*......	389.
4762	13" VGA Monitor *(9CM082)*......	449.
	Micron Technology ... 2 years	
5818	Beyond 640 EMS Board 1 MB *(exp. to 8 MB w/daughter card)*.....	369.
5821	Beyond EX Extended Memory Board 2 MB *(exp. to 4 MB w/daughter card)*.....	599.
	Microsoft ... lifetime	
2870	Mach 20 *(1 year warranty)*.......	349.
2897	Mouse with Paintbrush..........	109.
2896	Mouse with Easy CAD...........	125.
2898	Mouse with Windows 286 2.1....	139.
	Mouse Systems ... lifetime	
2812	OmniMouse *(serial only; 1 year wrty)*	39.
4306	PC Mouse II w/PC Paint+.........	89.
	NEC ... 2 years	
4799	Multisync 2A *(VGA Monitor)*.....	499.
5085	Multisync 3-D Monitor...........	689.
	Orchid Technologies ... 4 years	
3069	Tiny Turbo 286 *(accelerator board)*	219.
4765	Designer 800 VGA *(360 x 480)*...	159.
4690	ProDesigner VGA *(800 x 600)*....	249.
	PC Power & Cooling Sys. ... 1 yr	
	REPLACEMENT POWER SUPPLIES	
3202	Turbo Cool 150 *(25° - 40° cooler)*	129.

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3205	Turbo Cool 250 *(25° - 30° cooler)*	$169.
3200	Silencer 150 *(84% noise reduction)*	115.
4514	Turbo Cool 375.................	299.
	Practical Peripherals ... 5 years	
3101	1200 Baud Internal Modem......	69.
3100	1200 Baud External Modem *(mini)*.	77.
3097	Microbuffer Inline *(par. print buffer/32k)*................	135.
3103	2400 Baud Internal Modem........	139.
3102	2400 Baud External Modem.......	179.
5285	2400 Baud Ext. MNP Modem *(Lev. 5)*	209.
4542	2400 Baud Internal Modem for PS/2..	229.
	Princeton Graphics ... 1 year	
3166	Ultrasync *(800 x 600 max. res.)*...	549.
	Quadram ... 1 year	
5143	JT-FAX 9600..................	549.
	Safe Power Systems ... 2 years	
4561	Safe 250W *(standby power bkup)*	249.
4562	Safe 425W *(standby power bkup)*	369.
4563	Safe 500W *(standby power bkup)*	495.
	SOTA Technology ... 2 years	
5107	Floppy Drive Controller *(S/P)*......	99.
5109	SOTA VGA/16 *(with 256k)*.......	219.
5111	SOTA 286i-12 *(12 MHz accelerator)*	299.
5402	SOTA 386i-16 *(16 MHz accelerator)*	419.
	Targus ... lifetime	
4899	Nylon Laptop carrying case......	55.
4901	Leather Laptop carrying case....	139.
	TheComplete PC ... 2 years	
4889	TheComplete Hand Scanner 400..	159.
5598	TheComplete Half Pg. Scanner 400	189.
4887	TheComplete FAX 9600..........	429.
5140	TheComplete Page Scanner......	549.
	OCR SOFTWARE	
5789	TheComplete OCR/HS 1.0.......	199.
5807	TheComplete OCR/Page 1.0......	319.
	Toshiba ... 1 year	
3684	T1000 Laptop *(80C88, 6.4 lbs.)*...	669.
4856	T3100E Laptop *(12 MHz, 20 Meg)*	2749.
4958	T1600 Laptop *(12 MHz, 20 Meg)*.	3249.
	Video 7 ... 5 years	
3778	VEGA VGA...................	259.
4193	FastWrite VGA *(includes 256k)*....	319.
4194	VRAM VGA *(includes 256k)*......	469.

Microsoft ... NCP
☐*Flight Simulator 4.0*–New version! Create and fly your own experimental aircraft or choose from a variety including the Sopwith Camel and Schwiezer 2-32 Sailplane. Moving scenery and random weather add to realism.... $39.

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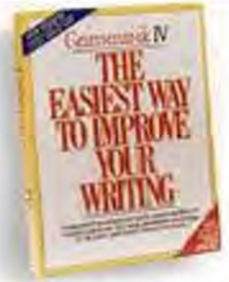
DRIVES

	IOMEGA ... 1 year	
2485	Bernoulli II Single 20 Meg Internal	$767.
5116	Bernoulli II Single 44 Meg Internal	995.
2486	Bernoulli II Dual 20 Meg External	1659.
5117	Bernoulli II Dual 44 Meg External	1969.
4276	20 Meg Cartridge Tripak *(5¼")*	169.
5113	44 Meg Cartridge Tripak *(5¼")*	249.
	CONTROLLERS (required)	
2499	PC2 Card	169.
2500	PC2B Card *(bootable card for PC/XT/AT)*	229.
2502	PC4 Card *(for PS/2 Model 50/60/70/80)*	299.
	Mountain Computer ... 1 year	
2917	40 Meg Internal Tape Drive	379.
2915	40 Meg External Tape Drive	479.
2916	40 Meg External Tape Drive with Power Supply	569.
5378	60 Meg External Tape Drive with Power Supply	1169.
5616	150 Meg External Tape Drive with Power Supply	1495.
5499	80 Meg Internal Tape Drive	519.
5503	80 Meg External Tape Drive	629.
5190	40 Meg Data Cartridges *(pre-formatted)*	35.
	Pacific Rim ... 1 year	
5010	1.2 Meg External *(for PS/2's)*	215.
5011	360k External 5¼" Drive	179.
	Plus Development ... 2 years	
3105	Hardcard 20 Meg *(49 ms)*	549.
3106	Hardcard 40 Meg *(28 ms)*	699.
	Seagate ... 1 year	
	FREE PCTV® Hard Drive Installation Tape with purchase of 20, 30 or 40 Meg Seagate drive for the IBM PC (not for AT). Beta or VHS.	
2285	20 Meg Internal Hard Drive ST225 *(w/controller and cables, 65 ms)*	289.
2286	30 Meg Internal Hard Drive ST238 *(w/controller and cables, 65 ms)*	299.
4554	40 Meg Int. HD ST251-1 (28 ms)	359.
2287	40 Meg Int. HD for PC 251-1 *(w/controller and cables, 28 ms)*	$435.
4624	80 Meg Int. HD ST4096 (28 ms)	619.
	TEAC ... 1 year	
4950	PC, XT 360k Drive *(5¼")*	79.
4951	720k Drive *(specify XT or AT, 3½")*	79.
4670	1.44 Meg Drive for XT *(3½")*	99.
4326	1.44 Meg Drive for AT *(includes Bastech software utilities, 3½" copy prot.)*	119.
	Toshiba ... 1 year	
3650	AT 360k Drive *(5¼")*	85.
3649	AT 1.2 Meg Drive *(5¼")*	99.
4755	AT 1.44 Meg Drive *(3½", includes Bastech software utilities)*	119.



Reference Software ... NCP

Grammatik IV 1.0–Checks for grammar, style, usage, punctuation and spelling errors in one pass! Now works within WordPerfect 5.0, Microsoft Word 5.0, Professional Write 2.1, WordStar 5.5, XY Write III & more.... $52.

MISCELLANEOUS

	CompuServe	
1676	CompuServe Information Service	24.
	Cables ... lifetime	
1019	Smartmodem-to-AT cable *(10 feet)*	15.
1050	Parallel Printer cable *(15 feet)*	19.

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Logitech ... limited lifetime

ScanMan Plus–Features new case design for easier handling! Offers O.C.R. compatibility for broader range of scanning capabilities. Includes enhanced PaintShow Plus graphic editor and works with most popular applications .. $185.

DISKS

All disks have a lifetime warranty.

	5¼" DS/DD Disks *(360k)*	
3291	Sony *(10 disks per box)*	12.
2789	Maxell MD2-D *(10 disks per box)*	13.
4192	Verbatim Datalife *(10 disks per box)*	13.
	5¼" DS/High Density Disks *(1.2 Meg)*	
3770	Verbatim Datalife *(10 disks per box)*	19.
3292	Sony *(10 disks per box)*	19.
2790	Maxell MD2-HD *(10 disks per box)*	19.
	3½" DS/DD Diskettes *(720k)*	
3297	Sony *(10 disks per box)*	15.
3772	Verbatim *(10 disks per box)*	15.
2792	Maxell *(10 disks per box)*	16.
	3½" DS/High-Density Diskettes *(1.44 Meg)*	
3298	Sony *(10 disks per box)*	32.
3773	Verbatim *(10 disks per box)*	32.
2793	Maxell *(10 disks per box)*	32.

KRAFT
TRACKBALL

Kraft ... 5 years

Trackball–For IBM and compatibles, features include software selectable dpi ranges from 10 to 1150, ergonomic design and easy installation. An optional foot pedal is available for one-handed control.......... $69.

