

# PC MAGAZINE

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SlashBar 1.0  
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COPY FILE(S)

DOS

FREE LOTUS-STYLE MENU  
FOR ALL YOUR APPLICATIONS

## Personal System/2: IBM's Bold New Line

- *New Graphics*
- *New Bus*
- *New DOS*
- *New Size*



- Next-Generation Workstations:
  - Fast
  - Powerful
  - Secure
  - Connectable

- Special Report: How the Lotus Lawsuit Affects You
- 10 Ultra-High-Res Graphics Boards



## IBM Builds New Plateau With Personal System/2

**PC ANALYSIS**

 BY BILL MACHRONE  
 AND PAUL SOMERSON

After 2 years of lackluster product introductions and an eroding market share, IBM took a bold step in April to shore up its position as the PC industry leader.

The company announced a sleek new line of computers—dubbed the Personal System/2 to differentiate it from the older generation of PC hardware—and a wide assortment of advanced peripherals and software. Calling the products “a new generation,” IBM officials rolled out:

- Three families of computers, featuring 3½-inch disks across the line and spanning the full range of Intel processors, with one chassis based on the 8086, two on the 80286, and one on the 80386.

- A new display standard built into two of the families, called Video Graphics Array (VGA), that offers higher resolutions and greater color selection than before.

- Four new analog monitors: an inexpensive black-and-white monochrome display, two smaller color displays, and one 16-inch high-resolution 1,024-by-768-dot display.

- Three enhanced families of printers, including two models of IBM's first 24-wire Proprinter, a speedier and whisper-silent Quietwriter printer, and a capable Ricoh-based laser printer with an optional adapter offering PostScript drivers and

*(continues on page 36)*


The Personal System/2 ranges from an 8086-based Model 30 (left), to the 80386-equipped Model 80. A line of four new analog displays—interchangeable among models—achieves higher resolutions and greater color choices than before.

## OS/2: Multitasking DOS Slated for '88

**PC PREVIEW**

BY CHARLES PETZOLD

It's not called DOS 5 or Protected Mode DOS or 286DOS or ADOS or CP-DOS.

It's called Operating System/2 (OS/2), and while it's not here yet, IBM plans a first quarter of 1988 release for the new operating system.

OS/2 is Microsoft's long-awaited multitasking operating system that exploits the “pro-

tected mode” of the 80286. Programs developed for OS/2 have access to 16 megabytes of real memory and 1 gigabyte of virtual memory.

These programs can be safely and efficiently multitasked, can create multiple threads of execution, and can engage in various types of interprocess and data sharing.

IBM's OS/2 will retail at \$325. The new operating system will run on all IBM PCs

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**SPECIAL REPORT:**
**IBM PS/2 MODEL 50**

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**A 6-YEAR HISTORY**

 Perspective on the newly expanded PC family ..... **46**
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# PS/2 Model 50: One-Stop Shopping For a Nearly State-of-the-Art 286 PC

## PC HANDS ON

BY CHARLES PETZOLD

The Personal System/2 Model 50 is the first computer to come with a built-in party game. The object of this game is to disassemble and reassemble the machine as quickly as possible. Screwdrivers are prohibited. Sound impossible? With a little practice, you might be able to clock in at under a minute.

This is no joke—the Model 50 has a modular construction that lends itself to the easy replacement of parts. The cover is connected by two thumbscrews at the back. Inside, the machine has no cables. The speaker slides out, the fan slides out, the floppy disk drive slides out, and the hard disk slides out. The only pieces bolted to the case are the power supply and the system board. Yet everything inside seems secure.

Remember how the screws that connect expansion boards to the chassis used to fall down to the system board? Those screws are gone. Thumbscrews on the outside of the case now hold down the expansion boards.

### Faster Than an AT

The PS/2 Model 50 is the lowest-cost 80286-based machine in the PS/2 line. The 80286 microprocessor in the Model 50 runs at 10 MHz with one wait state on memory accesses, so the machine's processing speed clocks in about 25 percent faster than the 8-MHz PC AT. The system board includes a megabyte of memory, a parallel port, a serial port, a mouse port, and the Video Graphics Array (VGA) video adapter. The only extra hardware you need is one of the four new IBM monitors.

In one sense, the Model 50 is

the simplest machine in the Personal System/2 line because it is available in only one configuration: a 20-megabyte hard disk and one 1.44-megabyte 3½-inch floppy disk drive are standard. The Model 50 has room for a second internal 1.44-megabyte 3½-inch disk drive (\$245), but not for a second hard disk. Installation of a second floppy disk drive is ridiculously easy. The 20-megabyte hard disk is the only hard disk currently available for the Model 50, but if others become available in the future, hard disk replacement should also be a snap.

The hard disk is rated at 80-millisecond access time, and PC Labs tests show that to be accurate. This is comparable to the hard disks that are standard IBM issue in the PC-XT and the XT Model 286. To people who are accustomed to a PC AT (which has a hard disk with a 30-milli-

second access time), the Model 50 hard disk will seem a little slow.

In comparison with PCs and ATs, the Model 50 box is tiny and occupies a smaller footprint than even the Model 30. It has about the same depth (16½ inches) as an old PC or XT, but the 14-inch width makes it about 6 inches narrower than a PC or XT and 9 inches narrower than an AT.

### Uses New Bus

The Model 50 uses IBM's new Micro Channel Architecture (MCA) bus for expansion boards. One slot is dedicated for the hard disk controller and



## Benchmark Tests: IBM Personal System/2 Model 50 vs. 8-MHz IBM PC AT

The 10-MHz IBM Personal System/2 Model 50 tested out at 20 percent faster than the 8-MHz PC AT across the board, except in two areas: floating-point calculations, where it is 40 percent faster, and in hard disk seeks, where the Model 50's disk takes more than twice as long as the hard disk delivered with the IBM PC AT.

### Performance Times

(Times given in seconds except where noted)

	NOP	80286 Instruction Mix	Conventional Memory	Floating-Point Calculation (with 80287)	BIOS Disk Seek (milliseconds)
8-MHz IBM PC AT	4.17	8.96	1.32	3.18	37.19
IBM PS/2 Model 50	3.36	7.14	1.00	1.86	80.52

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 128K loop.

The **80286 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

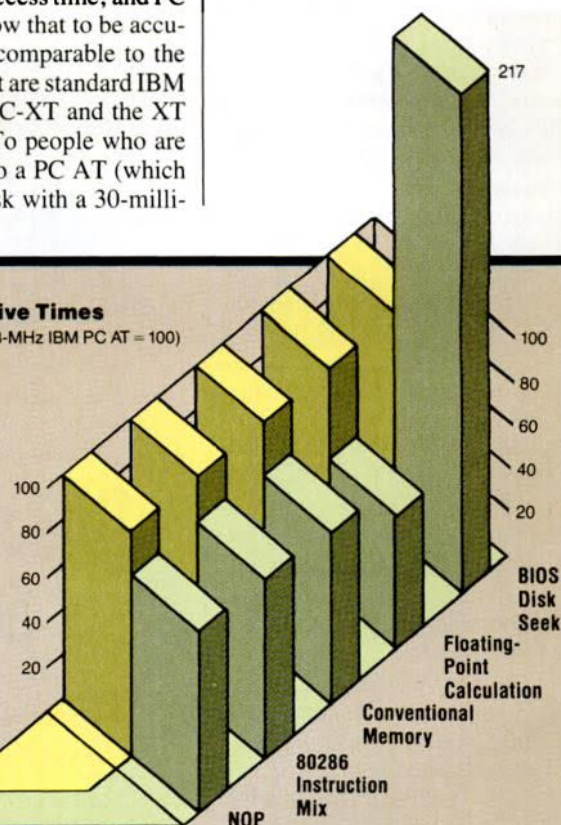
The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64K-byte records, then 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

