Chapter 22

IBM PS/1, PS/ValuePoint, and PS/2 System Hardware

This chapter identifies and describes each of the IBM Personal System/1 (PS/1), PS/ValuePoint, and Personal System/2 (PS/2) system units and standard features. (As a group, we'll call these the PS/x computers.) The chapter begins by explaining the major differences between the IBM PC and the PS/1, ValuePoint, and PS/2 systems and why each is so similar to, yet so different from, the classic PC line.

The chapter continues with a discussion of the primary PS/1, ValuePoint, and PS/2 models, which are based closely on the original PC line. These original systems sometimes are called Industry Standard Architecture (ISA) systems, and they include the standard ISA type of 8-bit and 16-bit I/O expansion slots. Others include more advanced EISA, PCI, and/or VESA Local Bus (VLB) buses. The chapter also examines the PS/x models and their respective submodels.

Differences between the PS/x Systems

The open architecture of IBM systems has allowed a variety of companies to introduce systems functionally identical to IBM's own. These compatible PCs strive to provide IBM PC performance for less-than-IBM prices. In fact, many exceed what IBM's own systems can do and offer higher performance, more features, or other benefits that the actual IBM systems lack. These non-IBM systems are usually called *IBM compatibles* or *IBM clones*. Because few systems actually duplicate IBM's own at the hardware level, the term *clone* is somewhat obsolete today. Most systems based on IBM designs are called *compatibles* because they are designed to work with the same basic software and peripheral components that IBM systems use.

IBM has done its best to keep the rest of the PC marketplace on its toes. IBM mounted an attack on several fronts, including introducing several lines of systems that cost much less than the premier PS/2 line. In September 1992, IBM formed the independent subsidiary, IBM Personal Computer Co., to develop and market various IBM personal computers. Another subsidiary, Ambra Computer Corp., was also formed to compete with low-end compatibles. IBM's lineup of PCs includes the following:

- PS/2
- PS/1
- PS/ValuePoint
- Ambra

Creating these brands is similar to the way General Motors sells Chevrolets and Buicks as well as Cadillacs. IBM's intent is to create products with performance and cost identities appropriate to different sorts of customers and distribution channels, as discussed in the following paragraphs.

PS/2

Introduced in April 1987, the PS/2 line targets large companies that expect to pay more for a premium product. The PS/2 line is generally more rugged than the PS/ValuePoint models and uses the less common but potent Micro Channel Architecture (MCA) bus (see table 22.4). PS/2s are positioned well as high-end desktops and servers. Also, service is better for the PS/2. Although the PS/ValuePoint line ships with 24-hour, seven-day-per-week, toll-free support via telephone and fax modem, the corporate-oriented PS/2 line includes all that plus on-site service that lasts for three years, under the latest warranty plan.

Note

We describe in detail the characteristics and strengths of the Micro Channel Architecture (MCA) bus in the PS/2 section found later in this chapter.

Some IBM PS/2s are sold under a variation called Ultimedia. The Ultimedia name is a multimedia version of the PS/2, although the name may apply to RISC and AS/400 computers. The first Ultimedia PS/2 was the M57 SLC, which is a special version of the PS/2 Model 57. The Ultimedia version included a built-in CD-ROM XA drive, an 80M hard drive, a 16-bit audio card, XGA video, and a "media control panel" on the front of the machine that includes a volume control and stereo output jacks.

PS/1

The PS/1 is IBM's low-cost line sold through retail outlets and superstores. The PS/1 was IBM's strategy to fight a two-front PC war. By introducing a more affordable PC, IBM was attempting to protect its premium line, the PS/2. There's little confusion between IBM's PS/2 and PS/1 lines because the former uses the Micro Channel, which is now clearly a proprietary architecture.

The focus of the PS/1—when first introduced, at least—was not all-out performance but ease of use for the first-time buyer. The PS/1s especially were designed for the new user who may even be intimidated by computer technology. IBM designed the PS/1 to be brought home as a learning tool or used in a small-business environment. Early models of the PS/1 included Windows and Microsoft Works preinstalled, including tutorials. Later, the PS/1 inherited Energy Star energy-saving compliance through a preinstalled Smart Energy System located on the motherboard. However, buyers noticed that value-line PCs such as the PS/1 didn't stack up as well against the compatibles. Often, the PS/1 had fewer slots and drive bays, proprietary video, and less CPU cache than found in other compatibles.

The PS/1 is targeted at definable customer sets. More than 40 remarketers are selling these new systems at over 3,000 outlets in the United States. The PS/1 Essential line, meant for small businesses, is sold through office warehouse stores such as Office Depot, Office Max, and Staples. The PS/1 Expert line, designed for advanced users, is sold through superstores such as Computer City, Elek-Tek, and BizMart. The PS/1 Consultant line, designed for home users, is sold through general merchandise and department stores such as Montgomery Ward, Sears, and Circuit City.

PS/ValuePoint

The PS/ValuePoint systems are virtually identical to the PS/1 systems, except that they offer greater expansion capabilities, higher performance versions, longer warranties, and are ordered, serviced, and supported directly through IBM. The PS/ValuePoint, or ValuePoint, line competes effectively with some clones, acting as a low-priced corporate desktop line. When first introduced in October 1992, they were called "clone-killers." (In fact, IBM's ValuePoint marketing literature talked about the "end of the Clone Age.") The ValuePoint line was designed as a line of budget business computers to be sold through IBM's new mail-order enterprise (IBM PC Direct) as well as through retailers and IBM-authorized dealers. It has helped IBM gain market share in areas in which it had not been successful. The ValuePoint line replaced the PS/1 Pro line of computers. In May 1994, the ValuePoint line was split into two lines: the more-powerful ValuePoint Performance Series and the mainstream ValuePoint Si Series.

Ambra

Ambra is a low-end PC line designed to be sold directly through mail order to compete with other high-end mail-order systems. The Ambra line was launched by Individual Computer Products International, a subsidiary started by IBM Europe. Ambra was then sold by Ambra Computer Corp. In the United States, Ambra is a line of mass market, low-end Asian desktop personal computers and notebooks. The subsidiary was kept virtually separate from its parent because IBM wanted to maintain its traditional image of being a supplier of high-quality corporate computers. Ambra machines are sold through retailers, dealers, and direct sales channels only. In the United States, the European division was closed down in spring of 1994.

Note

At the time of this writing, IBM decided to merge the marketing of the PS/2 and ValuePoint lines under a single name, tentatively called Commercial Desktop. The decision to market PS/2s and ValuePoint models under the same name is intended to sharpen marketing focus and eliminate unnecessary competition. Also, IBM announced in August 1994 that the Ambra line was being phased out.

The Major Differences

As you can see, each PS/x is aimed at a certain market, but the primary differences are fewer than you might think. The differences are categorized into the areas discussed in the following sections.

Construction. Few construction differences exist between the PS/2, PS/1, PS/ValuePoint, and Ambra lines. Overall, the PS/x line is the most sophisticated for design and construction. They were designed with automated assembly in mind. Because parts and components are modular, technicians and users can remove and reinstall most of them without using any tools.

The no-tool disassembly concept carries over to the floppy and hard disk drives. To remove the floppy disk drive, you hold the front of the drive while bending a plastic tab and pull the drive from the system unit. To replace the drive, slide the drive back into the case until it snaps into place. As a technician, you can amaze people unfamiliar with these systems when you open the system, remove a drive, replace it with a new unit, and close the system, all within 30 seconds. People who usually work on other types of systems, or who have never seen the inside of a PS/x system, are usually quite impressed.

A feature of the PS/2 and ValuePoint line is that several models contain no cables, which is amazing when you think of the earlier systems with their mazes of cables for carrying power and data. Eliminating cables makes components easier to install and also removes

perhaps the largest single source of errors and problems. PS/2 systems are also much better shielded against stray signals because of their circuit and case design.

Parts and Availability. The small amount of labor required to service PS/x systems has changed the repair and service industry. The modular construction should make labor less expensive than parts on the repair bill. Parts pricing and availability are much more important when you service a PS/x.

The availability and price of parts, however, can be a problem. A PS/x system doesn't have many parts; the PS/x motherboard contains many components that other systems house on expansion adapter cards. For example, a PS/x integrates the mouse, serial, game, and parallel ports; video card; and floppy disk and hard disk controllers onto the motherboard. Occasionally, a certain bus video card, such as PCI, may be placed in an expansion slot. Having so much integration makes the PS/x computers much easier to repair, but may require replacing the motherboard more often than in earlier systems. Frequently, however, replacing an inexpensive adapter can solve a problem.

Because many of the custom chips used in the PS/x boards are unavailable separately, PS/x motherboards are very difficult to repair. Unlike motherboards in other systems, PS/x motherboards usually must be replaced (or exchanged) rather than repaired. Although very little motherboard repair occurs even with non-PS/2 systems because repairing a motherboard is usually more costly than replacing it, the repair or replacement issue is more important with the PS/xs because the PS/x motherboard contains so many more components (and therefore more potential places for things to go wrong) than other motherboards.

Design. The primary difference between the various PS/xs is the buses provided with each system. Typically, the PS/2 line offers only Micro Channel Architecture (MCA) buses. The PS/ValuePoint and Ambra lines offer a choice between PCI or VLB and a handful of ISA slots. PS/1 systems often offer all ISA slots with integrated local-bus video.

However, these bus distinctions are being blurred by IBM, precipitating the demise of some IBM subsidiaries. The ValuePoint Performance Series introduced in May 1994 incorporates IBM's SelectaBus feature. This technology allows ValuePoint customers to choose and upgrade the system's local bus to support either VESA or PCI, solving the PCI versus VLB dilemma. Although the motherboard is based on VESA's VLB, IBM figured out an intelligent way to support PCI as well, using a swappable backplane (called a riser) into which you plug add-in cards. The VL version of the swappable backplane adds one VL-Bus slot and four ISA slots. The PCI backplane has room for two PCI cards and two ISA cards. And, for maximum flexibility, you also can get a backplane that supports five ISA cards. Whereas the VLB version of the ValuePoint's backplane has room for only one VLB card, this is not a major snag because both video and hard disk controllers are already integrated onto the motherboard's VL-Bus.

Video. The three lines differ in video performance as well. The PS/2 video subsystem differs greatly from a PC subsystem. The original PC systems had a Monochrome Display Adapter (MDA), Color Graphics Adapter (CGA), or Enhanced Graphics Adapter (EGA) available as a plug-in board. The PS/2 Models 25 and 30 included a built-in video adapter on the motherboard called the MultiColor Graphics Array (MCGA). PS/2 Models 50 and up (as well as the 25-286 and 30-286) contain a built-in video subsystem: the Video Graphics Array (VGA), which is a higher-end system. The MCGA is a subset of the VGA and lacks color capability in the highest-resolution mode. Some newer systems, such as Models P75, 90, and 95, include eXtended Graphics Array (XGA) on either the motherboard or a card. The newer XGA standard is a super-VGA type of adapter that includes more resolution and colors than the standard VGA and retains backward compatibility.

The VGA and XGA support all video modes available in the earlier MDA, CGA, and EGA, as well as some newer VGA- and XGA-specific modes. Because this downward compatibility is almost 100 percent, few programs are unable to run on a VGA- or an XGA-equipped system, although programs not written specifically for VGA or XGA cannot take advantage of their extra resolution and color capability.

Because VGA and XGA supersede EGA and all other previous standards, IBM has stopped producing all other video adapters, including EGA. For a while, IBM sold a VGA card for upgrading PC systems to VGA; this 8-bit board, called the IBM PS/2 Display Adapter, plugged into any IBM PC or PC-compatible system. IBM discontinued the board, leaving only aftermarket boards available for upgrading older systems. Most video-card vendors have followed IBM's lead and have also discontinued EGA boards. These vendors have successfully cloned the VGA and XGA technology, providing many video-card choices for upgrading PC and PC-compatible systems.

In contrast to other graphics adapters, VGA and XGA have analog output and require displays that can accept this signal. Other graphics adapters use a digital signal and work with monitors designed to accept the signal. Therefore, if you are upgrading a system to VGA or XGA, you probably also need to add a new monitor to your shopping list. Some monitors, such as the NEC MultiSync and the Sony Multiscan, accept both digital and analog signals. These monitors offer a flexibility for working with older digital systems not found in IBM's monitors, but they can be more expensive. If you have such a monitor and are upgrading your system's video adapter to VGA or XGA, you do not need a new monitor.

The change to analog displays comes for two primary reasons: color and money. With an analog display, many colors become available without a big jump in cost. VGA is designed to display as many as 262,144 colors, which would require a digital interface design with at least 18 lines to transmit all this color information to the monitor. Using an interface with 18 digital driver circuits on the video card, running through a thick cable containing at least 18 shielded wires, to a monitor with 18 digital receiver cir-

cuits, would cost thousands of dollars. A much simpler and less costly approach is to convert the digital color information to analog information for transmission and use by the display. This approach reduces the amount of circuitry required and allows for a much smaller cable. Analog transmission can send the same color information through fewer wires and circuits.

With the recent iterations of the PS/2 Models 76 and 77, the XGA graphics chip was replaced by an S3-accelerated local-bus video chip. The new Models 76 and 77 include an S3 Inc. graphics chip in a local-bus design instead of the XGA standard of past PS/2 generations. IBM held onto XGA for several generations of PS/2 systems because many large customers developed applications that wrote directly to the XGA chip.

Repair and Support Policies. All PS/x lines include toll-free technical support, 24 hours a day, seven days a week. The differences between the lines are the length of warranty and availability of on-site service. The PS/2 line includes three years of on-site, same-day service, averaging a four-hour response time. The ValuePoint Performance series also includes three years of on-site service, but only for the next business day. The ValuePoint Si series includes a one-year warranty with next-day, on-site service. The IBM PS/1 comes with a one-year replacement policy via overnight shipping. The Ambra line includes a one-year, on-site warranty. However, there's a catch: Only the system unit is covered. A defective keyboard, mouse, or monitor must be shipped back for repair; Ambra promises a 48-hour turnaround.

Expandability. The more consumer-oriented the line, the less expandable it is. For example, the Ambra D4100I/VL, for example, offers no 32- or 8-bit slots. It includes five 16-bit slots and one VESA Local Bus (VLB) slot. Yet this is no hard and fast rule. The PS/2 Models 77i and 77s (a 66 MHz 486DX system) can hold a maximum of 64M of memory. The similarly configured ValuePoint Performance model can hold a maximum of 128M.

Energy Conservation. Most PS/x computers are Energy Star compliant, idling to less than 70 watts for both monitor and system unit. (Some PS/2 527M hard disk drive models do not meet compliance as well as faster ValuePoint Si Series models.) For the PS/1, for example, power management is controlled through a preinstalled Smart Energy System located on the motherboard. Energy Star compliance offers a deep-sleep standby mode and Rapid Resume, a feature that allows the last Window visible to return when the system quickly wakes up. In standby mode, power consumption in the PS/1's system unit drops from 38.0 watts to just 0.8; monitor power consumption, from 82.7 watts to 20.3. The Rapid Resume feature is possible only on the PS/1, however, because it is more than a simple software utility. It works hand-in-hand with IBM's own BIOS, dedicated circuitry on the motherboard, and a specialized power switch. The BIOS intercepts an off signal from the power switch, and, if applications or documents are open, writes the entire contents of the PC's memory to a file on the hard drive. When the PC reboots (regardless of when, even if you've unplugged or moved the machine), it swaps the contents of that file back into the system RAM. You're back in business without a perceptible delay.

Documentation. The Ambra line includes two well-organized, concise users' guides (beginner and advanced). The manuals include a table of contents but no index or glossary. The text is readable but not detailed. A basic troubleshooting section is included. The illustrations are useful, but few. An on-line help system is provided for the setup CMOS, but no on-line documentation is available. The ValuePoint's manuals demonstrate its corporate focus: Users get an "Intro to Computers" course, and administrators receive support information.

Micro Channel Architecture (MCA) Slots

As mentioned earlier, perhaps the most important difference between PS/2 systems and the other PS/x systems is the I/O adapter board interface bus, or slots. This difference is described in the following sections in more detail.

PS/2 Models 50 and higher incorporate a new bus interface called Micro Channel Architecture (MCA). MCA is a new slot design that is incompatible with the ISA slot system but offers improvements in many areas. The first consequence of this bus is that a design adapter that plugs into the ISA 8-bit or 8/16-bit slots cannot plug into MCA slots. MCA is both physically and electrically different from ISA.

MCA Advantages. MCA was designed to meet strict FCC regulations for Class B certification. These requirements are much more strict than for Class A, which covers allowable emissions in a location zoned as commercial or industrial. Class B requirements are for systems sold in residential environments and are designed to eliminate electrical interference with devices such as televisions and radios. Meeting Class B requirements should give these systems a distinct advantage as clock rates (speeds) go ever higher. People in the communications and radio industry know that as the frequency of an oscillator increases, so does the problem of noise emissions. MCA has many ground connections for shielding, including a ground pin no farther than one-tenth of an inch from any signal line in the slot. Appendix A includes a pinout diagram of ISA and MCA bus slots.

MCA is designed to eliminate the bane of adapter board installers: setting jumpers and switches to configure the adapters. In surveys, IBM found that as many as 60 percent of all technician service calls were "no problem" calls; they were switch- and jumper-setting sessions. No wonder switches and jumpers are a problem, considering the number of switches and jumpers on some memory and multifunction boards. Setting them correctly can be very difficult, and nearly impossible without the board's original manual because each manufacturer's board is different. If you buy new boards, you might save money if you buy whatever board is on sale; you probably will end up with many different adapter boards, however, most with hard-to-read manuals and a bunch of jumpers and switches to set.

IBM's answer to this problem is called Programmable Option Selection (POS), a built-in feature on all MCA-equipped systems. The POS uses a special file called an *Adapter Description File* (with the file extension ADF) that comes with each adapter. The ADF file contains all possible setting attributes for the board and is read in by the system start-up disk or reference disk. The reference disk contains a special configuration routine that reads all the files and decides on nonconflicting settings for each board. The operator might need to select particular settings when two boards conflict. When the settings are set, they are stored in CMOS (battery-saved memory) and are available every time the system is started. The settings can be stored on disk also for backup, in case of a battery failure, or to quickly restore a configuration to several systems. The POS feature saves much labor and time, and is affecting the upgrade and repair industry: Many manufacturers have established switchless setups for their adapters to make them more "PS/2-like."

This advantage of MCA might become a moot point, however. The Plug and Play (PnP) specification developed by Microsoft Corp. and Intel Corp. and to be supported by hundreds of vendors will allow sound and other expansion cards to be self-configuring. Just plug in the new card and available resources will be automatically detected, and the card will be configured with minimal work. However, your system BIOS, the add-in devices, and the operating system must all support PnP. PnP will become a popular feature supported by Microsoft Windows 4.0.

Finally, MCA-equipped systems are much more reliable than ISA-equipped systems for several reasons. The rest of this section discusses the reliability of the MCA system, particularly timing considerations.

MCA Reliability. One reason that MCA-equipped systems are more reliable than those with ISA bus interfaces is that the MCA is well-shielded. MCA-equipped systems therefore are more immune to noise from radio transmissions or any electrical noise.

This reason might be minor compared with the timing of the MCA bus. The MCA is asynchronous, which means that communication between adapters and the system board doesn't depend on timing. This feature solves a relatively common problem with bus systems. Have you ever had problems getting a system to work, only to find that moving a board to a different slot or switching two boards allows the system to operate normally? (By the way, I don't think that any IBM service manual officially suggests this solution.) The problem that moving or switching boards solves is one of timing. Each slot is supposed to carry the same signals as all the other slots, but that doesn't exactly happen. Effects on the bus, such as capacitance and signal propagation delays, can cause timing windows to "appear" differently in different slots, which can affect a board's functioning in that slot. MCA eliminates this type of problem; it is designed so that a board can tell it to "wait"—in effect, slowing the system by adding wait states until the board is ready.

Another timing-related problem is known to people who use some of the "turbo" IBM-compatible systems. In these "hypersystems," some boards cannot keep up with the system speed and do not work at all. On some systems, some of these boards can work if the system is slowed by adding wait states to operations or by reducing the speed of the system clock—but then the system doesn't really operate at its full performance capacity. Many communications, networking, and memory adapters can be speed-limiting in this way. With MCA, the bus cycles at a fixed, constant speed among all the systems, no matter what the microprocessor clock speed; the MCA always waits for a board, inserting wait states until the board is ready to proceed. Although this process might slow the system somewhat, the board and system work. Therefore, the same adapter functions in the 10 MHz Model 50 or the 50 MHz Model 90, regardless of their different clock speeds.

Other MCA design parameters for performance improvements exist, but they are more difficult to see. Most benchmarks have not proven any performance advantage in MCA systems over those with the standard ISA slots. IBM has demonstrated MCA coprocessing capabilities, however, which showed excellent performance. Taking full advantage of MCA's performance capabilities requires new bus master adapter designs. These new designs are adapters with processors that can function independently of the system or even take control of it. For now, MCA provides increased reliability and easy setup and use. The improvements incorporated into this bus make it the standard bus for the future; for now, however, many more systems in use still have the earlier ISA bus design (see table 22.3).

Fortunately, most troubleshooting techniques and methods apply equally to the MCA and the ISA bus systems. The MCA systems suffer fewer failures overall, and are much easier to set up and install. The real question is, how much are customers willing to pay for these features?

PS/2 System-Unit Features by Model

This section provides a reference to most PS/2 systems that IBM has produced. The standard parts included with each system unit include the items in this list:

- Motherboard with the CPU (central processing unit, or microprocessor) and other primary computer circuitry
- Case with internal power supply
- Keyboard
- Standard adapters or plug-in cards
- Some form of disk drive (usually)

This section also includes the following various kinds of information about each system unit:

- A listing of specific components
- Technical data and specifications

- An explanation of each submodel, with details about differences and features of each model, including changes from model to model and version to version
- Price of each system and option

Note

Prices shown are the IBM list prices and usually do not reflect true purchase prices. Normally, a standard discount of 30 percent is subtracted from the retail price. On recent PS/x models, IBM has lowered margins to the point that they use a street price instead of a retail price. This means, in most cases, discounts are usually greater than 10 percent. Retail prices are provided for comparison and reference only. If a model has been discontinued, the price given represents the retail list price at the time the system was withdrawn.

Decoding PS/2 Model Numbers

With the large variety of PS/2 systems now available, you might have difficulty telling from the model number how one differs from another. IBM's model-designation scheme started out with some reasoning behind it; but the increasingly large number of models made the original scheme difficult to adhere to and resulted in many inconsistencies in model designations. To restore consistency and enable greater understanding of the product line, IBM recently created a new model-designation scheme. This section provides an explanation of the older, inconsistent scheme, as well as the new method.

The following list shows examples of the use of the old system:

Model	Meaning
Model 70-121	120M HD, one floppy disk drive
Model 30-E41	10 MHz 286, 45M HD, one floppy disk drive
Model 70-B61	25 MHz 486, 60M HD, one floppy disk drive

Table 22.1 describes the original PS/2 model designation meanings used by IBM for the PS/2 Models 25, 25-286, 30, 30-286, 50, 55, 60, 65, 70, P70, P75, and 80.

Table 22.1 PS/2 Model Designation Codes (for Original Models)

Model	Meaning
2	20M hard disk drive
3	30M hard disk drive (except A3*)
4	45M hard disk drive
6	60M hard disk drive
8	80M hard disk drive
**0	Medialess (no hard disk, no floppy disk drives)

(continues)

Table 22.1 Continued

Model	Meaning
**1	1 floppy disk drive
**1	Monochrome display (25 only)
**2	2 floppy disk drives
**4	Color display (25, 25-286 only)
**6	10 MHz 286; 1 floppy disk (25-286 only)
0**	Space-saving keyboard (25-286 only)
12*	120M hard disk drive
A2*	25 MHz 386; 120M hard disk drive
B2*	25 MHz 486; 120M hard disk drive
16*	160M hard disk drive
A16	160M hard disk drive
32*	320M hard disk drive
40*	400M hard disk drive
A**	25 MHz 386 processor
A3*	25 MHz 386 processor; 320M hard disk drive
B**	25 MHz 486 processor
C**	Color display
E**	10 MHz 286 (30-286 only)
E6*	16 MHz 386; 60M hard disk drive (70 only)
G**	Enhanced keyboard
L0*	Token-Ring LAN adapter (25 only)
LE*	EtherNet LAN adapter (55 only)
LT*	16/4 Token-Ring LAN adapter (55 only)
M**	Monochrome display

** Represents any number or letter*

Table 22.2 describes the new model-designation meanings used by IBM for the PS/2 Models 35, 40, L40, 56, 56LS, 57, 76, 77, 90, and 95.

Table 22.2 PS/2 Model Designation Codes (for Models Introduced after 10/90)

Model	Meaning
?**	Different hardware/software configurations
3	16 MHz 386SX
4	20 MHz 386SX
5	20 MHz 386SLC
6	25 MHz 386SLC
7	20 MHz 386SLC-LP

8	20 MHz 386DX

Model	Meaning
9	25 MHz 386SLC
B	50 MHz 486SLC2
D	33 MHz 486SLC
E	75 MHz 486SLC3
F	20 MHz 486DX
G	20 MHz 486SX
H	25 MHz 486SX
J	25 MHz 486DX
K	33 MHz 486DX
L	50 MHz 486DX2
M	50 MHz 486DX
N	66 MHz 486DX2
P	60 MHz Pentium
Q	66 MHz Pentium
T	100 MHz 486DX4
U	33 MHz 486SX
**0	No hard disk, one floppy disk drive
**2	20M hard disk drive
**3	40M hard disk drive
**4	60M hard disk drive
**5	80M hard disk drive
**6	100M or 104M hard disk drive
**7	120M hard disk drive
**9	160M or 170M hard disk drive
**A	200M, 208M, or 212M hard disk drive
**B	240M, 245M, or 250M hard disk drive
**C	270M hard disk drive
**D	320M, 340M, or 360M hard disk drive
**F	400M or 420M hard disk drive
**G	540M hard disk drive
**T	1G hard disk drive
**X	Medialess (no hard disk, no floppy disk drives)

The following list shows examples of the use of the new system:

Model	Meaning
Model 35-24X	Token ring, 20 MHz 386SX, no media
Model 40-040	20 MHz 386SX, 1 floppy disk drive, no hard disk
Model 9576-ATB	Model 76, 100 MHz DX4, 250M hard disk drive

Table 22.3 provides a reference list of all IBM PS/2 models that use the Industry Standard Architecture (ISA) bus and

Table 22.3 IBM PS/2 System Models with ISA Bus

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
25						
8525-001	8086	8	512K	640K	1×720K	—
8525-G01	8086	8	512K	640K	1×720K	—
8525-004	8086	8	512K	640K	1×720K	—
8525-G04	8086	8	512K	640K	1×720K	—
25 LS						
8525-L01	8086	8	640K	640K	1×720K	—
8525-L04	8086	8	640K	640K	1×720K	—
30						
8530-001	8086	8	640K	640K	1×720K	—
8530-002	8086	8	640K	640K	2×720K	—
8530-021	8086	8	640K	640K	1×720K	20M
PS/1 286						
2011-M01	286	10	512K	2.5M	1×1.44M	—
2011-C01	286	10	512K	2.5M	1×1.44M	—
2011-M34	286	10	1M	2.5M	1×1.44M	30M
2011-C34	286	10	1M	2.5M	1×1.44M	30M
PS/1 SX						
2121-C42	386SX	16	2M	6M	1×1.44M	40M
2121-B82	386SX	16	2M	6M	1×1.44M	80M
2121-C92	386SX	16	2M	6M	1×1.44M	129M
25 286						
8525-006	286	10	1M	4M	1×1.44M	—
8525-G06	286	10	1M	4M	1×1.44M	—
8525-036	286	10	1M	4M	1×1.44M	30M
8525-G36	286	10	1M	4M	1×1.44M	30M
25 SX						
8525-K00	386SX	16	1M	16M	1×1.44M	—

cture (ISA) bus and shows their standard.

	Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
	ISA/8	2/2	MCGA	SS	08/04/87	—
	ISA/8	2/2	MCGA	Enh	08/04/87	—
	ISA/8	2/2	MCGA	SS	08/04/87	—
	ISA/8	2/2	MCGA	Enh	08/04/87	—
	ISA/8	2/1	MCGA	Enh	06/02/88	—
	ISA/8	2/1	MCGA	Enh	06/02/88	—
	ISA/8	3/3	MCGA	Enh	04/04/89	—
	ISA/8	3/3	MCGA	Enh	04/02/87	—
	ISA/8	3/3	MCGA	Enh	04/02/87	—
	ISA/16	0	VGA	Enh	06/26/90	—
	ISA/16	0	VGA	Enh	06/26/90	—
	ISA/16	0	VGA	Enh	06/26/90	—
	ISA/16	0	VGA	Enh	06/26/90	—
	ISA/16	0	VGA	Enh	10/07/91	—
	ISA/16	2/2	VGA	Enh	10/07/91	—
	ISA/16	2/2	VGA	Enh	10/07/91	—
	ISA/16	2/2	VGA	SS	05/10/90	—
	ISA/16	2/2	VGA	Enh	05/10/90	—
	ISA/16	2/2	VGA	SS	05/10/90	—
	ISA/16	2/2	VGA	Enh	05/10/90	—
	ISA/16	2/2	VGA	Enh	01/21/92	—

(continues)

8525-K01	386SX	16	4M	16M	1×1.44M	—
8525-L01	386SX	16	4M	16M	1×1.44M	—

Table 22.3 Continued

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
30 286						
8530-E01	286	10	1M	4M	1×1.44M	—
8530-E21	286	10	1M	4M	1×1.44M	20M
8530-E31	286	10	1M	4M	1×1.44M	30M
8530-E41	286	10	1M	4M	1×1.44M	45M
35 SX						
8535-040	386SX	20	2M	16M	1×1.44M	—
8535-043	386SX	20	2M	16M	1×1.44M	40M
35 LS						
8535-14X	386SX	20	2M	16M	—	—
8535-24X	386SX	20	2M	16M	—	—
40 SX						
8540-040	386SX	20	2M	16M	1×1.44M	—
8540-043	386SX	20	2M	16M	1×1.44M	40M
8540-045	386SX	20	2M	16M	1×1.44M	80M
L40 SX						
8543-044	386SX	20	2M	18M	1×1.44M	60M
PS/2 Model E						
9533-DB7	486SLC2	50	4M	16M	1×1.44M	120M
9533-DBD	486SLC2	50	8M	16M	1×1.44M	120M
9533-DLA	486SLC2	50	8M	16M	1×2.88M	212M
9533-DLG	486SLC2	50	8M	16M	1×2.88M	540M
9533-GB7	486SLC2	50	8M	16M	1×1.44M	120M
9533-GBD	486SLC2	50	8M	16M	1×1.44M	340M
9533-GBX	486SLC2	50	4M	16M	1×1.44M	n/a
9533-2BX	486SLC2	50	4M	16M	n/a	n/a

	ISA/16	2/1	VGA	Enh	01/21/92	—
	ISA/16	2/1	VGA	Enh	01/21/92	—

	Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
	ISA/16	3/3	VGA	Enh	09/13/87	05/04/92
	ISA/16	3/3	VGA	Enh	09/13/88	09/11/91
	ISA/16	3/3	VGA	Enh	09/26/89	01/17/92
	ISA/16	3/3	VGA	Enh	04/23/91	05/04/92
	ISA/16	3/3	VGA	Any	06/11/91	—
	ISA/16	3/3	VGA	Any	06/11/91	—
	ISA/16	3/2	VGA	Any	10/17/91	—
	ISA/16	3/2	VGA	Any	06/11/91	—
	ISA/16	5/5	VGA	Any	06/11/91	—
	ISA/16	5/5	VGA	Any	06/11/91	—
	ISA/16	5/5	VGA	Any	06/11/91	—
	ISA/16	0	VGA	SS	03/26/91	07/21/92
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—
	ISA/16	2 PCMCIA	VGA	SS w/Trackpoint	06/14/93	—

** Sales of this system unit are limited to the educational market. Suggested pricing was not available before press time.*

Table 22.4 IBM PS/2 System Models with MCA Bus

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
50						
8550-021	286	10	1M	1M	1×1.44M	20M
50Z						
8550-031	286	10	1M	2M	1×1.44M	30M
8550-061	286	10	1M	2M	1×1.44M	60M
53						
9553-0B7	486SLC2	50	4M	16M	1×1.44M	120M
9553-0BB	486SLC2	50	4M	16M	1×1.44M	250M
55 SX						
8555-031	386SX	16	2M	8M	1×1.44M	30M
8555-041	386SX	16	4M	8M	1×1.44M	40M
8555-061	386SX	16	2M	8M	1×1.44M	60M
8555-081	386SX	16	4M	8M	1×1.44M	80M
55 LS						
8555-LT0	386SX	16	4M	8M	—	—
8555-LE0	386SX	16	4M	8M	—	—
56 SX						
8556-043	386SX	20	4M	16M	1×2.88M	40M
8556-045	386SX	20	4M	16M	1×2.88M	80M
56 SLC						
8556-055	386SLC	20	4M	16M	1×2.88M	80M
8556-059	386SLC	20	4M	16M	1×2.88M	160M
56 LS						
8556-14x	386SX	20	4M	16M	—	—
8556-24x	386SX	20	4M	16M	—	—
56 SLC LS						
8556-15x	386SLC	20	4M	16M	—	—
8556-25x	386SLC	20	4M	16M	—	—
57 SX						

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/16	4/3	VGA	Enh	04/02/87	05/03/89
MCA/16	4/3	VGA	Enh	06/07/88	07/23/91
MCA/16	4/3	VGA	Enh	06/07/88	07/23/91
MCA/16	3/3	XGA	Any	11/09/93	—
MCA/16	3/3	XGA	Any	11/09/93	—
MCA/16	3/3	VGA	Enh	05/09/89	09/11/91
MCA/16	3/3	VGA	Enh	06/11/91	05/25/92
MCA/16	3/3	VGA	Enh	05/09/89	09/11/91
MCA/16	3/3	VGA	Enh	06/11/91	05/25/92
MCA/16	3/2	VGA	Enh	10/09/90	05/25/92
MCA/16	3/2	VGA	Enh	10/09/90	05/25/92
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/2	VGA	Any	02/25/92	—
MCA/16	3/2	VGA	Any	02/25/92	—
MCA/16	3/2	VGA	Any	02/25/92	—
MCA/16	3/2	VGA	Any	02/25/92	—

(continues)

8557-045	386SX	20	4M	16M	1×2.88M	80M
8557-049	386SX	20	4M	16M	1×2.88M	160M

Table 22.4 Continued

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
57 SLC						
8557-055	386SLC	20	4M	16M	1×2.88M	80M
8557-059	386SLC	20	4M	16M	1×2.88M	160M
M57 SLC						
8557-255	386SLC	20	4M	16M	1×2.88M	80M
8557-259	386SLC	20	4M	16M	1×2.88M	160M
60						
8560-041	286	10	1M	1M	1×1.44M	44M
8560-071	286	10	1M	1M	1×1.44M	70M
65 SX						
8565-061	386SX	16	2M	8M	1×1.44M	60M
8565-121	386SX	16	2M	8M	1×1.44M	120M
8565-321	386SX	16	2M	8M	1×1.44M	320M
70 386						
8570-E61	386DX	16	2M	6M	1×1.44M	60M
8570-061	386DX	20	2M	6M	1×1.44M	80M
8570-081	386DX	20	4M	6M	1×1.44M	80M
8570-121	386DX	20	2M	6M	1×1.44M	120M
8570-161	386DX	20	4M	6M	1×1.44M	160M
8570-A61	386DX	25	2M	8M	1×1.44M	60M
8570-A81	386DX	25	4M	8M	1×1.44M	80M
8570-A21	386DX	25	2M	8M	1×1.44M	120M
8570-A16	386DX	25	4M	8M	1×1.44M	160M
70 486						
8570-B61	486DX	25	2M	8M	1×1.44M	60M
8570-B21	486DX	25	2M	8M	1×1.44M	120M
P70 386						
8573-031	386DX	16	2M	8M	1×1.44M	30M
8573-061	386DX	20	4M	8M	1×1.44M	60M
8573-121	386DX	20	4M	8M	1×1.44M	120M
P75 486						

	MCA/16	5/5	VGA	Any	06/11/91	—
	MCA/16	5/5	VGA	Any	06/11/91	—
	MCA/16	5/5	VGA	Any	02/25/92	—
	MCA/16	5/5	VGA	Any	02/25/92	—
	MCA/16	5/3	XGA	Any	10/17/91	02/25/92
	MCA/16	5/3	XGA	Any	02/25/92	—
	MCA/16	8/7	VGA	Enh	04/02/87	10/31/90
	MCA/16	8/7	VGA	Enh	04/02/87	10/31/90
	MCA/16	8/7	VGA	Enh	03/20/90	07/23/91
	MCA/16	8/7	VGA	Enh	03/20/90	07/23/91
	MCA/16	8/7	VGA	Enh	10/30/90	07/23/91
	MCA/32	3/3	VGA	Enh	06/07/88	07/23/91
	MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
	MCA/32	3/3	VGA	Enh	06/11/91	—
	MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
	MCA/32	3/3	VGA	Enh	06/11/91	—
	MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
	MCA/32	3/3	VGA	Enh	06/11/91	01/17/92
	MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
	MCA/32	3/3	VGA	Enh	06/11/91	—
	MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
	MCA/32	3/3	VGA	Enh	06/20/89	09/11/91
	MCA/32	2/2	VGA	Enh	03/20/90	07/23/91
	MCA/32	2/2	VGA	Enh	05/09/89	07/23/91
	MCA/32	2/2	VGA	Enh	05/09/89	—

	Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn

(continues)

8573-161	486DX	33	8M	16M	1×1.44M	160M
8573-401	486DX	33	8M	16M	1×1.44M	400M

Table 22.4 Continued

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
80 386						
8580-041	386DX	16	1M	4M	1×1.44M	44M
8580-071	386DX	16	2M	4M	1×1.44M	70M
8580-081	386DX	20	4M	4M	1×1.44M	80M
8580-111	386DX	20	2M	4M	1×1.44M	115M
8580-121	386DX	20	2M	4M	1×1.44M	120M
8580-161	386DX	20	4M	4M	1×1.44M	160M
8580-311	386DX	20	2M	4M	1×1.44M	314M
8580-321	386DX	20	4M	4M	1×1.44M	320M
8580-A21	386DX	25	4M	8M	1×1.44M	120M
8580-A16	386DX	25	4M	8M	1×1.44M	160M
8580-A31	386DX	25	4M	8M	1×1.44M	320M
90 XP 486						
8590-0G5	486SX	20	4M	64M	1×1.44M	80M
8590-0G9	486SX	20	4M	64M	1×1.44M	160M
8590-0H5	486SX	25	4M	64M	1×1.44M	80M
8590-0H9	486SX	25	4M	64M	1×1.44M	160M
8590-0J5	486DX	25	8M	64M	1×1.44M	80M
8590-0J9	486DX	25	8M	64M	1×1.44M	160M
8590-0K9	486DX	33	8M	64M	1×1.44M	320M
8590-0KD	486DX	33	8M	64M	1×1.44M	320M
8590-0KF	486DX	33	8M	64M	1×1.44M	400M
95 XP 486						
8595-0G9	486SX	20	4M	64M	1×1.44M	160M
8595-0GF	486SX	20	4M	64M	1×1.44M	400M
8595-0H9	486SX	25	8M	64M	1×1.44M	160M
8595-0HF	486SX	25	8M	64M	1×1.44M	400M
8595-0J9	486DX	25	8M	64M	1×1.44M	160M
8595-0JD	486DX	25	8M	64M	1×1.44M	320M
8595-0JF	486DX	25	8M	64M	1×1.44M	400M
8595-0KD	486DX	33	8M	64M	1×1.44M	320M
8595-0KF	486DX	33	8M	64M	1×1.44M	400M

MCA/32	4/4	XGA	Enh	11/12/90	—
MCA/32	4/4	XGA	Enh	11/12/90	—

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/32	8/7	VGA	Enh	04/02/87	10/31/90
MCA/32	8/7	VGA	Enh	04/02/87	10/31/90
MCA/32	8/7	VGA	Enh	10/30/90	—
MCA/32	8/7	VGA	Enh	04/02/87	12/27/90
MCA/32	8/7	VGA	Enh	03/20/90	01/29/91
MCA/32	8/7	VGA	Enh	10/30/90	—
MCA/32	8/7	VGA	Enh	08/04/87	12/27/90
MCA/32	8/7	VGA	Enh	03/20/90	—
MCA/32	8/7	VGA	Enh	03/20/90	01/29/91
MCA/32	8/7	VGA	Enh	10/30/90	—
MCA/32	8/7	VGA	Enh	03/20/90	—
MCA/32	4/3	XGA	Enh	04/23/91	01/17/92
MCA/32	4/3	XGA	Enh	04/23/91	01/17/92
MCA/32	4/3	XGA	Enh	10/17/91	—
MCA/32	4/3	XGA	Enh	10/17/91	—
MCA/32	4/3	XGA	Enh	10/30/90	01/17/92
MCA/32	4/3	XGA	Enh	10/30/90	01/17/92
MCA/32	4/3	XGA	Enh	10/17/91	—
MCA/32	4/3	XGA	Enh	10/30/90	—
MCA/32	4/3	XGA	Enh	10/17/91	—
MCA/32	8/6	XGA	Enh	04/23/91	01/17/92
MCA/32	8/6	XGA	Enh	04/23/91	01/17/92
MCA/32	8/6	XGA	Enh	10/17/91	—
MCA/32	8/6	XGA	Enh	10/17/91	—
MCA/32	8/6	XGA	Enh	10/30/90	01/17/92
MCA/32	8/6	XGA	Enh	10/30/90	01/17/92
MCA/32	8/6	XGA	Enh	04/23/91	01/17/92
MCA/32	8/6	XGA	Enh	10/30/90	—
MCA/32	8/6	XGA	Enh	04/23/91	—

Keyboards available include the Enhanced (101-key), Space-Saving (84-key), and Host-Connected (122-key). If "Any" is indicated, the purchaser can choose any of the three.

Differences between PS/2 and PC Systems

Except for the obvious differences in appearance between PS/2 systems and the earlier "classic" (ISA) line of systems, they are quite similar. For troubleshooting and repair, you can consider the PS/2 systems as simply another type of PC-compatible system. All the troubleshooting techniques used on the other systems apply to the PS/2, although some repairs are conducted differently. For example, because each PS/2 motherboard includes a built-in floppy disk controller, if you determine that this controller is defective (using the same troubleshooting techniques as for the earlier systems), you must replace the entire motherboard. In contrast, on an IBM PC system with the same problem, you replace only the floppy controller card, a much less costly operation.

After working on a PS/2 system for some time, you will discover several positive features of these systems. The PS/2 is much more reliable than the earlier types of systems, for several reasons including the following:

- Robotic assembly of most of the system eliminates most human error during assembly.
- The presence of fewer cables than other systems—or no cables at all—eliminates one of the biggest problem areas for repairs.
- Better shielding than in other systems prevents reception and transmission of stray signals.
- The PS/2 systems have no switches or jumpers to set, a feature that eliminates many service calls due to operator installation or configuration errors.
- The systems can be taken apart and reassembled with no tools or only a few tools for special operations. Stripping down a PS/2 system to the motherboard usually takes less than one minute.

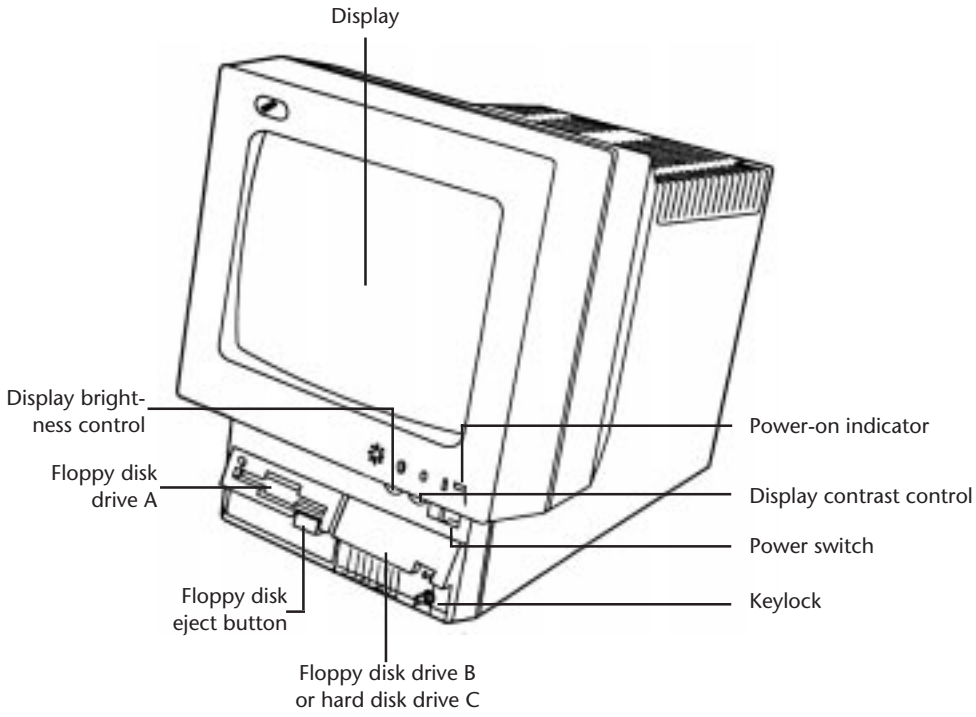
You will also discover several negative features as well:

- Because the motherboard includes so many features, it is likely to be replaced more often than in other systems.
- Parts are more expensive than for other systems, and items such as motherboards, power supplies, and floppy drives can be much more expensive. Because of greatly reduced frequency of repair and the decreased labor required for each repair, however, maintaining a PS/2 system costs about half as much as maintaining other systems.

The primary areas of difference between PS/2 and IBM PC systems are design and construction, video, and I/O adapter board slots.

PS/2 Model 25

The PS/2 Model 25, the lowest-priced PS/2 family member, was introduced August 11, 1987 (see fig. 22.1). The Model 25 (8525) is a general-purpose system that incorporates the PC-style 8-bit slot architecture, enabling this system to accept most current adapters.