MEMORY

3248	256k DRAMs *(120 nanosecond)*	call
4366	1 Meg x 9 SIMMs *(100 nanosecond)*	call
5510	1 Meg x 9 SIMMs *(80 nanosecond)*	call
5746	1 Meg Chips *(80 nanosecond)*	call

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- Upon receipt and approval, personal and company checks now clear the same day for immediate shipment of your order.
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- 120 day limited warranty on all products.*
- To order, call us Monday through Friday 9:00 to 9:00, or Saturday 9:00 to 5:30. You can call our business offices at 603/446-3383 Monday through Friday 9:00 to 5:30.

SHIPPING

Note: Accounts on net terms pay actual shipping.

Continental US:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add $3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.

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- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add $3 per order.

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- Call 603/446-3383 for information.

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PC Construction.

Using the old beam.
(Or, how we learned to log on.)

It takes a lot of lumber to run a computer mail order business here in the high rise hamlet of Marlow, NH (pop. 560). In fact, we recently started construction of a new sales and distribution center. Inspired by our well-built mascots, we've cleared ten acres, put in a new road, dug a pond, and are getting as much done as possible before winter. (At which time any tools you drop outside are lost until spring).

Fast stud service!

Admittedly, we've kept the local carpenters pretty busy since 1982, when we had them put some shelves in a closet to create our first warehouse. They've already restored the stately Christmas Tree Inn (c. 1833) to serve as our headquarters and conference center, rebuilt the dam out front, and even created a state-of-the-art TV production studio.

And what, you may ask, do all those sticks, stones, bricks, bracks, tongues and grooves rest upon? An awful lot of concrete to tell the truth. But it sure helps to have a solid base of customers. So next time you're remodeling your micro, call us for the peripherals and programs. We'll make sure you don't get hammered on price. And we'll provide the toll-free technical support you need to make sure that everything's screwed on right and no wires are crossed. Plus, to keep you on the straight and narrow, we have a gift to help you follow all the rules. Read on!

Take our measure. For free!

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proved a bit more sensitive than the 25120. While the pen proximity necessary for detection measured 0.87 inch for both tablets, the 23120 could detect its cursor 1 inch away, the 25120 only 0.75 inch.

Software support from CalComp is scanty at best. Nothing is provided with the 2500 Series. The DrawingBoard 2300 includes a coupon good for your choice of template for one of the following applications: *AutoCAD*, *Cadkey*, *VersaCAD Design*, or *Microsoft Windows*. The *AutoCAD* and *Windows* templates also include special driver software. Included with the three CAD templates are special small templates for the CalComp 16-button cursors.

Both the DrawingBoard 2300 and 2500 Series are compatible with applications that recognize the commands used by CalComp 2000 Series or 9100 Series and Summagraphics MM Digitizer Series tablets. In addition, the documentation is unusually good and provides in-depth descriptions of the data formats used by the tablets. The DrawingBoard 2300 carries a full five-year warranty. The 2500 warranty runs only one year.

The 2500 Series comes out ahead as far as accuracy and resolution are concerned, but not by enough to make a difference in most applications. It resolves up to 1,278 lines per inch with 0.015-inch accuracy. The DrawingBoard 2300 resolves up to 1,016 lines per inch with 0.025-inch accuracy. Either tablet outputs up to 150 points per second.

The CalComp 2500 Series tablets have all the qualities to make a decent tablet, but the DrawingBoard 2300 is so much better, particularly in its ergonomic design, that the 2500 Series may just be an evolutionary dead end. The CalComp line might not fare too badly with the DrawingBoard 2300 as its flagship.

TAKING ADVANTAGE OF TEMPLATES

A *template* puts menu selections on a tablet. It's usually in the form of a laminated plastic sheet that defines and identifies areas on the tablet that will elicit functions in an application. Move the pen or cursor into an area, click a button, and the specified function is carried out. It's that easy.

Templates end up making you watch the tablet and not the screen, and they shrink the area of the tablet that you can actually use for drawing—increasing speed and convenience, but trimming accuracy. Templates are most often used with CAD programs. In fact, *AutoCAD* includes its own template for tablet users. Many tablet makers offer templates for commonly used applications like *Microsoft Windows* and *PageMaker*, usually through a coupon redeemable through Promontory Systems.

Formerly called AutoEase, Promontory Systems markets templates that enhance most popular CAD packages as well as *Microsoft Windows*, *PageMaker*, and *Micrografx Designer*. Each Promontory template set comes complete with its own icon-based templates that will work with any tablet. Some companies, such as CalComp and Kurta, have already incorporated Promontory's line of products into their tablets. Others, like Pencept and Summagraphics, offer a coupon redeemable for your choice of template. For more information, contact Promontory Systems Inc., 1325 S. 800 East, Orem, UT 84058; (800) 748-4774, (801) 224-8833. ■

Promontory Systems' AutoMASTER template set enhances *AutoCAD*, expanding its capabilities as an architectural design tool. The package comes with software and menu templates for everything from an overall residential or commercial plan all the way down to electronics schemes and mechanical fasteners within the walls.

GTCO CORP.

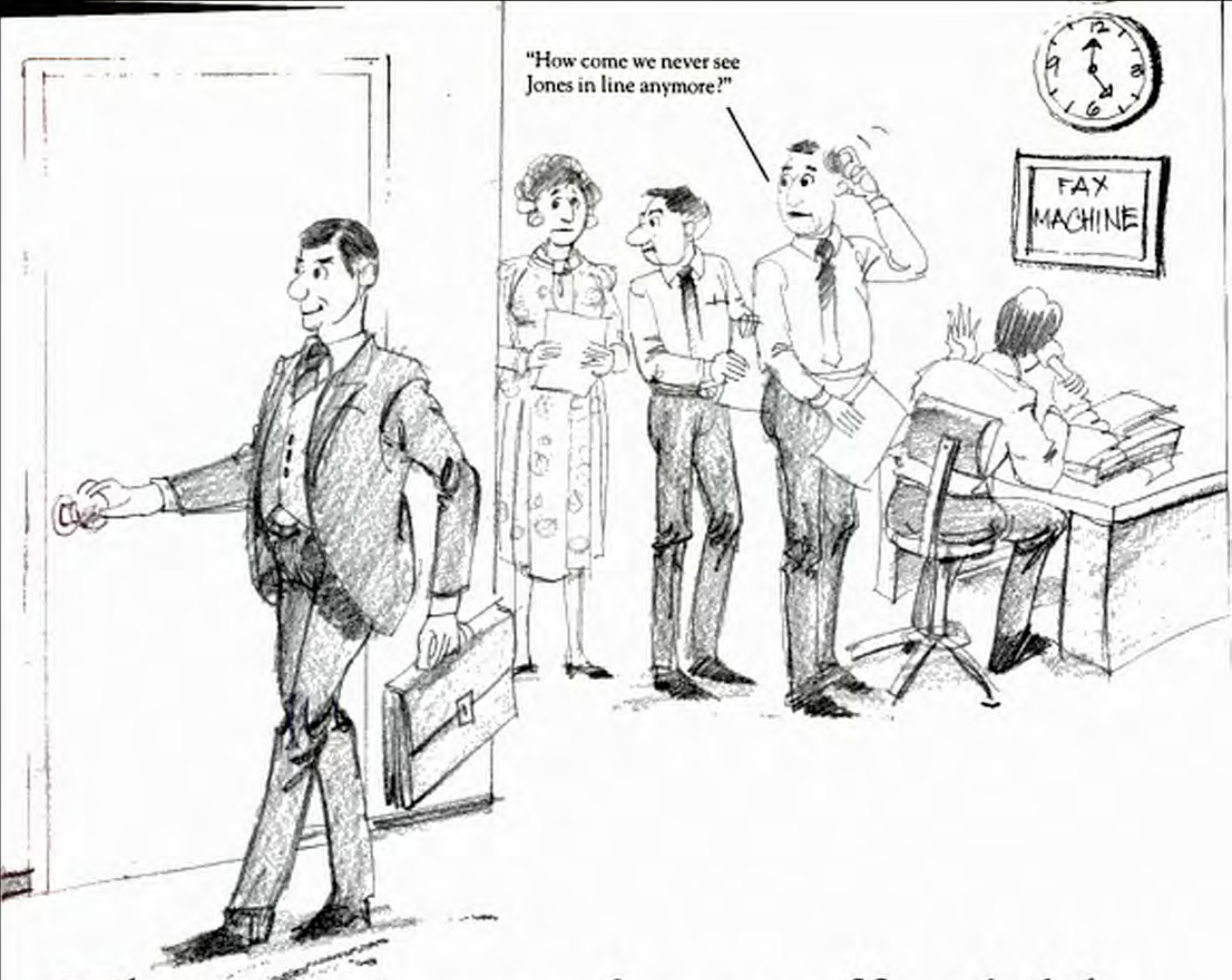
SketchMaster

by Frank Bican

GTCO has been in the tablet business since 1975, a full six years before the first IBM PC hit the shelves. Many of its larger models are just too expensive for the general PC market, but its new SketchMaster tablet rates high on the affordability scale and offers commendable performance to boot.