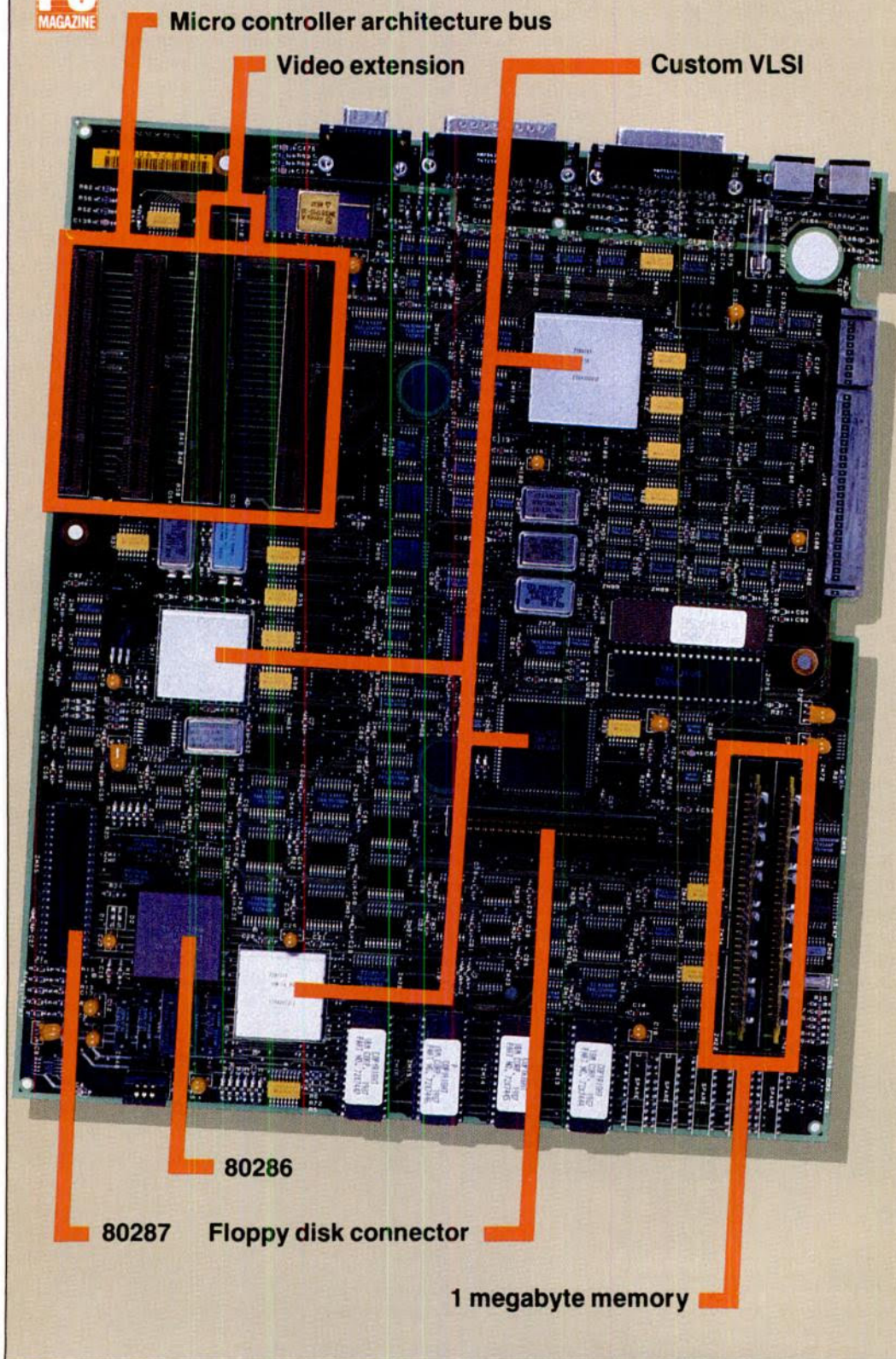
### Relative Times

(Ratio: 8-MHz IBM PC AT = 100)



PC  
MAGAZINE

## PS/2 Model 50 System Board

PC  
MAGAZINEF A C T  
F I L E

**Personal System/2 Model 50**  
IBM Corp.

Contact your local authorized IBM dealer.

**List Price:** \$3,595

**Requires:** One of IBM's four Personal System/2 Monitors (either the 8503, 8512, 8513, or 8514), DOS 3.3.


**In Short:** The Model 50 is a small but powerful 80286-based machine with everything except a monitor built into the box (including a 640 by 480 graphics adapter). The only real drawbacks are an unimpressive 20-megabyte hard disk and limited expansion capabilities.

CIRCLE 421 ON READER SERVICE CARD

"IBM Goes Analog," First Looks, page 43.)

What does the Model 50 give you over the Model 30? The Model 50 is faster because it uses an 80286 rather than an 8086. The Model 50 has EGA-compatible graphics while the Model 30 does not. In the future, the Model 50 will be able to run the new OS/2 operating system while the Model 30 will not. On the other hand, the Model 30 can use existing expansion boards while the Model 50 requires boards based on the new MCA bus, and there are very few of those right now.

What do you lose by not making the step up to the Model 60? The floor-standing Model 60 also runs a 10-MHz 80286, but it comes with a 44-megabyte or 70-megabyte hard disk (rated at 30-millisecond access time rather than 80) and can also take a second hard disk. The Model 60 has seven free expansion slots rather than the three in the Model 50.

I suspect the Model 50 will be a popular item in the Personal System/2 line for PC users who do not have large mass-storage requirements or a need to add expansion boards. The small box and simple internal construction make an appealing combination; the lack of options makes it an easy buy. 

three are free. (The machine doesn't need a floppy disk controller because it's built into the system board.) After OS/2 comes out some time next year, you will probably want to use one or two of the free slots to expand memory beyond the 1

megabyte on the system board.

I tested the Model 50 with IBM's 8513 12-inch color display. To my mind and eyes, a 12-inch display borders on the unacceptable, but it's definitely usable and it doesn't swamp the system unit with its size. The

VGA graphics adapter built into the Model 50 is EGA compatible but uses a larger 8- by 16-character box in text modes. The VGA is also capable of graphics modes of 640 by 480 pixels with 16 colors and 320 by 200 with 256 colors. (See

## Personal System/2

(continued from page 33)

more fonts than the Apple LaserWriter.

- Two new operating systems: Operating System/2 (OS/2), which will offer true multitasking, available early next year for 80286 and 80386 machines; and a beefed-up version of the existing DOS 3.x.

- A removable-media optical WORM (write once, read many) disk drive capable of storing 200 megabytes of data.

- A host of other products, including new LAN and 3270 emulators and software; a tape drive adapter; hard disks of varying sizes up to 115 megabytes; a 336-voice MIDI "music feature" and a new speech reproduction board; a two-button mouse; and assorted products that increase memory size, facilitate data transfer, and upgrade standard IBM applications software.

As important as what IBM announced is what it didn't announce. For the last 6 months, nervous competitors had speculated that IBM was going to reverse direction and shut down its open architecture. Word was that ROMs would be serialized, or "fingerprinted," to ensure that the new operating system wouldn't work on non-IBM hardware, and that the entire motherboard would be reduced to a handful of chips impossible to duplicate and so inexpensive

to produce that clone makers wouldn't have a chance.