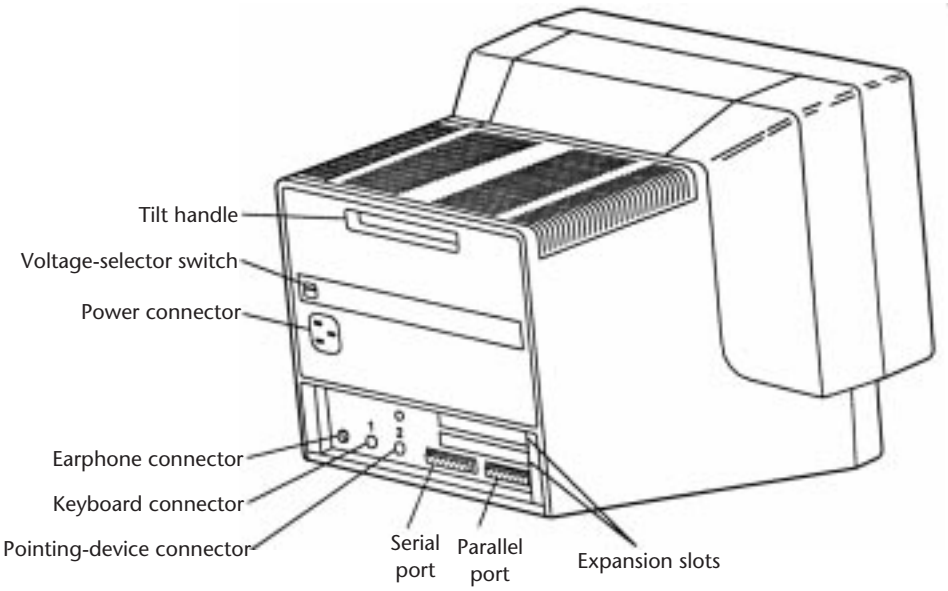
The Model 25 uses the Intel 8086 processor and operates at 8 MHz with 0 wait states to read-only memory (ROM). This system is 40 percent smaller and more than twice as fast as the original IBM PC.

Fig. 22.1
PS/2 Model 25 (front view).

The Model 25's display is integrated into the system unit, which makes it look similar to the Apple Macintosh. With the Model 25, you can choose one of two keyboards: the IBM Space-Saving Keyboard or the IBM Enhanced Keyboard, which has a numeric keypad. You also can choose one of two displays: monochrome or color. A second 3 1/2-inch floppy disk drive, a 20M hard disk, and an additional 128K of RAM memory are available.

The Model 25 offers the same text and graphics capabilities as the IBM PS/2 Model 30. The built-in MultiColor Graphics Array (MCGA) can display as many as 256 colors on the system's color monitor (from a palette of more than 256,000 colors) or 64 shades of gray on the monochrome monitor.

Two 8-bit expansion slots enable you to attach many existing personal computer cards.



A 12-inch analog display (color or monochrome), a display adapter, an RS-232C serial adapter, a parallel adapter, and a floppy disk drive adapter are standard, increasing the function of the standard unit. Figure 22.2 shows the rear panel of the Model 25.

Fig. 22.2
PS/2 Model 25 (rear view).

Each model of the PS/2 Model 25 includes the following features:

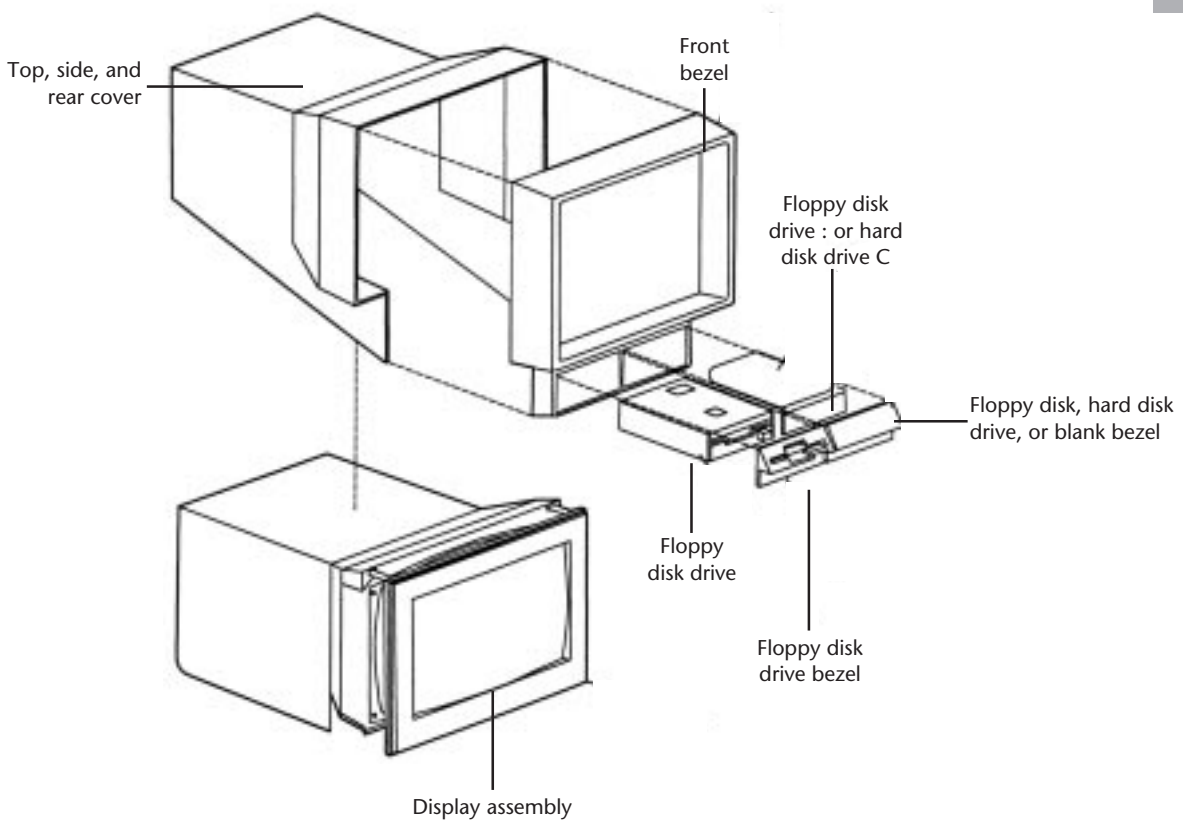
- Approximately twice the speed of the IBM PC or IBM XT
- Two 8-bit expansion slots (one full-size and one 8-inch), which allow attachment of many existing PC cards
- Integrated MultiColor Graphics Array (MCGA) graphics

  Displays 256 colors from 262,144 possible colors

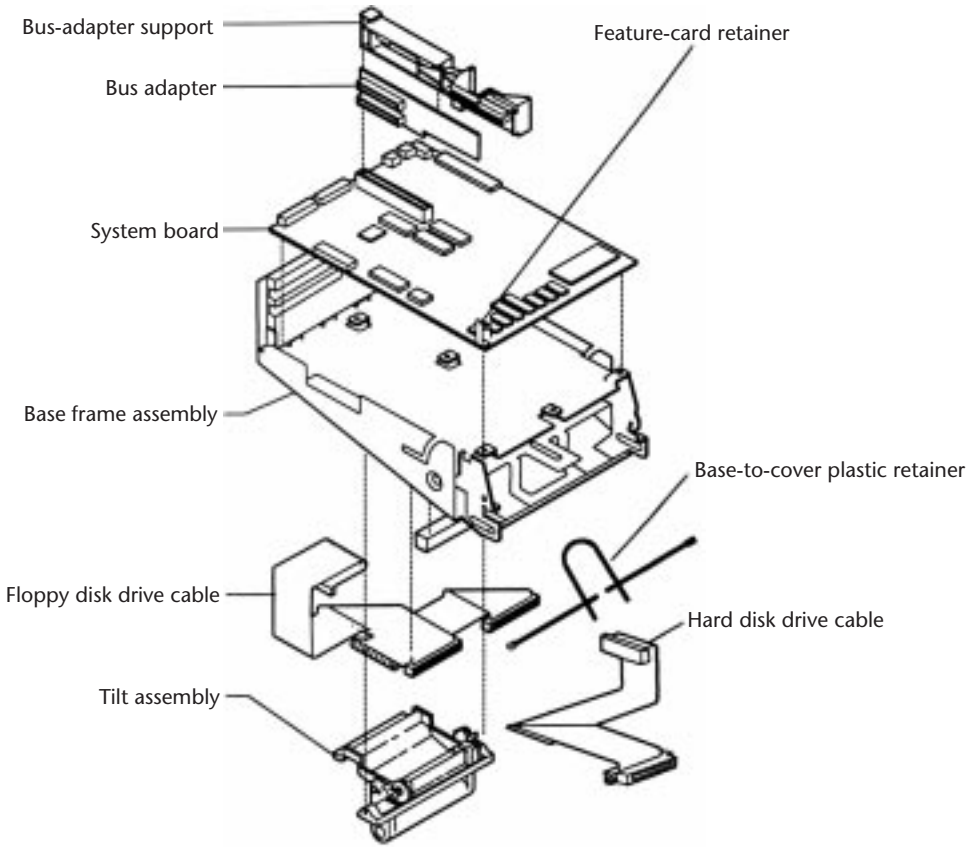
  Displays 64 shades of gray
- 512K of RAM standard, expandable to 640K on the motherboard
- Integrated floppy disk controller for as many as two 3 1/2-inch 720K drives
- One 3 1/2-inch (720K) floppy disk drive
- 12-inch analog display (color or monochrome)

- IBM Space-Saving Keyboard or Enhanced Keyboard
- Integrated serial port, parallel port, mouse port, and keyboard port
- Audio earphone connector
- Math coprocessor socket
- Advanced technology that eliminates jumpers and switches

Some PC adapters do not work in the Model 25 for various reasons. Because of the integrated functions on the Model 25 motherboard, certain options (such as PC types of memory upgrades, floppy controllers, and graphics adapters) might conflict with what is already present on the motherboard. Moreover, because of physical constraints, adapter cards thicker than 0.8 inch might not work, and one of the two slots is a half-length slot. The integrated MCGA does not support modes that support the 5151 Mono-



chrome Display. The Model 25 has analog graphics output and does not support digital display devices. Figures 22.3 and 22.4 illustrate the locations of internal components of



the PS/2 Model 25.

Fig. 22.3
PS/2 Model 25 interior (part 1).

Fig. 22.4
PS/2 Model 25 interior (part 2).

IBM expanded the usefulness of the Model 25 in two main ways: by offering a version for use on a local area network (LAN) and by providing hard disks for data and program storage.

LAN Support. On June 2, 1988, IBM introduced a specially configured version of the

Model 25, called the Model 25 LAN Station, or LS. This system is basically a standard Model 25 preconfigured with the IBM Token-Ring Network PC Adapter for use in a LAN. The Model 25 LS is available in both monochrome (8525-L01) and color (8525-L04)

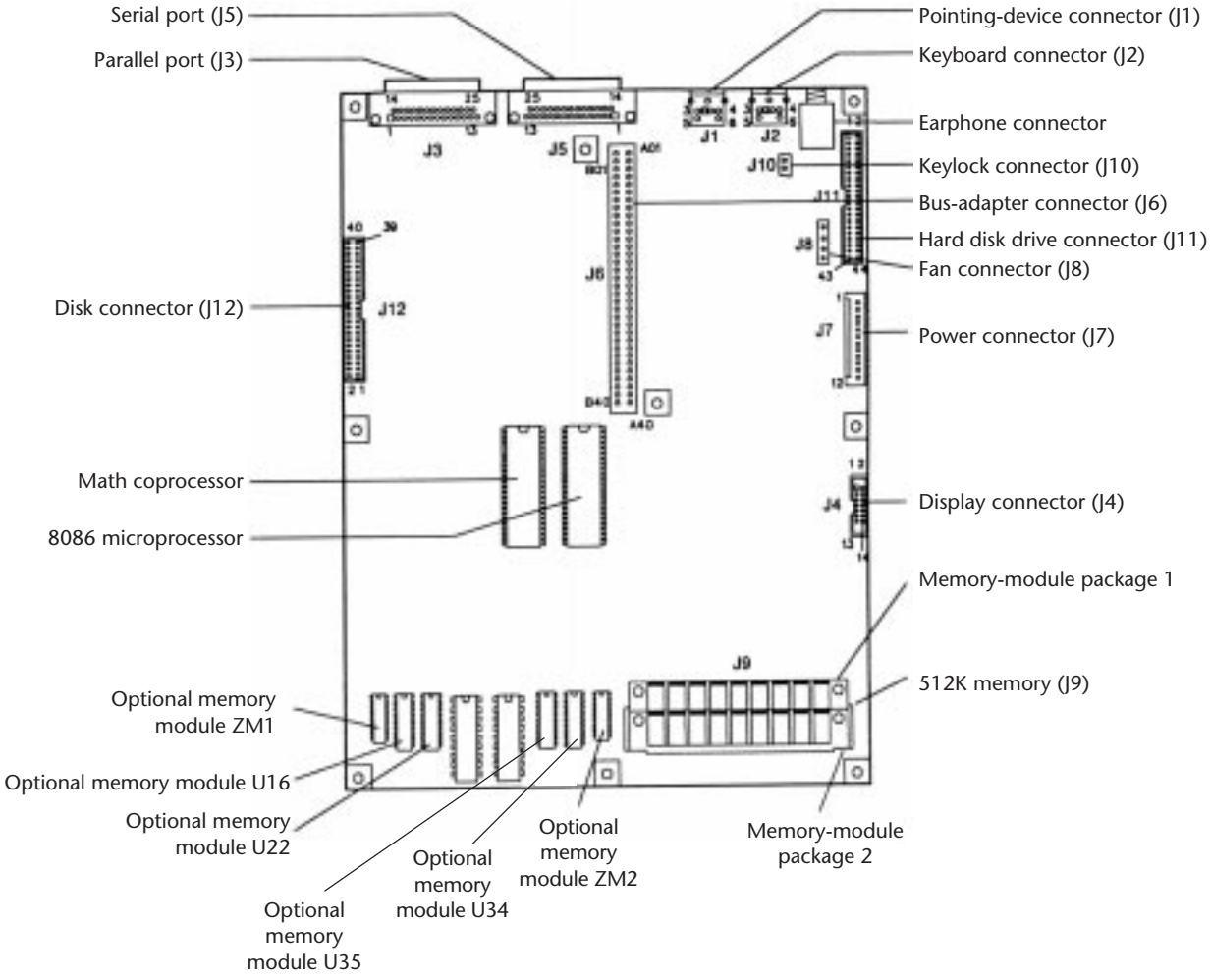
versions. The Models L01 and L04 include the Enhanced Keyboard and 640K of RAM. Because the Token-Ring Adapter II card uses the half-length expansion slot, the LS models have only a single full-length expansion slot remaining in the system unit for other adapter boards. Both models come with one 3 1/2-inch (720K) floppy disk drive. A second 720K floppy or a 20M hard drive is available.

LAN software for operating on a network is not supplied with this system and must be purchased separately. Because many people buy LAN software from a third party such as Novell, the fact that the software support is "unbundled" is beneficial. You then can choose which software to use.

Hard Disk Drives. For increased storage, IBM made a 20M hard disk drive for the Model 25. Each system has the capacity to use one hard disk drive. On models with two floppy disk drives, the 20M hard disk replaces the second floppy disk drive.

The IBM PS/2 Model 25 20M hard disk drive (78X8958) features 20M of storage, 3 1/2-inch hard disk technology, a stepper motor head-actuator mechanism, and a keylocked bezel, which disables the keyboard. It also has a built-in controller that plugs into a special port on the motherboard and does not occupy an expansion slot. (Because the controller is integrated on the drive, the term IDE—Integrated Drive Electronics—is used to describe this type of drive.) The hard disk drive is essentially the same one used in the Model 30. The built-in controller on this drive unit conserves a precious slot in the Model 25. Because the Model 25 has only two slots, conserving one of them is an important consideration.

IBM produced another hard disk for the Model 25—the 20M hard disk drive with adapter (27F4130). The controller uses RLL encoding and achieves higher data-transmission speeds than the built-in controller on the other hard drive. Like the currently available hard drive for the Model 25, the older drive uses 3 1/2-inch hard disk technology, a stepper motor head-actuator mechanism, and a keylocked bezel, which disables the keyboard. The older drive uses a higher-speed stepper motor and also has a special actuator that parks the heads automatically when the power is turned off. This drive, however, requires a separate controller, which occupies one of only two slots available in the Model 25; probably because of this limitation, IBM has discontinued production of this



hard disk drive.

Table 22.5 lists the PS/2 Model 25 technical specifications; figure 22.5 shows the PS/2 Model 25 system board.

Fig. 22.5
The PS/2 Model 25 system board.

Table 22.5 PS/2 Model 25 Technical Specifications

System Architecture	
Microprocessor	8086
Clock speed	8 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	8-bit

Interrupt levels	8
Type	Edge-triggered
Shareable	No
DMA channels	3
DMA burst mode supported	No
System Architecture	
Bus masters supported	No
Upgradeable processor complex	No
Memory	
Standard on system board	512K
Maximum on system board	640K
Maximum total memory	640K
Memory speed and type	150ns dynamic RAM
System board memory-socket type	9-bit SIMM (single in-line memory module)
Number of memory-module sockets	2
Number available in standard configuration	0
Memory used on system board	Two 256K 9-bit SIMMs, one socketed bank of four 64K×4-bit and two 64K×1-bit chips
Memory cache controller	No
Wait states:	
System board	0
Adapter	4
Standard Features	
ROM size	64K
ROM shadowing	No
Optional math coprocessor	8087
Coprocessor speed	8 MHz
Standard graphics	MCGA (MultiColor Graphics Array)
Built-in display	Yes
Monochrome	Model 8525-xx1
Color	Model 82525-xx4
Dot pitch (mm)	0.38
Audio earphone jack	Yes
RS232C serial ports	1
UART chip used	NS8250B
Maximum speed	9,600 bps
Maximum number ports	2
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Maximum number ports	2
CMOS real-time clock (RTC)	No
CMOS RAM	None

(continues)

Disk Storage	
Internal disk and tape drive bays	2
Number of 3 1/2- and 5 1/4-inch bays	2/0
Standard floppy disk drives	15720K

Table 22.5 Continued

Disk Storage		
Optional floppy disk drives:		
5 1/4-inch 360K	Optional	
5 1/4-inch 1.2M	No	
3 1/2-inch 720K	Standard	
3 1/2-inch 1.44M	No	
3 1/2-inch 2.88M	No	
Hard disk controller included	IDE connector on system board and/or an ST-506/412 RLL controller in the short slot	
IDE/ST-506 hard disks available	20M	
Drive form factor	3 1/2-inch	
Drive interface	IDE	ST-506
Average access rate (ms)	80	3
Encoding scheme	MFM	RLL
BIOS drive type number	26	36
Cylinders	612	402
Heads	4	4
Sectors per track	17	26
Rotational speed (RPM)	3600	3600
Interleave factor	3:1	3:1
Data transfer rate (K/second)	170	260
Automatic head parking	No	Yes
Expansion Slots		
Total adapter slots	2	
Number of long and short slots	1/1	
Number of 8-/16-/32-bit slots	2/0/0	
Available slots	2	
Keyboard Specifications		
101-key Enhanced Keyboard	Yes (Gxx,Lxx)	
84-key Space-Saving Keyboard	Yes (0xx)	
Fast keyboard speed setting	No	
Keyboard cable length:		
Space-Saving Keyboard	5 feet	
Enhanced Keyboard	6 feet	
Security Features		
Keylock:		

Locks cover	Yes (with optional hard disk)
Locks keyboard	Yes
Keyboard password	No
Power-on password	No
Network server mode	No
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	15.0 inches
Width footprint	9.5 inches
Width display	12.6 inches
Depth	14.7 inches
Weight:	
001/G01	31.0 pounds
L01	32.0 pounds
004/G04	36.0 pounds
L04	37.0 pounds
Carrying case	Optional
Environmental Specifications	
Power-supply output	90 watts (001/G01) 115 watts (004/G04)
Worldwide (110/60,220/50)	Yes
Auto-sensing/switching	Manual switch
Maximum current:	
90-137 VAC	2.8 amps
80-259 VAC	1.7 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	683
Noise (Avg dB, operating, 1m)	44 dB
FCC classification	Class B

Table 22.6 shows the primary specifications of the different versions of PS/2 Model 25.

PS/2 Model 30

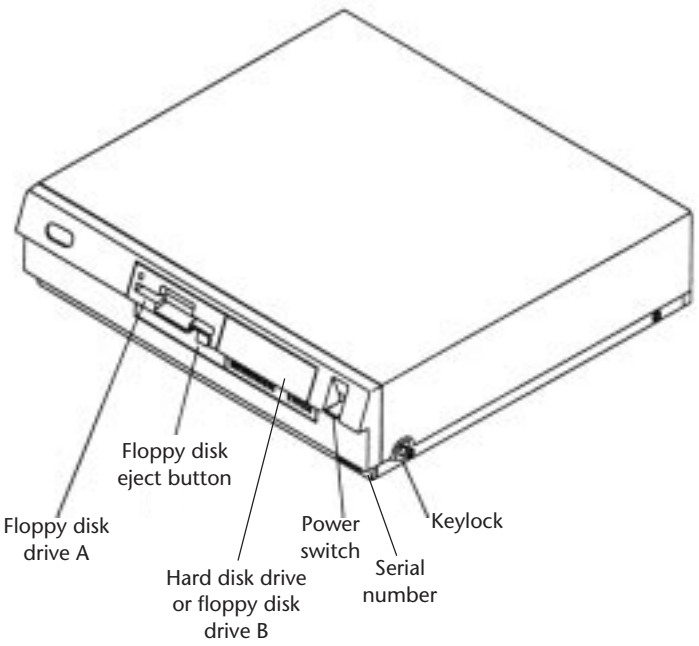
The IBM PS/2 Model 30 (IBM 8530), announced April 2, 1987, is a general-purpose system designed to offer more features and performance than the IBM PC and XT—especially in display graphics—and at a lower price. This system includes as standard many features built into the system board, including a graphics adapter, parallel port, serial port, clock calendar, 640K of RAM, and a mouse port. The Model 30 also uses

Fig. 22.6
PS/2 Model 30 (front view).

Fig. 22.7
PS/2 Model 30 (rear view).

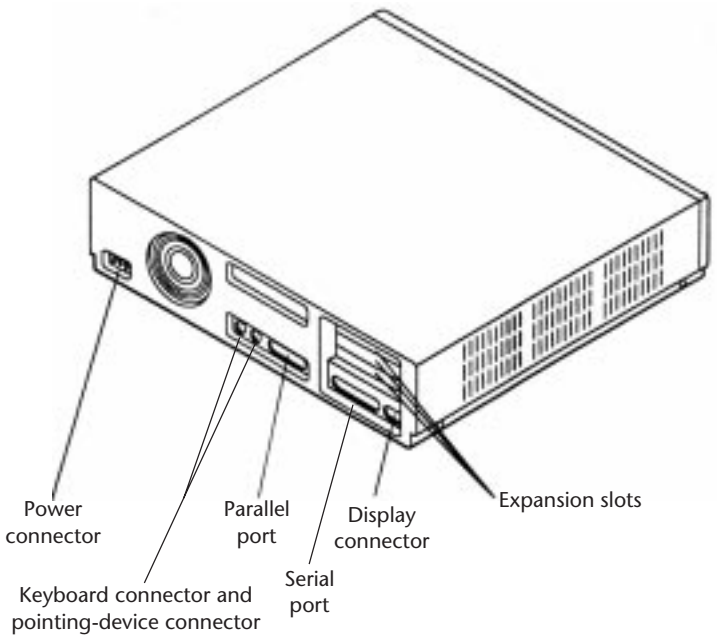
Table 22.6 IBM PS/2 Model 25 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
25						
8525-001	8086	8	512K	640K	1×720K	—
8525-G01	8086	8	512K	640K	1×720K	—
8525-004	8086	8	512K	640K	1×720K	—
8525-G04	8086	8	512K	640K	1×720K	—



many existing PC adapter cards for further expansion due to its ISA 8-bit slots. Figure 22.6 shows a front view, and figure 22.7 shows a rear-panel view of the Model 30. As of

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
ISA/8	2/2	MCGA	SS	08/04/87	—
ISA/8	2/2	MCGA	Enh	08/07/87	—
ISA/8	2/2	MCGA	SS	08/04/87	—
ISA/8	2/2	MCGA	Enh	08/04/87	—



December 27, 1990, all versions of the PS/2 Model 30 have been discontinued and no longer are available.

25 LS					
8525-L01 — —	8086 ISA/8	8 2/1	640K MCGA	640K Enh	1×720K 06/02/88
8525-L04 — —	8086 ISA/8	8 2/1	640K MCGA	640K Enh	1×720K 06/02/88

Models that end in xx1 have the monochrome analog display as a built-in feature; models that end in xx4 have the color display. The 25LS models also include an IBM Token-Ring Adapter II card in the half-length slot.

The Model 30 is based on an 8086 microprocessor, running at 8 MHz with 0 wait states. Performance is enhanced by the use of a 16-bit-wide data path to the motherboard memory, which results in internal processing speed nearly comparable to a 6 MHz AT and more than twice as fast as the 8088-based PC or XT.

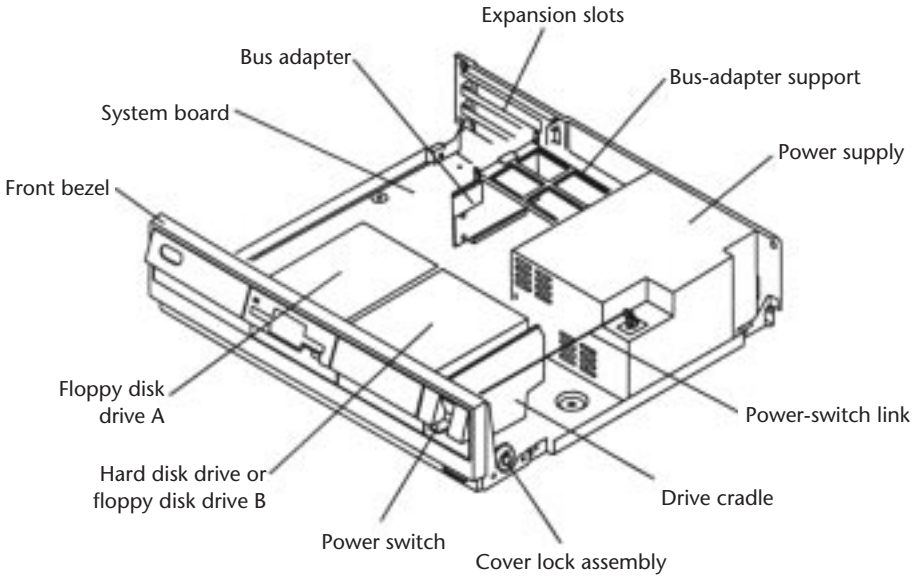
Major features of the Model 30 include the items in this list:

- Many functions integrated on the motherboard, including disk controllers, graphics, and ports
- Integrated MCGA graphics displays as many as 256 colors or 64 shades of gray
- Approximately twice the performance speed of 8088-based IBM PC and IBM XT systems
- Smaller design, with reduced power requirements
- Worldwide power supply
- Switchless installation and configuration
- 640K random-access memory (RAM)
- 16-bit access to motherboard memory
- Integrated floppy disk controller for two 720K drives
- Integrated serial port, parallel port, mouse port, and keyboard port
- IBM Enhanced Keyboard
- Time-of-day clock with extended-life battery
- Socket for a math coprocessor
- Three expansion slots to accommodate PC or XT 8-bit adapter cards

Figure 22.8 shows an interior view of the Model 30.

The Model 30 was available in three versions: the 30-001, with one 3 1/2-inch (720K) floppy drive; the 30-002, with two 3 1/2-inch (720K) floppy drives; and the 30-021, with

a 20M hard disk drive and a single 3 1/2-inch (720K) floppy drive. All models included 640K RAM.



Graphics Adapter. MultiColor Graphics Array (MCGA), the graphics adapter function integrated into the Model 30 motherboard, supports all Color Graphics Adapter (CGA) modes when an analog PS/2 display is attached. Other digital displays are incompatible. In addition to providing existing CGA mode support, MCGA supports four expanded modes, a subset of the VGA processor on Models 50 and higher:

640×480 by 2 colors—all points addressable

320×200 by 256 colors—all points addressable

40×25 by 16 colors for text (8-by-16-character box)

80×25 by 16 colors for text (8-by-16-character box)

Fig. 22.8
PS/2 Model 30 interior.

The integrated graphics adapter automatically switches from color to 64 shades of gray when connected to a monochrome analog display. This feature enables users who prefer a monochrome display to execute color-based applications without compatibility problems or troublesome software reconfiguration.

Table 22.7 lists the PS/2 Model 30 technical specifications.

(continues)

Table 22.7 PS/2 Model 30 Technical Specifications

System Architecture	
Microprocessor	8086
Clock speed	8 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	8-bit
Interrupt levels	8
Type	Edge-triggered
Shareable	No
DMA channels	3
DMA burst mode supported	No
Bus masters supported	No
Upgradeable processor complex	No

Table 22.7 Continued

Memory	
Standard on system board	640K
Maximum on system board	640K
Maximum total memory	640K
Memory speed and type	150ns dynamic RAM
System board memory-socket type	9-bit SIMM (single in-line memory module)
Number of memory-module sockets	2
Number available in standard configuration	0
Memory used on system board	Two 256K 9-bit SIMMs, one soldered bank of four 64K×4-bit and two 64K×1-bit chips
Memory cache controller	No
Wait states:	
System board	0
Adapter	4
Standard Features	
ROM size	64K
ROM shadowing	No
Optional math coprocessor	8087
Coprocessor speed	8 MHz
System Architecture	
Standard graphics	MCGA (MultiColor Graphics Array)
RS232C serial ports	1
UART chip used	NS8250B
Maximum speed (bits per second)	9,600 bps
Maximum number of ports supported	2
Pointing device (mouse) ports	1
Parallel printer port	1
Bidirectional	Yes
Maximum number of ports supported	2
CMOS real-time clock (RTC)	Yes
CMOS RAM	None
Battery life	5 years
Replaceable	Yes (replace bus adapter)
Disk Storage	

Internal disk and tape drive bays	2
Number of 3 1/2- and 5 1/4-inch bays	2/0
Standard floppy drives	15720K 25720K (002)
Optional floppy drives:	
5 1/4-inch 360K	Optional
5 1/4-inch 1.2M	No
3 1/2-inch 720K	Standard
3 1/2-inch 1.44M	No
3 1/2-inch 2.88M	No
Hard disk controller included	IDE connector on system board
IDE hard disks available	20M
Drive form factor	3 1/2-inch
Controller type	IDE
Average access rate (ms)	80
Encoding scheme	MFM
Disk Storage	
BIOS drive type number	26
Cylinders	612
Heads	4
Sectors per track	17
Rotational speed (RPM)	3600
Interleave factor	3:1
Data transfer rate (K/second)	170
Automatic head parking	No
Expansion Slots	
Total adapter slots	3
Number of long and short slots	3/0
Number of 8-/16-/32-bit slots	3/0/0
Available slots	3
Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	No
Keyboard cable length	3 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	Yes
Keyboard password	No
Power-on password	No
Network server mode	No
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	4.0 inches
Width	15.6 inches
Depth	16.0 inches
Weight:	
00x	17.5 pounds

021	21.0 pounds
Environmental Specifications	
Power-supply output	70 watts
Worldwide (110/60,220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	1.5 amps
180-265 VAC	0.75 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	341
Noise (Average dB, operating, 1m)	37.5 dB
FCC classification	Class B

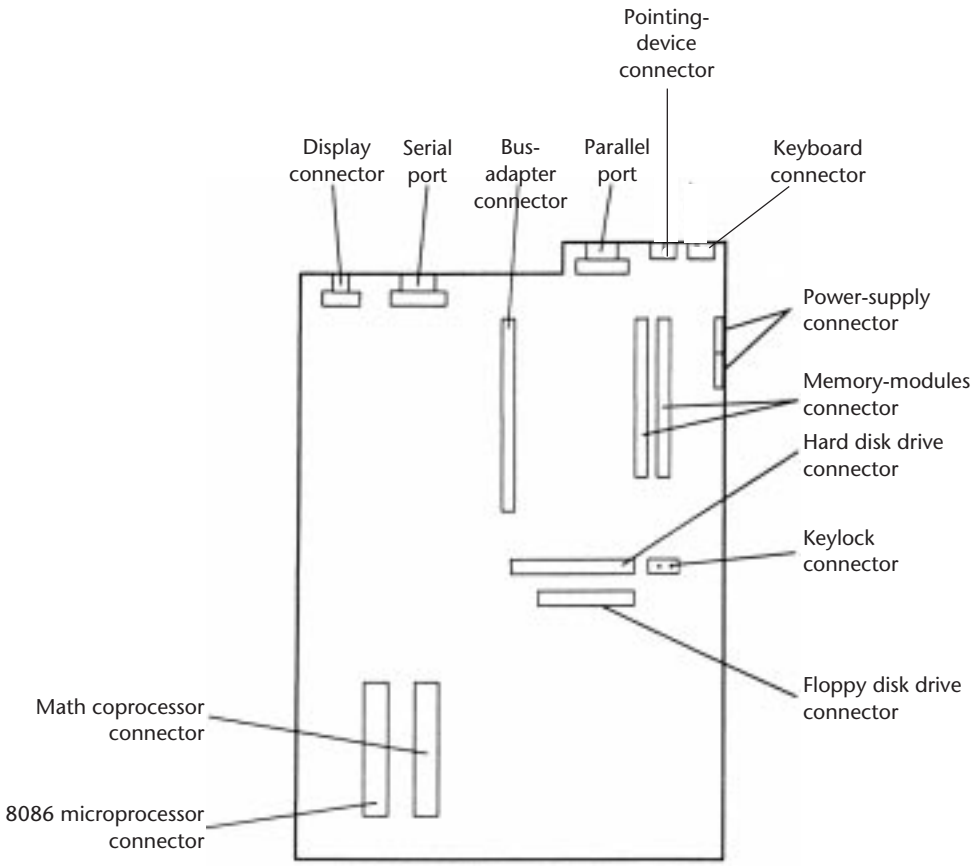


Fig. 22.9
PS/2 Model 30 (8530-001) system board.

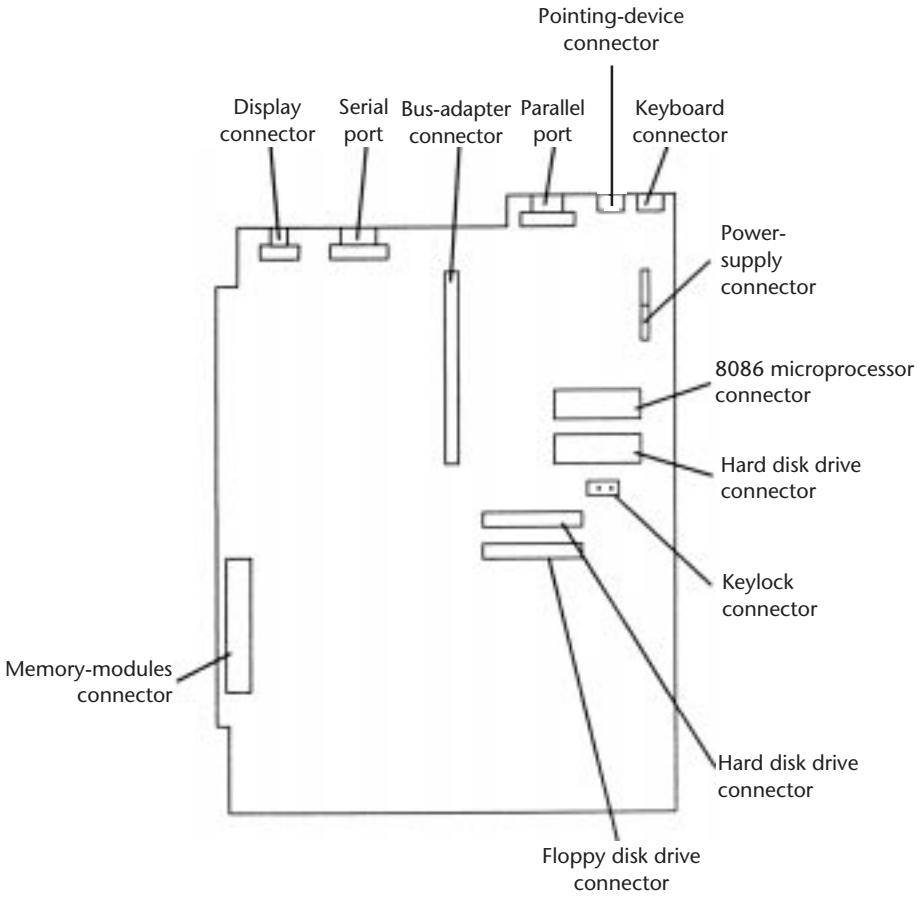


Fig. 22.10
Standard PS/2 Model 30 system board.

Table 22.8 shows the primary specifications of the different versions of PS/2 Model 30. Figures 22.9 and 22.10 show the system boards for the PS/2 Model 30 (8530-001) and the standard PS/2 Model 30.

Table 22.8 IBM PS/2 Model 25 Model Summary

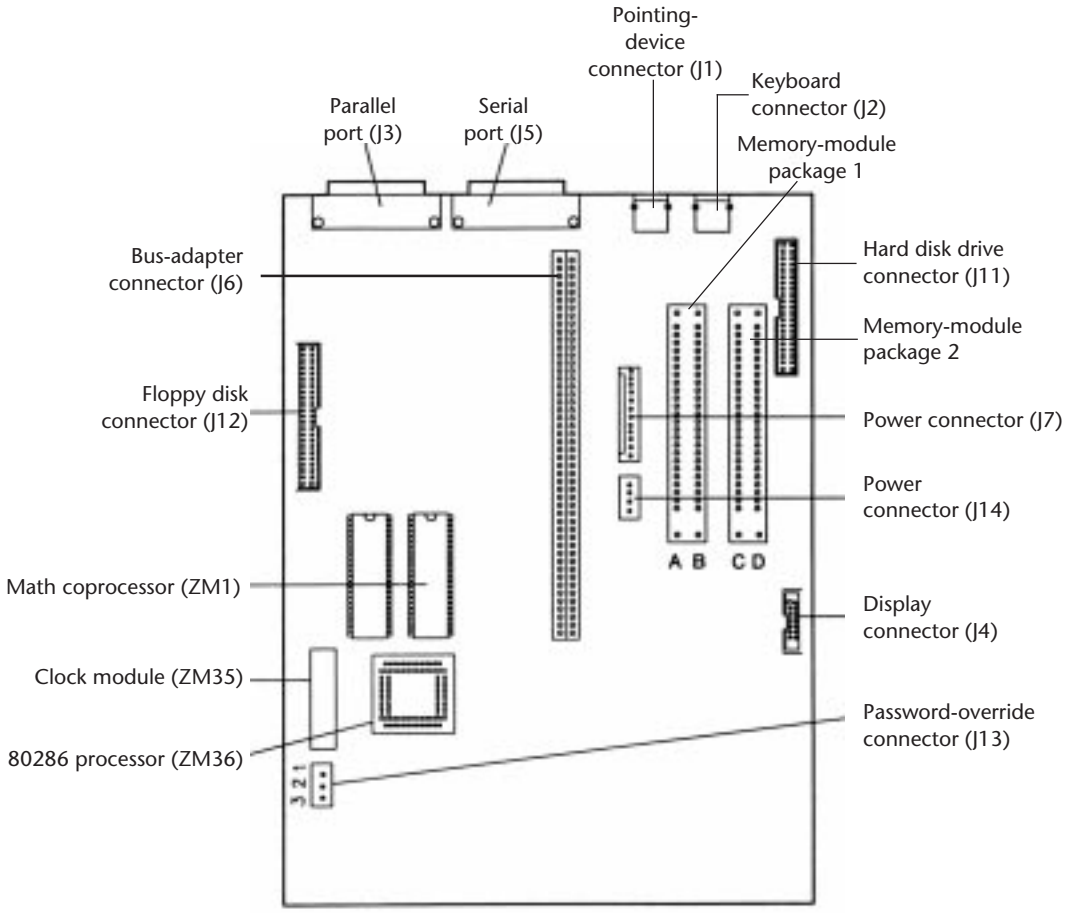
STANDARD Total Hard Disk	STANDARD Part Number	CPU Type	MHz	PLANAR MEMORY Bus Std. Video	Bus Max.	Keyboard	Floppy Drive	Available Date Intro-duced	Date Withdrawn
30									
8530-001		8086	8	640K	640K		1×720K	04/04/89	—
		ISA/8	3/3	MCGA	Enh				12/27/90
8530-002		8086	8	640K	640K		2×720K	04/02/87	—
		ISA/8	3/3	MCGA	Enh				07/05/89
8530-021		8086	8	640K	640K		1×720K	04/02/87	
20M		ISA/8	3/3	MCGA	Enh				12/27/90

All models of the 8530 have been discontinued and are no longer available from IBM.

PS/2 Model 25 286

Introduced on May 10, 1990, the PS/2 Model 25 286 (8525) unit is an enhanced version of the PS/2 Model 25. It is a standard Model 25 with an upgraded motherboard that makes it an AT-type system. This system features an 80286 microprocessor, expanded system-board memory (1M to 4M), high-density 3 1/2-inch (1.44M) floppy disk drives, and an integrated 12-inch VGA color monitor. The Model 25 286 utilizes the 80286 processor operating at 10 MHz with 1 wait state to system memory and has the following integrated functions: parallel port, serial port, pointing device port, keyboard port, an audio earphone connector, 1.44M floppy disk drive support, and VGA graphics. The Model 25 286 is offered in floppy drive only and 30M hard disk models with the IBM

Enhanced (101-key) or Space-Saving (84-key) Keyboard. It features 1M standard memory,



with a maximum of 4M on the system board. The Model 25 286 is physically very similar to the Model 25 (see figures 22.1 through 22.4 earlier in this chapter, which show

exterior and interior views of the Model 25).

The Model 25 286 differs significantly from the Model 25: It is a full AT-class system, and the original Model 25 is a PC-class system. They differ in virtually every way except appearance. (Refer to figures 22.1 through 22.4.) The Model 25 286 has a high-density floppy disk controller and a full VGA adapter integrated on the system board. An integrated color display is the only one offered. System memory can be increased to 4M on the system board and can address a maximum of 16M, providing functionality with DOS and Windows. As an AT-class system, the Model 25 286 is capable of running OS/2; the Model 25 is not. The Model 25 286 makes a perfect LAN workstation, although it is not sold preconfigured as one.

Like the Model 25, the Model 25 286 is compatible with the IBM AT at the BIOS interface level (although the BIOS is not identical) and at most hardware interfaces. Because many features are integrated on the motherboard in this system, many cards—graphics adapters, some disk controllers, and others—do not work with this system, and memory adapters that are not flexible in setting the starting memory address might not work either.

The motherboard in this system is identical to that of the Model 30 286. The BIOS is the same as the Model 30 286 as well, at least for the later versions.

The versions of this PS/2 model differ in type of keyboard (Enhanced or Space-Saving) and whether a 30M hard disk is included. Hard disks are available from IBM that will fit this system in sizes from 20M through 45M, but only the 30M is installed as standard. Hard disks are available from other manufacturers as well.

Figure 22.11 shows the Model 25 286 (and also 30 286) motherboard.

Fig. 22.11
PS/2 Model 25 286 (and 30 286) system board.

Table 22.9 lists the technical specifications for the PS/2 Model 25 286.

Table 22.9 PS/2 Model 25 286 Technical Specifications

System Architecture	
Microprocessor	80286
Clock speed	10 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	16-bit
Interrupt levels	16

Type	Edge-triggered
Shareable	No
DMA channels	7
DMA burst mode supported	No
Bus masters supported	No
Upgradeable processor complex	No

Memory

Standard on system board	1M
Maximum on system board	4M
Maximum total memory	16M
Memory speed and type	120ns dynamic RAM
System board memory-socket type	9-bit SIMM (single in-line memory module)
Number of memory-module sockets	4
Number available in standard configuration	2
Memory used on system board	256K/1M 9-bit SIMMs
Memory cache controller	No
Wait states:	
System board	1
Adapter	1

Standard Features

ROM size	128K
ROM shadowing	No
Optional math coprocessor	80287
Coprocessor speed	6.67 MHz
Standard graphics	VGA (Video Graphics Array)
Built-in display	Yes
Monochrome	No
Color	(006,G06)
Dot pitch (mm)	.28
Audio earphone jack	Yes

Standard Features

RS232C serial ports	1
UART chip used	NS16450
Maximum speed	19,200 bps
Maximum number of ports supported	2
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Maximum number of ports supported	2

(continues)

CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes
Battery life	10 years
Replaceable	Yes (Dallas module)

Disk Storage

Internal disk and tape drive bays	2				
Number of 3 1/2- and 5 1/4-inch bays	2/0				
Standard floppy drives	1x1.44M				
Optional floppy drives:					
5 1/4-inch 360K	Optional				
5 1/4-inch 1.2M	No				
3 1/2-inch 720K	No				
3 1/2-inch 1.44M	Standard				
3 1/2-inch 2.88M	No				
Hard disk controller included	IDE connector on system board				
IDE hard disks available	20/30/45M				
Drive form factor	3 1/2-inch				
Drive interface	IDE				
Drive capacity	20M	20M	30M	30M	45M
Average access rate (ms)	80	27	27	19	32
Encoding scheme	MFM	RLL	RLL	RLL	RLL
BIOS drive type number	26	34	33	35	37
Cylinders	612	775	614	921	580
Heads	4	2	4	2	6
Sectors per track	17	27	25	33	26
Rotational speed (RPM)	3600	3600	3600	3600	3600
Interleave factor	2:1	3:1	3:1	4:1	3:1
Data transfer rate (K/second)	255	270	250	248	260
Automatic head parking	No	No	No	Yes	Yes

Table 22.9 Continued

Expansion Slots

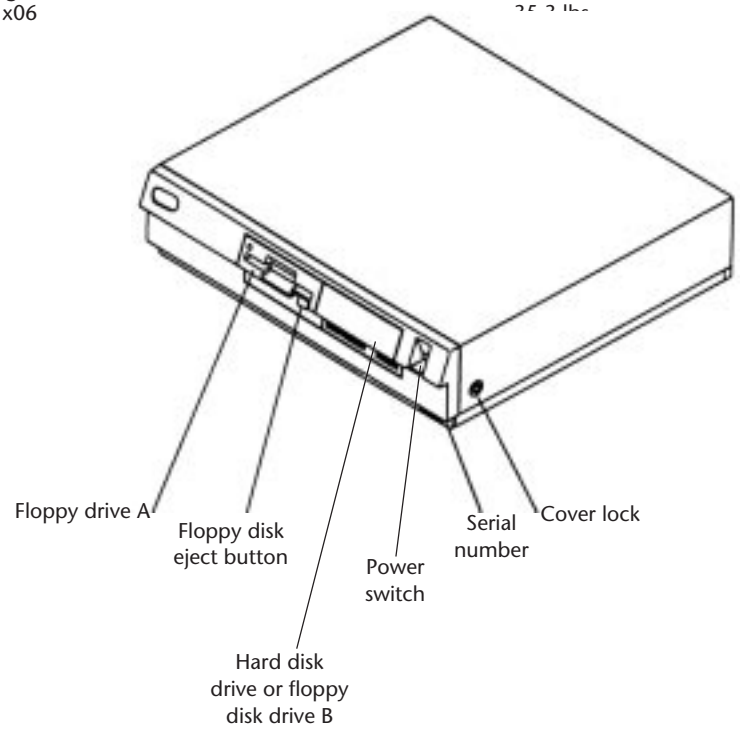
Total adapter slots	2
Number of long and short slots	1/1
Number of 8-/16-/32-bit slots	0/2/0
Available slots	2

Keyboard Specifications

101-key Enhanced Keyboard	Yes (Gxx)
84-key Space-Saving Keyboard	Yes (0xx)
Fast keyboard speed setting	Yes
Keyboard cable length:	
Space-Saving Keyboard	5 feet
Enhanced Keyboard	6 feet

Security Features	
Keylock:	
Locks cover	Yes (x36)
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes

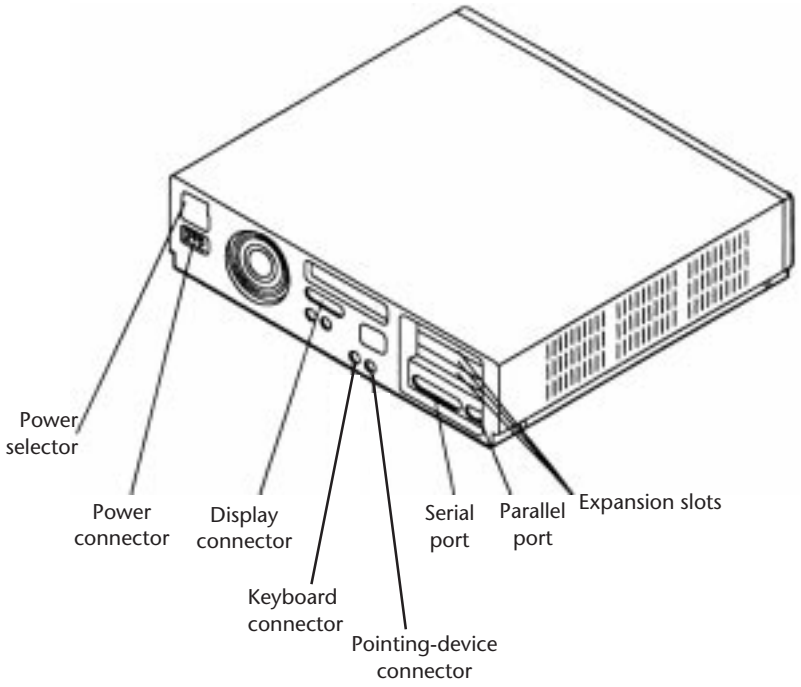
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	15.0 inches
Footprint width	9.5 inches
Display width	12.6 inches
Depth	14.7 inches
Weight:	
x06	[illegible]



x36	37.0 lbs
Carrying case	Optional

Environmental Specifications	
Power-supply output	124.5 watts
Worldwide (110/60,220/50)	Yes
Auto-sensing/switching	Manual switch
Maximum current:	
90-137 VAC	3.0 amps
80-259 VAC	1.7 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet

Environmental Specifications	
Heat (BTUs/hour)	654
Noise (Average dB, operating, 1m)	51 dB
FCC classification	Class B



PS/2 Model 30 286

The IBM PS/2 Model 30 286 (8530), introduced September 13, 1988, was the first PS/2

system with the full 16-bit ISA slot design in the original IBM AT and IBM XT 286 systems. Some people considered the Model 30 286 a reintroduction of the IBM AT; in slot design, it was. IBM supports both original Industry Standard Architecture (ISA) and Micro Channel Architecture (MCA). MCA-equipped PS/2 systems, however, are still (and will be for some time) IBM's primary platform. Figure 22.12 shows a front view, and figure 22.13 shows a rear view of the Model 30 286.