The plain gray tablet measures 15.5 by 15.5 inches, so it shouldn't require you to give up too much desktop space. The lighter-gray active workspace measures 12.5 by 12.5 inches, but that's a bit misleading, because in reality, the electronic image space is slightly smaller, at 11.7 by 11.7 inches. When used with *AutoCAD*, the default workspace shrinks still more, to 9 by 10.3 inches. Still, these dimensions are larger than those of some of the more portly tablets we looked at.

Covering the work surface is a clear acetate overlay, glued permanently in place along the lower edge. Considerably thin-


"How come we never see Jones in line anymore?"
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Offer good through 11/30/89.

National Semiconductor

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CIRCLE 168 ON READER SERVICE CARD

ner than the robust overlays on the Kurta and Houston Instrument tablets, it could prove to be difficult to replace when it inevitably becomes wrinkled or scratched.

On the back of the enclosure are RJ-11 telephone-type connectors for the pointing device and serial cables and a mere three DIP switches. The latter select 9,600/auto baud rates, ASCII/binary output, and odd/no parity. Needless to say, setup is a breeze.

Conspicuously absent is the usual power brick to drive the entire assembly. Instead, the tablet draws its power from the serial port. This should pose no problem for AT-class machines, but it could be a problem with older PCs and their anemic 63-watt power supplies. Then again, if you're running *AutoCAD* on an old 8088-based PC, you've already got enough problems to warrant buying a new computer before worrying about tablets.

Missing from our evaluation unit was a pen. In its place was a mail-in card for the latest version, as well as mail-in cards for *AutoCAD*, *CadKey*, *VersaCAD Design*, and *Microsoft Windows* templates, all at no additional charge. Perhaps not exactly the ticket for those who require instant gratification, but at least you have the chance to get the latest versions of all the peripherals, even though the package may have been sitting on your dealer's shelf for a while.

The four-button cursor included with the package proved just adequate. Its antenna coil has an opening of only about 0.1 inch and is obscured by cross hairs in the center. It is fastened into place with plastic film that's not exactly optically transparent. It proved considerably more difficult to use than it should have.

At $449, GTCO Corp.'s SketchMaster is a good buy, especially with the enclosed coupon for complimentary application software templates. It is an adequate performer, keeping up with rapid drawing movements with minimal breakup of the on-screen image.

GTCO's manual for the SketchMaster is virtually nonexistent, totalling a scant six pages (one of which is devoted to the warranty). Admittedly, not much is needed to set it up, but there is actually more information in the READ.ME file on the *AutoCAD/Windows* driver diskette.

FACT FILE

SketchMaster
GTCO Corp., 7125 Riverwood Dr., Columbia, MD 21046; (800) DIGIPAD, (301) 290-6688.
List Price: With pen and cursor, $449.
Requires: Serial port.
In Short: Reasonably priced and graced with competent performance, the SketchMaster deserves a close look for many tablet applications. Drivers for *AutoCAD* and *Windows*, as well as Summagraphics MM emulation, make it quite versatile.

CIRCLE 497 ON READER SERVICE CARD

GTCO understands the tablet market and supplies a serial cable with a DB-9 connector for AT- or 386-class machines, the only ones truly suitable for CAD. For those occasions where a DB-25 connector is called for, GTCO also includes a 9- to 25-pin adapter.

For actually laying out a drawing with *AutoCAD*, the SketchMaster proved to be an adequate performer. There was some breakup of the vertical on-screen cross hair in the line-drawing function, but not enough to be bothersome. Quite unlike some of the other tablets, the SketchMaster was decidedly fast in keeping up with cursor motion and was not one to miss button-clicks when used in freehand drawing motions.

It may not be a model of perfection as tablets go, but the GTCO SketchMaster is certainly worth considering. In its 12- by 12-inch version, it retails for a reasonable $449, including pen, four-button cursor, and *AutoCAD* and *Windows* drivers. A 12- by 18-inch version is also available for $699, and while the extra space could prove useful, the price differential for nothing more than additional plastic seems a little out of line.

HEWLETT-PACKARD CORP.

HP SketchPro

by Frank Bican

Hewlett-Packard Corp. has been the darling of the engineering crowd for over 30 years, but its name really became a household word when the company started making the first affordable scientific calculators in the early 1970s. With a lineup of plotters of nearly every size, it would only be natural for the company to offer a tablet as well.

At a list-price of $599, the HP SketchPro is moderately expensive, but if you're one who subscribes to the philosophy that you get what you pay for, you probably won't be disappointed. Where some manufacturers cheat by making everything optional, this one is a complete package—tablet, pen, cursor, and software.

Construction quality and ergonomics are strong points for the SketchPro. The very compact tablet (only 12.8 by 13.5 inches) has a gentle slope that makes prolonged use easy, and the rugged overlay covering the 11- by 11-inch workspace should resist all efforts to bend or scratch it. That's important, because it is securely glued into place and would be difficult to replace.

Along the top edge of the tablet is a row of 22 soft keys. Of these, 12 are predefined

The HP SketchPro, $599, provides the quality that you expect from Hewlett-Packard. It is comfortable to use, compact, and complete, offering not only software but also 22 soft keys to control cursor movement, aspect ratio, size, tracking velocity, and more.

DIGITIZING TABLETS: SUMMARY OF FEATURES

(Products listed in ascending price order)

The following glossary analyzes some of the terms in this table of features. The phrases in bold type are listed in the same order as they occur in the table.

Pen The terms *pen* and *stylus* are basically synonymous; both devices resemble overweight ballpoint pens. A pen may have an ink cartridge to let users see on paper what they have drawn on the screen. Pens may also have one or more buttons that correspond to the Enter key or perform other functions.

Cursor Unlike the blinking geometric shape on your screen, a tablet cursor is a hand-held pointing device larger than a mouse, with from 1 to 16 buttons and a clear reticle with cross hairs to allow precise selection of points. It is best used for tracing a mechanical or architectural drawing and is not recommended for freehand drawing.

Proximity is a measurement of the maximum distance between the tablet and the pointing device at which the digitizer works. This becomes a factor when bulky items are placed on a tablet for tracing. A distance of 0.25 inch is acceptable; 1 inch is excellent.

Template A template is used on the tablet as an aid to inputting information; it corresponds to a menu on which items are selected with the pointing device. Templates are customized either to a specific application (CAD being the most prevalent one) or to an operating system.

Resolution A measurement of how many lines can be individually distinguished within a given distance. The more lines of resolution per inch, the better.

Accuracy describes how closely a digitized point comes to the correct representation of the cursor position. The smaller this distance, the better. Human and environmental factors like humidity, electricity, and stylus tilting can cause the accuracy to deteriorate.

	Pentel DST-4AN Pentel of America $420 including pen	**Genius Digitizing Tablet GT-1212A** KYE International Corp. $429 including cursor	**SketchMaster** GTCO Corp. $449 including pen and cursor	**Drawingboard 2300 Model 23120** CalComp $595 including pen and 4-button cursor, or 16-button cursor
Size of tablet in inches	17.3 x 11.0 x 1.2	16.3 x 16.6 x 1.9	15.5 x 15.5 x 2.6	14.9 x 15.9 x 1.7
Size of work space in inches	11.7 x 8.3	12.0 x 12.0	12.5 x 12.5	12.2 x 12.2
Technology used	Electromagnetic	Electromagnetic	Electromagnetic	Electromagnetic
POINTING DEVICES				
Pen with button	☐	■	■	Optional ($115)
Pen with ink	☐	☐	■	■
4-button cursor	Optional ($90)	■	■	■
16-button cursor	☐	☐	☐	■
Other cursors available	☐	☐	☐	☐
Mouse driver	☐	■	☐	■
Device is programmable	☐	☐	■	■
Other pointing devices available	☐	☐	☐	Pressure-sensitive stylus ($595), dual-transducer y-box ($245)
Pen proximity (inches)	1/16	3/4	1/4	7/8
Cursor proximity (inches)	1/16	3/4	1/2	1
Screen displays work in real time	☐	■	■	■
Connection to PC	Serial port	Serial port	Serial port	Serial port
Length of pen cord (inches)	36	45	39	42
Length of cursor cord (inches)	36	47	46	42
TEMPLATES				
AutoCAD	■ (Version 2.6 only)	■	■*	■
Microsoft Windows	☐	☐	■*	■
Other	None	*CassCAD*	*Cadkey**, *VersaCAD**	*Cadkey*, *VersaCAD*
Allows user-customizable macros	☐	☐	☐	☐
Software supplied	None	*AutoCAD* Template Menu, *Dr. Halo III*, *Menu Maker*	*AutoCAD* and *Windows* drivers	Driver supplied with *AutoCAD* or *Windows* template
MANUFACTURER'S PERFORMANCE CLAIMS				
Resolution (lines per inch)	200	1,000	1,000	1,016
Accuracy (inches)	0.1	0.01	0.01	0.025

—Editor's Choice ■—Yes ☐—No

*This template can be obtained with an included coupon redeemable through Promontory Systems.