While IBM did indeed reduce the chip count, wrap everything around five new custom VLSI gate arrays, and run all but the low-end Model 30 off a new state-of-the-art bus design called Micro Channel Architecture (MCA), IBM representatives went to great pains to emphasize that the PS/2 line would remain wide open to third-party manufacturers. And despite price cuts in the existing line, clone makers breathed easier when they learned that the lowest-priced system would retail for around \$2,000.

Still, in contrast to the PC's 100 percent reliance on off-the-shelf parts, the new machines contain as little as 20 percent shelf components. This, coupled with potential patent or copyright infringement on the MCA bus, will make these machines far more difficult to clone than the PC and AT.

The most modest PS/2 machine is IBM's 8086-based Model 30, running at 8 MHz with zero wait states. It has three old-style PC-compatible expansion slots and comes with either two 3½-inch 720K-byte floppy disks or one floppy disk and a slow (80-millisecond) 20-megabyte hard disk. The on-board graphics chip emulates the old CGA while offering 320 by 200 pixels with 256 colors out of a palette of 256,000, as well as 640 by 480 two-color

graphics. The Model 30 comes with 640K bytes of RAM; all other machines in the series boast a full megabyte (except for the top Model 80 version, which offers 2 megabytes).

As with all the machines in the PS/2 series, the I/O ports are on the system board and include serial, bidirectional parallel, a pointing device, and video. The math coprocessor in each runs at the same clock speed as the main CPU. And for the first time IBM is selling a two-button mouse, for \$95.

The 80286-based Model 50 runs at 10 MHz and is built around the new Micro Channel Architecture. It's about half the size of a PC AT and takes either two 1.44-megabyte floppy disks or one floppy disk and the same stately 20-megabyte hard disk as the Model 30.

IBM's Model 50 is the lowest-priced machine with the new VGA graphics. While it emulates today's 640 by 350 by 16-color EGA graphics, it also offers 16 colors from a palette of 256,000 in 640 by 480 pixels or 256 colors in 320 by 200 pixels. If you want even more resolution, you can opt for the 8514/A adapter, which boosts resolution to 1,024 by 768, deep into CAD/CAM and engineering workstation territory.

At the top of the 80286 heap are two versions of the Model 60, a floor-standing machine with seven expansion slots and room for larger, faster hard

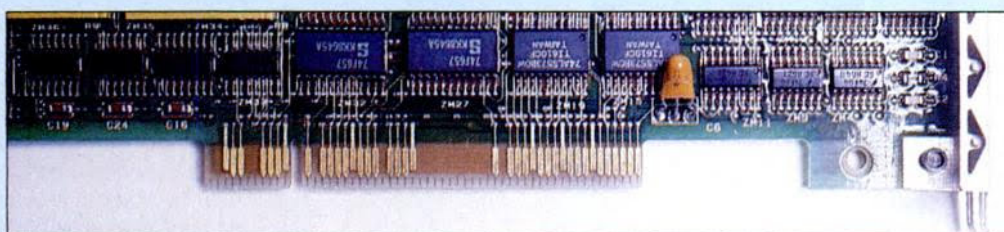
disks. It runs at the same speed as the Model 50, but the speedier disks increase overall throughput. There's also more room for expansion memory, up to 15 megabytes.

The flagship 80386-based Model 80 is also a floor-standing unit and comes standard with 1 or 2 megabytes of 80-nanosecond RAM, four 16-bit slots and three 32-bit slots, and one of three hard disks. Two 16-MHz versions (1 megabyte of RAM and a 40-megabyte drive or 2 megabytes and a 70-megabyte drive) will be available in July, and a pricey (\$11,000) 20-MHz screamer with 2 megabytes of RAM and a 115-megabyte hard disk is scheduled to shake up the industry in the fourth quarter of this year.

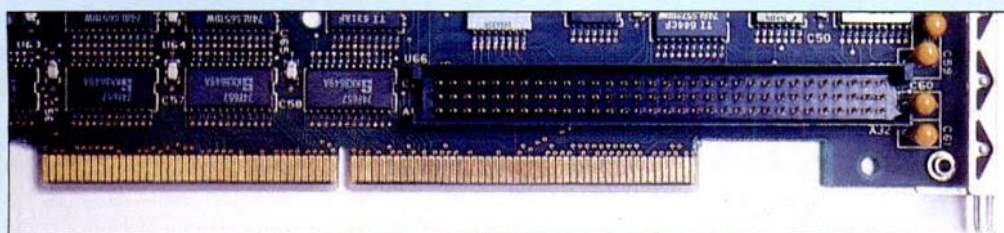
All models come with the new 101-key keyboard, built-in clock/calendar, and three-level security devices, and they show that IBM has been listening to its customers. Configuration is done by polling the hardware; there isn't a single DIP switch anywhere. The PC's rat's nest of cables has been replaced by sturdy upright printed circuit boards. All switches (including the big red one) and indicator lights are on the front panel. Covers and cables are held together with thumbscrews rather than slotted hex nuts, and cables have all been lengthened.

The Guide to Operations is a slender pamphlet rather than a thick binder. Construction is modular; one IBM representative disassembled and then reassembled an entire unit in well under a minute. Since better construction means fewer mechanical headaches, maintenance contracts have been slashed to a third of their previous cost.

The Personal System/2 has its work cut out for it. These machines must satisfy users' cravings for more speed, regain IBM's dominant market share, offer connectivity solutions for IBM's mainframe customers and the growing league of local area networkers, remain compatible with existing software, and be a platform for future growth. It's a tall order, but if the initial entries are any indication, IBM is well on the way. ☐



Above, edge connectors for the Model 50 and 60 expansion boards; below, a Model 80 32-bit connector. The 16-bit micro channel uses 77 signal lines, 29 power and ground lines, a separate audio ground line, and 5 reserved lines. Grounds are heavily dispersed throughout the bus to achieve reliability and a quiet RF level.



## OS/2

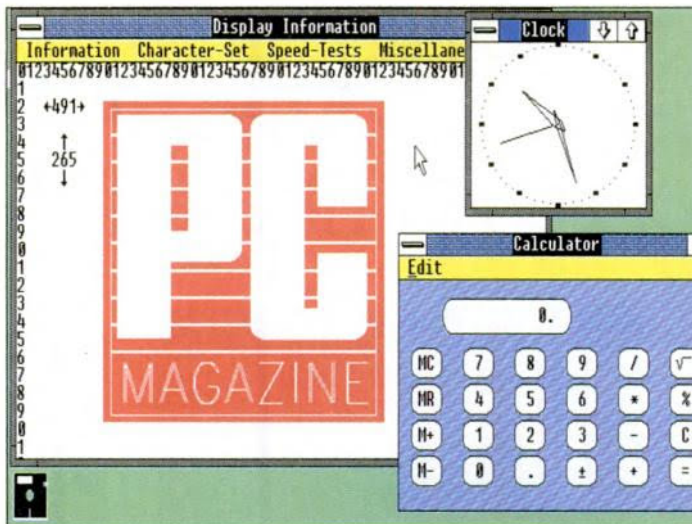
(continued from page 33)

built around the Intel 80286 or 80386.

When running on the PS/2 machines, OS/2 can take advantage of ROM BIOS code built into the new machines to enable protected mode to run in less memory space. On the AT and XT Model 286, OS/2 must duplicate all BIOS functions in RAM-based drivers.