Fig. 22.12
PS/2 Model 30 286.

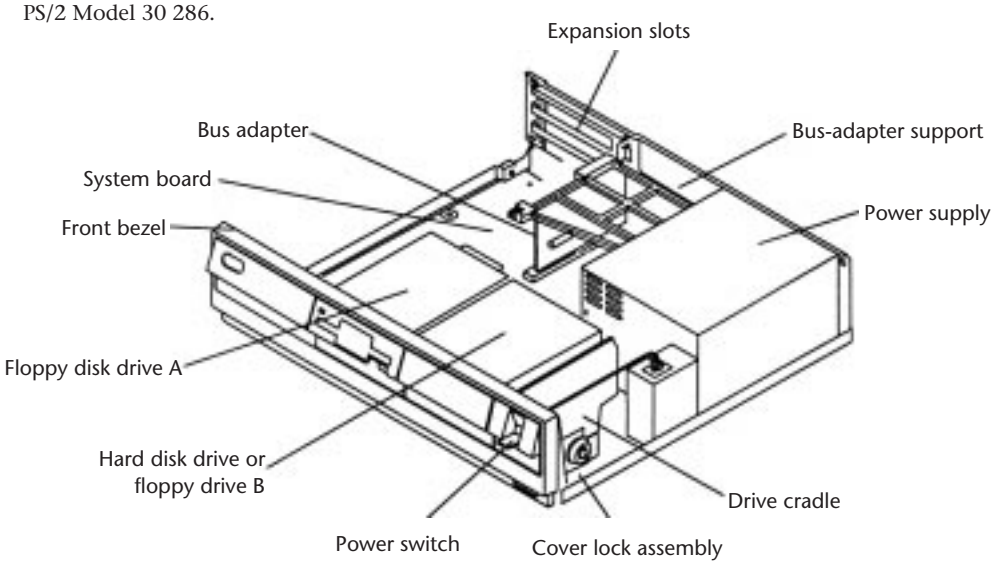


Table 22.1(s the primary specifications of the different versions of PS/2 Model 25 286.

Table 22.10 IBM PS/2 Model 25 286 Model Summary

STANDARD Part Number	CPU Type	MHz	PLANAR MEMORY Std. Video	Max. Keyboard	Floppy Drive	Available Date
STANDARD Hard Disk	Bus	Slots				Intro-duced
						Withdrawn
25 286						
8525-006	286	10	1M	4M	1x1.44M	
—	ISA/16	2/2	VGA	SS	05/10/90	
—						
8525-G06	286	10	1M	4M	2x1.44M	
—	ISA/16	2/2	VGA	Enh	05/10/90	
—						
8525-036	286	10	1M	4M	2x1.44M	
30M	ISA/16	2/2	VGA	SS	05/10/90	
—						
8525-G36	286	10	1M	4M	2x1.44M	
30M	ISA/16	2/2	VGA	Enh	05/10/90	
—						

Keyboards available include the Enhanced (101-key), Space-Saving (84-key), and Host-Connected (122-key). If "Any" is indicated, purchaser could choose any of the three.

Fig. 22.13
PS/2 Model 30 286 (rear view).

The PS/2 Model 30 286 is an 80286 version of the Model 30. Although it shares the shape
and form of the Model 30, its motherboard and circuitry are very different. The Model 30 is a PC-type system, and the Model 30 286 is an AT-type system. The Model 30 286 has processor performance equal to the Model 50 and includes a 1.44M floppy disk drive and VGA graphics. The Model 30 286 uses the Intel 80286 processor and operates at 10 MHz with 1 wait state to ROM. In addition to accepting most IBM PC and XT adapter cards, the Model 30 286
accepts most AT adapter cards. Figure 22.14 shows an interior view of the Model 30 286.

Fig. 22.14
PS/2 Model 30286 (interior view).

Think of the Model 30 286 as equal to the Model 50, except that it uses ISA slots rather than MCA slots. The Model 30 286 is very similar to the Model 25 286. In fact, the

mother-boards in the two systems are identical. The Models 25 286 and 30 286 can be considered identical systems in hardware and BIOS; they differ only in physical shape and form.

The PS/2 Model 30 286 includes these standard features:

- Greatly improved performance over the XT, the AT, and 8086-based versions of the Model 25 and Model 30
- 10 MHz 80286 16-bit microprocessor, 1 wait state
- Optional 80287 coprocessor
- 16-bit ISA bus for adapters
- Three full-sized slots
- 1M random-access memory (RAM) standard
- Memory expansion to 4M on the system board
- 1.44M, 3 1/2-inch floppy disk drive
- Universal, automatic voltage-sensing power supply
- Keyboard port, serial/asynchronous port, parallel port, mouse port, and Video Graphics Array (VGA) port
- IBM Enhanced Keyboard
- Switchless installation and configuration

Several versions of the Model 30 286 have been available. The Model E01 (8530-E01) was a single floppy disk drive version of the Model 30 286 (without a hard disk drive). An optional 3 1/2-inch 20M hard disk drive (27F4969) was available for this model. The second model (8530-E21) included the 20M drive as a standard feature. Otherwise, these models were identical. The 30 286 was then available with 30M and 45M IDE (Integrated Drive Electronics) hard disk drives that plug into a modified slot connector on the motherboard. As of May 4, 1992, even these newer models have been discontinued. Currently, all 8530 systems have been withdrawn from marketing by IBM.

The PS/2 Model 30 286 is compatible with the PC, XT, and AT at the BIOS level and at most hardware interfaces. Because many components are included on the motherboard, however, many boards that could be used in the standard PC, XT, or AT systems do not work in the Model 30 286, even though it has the ISA-style slots. Boards not likely to work include graphics adapters, some memory adapters (especially those not flexible in setting the starting memory address), and some other cards. Because of the built-in VGA, an analog display is required.

(continues)

Available versions of this model differ only in the standard hard disk supplied with the unit. Available models offer no hard drive, a 30M hard drive, or a 45M hard drive. Hard disks for installation after you purchase the system are available from other manufacturers.

Table 22.11 lists the technical specifications for the PS/2 Model 30 286.

Table 22.11 PS/2 Model 30 286 Technical Specifications

System Architecture	
Microprocessor	80286
Clock speed	10 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Edge-triggered
Shareable	No
DMA channels	7
DMA burst mode supported	No
Bus masters supported	No
Upgradeable processor complex	No
Memory	
Standard on system board	1M
Maximum on system board	4M
Maximum total memory	16M
Memory speed (ns) and type	120ns dynamic RAM
System board memory-socket type	9-bit SIMM (single in-line memory module)
Number of memory module sockets	4
Number available in standard configuration	2
Memory used on system board	256K/1M 9-bit SIMMs
Memory cache controller	No
Wait states:	
System board	1
Adapter	1
Standard Features	
ROM size	128K
ROM shadowing	No

Optional math coprocessor	80287
Coprocessor speed	6.67 MHz
Standard graphics	VGA (Video Graphics Array)
RS232C serial ports	1
UART chip used	NS16450
Maximum speed (bits/second)	19,200 bps
Maximum number of ports	2

Table 22.11 Continued

Standard Features					
Pointing device (mouse) ports	1				
Parallel printer ports	1				
Bidirectional	Yes				
Maximum number of ports	2				
CMOS real-time clock (RTC)	Yes				
CMOS RAM	64 bytes				
Battery life	10 years				
Replaceable	Yes (Dallas module)				
Disk Storage					
Internal disk and tape drive bays	2				
Number of 3 1/2- and 5 1/4-inch bays	2/0				
Standard floppy drives	1×1.44M				
Optional floppy drives:					
5 1/4-inch 360K	Optional				
5 1/4-inch 1.2M	No				
3 1/2-inch 720K	No				
3 1/2-inch 1.44M	Standard				
3 1/2-inch 2.88M	No				
Hard disk controller included	IDE connector on system board				
IDE hard disks available	20/30/45M				
Drive form factor	3 1/2-inch				
Drive interface	IDE				
Drive capacity	20M	20M	30M	30M	45M
Average access rate (ms)	80	27	27	19	32
Encoding scheme	MFM	RLL	RLL	RLL	RLL
BIOS drive type number	26	34	33	35	37
Cylinders	612	775	614	921	580
Heads	4	2	4	2	6
Sectors per track	17	27	25	33	26
Rotational speed (RPM)	3600	3600	3600	3600	3600

Interleave factor	2:1	3:1	3:1	4:1	3:1
Data transfer rate (K/second)	255	270	250	248	260
Automatic head parking	No	No	No	Yes	Yes
Expansion Slots					
Total adapter slots	3				
Number of long and short slots	3/0				
Number of 8-/16-/32-bit slots	0/3/0				
Available slots	3				
Keyboard Specifications					
101-key Enhanced Keyboard	Yes				
Fast keyboard speed setting	Yes				
Keyboard cable length	6 feet				
Security Features					
Keylock:					
Locks cover	Yes				
Locks keyboard	No				
Keyboard password	Yes				
Power-on password	Yes				
Network server mode	Yes				
Physical Specifications					
Footprint type	Desktop				
Dimensions:					
Height	4.0 inches				
Width	16.0 inches				
Depth	15.6 inches				
Weight	17.0 lbs (E01) 19.0 lbs				
Environmental Specifications					
Power-supply output	90 watts				
Worldwide (110/60, 220/50)	Yes				
Auto-sensing/switching	Manual switch				
Maximum current:					
90-137 VAC	2.5 amps				
180-265 VAC	1.3 amps				
Operating range:					
Temperature	60-90 degrees F				
Relative humidity	8-80 percent				
Maximum operating altitude	7,000 feet				
Heat (BTUs/hour)	438				
Noise (Average dB, operating, 1m)	46 dB				
FCC classification	Class B				

Table 22.12 shows the primary specifications of the various versions of PS/2 Model 30 286.

Table 22.12 IBM PS/2 Model 30 286 Model Summary

STANDARD Total Hard Disk	STANDARD Part Number Withdrawn	CPU Type	MHz Slots	PLANAR MEMORY Bus Std. Video	Date Max. Keyboard	Floppy Drive	Available Date Intro-duced
25 286							
8530-E01	—	286	10	1M	4M	1×1.44M	
	05/05/92	ISA/16	3/3	VGA	Enh		09/13/87
8530-E21		286	10	1M	4M	2×1.44M	
20M		ISA/16	3/3	VGA	Enh		09/13/88
09/11/91							
8530-E31		286	10	1M	4M	2×1.44M	
30M		ISA/16	3/3	VGA	Enh		09/26/89
01/17/92							
8530-E41		286	10	1M	4M	2×1.44M	
40M		ISA/16	3/3	VGA	Enh		04/23/91
05/04/92							

Note: *All the 30 286 models have been withdrawn and no longer are available from IBM.*

PS/2 Model 35 SX

The PS/2 Model 35 SX (8535), introduced June 11, 1991, uses the 80386SX microprocessor operating at 20 MHz with 0 to 2 wait states and has the following integrated func-

tions: parallel port, serial port, pointing device port, video graphics array (VGA 16-bit) port, keyboard port, 1.44M (million bytes) floppy disk drive support, math coprocessor socket, and three single in-line memory module (SIMM) sockets (two available for memory expansion). The PS/2 Model 35 SX is a three-slot, two-bay system; it is offered in floppy disk drive only (040) and a 40M hard disk model (043). All models come with 2M memory (expandable to 16M) standard on the system board. This system uses the 16-bit ISA for expansion, and its slots are full length. IBM's first 386 system using the ISA bus shows that, although the company's emphasis is on the MCA bus, it continues to support and enhance its offerings in the ISA realm.

All versions of the PS/2 Model 35 are compatible with the IBM AT at the BIOS interface level (although the BIOS is not identical) and at most hardware interfaces. This system also uses the same motherboard as the PS/2 Model 40 SX. The only difference is that the bus adapter in the Model 40 supports five slots rather than three, as in the Model 35. Because many features are already integrated in these systems, many standard ISA adapters such as graphics, memory, disk controller, and other cards might not operate.

The PS/2 Floor Stand option is available if you want to install the system unit vertically.

LAN Version. A special version of the Model 35, the Model 35 LS, provides a local area network (LAN) workstation solution and is available with all the standard features of the Model 35 SX, with this exception: No disk devices of any kind are installed in this medialess system; rather, a 16/4 Token-Ring adapter or IBM EtherNet adapter with Remote Initial Program Load (RIPL) occupies one of the three adapter slots. The 35 LS-24X includes an IBM 16/4 Token-Ring adapter as a standard feature; the 35 LS-14X model includes an IBM EtherNet adapter as a standard feature.

With the RIPL ROM, the system can "boot" DOS or OS/2 from the LAN server machine. The diskless Model 35 LS is fully upgradeable to the Model 35 SX configurations.

The Models 35 SX and LS both have a universal power supply with an autosense circuit. No manual switching is required. The Models 35 SX and LS, therefore, can easily be used worldwide.

Standard versions of Model 35 SX differ only in the choice of whether to have a hard disk; the LS version is completely diskless. In other respects, the models are similar.

Keyboard Options. Both the PS/2 Model 35 SX and 35 LS support the IBM Enhanced Keyboard (101/102 keys), Space-Saving Keyboard (84/85 keys), and the IBM Host-Connected Keyboard (122 keys). The Host-Connected Keyboard is similar to the 3270 keyboard offered with 3270 IBM PC and IBM AT systems. This keyboard is similar in design to that of a 3270 terminal keyboard and offers keys dedicated to 3270 functions. The Host-Connected Keyboard is supported by the BIOS in this system and cannot be retro-fitted to PS/2 systems that do not have the proper BIOS support. When you purchase a Model 35 SX or LS, you must choose any one of these three keyboards.

Floppy Drive Support. The Model 35 SX has BIOS support for the new 2.88M floppy drive.

Although this drive does not come standard in this system, one is available from IBM. The Model 35 SX is one of the first systems to support this drive.

One very interesting feature of the Model 35 SX is its selectable-boot feature. As part of the system CMOS setup program, the user can specify which drive should be booted from and in which order the boot process should try each drive selected. The system supports an internally mounted 5 1/4-inch 1.2M drive in addition to the standard 3 1/2-inch 1.44M drive, and you can specify either drive as the primary boot device. You also can specify booting only from the hard disk, or even from a network file server (RIPL). This setup offers flexibility not found on many other systems.

The Model 35 SX system unit has two drive bays that can accommodate 5 1/4-inch or 3 1/2-inch devices, unlike many other PS/2 systems. Most older PS/2 systems cannot fit 5 1/4-inch devices internally.

Table 22.13 gives the specifications for the PS/2 model 35 SX.

Table 22.13 PS/2 Model 35 SX Technical Specifications

System Architecture	
Microprocessor	80386SX
Clock speed	20 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Edge-triggered
Shareable	No
DMA channels	7
DMA burst mode supported	No
Bus masters supported	No
Upgradeable processor complex	No
Memory	
Standard on system board	2M
Maximum on system board	16M
Maximum total memory	16M
Memory speed and type	85ns dynamic RAM
System-board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory-module sockets	3
Number available in standard configuration	2
Memory used on system board	1M/2M/4M/8M 36-bit SIMMs
Memory cache controller	No
Wait states:	
System board	0-2
Adapter	1

(continues)

Standard Features	
ROM size	128K
ROM shadowing	Yes
Optional math coprocessor	80387SX
Coprocessor speed	20 MHz
Standard graphics	VGA (Video Graphics Array)
8-/16-/32-bit controller	16-bit
Bus master	No
Video RAM (VRAM)	256K
RS232C serial ports	1
UART chip used	NS16450
Maximum speed (bits/second)	19,200 bps
Maximum number of ports	2

Standard Features	
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Maximum number of ports	2
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes
CMOS battery life	10 years
Replaceable battery	Yes (Dallas module)

Disk Storage		
Internal disk and tape drive bays	2	
Number of 3 1/2- and 5 1/4-inch bays	0/2	
Selectable boot drive	Yes	
Bootable drives	All physical drives	
Standard floppy drives	1×1.44M	
None (24X)		
Optional floppy drives:		
5 1/4-inch 360K	Optional	
5 1/4-inch 1.2M	Optional	
3 1/2-inch 720K	No	
3 1/2-inch 1.44M	Standard	
3 1/2-inch 2.88M	Optional	
Hard disk controller included	IDE connector on system board	
IDE hard drives available	40/80M	
Drive form factor	3 1/2-inch	
Drive interface	IDE	
Drive capacity	40M	80M
Average access rate (ms)	17	17
Read-ahead cache	32K	32K

Encoding scheme	RLL	RLL
Cylinders	1038	1021
Heads	2	4
Sectors per track	39	39
Rotational speed (RPM)	3600	3600
Interleave factor	1:1	1:1
Data transfer rate (K/second)	1170	1170
Automatic head parking	Yes	Yes
Expansion Slots		
Total adapter slots	3	
Number of long and short slots	3/0	
Number of 8-/16-/32-bit slots	0/3/0	
Available slots	3	

Table 22.13 Continued

Keyboard Specifications	
Keyboard choices	122-key Host-Connected Keyboard 101-key Enhanced Keyboard 84-key Space-Saving Keyboard
Fast keyboard speed setting	Yes
Keyboard cable length	10 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Orientation	Horizontal (vertical with optional stand)
Dimensions:	
Height	4.5 inches
Width	14.2 inches
Depth	15.6 inches
Weight:	
24X	22.4 lbs
040	23.8 lbs
043	20.9 lbs
Environmental Specifications	

Power-supply output	118 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	3.5 amps
180-265 VAC	1.75 amps
Operating range:	
Temperature	50-95 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour):	
24X	123
040	130
043	144
FCC classification	Class B

PS/2 Model 40 SX

The PS/2 Model 40 SX (8540), introduced June 11, 1991, uses the 80386SX microprocessor operating at 20 MHz with
pandable to 16M on planar), 3 1/2-inch drive options, and 16-bit VGA. The system also provides five full-size, custo

8-/16-bit expansion card slots. The 80386SX microprocessor PS/2 Model 40 SX has the following integrated functions: parallel port, serial port, pointing device port, VGA port, keyboard port, 1.44M floppy disk drive support, math coprocessor socket, and three single in-line memory module (SIMM) sockets (two available for memory expansion).

The Model 40 SX has a universal power supply with an autosense circuit. No manual switching is required. Therefore, the Model 40 SX can easily be used worldwide.

The PS/2 Model 40 SX is compatible with the IBM AT at the BIOS interface level (although the BIOS is not identical) and at most hardware interfaces. This system also uses the same motherboard as the PS/2 Model 35 SX. The only difference is that the bus adapter in the Model 40 supports five slots rather than three, as in the Model 35. Because many features are already integrated in these systems, many standard ISA adapters such as graphics, memory, disk controller, and other cards might not operate.

The standard versions of the Model 40 SX differ only by whether and what kind of hard disk drive they provide: a floppy-drive-only model (8540-040), a 40M hard disk model (8540-043), or an 80M hard disk model (8540-045). In other respects the versions are similar.

The PS/2 Floor Stand option is available if you want to install the system unit vertically.

Keyboard Options. The PS/2 Model 40 SX supports the IBM Enhanced Keyboard (101/102 keys), Space-Saving Keyboard (84/85 keys), and the IBM Host-Connected Keyboard (122 keys). The Host-Connected Keyboard is similar to the 3270 keyboard offered with 3270 IBM PC and IBM AT systems. This keyboard is similar in design to a 3270 terminal keyboard and offers keys dedicated to 3270 functions. The Host-Connected Keyboard is supported by the BIOS in this system and cannot be retrofitted to PS/2 systems that do not have the proper BIOS support.

When you purchase a Model 40 SX, you can choose any of these three keyboards. The

ting at 20 MHz with 0 to 2 wait states to system memory. The Model 40 SX ships with 2M system board memory (ex-
five full-size, customer-accessible,

keyboard can be specified only in new equipment orders and cannot be ordered separately for on-order or installed equipment.

Floppy Drive Support. The Model 40 SX has BIOS support for the new 2.88M floppy drive. Although this drive does not come standard in this system, one is available from IBM. The Model 40 SX is one of the first systems to support this drive.

Table 22.14 shows the primary specifications of the various versions of PS2/ Model 35 SX and LS.

Table 22.14 IBM PS/2 Model 35 SX/LS Model Summary

Part Number	CPU Type	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	Total Hard Disk	STANDARD Bus	Date Available	Date Withdrawn	Date Introduced
35 SX										
8535-040	386SX	20	2M	16M	1×1.44M	—	ISA/16	3/3	VGA	Any	06/11/91	—
8535-043	386SX	20	2M	16M	2×1.44M	40M	ISA/16	3/3	VGA	Any	06/11/91	—
35 LS										

(continues)

8535-14X — —	386SX ISA/16	20 3/3	2M VGA	16M Any	— 10/17/91
8535-24X — —	386SX ISA/16	20 3/3	2M VGA	16M Any	— 06/11/91

Keyboards available include the Enhanced (101-key), Space-Saving (84-key), and Host-Connected (122-key). If "Any" is indicated, purchaser could choose any of the three.

One very interesting feature of the Model 40 SX is its selectable-boot feature. As part of the system CMOS setup program, you can specify from which drive it should be booted and in which order the boot process should try each drive selected. The system supports an internally mounted 5 1/4-inch 1.2M drive in addition to the standard 3 1/2-inch 1.44M drive; you can specify either drive as the primary boot device. You also can specify booting only from the hard disk, or even from a network file server (RIPL). This setup offers flexibility not found on many other systems.

The Model 40 SX has two or three available drive bays (depending on whether the model has a hard disk) and supports up to two hard disks and a variety of optional floppy disk devices, including a 5 1/4-inch internally mounted 1.2M floppy drive or a 2.88M 3 1/2-inch floppy drive. Because of a selectable boot feature, you can boot the system from any
installed drive.

Table 22.15 lists the technical specifications for the PS/2 model 40 SX.

Table 22.15 PS/2 Model 40 SX Technical Specifications

System Architecture	
Microprocessor	80386SX
Clock speed	20 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Edge-triggered
Shareable	No
DMA channels	7
DMA burst mode supported	No
Bus masters supported	No
Upgradeable processor complex	No
Memory	
Standard on system board	2M
Maximum on system board	16M
Maximum total memory	16M

Memory speed and type	85ns dynamic RAM
System board memory-socket type	36-bit SIMM (single in-line memory module)
Number of memory-module sockets	3
Number available in standard configuration	2
Memory used on system board	1M/2M/4M/8M 36-bit SIMMs
Memory cache controller	No
Wait states:	
System board	0-2
Adapter	1
Standard Features	
ROM size	128K
ROM shadowing	Yes
Optional math coprocessor	80387SX
Coprocessor speed	20 MHz
Standard graphics	VGA (Video Graphics Array)
8-/16-/32-bit controller	16-bit
Bus master	No
Video RAM (VRAM)	256K
RS232C serial ports	1
UART chip used	NS16450
Maximum speed (bits per second)	19,200 bps
Maximum number of ports	2

Table 22.15 Continued

Standard Features	
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Maximum number of ports	2
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes
CMOS battery life	10 years
Replaceable	Yes (Dallas module)
Disk Storage	
Internal disk and tape drive bays	4
Number of 3 1/2- and 5 1/4-inch bays	1/3
Selectable boot drive	Yes
Bootable drives	All physical drives

Standard floppy drives	1×1.44M	
Optional floppy drives:		
5 1/4-inch 360K	Optional	
5 1/4-inch 1.2M	Optional	
3 1/2-inch 720K	No	
3 1/2-inch 1.44M	Standard	
3 1/2-inch 2.88M	Optional	
Hard disk controller included	IDE connector on system board	
IDE hard drives available	40/80M	
Drive form factor	3 1/2-inch	
Drive interface	IDE	
Drive capacity	40M	80M
Average access rate (ms)	17	17
Read-ahead cache	32K	32K
Encoding scheme	RLL	RLL
Cylinders	1038	1021
Heads	2	4
Sectors per track	39	39
Rotational speed (RPM)	3600	3600
Interleave factor	1:1	1:1
Data transfer rate (K/second)	1170	1170
Automatic head parking	Yes	Yes

Expansion Slots

Total adapter slots	5
Number of long and short slots	5/0
Number of 8-/16-/32-bit slots	0/5/0
Available slots	5

Keyboard Specifications

Keyboard choices	122-key Host-Connected Keyboard 101-key Enhanced Keyboard 84-key Space-Saving Keyboard
Fast keyboard speed setting	Yes
Keyboard cable length	10 feet

Security Features

Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes

Physical Specifications

Footprint type	Desktop
Orientation	Horizontal/vertical (stand included)
Dimensions:	

Height	6.7 inches
Width	17.3 inches
Depth	15.5 inches
Weight:	26.3 lbs (040) 27.8 lbs
Environmental Specifications	
Power-supply output	197 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Manual switch
Maximum current:	
90-137 VAC	6.0 amps
180-265 VAC	3.0 amps
Operating range:	
Temperature	50-95 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	190
FCC classification	Class B

Table 22.16 shows the primary specifications of the various versions of PS/2 Model 40 SX.

Table 22.16 IBM PS/2 Model 40 SX Model Summary

STANDARD Total Hard Disk			PLANAR MEMORY		STANDARD Bus Date	Floppy Available Date
Part Number	CPU Type	MHz Slots	Std. Video	Max. Keyboard		Drive Intro-

duced	Withdrawn				
40 SX					
8540-040 — 12/21/92	386SX ISA/16	20 5/5	2M VGA	16M Any	1×1.44M 06/11/91
8540-043 40M 12/21/92	386SX ISA/16	20 5/5	2M VGA	16M Any	1×1.44M 06/11/91
8540-045 80M 12/21/92	386SX ISA/16	20 5/5	2M VGA	16M Any	1×1.44M 06/11/91

Keyboards available include the Enhanced (101-key), Space-Saving (84-key), and Host-Connected (122-key). If "Any" is indicated, the purchaser could choose any of the three.

PS/2 Model L40 SX

The PS/2 Model L40 SX, announced March 26, 1991, is a small, lightweight, battery-operated (AC/DC) portable laptop system. The PS/2 Model L40 SX is designed for people who want a high-function portable that is easy to carry and has the speed and capacity to support advanced applications. Standard features include a 20 MHz 80386SX processor; 2M of 80ns memory (expandable to 18M); 60M 2 1/2-inch hard disk; 3 1/2-inch 1.44M floppy disk drive; 10mm-thick, cold fluorescent, black-and-white LCD with VGA resolution; 84/85 key keyboard; and serial, parallel, keypad/mouse, VGA, and external expansion I/O ports for attaching external devices. In addition, each system includes an external 17-key numeric keypad, an AC adapter, a rechargeable battery pack, and a carrying case. Options for the PS/2 Model L40 SX include a one-slot expansion chassis, a data/fax modem (for the U.S. and Canada); a second serial adapter; a Trackpoint pointing device; 2M, 4M, or 8M memory upgrades; a quick charger; and a car-battery adapter.

The PS/2 Model L40 SX physical package is based on a clamshell design. It fits in most attaché cases and weighs 7.7 pounds, including the rechargeable battery pack. The PS/2 Model L40 SX features the familiar IBM keyboard size and layout; 80386SX architecture; large, easy-to-read display; high-capacity hard disk; and efficient battery-power management, while maintaining the light weight of a notebook portable. Compared to the IBM PS/2 Model P70, the PS/2 Model L40 SX adds battery operation, clamshell design, black-on-white LCD, and a smaller, lighter package.

System Expansion and Restrictions. The Model L40 SX is designed to be compatible with the IBM AT at the BIOS interface level and at most hardware interfaces, and the system is very expandable. Many I/O connections are provided as standard. An external numeric keypad, included with the unit, plugs into the standard mouse port. The numeric keypad has a mouse port to enable numeric keypad and mouse connections to operate concurrently. The L40 has a standard serial port, parallel port, VGA display port, and a special external expansion port reserved for an expansion chassis or base station called the Communications Cartridge I.

The PS/2 Communications Cartridge I is a one-slot expansion unit that you use with the Model L40 SX. The unit contains one half-size card slot especially designed to support Token-Ring, 3270, or 5250 communications adapter cards. Although the Communications Cartridge I was designed primarily for these communications adapters, other types

Memory	
System board memory-socket type	36-bit CMOS SIMMs, specially keyed
Number system-board memory modules	2
Number available in standard configuration	2
Memory used on system board	2M soldered, and 2M/4M/8M 36-bit CMOS SIMMs
Memory cache controller	No
Wait states:	
System board	0-2
Standard Features	
ROM size	128K
ROM shadowing	Yes
Optional math coprocessor	80387SX
Coprocessor speed	20 MHz
Standard graphics	VGA (Video Graphics Array)
8-/16-/32-bit controller	8-bit
Bus master	No
Video RAM (VRAM)	256K
Built-in display	Yes
Type	LCD
Dimensions (Diag/H×W)	10 inches/6 × 5 × 8 inches
Number of grayshades	32
Backlit/sidelit	Sidelit
Supertwisted	Yes
Contrast ratio	12:1
Detachable	No
External monitor port	Yes
External display disables LCD	Yes
LCD indicators	Yes
RS232C serial ports	1
UART chip used	NS16450
Maximum speed (bits/second)	19,200 bps
Maximum number of ports supported	2
Internal modem	Optional
Hayes-compatible	Yes
Asynchronous/synchronous	Yes/Yes
FAX capable	Yes
Group III compatible	Yes
FAX software included	Yes
Send/receive FAX	Yes/Yes
Maximum speed (bps):	
Data	2,400 bps
FAX	9,600 bps
Pointing device (mouse) ports	1

(continues)

Table 22.17 Continued

Standard Features	
Parallel printer ports	1
Bidirectional	Yes
Maximum number of ports supported	1
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes
CMOS battery life	5 years
Replaceable	Yes
Disk Storage	
Internal disk and tape drive bays	2
Number of 3 1/2- and 5 1/4-inch bays	1/0
Standard floppy drives	1×1.44M
Hard disk controller included	IDE connector on system board
IDE hard disks available	60M
Drive form factor	2 inches
Drive interface	IDE
Average access rate (ms)	19
Encoding scheme	RLL
Cylinders	822
Heads	4
Sectors per track	38
Rotational speed (RPM)	3600
Interleave factor	1:1
Data transfer rate (K/second)	1140
Automatic head parking	Yes
Expansion Slots	
Total adapter slots	0
Available slots	0
Keyboard Specifications	
101-key Enhanced Keyboard	Yes (with external keypad)
84-key keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard detachable	No

Security Features	
Keylock:	
Locks cover	No
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Laptop
Dimensions:	
Height	2.1 inches
Width	12.8 inches
Depth	10.7 inches
Weight: with battery	7.7 lbs
Carrying case	Leather, included
Environmental Specifications	
Power supply:	
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-265 VAC	2.7 amps
Operating range:	
Temperature	41-95 degrees F
Relative humidity	5-95 percent
Maximum operating altitude	8,000 feet
Heat (BTUs/hour)	136
Noise (Average dB, operating, 1m)	32 dB
FCC classification	Class B
Miscellaneous	
A/C adapter included	Yes
Quick charger	Optional
Car cigarette lighter adapter	Optional
Battery pack included	Yes
Battery charge duration	3 hours
Setup and power-management software	Yes
Speed-setting switch and software	Yes

Table 22.18 shows the primary specifications of the PS/2 Model L40 SX.

Table 22.18 IBM PS/2 Model L40 SX Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
L40 SX						
8543-044	386SX	20	2M	18M	1×1.44M	60M

Table 22.19 shows accessories available from IBM for the PS/2 Model L40 SX.

Table 22.19 IBM PS/2 Model L40 SX Special Accessories

Description	Part Number	Price	Notes
Communications Cartridge I	3541001	$595	One-slot expansion chassis
Rechargeable battery pack	79F0197	130	3 hours use/up to 500 charges
Quick charger	79F0192	132	Charges in 2 1/2 hours rather than 8 hours
Car battery adapter	79F1012	165	Lighter socket runs and recharges L40
Leather carrying case	79F3981	71	Included with L40SX, black leather
Deluxe carrying case	79F0981	115	Cloth case, pockets and compartments
Airline travel hard case	79F3844	247	Plastic, padded, wheels, storage
Serial adapter for L40 SX	79F0979	119	Second serial, N/A with internal FAX or modem

PS/2 Model 50

The IBM PS/2 Model 50, which uses MCA, was introduced April 2, 1987, as an entry-level desktop system in the PS/2 family. Figure 22.15 shows a front view of the Model 50. As of July 23, 1991, all models of the 50 and 50 Z were discontinued and no longer are available from IBM.

The Model 50 features a 10 MHz 286 processor running with 0 or 1 wait state, depending on the model version, and 1M of memory on the system board. System-board memory can be expanded to 2M on Model 50 Z systems, but is limited to 1M on the standard model (8550-021). As much as 16M of additional memory can be added with memory adapter cards. The IBM Model 50 comes standard with a 1.44M, 3 1/2-inch floppy disk drive; a 20M, 30M, or 60M hard disk drive (depending on the model); a serial port; a parallel port; a mouse port; and a Video Graphics Array (VGA) port. Figure 22.16 shows the rear panel of the Model 50.

Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
ISA/16	0	VGA	SS	03/26/91	07/21/92

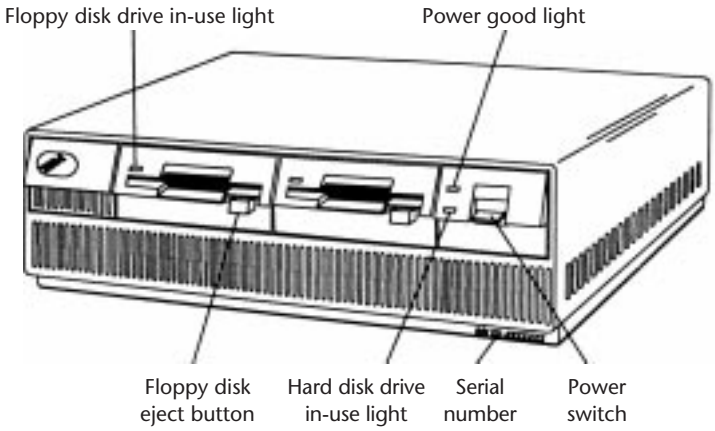


Fig. 22.15
PS/2 Model 50.

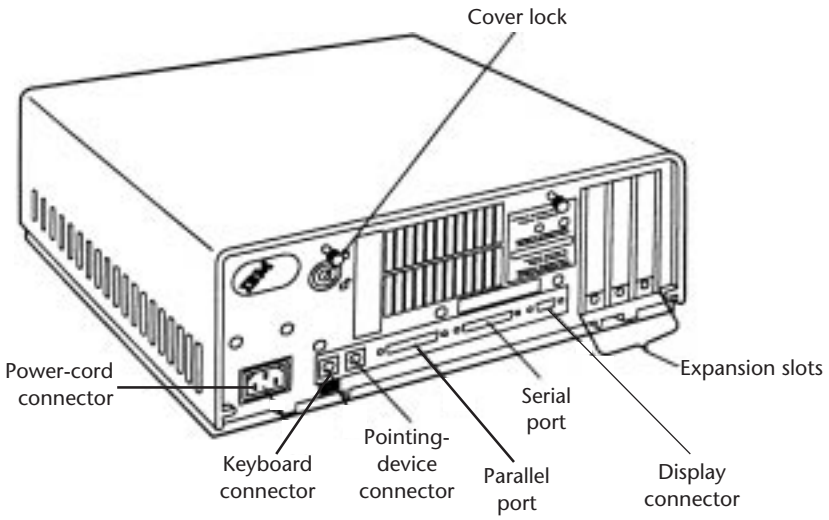


Fig. 22.16
PS/2 Model 50 rear panel view.

The 80286 10 MHz 16-bit microprocessor running with 1 wait state enables the 50-021 to perform approximately 20 percent faster than the IBM XT 286 or the IBM AT Model 339. The Model 50 Z systems (8550-031 and 8550-061) run with 0 wait states to motherboard memory access, which translates into an additional 20 percent performance increase for most computational tasks.

The Model 50 has two levels of BIOS, which total 128K: a Compatibility BIOS (CBIOS) with memory addressability of up to 1M provides support for real-mode-based application programs. An additional version of BIOS, Advanced BIOS (ABIOS), provides support for protected-mode-based multitasking operating systems and has extended memory addressability of up to 16M.

Note

Real mode is a mode in which the 80286 processor can emulate 8086 or 8088 processors for compatibility purposes. DOS runs under this mode. Protected mode, not found in the 8086 or 8088 processors, allows for specialized support of multitasking. Advanced multitasking operating systems such as OS/2 run under this mode.

Additional features of the system unit include four 16-bit I/O slots (with one slot occupied by the disk controller adapter); a 94-watt, automatic voltage-sensing, universal power supply; a time-and-date clock with battery backup; a socket for an 80287; an additional position for a second 3 1/2-inch floppy disk drive; and the IBM Enhanced Keyboard. Figure 22.17 shows an interior view of the Model 50.

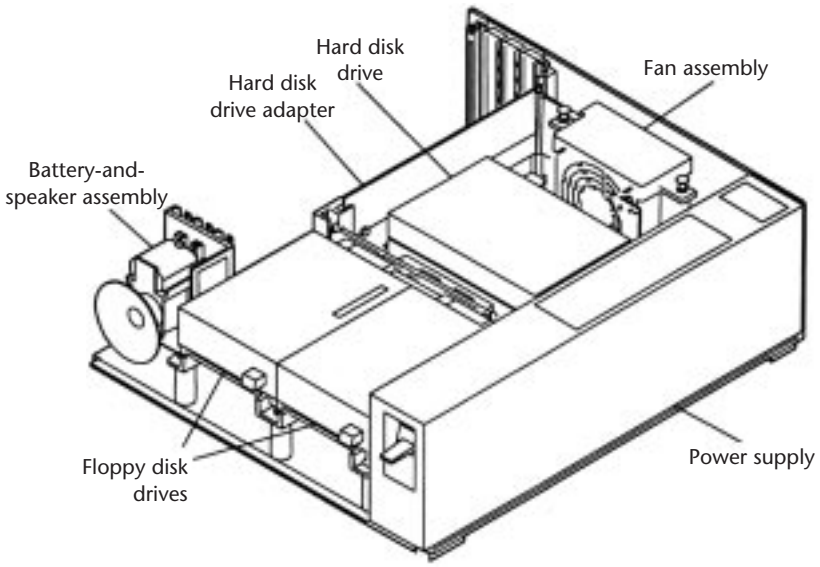


Fig. 22.17
PS/2 Model 50 interior view.

Model 50 Z. On June 2, 1988, IBM introduced the PS/2 Model 50 Z (actually the 8550-031 and the 8550-061). These models offer improved performance and greater hard disk capacity. Higher-speed (85ns) memory provides 0-wait-state processor performance and can be upgraded to 2M on the system board. The 50 Z comes with a 30M or 60M hard disk drive, which provides greater capacity and improved average access time over the standard 20M hard disk in Model 50-021.

Floppy Drive Support. The standard 1.44M drive in all the Model 50 systems can format, read, and write to either 720K (double density) or 1.44M (high density) floppy disks. In double-density mode, this drive is fully compatible with the 720K (3 1/2-inch) floppy disk drive. In high-density mode, the standard drive doubles the data capability to 1.44M and the data rate to 500K bits per second.

Note

Because of the capabilities and design of the disk media, you should not use the 1.44M drive to for-mat a 720K (1M unformatted) disk as 1.44M, or to format a 1.44M (2M unformatted) disk as 720K.

A 5 1/4-inch external disk drive (360K) is available that enables you to convert or operate existing 5 1/4-inch applications. To operate, this drive requires the External Diskette Drive Adapter/A. The adapter card plugs into the connector for the 3 1/2-inch drive B. When the external drive is installed, it becomes drive B. Unfortunately, the external disk drive consumes one slot and the drive B position.

System Expansion. In response to user complaints about the storage capacity of the original 20M Model 50, IBM offers the PS/2 60M hard disk drive as an upgrade option. You can install this drive by replacing the existing 20M hard disk in the PS/2 Model 50 (8550-021) or 30M in the Model 50 Z (8550-031). No trade-in is available for the earlier drive. This drive provides 60M of storage and a faster access time of 27ms. The replacement adapter card required for the 50-021 is included.

For additional memory, IBM offers the PS/2 1-8M Memory Expansion Adapter/A and the PS/2 2-8M Memory Expansion Adapter/A—16-bit, full-length circuit cards. You can expand either card to a maximum of 8M by using optional memory kits. You can configure the adapter memory from 1M to 8M by using either the 0.5M memory module kit or the 2M memory module kit. These cards can be installed in any open expansion slot on the Model 50. The adapter is easy to set up because it contains no jumpers or hardware switches. An additional feature is an on-board ROM that contains a POST and microcode to initialize the card.

These memory cards also provide support for two different operating modes: expanded memory and extended memory. Used as expanded memory, the adapter card's memory is compatible with applications written to the LIM EMS V4.0 standard. In addition, you can use the adapter card's memory as extended memory for DOS or OS/2. By installing two adapters, each filled to 8M, a user can reach the system address limit of 16M for the Model 50.

Because of the 0 wait states on the 50 Z systems, IBM offers a special motherboard memory upgrade for only these systems. This upgrade consists of one 2M, 85ns memory kit, which you install on the system board of the 50-031 or 50-061, replacing the standard 1M of memory. This upgrade brings the system board to its maximum capacity of 2M for these models.

Table 22.20 lists the technical specifications for the PS/2 Model 50.

Table 22.20 PS/2 Model 50 Technical Specifications

System Architecture	
Microprocessor	80286
Clock speed	10 MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	1M
Maximum on system board	2M 1M (021)
Maximum total memory	16M
Memory speed and type	85ns dynamic RAM 150ns dynamic RAM (021)
System board memory-socket type	36-bit SIMM (single in-line memory module) 9-bit SIMM (021)
Number of memory-module sockets	1 2 (021)
Number available in standard configuration	0
Memory used on system board	1M/2M 36-bit SIMM 512K 9-bit SIMMs (021)
Memory cache controller	No
Wait states:	
System board	0 1 (021)
Adapter	0-1
Standard Features	
ROM size	128K
ROM shadowing	No
Optional math coprocessor	80287
Coprocessor speed	10 MHz

Standard Features			
Standard graphics	VGA (Video Graphics Array)		
8-/16-/32-bit controller	8-bit		
Bus master	No		
Video RAM (VRAM)	256K		
RS232C serial ports	1		
UART chip used	NS16550		
Maximum speed (bits per second)	19,200 bps		
FIFO mode enabled	No		
Maximum number of ports	8		
Pointing device (mouse) ports	1		
Parallel printer ports	1		
Bidirectional	Yes		
Maximum number of ports	8		
CMOS real-time clock (RTC)	Yes		
CMOS RAM	64 bytes		
Battery life	5 years		
Replaceable	Yes		
Disk Storage			
Internal disk and tape drive bays	3		
Number of 3 1/2- and 5 1/4-inch bays	3/0		
Standard floppy drives	1×1.44M		
Optional floppy drives:			
5 1/4-inch 360K	Optional		
5 1/4-inch 1.2M	Optional		
3 1/2-inch 720K	No		
3 1/2-inch 1.44M	Standard		
3 1/2-inch 2.88M	No		
Hard disk controller included	IDE connector on Interposer Card ST-506 Controller (021)		
ST-506/IDE hard disks available	20/30/60M		
Drive form factor	3 1/2-inch		
Drive capacity	20M	30M	60M
Drive interface	ST-506	IDE	IDE
Average access rate (ms)	80	39	27
Encoding scheme	MFM	RLL	RLL
BIOS drive type number	30	33	None
Cylinders	611	614	762
Heads	4	4	6
Sectors per track	17	25	26
Rotational speed (RPM)	3600	3600	3600
Interleave factor	1:1	1:1	1:1
Data transfer rate (K/second)	510	750	780
Automatic head parking	No	No	Yes

(continues)

Table 22.20 Continued

Expansion Slots	
Total adapter slots	3
Number of long and short slots	3/0
Number of 8-/16-/32-bit slots	0/3/0
Number of slots with video ext.	1
Available slots	3
Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	6 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	5.5 inches
Width	14.2 inches
Depth	16.5 inches
Weight	23.0 lbs 21.0 lbs (021)
Environmental Specifications	
Power-supply output	94 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	2.7 amps
180-265 VAC	1.4 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	494
Noise (Average dB, operating, 1m)	46 dB
FCC classification	Class B

Figures 22.18 and 22.19 show the layout and components on Model 50 and 50 Z motherboards, respectively.