GraphicMaster Numonics Corp. $595 including pen and 4-button cursor, or 16-button cursor	**Numonics 2206** Numonics Corp $595 including pen and 4-button cursor, or 16-button cursor	**HP SketchPro** Hewlett-Packard Corp. $599 including pen and cursor	**SPC-1212 Opaque Digitizer** Scriptel Corp. $599 including pen or cursor	**SummaSketch II** Summagraphics Corp. $599 including pen and cursor, $699 with 16-button cursor	**Penpad 300** Pencept $695 including pen or cursor	**Tiger Tablet** Hitachi America HDG-1111C $727	**Wacom SD-420L** Wacom $795
15.0 x 15.0 x 1.0	23.0 x 23.0 x 1.0	12.8 x 13.5 x 2.0	15.5 x 16.5 x 2.9	16.2 x 16.5 x 1.7	15.7 x 16.6 x 0.6	17.2 x 16.0 x 2.8	16.5 x 16.5 x 3.0
12.5 x 12.5	20.5 x 20.5	11.0 x 11.0	12.2 x 12.2	12.0 x 12.0	11.0 x 11.0	11.0 x 11.0	12.0 x 12.0
Electromagnetic	Electromagnetic	Electromagnetic	Resistive decoding	Electromagnetic	Electromagnetic	Electromagnetic	Electromagnetic
Optional ($75)	Optional ($75)	☐	☐	■	■	■	Optional ($80)
■	■	☐	☐	☐	■	☐	■
■	■	■	■	■	■	Optional ($251)	Optional ($150)
Optional ($205)	Optional ($205)	☐	☐	■	■	☐	☐
☐	☐	☐	☐	☐	☐	**12-button ($271)**	☐
■	■	■	☐	■	■	■	■
■	■	■	■	■	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	**Pressure-sensitive stylus ($125)**
1 1/4	1/4	1/8	3/8	1/2	7/8	1/8	1/4
2	3/8	3/8	3/8	3/4	1 1/4	1/4	1/4
■	☐	☐	☐	■	■	■	■
Serial port	Serial port	Serial port	Serial port	Serial port	Serial port	Serial port	Serial port
40	35	29	48	39	48	33	Cordless
40	37	31	44	39	48	48	Cordless
☐	☐	☐	☐	■*	☐	☐	☐
☐	☐	☐	☐	■*	☐	☐	☐
Setup	No	No	No	Cadkey*, VersaCAD*	No	*VersaCAD*	None
☐	☐	☐	☐	☐	☐	☐	☐
AutoCAD and *Windows* drivers, diagnostics, PC and Macintosh drivers	*AutoCAD* and *Windows* drivers, diagnostics, PC and Macintosh drivers	None	None	*AutoCAD* and *Windows* drivers, test and reset utilities	*AutoCAD* and *Windows* drivers, diagnostics and configuration, documentation	None	Test and diagnostics, *AutoCAD* driver
1,000	1,000	1,219	1,000	1,016	1,000	1,000	1,270
0.01	0.02	0.02	0.01	0.015	Cursor, 0.001; stylus, 0.005	0.02	0.01

CONTINUES

"Uh, my system crashed and my file disappeared."

"I'm sorry about those files but I'm sure there's hard copy around here somewhere."

"Someone must have been playing with my computer while I was out to lunch."

"My secretary spilled a cup of coffee on my desk and it ran over my disk."

"I don't know what happened to the files, they just disappeared."

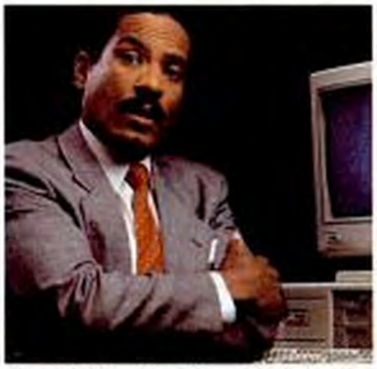
"Nobody told me that I was supposed to backup."

"My dog ate my data."

"I put the files on the floppy and then someone must have taken my disk."

"Well, it's a long story and I wouldn't want to bore you..."

"Have you ever had one of those days?"



"I can't believe that it's my fault, it's your system."

"I think I'm in trouble here."

You are surrounded by a bunch of losers.

As a manager of PCs, you've heard it all before. Every conceivable excuse and even a few that try your imagination.

And every day the situation gets worse. More and more of your company's critical data is taken off the network and manipulated on desktop computers. By users who mean well, but back up irregularly, improperly or not at all.

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Irwin Tape Backup Systems are fast, easy-to-use, and best of all: they operate unattended. You set the time, the day and the files you wish to have backed up, and our sophisticated, powerful EzTape® software will do the rest.

You can back up desktops individually, the network server or any combination of such devices.

Irwin Tape Backup Systems are compatible with every major industry LAN including Novell® (2.0A, ELS, 2.1X and SFT), 3Com,™ TOPS,® IBM PC LAN,™ AT&T StarLAN,™ AppleShare® and others.

We offer a wide selection of high-capacity, high-speed drives in both internal and external models. From 120 megabyte minicartridge drives to our high-performance 250 megabyte data cartridge drives.

Irwin Tape Backup Systems are available for PCs, PS/2® models, Macs, even laptops. And they work with multiple operating systems like Xenix, OS/2 and Macintosh®—in addition to MS-DOS.

So don't let your company's valuable data get lost or damaged. Call Irwin today at 1-800-BACKUP1.

And make everyone in your workgroup a winner.

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DIGITIZING TABLETS: SUMMARY OF FEATURES

(Products listed in ascending price order)

	PC **HIPAD Plus 9018** Houston Instrument $895 including pen and cursor	**CalComp 2500 Series Model 25120** CalComp $915	PC **IS/ONE** Kurta $995 including choice of pen or cursor	**RDT-1212 Transparent Glass Digitizer** Scriptel Corp. $995 including pen or cursor	PC **Wacom SD-421L** Wacom $895	**SummaSketch II Professional** Summagraphics $999 including pen and 4-button cursor, $1,099 with 16-button cursor	**Penpad 320** Pencept $1,095 including pen or cursor
Size of tablet in inches	21.2 x 16.8 x 1.7	14.9 x 15.7 x 2.5	20.0 x 16.0 x 2.6	15.5 x 16.5 x 2.9	16.5 x 16.5 x 3.0	23.0 x 17.5 x 1.7	15.7 x 16.6 x 0.8
Size of work space in inches	12.0 x 18.0	12.0 x 12.0	17.0 x 12.0	12.2 x 12.7	12.0 x 12.0	18.0 x 12.0	11.0 x 11.0
Technology used	Electromagnetic	Electromagnetic	Electromagnetic	Resistive decoding	Electromagnetic	Electromagnetic	Electromagnetic
POINTING DEVICE							
Pen with button	■	☐	■	☐	Optional ($80)	■	■
Pen with ink	■	☐	■	☐	■	■	■
4-button cursor	■	Optional ($208)	■	■	Optional ($150)	■	■
16-button cursor	☐	Optional ($275)	☐	☐	☐	■	■
Other cursors available	☐	☐	☐ 12-button ($195)	☐	☐	☐	☐
Mouse driver	■	☐	■	■	■	■	■
Device is programmable	■	■	■	■	☐	■	■
Other pointing devices available	☐	☐	4-button cordless cursor ($100), 3-button cordless stylus ($100), 2-button stylus ($100)	☐	Pressure-sensitive stylus ($125)	☐	☐
Pen proximity (inches)	3/4	7/8	1/2	3/8	1/4	3/4	7/8
Cursor proximity (inches)	1/2	3/4	1/2	3/8	1/4	1	7/8
Screen displays work in real time	■	■	■	☐	■	■	☐
Connection to PC	Serial port	Serial port	Serial port	Serial port	Serial port	Serial port	Proprietary full slot interface card
Length of pen cord (inches)	35	51	40	48	Cordless	39	48
Length of cursor cord (inches)	35	51	43	44	Cordless	39	48
TEMPLATES							
AutoCAD	■*	☐	Optional $99	☐	☐	■*	■
Microsoft Windows	■*	☐	☐	☐	☐	■*	☐
Other	*Cadkey**, *VersaCAD** setup menu	☐	*PageMaker, VersaCAD*	☐	☐	*Cadkey**, *VersaCAD**	*Cadkey, CADvance, Pendraw, Penform, VersaCAD*
Allows user-customizable macros	☐	☐	■	☐	☐	☐	■
Software supplied	*AutoCAD* driver	None	*IS/Pensmith*	None	*AutoCAD* driver, test and diagnostics	*AutoCAD* and *Windows* drivers, test and reset utilities	*AutoCAD* and *Windows* drivers, diagnostics and setup, Microsoft Mouse Driver, one Penpad application
MANUFACTURER'S PERFORMANCE CLAIMS							
Resolution (lines per inch)	2,540	1,278	1,000	1,000	1,270	1,016	1,000
Accuracy (inches)	0.01	0.015	0.035	0.01	0.01	0.015	Cursor, 0.001; stylus, 0.005

PC—Editor's Choice ■—Yes ☐—No

*This template can be obtained with an included coupon redeemable through Promontory Systems.