As is currently the case with MS-DOS, Microsoft will also license OS/2 to be sold by other PC vendors for their own 80286 and 80386-based machines, but Microsoft will not sell OS/2 directly to end users. The IBM version of OS/2 will most likely run on many AT compatibles. However, because OS/2 must access the machine's hardware directly, it probably will not run on all of them. It will be the responsibility of the computer maker to ensure compatibility.

Under OS/2 Version 1.0, a session is divided into one or



Windows, Version 2.0, will allow overlapping windows. Most programs (such as the PC Labs Windows benchmark test program) run fine under Windows 2.0.

more "screen groups." A user switches between screen groups via a "Session Manager" menu. All but one of the screen groups run in protected mode. The protected-mode screen groups have a user interface that's virtually the same as today's DOS interface but has some new commands and en-

hanced batch file operation.

Within each protected-mode screen group, one or more programs specially written for OS/2 can run simultaneously. Most often, only one program that actually uses the display will be running in each screen group. A user can run some programs "in the background."

## And the Winner Is . . . Windows

Out of the Windows Wars of 1985 a winner has emerged. IBM has chosen *Microsoft Windows* to play an important role in IBM's plans for the future. IBM has not merely accepted *Windows*—it's embraced it.

*Windows* will be an integral part of Operating System/2 in the form of the Presentation Manager. But because OS/2 is also part of IBM's ambitious System Application Architecture (SAA), the presence of *Windows* in OS/2 has profound implications.

SAA is an attempt by IBM to eliminate critical weaknesses in IBM's entire line of computers by standardizing communications protocols, applications program interfaces, screen displays, and user interfaces. For systems capable of graphics, the *Windows* display design, keyboard interface, and the use of menus and dialog boxes will be-

come an IBM standard.

This means that the *Windows* user interface is likely to also become familiar to users of IBM's minicomputers and mainframes. It also means that programmers may someday be able to write a single graphics-based *Windows* program that can be recompiled to run on a variety of IBM computers beyond the PS/2 models.

Working with IBM, Microsoft has made some changes to *Windows* to accommodate this objective. First, the user interface of the OS/2 Windows Presentation Manager will be somewhat different from current *Windows*. The windows will be overlapping (rather than tiled), and the use of the keyboard and menus will be changed slightly. Second, the entire Graphics Device Interface (GDI) of *Windows* will be replaced with IBM's GDDM, its graphics system for mainframe computers.

Current programs that run under *Windows* will have to be modified somewhat and recompiled to run under the OS/2 Windows Presentation Manager. Programs that make heavy use of graphics will require the most changes.

Users can get a preview of the Windows Presentation Manager when Microsoft releases *Windows*, Version 2.0 (scheduled for 3rd quarter 1987). *Windows* 2.0 runs under existing DOS versions and incorporates the changes being made to the interface for the OS/2 Windows Presentation Manager. Virtually all existing *Windows*-compatible programs will run under *Windows* 2.0.

For more-immediate needs, a new *Microsoft Windows*, Version 1.04, will be essentially the same as *Windows* 1.03 but will include drivers to use the new video modes and printers introduced with the IBM PS/2 machines.

—Charles Petzold

One screen group is reserved for a "DOS compatibility box" that does not run in protected mode. This provides an environment that can run most existing DOS programs. OS/2 uses the same file system as current versions of DOS so that protected-mode programs and current programs can use the same files.

OS/2 always multitasks all programs running in all protected-mode screen groups. However, OS/2 must suspend operation of the DOS-compatibility screen group when a protected-mode screen group is visible. Because current DOS programs cannot run in protected mode, the DOS compatibility box is isolated from the protected-mode groups. For instance, a DOS TSR program cannot be used while a protected-mode screen group is visible.

That's OS/2, Version 1.0. At some future time, IBM will release OS/2, Version 1.1. Under OS/2 1.1, one of the protected-mode screen groups will be a graphics-based windowing system. IBM calls this the Presentation Manager, and Microsoft calls it the Windows Presentation Manager. It's essentially a protected-mode version of *Microsoft Windows*.

Under OS/2 1.1, programmers will have a choice of developing applications for the Windows Presentation Manager environment or for a nonwindowing environment. This choice will probably be based on the use of the display by the program. Character-mode applications can take advantage of OS/2's rich set of character-mode video output routines. Applications that use graphics can be written for the Presentation Manager and take advantage of the built-in graphics and dialog box logic.

Although OS/2 will run on machines using the 80386 microprocessor, OS/2 will not yet support the 80386's 32-bit linear addressing space. However, Microsoft intends to carry the OS/2 applications program interface into the 80386 upgrade. For both program developers and users, the transition to the 80386 operating system will be much simpler than the current step up from DOS to OS/2. □

# IBM Goes Analog: New Video Standards Show off Color

**PC HANDS ON**

BY CHARLES PETZOLD

IBM product announcements aren't normally accompanied by oohing and aahing from the audience, but the new color graphics of the Personal System/2 machines are surprisingly spectacular, indicating a recognition by IBM of the importance of graphics in the future of computer software.

All the new PS/2 machines have a video adapter built onto the system board. These video adapters have a graphics resolution of 640 by 480 pixels and text-mode character boxes of 8 by 16 or 9 by 16.

The big change is that IBM has gone analog. The new video adapters and monitors use analog signals and can generate 64 values for each of the red, green, and blue primaries. The result? A total of 262,144 colors, of which 256 can be displayed simultaneously.

The low-end Model 30 contains a built-in Multicolor Graphics Array (MCGA) video adapter. The MCGA emulates the two graphics modes of the IBM CGA (320 by 200 with 4 colors and 640 by 200 with 2 colors) and adds two new graphics modes: 640 by 480 with 2 colors and 320 by 200 with 256 colors. In text mode, the MCGA uses 16 colors and an 8-by-16-character box.

The Models 50, 60, and 80 contain a Video Graphics Array (VGA) video adapter on the system board. The VGA emulates the EGA, duplicates the graphics modes of the MCGA, and adds a 640 by 480 16-color graphics mode. In text mode, the VGA uses a 9 by 16 box.

An owner of a Model 30 (or an existing PC, PC-XT, or PC AT) will be able to add VGA graphics with the PS/2 Display Adapter; IBM expects the board to ship in July and to carry a list price of \$595.

IBM has left open an annoy-

ing gap in these new graphics standards. The only video mode that can display 256 simultaneous colors on the MCGA and VGA boards has a resolution of 320 by 200 pixels, not wide enough for the 80-column text required by some graphics programs.


The PS/2 MCGA and VGA video adapters have proprietary 15-pin connectors that require one of IBM's four new analog monitors. You can connect any of the new monitors to either the MCGA or VGA adapter.

Overall, the new monitors are somewhat unsatisfactory.

The 14-inch 8512 color monitor has a good price (\$595) but uses a .41mm stripe format that makes the image a little grainy. The 12-inch 8513 color monitor is sharper (.28mm dot pitch) but with a smaller viewing area. The 12-inch 8503 monochrome display is reasonably priced (\$250), but you lose color (the display uses 64 shades of gray). The 16-inch 8514 has color and size, but it costs \$1,550.

While you can attach the 16-inch 8514 monitor to the MCGA or VGA adapter, this monitor is really designed for the new PS/2 8514/A Display

Adapter board. This \$1,290 board is scheduled for June shipment. The 8514/A uses the new bus connector and thus can be installed only in a PS/2 Model 50, 60, or 80. It allows all VGA video modes and adds a 1,024 by 768 16-color graphics mode. With the 8514 Memory Expansion Kit, the board can display 256 simultaneous colors in 640 by 480 and 1,024 by 768 graphics resolutions.