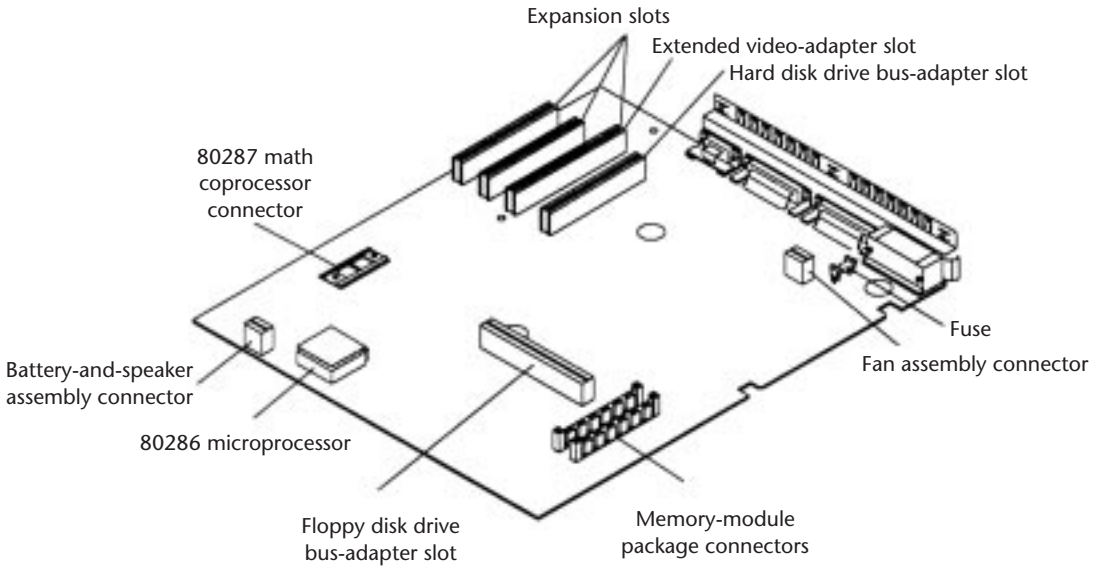


Fig. 22.18
PS/2 Model 50 system board.

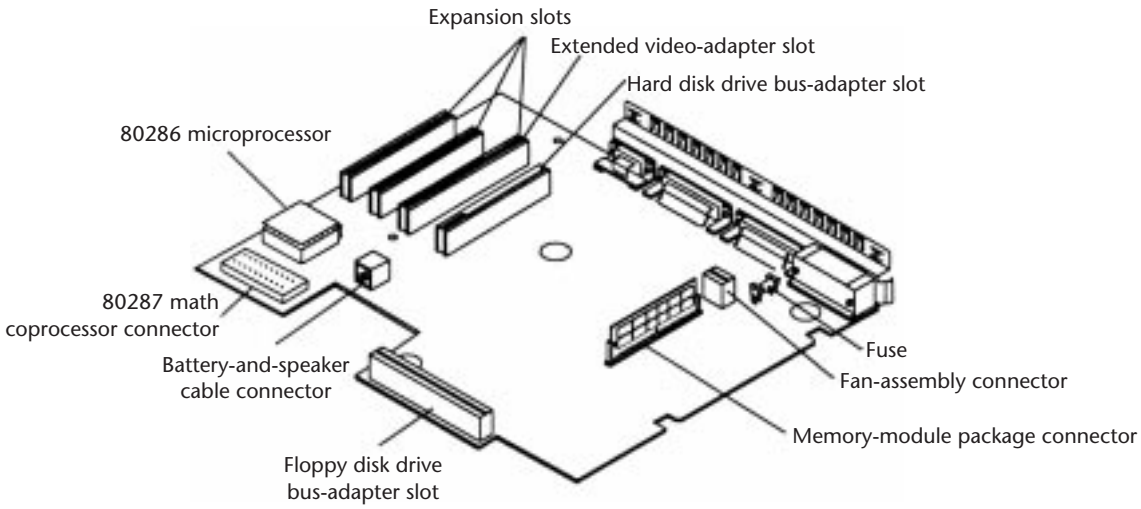


Fig. 22.19
PS/2 Model 50Z system board.

Table 22.21 shows the primary specifications of the different versions of PS/2 Model 50.

Table 22.21 IBM PS/2 Model 50 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
50						
8550-021	286	10	1M	1M	1×1.44M	20M
50 Z						
8550-031	286	10	1M	2M	1×1.44M	30M
8550-061	286	10	1M	2M	1×1.44M	60M

Note: *All 50 and 50 Z models have been withdrawn from marketing by IBM.*

PS/2 E

Introduced in the summer of 1993, the PS/2 E was designed to be a "green machine," running on only 24 watts (excluding monitor) and earning an EPA Energy Star rating. The system is designed to be used with a new 10.4-inch LCD thin-film transistor (TFT) monitor. One unique design feature of the PS/2 E is that all optional devices must be PCMCIA because no ISA slots are available. The PS/2 E is almost portfolio-size and light enough to carry under one arm. The PS/2 E uses 80486SLC2 processor running double-clocked at 50 MHz while communicating on the system bus at 25 MHz.

The PCMCIA bus accepts externally installed PCMCIA devices only. The PCMCIA slots can accommodate up to four Type I, up to four Type II, and up to two Type III devices. The exclusive use of PCMCIA adds to the compact design of the system and effectively eliminates any need to open it. The PS/2 E does not include a cooling fan.

The mouse is a built-in joystick-like stub positioned at the intersection of the G, H, and B keys on the keyboard. Although it sounds obtrusive, it isn't. It actually feels quite natural to use, partly because of the placement of the mouse buttons, which sit below the spacebar and are actuated without interfering with any of the keys. This is the same TrackPoint II mouse found on IBM laptops, although this one works more smoothly

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/16	4/3	VGA	Enh	04/02/87	05/03/89
MCA/16	4/3	VGA	Enh	06/07/88	07/23/91
MCA/16	4/3	VGA	Enh	06/07/88	07/23/91

and precisely. The keyboard itself is small and very light. The keys are thinner than usual; travel is soft and quiet; and tactile feedback has been sacrificed. The arrangement of the keys is as close to normal as can be expected, although Delete, Home, and Insert will seem just slightly out of position. Spacing is good for its size and should pose no problem for anyone with normal-size hands.

The PS/2 E comes standard with 4M and is expandable to 16M. The on-board XGA-2 video controller is capable of 1,024 by 768 with 256 colors with its 1M of VRAM. The drives included on most variations of the PS/2 E include a 1.44M 3 1/2-inch disk drive and a 120M 2 1/2-inch form factor IDE hard drive with a 17-ms average seek time and built-in IDE controller.

The PS/2E is a suitable system for tight places with light Windows tasks. It is designed as a Windows computer, as evidenced by the built-in mouse, and performs well in this environment. It has the looks and credentials to fit into an educational situation, should IBM decide to market it as an educational tool, with its power management, silent operation, and compact size. This also makes it a good fit for hospital use and other institutions where power, noise, and space are concerns.

Table 22.22 lists the technical specifications for the PS/2 Model E.

Table 22.22 PS/2 Model E Technical Specifications

System Architecture	
Microprocessor Clock speed	486SLC2 50 MHz
L1 Internal Memory Cache	16K
L2 External Memory	n/a
Math coprocessor	Optional
Bus type	MCA (Micro Channel Architecture)
Data path	16-bit
Upgradeable processor complex	No
Memory	
Standard on system board	4M
Maximum on system board	16M
Maximum total memory	16M
Memory speed and type	70ns dynamic RAM
System board memory-socket type	36-bit SIMM (single in-line memory module)
Standard Features	
Optional math coprocessor	80387SX
Standard graphics Video RAM (VRAM) Max. resolution	Integrated XGA-2 1M 1280 × 1024
RS232C serial ports	1
Pointing device (mouse) ports	1
Parallel printer ports Bidirectional	1 Yes
Disk Storage	
Internal disk and tape drive bays Number of 3 1/2- and 5 1/4-inch bays	3 3/0
Standard floppy drives	1×1.44M

Disk Storage			
Optional floppy drives:			
5 1/4-inch 360K	Optional		
5 1/4-inch 1.2M	Optional		
3 1/2-inch 720K	No		
3 1/2-inch 1.44M	Standard		
3 1/2-inch 2.88M	Yes		
Hard disk controller included	IDE connector		
ST-506/IDE hard disks available	120M/212M/540M		
Drive form factor	3 1/2-inch		
Drive capacity	120M	212M	540M
Drive interface	IDE	IDE	IDE
Average access rate (ms)	17	17	17
Expansion Slots			
Total adapter slots	4 PCMCIA Type I/II or 2 Type III		
Number of long and short slots	n/a		
Number of 8-/16-/32-bit slots	n/a		
Available slots	4 PCMCIA Type I/II or 2 Type III		
Keyboard Specifications			
101-key Enhanced Keyboard	Yes		
Fast keyboard speed setting	Yes		
Keyboard cable length	6 feet		
Security Features			
Keylock:			
Locks cover	Yes		
Locks keyboard	No		
Keyboard password	Yes		
Power-on password	Yes		
Network server mode	Yes		
Physical Specifications			
Footprint type	Desktop		
Dimensions:			
Height	2.5 inches		
Width	12 inches		
Depth	12 inches		
Weight	10.0 lbs		
FCC classification	Class B		

Table 22.23 shows the primary specifications of the different versions of PS/2 Model E.

Table 22.23 IBM PS/2 Model E Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk	Bus Type
E							
9533-DB7	486SLC2	50	4M	16M	1×1.44M	120M	ISA/16
9533-DBD	486SLC2	50	8M	16M	1×1.44M	120M	ISA/16
9533-DLA	486SLC2	50	8M	16M	1×2.88M	212M	ISA/16
9533-DLG	486SLC2	50	8M	16M	1×2.88M	540M	ISA/16
9533-GB7	486SLC2	50	8M	16M	1×44M	120M	ISA/16
9533-GBD	486SLC2	50	8M	16M	1×44M	340M	ISA/16
9533-GBX	486SLC2	50	4M	16M	1×44M	n/a	ISA/16
9533-2BX	486SLC2	50	4M	16M	n/a	n/a	ISA/16

PS/2 Model 53

The IBM PS/2 Model 53 broadened IBM's line of MCA desktop systems by offering this entry-level model on November 9, 1993. Besides the PS/2 E, the Model 53 was the first updating of the PS/2 line since September 1992. The system features the IBM 486SLC chip running at 50 MHz internally and 25 MHz externally. That processor, which has a 16K internal cache, is comparable to a 33-MHz 486SX chip. The PS/2 53 base models come standard with 4M of memory that can be upgraded to 16M on the system board. Hard disks range from 120M (9553-0B7) to 250M (9553-0BB).

Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
4 PCMCIA Type I/II or 2 Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—
4 PCMCIA Type I/II or 2 Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—
4 PCMCIA Type I/II or 2 Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—
4 PCMCIA Type I/II or 2 Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—
4 PCMCIA Type I/II or 2 Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—
4 PCMCIA Type I/II or Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—
4 PCMCIA Type I/II or 2 Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—
4 PCMCIA Type I/II or 2 Type III/4 PCMCIA Type I/II or 2 Type III	XGA-2	Any	07/94	—

With the video system's 1M of dynamic RAM, which is not upgradeable, users can get graphics resolutions as high as 1,024 by 768 with 256 colors. The PS/2 53 is available in four configurations.

The PS/2 Model 53LS is identical to the Model 53, but lacks internal drives. It was designed as a low-cost Token-Ring (9553-2BX) or 10Base-T EtherNet (9553-1BX) medialess model.

Table 22.24 lists the technical specifications for the PS/2 Model 53.

Table 22.24 PS/2 Model 53 Technical Specifications

System Architecture	
Microprocessor	486SLC2
Clock speed	50 MHz
L1 Internal Memory Cache	16K
L2 External Memory	n/a
Math coprocessor	Optional
Bus type	MCA (Micro Channel Architecture)
Data path	16-bit
Upgradeable processor complex	No
Memory	
Standard on system board	4M
Maximum on system board	16M
Maximum total memory	16M
Memory speed and type	70ns dynamic RAM
System board memory-socket type	36-bit SIMM (single in-line memory module)
Number of memory-module sockets	3
Standard Features	
Optional math coprocessor	80387SX
Standard graphics	VESA SVGA (super-VGA)
8-/16-/32-bit controller	32-bit
Bus master	No
Video RAM (VRAM)	1M
Maximum resolution	1,024 × 768
RS232C serial ports	1
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Disk Storage	
Internal disk and tape drive bays	3
Number of 3 1/2- and 5 1/4-inch bays	3/0
Standard floppy drives	1×1.44M

Disk Storage		
Optional floppy drives:		
5 1/4-inch 360K	Optional	
5 1/4-inch 1.2M	Optional	
3 1/2-inch 720K	No	
3 1/2-inch 1.44M	Standard	
3 1/2-inch 2.88M	Yes	
Hard disk controller included	IDE connector	
ST-506/IDE hard disks available	120M/250M	
Drive form factor	3 1/2-inch	
Drive capacity	120M	250M
Drive interface	IDE	IDE
Average access rate (ms)	14	14
Expansion Slots		
Total adapter slots	3	
Number of long and short slots	3/0	
Number of 8-/16-/32-bit slots	0/0/3	
Available slots	3	
Keyboard Specifications		
101-key Enhanced Keyboard	Yes	
Fast keyboard speed setting	Yes	
Keyboard cable length	6 feet	
Security Features		
Keylock:		
Locks cover	Yes	
Locks keyboard	No	
Keyboard password	Yes	
Power-on password	Yes	
Network server mode	Yes	
Physical Specifications		
Footprint type	Desktop	
Dimensions:		
Height	4.07 inches	
Width	15.1 inches	
Depth	16 inches	
Weight	20.0 lbs	
FCC classification	Class B	

Table 22.25 shows the primary specifications of the different versions of PS/2 Model 53.

Table 22.25 IBM PS/2 Model 53 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
53						
9553-0B7	486SLC2	50	4M	16M	1×1.44M	170M
9553-0BB	486SLC2	50	4M	16M	1×1.44M	250M
53LS						
9553LS-1BX	486SLC2	50	4M	16M	1×1.44M	n/a
9553LS-2BX	486SLC2	50	4M	16M	1×1.44M	n/a

PS/2 Model 55 SX

The PS/2 Model 55 SX, introduced May 9, 1989, has been one of IBM's top-selling systems because of the system's reasonable performance, modular construction, low price, and compact, efficient design. Model 55 SX systems use the 386 SX processor running at 16 MHz. They have 2M as standard memory in the 30M and 60M hard drive configurations, and 4M as standard memory in the 40M and 80M hard drive configurations. These Model 55 SX systems have the capability of supporting up to 16M of memory and have offered hard disks from 30M to 80M. Additional features include 1.44M, 3 1/2-inch floppy disk drive; ports (keyboard, pointing device, serial/asynchronous, parallel, VGA); three MCA I/O slots, and an Enhanced Keyboard. Figure 22.20 shows a front view, and figure 22.21 shows a rear panel view of a Model 55 SX.

Also available are special diskless versions of the Model 55 SX with preinstalled IBM Token-Ring or EtherNet Adapters. These "Lxx" versions are designed as LAN workstations and have the capability to boot directly from the LAN server system. The -LEx models include an IBM EtherNet Adapter, and the -LTx models include an IBM Token-Ring Network Adapter. Although these models come without any drives, they can be upgraded later with both floppy and hard disk drives.

The PS/2 Model 55 SX is designed to maintain compatibility with many software products currently operating under DOS and OS/2 on the IBM AT and the rest of the PS/2 family. These systems have full 80386 memory management capability, which means that they can operate in 32-bit software mode. Figure 22.22 shows an interior view of the Model 55 SX.

	Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
	MCA/16	3/3	VESA SVGA	Any	11/09/93	—
	MCA/16	3/3	VESA SVGA	Any	11/09/93	—
	MCA/16	3/3	VESA SVGA	Any	11/09/93	—
	MCA/16	3/3	VESA SVGA	Any	11/09/93	—

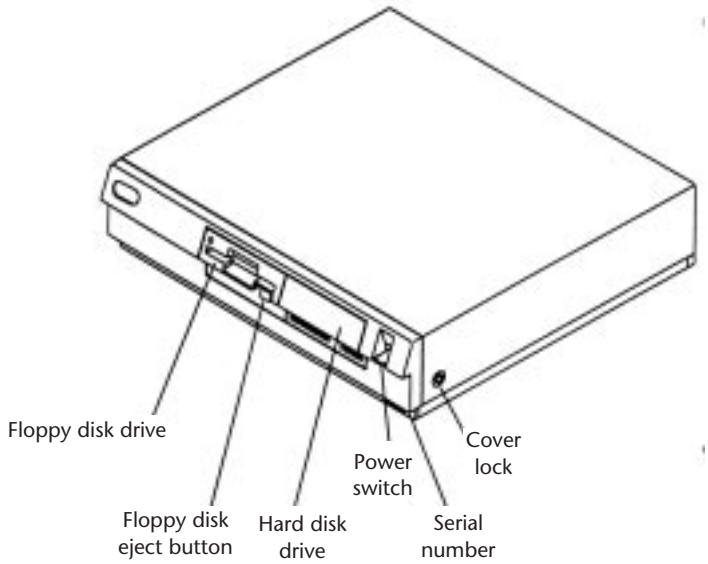


Fig. 22.20
PS/2 Model 55 SX.

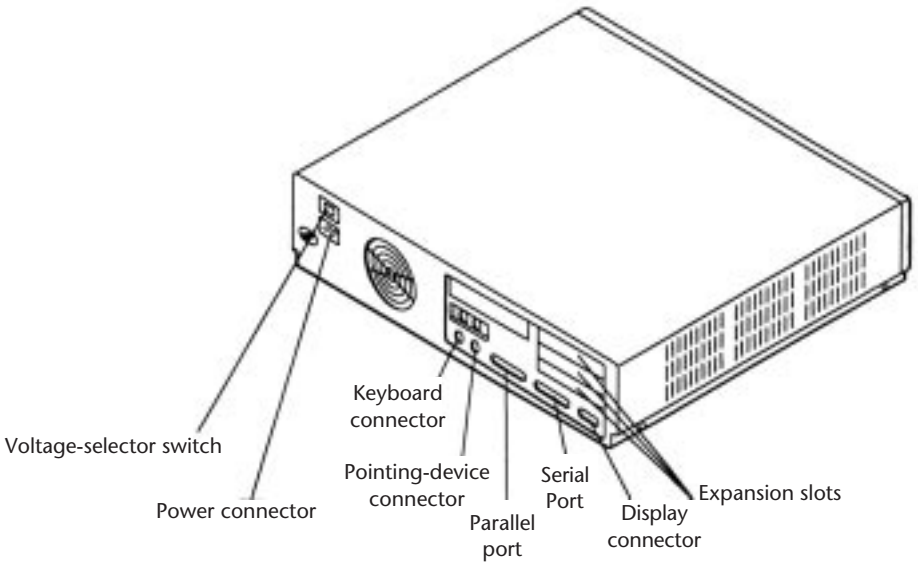


Fig. 22.21
PS/2 Model 55 SX rear panel view.

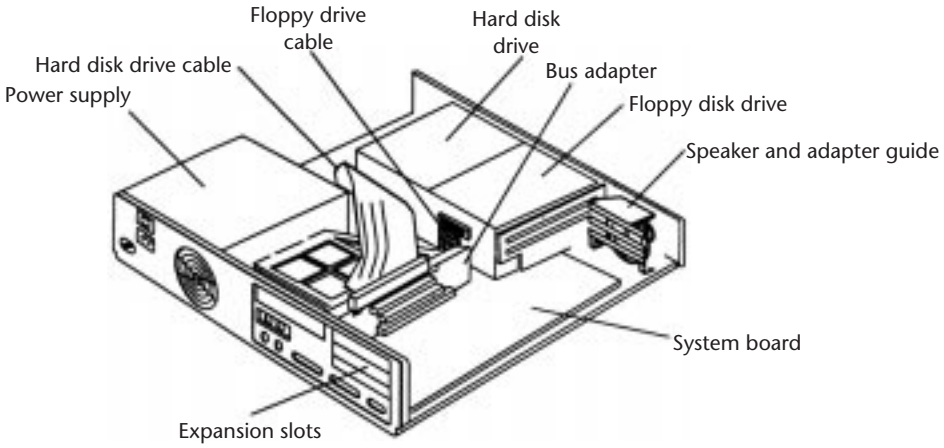


Fig. 22.22
PS/2 Model 55 SX interior view.

The various models of the 55 SX differ only in the size of the preinstalled hard disk. Models have been available with 30M, 40M, 60M, and 80M drives. The 30M and 60M drive models have been discontinued by IBM, and the 40M and 80M models have taken their place.

Table 22.26 lists the technical specifications for the PS/2 model 55SX.

Table 22.26 PS/2 Model 55 SX Technical Specifications

System Architecture	
Microprocessor	80386SX
Clock speed	16 MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	4M
Maximum on system board	8M
Maximum total memory	16M
Memory speed and type	100ns dynamic RAM
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	2
Number available in standard configuration	1
Memory used on system board	1M/2M/4M 36-bit SIMMs
Memory cache controller	No
Wait states:	
System board	0-2
Adapter	0-4
Standard Features	
ROM size	128K
ROM shadowing	Yes
Optional math coprocessor	80387SX
Coprocessor speed	16 MHz
Standard graphics	VGA (Video Graphics Array)
8-/16-/32-bit controller	8-bit
Bus master	No
Video RAM (VRAM)	256K
RS232C serial ports	1
UART chip used	NS16550A
Maximum speed (bits/second)	19,200 bps

(continues)

Table 22.26 Continued

Standard Features				
FIFO mode enabled	Yes			
Maximum number of ports	8			
Pointing device (mouse) ports	1			
Parallel printer ports	1			
Bidirectional	Yes			
Maximum number of ports supported	8			
CMOS real-time clock (RTC)	Yes			
CMOS RAM	64 bytes			
Battery life	10 years			
Replaceable	Yes (Dallas module)			
Disk Storage				
Internal disk and tape drive bays	2			
Number of 3 1/2- and 5 1/4-inch bays	2/0			
Standard floppy drives	1×1.44M			
None (LT0, LE0)				
Optional floppy drives:				
5 1/4-inch 360K	Optional			
5 1/4-inch 1.2M	Optional			
3 1/2-inch 720K	No			
3 1/2-inch 1.44M	Standard			
3 1/2-inch 2.88M	No			
Hard disk controller included	IDE connector on bus adapter			
IDE hard disks available	30M/40M/60M/80M			
Drive form factor	3 1/2-inch			
Drive interface	IDE			
Drive capacity	30M	40M	60M	80M
Average access rate (ms)	27	17	27	17
Read-ahead cache	No	32K	No	32K
Encoding scheme	RLL	RLL	RLL	RLL
BIOS drive type number	33	None	None	None
Cylinders	614	1038	762	1021
Heads	4	2	6	4
Sectors per track	25	39	26	39
Rotational speed (RPM)	3600	3600	3600	3600
Interleave factor	1:1	1:1	1:1	1:1
Actual transfer rate (K/second)	750	1170	780	1170
Automatic head parking	No	Yes	Yes	Yes

Expansion Slots	
Total adapter slots	3
Number of long and short slots	3/0
Number of 8-/16-/32-bit slots	0/3/0
Number of slots with video ext.	1
Available slots	3
Keyboard specifications:	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	6 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	4.0 inches
Width	16.0 inches
Depth	15.6 inches
Weight	15.5 lbs (LT0, LE0) 19.0 lbs
Environmental Specifications	
Power-supply output	90 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Manual switch
Maximum current:	
90-137 VAC	2.5 amps
180-265 VAC	1.3 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	438
Noise (Average dB, operating, 1m)	40 dB
FCC classification	Class B

Table 22.27 shows the primary specifications of the various versions of PS/2 Model 55 SX.

Table 22.27 IBM PS/2 Model 55 SX Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
53						
8555-031	386SX	16	2M	8M	1×1.44M	30M
8555-041	386SX	16	4M	8M	1×1.44M	40M
8555-061	386SX	16	2M	8M	1×1.44M	60M
8555-081	386SX	16	4M	8M	1×1.44M	80M
55 LS						
8555-LT0	386SX	16	4M	8M	—	—
8555-LE0	386SX16	16	4M	8M	—	—

The LTO model includes an IBM 16/4 Token-Ring Adapter, and the LEO model includes an IBM EtherNet adapter. Both of these models are also diskless.

Figure 22.23 shows the Model 55 SX motherboard components and layout.

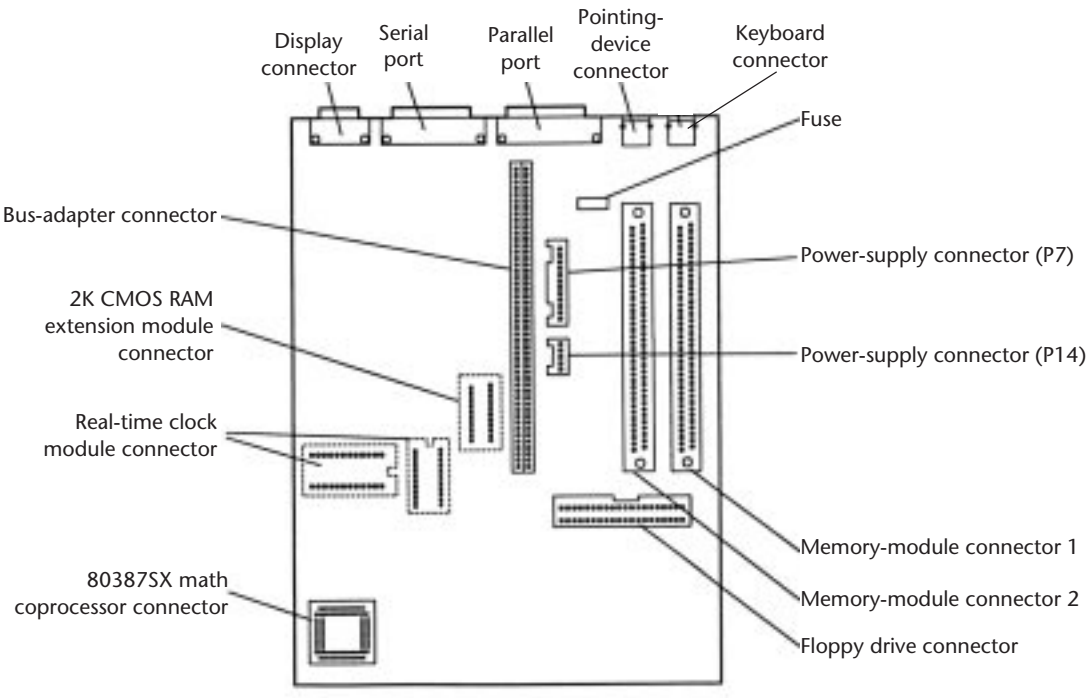


Fig. 22.23
PS/2 Model 55 SX system board.

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/16	3/3	VGA	Enh	05/09/89	09/11/91
MCA/16	3/3	VGA	Enh	06/11/91	05/25/92
MCA/16	3/3	VGA	Enh	05/09/89	09/11/91
MCA/16	3/3	VGA	Enh	06/11/91	05/25/92
MCA/16	3/2	VGA	Enh	10/09/90	05/25/92
MCA/16	3/2	VGA	Enh	10/09/90	05/25/92

PS/2 Model 56 SX, SLC, LS, and LS SLC

The PS/2 Model 56, introduced February 25, 1992, is an MCA system designed to replace the PS/2 Model 55 SX. The system has a 386SX or 386SLC 20 MHz processor and offers improvements such as increased speed, configuration flexibility, and a Small Computer System Interface (SCSI) input/output interface. For improved graphics performance, video is provided through an enhanced 16-bit VGA controller integrated on the system board. Several models are offered including models with SCSI hard disk capacities of 80M and 160M, with or without the 386SLC processor option, and LAN versions with built-in Token-Ring or EtherNet adapters.

The SLC models use a new custom, high-speed processor. The new IBM 386SLC processor is designed and manufactured in IBM's Burlington, Vermont, semiconductor facility. The 386SLC chip powers the PS/2 cached processor option. This processor includes a built-in cache controller and 8K cache similar to 486 processors. The 386SLC is up to 88 percent faster than the standard 386SX processor. The standard Model 56 SX systems can be upgraded to the SLC processor by adding the PS/2 cached processor option.

The PS/2 Model 56 is designed for desktop operation but ships with a vertical stand, allowing the customer the flexibility of horizontal or vertical orientation. The mechanical package allows for expansion with three 16-bit slots for MCA adapters and two bays for I/O devices. One of the bays contains an extra-high-density 3 1/2-inch 2.88M (million bytes) media sense floppy disk drive. Another bay contains an SCSI hard disk.

SCSI Standard. The SCSI controller is integrated in the system board, so a slot is not required, and the controller can support up to seven SCSI devices (including the standard SCSI hard disk). Two of the additional SCSI devices can be attached internally and the remaining devices externally with the external SCSI connector.

System Memory. The system ships with one 4M single in-line memory module (SIMM) located in the first SIMM socket on the motherboard. The PS/2 Model 56 supports up to 16M of 70ns memory on the system board in three SIMM sockets, all of which are addressable by direct memory address (DMA). Because the system board supports the full 16M, memory should not be installed via adapter cards in the bus. The Model 56 supports 2M, 4M, and 8M memory SIMMs (70ns only). To take advantage of enhanced performance via interleaved memory, SIMMs should be installed using all 2M or all 4M SIMMs. One, two, or three 2M SIMMs provide memory interleaving. Two or three 4M SIMMs also provide memory interleaving. The 8M SIMMs do not provide interleaving, but do allow the maximum capacity of 16M to be reached.

Keyboard Options. The PS/2 Model 56 supports the IBM Enhanced Keyboard (101/102 keys), Space-Saving Keyboard (84/85 keys), and the IBM Host-Connected Keyboard (122 keys). The Host-Connected Keyboard is similar to the 3270 keyboard offered with 3270 IBM PC and IBM AT systems. This keyboard is similar in design to that of a 3270 terminal keyboard and offers keys dedicated to 3270 functions. The Host-Connected Keyboard is supported by the BIOS in this system and cannot be retrofitted to PS/2 systems that do not have the proper BIOS support.

When you purchase a Model 56, you can choose any of these three keyboards. The keyboard can be specified only in new equipment orders and cannot be ordered separately for on-order or installed equipment.

Floppy Drive Support. The Model 56 includes a standard 2.88M floppy disk drive. This drive is fully compatible with 1.44M and 720K floppy disk drives. The drive includes a media sensor that prevents accidentally formatting floppy disks to the wrong capacity (which can result in data loss).

DOS 5.0 is the minimum DOS version supported on this system. Because of the 2.88M floppy disk drive, versions of DOS prior to 5.0 (or other operating systems or applications) might not format floppy disk media correctly. Use of the proper level of operating system along with the new 2.88M floppy disk drive provides media sensing of 720K, 1.44M, and 2.88M floppy disks, giving greater ease in formatting, reading, and writing floppy disks.

Initial Microcode Load. One very special feature of the Model 56 is called Initial Microcode Load (IML). The ROM BIOS is stored on the hard disk in a protected 3M partition and loaded from the disk during a "pre-boot" process. The formatted capacity of the hard disk is reduced by 3M, and the total user-accessible capacity might vary slightly, based on operating environments. This partition is protected from normal access and does not appear to the system when it is running FDISK or FORMAT. In fact, the partition is so well protected that the system BIOS cannot even access this system partition with standard Int 13h commands. For all intents and purposes the hard disk is simply 3M smaller than it would normally be. The 3M system partition also contains a copy of the Reference disk, which means that the setup program is effectively in ROM as well! The setup program is accessed by pressing Ctrl-Alt-Ins when the cursor shifts to the right-hand portion of the screen during a boot operation.

Having a disk-based ROM offers an unprecedented level of control over the system compared to other models. For example, updating the ROM BIOS to a new version simply
requires booting from a newer Reference disk and selecting the option that updates the system partition. This feature enables IBM to keep in step with ROM upgrades for new features and fix bugs in the BIOS without the expense and hassle of replacing ROM chips.

The optional 386SLC processor was designed, developed, and manufactured by IBM under a long-standing agreement with Intel. This chip has the same 32-bit internal, 16-bit external design as the Intel 386SX and is fully compatible with Intel 386 architecture. Intel participated in testing the 386SLC and determined the processor to be compatible with the Intel 386 architecture. IBM designed the 386SLC with 8K of internal cache and an internal cache controller, which improves performance by accessing data from high-speed cache memory rather than system memory, whenever possible. This is very similar to the 486 and is the primary reason for the increased performance. Performance has been further enhanced by optimizing commonly used instructions.

LS models are designed as LAN stations and include no disk drives. These diskless models are available in several versions, with or without the 386SLC processor. The -1xx models include an IBM EtherNet adapter in one of the three slots, and the -2xx models include an IBM Token-Ring network adapter in one of the three slots.

Table 22.28 lists the technical specifications for the PS/2 Model 56.

Table 22.28 PS/2 Model 56 Technical Specifications

System Architecture	
Microprocessor	80386SX (04x) 80386SLC (05x)
Optional microprocessor	80386SLC (04x)
Clock speed	20MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	4M
Maximum on system board	16M
Maximum total memory	16M

(continues)

Table 22.28 Continued

Memory	
Memory speed and type	70ns dynamic RAM
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	3
Number available in standard configuration	2
Memory used on system board	2M/4M/8M 36-bit SIMMs
Memory interleaving	Yes (2M/4M SIMMs only)
Memory cache controller	No
Wait states:	
System board	0-2
Adapter	0-4
Standard Features	
ROM size	128K
ROM shadowing	Yes
BIOS extensions stored on disk	Yes
Setup and Diagnostics stored on disk	Yes
Optional math coprocessor	80387SX
Coprocessor speed	20 MHz
Standard graphics	VGA
8-/16-/32-bit controller	16-bit
Bus master	No
Video RAM (VRAM)	256K
RS232C serial ports	1
UART chip used	Custom (compatible with NS16550A)
Maximum speed (bits/second)	345,600
FIFO mode enabled	Yes
Supports DMA data transfer	Yes
Maximum number of ports	8
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Supports DMA data transfer	Yes
Maximum number of ports	8
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes + 2K extension
Battery life	10 years
Replaceable	Yes (Dallas module)
Disk Storage	
Internal disk and tape drive bays	4
Number of 3 1/2- and 5 1/4-inch bays	1/3

Disk Storage						
Selectable boot drive	Yes					
Bootable drives	All physical drives					
Standard floppy drives	1×2.88M					
Optional floppy drives:						
5 1/4-inch 360K	Optional					
5 1/4-inch 1.2M	Optional					
3 1/2-inch 720K	No					
3 1/2-inch 1.44M	Optional					
3 1/2-inch 2.88M	Standard					
Hard disk controller included:	SCSI integrated on system board					
Bus master	Yes					
Devices supported per adapter	7					
Adapters supported per system	4					
SCSI hard disks available	60M/80M/120M/160M/320M/400M					
Drive form factor	3 1/2-inch					
Drive interface	SCSI					
Drive capacity	60M	80M	120M	160M	320M	400M
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors per track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes
Expansion Slots						
Total adapter slots	3					
Number of long and short slots	3/0					
Number of 8-/16-/32-bit slots	0/3/0					
Number of slots with video ext.	1					
Available slots	3 2 (1xx, 2xx)					
Keyboard Specifications						
Keyboard choices	122-key Host-Connected Keyboard 101-key Enhanced Keyboard 84-key Space-Saving Keyboard					
Fast keyboard speed setting	Yes					
Keyboard cable length	10 feet					

(continues)

Table 22.28 Continued

Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Orientation	Horizontal/vertical
Dimensions:	
Height	4.5 inches
Width	14.2 inches
Depth	15.6 inches
Weight	24 lbs
Environmental Specifications	
Power-supply output	118 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	3.5 amps
180-265 VAC	1.75 amps
Operating range:	
Temperature	50-95 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	154
FCC classification	Class B

Table 22.30 shows the primary specifications of the different versions of PS/2 Model 56.

PS/2 Model 56 486SLC3, LS, and 57 486SLC3, M57 486SLC3 Ultimedia

The PS/2 Models 56 486SLC3 and 57 486SLC3 are revamped versions of the PS/2 Model 56 discussed earlier. The M57 486SLC3 Ultimedia is the multimedia version of the 57 486SLC3. Announced in October 1993, these models feature IBM's clock-tripled 75-MHz 486SLC processor and an MCA bus. Both models include XGA-2 local-bus graphics and "green," energy-saving capabilities. The 486SLC includes 16K cache, compared to the 8K

found in Intel's 486SX and 486DX processors. The PS/2 Models 56 and 57 come standard with 8M RAM (4M for the LS variants) and are expandable to 16M on the system board. These systems are available in a variety of hard drive sizes, from 104M to 540M. Like the Model 56 SLC, the SCSI controller is integrated in the system board, and an external SCSI connector is available. These models come standard with one 2.88M floppy drive.

The M57 486SLC3 Ultimedia also includes IBM's Audiovation 16-bit sound card and a double-speed, multisession CD-ROM drive. This makes the M57 MPC Level 2 certified.

Table 22.29 lists the technical specifications for the PS/2 Model 56 486SLC3 and 57 486SLC3.

Table 22.29 PS/2 Model 56 486SLC3 and Model 57 486SLC3 Technical Specifications

System Architecture	
Microprocessor Clock speed	80486SLC3 75/25 MHz
L1/L2 cache	16K/n/a
Bus type Bus width	MCA (Micro Channel Architecture) 16-bit
Upgradeable processor complex	No
Memory	
Standard on system board	8M (4M LS)
Maximum on system board	16M
Maximum total memory	16M
Memory speed and type	70ns dynamic RAM
System board memory socket type Number of memory module sockets Number available in standard configuration	36-bit SIMM (single in-line memory module) 3 3
Memory used on system board	2M/4M/8M 36-bit SIMMs
Memory interleaving	Yes (2M/4M SIMMs only)
Optional math coprocessor	80387SX
Standard graphics Video RAM (VRAM)	XGA-2 1M
RS232C serial ports	1
UART chip used	Custom (compatible with NS16550A)
Pointing device (mouse) ports	1

(continues)

Table 22.29 Continued

Standard Features				
Parallel printer ports	1			
Bidirectional	Yes			
Disk Storage				
Internal disk and tape drive bays Number of 3 1/2- and 5 1/4-inch bays	3 (4 Model 57) 1/3 (1/4 Model 57)			
Standard floppy drives	1×2.88M			
Optional floppy drives: 5 1/4-inch 360K 5 1/4-inch 1.2M 3 1/2-inch 720K 3 1/2-inch 1.44M 3 1/2-inch 2.88M	 Optional Optional No Optional Standard			
Hard disk controller included	SCSI integrated on system board			
Bus master	Yes			
Devices supported per adapter	7			
Adapters supported per system	4			
SCSI hard disks available	170M/270M/340M/540M			
Drive form factor	3 1/2-inch			
Drive interface	SCSI			
Drive capacity	170M	270M	340M	540M
Average access rate (ms)	13	12	13	8.5
Interleave factor	1:1	1:1	1:1	1:1
Automatic head parking	Yes	Yes	Yes	Yes
Expansion Slots				
Total adapter slots Number of long and short slots Number of 8-/16-/32-bit slots	3 3/0 (5/0 Model 57) 0/3/0 (0/5/0 Model 57)			
Available slots	3 (5 Model 57)			
Keyboard Specifications				
Keyboard choices	122-key Host-Connected Keyboard 101-key Enhanced Keyboard 84-key Space-Saving Keyboard			
Fast keyboard speed setting	Yes			

Keyboard Specifications	
Keyboard cable length	10 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Orientation	Horizontal/vertical
Dimensions:	
Height	4.5 inches
Width	14.2 inches
Depth	15.6 inches
Weight	30 lbs
FCC classification	Class B

PS/2 Model 57 SX

The PS/2 Model 57 SX, introduced June 11, 1991, is an MCA system designed to complement and enhance the PS/2 Model 55 SX, the PS/2 Model 65 SX, and the low end of the PS/2 Model 70 386 family. The system has a 386SX 20 MHz processor and offers improvements such as increased speed, configuration flexibility, and a Small Computer System Interface (SCSI) input/output interface. For improved graphics performance, video is provided through an enhanced 16-bit VGA controller integrated on the system board. Several models are offered with SCSI hard disk capacities of 80M and 160M.

On October 17, 1991, IBM introduced a new custom, high-speed processor upgrade for the Model 57. The new upgrade option utilizes the powerful IBM 386SLC processor, designed and manufactured in IBM's Burlington, Vermont, semiconductor facility. The 386SLC chip powers the PS/2 cached processor option. This processor includes a built-in cache controller and 8K cache similar to 486 processors. The 386SLC is up to 88 percent faster than the standard 386SX processor.

Table 22.32 shows the primary specifications of the different versions of PS/2 Model 57 SX.

Table 22.30 IBM PS/2 Models *56 SX*, *56 SLC*, *56 LS*, *56 SLC LS*,

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
56 SX						
8556-043	386SX	20	4M	16M	1×2.88M	40M
8556-045	386SX	20	4M	16M	1×2.88M	80M
56 SLC						
8556-055	386SLC	20	4M	16M	1×2.88M	80M
8556-059	386SLC	20	4M	16M	1×2.88M	160M
56 LS						
8556-14x	386SX	20	4M	16M	—	—
8556-24x	386SX	20	4M	16M	—	—
56 SLC LS						
8556-15x	386SLC	20	4M	16M	—	—
8556-25x	386SLC	20	4M	16M	—	—
56 486SLC3						
9556-DE9	486SLC3	75	8M	16M	1×2.88M	170M
9556-DEB	486SLC3	75	8M	16M	1×2.88M	270M
9556-DE9	486SLC3	75	8M	16M	1×2.88M	340M
56LS 486SLC						
9556LS-1EX	486SLC3	75	4M	16M	—	—
9556LS-2EX	486SLC3	75	4M	16M	—	—
57 486SLC3						
9557-DE9	486SLC3	75	8M	16M	1×2.88M	170M
9557-DEB	486SLC3	75	8M	16M	1×2.88M	270M
9557-DED	486SLC3	75	8M	16M	1×2.88M	340M
9557-DEG	486SLC3	75	8M	16M	1×2.88M	540M
M57 486SLC3 Ultimedia						
9557-6EB	486SLC3	75	8M	16M	1×2.88M	270M
9557-6EG	486SLC3	75	8M	16M	1×2.88M	540M
9557-7EB	486SLC3	75	8M	16M	1×2.88M	270M
9557-7EG	486SLC3	75	8M	16M	1×2.88M	540M

56 486SLC3, 56LS 486SLC, 57 486SLC3, and M57 486SLC3 Ultimedia Model Summary

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	VGA	Any	02/25/92	—
MCA/16	3/3	XGA-2	Any	02/01/94	—
MCA/16	3/3	XGA-2	Any	02/01/94	—
MCA/16	3/3	XGA-2	Any	02/01/94	—
MCA/16	3/3	XGA-2	Any	02/01/94	—
MCA/16	3/3	XGA-2	Any	02/01/94	—
MCA/16	5/5	XGA-2	Any	02/01/94	—
MCA/16	5/5	XGA-2	Any	02/01/94	—
MCA/16	5/5	XGA-2	Any	02/01/94	—
MCA/16	5/5	XGA-2	Any	02/01/94	—
MCA/16	5/3	XGA-2	Any	02/01/94	—
MCA/16	5/3	XGA-2	Any	02/01/94	—
MCA/16	5/3	XGA-2	Any	02/01/94	—
MCA/16	5/3	XGA-2	Any	02/01/94	—

The PS/2 Model 57 SX is designed for desktop operation but ships with a vertical stand, allowing the customer the flexibility of horizontal or vertical orientation. The mechanical package allows for expansion with five 16-bit slots for MCA adapters and four bays for I/O devices. One of the four bays contains an extra-high-density 3 1/2-inch 2.88M (million bytes) media sense floppy disk drive. Another bay contains a SCSI hard disk. Additional 5 1/4-inch and/or 3 1/2-inch devices, floppy disk drives, hard disks, tape and CD-ROM drives, and similar devices might be installed in the two remaining bays.

SCSI Standard. The SCSI controller is integrated in the system board, so a slot is not required, and the controller can support as many as seven SCSI devices (including the standard SCSI hard disk). Two of the additional SCSI devices can be attached internally and the remaining devices externally with the external SCSI connector.

System Memory. The system ships with one 4M single in-line memory module (SIMM) located in the first SIMM socket on the motherboard. The PS/2 Model 57 SX supports up to 16M of 70ns memory on the system board in three SIMM sockets, all of which are addressable by direct memory address (DMA). Because the system board supports the full 16M, memory should not be installed with adapter cards in the bus. The Model 57 SX supports 2M, 4M, and 8M memory SIMMs (70ns only). To take advantage of enhanced performance with interleaved memory, SIMMs should be installed using all 2M or all 4M SIMMs. One, two, or three 2M SIMMs provide memory interleaving. Two or three 4M SIMMs also provide memory interleaving. The 8M SIMMs do not provide interleaving, but do allow the maximum capacity of 16M to be reached.

Keyboard Options. The PS/2 Model 57 supports the IBM Enhanced Keyboard (101/102 keys), Space-Saving Keyboard (84/85 keys), and the IBM Host-Connected Keyboard (122 keys). The Host-Connected Keyboard is similar to the 3270 keyboard offered with 3270 IBM PC and IBM AT systems. This keyboard is similar in design to that of a 3270 terminal keyboard and offers keys dedicated to 3270 functions. The Host-Connected Keyboard is supported by the BIOS in this system and cannot be retrofitted to PS/2 systems that do not have the proper BIOS support.

When you purchase a Model 57, you can choose any of these three keyboards. The keyboard can be specified only in new equipment orders and cannot be ordered separately for on-order or installed equipment.

Floppy Drive Support. The Model 57 is the first system in the PC world to be shipped with a standard 2.88M floppy disk drive (although the drive is supported as an option in several other PS/2 systems). This drive is fully compatible with 1.44M and 720K floppy disk drives. The drive includes a media sensor that prevents accidentally formatting floppy disks to the wrong capacity (which can result in data loss).

DOS 5.0 is the minimum DOS version supported on this system. Because of the 2.88M floppy disk drive, versions of DOS prior to 5.0 (or other operating systems or applications) might not format floppy disk media correctly. Use of the proper level of operating system along with the new 2.88M floppy disk drive provides media sensing of 720K, 1.44M, and 2.88M floppy disks, making it easier to format, read, and write floppy disks.