Datatab ACT1212 ALTEK $1,310	**Grafbar GP-7 Mark II** Science Accessories Corp. $1,315 including pen or 4-button cursor	**Wacom SD-322L** Wacom $1,345	**ZedPEN** Numonics $1,395 including pen	**Penpad 310** Pencept $1,395 including pen or cursor
25.2 x 19.2 x 1.8	1.9 x 19.0 x 6.5	20.7 x 20.7 x 3.5	21.5 x 16.2 x 2.5	15.7 x 16.7 x 0.6
19.3 x 13.4	25.5 x 23.5	16.0 x 16.0	17.5 x 12.7	11.0 x 11.0
Electromagnetic	Sonic pulse	Electromagnetic	Electromagnetic	Electromagnetic
☐	☐	Optional ($80)	☐	■
■	■	■	☐	■
Optional ($290)	■	Optional ($150)	☐	■
Optional ($360)	☐	☐	☐	■
2-button ($145)	1-button ($175)	☐	☐	☐
☐	☐	■	☐	■
☐	■	☐	■	■
☐	☐	Pressure-sensitive stylus ($125)	☐	☐
3/8	27	1/4	1/2	7/8
1/2	27	1/4	N/A	7/8
☐	■	■	■	☐
Serial port	Serial port	Serial port	Serial port	Serial port
38	60	Cordless	44	48
42	60	Cordless	N/A	48
☐	☐	☐	☐	■
☐	☐	☐	☐	☐
☐	None	☐	☐	*Cadkey, CADvance, DOS, Pendraw, Penform, VersaCAD*
☐	☐	☐	■ (through optional software)	■
None	On request: *AutoCAD* driver, *Microsoft Windows* 1.03, startup package	*AutoCAD* driver, test and diagnostics	None	ADI driver, diagnostics and setup, *Windows* driver, one Penpad application
1,000	254	1,270	1,000	1,000
0.001	0.01	0.01	0.025	Cursor, 0.001; stylus, 0.005

ENDS

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and Feel

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CIRCLE 160 ON READER SERVICE CARD

and allow control of cursor output, aspect ratio, size, tracking velocity when emulating a mouse, and more, even with applications that don't have these features. The remaining ten soft keys are there for software developers to use, but sadly, there is no way for the casual user to program them.

HP's buttonless pen is one of the most comfortable to use, and a welcome byproduct of its trochoidal shape is its resistance to rolling off the tablet every time it is set down. The cord, at just 29 inches, is rather short, however.

The cursor, although attractive, is sometimes difficult to use. Unlike the 1.5-inch antenna coils used by some of the other manufacturers, HP has chosen a diminutive 0.1-inch aperture, further obscured by a red dot in its center. Tracing really intricate drawings could make you squint more than Mr. Magoo.

HP gets high marks for the excellent documentation supplied with the SketchPro. Thorough and well illustrated, it makes light work of selecting settings for the formidable bank of 32 DIP switches on the back of the tablet. Indeed, the list of switch settings for ten popular CAD programs is all that many users will ever need to know, but for those with unusual requirements, the manual will prove welcome.

FACT FILE

HP SketchPro
Hewlett-Packard Corp., 3000 Hanover St., Palo Alto, CA 94304; (800) 752-0900.
List Price: $599.
Requires: Serial port.
In Short: High-quality construction and considerable versatility are offset somewhat by mediocre performance. Still, the SketchPro is worthy of consideration by those who are charmed by the HP name.

CIRCLE 408 ON READER SERVICE CARD

In addition to its native mode, the SketchPro provides emulations of the Summagraphics Bit Pad II and Hitachi's HDG-1111B tablet (the latter with *AutoCAD*). It can also emulate a Microsoft mouse when used with the driver supplied on a diskette.

Testing with *AutoCAD* brought out the SketchPro's only downside: less than perfect performance. Its continuous output rate was slow, making for intermittent updating of the on-screen image position. Button clicks were also occasionally missed when either pointing device was moving quickly across the board.

The pen functioned reliably only when within 0.12 inch of the tablet's surface. Even though this exceeds HP's claim of operation within 0.1 inch, it precludes the tracing of relatively thick objects, such as a page bound within a book or magazine.

Despite these criticisms, the Hewlett-Packard SketchPro remains a leading contender for PC-based CAD applications when quality and completeness outweigh the quest for a rock-bottom price.

HITACHI AMERICA LTD.

Tiger Tablet HDG-1111C

by Frank Bican

With products ranging from nuclear reactors to medical instruments to television sets to semiconductors, Hitachi has burgeoned into a multinational conglomerate. But behemoth sales don't necessarily signal the most innovative products in a particular product line. That's the impression you get from the Tiger Tablet HDG-1111C.

A simple white wedge of plastic, the work surface is free of any seams. This may be as much for safety as anything else, because while the majority of the tablets we looked at were powered by the serial port or low-voltage power transformer, this one runs directly off a 110-volt power cord. A little spilled coffee could have disastrous consequences if it found its way inside.

Judging by its prodigious physical dimensions (17.2 by 16 inches), one would expect a larger workspace than the Tiger's 11 by 11 inches. It is probably for this reason that Hitachi put a proximity indicator LED along the top to indicate when the pointing device is within the active area. *AutoCAD* users may long for more than the meager 7.9- by 8.9-inch drawing space they will find.

Placing your favorite tools on top of the tablet may not be the best idea. Because it is painted with a particularly abrasive bright white paint, it tends to pick up scuff marks quite easily. Indeed, while undergoing tests in PC Labs, our unit picked up a couple of marks from a ruler being used for measurements.

On the rear of the enclosure are 24 DIP switches for configuring the tablet for applications. We were lucky—the switches were set properly for *AutoCAD* right out of the box. If the settings aren't right for your software, you'll have to consult the relatively skimpy manual for help. Its tables list each switch's function, but it doesn't offer any advice on which selections should be made for any of the major CAD packages.

Testing in PC Labs showed the HDG-1111C to be a rather lackluster performer, particularly when we used the pen. When it was raised as little as .12 inch from the work surface, the on-screen image jumped around wildly.

The optional 4- and 12-button cursors ($251 and $271, respectively) supplied with the test unit performed somewhat better, with no problems encountered until they were raised more than .25 inch off of the board. Both have .5-inch diameter nonmagnifying reticles that provide clear views of your work. Curiously, though, the 4-button cursor is fitted with a felt friction-reducing pad on the bottom, while the 12-button cursor has none.

Most interesting of all the Tiger Tablet's pointing devices is the optional 3-button pen ($159). It has an angled tip that remains perpendicular to the tablet when held at a conventional writing angle, three backward-sloping buttons along its top

Hitachi America's Tiger Tablet HDG-1111C is one of the biggest and newest names in the tablet market. It offers lackluster performance for the higher-than-average price of $727, which does not include any pointing devices, templates, or cables.

FACT FILE

Tiger Tablet HDG-1111C
Hitachi America Ltd., 950 Benicia Ave.,
Sunnyvale, CA 94086; (408) 773-8833.
List Price: Tablet, $727; stylus, $159; 4-button cursor, $251; 12-button cursor, $271; serial cable, $29.
Requires: Serial port.
In Short: An average performer in our tests, the Tiger Tablet is somewhat overpriced in relation to the competition.

CIRCLE **427** ON READER SERVICE CARD

edge, and a pair of wings at the back, presumably to keep it from rolling off the tablet when laid down. This is the pen that Buck Rogers would want.

The Tiger Tablet's most serious flaw is its price—$727. That's a whole lot for a tablet with no overlay, templates, cable, or standard pointing device. A bare-bones configuration will set you back a whopping $915. There are more-attractive digitizing alternatives available for considerably less money.

HOUSTON INSTRUMENT

HIPAD Plus 9018

by Frank Bican

The Houston Instrument moniker has become practically synonymous with plotters and tablets at engineering firms throughout the world. Its HIPAD Plus line of tablets runs the gamut from a $5,400 44- by 60-inch monster right down to the $895 12- by 18-inch unit (and its $550 12- by 12-inch sibling) that we evaluated.

Those obsessed with numbers and specifications will delight in the HIPAD Plus 9018. Its 2,540-line-per-inch resolution is more than double that of many of its competitors. Its maximum communication rate is 38,400 bits per second, four times quicker than most. And finally, in addition to its native mode, it possesses full or partial emulation modes for no fewer than 12 other graphics tablets and a Mouse Systems mouse.