In conclusion, at the low-cost end you can run 640 by 480 graphics on PS/2 models by connecting the \$250 8503 monochrome monitor or the \$595 8512 color monitor. At the high end, you'll be able to match an 8514/A board, an 8514 monitor, and an 8514 memory expansion kit to achieve 1,024 by 768 resolution at a cost of \$3,110. 

## Character Modes

Mode	Rows	Cols	Board	Char. Box	Resolution	Colors
0, 1	25	40	CGA	8 by 8	320 × 200	16
			EGA	8 by 14	320 × 350	16 out of 64
			MCGA	8 by 16	320 × 400	16 out of 262,144
			VGA	9 by 16	360 × 400	16 out of 262,144
2, 3	25	80	CGA	8 by 8	640 × 200	16
			EGA	8 by 14	640 × 350	16 out of 64
			MCGA	8 by 16	640 × 400	16 out of 262,144
			VGA	9 by 16	720 × 400	16 out of 262,144
7	25	80	MDA	9 by 14	720 × 350	Monochrome
			EGA	9 by 14	720 × 350	Monochrome
			VGA	9 by 16	720 × 400	Monochrome

## Graphics Modes

Mode	Resolution	Board	Colors
4, 5	320 × 200	CGA	4 (two palettes)
		EGA	4 out of 64
		MCGA	4 out of 262,144
		VGA	4 out of 262,144
6	640 × 200	CGA	2 (foreground selectable)
		EGA	2 out of 64
		MCGA	2 out of 262,144
		VGA	2 out of 262,144
13	320 × 200	EGA	16 out of 64
		VGA	16 out of 262,144
14	640 × 200	EGA	16 out of 64
		VGA	16 out of 262,144
15	640 × 350	EGA	Monochrome
		VGA	Monochrome
16	640 × 350	EGA	16 out of 64
		VGA	16 out of 262,144
17	640 × 480	MCGA	2 out of 262,144
		VGA	2 out of 262,144
18	640 × 480	VGA	16 out of 262,144
19	320 × 200	MCGA	256 out of 262,144
		VGA	256 out of 262,144

# IBM's Bargain Model 30: The New PC with the Old Bus, MCGA Video

## PC HANDS ON

BY GUS VENDITTO

Pity the poor Model 30. Saddled from birth with an identity crisis, this PC will long be forcing its owner to answer the question, "The Model 30...is that one of those new PCs with a different bus?"

The Personal System/2 Model 30 does not have the new Micro Channel Architecture bus that distinguishes the Models 50, 60, and 80. This junior child in the PS/2 family is distinguished more by its use of an 8086-2 microprocessor (the first time this 9-year-old Intel chip is at the heart of an IBM personal computer) and by a performance that is, if not equal to, within shouting distance of IBM's own 8-MHz PC AT for most operations—and at half the price. The Model 30 also will not have the ability to run

IBM's multitasking OS/2, due early next year.

The Model 30 runs at 8 MHz with zero wait states, using a 16-bit data bus for ROM and read/write memory, and 8-bit transfers in I/O and DMA operations. There are 128K bytes of 125-nanosecond RAM socketed to the motherboard; the remainder of the 640K base memory sits in two banks of IBM's new 9-bit SIP (single-inline package) RAM.

The Personal System/2 Model 30 is for people who want to get their feet wet in the latest technology but are not ready to take the plunge of buying new boards to outfit their systems.

Of course, by building most of the functions you need into the system board, IBM is betting you won't have to move those add-in cards anyway. Like a Toyota, most of what you want is standard. And it better

be: there are only three side-mounted add-in slots for XT-compatible boards.

Parallel, serial, and mouse ports, real-time clock, floppy disk controller, display controller, and connector for the hard disk are all built into the system board using custom VLSI gate arrays. There are no jumpers or switches to set; all configurations are done through software.

There are two models: a \$1,695 two-floppy-disk version and a \$2,295 one-floppy-disk, one-hard-disk machine. All floppy disk drives are 3½-inch, 720K-byte. The slow hard disk (rated by IBM at 80 milliseconds, tested by PC Labs at 83) is the Model 30's Achilles' heel. It makes sense to buy the \$1,695 version and wait for the inevitable introduction of a faster external hard disk by a third party. Because the Model 30's hard disk has a built-in controller, you won't waste an expansion

slot if you do. Unlike the Model 50, some cabling is required for disk-to-system-board connections.

Although not explicitly supported by IBM, there is enough room behind the floppy disk drive to add a third drive, once a third-party developer comes up with a design.

The Model 30 will appeal to the budget-conscious. It doesn't equal the value offered by low-cost AT clones in absolute dollars and cents, but at a basement price it gives you IBM's rock-solid construction standards (evident everywhere in this machine from the solid keyboard feel to the tight fit of the add-in rack mount). And it lets you buy into a piece of IBM's new analog graphics standard at the ground floor.

You'll need any of the four new analog monitors; it doesn't matter which you choose—the 12-inch monochrome Model



## Benchmark Tests: IBM Personal System/2 Model 30 vs. IBM PC-XT

Running an Intel 8086 at 8 MHz, the IBM Personal System/2 Model 30 delivers the kind of performance gain over the 4.77-MHz PC-XT that you'd expect from those specs. There were no compatibility problems with any of the benchmark test programs.

### Performance Times

(Times given in seconds except where noted)

	NOP	8086 Instruction Mix	Conventional Memory	Floating- Point Calculation (with 8087)	BIOS Disk Seek (milliseconds)
IBM PC-XT	10.1	32.0	5.9	4.8	95.0
IBM PS/2 Model 30	4.2	16.5	3.2	2.4	82.4

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 128K loop.

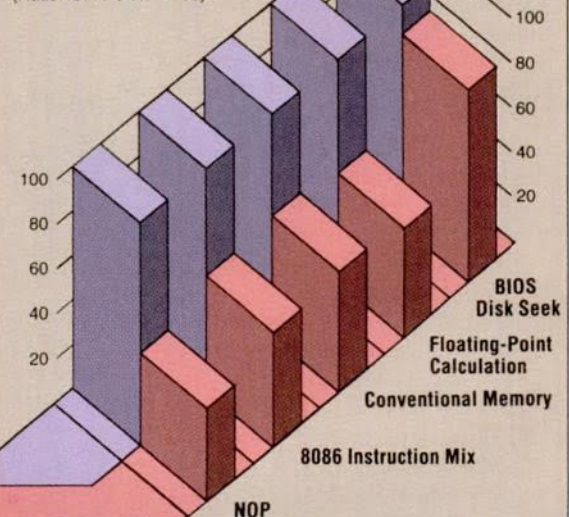
The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64K-byte records, then 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

### Relative Times

(Ratio: IBM PC-XT = 100)