Initial Microcode Load. One special feature of the Model 57 is called Initial Microcode Load (IML). The ROM BIOS is stored on the hard disk in a protected 3M partition and loaded from the disk during a "pre-boot" process. The formatted capacity of the hard disk is reduced by 3M, and the total user-accessible capacity might vary slightly, based on operating environments. This partition is protected from normal access and does not appear to the system when running FDISK or FORMAT. In fact, the partition is so well protected that the system BIOS cannot even access this system partition with standard Int 13h commands. For all intents and purposes the hard disk is 3M smaller than it would normally be. The 3M system partition also contains a copy of the Reference disk, which means that the setup program is effectively in ROM as well. The setup program is accessed by pressing Ctrl-Alt-Ins when the cursor shifts to the right-hand portion of the screen during a boot operation.

Having a disk-based ROM offers an unprecedented level of control over the system compared to other models. Updating the ROM BIOS to a new version, for example, simply requires booting from a newer Reference disk and selecting the option that updates the system partition. This feature enables IBM to keep in step with ROM upgrades for new features and fix bugs in the BIOS without the expense and hassle of replacing ROM chips.

The optional 386SLC processor was designed, developed, and manufactured by IBM under a long-standing agreement with Intel. This chip has the same 32-bit internal, 16-bit external design as the Intel 386SX and is fully compatible with Intel 386 architecture. Intel participated in testing the 386SLC and has determined the processor to be compatible with the Intel 386 architecture. IBM designed the 386SLC with 8K of internal cache and an internal cache controller that improves performance by accessing data from high-speed cache memory rather than system memory, whenever possible. This is very similar to the 486 and is the primary reason for the increased performance. Performance has been further enhanced by optimizing commonly used instructions.

Because of IBM's deal with Intel, you may see other compatible systems using the 386SLC processor. Until then, only IBM systems will contain the new chip. Because of the enhanced 486-like design, installation of this chip will allow the Model 57 to perform faster than nearly all 25 MHz 386DX-based systems from IBM and other manufacturers. The 386SLC processor option card installs easily in the math coprocessor socket on the Model 57 SX system board. A socket on the 386SLC module is available for installation of a math coprocessor if you want one, or if one has already been installed in the system.

On October 17, 1991, IBM pre-announced the PS/2 Ultimedia Model M57 SLC (8557-255). This enhanced version of the 57 includes the 386SLC processor module, for performance nearly double that of the standard Model 57. It also includes OS/2 2.0, whose availability coincides with the availability of this system in March 1992. This system also has complete multimedia capability. It adds the following standard product improvements to the model standard Model 57:

- Multimedia front panel with stereo headphone jack, mono microphone jack, volume control, and enhanced loudspeaker
- 16-bit eXtended Graphics Array (XGA) adapter card with 1M VRAM that supports 640×480 with 65,000 colors or 1024×768 with 256 colors
- 16-bit audio adapter card with I/O to the front panel that supports FM-quality stereo
- IBM PS/2 mouse
- 160M SCSI fixed disk
- A new CD-ROM/XA drive (PS/2 CD-ROM II) with connection to the multimedia front panel, supporting existing CD-ROM formats and enabled to support new CD-ROM/XA formats
- A CD containing three operating systems or environments, a variety of multimedia application samplers, and an "Introducing Ultimedia" demonstration
- Operating systems supplied on CD-ROM include IBM OS/2 Version 2.0, IBM DOS 5.0, and Microsoft Windows 3.0 with Microsoft Multimedia Windows Extensions 1.0.

The PS/2 Ultimedia Model M57 SLC (8557-255) includes the IBM 386 SLC microprocessor as a standard item. This system is designed for desktop and floor standing operation (a floor stand is included). The mechanical package has five Micro Channel slots and four bays for I/O devices. The Audio Capture and Playback Adapter and the XGA Adapter are installed in two of the slots, leaving three slots for future expansion. A 3 1/2-inch 2.88M media sense disk drive, an SCSI fixed disk, and a CD-ROM/XA drive are installed in three of the bays. An additional 5 1/4-inch or 3 1/2-inch device, optical disk drive, fixed disk drive, tape drive, CD-ROM drive, or a similar device can be installed in the one remaining bay.

The primary video in the Ultimedia is provided by the 16-bit IBM PS/2 XGA Display Adapter/A. Additionally, an enhanced VGA port is provided, for direct video display/monitor connections or indirect connections via the video feature bus connections to Micro Channel slot #2.

With OS/2 Version 2.0 as a standard feature, users can run OS/2, DOS, and Windows applications. Multimedia applications supported in any of the operating systems can be used effectively by the PS/2 Ultimedia Model M57 SLC user. XGA graphics and CD-ROM/XA are leading-edge technologies. They offer capabilities yet to be exploited, making this one of the most advanced multimedia systems available. IBM introduced IBM multimedia extensions to OS/2 in 1992. These extensions exploit the CD-ROM Extended Architecture (CD-ROM/XA) capabilities for interleaved data and compressed audio enabled by the PS/2 CD-ROM II drive. IBM also has provided the new PS/2 CD-ROM II drive as an optional feature on all IBM SCSI-supported PS/2 systems in the future.

Table 22.31 lists the technical specifications for the PS/2 model 57 SX.

Table 22.31 PS/2 Model 57 SX Technical Specifications

System Architecture	
Microprocessor	80386SX (04x) 80386SLC (05x)
Optional microprocessor	80386SLC (04x)
Clock speed	20MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	4M
Maximum on system board	16M
Maximum total memory	16M
Memory speed and type	70ns dynamic RAM
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	3
Number available in standard configuration	2
Memory used on system board	2M/4M/8M 36-bit SIMMs
Memory interleaving	Yes (2M/4M SIMMs only)
Memory cache controller	No
Wait states:	
System board	0-2
Adapter	0-4
Standard Features	
ROM size	128K
ROM shadowing	Yes
BIOS extensions stored on disk	Yes
Setup and Diagnostics stored on disk	Yes
Optional math coprocessor	80387SX
Coprocessor speed	20 MHz
Standard graphics	VGA XGA (255, 259)
8-/16-/32-bit controller	16-bit
Bus master	No Yes (XGA)
Video RAM (VRAM)	256K (1M on XGA)
RS232C serial ports	1

(continues)

Table 22.31 Continued

Standard Features						
UART chip used	Custom (compatible with NS16550A)					
Maximum speed (bits/second)	345,600					
FIFO mode enabled	Yes					
Supports DMA data transfer	Yes					
Maximum number of ports	8					
Pointing device (mouse) ports	1					
Parallel printer ports	1					
Bidirectional	Yes					
Supports DMA data transfer	Yes					
Maximum number of ports	8					
CMOS real-time clock (RTC)	Yes					
CMOS RAM	64 bytes + 2K extension					
Battery life	5 years					
Replaceable	Yes					
Disk Storage						
Internal disk and tape drive bays	4					
Number of 3 1/2- and 5 1/4-inch bays	1/3					
Selectable boot drive	Yes					
Bootable drives	All physical drives					
Standard floppy drives	1×2.88M					
Optional floppy drives:						
5 1/4-inch 360K	Optional					
5 1/4-inch 1.2M	Optional					
3 1/2-inch 720K	No					
3 1/2-inch 1.44M	Optional					
3 1/2-inch 2.88M	Standard					
Hard disk controller included	SCSI integrated on system board					
Bus master	Yes					
Devices supported per adapter	7					
Adapters supported per system	4					
SCSI hard disks available	60M/80M/120M/160M/320M/400M					
Drive form factor	3 1/2-inch					
Drive interface	SCSI					
Drive capacity	60M	80M	120M	160M	320M	400M
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors per track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes

PS/2 Ultimedia Model M57 SLC (8557-255)	
CD-ROM/XA drive characteristics:	
Formats	CD-DA, CD-ROM, CD-ROM/XA
Capacity	Typically 600M, media-dependent
Access time	380ms
Burst (64K) transfer rate	1.5M/sec
Sustained transfer rate	150K/second
Latency	56ms to 150ms
Expansion Slots	
Total adapter slots	5
Number of long and short slots	5/0
Number of 8-/16-/32-bit slots	0/5/0
Number of slots with video ext.	1
Available slots	5
Keyboard Specifications	
Keyboard choices	122-key Host-Connected Keyboard 101-key Enhanced Keyboard 84-key Space-Saving Keyboard
Fast keyboard speed setting	Yes
Keyboard cable length	10 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Orientation	Horizontal/vertical (stand included)
Dimensions:	
Height	6.7 inches
Width	17.3 inches
Depth	15.5 inches
Weight	32.0 lbs
Environmental Specifications	
Power-supply output	197 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Manual switch
Maximum current:	
90-137 VAC	6.0 amps
180-265 VAC	3.0 amps
Operating range:	
Temperature	50-95 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	120
FCC classification	Class B

Table 22.32 shows the primary specifications of the various versions of PS/2 Model 57 SX.

Table 23.32 IBM PS/2 Model 57 SX Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
57 SX						
8557-045	386SX	20	4M	16M	1×2.88M	80M
8557-049	386SX	20	4M	16M	1×2.88M	160M
57 SLC						
8557-055	386SLC	20	4M	16M	1×2.88M	80M
8557-059	386SLC	20	4M	16M	1×2.88M	160M
M57 SLC						
8557-255	386SLC	20	4M	16M	1×2.88M	80M
8557-259	386SLC	20	4M	16M	1×2.88M	160M

Keyboards available include the Enhanced (101-key), Space-Saving (84-key), and Host-Connected (122-key). If "Any" is indicated, purchaser could choose any of the three.

PS/2 Model 60

The IBM PS/2 Model 60, introduced April 2, 1987, is a mid-range, desk-side system in the PS/2 family using 16-bit MCA I/O slots. As of October 31, 1990, IBM has withdrawn all versions of the Model 60, and the system is no longer available. Figure 22.24 shows a front view of the Model 60.

The system unit features a 10 MHz microprocessor running with 1 wait state, enabling the Model 60 to perform approximately 20 percent faster than the IBM XT 286 or the IBM AT Model 339. The system-board limit of 1M memory is provided. The Model 60 comes standard with a 1.44M, 3 1/2-inch floppy disk drive; a 44M or a 70M hard disk drive; a disk controller; a serial port; a parallel port; a mouse port; a VGA port; and an 80287 coprocessor socket.

The system has two levels of BIOS, which total 128K: a Compatibility BIOS (CBIOS) with memory addressability of up to 1M provides support for real-mode-based application programs, and Advanced BIOS (ABIOS) provides support for protected-mode-based multitasking operating systems and has extended memory addressability up to 16M.

Additional features of the system unit include eight 16-bit MCA I/O slots (with one slot occupied by the disk controller adapter); an automatic voltage-sensing, universal power supply; a time-and-date clock with battery backup; an additional slot for a second 3 1/2-inch floppy disk drive; and the IBM Enhanced Keyboard. Figure 22.25 shows the rear panel, and figure 22.26 shows the interior view of a Model 60.

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/16	5/5	VGA	Any	06/11/91	12/21/92
MCA/16	5/5	VGA	Any	06/11/91	12/21/92
MCA/16	5/5	VGA	Any	02/25/92	—
MCA/16	5/5	VGA	Any	02/25/92	—
MCA/16	5/3	XGA	Any	10/17/91	02/25/92
MCA/16	5/3	XGA	Any	02/25/92	—

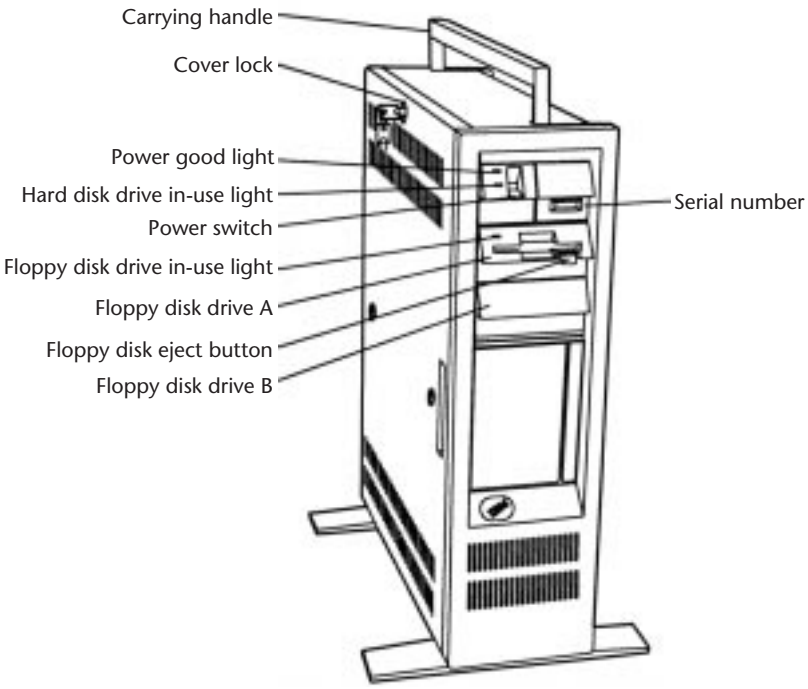


Fig. 22.24
PS/2 Model 60.

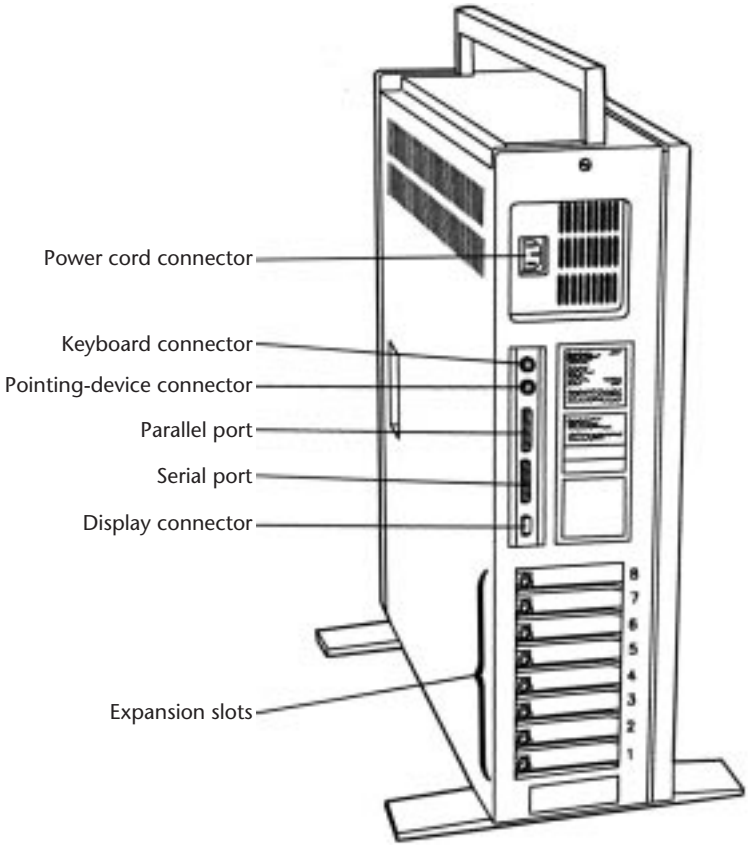


Fig. 22.25
PS/2 Model 60 rear panel view.

IBM produced two versions of the Model 60, differing only in the hard disk and controller board supplied. The 70M drive is included with the 60-071 and also can be added as a second drive in that system. The 70M drive attaches using the high-performance Enhanced Small Device Interface (ESDI) disk adapter provided with the system unit and does not require an additional expansion slot. The ESDI adapter (standard in the 60-071) can connect up to two drives and allows for an extremely high data-transfer rate of 10 mbps (megabits per second) as well as increased reliability.

The standard Model 60-041 includes an ST-506/412 hard disk controller, which can connect up to two drives. The maximum transfer rate for this controller is 5 mbps (half that possible with the ESDI controller).

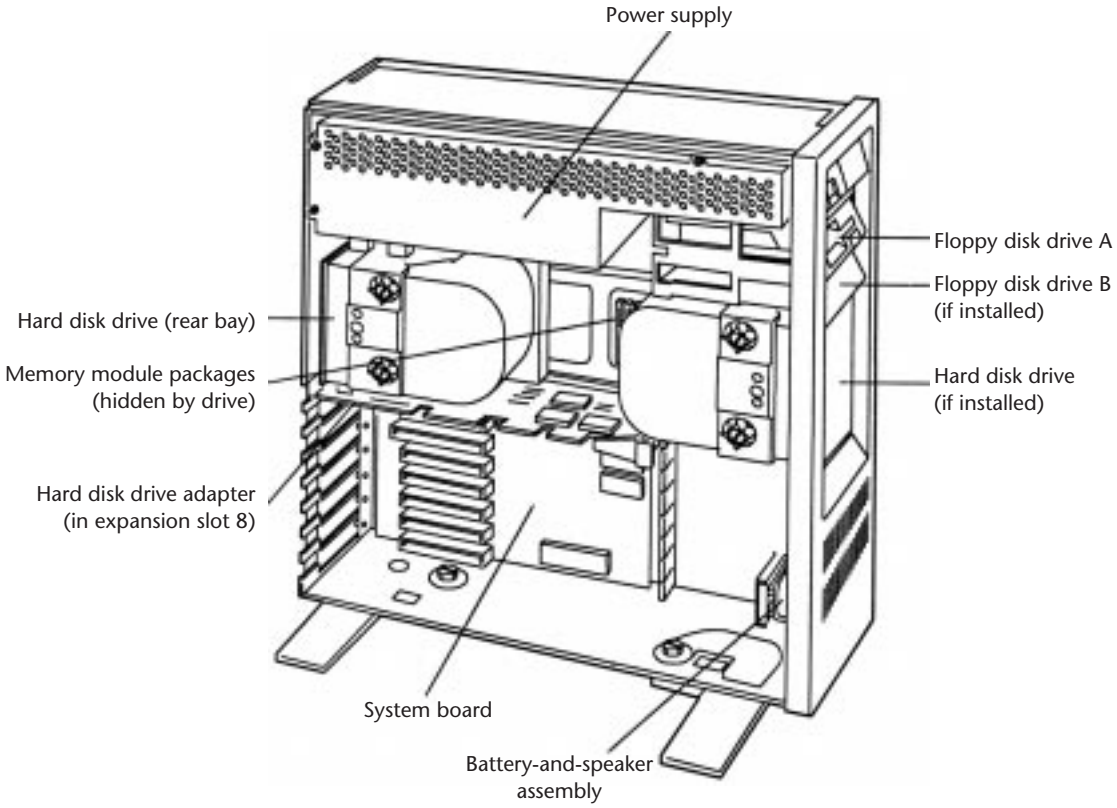


Fig. 22.26
PS/2 Model 60 (interior view).

Table 22.33 lists the technical specifications for the PS/2 Model 60.

Table 22.33 PS/2 Model 60 Technical Specifications

System Architecture	
Microprocessor	80286
Clock speed	10 MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	1M
Maximum on system board	1M

(continues)

Table 22.33 Continued

Memory					
Maximum total memory	16M				
Memory speed and type	150ns dynamic RAM				
System board memory socket type	9-bit SIMM (single in-line memory module)				
Number of memory module sockets	4				
Number available in standard configuration	0				
Memory used on system board	256K 9-bit SIMMs				
Memory cache controller	No				
Wait states:					
System board	1				
Adapter	0-1				
Standard Features					
ROM size	128K				
ROM shadowing	No				
Optional math coprocessor	80287				
Coprocessor speed	10 MHz				
Standard graphics	VGA (Video Graphics Array)				
8-/16-/32-bit controller	8-bit				
Bus master	No				
Video RAM (VRAM)	256K				
RS232C serial ports	1				
UART chip used	NS16550				
Maximum speed (bits/second)	19,200 bps				
FIFO mode enabled	No				
Maximum number of ports	8				
Pointing device (mouse) ports	1				
Parallel printer ports	1				
Bidirectional	Yes				
Maximum number of ports	8				
CMOS real-time clock (RTC)	Yes				
CMOS RAM	64 bytes + 2K extension				
Battery life	5 years				
Replaceable	Yes				
Disk Storage					
Internal disk and tape drive bays	4				
Number of 3 1/2- and 5 1/4-inch bays	2/2				
Standard floppy drives	1×1.44M				
Optional floppy drives:					
5 1/4-inch 360K	Optional				
5 1/4-inch 1.2M	Optional				
3 1/2-inch 720K	No				
3 1/2-inch 1.44M	Standard				
3 1/2-inch 2.88M	No				
Hard disk controller included	ESDI controller ST-506 controller (041)				
ST-506/ESDI hard disks available	44M/70M/115M/314M				
Drive form factor	5 1/4-inch				
Drive capacity	44M	44M	70M	115M	314M
Drive interface	ST-506	ST-506	ESDI	ESDI	ESDI
Average access rate (ms)	40	40	30	28	23
Encoding scheme	MFM	MFM	RLL	RLL	RLL

Disk Storage					
BIOS drive type	31	32	None	None	None
Cylinders	733	1024	583	915	1225
Heads	7	5	7	7	15
Sectors per track	17	17	36	36	34
Rotational speed (RPM)	3600	3600	3600	3600	3600
Interleave factor	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	510	510	1080	1080	1020
Automatic head parking	Yes	Yes	Yes	Yes	Yes
Expansion Slots					
Total adapter slots	8				
Number of long and short slots	8/0				
Number of 8-/16-/32-bit slots	0/8/0				
Number of slots with video ext.	1				
Available slots	7				
Keyboard Specifications					
101-key Enhanced Keyboard	Yes				
Fast keyboard speed setting	Yes				
Keyboard cable length	10 feet				
Security Features					
Keylock:					
Locks cover	Yes				
Locks keyboard	No				
Keyboard password	Yes				
Power-on password	Yes				
Network server mode	Yes				
Physical Specifications					
Footprint type	Floor-standing				
Dimensions:					
Height	23.5 inches				
Width	6.5 inches				
Depth	19.0 inches				
Weight	47.0 lbs				
Environmental Specifications					
Power-supply output	207 watts (041) 225 watts (071)				
Worldwide (110/60, 220/50)	Yes				
Auto-sensing/switching	Yes				
Maximum current:					
90-137 VAC	5.3 amps				
180-265 VAC	2.7 amps				
Operating range:					
Temperature	60-90 degrees F				
Relative humidity	8-80 percent				
Maximum operating altitude	7,000 feet				
Heat (BTUs/hour)	1240				
Noise (Average dB, operating, 1m)	46 dB				
FCC classification	Class B				

Table 22.34 shows the primary specifications of the various versions of PS/2 Model 60.

Table 22.34 IBM PS/2 Model 60 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
60						
8560-041	286	10	1M	1M	1×1.44M	44M
8560-071	286	10	1M	1M	1×1.44M	70M

Figure 22.27 shows the motherboard components and layout of a Model 60.

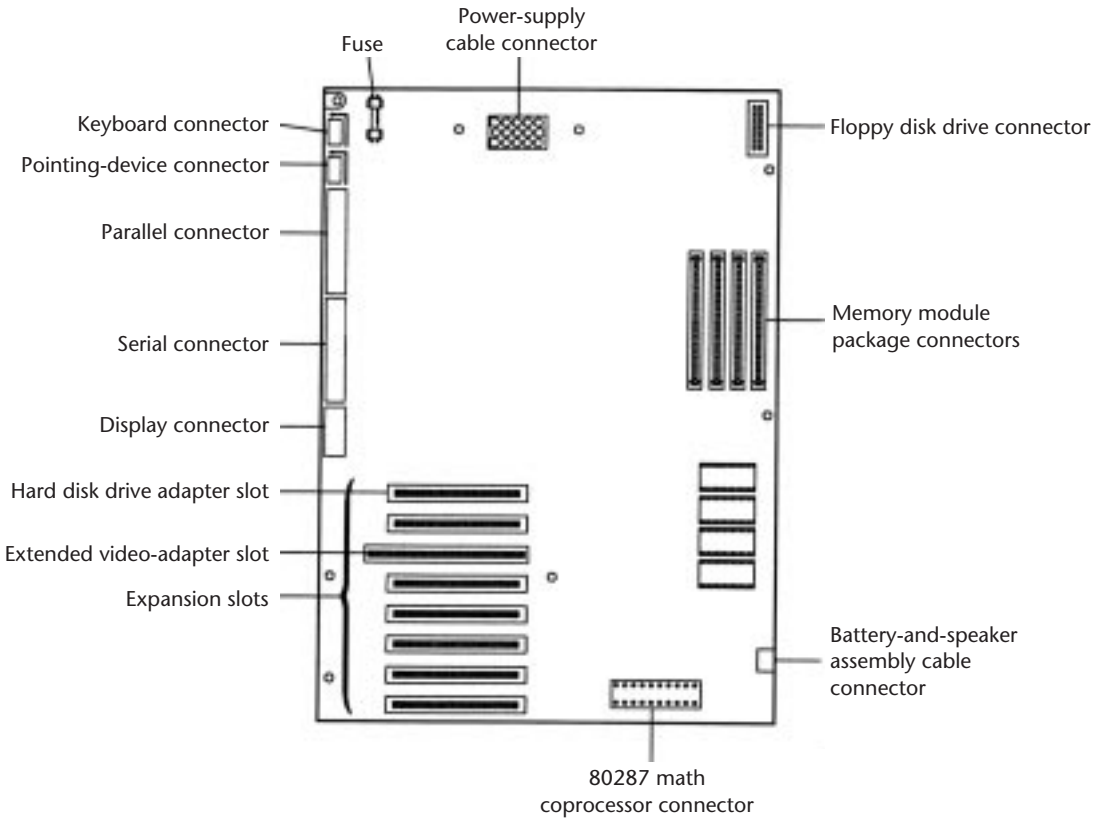


Fig. 22.27
PS/2 Model 60 system board.

Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
MCA/16	8/7	VGA	Enh	04/02/87	10/31/90
MCA/16	8/7	VGA	Enh	04/02/87	10/31/90

PS/2 Model 65 SX

The PS/2 Model 65 SX, introduced March 20, 1990, is based on the Intel 80386SX processor running at 16 MHz and uses 16-bit MCA I/O slots. All models of the Model 65 SX were discontinued on July 23, 1991, and are no longer available from IBM. Figure 22.28 and figure 22.29 show front and rear panel views of the Model 65, respectively.

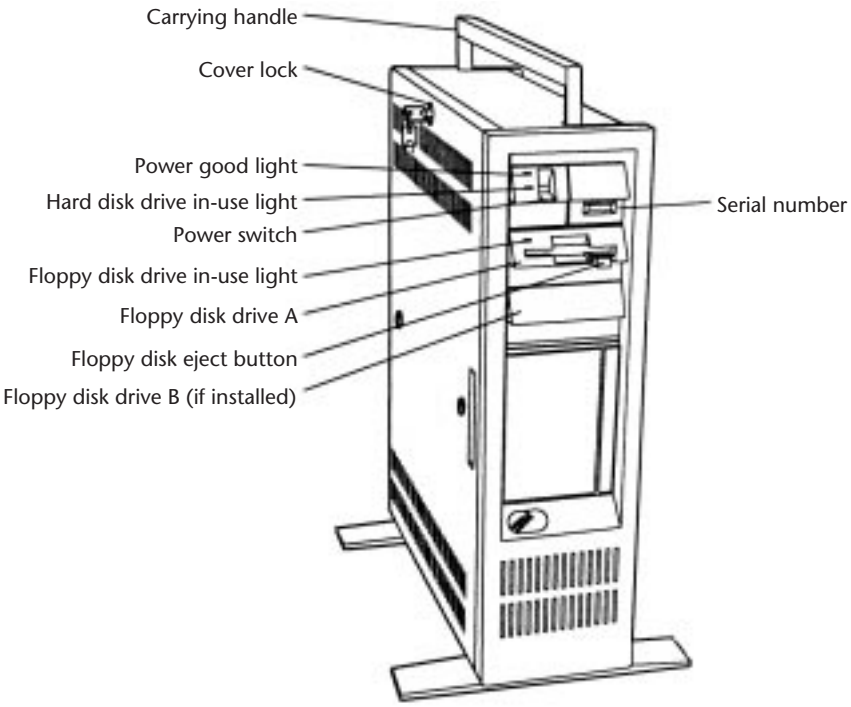


Fig. 22.28
PS/2 Model 65 SX.

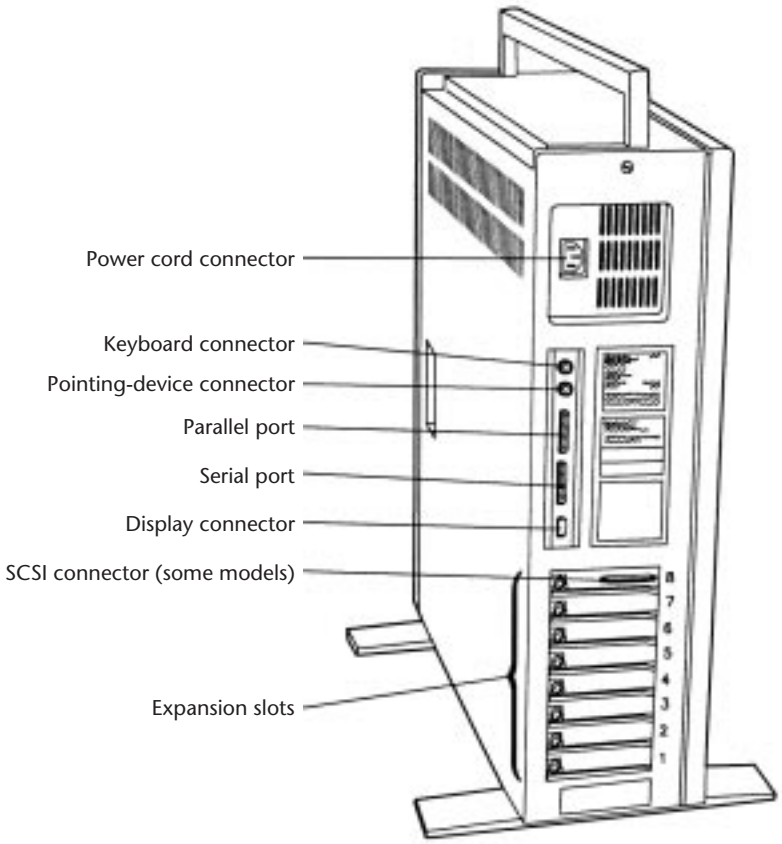


Fig. 22.29
PS/2 Model 65 SX rear panel view.

Standard features of the Model 65 SX include a 1.44M, 3 1/2-inch, half-height floppy disk drive; VGA graphics adapter; 2M of memory; a 250-watt power supply; a time-and-date clock with battery backup; and the IBM Enhanced PC Keyboard. Two memory SIMM sockets are provided on the system board; one contains 2M of 100ns memory. Both versions of the Model 65 SX can be expanded to 8M of memory on the system board and support up to 16M total system memory. This can be done by removing the standard 2M SIMM and using 4M SIMMs instead. Figure 22.30 shows an interior view of the Model 65.

The hard disk drive controller is the PS/2 Micro Channel SCSI (Small Computer System Interface) Adapter. This bus master adapter provides additional expansion capability and an interface for the 3 1/2-inch, half-height SCSI hard disk drives of either 60M (8565-061) or 120M (8565-121).

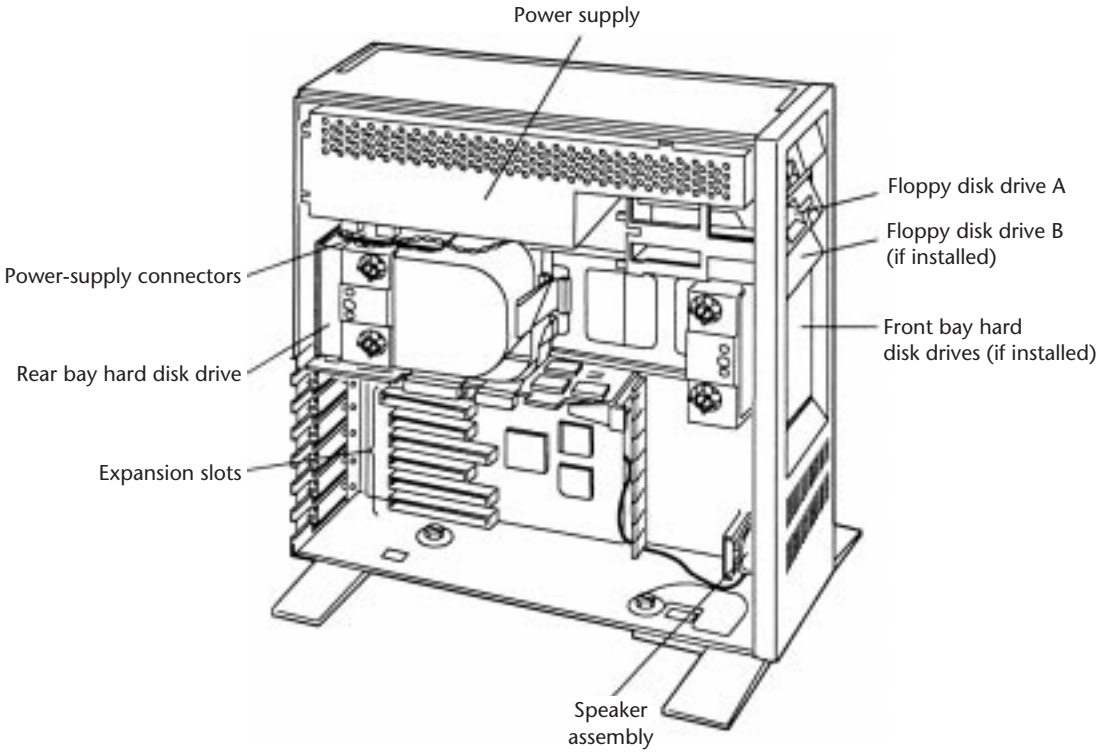


Fig. 22.30
PS/2 Model 65 SX (interior view).

The Model 65 SX has two levels of BIOS, which total 128K: a Compatibility BIOS (CBIOS) with memory addressability of up to 1M provides support for real-mode-based application programs, and Advanced BIOS (ABIOS) provides support for protected-mode-based multitasking operating systems and has extended memory addressability up to 16M.

Design enhancements to these systems offer significant advantages in configuration flexibility and expansion. In addition to providing seven available adapter slots, the standard configuration supports as many as five or six internal drives.

Drive Support. The PS/2 65 SX design provides five drive bays. The three bays in the front of the system are user-accessible; they can contain devices that require insertion and removal of media. The remaining two bays are designed for nonaccessible devices such as hard disks. The accessible bays consist of two 3 1/2-inch, half-height bays and one 5 1/4-inch, full-height bay. The top 3 1/2-inch, half-height bay contains a standard 1.44M floppy disk drive; the second 3 1/2-inch, half-height bay and the 5 1/4-inch, full-height bay are open for expansion purposes.

The standard hard disk drive configuration of the PS/2 Model 65 SX contains one SCSI hard disk drive located in one of the two nonaccessible bays. The other nonaccessible bay contains the necessary hardware to install a second IBM SCSI hard disk drive. The accessible 5 1/4-inch, full-height bay can be converted into two 3 1/2-inch, half-height bays through the use of the optional Fixed Disk Drive Kit A (1053) (6451053). This conversion allows the installation of third and fourth IBM SCSI hard disk drives.

The drive controller is the IBM PS/2 Micro Channel SCSI Adapter—a 16-bit MCA master adapter. Internal cabling is provided to support the standard hard disk drive and two additional internal SCSI devices. External SCSI devices attach directly to the IBM PS/2 Micro Channel SCSI Adapter external port, using the PS/2 card to option cable.

The specifications for the IBM PS/2 Micro Channel SCSI Adapter are as follows:

- Industry-standard interface (ANSI standard X3.131-1986)
- PS/2 16-bit intelligent bus master adapter
- Support for as many as seven physical SCSI devices
- Support for internal and external SCSI devices (single-ended)
- Micro Channel data transfer rate of up to 8.3M per second
- Support for asynchronous or synchronous SCSI devices

Table 22.35 lists the technical specifications for the PS/2 Model 65 SX.

Table 22.35 PS/2 Model 65 SX Technical Specifications

System Architecture	
Microprocessor	80386SX
Clock speed	16 MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	2M
Maximum on system board	8M
Maximum total memory	16M
Memory speed and type	100ns dynamic RAM

Memory	
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	2
Number available in standard configuration	1
Memory used on system board	1M/2M/4M 36-bit SIMMs
Memory cache controller	No
Wait states:	
System board	0-2
Adapters	0-4
Standard Features	
ROM size	128K
ROM shadowing	Yes
Optional math coprocessor	80387SX
Coprocessor speed	16 MHz
Standard graphics	VGA
8-/16-/32-bit controller	8-bit
Bus master	No
Video RAM (VRAM)	256K
RS232C serial ports	1
UART chip used	NS16550A
Maximum speed (bits/second)	19,200 bps
FIFO mode enabled	Yes
Maximum number of ports	8
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Maximum number of ports	8
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes + 2K extension
Battery life	10 years
Replaceable	Yes (Dallas module)
Disk Storage	
Internal disk and tape drive bays	5 or 6 (reconfigurable)
Number of 3 1/2- and 5 1/4-inch bays	4/1 or 6/0 (reconfigurable)
Standard floppy drives	1×1.44M
Optional floppy drives:	
5 1/4-inch 360K	Optional
5 1/4-inch 1.2M	Optional
3 1/2-inch 720K	No
3 1/2-inch 1.44M	Standard
3 1/2-inch 2.88M	No
Hard disk controller included	16-bit SCSI adapter
Bus master	Yes
Devices supported per adapter	7
Adapters supported per system	4

(continues)

Table 22.35 Continued

Disk Storage						
SCSI hard disks available	60M/80M/120M/160M/320M/400M					
Drive form factor	3 1/2-inch					
Drive interface	SCSI					
Drive capacity	60M	80M	120M	160M	320M	400M
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors per track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/sec)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes
Expansion Slots						
Total adapter slots	8					
Number of long and short slots	8/0					
Number of 8-/16-/32-bit slots	0/8/0					
Number of slots with video ext.	1					
Available slots	7					
Keyboard Specifications						
101-key Enhanced Keyboard	Yes					
Fast keyboard speed setting	Yes					
Keyboard cable length	10 feet					
Keylock:						
Locks cover	Yes					
Locks keyboard	No					
Keyboard password	Yes					
Power-on password	Yes					
Network server mode	Yes					
Physical Specifications						
Footprint type	Floor-standing					
Dimensions:						
Height	23.5 inches					
Width	6.5 inches					
Depth	19.0 inches					
Weight	52.0 lbs					
Environmental Specifications						
Power-supply output	250 watts					
Worldwide (110/60, 220/50)	Yes					
Auto-sensing/switching	Yes					

Environmental Specifications	
Maximum current:	
90-137 VAC	5.3 amps
180-265 VAC	2.7 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	1218
Noise (Average dB, operating, 1m)	54 dB
FCC classification	Class B

Figure 22.31 shows the motherboard components and layout for the Model 65.

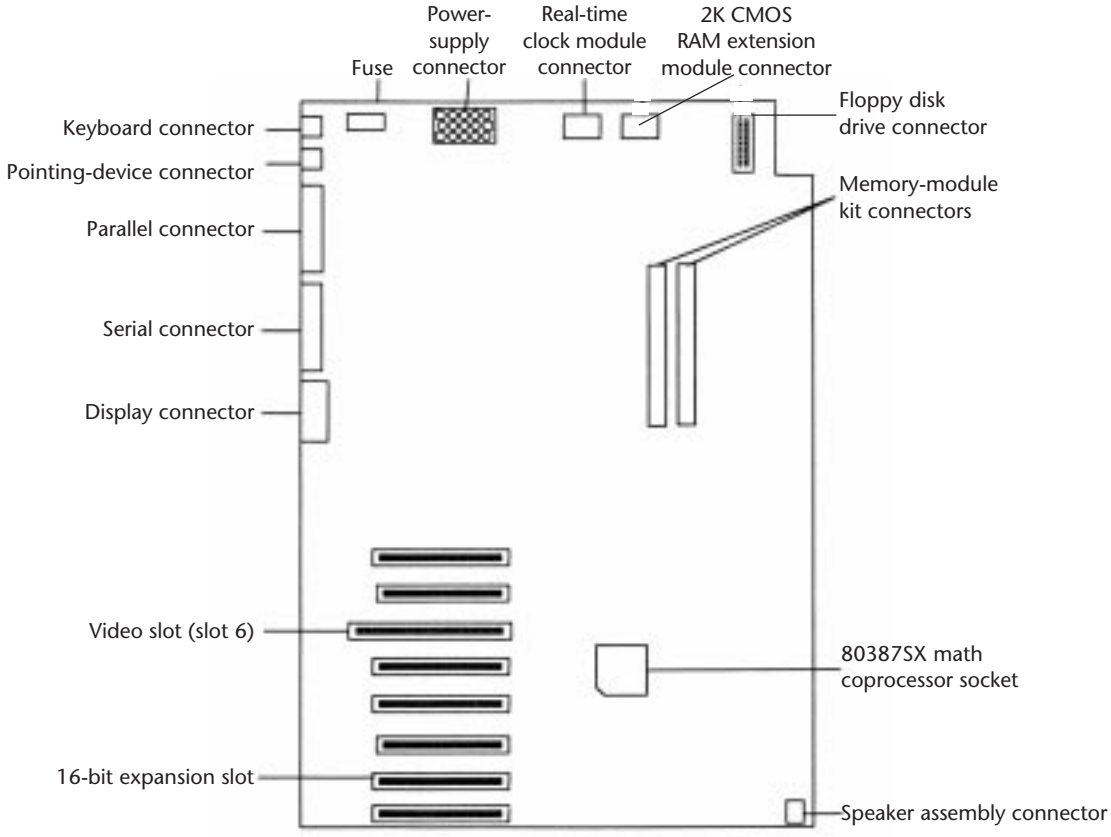


Fig. 22.31
PS/2 Model 65 SX system board.

Table 22.36 shows the primary specifications of the various versions of PS/2 Model 65 SX.

Table 22.36 IBM PS/2 Model 65 SX Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
65 SX						
8565-061	386SX	16	2M	8M	1×1.44M	60M
8565-121	386SX	16	2M	8M	1×1.44M	120M
8565-321	386SX	50	2M	8M	1×1.44M	320M

Note: *All Model 65 units are discontinued.*

PS/2 Model 70 386

The PS/2 Model 70 386, introduced June 2, 1988, is a desktop, high-end system in the PS/2 family. The Model 70 386 includes Micro Channel Architecture (MCA). Figure 22.32 shows a front view of the Model 70.

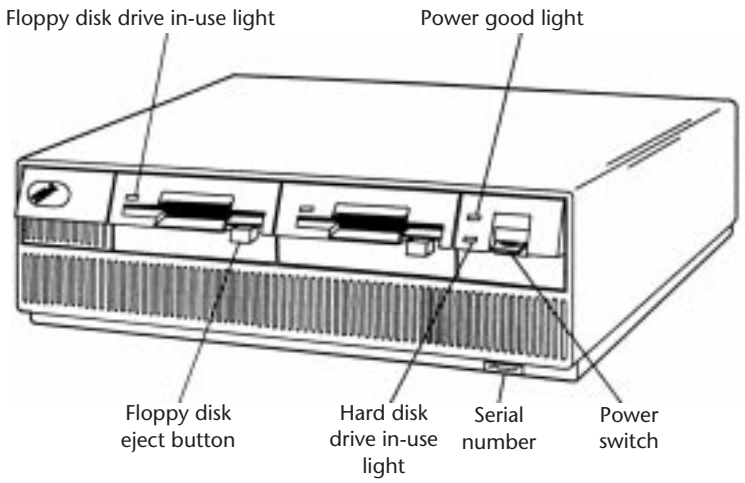


Fig. 22.32
PS/2 Model 70.

The basic system features a 16 MHz, 20 MHz, or 25 MHz 80386 microprocessor and 2M or 4M of high-speed memory on the motherboard. Motherboard memory is expandable to 6M or 8M depending on the model; you can expand total memory to 16M with memory adapters. The Model 70 386 comes with a 1.44M, 3 1/2-inch floppy disk drive and either a 60M or 120M hard disk drive with integrated controller (IDE) as standard. A serial port, parallel port, mouse port, and VGA port also are standard. Figure 22.33 shows a rear panel view of the Model 70.

Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
MCA/16	8/7	VGA	Enh	03/20/90	07/23/91
MCA/16	8/7	VGA	Enh	03/20/90	07/23/91
MCA/16	8/7	VGA	Enh	10/30/90	07/23/91

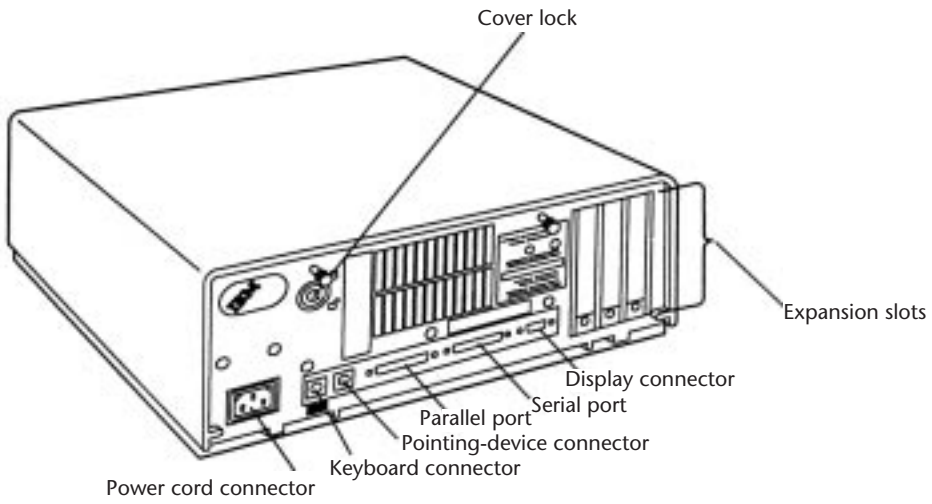


Fig. 22.33
PS/2 Model 70 rear panel.

The top-of-the-line 70 386-Axx models feature a 25 MHz 80386 32-bit microprocessor and an Intel 82385 memory cache controller with a high-speed 64K static memory cache. This memory cache lets the Model 70 386 perform approximately 150 percent faster than the 20 MHz versions of the Model 80. The Model 70 386 is about 250 percent faster than the Model 50.

The Model 70 386 has two levels of BIOS, which total 128K: a Compatibility BIOS (CBIOS) with memory addressability of up to 1M provides support for real-mode-based application programs; and Advanced BIOS (ABIOS) provides support for protected-mode-based multitasking operating systems and has extended memory addressability up to 16M.

Additional features of the Model 70 386 include one 16-bit and two 32-bit I/O slots.

Because all the hard disks available with the Model 70 386 have integrated (embedded) controllers, no slot is lost to a disk controller card. The Model 70 386 also has a 132-watt, automatic voltage-sensing, universal power supply; a time-and-date clock with battery backup; an additional slot for a second 3 1/2-inch floppy disk drive; an optional 16 MHz, 20 MHz, or 25 MHz 80387 coprocessor; and the IBM Enhanced Keyboard. Figure 22.34 shows the interior view of the Model 70.