Constructed of an attractive dark-gray plastic, the tablet is a slender 1.7 inches thick at the rear, tapering to just .5 inch at the front, giving the work surface a slight slant. Should additional tilt be desired, two plastic legs can be folded out of the bottom.

The 9018's 12- by 18-inch workspace is covered by a very heavy clear acetate overlay. While it would most often be used to hold a working drawing in place, it is also used to hold the parameter menu template.

Unlike many other tablets, this one doesn't have a single DIP switch. All of the parameter settings are made with a pointing device and the parameter template. These include such settings as baud rate, emulation mode, report rate, and resolution.

The procedure for changing parameters is quite simple. While pressing a switch on the back of the tablet (it's not necessary to quit whatever program is running), you just hold either pointing device over the desired selection and press any of its buttons. The tablet will beep to let you know that the selection has been made. When everything is properly configured, these start-up settings can be saved in nonvolatile RAM. Be careful not to misplace the template, because changing settings without it will be difficult.

Houston Instrument claims that the HIPAD Plus 9018 contains special circuitry that eliminates parallax errors that can be caused by tilting the pen. Testing at PC Labs tended to bear out that assertion, at least while the pen was held at an angle of 45 to 90 degrees to the tablet. Below 45 degrees, the tablet simply stopped sending any coordinates to the PC. It's hard to

The HIPAD Plus 9018 is Houston Instrument's best digitizing tablet. At $895, it may be expensive, but in this case you get what you pay for. Outstanding speed, 2,540-line-per-inch resolution, and your choice of application templates make the HIPAD a good buy.

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CIRCLE 176 ON READER SERVICE CARD

FACT FILE

EDITOR'S CHOICE

HIPAD Plus 9018
Houston Instrument, 8500 Cameron Rd., Austin, TX 78753; (800) 444-3425, (512) 835-0900.
List Price: With pen and cursor, $895.
Requires: Serial port
In Short: Its top-quality construction, numerous emulation modes, good performance, and excellent documentation make the HIPAD Plus 9018 a winning choice among tablets.

CIRCLE 409 ON READER SERVICE CARD

imagine why anyone would want to hold it at such a shallow angle, though.

The standard four-button cursor proved to be every bit as capable a performer as the pen. Far from the minuscule antenna coils found on some cursors, this one measures a generous 1.1 inches in diameter. Within it is a nonmagnifying cross-hair reticle that proved quite easy on the eyes when tracing out a drawing.

In addition to its plethora of tablet emulations, the HIPAD Plus 9018 includes a disk with an Autodesk ADI device driver. In addition to allowing the tablet to function with *AutoCAD*, this one is supposed to function with *AutoSketch* and *AutoShade* as well.

Even though you probably won't have to consult the manual very often, you'll appreciate what a clear and thorough job Houston Instrument has done with it. It certainly rates as one of the best of the lot.

Although the suggested list price of $895 is fairly high among this group, it seems completely in line, considering the 9018's spacious 12- by 18-inch workspace and excellent performance. For those on a tighter budget, the HIPAD Plus 9012 offers identical performance in a smaller, 12- by 12-inch tablet for a more affordable $550.

KURTA CORP.

IS/ONE

by Frank Bican

Cordless technology is being applied to a growing number of applications, keeping battery makers smiling all the way to the bank. These devices range from conveniences (such as a cordless phone or a battery-powered laptop) to devices that could not exist without cordless control. Just try to picture a corded garage door opener.

Cursors and pens with cords are quite usable, and they have the advantage of being difficult to lose, but once you've tried Kurta's cordless counterparts with the $995 IS/ONE (Input System/ONE) tablet, you'll never want to go back.

Tablets were originally designed to make drafting work easier—cordlessness brings ease-of-use one step further. Switching between a cursor and pen with most other tablets means unplugging one, plugging in the other (maybe untangling the cords), and perhaps changing a few DIP switch settings.

Not so with the Kurta's cordless pointers. Just pick up the pointer you want and you're ready to go. Switching among pointers during an *AutoCAD* drawing proved quite useful. I could use the cursor for laying out precise lines and then change to the pen for a little freehand work.

Both the three-switch pen and the four-button cursor are powered by five LR44-size alkaline batteries. To keep them from wasting their precious energy when left unattended, Kurta has designed hand-capacitance switches into each so that they operate only when being held.

Expanding on the IS/ONE's capabilities, Kurta offers over 20 templates, ranging from general-purpose CAD applications, to specialized subtemplates (fluid power, architecture, and the like), to *PageMaker*. Although the $99 price for each seems a bit high, the templates could prove to be worth far more if you really need them.

The Kurta IS/ONE tablet, $995, is a former *PC Magazine* Award for Technical Excellence winner that brings the ease-of-use and convenience of cordless technology to digitizing tablets. Twenty programmable soft keys reside along the top, allowing you to expand the tablet's power and functionality.

Besides the templates, the IS/ONE also incorporates a horizontal row of 20 programmable soft keys along the top edge of the work surface. Four of these select various working combinations of the pen's switches, five select among alternative operating modes, and the remainder can be programmed. When used with a program on the utility disk, the resultant macros can be stored in a file for later recall.

FACT FILE

EDITOR'S CHOICE

IS/ONE
Kurta Corp., 3007 E. Chambers St., Phoenix, AZ 85040; (602) 276-5533.
List Price: Tablet, $995 with one cursor or pen; corded 1-switch ink pen, $150; corded 2-switch pen, $100; corded 4-button cursor, $100; corded 12-button cursor, $195; cordless 3-switch pen, $100; cordless 4-button cursor, $100; templates, $99; serial cable, software, and manuals $50.
Requires: Serial port.
In Short: Commendable performance, the convenience of being able to switch back and forth between the cordless pen and cursor, and a wide range of optional templates make the IS/ONE a premium graphics tablet for PC-based CAD and DTP applications.

CIRCLE 410 ON READER SERVICE CARD

Also on the utility disk is a device driver that Kurta refers to as PENSMITH. It serves as both an *AutoCAD* ADI driver as well as one for a Microsoft mouse. Toggling between tablet and mouse modes requires a click on one of the soft keys.

All three of Kurta's cursor configurations are quite colorful. The buttons are arranged in circular fashion, and each is a different color. Handsome though they may be, I doubt that the 12- or 16-button models are particularly easy to use without some practice. In any case, their nonmagnifying, half-inch cross-hair reticles are adequate for most applications.

Tests at PC Labs showed all of the IS/ONE's pointing devices to be similar performers; each could continue tracing over objects as thick as 0.5 inch. Even though the cordless pointers seem like prime candidates for interference, none was observed.

The cabinet of the IS/ONE is made of a uniform gray plastic and measures 20 by 16 inches. A recessed 17- by 12-inch workspace holds a sturdy acetate overlay.

Although the review unit's overlay was smooth, a matte-finish version is available as an $18 option.

On the back of the enclosure is a bank of 24 DIP switches that select the default configuration as well as connectors for the power cord, cord-type pointing device, and serial cable. The last has a DIN-type connector at the tablet end and a DB-9 connector for the serial port.

Further enhancing the appeal of this tablet, Kurta offers interface kits for Macintosh Plus, SE, and II*x* systems, and for the Amiga.

Unless you can think of some reason why you must have a corded pointer, stick with one of Kurta's cordless models (they cost no more, and in some cases less) and relish the freedom the IS/ONE provides.

KYE INTERNATIONAL CORP.

Genius Digitizing Tablet GT-1212A

by Frank Bican

KYE International Corp. offers a number of alternate input devices and attendant software for many graphics applications, including scanners, mice, and entry-level CAD and desktop publishing software. The most interesting and ambitious of the lot, though, has to be the Genius Digitizing Tablet GT-1212A.

Bundled as a relatively complete package including tablet, four-button cursor, *AutoCAD* template, and more software than you might expect, the Genius Tablet is a surprising bargain.

Its $429 suggested list price makes the GT-1212A one of the least-expensive tablets available. That would be a reasonable enough price, but a quick check through some recent mail-order ads revealed prices as low as $309.

For that sum, KYE throws in quite a bit more software than the usual *AutoCAD* driver. You get a copy of Media Cybernetics' *Dr. Halo III*, a general purpose icon-based drawing program much along the lines of *PC/Paintbrush Plus*. It's not the type of program that one would use as a substitute for an honest-to-gosh CAD package, but then again, it's a whole lot easier to use for making freehand drawings.

But that's not the last of the bonus software. KYE also bundles *Genius Menu Maker*, a program that can be used to generate pop-up function menus not only for CAD applications, but for programs such as *Lotus 1-2-3* as well. *Menu Maker* would seem to be better suited to a mouse than a tablet, but that's all right because the Genius tablet is capable of emulating both Microsoft and Mouse Systems mice.