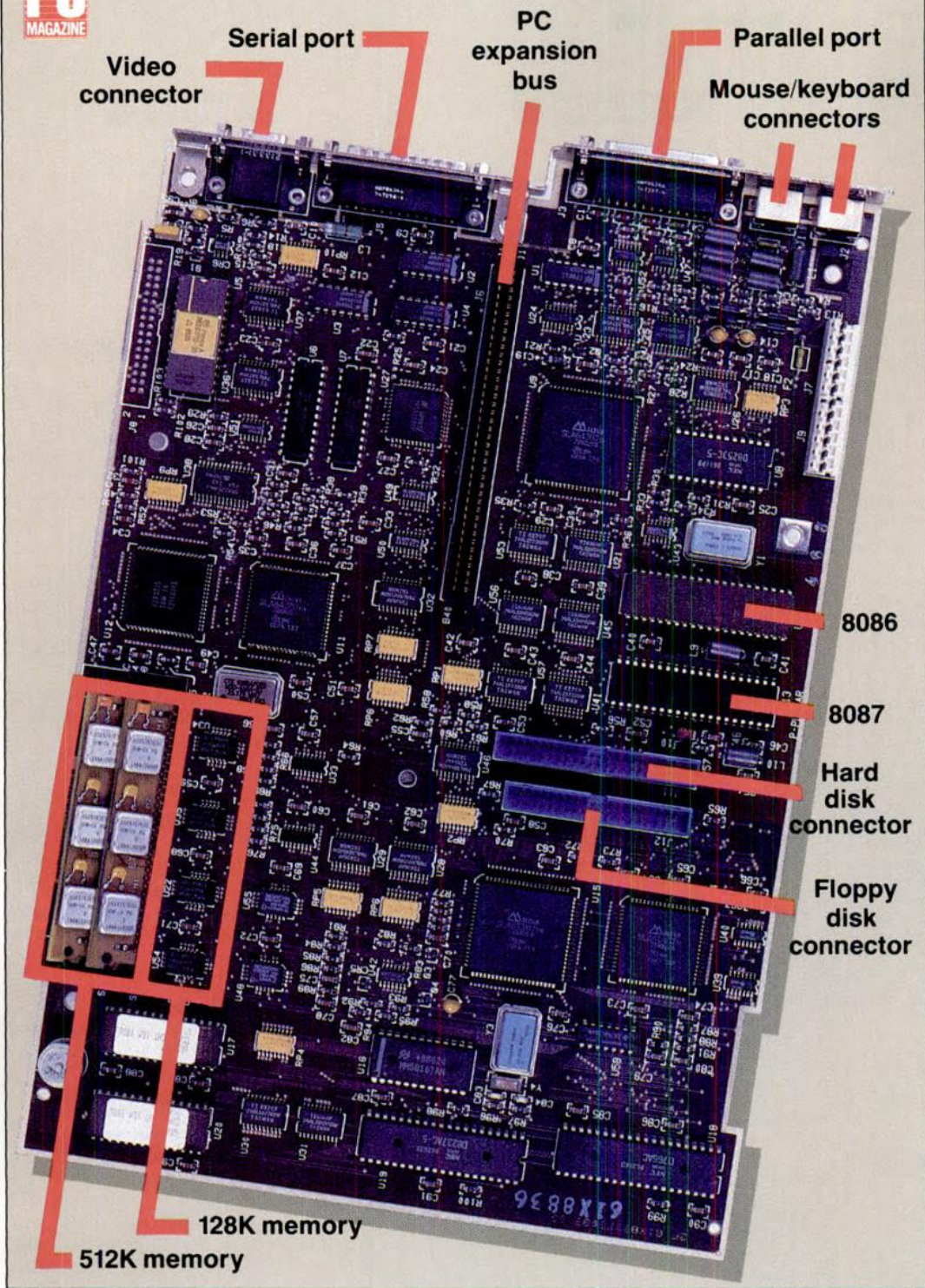


The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.





## PS/2 Model 30 System Board



## FACT FILE

**Personal System/2 Model 30**  
IBM Corp.

Consult your local authorized IBM dealer.

**List Price:** Model 30-010 with two disk drives, \$1,695; Model 30-020 with one floppy and one hard disk drive, \$2,295.

**Requires:** A Personal System/2 monitor, DOS 3.3.


**In Short:** A compact, well-built 8-MHz machine that bridges a gap between IBM's PC line and the Personal System/2 family, and offers its own new graphics standard, MCGA.

CIRCLE 425 ON READER SERVICE CARD

50, 60, and 80 all use 1.44-megabyte 3½-inch drives. These drives can read 720K-byte, but if they write to high-density disks, the Model 30 won't be able to read them. I experienced problems reading 720K-byte disks that had been formatted in an external 720K-byte drive. The problems probably are a result of formatting the disks under DOS 3.2 and trying to read them under DOS 3.3, but 3.3 was supposed to improve control of 3½-inch media, not hamper it.

The biggest adjustment for XT and old AT owners is likely to be in using the 101-key enhanced keyboard introduced with the 8-MHz AT. It's now standard across IBM's entire workstation line, so there's no getting around it.

Anyone looking to buy an inexpensive computer will want to look hard at the Model 30. With a CPU weight of 15.7 pounds, it's light enough to be moved often. At 16 inches wide by 15.6 inches long by 4 inches high, it's small enough to be unobtrusive. And at a noise level of 38 decibels, it's 4 decibels quieter than an AT. It even comes with the cache of an AT-style system lock-and-key.

Just as soon as dealers discount it, the Model 30 will be a good buy for anyone not interested in using the next generation of operating systems. 

8503 (\$250), 12-inch color Model 8513 (\$685), 14-inch color Model 8512 (\$595), or 1,024- by 768-pixel-capable 16-inch Model 8514 (\$1,550).

You'll get MCGA—not VGA—graphics, an enhanced CGA standard that has a color text mode better than EGA's (640 by 400, instead of 640 by 350) and offers a new 256-color mode (at a VCR-like resolution

of 320 by 200) that far outstrips anything the EGA can muster in generating color images. The machine has the potential to be a dazzler when software designers catch up.

Disk compatibility is certain to bedevil your office unless you invest in an external 5¼-inch floppy disk drive (\$395 with adapter) for this machine or a 3½-inch, 720K-byte disk

drive (\$170) for your other PCs.

Once they are copied to the smaller media, XT and AT programs will run fine in the new machine. Make sure that all of your software is registered now, because PS/2-related updates for major applications are on the way.

Expect to have problems sharing disks with the Model 30's more-mature siblings: the



## IBM Personal Computing, a 6-Year History

The original PC packed a whopping 16K bytes of RAM, considered a lot in 1981 but not even enough to boot today's DOS. The base configuration was intended for use with a television display and cassette drive, thus no disk drives were included. That ground-breaking PC could be expanded to 256K bytes of RAM and two 160K disk drives. Before long, every user shelled out at least \$750 for a 160K disk drive and \$345 for a monochrome display, and \$415 for an additional 48K RAM. Add-in board manufacturers grew up overnight to satisfy the demand for more memory.

By early 1983, IBM responded by introducing the PC-XT with a Seagate 10-megabyte fixed disk and a base memory of 128K RAM. The XT's base memory could be upgraded to 256K RAM on the motherboard, and IBM supported the addition of 384K on an expansion board, bringing total system RAM to 640K.

The first real speed increase from a 4.77-MHz clock speed came with the introduction of the 6-MHz AT in August of 1984, base configured with 256K RAM on the motherboard and with one high-density 1.2-megabyte floppy disk drive. An enhanced configuration offered 512K RAM on the motherboard and a 20-megabyte fixed disk for \$5,795.

IBM boosted its AT speed to 8-MHz in 1986. The PC-XT Model 286 was the first IBM product to offer 640K in a base configuration, but neither the XT 286 nor the high-end RT PC gained the widespread acceptance of the PC, XT, or AT.