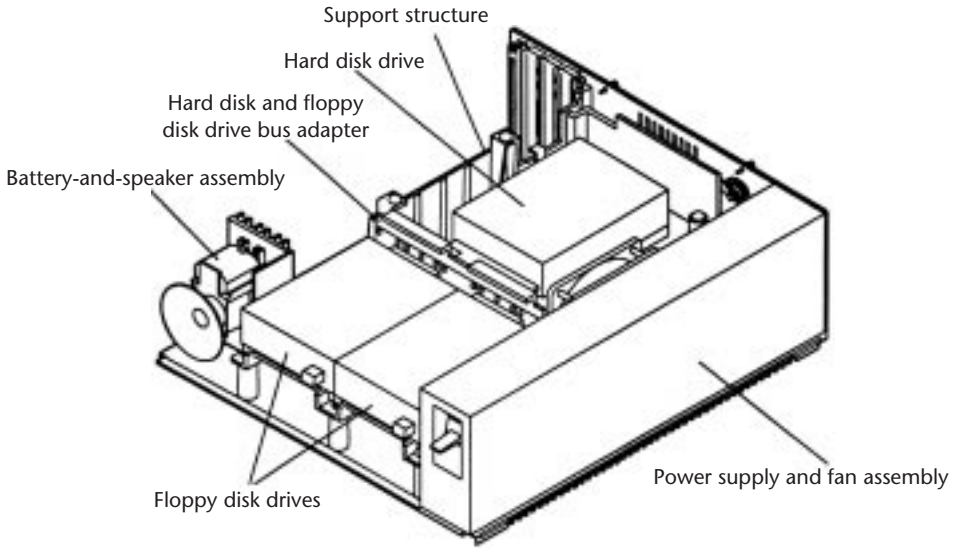


Fig. 22.34
PS/2 Model 70 interior view.

Several versions of the Model 70 386 are available. They differ mainly in clock speed, installed hard disk storage, and memory capabilities. Available system clock speeds are 16 MHz, 20 MHz, and 25 Mhz, and hard disks are available with 60M, 80M, 120M, and 160M of capacity. The 25 MHz models offer memory expansion to 8M on the system board and feature an upgradeable processor on a daughterboard (currently, only a single upgrade is available to a 25 MHz 80486DX processor).

The 25 MHz models have a few outstanding differences from the other models that give this system a higher-than-expected performance level. The 70 386-Axx models use an Intel 82385 cache controller chip, which manages 64K of extremely high-speed static memory. This memory is accessed at 0 wait states and uses a special algorithm to ensure an exceptionally high bit ratio for cache memory access. Because of this system's speed, this version of the Model 70 386 requires extremely fast (80ns) memory, which the other models do not need. Remember this requirement when you purchase additional memory for this system and when you make repairs.

The 80387 math coprocessor chip selected for each system unit must match the main processor in speed, and the 80387 chips (especially the 25 MHz chip) are expensive. These chips are no longer being sold by IBM and must be obtained from other sources.

Table 22.37 lists the technical specifications for the PS/2 Model 70 386.

Table 22.37 PS/2 Model 70 386 Technical Specifications

System Architecture	
Microprocessor	80386DX
Clock speed	16 MHz (Exx) 20 MHz (0xx,1xx) 25 MHz (Axx)
Bus type	MCA (Micro Channel Architecture)
Bus width	32-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No Yes (Axx)
Memory	
Standard on system board	4M
Maximum on system board	6M 8M (Axx)
Maximum total memory	16M
Memory speed and type	85ns dynamic RAM 80ns dynamic RAM (Axx)
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	3 4 (Axx)
Number available in standard configuration	1 2 (Axx)
Memory used on system board	1M/2M 36-bit SIMMs
Paged memory logic	Yes
Memory cache controller	No Yes (Axx)
Internal/external cache	External
Standard memory cache size	64K
Cache memory speed and type	25ns static RAM
Wait states:	
System board	0-5 (Axx, 95 percent 0 wait states) 0-2
Adapter	0-7 (Axx, 95 percent 0 wait states) 0-4

(continues)

Table 22.37 Continued

Standard Features				
ROM size	128K			
ROM shadowing	Yes			
Optional math coprocessor	80387DX			
Coprocessor speed	16 MHz (Exx) 20 MHz (0xx,1xx) 25 MHz (Axx)			
Standard graphics	VGA (Video Graphics Array)			
8-/16-/32-bit controller	8-bit			
Bus master	No			
Video RAM (VRAM)	256K			
RS232C serial ports	1			
UART chip used	NS16550A			
Maximum speed (bits/second)	19,200 bps			
FIFO mode enabled	Yes			
Maximum number of ports	8			
Pointing device (mouse) ports	1			
Parallel printer ports	1			
Bidirectional	Yes			
Maximum number of ports	8			
CMOS real-time clock (RTC)	Yes			
CMOS RAM	64 bytes + 2K extension			
Battery life	5 years			
Replaceable	Yes			
Disk Storage				
Internal disk and tape drive bays	3			
Number 3 1/2- and 5 1/4-inch bays	3/0			
Standard floppy drives	1×1.44M			
Optional floppy drives:				
5 1/4-inch 360K	Optional			
5 1/4-inch 1.2M	Optional			
3 1/2-inch 720K	No			
3 1/2-inch 1.44M	Standard			
3 1/2-inch 2.88M	No			
Hard disk controller included	IDE connector on Interposer Card			
IDE hard disks available	60M/80M/120M/160M			
Drive form factor	3 1/2-inch			
Drive interface	IDE			
Drive capacity	60M	80M	120M	160M
Average access rate (ms)	27	17	23	16
Read-ahead cache	No	32K	No	32K
Encoding scheme	RLL	RLL	RLL	RLL
Cylinders	762	1021	920	1021
Heads	6	4	8	8
Sectors per track	26	39	32	39
Rotational speed (RPM)	3600	3600	3600	3600

Disk Storage				
Interleave factor	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	780	1170	960	1170
Automatic head parking	Yes	Yes	Yes	Yes
Expansion Slots				
Total adapter slots	3			
Number of long and short slots	3/0			
Number of 8-/16-/32-bit slots	0/1/2			
Number of slots with video ext.	1			
Available slots	3			
Keyboard Specifications				
101-key Enhanced Keyboard	Yes			
Fast keyboard speed setting	Yes			
Keyboard cable length	6 feet			
Security Features				
Keylock:				
Locks cover	Yes			
Locks keyboard	No			
Keyboard password	Yes			
Power-on password	Yes			
Network server mode	Yes			
Physical Specifications				
Footprint type	Desktop			
Dimensions:				
Height	5.5 inches			
Width	14.2 inches			
Depth	16.5 inches			
Weight	21.0 lbs			
Environmental Specifications				
Power-supply output	132 watts			
Worldwide (110/60, 220/50)	Yes			
Auto-sensing/switching	Yes			
Maximum current:				
90-137 VAC	2.7 amps			
180-265 VAC	1.4 amps			
Operating range:				
Temperature	60-90 degrees F			
Relative humidity	8-80 percent			
Maximum operating altitude	7,000 feet			
Heat (BTUs/hour)	751			
Noise (average dB, operating, 1m)	40 dB			
FCC classification	Class B			

Figures 22.35, 22.36, and 22.37 show the components and layouts of the three different types of Model 70 motherboards.

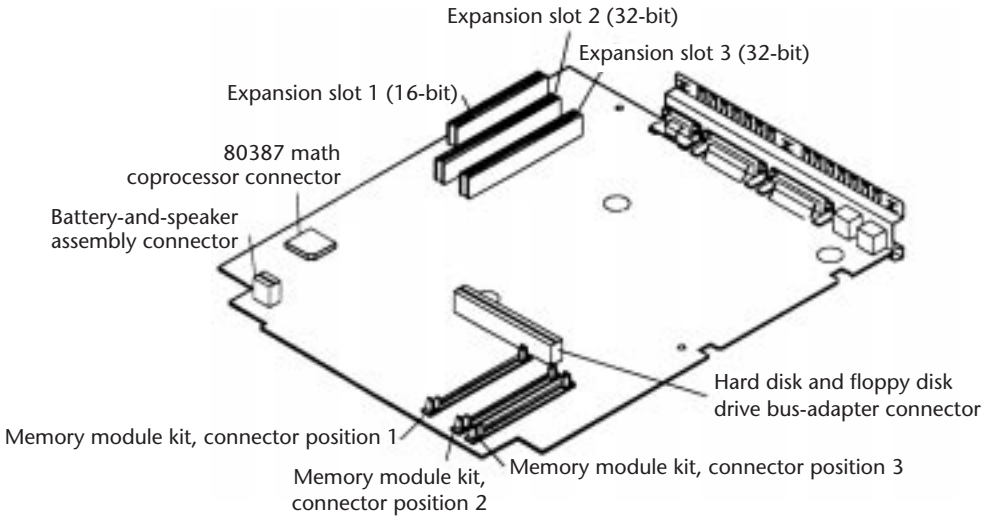


Fig. 22.35
PS/2 Model 70 386 system board (16 MHz and 20 MHz, type 1).

Table 22.38 shows the primary specifications of the various versions of PS/2 Model 70 386.

Table 22.38 IBM PS/2 Model 70 386 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
70 386						
8570-E61	386DX	16	2M	6M	1×1.44M	60M
8570-061	386DX	20	2M	6M	1×1.44M	60M
8570-081	386DX	20	4M	6M	1×1.44M	80M
8570-121	386DX	20	2M	6M	1×1.44M	120M
8570-161	386DX	20	4M	6M	1×1.44M	160M
8570-A61	386DX	25	2M	8M	1×1.44M	60M
8570-A81	386DX	25	4M	8M	1×1.44M	80M
8570-A21	386DX	25	2M	8M	1×1.44M	120M
8570-A16	386DX	25	4M	8M	1×1.44M	160M

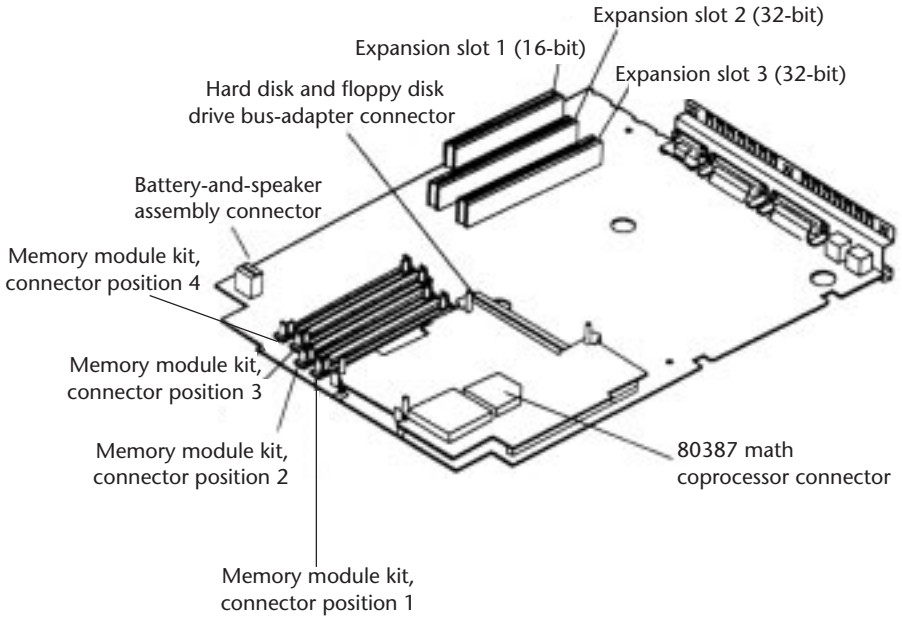


Fig. 22.36
PS/2 Model 70 386 system board (16 MHz and 20 MHz, type 2).

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/32	3/3	VGA	Enh	06/07/88	07/23/91
MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
MCA/32	3/3	VGA	Enh	06/11/91	—
MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
MCA/32	3/3	VGA	Enh	06/11/91	—
MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
MCA/32	3/3	VGA	Enh	06/11/91	01/17/92
MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
MCA/32	3/3	VGA	Enh	06/11/91	—

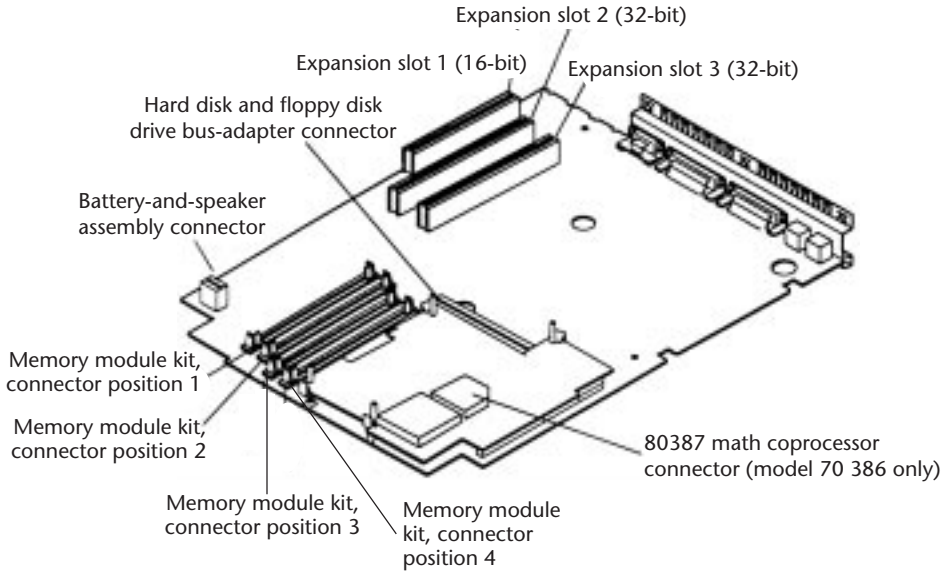


Fig. 22.37
PS/2 Model 70 386 system board (25 MHz, type 3).

PS/2 Model 70 486

The IBM PS/2 Model 70 486, introduced June 20, 1989, is essentially a Model 70 386-Axx with the 486 25 MHz Power Platform upgrade. The 25 MHz 80486 32-bit microprocessor replaces the 386 processor module standard in the Model 70 386. The Model 70 496 is no different from a Model 70 386 with the Power Platform added later.

The Model 70 486 has been discontinued by IBM as of 09/11/91 and is no longer available. The 486 Power Platform, however, is still available for upgrading existing 25 MHz Model 70 386 systems.

The basic system features a 25 MHz 80486 32-bit microprocessor with a built-in 8K memory cache. With this processor and memory cache, this unit can perform approximately 100 percent faster than the 386 version. Also included is 4M of high-speed memory on the motherboard, expandable to 8M, with total memory expandable to 16M (with memory adapters). This system comes with a 1.44M, 3 1/2-inch floppy disk drive and either a 60M or 120M hard disk drive with integrated controller (IDE) as standard. Also standard are a serial port, parallel port, mouse port, and VGA port.

The Model 70 486 has two levels of BIOS, which total 128K: A Compatibility BIOS (CBIOS) with memory addressability of up to 1M provides support for real-mode-based application programs; and an additional version of BIOS, Advanced BIOS (ABIOS), provides support for protected-mode-based multitasking operating systems and has extended memory addressability of up to 16M.

Additional features of the Model 70 486 include one 16-bit and two 32-bit I/O slots. Because all the hard disks available with the Model 70 have integrated (embedded) controllers, no slot is lost to a disk controller card. The Model 70 486 also has a 25 MHz 80387 math coprocessor; a 132-watt, automatic voltage-sensing, universal power supply; a time-and-date clock with battery backup; an additional slot for a second 3 1/2-inch floppy disk drive; and the IBM Enhanced Keyboard.

Table 22.39 lists the technical specifications for the PS/2 Model 70 486.

Table 22.39 PS/2 Model 70 486 Technical Specifications

System Architecture	
Microprocessor	80486
Clock speed	25 MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	32-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
486 burst mode enabled	No
Upgradeable processor complex	Included
Memory	
Standard on system board	2M
Maximum on system board	8M
Maximum total memory	16M
Memory speed and type	80ns dynamic RAM
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	4
Number available in standard configuration	3
Memory used on system board	2M 36-bit SIMMs
Paged memory logic	Yes
Memory cache controller	Yes
Internal/external cache	Internal
Standard memory cache size	8K
Optional external memory cache	No
Wait states:	
System board	0-5 (95 percent 0 wait states)
Adapter	0-7
Standard Features	
ROM size	128K
ROM shadowing	Yes
Math coprocessor	Built-in
Coprocessor speed	25 MHz

(continues)

Table 22.39 Continued

Standard Features				
Standard graphics	VGA			
8-/16-/32-bit controller	8-bit			
Bus master	No			
Video RAM (VRAM)	256K			
RS232C serial ports	1			
UART chip used	NS16550A			
Maximum speed (bits/second)	19,200 bps			
FIFO mode enabled	Yes			
Maximum number of ports	8			
Pointing device (mouse) ports	1			
Parallel printer ports	1			
Bidirectional	Yes			
Maximum number of ports	8			
CMOS real-time clock (RTC)	Yes			
CMOS RAM	64 bytes + 2K extension			
Replaceable	Yes			
Disk Storage				
Internal disk and tape drive bays	3			
Number of 3 1/2- and 5 1/4-inch bays	3/0			
Standard floppy drives	1×1.44M			
Optional floppy drives:				
5 1/4-inch 360K	Optional			
5 1/4-inch 1.2M	Optional			
3 1/2-inch 720K	No			
3 1/2-inch 1.44M	Standard			
3 1/2-inch 2.88M	No			
Hard disk controller included	IDE connector on Interposer Card			
IDE hard disks available	60M/80M/120M/160M			
Drive form factor	3 1/2-inch			
Drive interface	IDE			
Drive capacity	60M	80M	120M	160M
Average access rate (ms)	27	17	23	16
Read-ahead cache	No	32K	No	32K
Encoding scheme	RLL	RLL	RLL	RLL
Cylinders	762	1021	920	1021
Heads	6	4	8	8
Sectors per track	26	39	32	39
Rotational speed (RPM)	3600	3600	3600	3600
Interleave factor	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	780	1170	960	1170
Automatic head parking	Yes	Yes	Yes	Yes

Expansion Slots	
Total adapter slots	3
Number of long and short slots	3/0
Number of 8-/16-/32-bit slots	0/1/2
Number of slots with video ext.	1
Available slots	3
Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	6 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	5.5 inches
Width	14.2 inches
Depth	16.5 inches
Weight	21.0 lbs
Environmental Specifications	
Power-supply output	132 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	2.7 amps
180-265 VAC	1.4 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	751
Noise (Average dB, operating, 1m)	40 dB
FCC classification	Class B

Table 22.40 shows the primary specifications of the various versions of PS/2 Model 70 486.

Table 22.40 IBM PS/2 Model 70 486 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
70 486						
8570-B61	486DX	25	2M	8M	1×1.44M	60M
8570-B21	486DX	25	2M	8M	1×1.44M	120M

PS/2 Model P70 386

The PS/2 Model P70 386 (8573), introduced May 9, 1989, is a high-function, high-performance portable system designed to complement the PS/2 Model 70 386 desktop family of products. IBM has made the PS/2 Model P70 386 in 16 MHz and 20 MHz versions with 30M, 60M, and 120M hard disks. Effective July 23, 1991, IBM discontinued two versions of the Model P70 386: the 16 MHz model (031) and the 20 MHz, 60M disk model (061). The Model P70 386-121 (120M disk) continues to be sold. Figure 22.38 shows a front view of the Model P70.

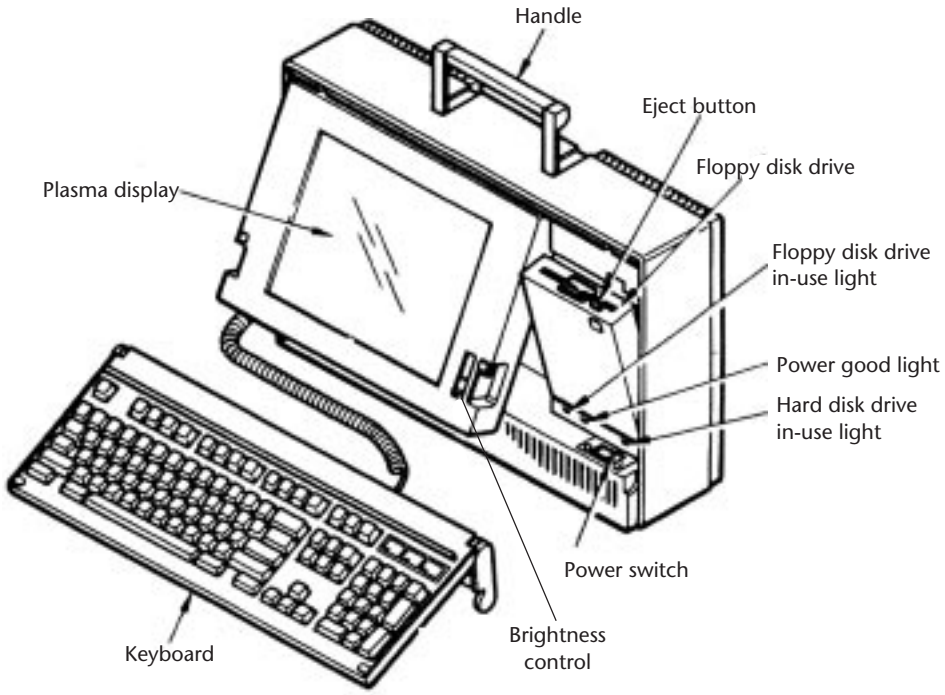


Fig. 22.38
PS/2 Model P70 386.

Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
MCA/32	3/3	VGA	Enh	09/26/89	09/11/91
MCA/32	3/3	VGA	Enh	06/20/89	09/11/91

The Model P70 386 includes MCA I/O slots, a VGA 16-grayscale plasma display, and a fully compatible PS/2 Enhanced Keyboard, all neatly integrated into a single package. It features an 80386DX processor, high-density memory technology, and a wide range of integrated features, supporting up to 16M of high-speed memory (4M standard, expandable up to 8M on system board), 120M or more disk storage, and an optional 80387 math coprocessor. Like most PS/2 systems, all models come standard with a 1.44M, 3 1/2-inch floppy disk drive, a pointing device port, a serial/asynchronous port, a parallel port, a VGA port, and an external storage device port. Figure 22.39 shows the rear panel view of the Model P70.

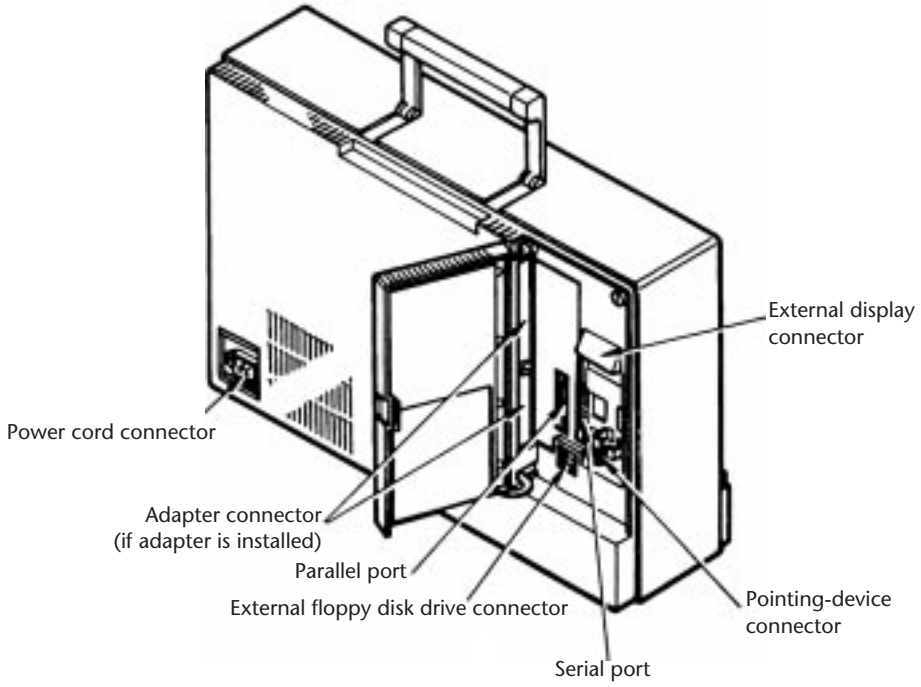


Fig. 22.39
PS/2 Model P70 386 rear panel view.

Exceptional features for a portable computer include the Model 70's two MCA expansion slots (one full and one half-length) and its ergonomic briefcase portable design. The expansion slots can be used for products such as the IBM PS/2 300/1200/2400 Internal Modem/A or P70 386 Token-Ring Adapter. Figure 22.40 shows the interior view of the P70.

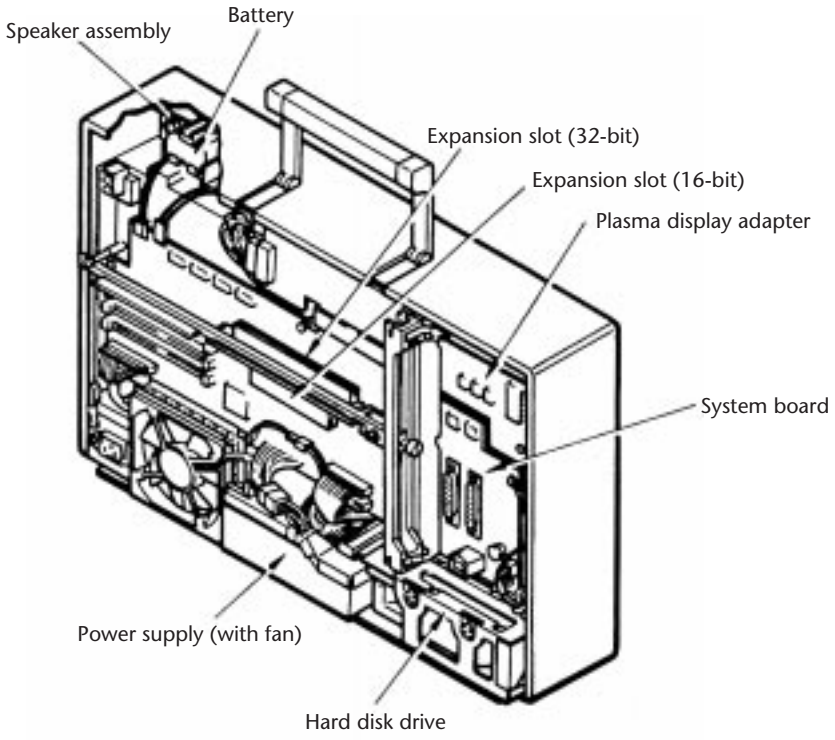


Fig. 22.40
PS/2 Model P70 386 interior view.

One exception to the norm is the external storage device port. The equivalent of the drive B internal floppy disk port, as found in the desktop Model 70, it permits attachment of externally powered devices, such as the IBM 360K external disk drive and some other manufacturers' backup devices. A cable (part number 23F2716) 35.5 centimeters or 14 inches long is available for attaching external drives. The cable features a Hoshiden Connector to attach to the P70 386 with an industry standard 37-pin D-shell connector that connects to the externally powered devices.

The VGA port supports all VGA graphics and text modes including 640 × 480 graphics, 320 × 200 graphics in 256 colors, and 720 × 400 text using any optional PS/2 VGA color display; and yet maintains compatibility with CGA and EGA modes. The gas plasma display normally shuts down when an external display is connected. You can override this feature and force both displays to operate simultaneously with the external display in monochrome mode, which is ideal for presentations using large-screen projection devices.

In addition, the system is designed for tool-free installation and includes security features in BIOS. The Model P70 386 has two levels of BIOS, which total 128K: A Compatibility BIOS (CBIOS) with memory addressability of up to 1M provides support for real-mode-based application programs; and an additional version of BIOS, Advanced BIOS (ABIOS), provides support for protected-mode-based multitasking operating systems and has extended memory addressability of up to 16M.

The P70 386 uses hard drives with integrated controllers (IDE). These drives plug directly into a special MCA IDE connector on the motherboard. All models use high-speed (85ns) memory and have memory paging and ROM shadowing to improve performance. Several accessories are available for the system, including three different carrying cases, the external storage device cable, and a keyboard extension cable.

Table 22.41 lists the technical specifications for the PS/2 Model P70 386.

Table 22.41 PS/2 Model P70 386 Technical Specifications

System Architecture	
Microprocessor	80386DX
Clock speed	20 MHz 16 MHz (031)
Bus type	MCA (Micro Channel Architecture)
Bus width	32-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	4M
Maximum on system board	8M
Maximum total memory	16M
Memory speed and type	85ns dynamic RAM
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	4
Number available in standard configuration	2
Memory used on system board	1M/2M 36-bit SIMMs
Page memory logic	Yes
Memory cache controller	No
Wait states:	
System board	0-2
Adapter	0-4
Standard Features	
ROM size	128K
ROM shadowing	Yes

(continues)

Table 22.41 Continued

Standard Features			
Optional math coprocessor	80387DX		
Coprocessor speed	20 MHz		
	16 MHz (031)		
Standard graphics	VGA		
8-/16-/32-bit controller	8-bit		
Bus master	No		
Video RAM (VRAM)	256K		
Integrated display	Yes		
Type	Gas plasma, orange		
Size (diagonal measure)	10 inches		
Grayshades	16		
RS232C serial ports	1		
UART chip used	NS16550A		
Maximum speed (bits/second)	19,200 bps		
FIFO mode enabled	Yes		
Maximum number of ports	8		
Pointing device (mouse) ports	1		
Parallel printer ports	1		
Bidirectional	Yes		
Maximum number of ports	8		
CMOS real-time clock (RTC)	Yes		
CMOS RAM	64 bytes + 2K extension		
Battery life	5 years		
Replaceable	Yes		
Disk Storage			
Internal disk and tape drive bays	2		
Number of 3 1/2- and 5 1/4-inch bays	2/0		
Standard floppy drives	1×1.44M		
Optional floppy drives:			
5 1/4-inch 360K	Optional		
5 1/4-inch 1.2M	Optional		
3 1/2-inch 720K	No		
3 1/2-inch 1.44M	Standard		
3 1/2-inch 2.88M	No		
Auxiliary storage connector	Yes		
Drives supported	5 1/4-inch 360K		
Cable adapter	Optional		
Hard disk controller included	MCA IDE connector on system board		
IDE hard disks available	30M/60M/120M		
Drive form factor	3 1/2-inch		
Drive interface	MCA IDE		
Drive capacity	30M	60M	120M
Average access rate (ms)	19	27	23
Encoding scheme	RLL	RLL	RLL
Cylinders	920	762	920
Heads	2	6	8
Sectors per track	32	26	32
Rotational speed (RPM)	3600	3600	3600

Disk Storage			
Interleave factor	1:1	1:1	1:1
Data transfer rate (K/second)	960	780	960
Automatic head parking	Yes	Yes	Yes
Expansion Slots			
Total adapter slots	2		
Number of long and short slots	1/1		
Number of 8-/16-/32-bit slots	0/1/1		
Number of slots with video ext.	0		
Available slots	2		
Keyboard Specifications			
101-key Enhanced Keyboard	Yes		
Fast keyboard speed setting	Yes		
Keyboard cable length	1.2 feet (14 inches)		
Keyboard extension cable	Optional, 6 feet		
Security Features			
Keylock:			
Locks cover	No		
Locks keyboard	No		
Keyboard password	Yes		
Power-on password	Yes		
Network server mode	Yes		
Physical Specifications			
Footprint type	Portable		
Dimensions:			
Height	12.0 inches		
Width	18.3 inches		
Depth	16.5 inches		
Weight	20.8 lbs		
Carrying handle	Yes		
Carrying case	Optional, three styles available		
Environmental Specifications			
Power-supply output	85 watts		
Worldwide (110/60, 220/50)	Yes		
Auto-sensing/switching	Yes		
Maximum current:			
90-137 VAC	2.4 amps		
180-264 VAC	1.2 amps		
Operating range:			
Temperature	50-95 degrees F		
Relative humidity	8-80 percent		
Maximum operating altitude	7,000 feet		
Heat (BTUs/hour)	480		
Noise (Average dB, operating, 1m)	39 dB		
FCC classification	Class B		

Table 22.42 shows the primary specifications of the various versions of PS/2 Model P70 386.

Table 22.42 IBM PS/2 Model P70 386 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
70 386						
8573-031	386DX	16	2M	8M	1×1.44M	30M
8573-061	386DX	20	4M	8M	1×1.44M	60M
8573-121	386DX	20	4M	8M	1×1.44M	120M

Figure 22.41 shows the components and layout of the Model P70 motherboard.

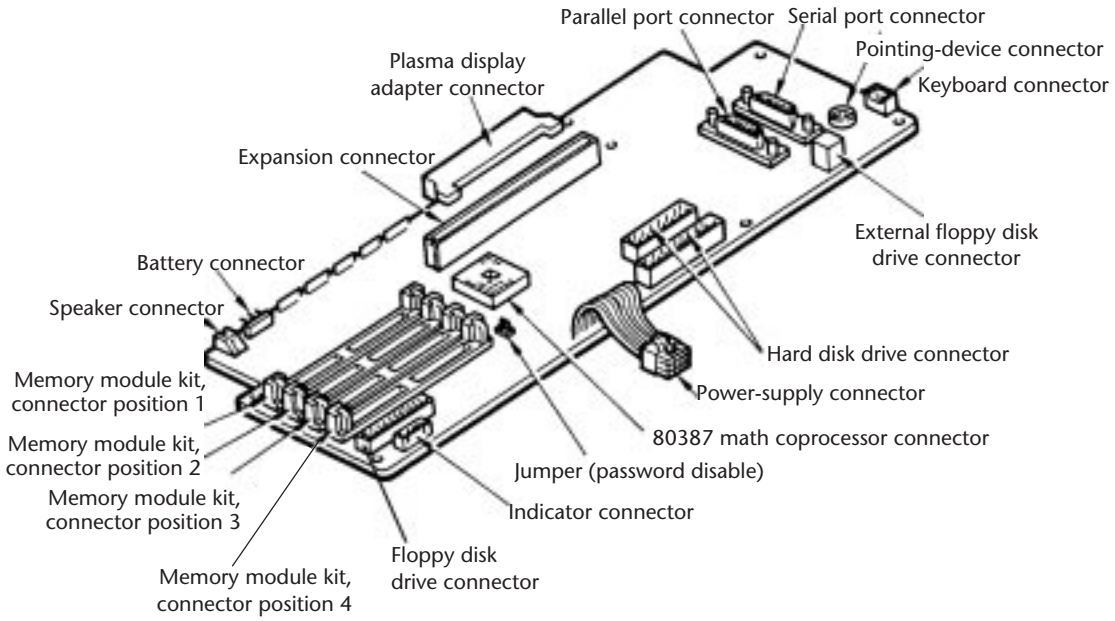


Fig. 22.41
PS/2 Model P70 386 system board.

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/32	2/2	VGA	Enh	03/20/90	07/23/91
MCA/32	2/2	VGA	Enh	05/09/89	07/23/91
MCA/32	2/2	VGA	Enh	05/09/89	—

Table 22.43 shows accessories available from IBM for the PS/2 Model P70 386.

Table 22.43 IBM PS/2 Model P70 386 Special Accessories

Description	Part	Price	Notes
Hartmann leather case	23F3192	$360	For P70 (not P75), pockets
Hartmann nylon case	23F3193	185	For P70 (not P75), pockets
Airline travel hard case	79F3205	299	Plastic, padded, wheels, storage
External storage device cable	23F2716	101	P70 360K, P75 360K/1.2M
Keyboard extension cable	79F3210	82	For P70/75, six-foot cable

PS/2 Model P75 486

The PS/2 Model P75 486, introduced November 12, 1990, is a high-end addition to IBM's portable computer family. The Model P75 486 features the powerful 486DX processor, operating at 33 MHz, and MCA slots. For several months after the introduction of this system, no other company had a portable as fast or as powerful. In fact, nearly every company that has tried to introduce a 33 MHz 486 portable has run into problems with the FCC in obtaining the proper Class B certification. This highlights one of the distinct advantages that IBM has with the Micro Channel Architecture: IBM can make systems faster and faster, while keeping them within noise-emission guidelines set by the FCC, because of the superior electrical characteristics of the MCA bus over the ISA or EISA bus.

The PS/2 Model P75 486 enables applications that require portability to run on a system that rivals many desktop or even floor-standing tower systems in capacity. This system allows a portable application to use the processing power of the 486DX processor operating at 33 MHz, up to 16M of main storage, hard disk capacity to 400M, an external SCSI port, and four MCA adapter slots. Because of the built-in SCSI interface, internal hard disk drives can be easily upgraded to well over 1 gigabyte in capacity. This system has one of the largest disk storage capabilities for a portable system.

The PS/2 Model P75 486 has the following features:

- 33 MHz 486DX processor on removable card
- 8M memory expandable to 16M
- Four slots (two full-length 32-bit, two half-length 16-bit)
- High-resolution eXtended Graphics Array (XGA) video port
- VGA 16-grayscale plasma display
- Choice of 160M or 400M disk drives
- Full-size PS/2 Enhanced Keyboard
- 3 1/2-inch 1.44M floppy disk drive
- External SCSI port
- AC operation (only)
- Maximum expansion

The PS/2 P75 486 offers power not previously available in a portable machine. It can be used as a network server or workstation for temporary offices at conventions, sporting events, and other temporary work locations. This system is ideal where a maximum system configuration must be carried along.

The PS/2 P75 486 does not run on batteries and has no "low-power" devices that would limit performance and expandability. Because of the extreme power and integration of this unit, it currently ranks as one of IBM's most expensive PCs.

In addition to the powerful processor, the PS/2 P75 486 features a SCSI hard disk drive up to 400M as standard. With 3 1/2-inch SCSI drives becoming available in the gigabyte-capacity range and higher, it will be easy to upgrade this system to even larger-capacity storage.

The XGA graphics adapter built-in on the unit offers graphics resolution of 1,024 × 768. Because this device also is configured as a bus master, the performance is far beyond a standard VGA, even at VGA resolution. A device driver package is included with drivers for many popular applications and environments, such as OS/2 and Windows.

Several accessories are available, including the IBM PS/2 travel case (part number 79F3205). This hard case is constructed of molded plastic with easy-rolling wheels and an integrated, telescopic handle for pulling. The interior is padded and provides space for the P75 (or P70 386), cables, and a mouse. The case is designed to provide an easy, safe way to transport the system. It conforms to FAA luggage regulations, so it can be carried on board an aircraft and stored under the seat.

Also available is a keyboard extension cable. The keyboard extension cable (part number 79F3210) gives users the flexibility of placing the keyboard and the system unit farther apart for more comfort and convenience.

Table 22.44 lists the technical specifications for the PS/2 Model P75 486.

Table 22.44 PS/2 Model P75 486 Technical Specifications

System Architecture	
Microprocessor	80486DX
Clock speed	33 MHz
Bus type	MCA
Bus width	32-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
486 burst mode enabled	No
Upgradeable processor complex	Yes
Memory	
Standard on system board	8M
Maximum on system board	16M
Maximum total memory	16M
Memory speed and type	70ns dynamic RAM
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory-module sockets	4
Number available in standard configuration	2
Memory used on system board	2M/4M 36-bit SIMMs
Paged memory logic	Yes
Memory cache controller	Yes
Internal/external cache	Internal
Standard memory cache size	8K
Optional external memory cache	No
Wait states:	
System board	0-5 (95 percent 0 wait states)
Adapter	0-7
Standard Features	
ROM size	128K
ROM shadowing	Yes
Math coprocessor	Built-in to 486
Coprocessor speed	33 MHz
Standard graphics	XGA (eXtended Graphics Array)
8-/16-/32-bit controller	16/32-bit
Bus master	Yes
Video RAM (VRAM)	1M
Integrated display	Yes, VGA mode only
Type	Gas plasma, orange
Size (diagonal measure)	10 inches
Grayshades	16

(continues)

Table 22.44 Continued

Standard Features						
RS232C serial ports	1					
UART chip used	NS16550A					
Maximum speed (bits/second)	19,200 bps					
FIFO mode enabled	Yes					
Maximum number of ports	8					
Pointing device (mouse) ports	1					
Parallel printer ports	1					
Bidirectional	Yes					
Maximum number of ports	8					
CMOS real-time clock (RTC)	Yes					
CMOS RAM	64 bytes + 2K extension					
Battery life	5 years					
Replaceable	Yes					
Disk Storage						
Internal disk and tape drive bays	2					
Number of 3 1/2- and 5 1/4-inch bays	2/0					
Standard floppy drives	1×1.44M					
Optional floppy drives:						
5 1/4-inch 360K	Optional					
5 1/4-inch 1.2M	Optional					
3 1/2-inch 720K	No					
3 1/2-inch 1.44M	Standard					
3 1/2-inch 2.88M	No					
Auxiliary storage connector	Yes					
Drives supported	5 1/4-inch 360K, 1.2M					
Cable adapter	Optional					
Hard disk controller included	SCSI integrated on system board					
Bus master	Yes					
Devices supported per adapter	7					
SCSI hard disks available	60M/80M/120M/160M/320M/400M					
Drive form factor	3 1/2-inch					
Drive interface	SCSI					
Drive capacity	60M	80M	120M	160M	320M	400M
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors per track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes

Expansion Slots	
Total adapter slots	4
Number of long and short slots	2/2
Number of 8-/16-/32-bit slots	0/2/2
Number of slots with video ext.	1
Available slots	4
Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	1.2 feet (14 inches)
Keyboard extension cable	Optional, 6 feet
Security Features	
Keylock:	
Locks cover	No
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Portable
Dimensions:	
Height	12.0 inches
Width	18.3 inches
Depth	6.1 inches
Weight	22.1 lbs
Carrying handle	Yes
Carrying case	Optional hard-shell case
Environmental Specifications	
Power-supply output	120 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	3.0 amps
180-264 VAC	1.5 amps
Operating range:	
Temperature	50-104 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	751
Noise (average dB, operating, 1m)	39 dB
FCC classification	Class B

Table 22.45 shows the primary specifications of the various versions of PS/2 Model P75 486.

Table 22.45 IBM PS/2 Model P75 486 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
P75 486						
8573-161	486DX	33	8M	16M	1×1.44M	160M
8573-401	486DX	33	8M	16M	1×1.44M	400M

Table 22.46 shows accessories available from IBM for the PS/2 Model P75 486.

Table 22.46 IBM PS/2 Model P75 486 Special Accessories

Description	Part	Price	Notes
Airline-travel hard case	79F3205	$299	Plastic, padded, wheels, storage
Keyboard extension cable	79F3210	82	For P70/75, 6-foot cable
External storage device cable	23F2716	101	P70 360K, P75 360K/1.2M

PS/2 Models 76, 77, and 77s Ultimedia

The PS/2 Models 76 and 77 use a series of processors: the Intel 33-MHz 486SX, the 66-MHz 486DX2, and the clock-tripled 100-MHz 486DX4. These systems were introduced June 13, 1994, after an aborted November 1993 ship date. The Models 76 and 77 were planned to use IBM's 33/99MHz "Blue Lightning" 486 CPU (a clock-tripled 486SLC3), but IBM felt customers were more comfortable with genuine Intel processors. The machines were first delayed by a shortage of Blue Lightning chips, and then later by a faulty controller IBM developed specifically for these models. Those models using DX4 chips can be upgraded to Intel Pentium P24T OverDrive processors, whereas the others accept 486 OverDrive and Pentium OverDrive upgrades.

These new systems are the first PS/2s that do not use IBM's internally developed XGA graphics chips. Instead, they come with S3-accelerated SVGA local-bus graphics and are capable of supporting resolutions as high as 1,280 by 1,024 with 256 colors. These new systems also use 32-bit Micro Channel Architecture slots, rather than the older 16-bit slots.

The 100-MHz 486DX4 models include a 16K L1 memory cache and a 256K L2 memory cache. The 486DX2-66 models include an 8K L1 cache and an external 128K cache. The 486SX versions have an 8K L1 cache and no L2 cache, which is optional. These systems come standard with 8M RAM and can accommodate up to 64M on the system board. The Models 76 and 77 come standard with 2.88M floppy disk drive. The hard disk drive may be either IDE or SCSI-2. Models with IDE are indicated by an "i" at the end of the model name, such as PS/2 Model 76i. SCSI models are indicated by an "s" ("PS/2 Model 76s"). Drive sizes range from 170M to 540M.

Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
MCA/32	4/4	XGA	Enh	11/12/90	—
MCA/32	4/4	XGA	Enh	11/12/90	—

The Model 77s is actually designed to be used as a server, and it will ship standard with ECC memory. Error-correcting code (ECC) memory detects and eliminates data errors without halting processing. Network managers consider ECC an extremely valuable component in any network server, although this feature is not cost-effective for systems based on low-power processors. For systems utilizing Intel's Pentium or DX4 chips, ECC is an excellent and inexpensive benefit. Unlike typical memory parity checking, which adds only one bit per byte, ECC generates multiple check bits to safeguard data against a variety of problems, including electrical noise, dynamic RAM (DRAM) errors, and rogue alpha particles.

The 77s Ultimedia is a multimedia version of the Model 77. The 77s Ultimedia includes a double-speed CD-ROM drive, an Audiovation sound card with IBM's programmable Mwave digital signal processor, and a MediaBurst movie card from VideoLogic Inc., in Cambridge, Mass.

Table 22.47 lists the technical specifications for the PS/2 Model 76 and 77.

Table 22.47 PS/2 Model 76 and 77 Technical Specifications

System Architecture	
Microprocessor	80486SX (*U*) 80486DX2 (*N*) 80486DX4 (*T*)
Clock speed	33 MHz (*U*) 66 MHz (*N*) 100 MHz (*T*)
L1/L2 cache	8K/Optional (*U*) 8K/128K (*N*) 16K/256K (*T*)
Bus type	MCA
Bus width	32-bit
Upgradeable processor complex	No

(continues)

Table 22.47 Continued

Memory	
Standard on system board	8M (16M on 9577-VTG)
Maximum on system board	64M
Maximum total memory	64M
Memory speed and type	70ns dynamic RAM
System board memory socket type Number of memory module sockets Number available in standard configuration	36-bit SIMM (single in-line memory module) 4 4
Memory used on system board	2M/4M/8M/16M 36-bit SIMMs
Optional math coprocessor	80487SX (*U*) Standard (*N*) Standard (*T*)
Standard graphics Video RAM (VRAM)	S3-accelerated local-bus SVGA graphics 1M
RS232C serial ports	1
UART chip used	Custom (compatible with NS16550A)
Pointing device (mouse) ports	1
Standard Features	
Parallel printer ports Bidirectional	1 Yes
Disk Storage	
Internal disk and tape drive bays Number of 3 1/2- and 5 1/4-inch bays	3 (4 Model 77) 1/3 (1/4 Model 77)
Standard floppy drives	1×2.88M
Optional floppy drives: 5 1/4-inch 360K 5 1/4-inch 1.2M 3 1/2-inch 720K 3 1/2-inch 1.44M 3 1/2-inch 2.88M	 Optional Optional No Optional Standard
Hard disk controller included: Bus master Devices supported per adapter Adapters supported per system	SCSI or IDE integrated on system board Yes 7 4
SCSI hard disks available	170M/270M/540M
Drive form factor	3 1/2-inch

Disk Storage			
Drive interface	IDE or SCSI		
Drive capacity	170M	270M	540M
Average access rate (ms)	12	12	8.5
Interleave factor	1:1	1:1	1:1
Automatic head parking	Yes	Yes	Yes
Expansion Slots			
Total adapter slots	3 (5 Model 77)		
Number of long and short slots	3/0 (5/0 Model 77)		
Number of 8-/16-/32-bit slots	0/3/0 (0/5/0 Model 77)		
Available slots	3 (5 Model 77)		
Keyboard Specifications			
Keyboard choices	122-key Host-Connected Keyboard 101-key Enhanced Keyboard 84-key Space-Saving Keyboard		
Fast keyboard speed setting	Yes		
Keyboard cable length	10 feet		
Security Features			
Keylock:			
Locks cover	Yes		
Locks keyboard	No		
Keyboard password	Yes		
Power-on password	Yes		
Network server mode	Yes		
Physical Specifications			
Footprint type	Desktop		
Orientation	Horizontal/vertical		
Dimensions:			
Height	4.5 inches (6.6 inches Model 77)		
Width	14.2 inches (17.3 inches Model 77)		
Depth	15.6 inches (15.5 inches Model 77)		
Weight	30 lbs. (35 lbs. Model 77)		
Power consumption	118 watts (195 watts Model 77)		
FCC classification	Class B		

Table 22.48 shows the primary specifications of the various versions of PS/2 Models 76 and 77.