One of the Genius tablet's more unusual features is its power source; the tablet gets its juice from the keyboard socket. A 12-inch cable runs between the keyboard plug and the tablet and diverts power through another short cable to a jack on the side of the serial port connector. This works well enough on an IBM or similarly constructed compatible where both the keyboard and serial port jacks are on the back of the cabinet. But on systems such as the Compaq Deskpro 386/25, where the serial port is on the back and the keyboard connector is on the front, it's an invitation to test the tensile strength limit of the adapter cable. For those not wishing to entwine their system with this cardiac bypass arrangement, an optional external power supply is available.

The two-button pen that is supplied with the GT-1212A is well-styled, but the four-button cursor leaves plenty to be desired. Its toylike neon-bright buttons beg to

KYE International Corp.'s Genius Digitizing Tablet GT-1212A doesn't represent any technological breakthroughs, but for $429, it's one of the least expensive and most complete packages available. It comes with a stack of software, including Genius *Menu Maker*, a program that lets users generate pop-up menus for many applications.

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CIRCLE 120 ON READER SERVICE CARD

FACT FILE

Genius Digitizing Tablet GT-1212A
KYE International Corp., 12675 Colony St., Chino, CA 91710; (800) 456-7593, (714) 590-3940.
List Price: With cursor, $429; pen, $50.
Requires: Serial port.
In Short: The oddball keyboard-jack power system is fine for IBMs, but a bit awkward for Compaqs. Still, the package comes complete with *Dr. Halo III*, performs quite well, and is one of the best buys in this group of tablets.

CIRCLE 411 ON READER SERVICE CARD

be yanked out by a two-year-old. Beyond that, the nonmagnifying reticle, though of adequate diameter, has cross hairs that are embossed into it rather than painted on. Unless oriented just so to the ambient light in the room, they are really quite difficult to see.

In testing, the Genius GT-1212A proved to be a capable, if not distinguished, performer. Both pointing devices were usable all the way out to 0.75 inch from the tablet's surface, and no matter how quickly an image was drawn, it remained faithful to the intent of its creator.

When price and versatility are your main considerations in selecting a graphics tablet, give the KYE Genius GT-1212A careful consideration. It may not advance the state of the art, but it offers a lot for your money.

NUMONICS CORP.

Numonics 2206 GraphicMaster ZedPEN

by Winn L. Rosch

Numonics has moved up from an undistinguished position in the tablet market to a solid number three in a newfangled way—mergers and acquisitions. In June 1987 it acquired Pencept; in October 1987 it added mouse-maker Torrington to its assets; and in April of this year it joined with Terminal Display Systems, England's only tablet-maker.

These three products give glimpses of that evolution. ZedPEN represents a novel technology added through the merger with TDS. The Numonics 2206 is the recent outgrowth of a proven line of Numonics tablets. The GraphicMaster is a revolutionary new offering crafted by Pencept that pits Numonics squarely against the latest and best the tablet market has to offer.

Introduced in October 1988, the $595 Numonics 2206 combines the best features of the company's 2205 (introduced in April 1987) and 2207 (introduced in April 1988), specifically, the quality and features of the former and the trimmer styling and downloadable commands of the latter.

While the combination is a good one, it's definitely dated. The result is still a big, heavy, pad measuring 23 by 23 inches and 1 inch thick. Covered in white-beige plastic, it's built on a solid black metal foundation. The top surface is unmarked except for the Numonics logo and model number. The 20.5- by 20.5-inch active area is not indicated in any way.

The tablet draws its electricity from a large black brick transformer that burrows into a wall outlet, supplying 500 milliamps of 5 volts DC and 130 milliamps of 12 VDC through its 78-inch cord. Numonics also supplies a 112-inch serial cable with the 2206, terminating in either a 9-pin D-shell (for ATs) or a 25-pin D-shell; you choose when you order.

The 2206 tablet provides two jacks on its rear panel that allow you to plug in both a cursor and pen at the same time. It generally recognizes whichever one is closer to the tablet.

The four-button cursor looks like a Transformer stolen from a child's toy box; it has a dark gray angular case with inset finger grips at either side. The 2.25- by 3.12- by 0.75-inch case is extended by a 1.5-inch reticle with a small central circle not pierced by the plus-shaped hairlines. It's easy to grasp but forces your fingers into a pincerlike grip that may not be comfortable for long periods. The cursor is available in one- and four-button models for $105, a 16-button version for $205, and a number of other variants.

The pen, 1.5 inches around and 6 inches long, is a fat imitation of a fountain pen. Although its plastic case feels a little slippery, it is easy enough to use. The inkless cartridge supplied by Numonics was molded from nylon; its almost dangerously sharp point quickly wears down to a smooth tip after a few minutes of use.

The $65 pen uses a tip-switch as its only control. For an additional barrel-mounted button, you'll have to spend $75 for the two-switch pen. All pointing devices for the 2206 are equipped with 36-inch cables.

Neither cursor nor pen demonstrated much proximity range. The pen was reliably detected at .25 inch; the cursor, at .37 inch. One feature we were delighted to find defeatable was the beep emitted by the tablet every time a point was indicated. Worse than the headache it caused, the beep slowed down response. Although the on-screen cursor moved rapidly, when points were specified in quick succession,

The three tablets representing Numonics' line include (left to right) the $1,395 ZedPEN, the $595 Numonics 2206, and the $595 GraphicMaster. The ZedPEN and the 2206 were once revolutionary products whose practicality and ergonomics have waned in comparison with the evolutionary, sleek, and upwardly mobile GraphicMaster.

often several would be lost because of beeping overhead. Turn off the beep, and the 2206 keeps up with the quickest *AutoCAD* drawing.

The setup of the 2206 is probably its most retrograde feature. To get the 2206 working, you must first adjust a bank of DIP switches on the rear panel to set serial speed and emulation mode, a process that is not helped much by a little pamphlet Numonics calls a user guide. We found (through experimentation, not through the pamphlet) that *AutoCAD* worked best with the 2206 in Summagraphics MM emulation, but the tablet yielded a modest 9.5- by 10-inch pad to cover the active drawing screen.

On the positive side, the 2206 is supplied with two disks of software that include ADI, mouse, and *Microsoft Windows* drivers in addition to diagnostics and field support.

THE GRAPHICMASTER

While the 2206 is evolutionary, the GraphicMaster is revolutionary, at least for Numonics. Because it's essentially a minimalist pad, it's a most desirable tablet. Heft the 15- by 15- by 1-inch tablet, and you'll think that there's almost nothing in your hands. The pad is only a thin sheet of plastic with a raised honeycomb of reinforcing ridges on the bottom. At about 2.25 pounds, it would be perfect for use on your lap if the ridges didn't do a meatcutter's job on your legs.

Underneath the tablet is a small area about the size of an index card that holds all of the electronics of the unit. On the right side of the electronics box are a jack to plug in the cursor and an LED to indicate mode changes.

The light weight of the pad is complemented by the relative freedom of having only one tether besides the cursor cable. Both power and signal travel through the same 81-inch cable. A 9-pin D-shell connector plugs into the back of the tablet, and a 25-pin D-shell is included for plugging into your own serial port. The GraphicMaster draws all the power it needs through the serial connection.

The menu system built into the electronics is activated by unplugging the cursor (or pen), holding down one of its buttons, then plugging it back in while keeping your finger on the button for two flashes of the LED indicator on the side. The placement of this LED is a design error—it should be on top of the tablet where it can be seen.

FACT FILE

Numonics Corp., 101 Commerce Dr., Montgomeryville, PA 18936; (800) 247-4517, (215) 362-2766.

Numonics 2206
List Price: With 4-button cursor and pen, or 16-button cursor, $595.
Requires: Serial port.
In Short: An older-design electromagnetic tablet that's eclipsed by its newer sibling (GraphicMaster) but nevertheless offers a good buy for a large, 20.5- by 20.5-inch tablet.

CIRCLE 412 ON READER SERVICE CARD

GraphicMaster
List Price: With 4-button cursor and pen, or 16-button cursor, $595.
Requires: Serial port.
In Short: A trendy blue tablet with good resolution and accuracy. Light in weight, the GraphicMaster draws its power through its serial connection.

CIRCLE 413 ON READER SERVICE CARD

ZedPEN
List Price: $1,395.
Requires: Serial port.
In Short: An old-style large electromagnetic tablet with a pressure pen capable of detecting 128 distinct levels of pressure. Once a leader in pressure-sensing, now outrun by the Wacom models.

CIRCLE 414 ON READER SERVICE CARD

After the flashes, the tablet itself becomes a selector—move the cursor to the emulation or operating mode you desire from those printed on the cheap paper menu template supplied with the tablet, then click. Emulations include Numonics, BPI, Summagraphics MM and Delta, Microsoft Mouse, and ASCII characters. As vital as this setup template is, it should be laminated or printed on something more substantial than the paper that was supplied with the unit we investigated.