The new Personal System/2 line represents a significant revamping of IBM personal computers. The low-end 8-MHz Model 30 uses the PC-XT bus but is faster, smaller, and more affordable than its ancestors. Models 50, 60, and 80 boast a new bus—the micro channel architecture—designed to handle data flow more efficiently. The Model 80 can address up to 16 megabytes of RAM, and the forthcoming 80-111 will run the 80386 processor at 20 MHz. All System/2 models include color graphics support on the motherboard and use analog signals for the display.

### August 1981

#### IBM Personal Computer (PC)

\$1,565

- 8088-based, 16K RAM
- no disk drives
- \$2,880 with 64K RAM and one 160K-byte floppy disk

### March 1983

#### IBM PC-XT

\$4,995

- 8088-based, 128K RAM
- one 360K-byte floppy disk, 10-Mbyte fixed disk

### October 1983

#### IBM PCjr

\$699

- 8088-based, 64K RAM
- no disk drives
- enhanced graphics support
- \$1,269 with 128K RAM and one 360K-byte floppy disk

#### IBM 3270 PC

\$4,290

- 8088-based, 256K RAM
- one 360K-byte floppy disk

#### IBM PC-XT Model 370

\$8,995

- 8088-based, 768K RAM
- one 360K-byte floppy disk, 10-Mbyte fixed disk

### March 1984

#### IBM Portable PC

\$2,895

- 8088-based, 256K RAM
- two 360K-byte floppy disks

### August 1984

#### IBM PC AT

\$3,995

- 80286-based, 256K RAM
- one 1.2-Mbyte floppy disk

### January 1986

#### IBM RT PC

\$11,700

- IBM 32-bit RISC processor, 1 Mbyte RAM
- one 1.2-Mbyte floppy disk, 40-Mbyte fixed disk

### April 1986

#### IBM PC Convertible

\$1,995

- 80C88-based, 256K RAM
- two 720K-byte floppy disks

### September 1986

#### IBM PC-XT Model 286

\$3,995

- 80286-based, 640K RAM
- one 1.2-Mbyte floppy disk, 20-Mbyte fixed disk

### April 1987

#### IBM Personal System/2

##### Model 30-002

\$1,695

- 8086-based, 640K RAM
- two 720K-byte floppy disks
- MDA-CGA display support

##### Model 30-021

\$2,295

- 8086-based, 640K RAM
- one 720K-byte floppy disk, 20-Mbyte fixed disk
- MDA-CGA display support

##### Model 50-021

\$3,595

- 80286-based, 1 Mbyte RAM
- 1.44-Mbyte floppy disk, 20-Mbyte fixed disk
- MDA, CGA, EGA, and VGA display support

##### Model 60-041

\$5,295

- 80286-based, 1 Mbyte RAM
- 1.44-Mbyte floppy disk, 44-Mbyte fixed disk
- MDA, CGA, EGA, and VGA display support

### Available Summer 1987

##### Model 60-071

\$6,295

- 80286-based, 1 Mbyte RAM
- 1.44-Mbyte floppy disk, 70-Mbyte fixed disk
- MDA, CGA, EGA, and VGA display support

##### Model 80-041

\$6,995

- 80386-based, 1 Mbyte RAM
- 1.44-Mbyte floppy disk, 44-Mbyte fixed disk
- MDA, CGA, EGA, and VGA display support

##### Model 80-071

\$8,495

- 80386-based, 2 Mbytes RAM
- 1.44-Mbyte floppy disk, 70-Mbyte fixed disk
- MDA, CGA, EGA, and VGA display support

### Available Fall 1987

##### Model 80-111

\$10,995

- 80386-based, 2 Mbytes RAM
- 1.44-Mbyte floppy disk, 115-Mbyte fixed disk
- MDA, CGA, EGA, and VGA display support

# Personal System/2 Gives Life To a Smarter, More Agile DOS

**PC** HANDS ON

BY PAUL SOMERSON

Each time IBM introduces a new line of hardware it bumps the DOS release up a notch. The XT jumped 1.1 users to the 2.0 version that understood hard disks and subdirectories. The AT's need for high-density floppies and larger hard disk storage, combined with network requirements for things like file sharing, brought on 3.x.

DOS 3.3 makes it easier to use both 720K bytes and the new 1.44-megabyte 3½-inch disks, but with reservations. In the past 6 years IBM has endorsed five different disk types. But out of the 25 different possible combinations of using the DISKCOPY command to move information from one to the other, 16 won't work.

Still, DOS 3.3 is smarter and much more versatile than previous releases. For the first time, it sets a default number of disk buffers based on your system's disk and memory storage. Under previous versions, the default was always 2 for non-ATs

or 3 for ATs. DOS will sniff out what hardware you have available and allocate from 2 (minimal RAM and no high-density floppy disks, 3½-inch disks, or hard disks) to 15 (any machine with 512K bytes or more of RAM).

IBM offers a new, complex international-character display feature called Code Page Switching, which works only on EGAs, PC Convertible LCD displays, new PS/2 displays, IBM Proprinters, and IBM Quietwriters. The manual admits "you can use code page switching without fully understanding everything about it," which is clearly going to be the case for most users. English speakers get off the hook easy and can ignore all this; residents of French-speaking Canada, Denmark, Norway, or Portugal will have to juggle these new files along with the new inscrutable code page commands CHCP and NLSFUNC and the enhanced GRAFTABL and MODE. In addition, KEYB has been streamlined, through the addition of a KEYBOARD.SYS command. DOS

3.3 users won't have to clutter up their DOS directories any longer with templates for Italian or German keys.

The most welcome new command of all is undoubtedly APPEND. Previous editions let you create a PATH that would tell DOS where to look for executable files so DOS could find and execute any program you wanted—unless the program happened to need a nonexecutable file, such as an overlay, to run properly. Moreover, DOS couldn't search the specified path for data files. Version 3.1 users could brute force their way around this obstacle in certain cases by using the SUBST command to fool a program into treating subdirectories as logical disk drives with drive letters.

APPEND simply extends the power of PATH to nonexecutable files. Actually, it's not all that simple. You can load the APPEND string into memory, after which it is treated like an internal DOS command. Or you can have DOS insert the string into the environment space. Adding the string to the envi-

**PC** F A C T  
MAGAZINE F I L E

## PC-DOS 3.3

IBM Corp.

Consult your local dealer.

List Price: \$120; upgrade, \$75.

**In Short:** This latest upgrade to DOS, prompted by IBM's PS/2 family, offers more flexibility.

Not copy protected.

CIRCLE 424 ON READER SERVICE CARD

ronment makes it accessible to any program run under the current command processor, and you can use APPEND and SET to view or modify the string. But if you (or your program) load an additional command processor, or exit the current one, DOS won't know about the APPEND string. However, if you decide to use the internal method, you'll be able to view or alter the string only with the APPEND command. You can opt for either method or both.

Before Version 3.3, users of IBM equipment with on-board clocks had to drag out the SETUP program on the diagnostics disk just to reset the time and date permanently. The DOS 3.3 DATE and TIME commands now do this for you.

With so many possible subdirectories and files on a typical hard disk, DOS can have a difficult time searching through paths and directories to figure out where files are. The new FASTOPEN command creates a table of recently opened files that lets DOS jump directly to the file's location on the disk. The table can contain up to 999 entries per hard disk, after which it starts getting rid of the least recently used files and adding the most recently used ones. Each entry eats up 35 bytes, so a full table can span 34K.