Table 22.48 IBM PS/2 Model 76 and 77 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk	Bus Type
76i							
9576-AU9	486SX	33	8M	64M	1×2.88M	170M	MCA/32
9576-AUB	486SX	33	8M	64M	1×2.88M	270M	MCA/32
9576-ANB	486DX2	66	8M	64M	1×2.88M	270M	MCA/32
9576-ATB	486DX4	100	8M	64M	1×2.88M	270M	MCA/32
76s							
9576-BUB	486SX	33	8M	64M	1×2.88M	270M	MCA/32
9576-BNB	486DX2	66	8M	64M	1×2.88M	270M	MCA/32
9576-BTB	486DX4	100	8M	64M	1×2.88M	270M	MCA/32
77i							
9577-AUB	486SX	33	8M	64M	1×2.88M	270M	MCA/32
9577-ANB	486DX2	66	8M	64M	1×2.88M	270M	MCA/32
9577-ANG	486DX2	66	8M	64M	1×2.88M	527M	MCA/32
9577-ATB	486DX4	100	8M	64M	1×2.88M	270M	MCA/32
9577-ATG	486DX4	100	8M	64M	1×2.88M	527M	MCA/32
77s							
9577-BUB	486SX	33	8M	64M	1×2.88M	270M	MCA/32
9577-BNB	486DX2	66	8M	64M	1×2.88M	270M	MCA/32
9577-BNG	486DX2	66	8M	64M	1×2.88M	540M	MCA/32
9577-BTB	486DX4	100	8M	64M	1×2.88M	270M	MCA/32
9577-BTG	486DX4	100	8M	64M	1×2.88M	540M	MCA/32
9577-VTG	486DX4	100	16M	64M	1×2.88M	540M	MCA/32
77s Ultimedia							
9577s-6NB	486DX2	66	8M	64M	1×2.88M	270M	MCA/32
9577s-7NB	486DX2	66	8M	64M	1×2.88M	270M	MCA/32
9577s-6NG	486DX2	66	8M	64M	1×2.88M	540M	MCA/32
9577s-7NG	486DX2	66	8M	64M	1×2.88M	540M	MCA/32
9577s-6TG	486DX2	100	8M	64M	1×2.88M	540M	MCA/32
9577s-7TG	486DX2	100	8M	64M	1×2.88M	540M	MCA/32

Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
3/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
3/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
3/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
3/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
3/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
3/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
3/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/5	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/3	S3-accelerated local-bus SVGA	Any	06/13/94	—
5/3	S3-accelerated local-bus SVGA	Any	06/13/94	—

PS/2 Model 80 386

IBM originally introduced the PS/2 Model 80 on April 2, 1987. Since then, many new models in the 80 family have been introduced and some have been discontinued. The Model 80 is a floor-standing, high-end system in the PS/2 family and includes MCA. Figure 22.42 shows a front view of the Model 80.

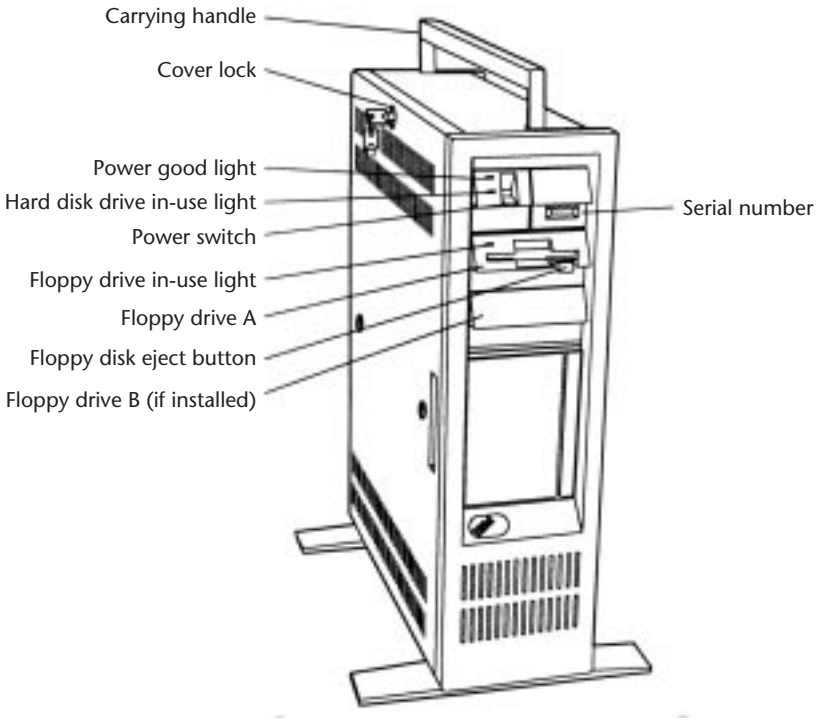


Fig. 22.42
PS/2 Model 80 386.

The basic Model 80 386 features a 16 MHz, 20 MHz, or 25 MHz 80386 microprocessor and 4M of high-speed (80ns) memory on the motherboard. Motherboard memory is expandable to 8M, depending on the model, and the total RAM can be expanded to 16M with memory adapters. This system comes standard with a 1.44M, 3 1/2-inch floppy disk drive and a wide variety of ST-506, ESDI, or SCSI hard disk drives ranging from 44M through 400M. Also standard are a serial port, parallel port, mouse port, and VGA port. Figure 22.43 shows the rear panel view of the Model 80.

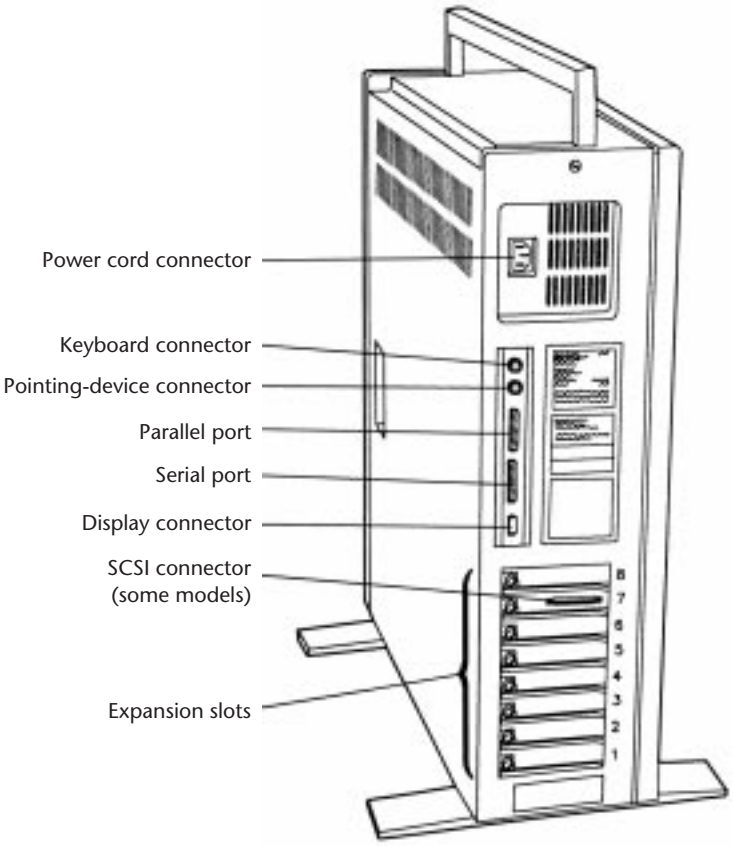


Fig. 22.43
PS/2 Model 80 386 rear panel view.

The 80386 32-bit microprocessor running at 16 MHz, 20 MHz, or 25 MHz coupled with the MCA and high-speed memory allows the Model 80 to perform three to four times faster than the IBM AT Model 339. The 80387 math coprocessor running at the system clock rate allows the Model 80 to perform math calculations four to five times faster than an IBM AT Model 339 with an 80287 math coprocessor.

The Model 80 386 has two levels of BIOS, which total 128K: A Compatibility BIOS (CBIOS) with memory addressability of up to 1M provides support for real-mode-based application programs; and an additional version of BIOS, Advanced BIOS (ABIOS), provides support for protected-mode-based multitasking operating systems and has extended memory addressability of up to 16M.

Additional features of the system unit include eight I/O bus slots, of which five are 16-bit slots and three are 16/32-bit slots. Each system includes a hard disk controller that occupies one 16-bit slot. This controller is either an ST-506/412, ESDI, or SCSI controller. The Model 80 also has a 225-watt or 242-watt, automatic voltage-sensing, universal power supply with auto-restart; a time-and-date clock with battery backup; an additional position for a second 3 1/2-inch floppy disk drive; an additional position for a second full-height 5 1/4-inch hard disk; and the IBM Enhanced Keyboard. Figure 22.44 shows the interior view of the Model 80.

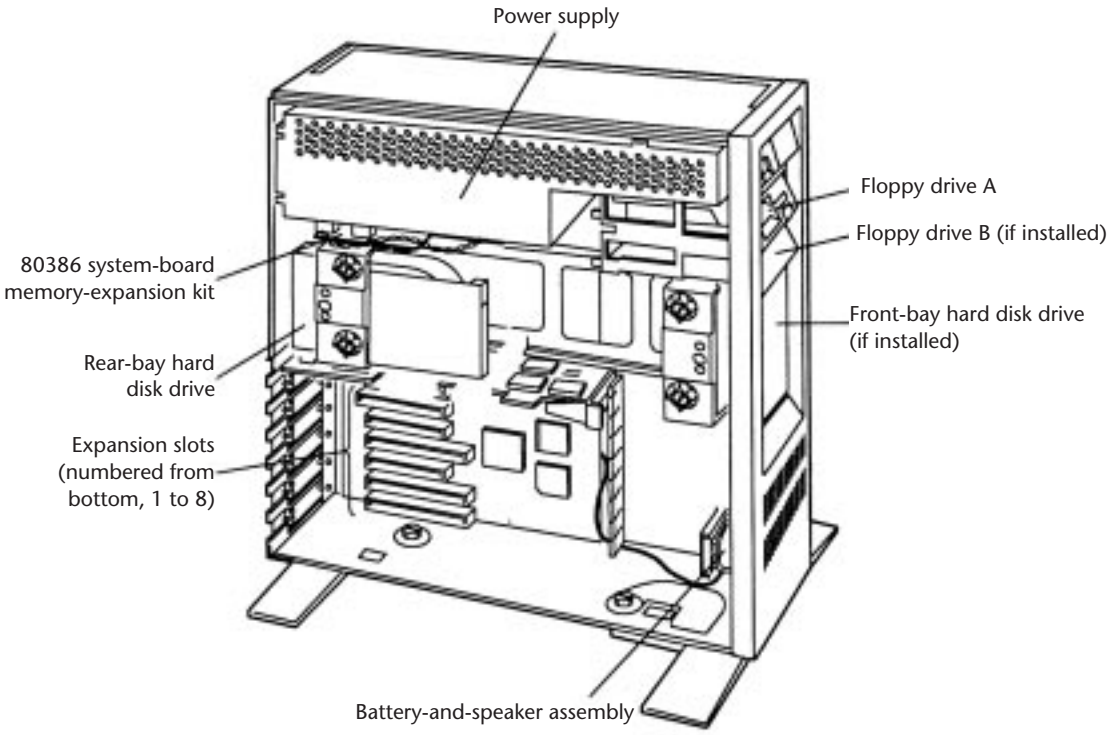


Fig. 22.44
PS/2 Model 80 386 interior view.

The auto-restart feature on the power supply enables the computer to restart automatically when AC power returns after a power decrease or outage. This feature enables the system to be programmed for unattended restart after power outages—a useful feature on a computer in a network file-server application.

Model 80 has a variety of configurations; three different Model 80 system boards are available. The motherboards differ primarily in the clock rate of the processor and the arrangement of the MCA slots. The 16 MHz and 20 MHz models have three 32-bit slots and five 16-bit MCA slots. One of the 16-bit slots includes a video extension connector. These motherboards also allow a maximum of 4M to be installed using two nonstandard memory connectors. None of the Model 80 systems used standard SIMM connectors; they use a custom-designed card, making the memory upgrades available only from IBM.

The 25 MHz model differs from the others in that it has four 32-bit slots and four 16-bit slots, with two of the 16-bit slots having the video extension connector. These systems also incorporate a 64K static RAM cache on the motherboard, which essentially makes these systems run at 0 wait states. These motherboards support a maximum of 8M using two custom 4M memory cards plugged directly into the motherboard. Any additional memory beyond these maximums must be installed using an adapter card.

The hard disk drive interfaces also differentiate the different models. Three different disk interfaces and drive types were supplied with the Model 80. The 041 model used an ST-506 type controller that handled up to two hard drives. The 071, 111, and 311 systems used an ESDI (Enhanced Small Device Interface) controller and drive. The ESDI controller supported up to two hard drives. The other (newer) models all include the IBM 16-bit MCA SCSI bus master adapter. This card provides an internal as well as external SCSI port for connecting devices. This card supports up to seven hard disks, and the system supports up to four of these cards. IBM has SCSI drives available from 60M through 400M to install in these systems. Also, because these drives are all in the 3 1/2-inch form factor (at least the ones from IBM), you can fit up to six of them inside the unit.

The 16 MHz systems also have a motherboard that always runs at 1 wait state, and does not offer ROM shadowing, in which the slower (150ns) ROM BIOS is copied into faster (80ns) motherboard memory chips. The ROM BIOS on this system board performs a ROM to RAM copy operation on startup that uses 128K of the total 16M of RAM. This copy then is used for all subsequent ROM operations, and because the ROM now effectively resides in 80ns RAM, access to these routines is improved significantly. The chips then are readdressed into the original BIOS locations and write protected. This means that you essentially have write-protected RAM acting as ROM, which can then run with fewer wait states. The 20 MHz systems incorporate a memory-paging scheme that reduces the number of wait states to 0 most of the time. All system board memory is accessed by a special paging scheme that allows for 0 wait state access to all 512 bytes within a single page. When access occurs outside the available page, you must perform a page swap requiring 2 wait states. Overall, this scheme allows for faster access to memory than a nonpaging, 1 wait state system. The 25 MHz systems incorporate a full-blown memory cache system that performs most operations in 25ns Static RAM. These systems are nearly always running at an apparent 0 wait states due to the efficiency of the cache.

Table 22.49 lists the technical specifications for the PS/2 Model 80 386.

Table 22.49 PS/2 Model 80 386 Technical Specifications

System Architecture	
Microprocessor	80386DX
Clock speed	16 MHz (041, 071) 20 MHz (081, 111, 121, 161, 311, 321) 25 MHz (Axx)
Bus type	MCA (Micro Channel Architecture)
Bus width	32-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
Upgradeable processor complex	No
Memory	
Standard on system board	4M
Maximum on system board	4M 8M (Axx)
Maximum total memory	16M
Memory speed and type	80ns dynamic RAM
System board memory socket type	Nonstandard memory card
Number of memory module sockets	2
Number available in standard configuration	1
Memory used on system board	1M/2M/4M card
Paged memory logic	Yes No (041,071)
Memory cache controller	No Yes (Axx)
Internal/external cache	External
Standard memory cache size	64K
Cache memory speed and type	25ns static RAM
Wait states:	
System board	0-5 (Axx, 95 percent 0 wait states) 0-2 (081, 111, 121, 161, 311, 321) 1 (041, 071)
Adapter	0-7 (Axx) 0-4

Standard Features	
ROM size	128K
ROM shadowing	Yes
	No (041, 071)
Optional math coprocessor	80387DX
	16 MHz (041, 071)
	20 MHz (081, 111, 121, 161, 311, 321)
	25 MHz (Axx)
Standard graphics	VGA (Video Graphics Array)
8-/16-/32-bit controller	8-bit
	No
Video RAM (VRAM)	256K
RS232C serial ports	1
UART chip used	NS16550A
	NS16550 (041, 071)
Maximum speed (bits/second)	19,200 bps
	Yes
	No (041, 071)
Maximum number of ports	8
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Maximum number of ports	8
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes + 2K extension
Battery life	5 years
Replaceable	Yes
Disk Storage	
Internal disk and tape drive bays	5 or 6 (reconfigurable)
	4 (041, 071, 111, 311)
Number of 3 1/2- and 5 1/4-inch bays	4/1 or 6/0 (reconfigurable)
	2/2 (041, 071, 111, 311)
Floppy drives standard	1×1.44M
Optional floppy drives	
5 1/4-inch 360K	Optional
5 1/4-inch 1.2M	Optional
3 1/2-inch 720K	No
3 1/2-inch 1.44M	Standard
3 1/2-inch 2.88M	No
Hard disk controller included	SCSI adapter (081, 121, 161, 321, Axx)
	ESDI controller (071, 111, 311)
	ST-506 controller (041)
SCSI host adapter type	16-bit SCSI adapter
Bus master	Yes

(continues)

Table 22.49 Continued

Disk Storage						
Devices supported per adapter	7					
Adapters supported per system	4					
ST-506/ESDI hard disks available	44M/70/115M/314M					
Drive form factor	5 1/4-inch					
Drive capacity	44M	44M	70M	115M	314M	
Drive interface	ST-506	ST-506	ESDI	ESDI	ESDI	
Average access rate (ms)	40	40	30	28	23	
Encoding scheme	MFM	MFM	RLL	RLL	RLL	
BIOS drive type	31	32	None	None	None	
Cylinders	733	1023	583	915	1225	
Heads	7	5	7	7	15	
Sectors per track	17	17	36	36	34	
Rotational speed (RPM)	3600	3600	3600	3600	3283	
Interleave factor	1:1	1:1	1:1	1:1	1:1	
Data transfer rate (K/second)	510	510	1080	1080	930	
Automatic head parking	Yes	Yes	Yes	Yes	Yes	
SCSI hard disks available	60M/80M/120M/160M/320M/400M					
Drive form factor	3 1/2-inch					
Drive interface	SCSI					
Drive capacity	60M	80M	120M	160M	320M	400M
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors per track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/sec.)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes
Expansion Slots						
Total adapter slots	8					
Number of long and short slots	8/0					
Number of 8-/16-/32-bit slots	0/5/3 0/4/4 (Axx)					
Number of slots with video ext.	1 2 (Axx)					
Available slots	7					

Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	10 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Floor-standing
Dimensions:	
Height	23.5 inches
Width	6.5 inches
Depth	19.0 inches
Weight	45.3 lbs 52.0 lbs (041, 071, 111, 311)
Environmental Specifications	
Power-supply output	242 watts 225 watts (041, 071, 111, 311)
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 volts AC	5.3 amps
180-265 volts AC	2.7 amps
Operating range:	
Temperature	60-90 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	1390 1245 (041, 071, 111, 311)
Noise (average dB, operating, 1m)	40 dB 46 dB (041, 071, 111, 311)
FCC classification	Class B

Figures 22.45 and 22.46 show the components and layout of the Model 80 type 1 and type 2 motherboards.

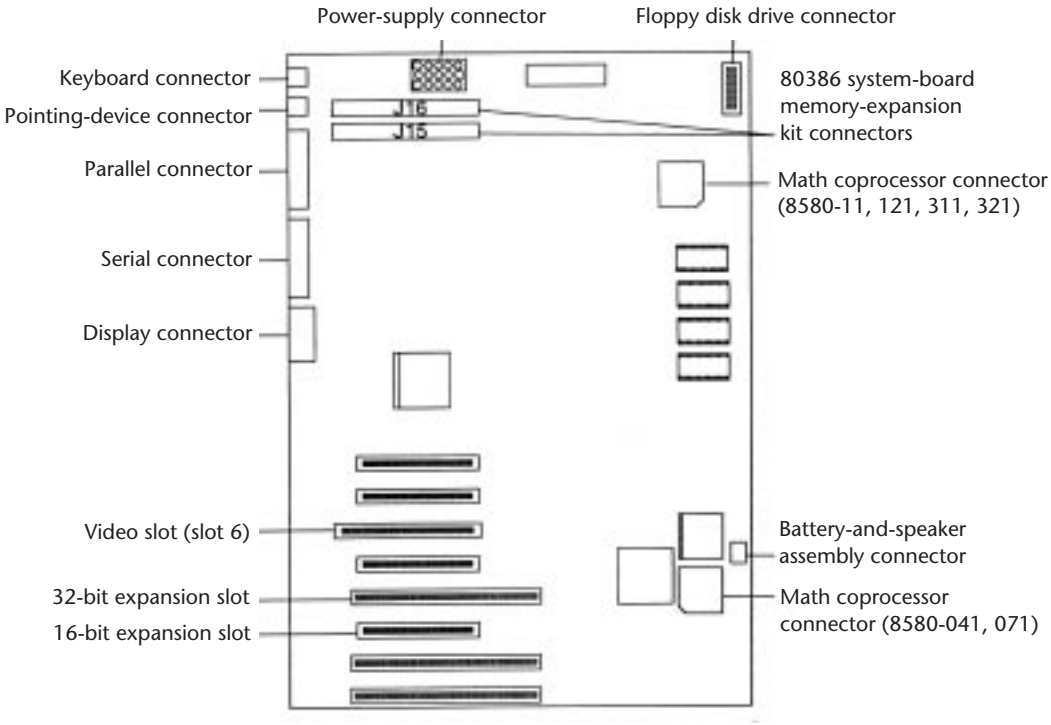


Fig. 22.45
PS/2 Model 80 386 system board (16 MHz and 20 MHz type 1).

Table 22.50 IBM PS/2 Model 80 386 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY MEMORY Std.	Max.	STANDARD Floppy Drive	Hard Disk
80 386						
8580-041	386DX	16	1M	4M	1×1.44M	44M
8580-071	386DX	16	2M	4M	1×1.44M	70M
8580-081	386DX	20	4M	4M	1×1.44M	80M
8580-111	386DX	20	2M	4M	1×1.44M	115M
8580-121	386DX	20	2M	4M	1×1.44M	120M
8580-161	386DX	20	4M	4M	1×1.44M	160M
8580-311	386DX	20	2M	4M	1×1.44M	314M
8580-321	386DX	20	4M	4M	1×1.44M	320M
8580-A21	386DX	25	4M	8M	1×1.44M	120M
8580-A16	386DX	25	4M	8M	1×1.44M	160M
8580-A31	386DX	25	4M	8M	1×1.44M	320M

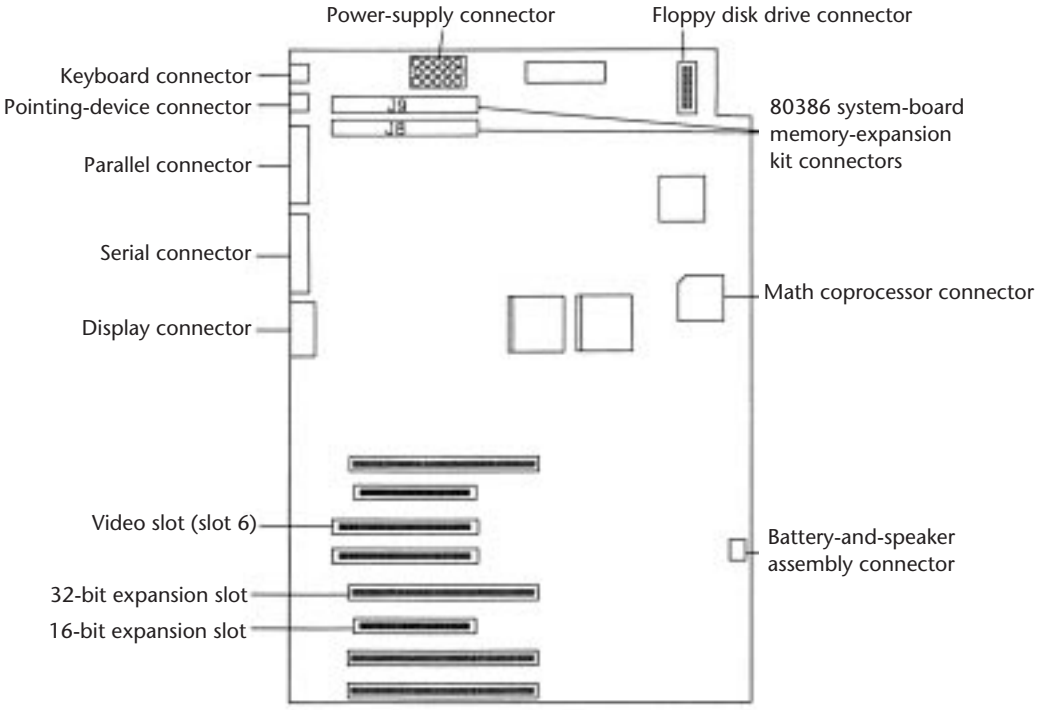


Fig. 22.46
PS/2 Model 80 386 system board (25 MHz type 2).

Table 22.50 shows the primary specifications of the various versions of PS/2 Model 80 386.

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/32	8/7	VGA	Enh	04/02/87	10/31/90
MCA/32	8/7	VGA	Enh	04/02/87	10/31/90
MCA/32	8/7	VGA	Enh	10/30/90	—
MCA/32	8/7	VGA	Enh	04/02/87	12/27/90
MCA/32	8/7	VGA	Enh	03/20/90	01/29/91
MCA/32	8/7	VGA	Enh	10/30/90	—
MCA/32	8/7	VGA	Enh	08/04/87	12/27/90
MCA/32	8/7	VGA	Enh	03/20/90	—
MCA/32	8/7	VGA	Enh	03/20/90	01/29/91
MCA/32	8/7	VGA	Enh	10/30/90	—
MCA/32	8/7	VGA	Enh	03/20/90	—

PS/2 Model 90 XP 486

The PS/2 Model 90 XP 486, introduced October 30, 1990, is a powerful and expandable MCA-based desktop system. Through an unusual design, the system's 32-bit 80486 processor is on a removable processor complex, allowing processor upgrade from the 25 MHz to the more powerful 33 MHz or 50 MHz system. This capability to upgrade can extend the life of the system as customer requirements for enhanced processor performance grow.

Highlights of the Model 90 include the following:

- Processor complex with 80486 20, 25, 33, or 50MHz processor
- 8M standard memory, expandable to 64M on the system board
- XGA graphics integrated on system board
- PS/2 SCSI 32-bit bus master adapter with cache
- Four internal storage device bays
- Four 32-bit Micro Channel expansion slots
- Two DMA serial ports and one DMA parallel port
- Selectable boot and disk loaded ROM BIOS

The PS/2 Model 90 XP 486 features the 20 MHz, 25 MHz, 33 MHz, or 50 MHz 80486 microprocessor. The processor includes an internal memory cache controller, an internal 8K memory cache, and an internal floating point processor unit. The PS/2 256K cache option provides additional memory cache capability beyond the 8K internal memory cache. The PS/2 256K cache option is supported on 486DX models of Model 90 and Model 95. This capability provides investment protection and flexibility for the user.

The Model 90 system provides four internal drive bays and four 32-bit MCA I/O slots (one slot is used for the IBM PS/2 Micro Channel SCSI Adapter with cache, leaving three available for expansion). The PS/2 Micro Channel SCSI adapter with cache allows up to seven SCSI devices to be attached to the Model 90. The Model 90 also supports an internal 5 1/4-inch floppy disk device. The 5 1/4-inch Slim High Disk Drive (part number 6451066) is an internal 5 1/4-inch, 1.2M floppy disk drive with electrical button eject. This drive does not require an attachment card or expansion slot for installation and is supported in Models 90 and 95.

The Model 90 memory subsystem has been designed for optimum performance with interleaved memory; it features parity memory checking for added reliability and data integrity. All system memory (up to 64M) is supported on the system board, eliminating the need for memory adapters in any of the expansion slots. Although the Model 90 supports a maximum of 64M of memory, only 16M of that is addressable by DMA. This effectively limits the use of memory past 16M to nonsystem operations such as caching, virtual memory, or other functions. The system board has a total of eight memory sockets, two of which are used by a pair of 2M SIMMs (single in-line memory modules) to

provide the standard 4M of memory. Optional 2M, 4M, and 8M memory SIMMs (70ns, 80ns, and 85ns only) are supported in matched pairs to provide various memory configurations up to 64M. Although 80ns and 85ns memory SIMMs are supported, 70ns memory SIMMs provide optimum memory subsystem performance.

The eXtended Graphics Array (XGA), high-performance, 32-bit bus master video subsystem is a standard feature of the PS/2 Model 90 XP 486 system. The integrated XGA provides 1024 × 768 × 16 colors or 640 × 480 × 256 colors as standard and can be optionally expanded to 1024 × 768 × 256 colors with the addition of one PS/2 video memory expansion option. XGA supports all VGA modes and is optimized for use with window managers and other graphical user interfaces, allowing for highly interactive pop-up icons and pull-down menus. XGA also provides hardware support for 132-character text mode (using 8515 or 8514 display) and 16-bit direct color mode (64K colors at 640 × 480 resolution). MCA slot 3 of the PS/2 Model 90 XP 486 system contains a video feature bus connector that can be used to install a video adapter.

Other features of the Model 90 include the dual direct memory address (DMA) serial ports and a DMA parallel port included as standard. One of the serial port connectors is standard 25-pin D-shell, and the other connector is 9-pin D-shell. The 9-pin D-shell connector requires an adapter for attaching devices with 25-pin D-shell connectors. The DMA serial port provides support for speeds from 300 bits per second to 345.6K bits per second. It reduces processor loading and overhead when used in high-speed communications and supports speeds up to 345.6K bits per second.

The Model 90 offers the selectable-boot feature. As part of the system CMOS setup program, the user can specify which drive should be booted from and in which order the boot process should try each drive (for example, boot first from drive A, and then drive C, and load BASIC). This step enables the user to boot or load a program from the optional 5 1/4-inch internal floppy disk drive as if it were drive A.

Initial Microcode Load. One special feature that the Model 90 has is called Initial Microcode Load (IML). The Model 90 stores the BIOS, configuration programs, and diagnostics on the hard disk in a protected 3M system partition and loaded from the disk during a "pre-boot" process. (The system programs also are provided on the PS/2 Model 90 XP 486 Reference Disk.) The formatted capacity of the hard disk is reduced by 3M, and the total user-accessible capacity might vary slightly, based on operating environments. This partition is not affected when the drive is formatted using the DOS or OS/2 FORMAT command.

The Initial Microcode Load (IML) loads the BIOS program from the hard disk drive into system memory. This process makes updating the BIOS an easy task when the time comes. Rather than pulling and replacing ROM chips on the motherboard, all you have to do is obtain a newer copy of the reference floppy disk and restore the system programs using that disk. Updates are available from your dealer or directly from IBM.

For example, a problem has been noted with Model 90 systems that have more than 8M of memory. To fix the problem, you need the Model 90 Reference Disk Version 1.02 or higher. To obtain the latest version, call 1-800-426-7282, weekdays between 8 a.m. and

8 p.m., Eastern Standard time. Specify the floppy disk for IBM PS/2 Model 90 XP 486. In Canada, call 1-800-465-1234 weekdays between 8 a.m. and 4:30 p.m. Eastern Standard time. In Alaska, call (414) 633-8108. The update will be sent to you and is installed in a menu-driven fashion. Because IBM sets the standards in this industry, you probably will see other compatible vendors adopting this disk-based BIOS approach as well. The flexibility and ease of upgrading are welcome.

On October 17, 1991, IBM enhanced the PS/2 Model 90 XP family with new Intel 486SX 25MHz (0Hx) models. The new systems come equipped with a new 486SX 25MHz processor complex, which provides improved performance over the previous 25MHz 486DX processor—and at a lower price. The new processor complex provides improved Micro Channel performance, better bus arbitration, and enhancements to the memory controller, making it ideal for multitasking or operating in heavily loaded networked environments. An improved physical design with fewer parts provides for greater reliability. The new processor complex also incorporates a conventional math coprocessor socket. Because of the improved price and performance of the new 25 MHz systems, earlier models using the 486SX 20MHz (0Gx) and 486 25MHz (0Jx) processor complex are being withdrawn. Because the 486SX lacks the integrated math coprocessor unit, a socket for the addition of the optional 487SX Math coprocessor is provided. In addition, these entry-level models can be upgraded to the more powerful 486/33MHz or the 486/50MHz processors with the IBM PS/2 486/33 and 486/50 processor upgrade options.

Table 22.51 lists the technical specifications for the PS/2 Model 90 XP 486.

Table 22.51 PS/2 Model 90 XP 486 Technical Specifications

System Architecture	
Microprocessor and clock speed	80486SX 20 MHz (0Gx) 80487SX 20 MHz 80486SX 25 MHz (0Hx) 80487SX 25 MHz 80486DX 25 MHz (0Jx) 80486DX 33 MHz (0Kx) 80486DX 50 MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	32-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
486 burst mode enabled	Yes
Upgradeable processor complex	Yes
Processor upgrades available	20 MHz 487SX 25 MHz 486SX 25 MHz 486DX 33 MHz 486DX 50 MHz 486DX

Memory	
Standard on system board	4M (0Gx) 8M (for all others)
Maximum on system board	64M
Maximum total memory	64M
Memory speed and type	70ns dynamic RAM
System board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	8
Number available in standard configuration	6 (0Gx) 4 (for all others)
Memory used on system board	2M/4M/8M SIMMs
Memory interleaving	Yes
Paged memory logic	Yes
Memory cache controller	Yes
Internal/external cache	Internal
Standard memory cache size	8K
Optional external memory cache	No (0Gx, 0Hx) Yes
External cache size	256K
Cache memory speed and type	17ns static RAM
Wait states:	
System board	0-5 (95 percent 0 wait states)
Adapter	0-7
System Features	
ROM size	128K
ROM shadowing	Yes
BIOS extensions stored on disk	Yes
Setup and Diagnostics stored on disk	Yes
Optional math coprocessor	80487SX (0Gx) Built-in to 486DX
Coprocessor speed	20 MHz (0Gx) 25 MHz (0Jx) 33 MHz (0Kx) 50 MHz
Standard graphics	XGA (eXtended Graphics Array)
8-/16-/32-bit controller	32-bit
Bus master	Yes
Video RAM (VRAM)	512K
RS232C serial ports	2
UART chip used	Custom (compatible with NS16550A)
Maximum speed (bits/second)	345,600 bps
FIFO mode enabled	Yes
Supports DMA data transfer	Yes
Maximum number of ports	8
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Supports DMA data transfer	Yes
Maximum number of ports	8

(continues)

Table 22.51 Continued

System Features						
CMOS real-time clock (RTC)	Yes					
CMOS RAM	64 bytes + 2K extension					
Battery life	5 years					
Replaceable	Yes					
Disk Storage						
Internal disk and tape drive bays	4					
Number of 3 1/2- and 5 1/4-inch bays	3/1					
Selectable boot drive	Yes					
Bootable drives	All physical drives					
Standard floppy drives	1×1.44M					
Optional floppy drives:						
5 1/4-inch 360K	Optional					
5 1/4-inch 1.2M	Optional					
3 1/2-inch 720K	No					
3 1/2-inch 1.44M	Standard					
3 1/2-inch 2.88M	No					
Hard disk controller included	32-bit SCSI adapter with 512K cache					
Bus master	Yes					
Devices supported per adapter	7					
Adapters supported per system	4					
SCSI hard disks available	60M/80M/120M/160M/320M/400M					
Drive form factor	3 1/2-inch					
Drive interface	SCSI					
Drive capacity	60M	80M	120M	160M	320M	400M
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors per track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes
Expansion Slots						
Total adapter slots	4					
Number of long and short slots	4/0					
Number of 8-/16-/32-bit slots	0/0/4					
Number of slots with video ext.	1					
Available slots	3					

Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	6 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	5.5 inches
Width	17.3 inches
Depth	16.9 inches
Weight	25.0 lbs
Environmental Specifications	
Power-supply output	194 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	4.8 amps
180-264 VAC	2.4 amps
Operating range	
Temperature	50-95 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	662
FCC classification	Class B

PS/2 Model 95 XP 486

The PS/2 Model 95 XP 486, introduced October 30, 1990, is a high-performance, highly expandable floor-standing system based on MCA. Like the Model 90, through an unusual design, this system's 32-bit 80486 processor is on a removable processor complex, allowing a processor upgrade from the 25 MHz to the more powerful 33 MHz or 50 MHz system. This capability to upgrade can extend the life of the system as customer requirements for enhanced processor performance grow.

Table 22.52 shows the primary specifications of the various versions of PS/2 Model 90 XP 486.

Table 22.52 IBM PS/2 Model 90 XP 486 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
90 XP 486						
8590-0G5	486SX	20	4M	64M	1×1.44M	80M
8590-0G9	486SX	20	4M	64M	1×1.44M	160M
8590-0H5	486SX	25	4M	64M	1×1.44M	80M
8590-0H9	486SX	25	4M	64M	1×1.44M	160M
8590-0J5	486SX	25	8M	64M	1×1.44M	80M
8590-0J9	486SX	25	8M	64M	1×1.44M	160M
8590-0K9	486SX	33	8M	64M	1×1.44M	320M
8590-0KD	486SX	33	8M	64M	1×1.44M	320M
8590-0KF	486SX	33	8M	64M	1×1.44M	400M

Highlights of the Model 95 include the following:

- Processor complex with 80486 20, 25, 33, or 50MHz processor
- 8M standard memory, expandable to 64M on the system board
- Enhanced Performance XGA Display Adapter/A standard
- PS/2 SCSI 32-bit bus master adapter with cache
- Seven internal storage device bays
- Eight 32-bit Micro Channel expansion slots
- One DMA serial port and one DMA parallel port
- Selectable boot and disk loaded ROM BIOS

The PS/2 Model 95 XP 486 features the 20, 25, 33, or 50 MHz 80486 microprocessor. The processor includes an internal memory cache controller, an internal 8K memory cache, and an internal floating point processor unit. The PS/2 256K cache option provides additional memory cache capability beyond the 8K internal memory cache. The PS/2 256K cache option is supported on 486DX models of Model 90 and Model 95. This capability provides investment protection and flexibility for the user.

The system provides a total of seven storage device bays: Two can accommodate 5 1/4-inch half-high drives and the other five support 3 1/2-inch devices. Up to five high-speed SCSI hard disk drives can be installed internally, and a variety of other storage devices can be installed, such as CD-ROM drives, 5 1/4-inch floppy disk drives, and tape backup devices. The PS/2 Micro Channel SCSI adapter with cache allows as many as seven SCSI devices to be attached to the PS/2 Model 95. The PS/2 Model 95 also supports

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/32	4/3	XGA	Enh	04/23/91	01/17/92
MCA/32	4/3	XGA	Enh	04/23/91	01/17/92
MCA/32	4/3	XGA	Enh	10/17/91	—
MCA/32	4/3	XGA	Enh	10/17/91	—
MCA/32	4/3	XGA	Enh	10/30/90	01/17/92
MCA/32	4/3	XGA	Enh	10/30/90	01/17/92
MCA/32	4/3	XGA	Enh	10/17/91	07/28/92
MCA/32	4/3	XGA	Enh	10/30/90	01/17/92
MCA/32	4/3	XGA	Enh	10/17/91	07/28/92

an internal 5 1/4-inch floppy disk device. The 5 1/4-inch Slim High Disk Drive (part number 6451066) is an internal 5 1/4-inch, 1.2M floppy disk drive with electrical button eject. This drive does not require an attachment card or expansion slot for installation and is supported in the Models 90 and 95.

The system provides eight 32-bit MCA slots: Two are used by the SCSI and XGA adapters, leaving six for other expansion adapters. A direct memory access (DMA) serial port and DMA parallel port are provided as standard. The Model 95 also features the capability of booting from any drive and an easy way to upgrade BIOS capability.

The Model 95 memory subsystem has been designed for optimum performance with interleaved memory; it features parity memory checking for added reliability and data integrity. All system memory (up to 64M) is supported on the system board, eliminating the need for memory adapters in any of the expansion slots. Although the Model 95 supports a maximum of 64M of memory, only 16M of that is addressable by DMA. This amount effectively limits the use of memory past 16M to nonsystem operations such as caching, virtual memory, or other functions. The system board has a total of eight memory sockets, two
of which are used by a pair of 2M SIMMs (single in-line memory modules) to provide the basic standard 4M of memory. (Note that the amount of standard memory can vary according to the model from 4M to 8M.) Optional 2M, 4M, and 8M memory SIMMs (70ns, 80ns, and 85ns only) are supported in matched pairs to provide various memory configurations up to 64M. Although 80ns and 85ns memory SIMMs are supported, 70ns memory SIMMs provide optimum memory subsystem performance.

The Extended Graphics Array (XGA) Display Adapter/A with its high-performance 32-bit bus master video subsystem is a standard feature of the PS/2 Model 95 XP 486. The XGA adapter provides 1024 × 768 × 16 colors or 640 × 480 × 256 colors as standard and can be

optionally expanded to 1024 × 768 × 256 colors with the addition of one PS/2 video memory expansion option. XGA supports all VGA modes and is optimized for use with window managers and other graphical user interfaces, allowing for highly interactive pop-up icons and pull-down menus. XGA also provides hardware support for 132-character text mode (using 8515 or 8514 display) and 16-bit direct color mode (64K colors at 640 × 480 resolution).

Other specific features of the Model 95 include a direct memory address (DMA) serial port and a DMA parallel port as standard. The DMA serial port provides support for speeds from 300 bits per second to 345.6K bits per second, which reduces processor loading and overhead when used in high-speed communications.

The Model 95 offers the selectable-boot feature. As part of the system CMOS setup program, the user can specify which drive should be booted from and in which order the boot process should try each drive (for example, boot first from A drive, and then C drive, and load BASIC). This allows the user to boot or load a program from the optional 5 1/4-inch internal floppy disk drive as if it were drive A.

Initial Microcode Load. One special Model 95 feature is Initial Microcode Load (IML). The Model 95 stores the BIOS, configuration programs, and diagnostics on the hard disk in a protected 3M partition and loaded from the disk during a "pre-boot" process. (The system programs also are provided on the PS/2 Model 95 Reference Disk.) The formatted capacity of the hard disk is reduced by 3M, and the total user-accessible capacity might vary slightly, based on operating environments. This partition is not affected when the drive is formatted using the DOS or OS/2 FORMAT command.

The Initial Microcode Load (IML) loads the BIOS program from the hard disk drive into system memory. This step makes updating the BIOS an easy task when the time comes. Rather than pulling and replacing ROM chips on the motherboard, all you have to do is obtain a newer copy of the reference floppy disk and restore the system programs using that disk. Updates are available from your dealer or directly from IBM.

For example, a problem has been noted with Model 95 systems that have more than 8M of memory. To fix the problem, you need the Model 95 Reference Disk Version 1.02 or higher. To obtain the latest version, call 1-800-426-7282, weekdays between 8 a.m. and 8 p.m., Eastern Standard time. Specify the floppy disk for IBM PS/2 Model 90 XP 486. In Canada, call 1-800-465-1234 weekdays between 8 a.m. and 4:30 p.m. Eastern Standard time. In Alaska, call (414) 633-8108. The update will be sent to you and is installed in a menu-driven fashion. Because IBM sets the standards in the computer industry, other IBM-compatible vendors probably will adopt this disk-based BIOS approach. The flexibility and ease of upgrading are welcome.

On October 17, 1991, IBM enhanced the PS/2 Model 95 XP family with new Intel 486SX 25 MHz (0Hx) models. The new systems come equipped with a new 486SX 25 MHz processor complex, which provides improved performance over the previous 25 MHz 486DX processor at a lower price. The new processor complex provides improved Micro Channel performance, better bus arbitration, and enhancements to the memory controller, making it ideal for multitasking or operating in heavily loaded networked environments. An

improved physical design with fewer parts provides greater reliability. The new processor complex also incorporates a conventional math coprocessor socket. Because of the improved price and performance of the new 25 MHz systems, earlier models using the 486SX 20MHz (0Gx) and 486 25 MHz (0Jx) processor complex are being withdrawn. Because the 486SX lacks the integrated math coprocessor unit, a socket for the addition of the optional 487SX math coprocessor is provided. In addition, these entry-level models may be upgraded to the more powerful 486/33MHz or the 486/50MHz processors with the IBM PS/2 486/33 and 486/50 processor-upgrade options.

Table 22.53 lists the technical specifications for the PS/2 model 95XP 486.