The GraphicMaster tablet works quite well, and it proved more than up to the speed required for *AutoCAD* with its 160-point-per-second maximum drawing speed. The range of its sensors was large, losing proximity only after the cursor was withdrawn 2 inches away from the tablet. At that point it became unstable and sent a jittery stream of data, with the indicated cursor position varying wildly until contact was lost. Resolution reaches the 1,000 lines per inch common among tablets. Accuracy is rated at 0.01 inch.

The four-button cursor accompanying the GraphicMaster has a 40-inch cord. Although shaped like a mouse, it's somewhat

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Desk Accessories	yes	no	no	no
Mouse Support	yes	no	yes	no
File search by name and content	yes	no	no	no
Encrypt/decrypt files	yes	yes	no	no
Screen saver	yes	yes	no	no
All memory available to user application	yes	yes	no	no
Password Protection	yes	yes	yes	no
Unlimited menus	yes	no	yes	no

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CIRCLE 130 ON READER SERVICE CARD

smaller (2.25 by 3.25 by 0.5 inches with a 1.5-inch paddle) and the buttons require curling your hand into an uncomfortable grip. The four blue buttons of the standard cursor are arranged in an inverted T, and the reticle is a pair of cross hairs with a small central target circle.

Slightly streamlined, the GraphicMaster pen is among the more comfortable pens to hold. The pen features a tip-switch and a sharp nylon uninked tip much like that of the 2206.

GraphicMaster pointing devices arrived with 40-inch cables ending in three-conductor miniature phone plugs. A 16-button cursor is available as a substitute for the combination of 4-button cursor and pen that's supplied as standard equipment. The tablet includes a Microsoft Mouse emulator, a *Windows* driver, and an *AutoCAD* ADI driver in addition to its diagnostics and maintenance routines.

> Slightly streamlined, the GraphicMaster pen is among the more comfortable to hold.

THE ZEDPEN

The ZedPEN system looks radically different from the rest of the Numonics line and most other tablets that find their way to these shores, probably because it comes from across the Atlantic, where Terminal Display Systems is the leading tablet vendor. The ZedPEN was the first product there to add a third dimension to tablet digitization. In England, what we call *zee*—as in *z*-coordinate—is pronounced *zed*, hence the name ZedPEN.

The tablet reflects another transatlantic difference. In America, the 12- by 12-inch tablet is tops; in Britain, it's the 12- by 17-inch size (standards A4 and A3, respectively). The tablet received for review, an A3, is thus hefty and expensive by U.S. standards: 14.5 pounds and $1,955. ZedPEN is also available in the smaller A4 format for $1,600.

The ZedPEN tablet is a white lucite wedge measuring 21.5 by 16.25 inches and rising from just under one inch at the front edge to a little over 2.5 inches at the rear. The drawing surface, with a 17.5- by 12.73-inch active area, is set off by a border about an inch wide around the tablet, a little wider on the right edge where there is a shallow trench for resting your pen.

On the back panel you find the connector to plug in the pen, a 12-VDC input to power the tablet, a red indicator LED, a small (.1 inch) reset button, two serial ports that use 25-pin D-shell connectors, and a 9-pin D-shell connector for the ZedPEN itself. All of the connectors are recessed about 2 inches under top of the tablet so that the connectors stay out of your way. The external transformer connects through a generous 112-inch cord, and the serial cable provided is even longer at 127 inches.

The ZedPEN pen is finished in brushed stainless steel and measures about 1.5 inches in circumference and 6 inches long. Although the steel makes it sturdy, the pen feels somewhat slippery. Because of the design of its sensory mechanism, ink cartridges cannot be loaded.

The entire ZedPEN system is self-programmed using the pen, tablet, and standard setup template. Press the reset button on the back of the tablet and it enters its setup mode. All you need to do to select mode or emulation is press the pen against the appropriate menu choice. Nonvolatile memory within the tablet remembers your choice. However, setting up the tablet is an act of faith because it yields no visual indication of its settings or even that a setting has been accepted and updated.

The proximity range of the system proved modest, only about 0.25 inch. The system is quick enough to draw points as fast as you can press them into *AutoCAD*.

The distinctive feature of the ZedPEN is its pressure sensitivity. The force applied to the pen tip is digitized and transmitted to the pad's computer host for use as applications see fit. The ZedPEN distinguishes 128 discrete pressure levels. At one time, the ZedPEN system was the only pressure-sensitive tablet available. Now it is showing its age (three years) as 256-level pressure pens and cordless pressure pens increasingly become available.

The ZedPEN is still a workable choice for applications that call for an extra dimension. However, it may no longer be the best choice. The same is true of Numonics 2206. The GraphicMaster, however, can hold its own against the best of them.

PENCEPT

Penpad 300
Penpad 310
Penpad 320

by Winn L. Rosch

Putting pen to tablet makes us wonder why we must still rattle our fingers on pesky and frustrating keyboards to get the words we want on PC screens. If we can draw on tablets, why can't we write what we want to say? Why can't computers understand what we write as they do what we type?

The same thoughts evidently occurred to the engineers at Pencept—and they did something about it. The top of the Penpad line amounts to what must be the smartest tablets around. Not only do these tablets let you draw lines but they can recognize your handwriting—or rather, your printing—as well, albeit within some rather severe limitations.

This sampling of three tablets from Pencept (now part of the Numonics empire) shows the most and least of the current product line. At the bottom is the Penpad 300, a tablet that simply adds a few new nuances to conventional digitizing designs. At the top is the Penpad 320, essen-

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Pencept, A Division of Numonics, 460 Totten Pond Rd., Waltham, MA 02154; (617) 890-8877.

Penpad 300
List Price: With pen or cursor, $695.
Requires: Serial port.
In Short: A modern, lightweight electromagnetic tablet with moderate resolution and the highest accuracy of any tablet tested (.001 inch). The tablet features a padded armrest.

CIRCLE 415 ON READER SERVICE CARD

Penpad 310
List Price: With pen or cursor, $1,395.
Requires: Serial port.
In Short: A lightweight, highly accurate tablet with hand-printed-text-recognition abilities. This model uses an external processor that can be connected to workstations as well as to PCs.

CIRCLE 416 ON READER SERVICE CARD

Penpad 320
List Price: With pen or cursor, $1,095.
Requires: Full-length expansion slot.
In Short: A lightweight, highly accurate tablet with hand-printed-text-recognition abilities, the Penpad 320 plugs into a free expansion slot.

CIRCLE 417 ON READER SERVICE CARD

tially a 300 with a college education—or at least grammar school training. Courtesy of hardware and software add-ons to the basic 300, it gives a snapshot of the future potentials of digitizing technology. The Penpad 310 crowds the 320, offering its capabilities to computers and workstations lacking the standard PC expansion bus.

Though at the bottom of the Pencept line, the $695 Penpad 300 is out ahead of other tablets as far as claimed accuracy is concerned. Switching to a pen trims accuracy (but not resolution) down to 0.005 inch, twice as sharp as the best of the rest. Because the other Penpad tablets share the same 300 mechanism, their specifications are the same.

Although this accuracy level is commendable, it's probably unnecessary for general drawing programs. But one critical application that likely benefits from the high accuracy is the recognition of hand-printed text. Little wonder the more expensive Model 320 ($1,095) and the Model 310 ($1,395) are built on such a precise platform.

Using the highly accurate digitizations of hand-printed characters, the 310 and 320 apply powerful pattern-matching algorithms to recognize each individual character you draw on the tablet. Pencept's interface software then allows you to use the recognized characters just like typed data as input to your applications. The macro facility built into the Pencept programs allows one recognized character to elicit elaborate functions. Or you can just write in data instead of typing it.

Externally, the Model 300 tablet upon which all three systems are based is refined but hardly distinguished. Like most recent tablet designs, it has the look and feel of a solid slab of plastic—and that's good. There's nothing to come loose or break. Measuring 15.75 by 16.75 inches, it yields a somewhat modest active digitizing area measuring 11 by 11 inches. Using its own driver under *AutoCAD* results in a drawing area of but 6.75 by 7.5 inches.

The one innovation incorporated into the Pencept design is a brown padded palm rest at the bottom of the drawing area that does double duty by stopping drawing pens from rolling off the surface.

Mass is saved in the slim tablet by the use of an external power source. In the Model 300 system, electricity comes from a lamprey transformer that plugs into a standard wall outlet and pulls the 6 watts required to make the three different voltages that run the tablet. The power lead plugs into a 6-inch pigtail dangling from the 25-pin D-shell connector at the end of the 69-inch serial cable that plugs into your PC. The 310 and 320 get the needed power to the serial cable in a somewhat different manner using special interfaces.

The Penpad 320 uses a proprietary PC expansion board that requires one full-length 8-bit slot for its connection with

Pencept offers many strong choices in its line of tablets: from left to right, the $695 Penpad 300, the $1,395 Penpad 310, and the $1,095 Penpad 320. The innovative 310 and 320 each offer basic handwriting recognition, while the 300 has superior accuracy.

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