One of the best pieces of news for many users is that DOS 3.3 supports up to four serial ports (OS/2 will support as many as eight). One of the worst is that IBM has idiotically moved all of the references to DEBUG (as well as LINK and EXE2BIN), conspicuous by

(continues on page 51)

## The IBM Obfuscation Elimination Facility

IBM is different from you and me—it talks funny. It's no wonder that IBM has problems hooking up different systems in its computer line to communicate with each other: IBM officials usually can't communicate with other human beings.

PC Magazine has come up with a solution. To commemorate the April 2 introduction of the Personal System/2, PC Magazine is proud to publish Release 1 of *The IBM-to-English Dictionary*, or (in the spirit of the subject) *The IBM Obfuscation Elimination Facility*. Here is the first installment.

### What IBM Calls It

### What It Really Is

Planar Board . . . . .	System board
Micro Channel Architecture . . . . .	Personal System/2 bus
Asynchronous Communications Adapter . . . . .	Serial port
Dual Asynchronous Adapter . . . . .	Two serial ports
Direct Access Storage Device (DASD) . . . . .	A disk
Fixed Disk . . . . .	A hard disk
Fixed File . . . . .	A hard disk
Data Migration Facility . . . . .	A cable
Memory Expansion Kit . . . . .	Overpriced RAM chips
SolutionPac . . . . .	Bundled hardware and software
Operating System/2 . . . . .	DOS 5
Presentation Manager . . . . .	Microsoft Windows
Systems Application Architecture . . . . .	Compatibility
TopView 1.12 . . . . .	Unhealthy nostalgia
IBM/Microsoft Joint Development Agreement . . . . .	Arm-twisting
IBM-Designed VLSI . . . . .	See you in court

## DOS 3.3

(continued from page 48)

their absence, to the DOS Technical Reference Manual.

The STACKS command comes out of the closet with 3.3. With Version 3.2, you could easily bring your machine to its knees by pounding on the keyboard too rapidly—and the only mention of the command that fixed the problem was isolated at the very end of the manual in a special appendix two pages long. With 3.3 it's at least moved to the CONFIG.SYS section, although the explanation is nearly as opaque as in previous editions. FDISK has also been moved from the front of the manual to where it belongs in the reference section.

FDISK now allows you to create two types of partitions—primary (the kind allowed by earlier DOS versions) and extended. Extended partitions are necessary on large hard disks; they allow users to lop off a massive amount of physical partition space and subdivide it into "logical" drives, each with its own drive letter all the way to drive Z.

The DOS BACKUP command has always been so pathetic that an entire industry of third-party backup software has evolved to fill in the gaps. While the 3.3 enhancements aren't going to put all those developers out of business, they will bring some users back into the fold. Under previous DOS versions you had to format a tall stack of disks before starting the backup process. If you ran out of formatted disks, you had to abort and either find a way to catch up or start the whole elaborate, time-consuming procedure over again.

Under DOS 3.3 you can have BACKUP summon the FORMAT command and prepare unformatted disks if necessary—with certain restrictions. FORMAT.COM has to be on your disk in a subdirectory your PATH knows about. And you have to match disk and drive sizes; it can't handle a 360K-byte disk in a 1.2-megabyte drive. The new BACKUP works faster, by copying all smaller files to a single enor-

## As New Models Arrive, Old Prices Drop

IBM did not neglect its existing line of PC-XTs and ATs when it introduced the Personal System/2 on April 2. It dropped prices on its full line of existing Personal Computers.

The cuts ranged from 35 percent off its base PC-XT

model to 9 percent off its 3270 PC ATs.

An IBM spokesman said that all models will be manufactured for as long as demand continues.

The following is the current IBM Personal Computer product line.

IBM Personal Computers	Old List Price	New List Price
IBM PC Convertible	\$1,995	\$1,695
IBM PC-XT Model 268	2,145	1,395
IBM PC-XT Model 278	2,295	1,545
IBM PC-XT Model 286	3,395	2,810
IBM PC AT Model 319	5,295	4,595
IBM PC AT Model 339	5,295	4,595
IBM PC AT/G	7,510	6,810
IBM PC AT/X	7,510	6,810
IBM 3270 PC Models 070, P70	4,435	4,200
IBM 3270 PC Models 071, P71	5,445	5,210
IBM 3270 PC AT Models 070, P70	7,140	6,440
IBM 3270 PC AT Models 071, P71	7,870	7,170

mous one called BACKUP.XXX and by creating a guide file called CONTROL.XXX that tells DOS how to take the big file apart and restore it properly later. Previous versions let you back up after a specified date; with 3.3 you can also back up files created after a certain time. And the new BACKUP will create a log file telling you what it did where.

The new RESTORE gives you a tremendous amount of flexibility in restoring backed-up files by date and time, as well as files deleted or changed since you backed them up or files that are no longer on the target disk. Better yet, while older versions of RESTORE let you obliterate your current system files (IBM-BIO.COM, IBMDOS.COM, and COMMAND.COM) with older backed-up versions, 3.3 RESTORE won't.

To make backups easier, DOS 3.3 ATTRIB now accepts wildcards and can change the directory attribute of all files in a subdirectory and in daughter subdirectories. Sadly, it still works just with archive bits and read-only bits; you can't have it hide or unhide a file.

Version 3.3 is the first version of DOS to recognize the previously undocumented but widely known technique of accessing environment variables by sandwiching them between percent signs. So if you issue the command SET MAGAZINE=PC to place the string MAGAZINE=PC into the environment, and then include a line in a batch file that says ECHO %MAGAZINE%, the batch file will print: PC.

Another poorly documented favorite of power users is the ability to nest batch files by loading additional command processors, and then pass parameters between them. *PC Magazine's* Productivity section has published many elegant tricks based on this technique, for tasks like displaying all files on a disk one by one and then erasing or copying files selectively. DOS 3.3 users no longer have to bounce through additional command processors; they can take advantage of the new CALL command instead.

Virtually all serious batch file users start all batch files with the command ECHO OFF to suppress DOS command

screen clutter. Unfortunately, with previous DOS versions, the very command that prevented commands from displaying had to be displayed itself. Now, by prefacing any batch file command with an @ symbol, you can prevent that command from appearing on-screen. So starting all your 3.3 batch files with @ECHO OFF disables the ECHO feature without telling the world you're doing so.

The 3.3 FORMAT command now lets you specify the number of tracks and number of sectors per track to format (on floppy disks only), so you can format a 720K-byte floppy disk in a 1.44-megabyte disk drive. However, to do so, you have to add the switches /N:9 /T:80 to the tail end of the command. It would have been easier to have a single /7 switch to handle this.

GRAPHICS now offers an /LCD switch "to print the image exactly as it appears on the IBM PC Convertible Liquid Crystal Display." What does this mean—murky and unreadable?

When the EGA was introduced, users complained that the MODE command couldn't handle the new graphics settings (such as 43 or 50 lines or the better color selection). Now that an even jazzier color standard is out, you'd think DOS could handle something past CGA. Guess again.

DOS 3.3 now issues a chilling variation on the old "Abort, Retry, Ignore?" message when tripping over an FCB/file sharing problem: "Abort, Fail?" What a choice.

Some explanations are welcome, if still misplaced. Early on the manual now warns that the command DEL FILENAME.? will expunge both files that have single-character extensions and files with no extensions at all. And while earlier versions hid the information about using SHELL to increase environment size, SET now steers users to it.

The price is high—\$120—and you may need the \$85 DOS Technical Reference Manual. But current users can upgrade for \$75, and—if you're a serious user—the improvements are well worth it. 