Table 22.53 PS/2 Model 95 XP 486 Technical Specifications

System Architecture	
Microprocessor and clock speed	80486SX 20 MHz (0Gx) 80487SX 20 MHz 80486SX 25 MHz (0Hx) 80487SX 25 MHz 80486DX 25 MHz (0Jx) 80486DX 33 MHz (0Kx) 80486DX 50 MHz
Bus type	MCA (Micro Channel Architecture)
Bus width	32-bit
Interrupt levels	16
Type	Level-sensitive
Shareable	Yes
DMA channels	15
DMA burst mode supported	Yes
Bus masters supported	15
486 burst mode enabled	Yes
Upgradeable processor complex	Yes
Processor upgrades available	20 MHz 487SX 25 MHz 486DX 33 MHz 486DX 50 MHz 486DX
Memory	
Standard on system board	4M (0Gx) 8M (for all others)
Maximum on system board	64M
Maximum total memory	64M
Memory speed and type	70ns dynamic RAM
System-board memory socket type	36-bit SIMM (single in-line memory module)
Number of memory module sockets	8
Number available in standard configuration	6 (0Gx) 4 (for all others)
Memory used on system board	2M/4M/8M SIMMs
Memory interleaving	Yes
Paged memory logic	Yes

(continues)

Table 22.53 Continued

Memory	
Memory cache controller	Yes
Internal/external cache	Internal
Standard memory cache size	8K
Optional external memory cache	No (0Gx, 0Hx) Yes (for all others)
External cache size	256K
Cache memory speed and type	17ns static RAM
Wait states:	
System board	0-5 (95 percent 0 wait states)
Adapter	0-7
Standard Features	
ROM size	128K
ROM shadowing	Yes
BIOS extensions stored on disk	Yes
Setup and Diagnostics stored on disk	Yes
Optional math coprocessor	80487SX (0Gx) Built-in to 486DX
Coprocessor speed	20 MHz (0Gx) 25 MHz (0Jx) 33 MHz (0Kx) 50 MHz
Standard graphics	XGA (eXtended Graphics Array)
8-/16-/32-bit controller	32-bit
Bus master	Yes
Video RAM (VRAM)	512K
RS232C serial ports	2
UART chip used	Custom (compatible with NS16550A)
Maximum speed (bits/second)	345,600 bps
FIFO mode enabled	Yes
Supports DMA data transfer	Yes
Maximum number of ports	8
Pointing device (mouse) ports	1
Parallel printer ports	1
Bidirectional	Yes
Supports DMA data transfer	Yes
Maximum number of ports	8
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes + 2K extension
Battery life	5 years
Replaceable	Yes
Disk Storage	
Internal disk and tape drive bays	7
Number of 3 1/2- and 5 1/4-inch bays	5/2
Selectable boot drive	Yes
Bootable drives	All physical drives
Standard floppy drives	1×1.44M

Disk Storage						
Optional floppy drives:						
5 1/4-inch 360K	Optional					
5 1/4-inch 1.2M	Optional					
3 1/2-inch 720K	No					
3 1/2-inch 1.44M	Standard					
3 1/2-inch 2.88M	No					
Hard disk controller included	32-bit SCSI adapter with 512K cache					
Bus master	Yes					
Devices supported per adapter	7					
Adapters supported per system	4					
SCSI hard disks available	60M/80M/120M/160M/320M/400M					
Drive form factor	3 1/2-inch					
Drive interface	SCSI					
Drive capacity	60M	80M	120M	160M	320M	400M
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors per track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes

Expansion Slots	
Total adapter slots	8
Number of long and short slots	8/0
Number of 8-/16-/32-bit slots	0/0/8
Number of slots with video ext.	2
Adapter form factor	IBM RISC system/6000
Available slots	6

Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	6 feet
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes

(continues)

Table 22.53 Continued

Physical Specifications	
Footprint type	Floor-standing
Dimensions:	
Height	19.8 inches
Width	8.0 inches
Depth	20.0 inches
Weight	51.0 lbs
Environmental Specifications	
Power-supply output	329 watts
Worldwide (110/60, 220/50)	Yes
Auto-sensing/switching	Yes
Maximum current:	
90-137 VAC	8.3 amps
180-264 VAC	4.7 amps
Operating range:	
Temperature	50-95 degrees F
Relative humidity	8-80 percent
Maximum operating altitude	7,000 feet
Heat (BTUs/hour)	1123
FCC classification	Class B

Table 22.54 shows the primary specifications of the various versions of PS/2 Model 95 XP 486.

Table 22.54 IBM PS/2 Model 95 XP 486 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
95 XP 486						
8595-0G9	486SX	20	4M	64M	1×1.44M	160M
8595-0GF	486SX	20	4M	64M	1×1.44M	400M
8595-0H9	486SX	25	8M	64M	1×1.44M	160M
8595-0HF	486SX	25	8M	64M	1×1.44M	400M
8595-0J9	486SX	25	8M	64M	1×1.44M	160M
8595-0JD	486SX	25	8M	64M	1×1.44M	320M
8595-0JF	486SX	25	8M	64M	1×1.44M	400M
8595-0KD	486SX	33	8M	64M	1×1.44M	320M
8595-0KF	486SX	33	8M	64M	1×1.44M	400M

PS/1 System-Unit Features by Model

Announced June 26, 1990, the IBM PS/1 Computer was designed for consumers who have little or no knowledge about computers and who intend to use their computers at home. The first PS/1 system was based on a 10 MHz 80286 processor with 512K or 1M of memory standard. The PS/1 was first made available in four basic models. The M01 was priced at $995 and included a monochrome VGA display and 512K of memory. The $1,499 M34 featured a 30M hard disk drive and 1M of standard RAM. These monochrome VGA configurations were available with color VGA monitors for $1,640 and $1,999, respectively.

On October 7, 1991, IBM expanded its PS/1 product line by introducing systems with 386SX processors. The $1,649 PS/1 SX C42 has a 16-MHz 386SX processor, 2M RAM (maximum of 6M), a 1.44M floppy disk drive, 12-inch VGA color monitor, and a 40M hard disk drive. The $2,199 PS/1 SX B82 model has all the features of the C42 but included an 80M hard disk drive. Both were 3 inches high, 11 inches wide, and 14 inches deep, weighing about nine pounds. A 2,400-bps modem was included along with Microsoft Works and Microsoft Windows 3.0. These newer models addressed a broader market, including small businesses and the advanced computing requirements of second-time buyers.

In September 1992, IBM introduced 21 new models of the PS/1, while segmenting the brand into three lines: PS/1 Essential models are for small businesses; the PS/1 Expert is for users who may already own microcomputers; and the PS/1 Consultant is targeted for students or those who take work home. Each line comprises a notebook model and six desktop machines.

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
MCA/32	8/6	XGA	Enh	04/23/91	01/17/92
MCA/32	8/6	XGA	Enh	04/23/91	01/17/92
MCA/32	8/6	XGA	Enh	10/17/91	—
MCA/32	8/6	XGA	Enh	10/17/91	—
MCA/32	8/6	XGA	Enh	10/30/90	01/17/92
MCA/32	8/6	XGA	Enh	10/30/90	01/17/92
MCA/32	8/6	XGA	Enh	04/23/91	01/17/92
MCA/32	8/6	XGA	Enh	10/30/90	01/17/92
MCA/32	8/6	XGA	Enh	04/23/91	—

These 386SX and 486SX desktop models all came with D0S 5.0, Windows 3.1, Microsoft Works for Windows, and Prodigy preloaded. The 486DX models have 0S/2 2.0 preloaded. Bundled with the PS/1 models are Microsoft's Works for Windows, Prodigy, and IBM-specific PS/2 Index, PS/1 Tutorial, and Promenade, a service for educating people on using their PS/1 computers. The PS/1 Essential line came bundled with Intuit's QuickBooks and Power Up's Express Publisher. The PS/1 Expert line included Power Up's Address Book Plus and Calendar Creator Plus. The PS/1 Consultant line comes with Intuit's Quicken for Windows' and Broderbund's The New Print Shop. The PS/note notebook, based on the IBM's SL processor, was also introduced, and included Prodigy, Promenade, and Delrina's WinFax Lite.

In October 1993, the PS/1 Consultant line was upgraded, adding multimedia and compliance with the EPA Energy Star conservation program. The special Rapid Resume utility is the most notable feature of the new systems. You can shut down your computer without having to save your documents or exit your applications. When the computer is restarted, everything loads just as you left it. The Rapid Resume feature is possible only on the PS/1, IBM contends, because it's more than a simple software utility. It works hand-in-hand with IBM's own BIOS, dedicated circuitry on the motherboard, and a specialized power switch. The BIOS intercepts an off signal from the power switch, and, if applications or documents are open, writes the entire contents of the PC's memory to a file on the hard drive. When the PC reboots (regardless of when, even if you've unplugged or moved the machine), it swaps the contents of that file back into the system RAM. You're back in business without a perceptible delay.

The multimedia features are also impressive, including a Sound Blaster 16 audio card and a front-loading double-speed CD-ROM drive. The PS/1 Multimedia Model comes with version 2.0 of Compton's Interactive Encyclopedia. Microsoft Windows and Works come preloaded on the hard drive, along with the software needed to log in to the America Online and Prodigy on-line services. The systems come with a unique one-year warranty: IBM will ship a new keyboard, monitor, or CPU via UPS within 24 hours of a mechanical mishap.

The PS/1 comes with three new software utilities: PS/1 Index, a concise tutorial that aids users with real-world applications; PS/1 Tutorial, which includes Windows Lessons and Software Descriptions; and PS/1 Fitness, which adds easy-to-understand dialog boxes to DOS utilities.

The $2,844 PS/1 Consultant 486DX2/66 uses a 66-MHz 80486DX microprocessor and comes in a minitower case with 8M of RAM, a 424M hard disk, and an internal fax modem. The $2,144 PS/1 Consultant Multimedia desktop system uses a 25-MHz 80486SX processor and has 4M of RAM, a 256M hard disk, a double-speed CD-ROM drive, and a Sound Blaster 16 audio card.

Standby mode forces the system into a low-power state and blanks the screen after a user-defined period; Rapid Resume, which meets the Energy Star rating, turns the system off after a period of inactivity and restores it to its previous state when it is turned back on.

Recent iterations of the PS/1 include "beefier" processors, such as the 66-MHz 486DX2, 255M hard drive, and local-bus video. The PS/1 line is targeted to small- or home-business users. The systems are sold through different outlets, typically to nontechnical users. The focus is the mass retail channel (Staples, CompUSA), and systems come with exceptionally helpful and professional manuals and software. IBM plays a name game, with each PS/1 receiving a suffix indicating where it is available. Consultant LBL (general merchandisers), Expert (computer stores), and Essential (office superstores) are the current monikers, with new Advisor (mass merchandisers) and Investor (warehouse or membership clubs) lines in the works.

The original PS/1 system came with an IBM Enhanced Keyboard, VGA display, IBM mouse, 2,400 bps internal modem, IBM DOS, Microsoft Works, and tutorials that enable the purchaser to run a variety of applications immediately after setting up the system. Included with U.S. models is software to access the IBM PS/1 on-line Users' Club through the Prodigy on-line communications service. Several models are available so that you can select the type of display (monochrome or color) and the system-unit configuration (a single floppy drive with 512K of memory or a single floppy drive and 30M hard disk with 1M of memory). Highlights of the original PS/1 included these items:

- 10-MHz 80286 processor
- 12-inch Video Graphics Array (VGA) display (color or black-and-white)
- IBM mouse
- 101-key IBM keyboard
- Built-in 2,400 bits-per-second (bps) modem
- Free three-month subscription to Prodigy
- PS/1 Club, an on-line customer support service
- Microsoft Works integrated application software
- Ease of set-up and use
- Preloaded DOS 4.0 and menu interface (on hard disk models)
- Possibility of future expansion with PS/1 options
- Special IBM warranty

The 386SX models also offer the following additional features:

- 16-MHz 386SX processor
- 2M RAM, expandable to 6M on the system board
- 12-inch Color Video Graphics Array (VGA) display

Table 22.55 shows the primary specifications of the various versions of the PS/1.

Table 22.55 IBM PS/1 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
PS/1 (June 1990)						
Model M01	286	10	512K	1M	1×1.44M	—
Model M34	286	10	1M	1M	1×1.44M	30M
PS/1 (October 1991)						
Model B82	386SX	16	2M	16M	1×1.44M	80M
Model C42	386SX	16	2M	16M	1×1.44M	40M
PS/1 Consultant						
2133-G11	386SX	25	2M	16M	1×1.44M	85M
2133-G13	386SX	25	2M	16M	1×1.44M, 1×1.2M	129M
2133-G14	386SX	25	2M	16M	1×1.44M, 1×1.2M	170M
2133-G43	486SX	20	4M	32M	1×1.44M	129M
2133-G44	486SX	20	4M	32M	1×1.44M, 1×1.2M	170M
2133-G76	486DX	33	8M	32M	1×1.44M, 1×1.2M	211M
PS/1 Essential						
2133-W11	386SX	25	2M	16M	1×1.44M	85M
2133-W13	386SX	25	2M	16M	1×1.44M, 1×1.2M	129M
2133-W14	386SX	25	2M	16M	1×1.44M, 1×1.2M	170M
2133-W43	486SX	20	4M	32M	1×1.44M	129M
2133-W44	486SX	20	4M	32M	1×1.44M, 1×1.2M	170M
2133-W76	486DX	33	8M	32M	1×1.44M, 1×1.2M	211M
PS/1 Expert						
2133-S11	386SX	25	2M	16M	1×1.44M	85M
2133-S13	386SX	25	2M	16M	1×1.44M, 1×1.2M	129M
2133-S14	386SX	25	2M	16M	1×1.44M, 1×1.2M	170M
2133-S43	486SX	20	4M	32M	1×1.44M	129M
2133-S44	486SX	20	4M	32M	1×1.44M, 1×1.2M	170M
2133-S76	486DX	33	8M	32M	1×1.44M, 1×1.2M	211M

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
ISA/16	0	VGA	Enh	06/26/90	10/07/91
ISA/16	0	VGA	Enh	06/26/90	10/07/91
MCA/16	2/2	VGA	Enh	10/07/91	09/09/92
MCA/16	0	VGA	Enh	10/07/91	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	3/3	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—
ISA/16	5/5	VGA	Enh	09/09/92	—

IBM introduced a special model (B84) of the PS/1 that is similar to the B82 but preloaded with OS/2 version 2.0. With OS/2 version 2.0, PS/1 users were able to run DOS, Windows, and OS/2 applications, exploiting virtually all software available, regardless of the environment for which the software was designed.

System Features. IBM designed the PS/1 to enable home consumers to buy everything in one convenient place. Most consumers can set up and use the PS/1 in 15 minutes. The setup is simple: Take the components out of the box, attach cables, plug in the system, and push one button. Because the user interface (in ROM) and DOS already are installed on the system, users select what they want to do from the first screen and (on the floppy-drive system) are prompted to insert the proper floppy disk or (on the hard-drive system) are presented with the program they select after the machine goes to the hard disk, on which all the software included with the PS/1 was preloaded.

One special feature of the PS/1 is its warranty. Although most repair service is available easily through IBM authorized dealers, you have also another option. IBM's Express Maintenance service provides parts directly to customers, normally within 48 hours. Because the PS/1 is a totally modular, snap-together unit, replacing any part of the system is a relatively easy task. You therefore have an alternate route for service if the dealer is too far away or does not have needed parts in stock.

With newer PS/1s, help is only a phone call away. All the systems come standard with IBM Online Housecall, a software program that enables an IBM technical support person to examine a user's system-control files and other files to fix software glitches and diagnose hardware failures over the telephone. A system can be viewed only with the user's permission because the user must start up the program before an IBM technician can access it.

All recent PS/1 models also include a 9,600/2,400 bps fax modem, PC-DOS 6.x, Microsoft Windows 3.x, Microsoft Works for Windows, the PS/1 Edition of American Online, Prodigy membership kit, a PS/1 Tutorial, PS/1 Index, PS/1 Fitness, and a choice of Quicken, Winfax Lite fax software, or The New Print Shop with America Online. All the software and DOS are preloaded, and everything is configured for an immediate start after you plug in the system.

The standard service and support provided with the PS/1 system is excellent. Although, if necessary, most repair service can be obtained easily through IBM authorized dealers, another route is available. IBM has a special toll-free service called Express Maintenance, which provides parts directly to the customer, normally within 48 hours. Support is available from the PS/1 Club, an on-line support service, exclusively available to PS/1 owners through Prodigy seven days a week, 365 days a year.

The PS/1 is compatible with the PS/2 Model 30-286 at the BIOS level (although the BIOS is not identical) and at most hardware interfaces. The PS/1 also is compatible with the original IBM AT system. The 286 PS/1 is about 50 percent faster than the IBM AT. All PS/1 systems incorporate many features that would have been extra-cost options on the original IBM AT system. Because the PS/1, like the PS/2, has many features integrated on its motherboard, many standard types of adapter cards—such as graphics adapters, some disk controllers, and many memory upgrades—do not work with it.

System Expansion and Restrictions. The PS/1 has some significant limitations and restrictions to expansion. The biggest limitation is that the system has no full-length expansion slots, although few expansion cards require the full 13-inch-long slot. Most PS/1 models include three 16-bit expansion slots and one local-bus expansion slot.

Early PS/1s had 512K or 2M of memory installed permanently on the motherboard, depending on the system. Current PS/1s accept up to either 32M or 64M of memory.

The limited number and kinds of possible expansion slots is a serious limitation, but less of a problem than it might seem at first, because of the special connectors the PS/1 provides for various options. The modem that comes with the system plugs into a special motherboard connector and does not require a slot.

On the PS/1, memory errors can go undetected more easily than in other IBM or IBM-compatible systems that do offer standard parity-checking. This statement might sound shocking and seem to reflect a seriously crippling feature of the system, but, in comparison, Apple Macintosh systems also do not have parity-checked memory as a standard feature. A computer does not require parity-checking to function, but the more "mission critical" that information accuracy is, the more parity-checking becomes an issue. The lack of parity-checking makes the PS/1 less suited for business applications use.

Table 22.56 describes the technical specifications for the 286 PS/1.

Table 22.56 PS/1 286 Technical Specifications

System Architecture	
Microprocessor	80286
Clock speed	10 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Edge-triggered
Shareable	No
DMA channels	7
DMA burst mode supported	No
Bus masters supported	No
Upgradeable processor complex	No

(continues)

Table 22.56 Continued

Memory	
Standard on system board	512K (x01) 1M (x34)
Maximum on system board	2.5M
Maximum total memory	8.5M
Memory speed and type	120ns dynamic RAM
System-board memory socket type	Proprietary card
Number of memory-module sockets	1
Number available in standard configurration	0 (x34) 1 (x01)
Memory used on system board	Soldered 512K bank, 512K/2M cards
Parity-checked memory	No
Memory cache controller	No
Wait states:	
System board	1
Adapter	1
Standard Features	
ROM size	256K
ROM shadowing	No
User interface menu in ROM	Yes
Optional math coprocessor	No
Standard graphics	VGA (Video Graphics Array)
Standard display	Included
Monochrome	(M01, M34)
Color	(C01, C34)
Audio earphone jack	Yes
2,400 bps modem	U.S./Canada only
Hayes-compatible	Yes
Phone cord and splitter included	Yes
RS232C serial ports	Optional (requires expansion chassis)
UART chip used	NS16450
Maximum speed (bits/second)	19,200 bps
DMA data transfer support	No
Maximum number of ports	1
Pointing device (mouse) ports	1
IBM mouse included	Yes
Parallel printer ports	1
Bidirectional	Yes
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes
Battery life	10 years
Replaceable	Yes (Dallas module)
Disk Storage	
Internal disk and tape drive bays	2
Number of 3 1/2- and 5 1/4-inch bays	2/0
Standard floppy disk drives	1×1.44M

Disk Storage	
Optional floppy disk drives:	
5 1/4-inch 360K	Optional
5 1/4-inch 1.2M	Optional
3 1/2-inch 720K	No
3 1/2-inch 1.44M	Standard
3 1/2-inch 2.88M	No
Hard disk controller included	IDE connector on system board
IDE hard disks available	30M
Drive form factor	3 1/2-inch
Drive interface	IDE
Average access rate (ms)	19
Encoding scheme	RLL
BIOS drive type number	35
Cylinders	921
Heads	2
Sectors per track	33
Rotational speed (RPM)	3600
Interleave factor	4:1
Data transfer rate (K/second)	248
Automatic head parking	Yes
Expansion Slots	
Total adapter slots	0
Number of long and short slots	0/0
Number of 8-/16-/32-bit slots	0/0/0
Available slots	0
With optional expansion unit:	
Total adapter slots	3
Number of long and short slots	2/1
Number of 8-/16-/32-bit slots	0/3/0
Available slots	3
Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	6 feet
Security Features	
Keylock:	
Locks cover	No
Locks keyboard	No
Keyboard password	No
Power-on password	No
Network server mode	No

(continues)

Table 22.56 Continued

Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	14.25 inches
Width footprint	10.75 inches
Width display	12.0 inches
Depth	17.0 inches
Weight:	
Color display	38.0 pounds
Mono display	31.0 pounds
Environmental Specifications	
Power supply:	
Worldwide (110/60, 220/50)	Yes
Auto-sensing and switching	Yes
Maximum current:	
90-137 VAC; color	2.5 amps
80-259 VAC; color	2.0 amps
90-137 VAC; mono	2.0 amps
80-259 VAC; mono	1.25 amps
Operating range:	
Temperature	50-95 degrees F
Relative humidity	8 to 80 percent
Heat (BTUs/hour)	358
FCC classification	Class B

Table 22.57 describes the technical specifications for the 386SX PS/1.

Table 22.57 PS/1 386SX Technical Specifications

System Architecture	
Microprocessor	80386SX
Clock speed	16 MHz
Bus type	ISA (Industry Standard Architecture)
Bus width	16-bit
Interrupt levels	16
Type	Edge-triggered
Shareable	No
DMA channels	7
DMA burst mode supported	No
Bus masters supported	No
Upgradeable processor complex	No

Memory	
Standard on system board	2M
Maximum on system board	6M
Maximum total memory	16M
Memory speed and type	100ns dynamic RAM
System-board memory socket type	Proprietary card
Number of memory-module sockets	1
Number available in standard configuration	1
Memory used on system board	Soldered 2M bank, 2M/4M cards
Parity-checked memory	No
Memory cache controller	No
Wait states:	
System board	0-2
Adapter	0-2

Standard Features	
ROM size	256K
ROM shadowing	Yes
User interface menu in ROM	Yes
Optional math coprocessor	387SX
Coprocessor speed	16 MHz
Standard graphics	VGA (Video Graphics Array)
Standard display	Color, included
Audio earphone jack	Yes
2,400 bps modem	U.S./Canada only
Hayes-compatible	Yes
Phone cord and splitter included	Yes
RS232C serial ports	Optional
UART chip used	NS16450
Maximum speed (bits/second)	19,200 bps
DMA data transfer support	No
Maximum number of ports	1
Pointing device (mouse) ports	1
IBM mouse included	Yes
Parallel printer ports	1
Bidirectional	Yes
CMOS real-time clock (RTC)	Yes
CMOS RAM	64 bytes
Battery life	10 years
Replaceable	Yes (Dallas module)

(continues)

Table 22.57 Continued

Disk Storage	
Internal disk and tape drive bays	2 (C42) 3 (B82, C92)
Number of 3 1/2- and 5 1/4-inch bays	2/0 (C42) 3/0 (B82, C92)
Standard floppy disk drives	1×1.44M
Optional floppy disk drives:	
5 1/4-inch 360K	Optional
5 1/4-inch 1.2M	Optional
3 1/2-inch 720K	No
3 1/2-inch 1.44M	Standard
3 1/2-inch 2.88M	No
Hard disk controller included	IDE connector on system board
IDE hard disks available	40M (C42) 80M (B82) 129M (C92)
Drive form factor	3 1/2-inch
Drive interface	IDE
Average access rate (ms)	21
Encoding scheme	RLL
Automatic head parking	Yes
Expansion Slots	
Total adapter slots	0 (C42) 2 (B82, C92)
Number of long and short slots	0/0 (C42) 0/2 (B82, C92)
Number of 8-/16-/32-bit slots	0/0/0 (C42) 0/2/0 (B82, C92)
Available slots	0 (C42) 2 (B82, C92)
With optional expansion unit:	
Total adapter slots	3 (C42)
Number of long and short slots	2/1 (C42)
Number of 8-/16-/32-bit slots	0/3/0 (C42)
Available slots	3 (C42)

Keyboard Specifications	
101-key Enhanced Keyboard	Yes
Fast keyboard speed setting	Yes
Keyboard cable length	6 feet
Security Features	
Keylock:	
Locks cover	No
Locks keyboard	No
Keyboard password	No
Power-on password	No
Network server mode	No
Physical Specifications	
Footprint type	Desktop
Dimensions:	
Height	14.25 inches (C42) 15.75 inches (B82, C92)
Width footprint	10.75 inches
Width display	12.0 inches
Depth	17.0 inches
Weight:	
Color display	39.0 pounds
Environmental Specifications	
Power supply:	
Worldwide (110/60, 220/50)	Yes
Auto-sensing and switching	Yes
Maximum current:	
90-137 VAC; color	2.5 amps
80-259 VAC; color	2.0 amps
Operating range:	
Temperature	50-95 degrees F
Relative humidity	8 to 80 percent
Heat (BTUs/hour)	358
FCC classification	Class B

Table 22.58 shows the primary specifications and costs of the various PS/1 models, and table 22.59 shows the accessories available from IBM for the PS/1.

Table 22.58 PS/1 Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
PS/1 286						
2011-M01	286	10	512K	2.5M	1×1.44M	—
2011-C01	286	10	512K	2.5M	1×1.44M	—
2011-M34	286	10	1M	2.5M	1×1.44M	30M
2011-C34	286	10	1M	2.5M	1×1.44M	30M
PS/1 SX						
2121-C42	386SX	16	2M	6M	1×1.44M	40M
2121-B82	386SX	16	2M	6M	1×1.44M	80M
2121-C92	386SX	16	2M	6M	1×1.44M	129M

Keyboards available include the Enhanced (101-key), Space-Saving (84-key), and Host-Connected (122-key).
Display.
If "Any" is indicated, purchaser can choose any of the three.

Table 22.59 PS/1 Special Accessories

Description	Part Number	Price
PS/1 286 to 386SX upgrade	93F2059	$1,045
PS/1 286 to 386SX upgrade	93F2059	845
PS/1 color display upgrade	1057108	699
PS/1 512K memory card	1057035	109
PS/12M memory card	1057660	279
PS/12M memory card	92F9935	279
PS/14M memory card	92F9694	549
5 1/4-inch 360K PS/1 286 drive	1057139	299
5 1/4-inch 360K PS/1 SX drive	92F9333	299
5 1/4-inch 1.2M PS/1 286 drive	1057191	299
5 1/4-inch 1.2M PS/1 SX drive	92F9334	299
3 1/2-inch 1.44M PS/1 drive	1057039	249
30M 3 1/2-inch IDE drive	1057036	599
80M 3 1/2-inch IDE drive	92F9937	1,060
129M 3 1/2-inch IDE drive	92F9938	1,500
PS/1 adapter expansion unit	1057028	169
AT serial/parallel adapter	6450215	161
Audio card/joystick connector	1057735	129
Audio card/joystick connector	92F9932	129
Audio card/joystick for 286	1057064	249
Second joystick	1057109	39
PS/1 two-piece dust cover set	95F1136	20

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn	Notes
ISA/16	0	VGA	Enh	06/26/90	—	Trade in x01 Model for B82 Model
ISA/16	0	VGA	Enh	06/26/90	—	Trade in x34 Model for B82 Model
ISA/16	0	VGA	Enh	06/26/90	—	Upgrade for mono systems
ISA/16	0	VGA	Enh	06/26/90	—	Upgrades to 1M on motherboard
ISA/16	0	VGA	Enh	10/07/91	—	Upgrades to 2.5M on motherboard
ISA/16	2/2	VGA	Enh	10/07/91	—	Upgrades to 4M on 386SX motherboard
ISA/16	2/2	VGA	Enh	10/07/91	—	Upgrades to 6M on 386SX motherboard
						Attaches to PS/1
						Attaches to PS/1
						Attaches to PS/1
						Attaches to PS/1
						PS/1 internal drive
						For PS/1-M01/C01
						For PS/1 386SX
						For PS/1 386SX
						Three slots: two 11-inch, one 9.5-inch
						Requires expansion unit
						Attaches to 286 motherboard
						Attaches to 386SX motherboard
						Includes joystick, MIDI connector
						Includes Y-cable for 1057064
						Water-repellent, antistatic

PS/1 Models Mxx have a built-in monochrome analog display, and Models Cxx have the Color Analog

PS/ValuePoint System-Unit Features by Model

IBM introduced its PS/ValuePoint line on October 20, 1992. At the time of the ValuePoint introduction, IBM's microcomputer market share had fallen from an estimated 30 percent in July 1991 to 18 percent in July 1992. The target of the ValuePoint line is corporate users desiring low-end microcomputers. The ValuePoint line was IBM's defense against Compaq Computer's affordable ProLinea line of computers, introduced in early 1992.

The new machines, which were first sold in Europe, are aimed at the middle ground between the entry-level PS/1 series and the increasingly upscale PS/2 machines. However, the prices of the ValuePoint line initially overlapped with those of PS/1 systems. Since 1992, the two have diverged to stake out their own niches. The ValuePoint PCs are available through IBM's sales force, resellers, and IBM PC Direct, the company's catalogue. They generally come with less software than the PS/1, but do have VESA local-bus graphics and 1M of video DRAM.

When first introduced, IBM unveiled four PS/ValuePoint machines. They start with the 325T, which contains an IBM 386SLC microprocessor running at 25 MHz and comes with 2M memory and a choice of 80M or 170M hard drive. The ValuePoint 425SX is equipped with an Intel 25-MHz 486SX, 8M RAM, and the same choice of drives as the 325T. The ValuePoint 433DX uses a 33-MHz 486DX chip, has 8M of memory, and a choice of either a 120M or 212M hard disk drive. The top of the line is the ValuePoint 466DX2, using Intel's clock-doubling 486DX2 66-MHz processor. This model comes with 8M of memory and a 212M hard disk drive. All ValuePoint machines come with five expansion slots and five bays for storage devices. Initially, they all used the ISA bus rather than the MCA bus found on PS/2 models. The PS/ValuePoint 325T came with DOS 5.0 preloaded, whereas the other models had IBM's OS/2 2.0.

Support

Initially, the ValuePoint systems did not come with the three-year warranty provided on some PS/2 models. Instead, they had a one-year warranty covering on-site service, with a promise of response within four hours. Since then, some high-end ValuePoint models now come with a three-year on-site warranty.

System Features

The IBM ValuePoint includes a ROM-based setup utility that provides menus and descriptions for various features. The cover's release latch located on the front of the system enables users to lift the cover on and off without any screws or tools. SIMMs install on the motherboard easily. The coprocessor socket resides on the motherboard, but you must remove the drive bracket assembly to access it.

In May 1994, the ValuePoint line was split into three lines: the ValuePoint P60/D (Pentium), the powerful ValuePoint Performance Series, and the mainstream ValuePoint Si Series. However, IBM intends to merge its PS/2 and ValuePoint lines into a unified solution for corporate customers. The resulting systems would move IBM toward industry-standard systems using the ISA and PCI buses with some of the PS/2's capabilities, such as IBM's plug and play features, data integrity, and built-in security. Table 22.61 shows the primary specifications of the early versions of the PS/ValuePoint.

Decoding ValuePoint Model Numbers

With the large variety of ValuePoint systems available, you might have difficulty telling from the model number how one differs from another.

Table 22.60 describes the model designation meanings used by IBM for its ValuePoint Performance Series, Si Series, and P60/D model.

Table 22.60 ValuePoint Model Designation Codes

Model	Meaning
6384-***	60-MHz Pentium series
64**-***	ValuePoint Performance Series
6381-***	ValuePoint Si Series
4-	PCI local-bus design
2-	ISA local-bus design
8*-*	Slimline (SpaceSaver) case (three slots, three bays)
8*-*	Desktop case (five slots, five bays)
9*-*	Mini-tower case (eight slots, six drive bays)
****-*0D	No hard drive
****-**F	Preinstalled IBM PC-DOS 6.3 and Windows 3.11
****-**G	Preinstalled OS/2 2.1
****-C**	33-MHz 486SX processor, Performance Series
****-H**	33-MHz 486DX processor, Performance Series
****-L**	66-MHz 486DX2 processor, Performance Series
****-X**	100-MHz 486DX4 processor, Performance Series
****-F**	25-MHz 486SX processor, Si Series
****-M**	33-MHz 486DX processor, Si Series
****-W**	66-MHz 486DX2 processor, Si Series

Table 22.61 First IBM PS/ValuePoints Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
PS/ValuePoint (October 1992)						
325T	386SLC	25	2M	8M	1×1.44M	80M
425SX	486SX	25	8M	16M	1×1.44M	80M
433DX	486DX	33	8M	16M	1×1.44M	120M
466DX2	486DX2	66	8M	16M	1×1.44M	120M

ValuePoint P60/D

The ValuePoint P60/D is IBM's foray into affordable Pentium-based PCs. The P60/D has a 60-MHz Pentium processor, which has a built-in 16K L1 cache. A 256K L2 cache comes standard, as well as 8M RAM (6384-193) or 16M RAM (6384-189, 6384-199). The P60/D uses 72-pin SIMM RAM for a maximum of 128M. Video graphics are provided through an onboard super-VGA PCI graphics chip. 1M video RAM comes standard, whereas an additional 2M is optional. A 1.44M disk drive comes standard, as well as either a 424M or 527M hard disk drive. A 1G hard disk is also available from IBM. The P60/D comes with various security features, including a key lock, power-on password, and administrator password.

The P60/D developed a reputation for an excellent keyboard, monitor, and mouse but not much else. (An optional keyboard with an integrated ThinkPoint II pointing device is available, similar to that found on IBM's popular ThinkPad line of notebooks.) Expandability is limited with the P60/D because of its small desktop case. No drive bays are free, and one of the ISA slots is difficult to access due to the tangle of cabling and proximity to the power supply. The machine comes with DOS 6.1 pre-installed. However, the P60/D does incorporate a unique riser-card design that allows additional expansion cards to be added. The riser card accommodates one half-size and one full-size ISA card and one full-size and one half-size 32-bit PCI card. The ValuePoint Performance Series takes this design one step farther by offering a choice of either VLB or PCI buses.

Table 22.62 lists the technical specifications for the ValuePoint P60/D.

Table 22.62 ValuePoint P60/D Technical Specifications

System Architecture	
Microprocessor Clock speed	Pentium 60 MHz
L1/L2 cache	16K/256K
Bus type Bus width	PCI 32-bit
Memory	
Standard on system board	16M (8M on 6384-193)
Maximum on system board	128M

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
ISA/16	5/5	ET4000 SVGA	Any	10/20/92	—
ISA/16	5/5	ET4000 SVGA	Any	10/20/92	—
ISA/16	5/5	ET4000 SVGA	Any	10/20/92	—
ISA/16	5/5	ET4000 SVGA	Any	10/20/92	—

Maximum total memory	128M
Memory	
Memory speed and type	70ns dynamic RAM
System board memory socket type Number of memory module sockets Number available in standard configuration	72-pin SIMM (single in-line memory module) 4 4
Memory used on system board	2M/4M/8M/16M 72-pin SIMMs
Optional math coprocessor	Standard
Standard graphics Video RAM (VRAM)	Local-bus SVGA graphics 1M
RS232C serial ports UART chip used	1 Custom (compatible with NS16550A)
Pointing device (mouse) ports	1
Standard Features	
Parallel printer ports Bidirectional	1 Yes
Disk Storage	
Internal disk and tape drive bays Number of 3 1/2- and 5 1/4-inch bays	5 1/2
Standard floppy drives	1×1.44M
Optional floppy drives: 5 1/4-inch 360K 5 1/4-inch 1.2M 3 1/2-inch 720K 3 1/2-inch 1.44M 3 1/2-inch 2.88M	 Optional Optional No Standard Optional
Hard disk controller included	IDE integrated on system board
IDE hard disks available	424M/527M
Drive form factor	3 1/2-inch
Drive interface	IDE
Drive capacity	424M 527M
Average access rate (ms)	13 9
Interleave factor	1:1 1:1
Automatic head parking	Yes Yes

(continues)

Table 22.62 Continued

Expansion Slots	
Total adapter slots	4
Number of long and short slots	4/0
Number of 8-/16-/32-bit slots	0/4/0
Available slots	4
Keyboard Specifications	
Keyboard choices:	
122-key Host-Connected Keyboard	
101-key Enhanced Keyboard	
84-key Space-Saving Keyboard	
Fast keyboard speed setting	Yes
Keyboard cable length	10 feet
Security Features	
Keylock:	
Locks cover	Yes
Locks keyboard	No
Keyboard password	Yes
Power-on password	Yes
Network server mode	Yes
Physical Specifications	
Footprint type	Desktop
Orientation	Horizontal/vertical
Dimensions:	
Height	5.8 inches
Width	15.9 inches
Depth	16.5 inches
Weight	22 lbs.
Power consumption	200 watts
FCC classification	Class B

Table 22.63 shows the primary specifications of the ValuePoint P60/D models.

Table 22.63 IBM ValuePoint P60/D Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
ValuePoint P60/D						
6384-189	Pentium	60	16M	128M	1×1.44M	424M
6384-193	Pentium	60	8M	128M	1×1.44M	527M
6384-199	Pentium	60	16M	128M	1×1.44M	527M

ValuePoint Performance Series

The ValuePoint Performance Series is a revamped ValuePoint PC, offering flexibility to users. Instead of offering only PCI or VL-Bus models, the ValuePoint Performance Series, introduced in May 1994, offers the SelectaBus. This technology enables ValuePoint customers to choose and upgrade the system's local bus to support either VESA or PCI, solving the PCI versus VLB dilemma.

The Performance Series motherboard is based on VESA's VLB. However, a swappable backplane (called a riser) enables you to plug in expansion cards for one bus or the other. The VL version of the swappable backplane adds one VL-Bus slot and four ISA slots. The PCI backplane has room for two PCI cards and two ISA cards. And, for maximum flexibility, you also can get a backplane that supports five ISA cards. Whereas the VL-Bus version of the ValuePoint's backplane has room for only one VL-Bus card, this is not a major snag because both video and hard disk controllers are already integrated onto the motherboard's VL-Bus.

One promising aspect of the Performance Series is that 64-bit local-bus video is included directly on the motherboard. This video is upgradeable from 1M to 2M and supports resolutions up to 1280 × 1024. Unlike other desktop systems that have expandable video memory, the ValuePoint is one of the few with a motherboard that uses socketed DRAM (dynamic RAM) instead of a proprietary expansion board. The ValuePoint Performance Series is upgradeable with a Pentium OverDrive processor, and a ZIF socket enables you to upgrade straight to any 486DX2 OverDrive processor.

The Performance Series has good ergonomics, thanks to a Lexmark International Inc. keyboard, perhaps the best basic 101-key keyboard money can buy. Also, all models of the ValuePoint Performance Series meet the Energy Star energy-conservation specs, except those with 527M hard disk drives.

Like the PS/2, the ValuePoint Performance Series includes IBM's HelpWare, which includes a 30-day money-back guarantee, 24-hour-a-day HelpCenter technical support, as well as BBS and faxback services.

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
PCI/32-bit, ISA/16	4/4	PCI SVGA	Any	10/18/93	—
PCI/32-bit, ISA/16	4/4	PCI SVGA	Any	10/18/93	—
PCI/32-bit, ISA/16	4/4	PCI SVGA	Any	10/18/93	—

Table 22.64 shows the primary specifications of the ValuePoint Performance Series models.

Table 22.64 IBM ValuePoint Performance Series Model Summary

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
ValuePoint Performance Series IntelDX4						
6482-X0D	486DX4	100	8M	128M	1×1.44M	—
6482-X4F	486DX4	100	8M	128M	1×1.44M	364M
6492-X0D	486DX4	100	8M	128M	1×1.44M	—
6492-X4F	486DX4	100	8M	128M	1×1.44M	364M
6484-X4G	486DX4	100	8M	128M	1×1.44M	364M
6484-X5F	486DX4	100	8M	128M	1×1.44M	527M
6484-X5G	486DX4	100	8M	128M	1×1.44M	527M
6494-X5F	486DX4	100	8M	128M	1×1.44M	527M
6494-X5G	486DX4	100	8M	128M	1×1.44M	527M
ValuePoint Performance Series IntelDX2 66						
6472-L0D	486DX2	66	8M	128M	1×1.44M	—
6472-L4F	486DX2	66	8M	128M	1×1.44M	364M
6472-L4G	486DX2	66	8M	128M	1×1.44M	364M
6482-L0D	486DX2	66	8M	128M	1×1.44M	—
6482-L4F	486DX2	66	8M	128M	1×1.44M	364M
6482-LPF	486DX2	66	8M	128M	1×1.44M	364M
6482-L5F	486DX2	66	8M	128M	1×1.44M	527M
6484-L4F	486DX2	66	8M	128M	1×1.44M	364M
6484-L5G	486DX2	66	8M	128M	1×1.44M	527M
6492-L0D	486DX2	66	8M	128M	1×1.44M	—
6492-L4F	486DX2	66	8M	128M	1×1.44M	364M
6492-L5F	486DX2	66	8M	128M	1×1.44M	527M
6494-L5F	486DX2	66	8M	128M	1×1.44M	527M
6494-L5G	486DX2	66	8M	128M	1×1.44M	527M
ValuePoint Performance Series IntelDX 33						
6472-H0D	486DX	33	8M	128M	1×1.44M	—
6472-H3B	486DX	33	8M	128M	1×1.44M	270M
6472-H4F	486DX	33	8M	128M	1×1.44M	364M
6482-H0D	486DX	33	8M	128M	1×1.44M	—
6482-H3B	486DX	33	8M	128M	1×1.44M	270M

Bus Type	Total Available Slots	STANDARD Video	STANDARD Keyboard	Date Introduced	Date Withdrawn
ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
PCI/32-bit	8/8	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—

(continues)

Table 22.64 Continued

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
ValuePoint Performance Series IntelDX 33						
6482-H3G	486DX	33	8M	128M	1×1.44M	270M
6482-H4F	486DX	33	8M	128M	1×1.44M	364M
6484-H4B	486DX	33	8M	128M	1×1.44M	364M
6484-H4G	486DX	33	8M	128M	1×1.44M	364M
ValuePoint Performance Series IntelSX 33						
6472-C0D	486SX	33	8M	128M	1×1.44M	—
6472-C3B	486SX	33	8M	128M	1×1.44M	270M
6482-C0D	486SX	33	8M	128M	1×1.44M	—
6482-C3B	486SX	33	8M	128M	1×1.44M	270M
6482-CNB	486SX	33	8M	128M	1×1.44M	270M

ValuePoint Si Series

The ValuePoint Si Series became more affordable by reducing graphics power and upgradability. Although the ValuePoint Si systems feature VESA local bus on the motherboard, they don't include an available VL-bus slot. The Si's use inferior graphics accelerators and come with 512K DRAM, upgradeable to only 1M (rather than the 2M of earlier ValuePoints). The 1M limits you to a maximum of 256 colors at 1024 × 768 resolution. With 2M, you can view 65,536 colors.

Table 22.65 shows the primary specifications of the ValuePoint Si Series models.

Table 22.65 IBM ValuePoint Si Series Models

Part Number	CPU	MHz	PLANAR MEMORY Std.	PLANAR MEMORY Max.	STANDARD Floppy Drive	STANDARD Hard Disk
ValuePoint Si Series 466DX2/Si						
6381-W30	486DX2	66	4M	64M	1×1.44M	120M
6381-W50	486DX2	66	4M	64M	1×1.44M	212M
ValuePoint Si Series 433DX/Si						
6381-M30	486DX	33	4M	64M	1×1.44M	120M
6381-M50	486DX	33	4M	64M	1×1.44M	212M
ValuePoint Si Series 425SX/Si						
6381-F30	486SX	25	4M	64M	1×1.44M	120M
6381-F50	486SX	25	4M	64M	1×1.44M	212M

	Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
	ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
	ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
	PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
	PCI/32-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
	ISA/16-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
	ISA/16-bit	3/3	VESA 64-bit SVGA	Any	05/23/94	—
	ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
	ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—
	ISA/16-bit	5/5	VESA 64-bit SVGA	Any	05/23/94	—

There are other compromises in the Si series. The ValuePoint 425SX/Si does not offer an optional secondary cache or a Pentium OverDrive socket. The ValuePoint 433DX/Si does accept up to 256K of secondary cache and a Pentium OverDrive chip, but lacks a ZIF socket, making upgrading the CPU more difficult. All Si models accept up to 64M RAM, (using 16M SIMMs) and provide three open ISA slots and one open drive bay, as do small-footprint ValuePoints.

Bus Type	Total Available Slots	STANDARD Video	Keyboard	Date Introduced	Date Withdrawn
ISA/16-bit, VLB/32-bit	3/3	SVGA	Any	08/02/93	—
ISA/32-bit, VLB/32-bit	3/3	SVGA	Any	08/02/93	—
ISA/16-bit, VLB/32-bit	3/3	SVGA	Any	08/02/93	—
ISA/32-bit, VLB/32-bit	3/3	SVGA	Any	08/02/93	—
ISA/16-bit, VLB/32-bit	3/3	SVGA	Any	08/02/93	—
ISA/32-bit, VLB/32-bit	3/3	SVGA	Any	08/02/93	—

PS/2 BIOS Information

To uniquely identify each PS/2 system model through software, IBM encodes each system with a unique set of identifying information. By using this information and comparing it to a chart showing what versions have been available, you might be able to determine whether a system has an out-of-date ROM release that might be causing problems. A review of this information shows just how many different systems IBM has released.

To identify one system from another, one item that many technicians use is the ROM BIOS date of creation. The date is stored in the ROM at absolute address FFFF:5. To see this date, you can use the DOS DEBUG program as follows:

1. Run the DEBUG program by typing the DEBUG command at the C: prompt:

   ```
   C:\>DEBUG
   ```

2. When the debug prompt (-) appears, type the following command and press Enter:

   ```
   -D FFFF:5 L 8
   ```

   This command instructs debug to dump the memory in segment FFFF and offset 5, for a length of 8 bytes.

3. Read the screen display, which looks something like the following line, showing the BIOS date, unless the compatible BIOS is nonstandard and does not store the date there:

   ```
   FFFF:0000       30 31 2F-31 38 2F 38 39      01/18/89
   ```

4. To exit DEBUG, press Q.

The screen looks something like this when you are done:

```
C:\>DEBUG
-D FFFF:5 L 8
FFFF:0000        30 31 2F-31 38 2F 38 39   01/18/89
-Q
```

Although many people use the BIOS date of creation to identify a system, IBM uses other information in addition to the version of BIOS to uniquely identify the system. IBM has given each PS/2 system a model ID byte (or model byte), a submodel byte, and a revision byte. With these three pieces of information, you can clearly identify any PS/2 system by booting the Reference Disk and executing the "Display Revision Levels" option at the main menu. The display that results looks something like the following:

```
    Model Byte: F8
Sub-Model Byte: 0B
      Revision: 00
```

The values are in hexadecimal because they represent raw byte values. Many diagnostics programs can locate this information for a given system because a standard way to retrieve the information involves executing an Int 15h instruction with the AH register set to C0, which returns a pointer to the location of the desired information.

You also can find out this information by using DEBUG. The first step in the procedure involves (A)ssembling at memory offset 100h a short program that will (MOV)e the value C0 into the AH register. Then execute (Int)errupt 15h, and (Int)errupt 3h. The Int 15 function C0 causes the ES and BX registers to contain the address of the System Configuration Parameters table. This table is in memory and contains information about how the system is configured and the model ID information you are looking for. The Int 3 is a breakpoint instruction that causes the program to stop and display the register contents.

After the program is assembled in memory, the (G)o instruction tells DEBUG to run the program, which occurs until the Int 3 instruction is reached and causes the program to stop, gives DEBUG control of the system, and displays the current contents of the registers. The correct location of the System Configuration Table then is in the ES:BX registers. For my P70 system that would be E000:7CED, but the address varies for other systems. When you run these steps, make sure that you substitute whatever is reported on your system in the ES and BX registers for the address in the (D)ump command. The "L A" part of the (D)ump command says that the (L)ength of data to dump is Ah (10) bytes. This includes the first two bytes of the table, which is a word indicating the length of the remaining portion of the table. Normally this word has a value of 0008h, which means that the remainder of the table is 8 bytes long.

To find out the model byte, submodel byte, and revision number of your system, you can execute these steps using DOS DEBUG. Notice that the address given in the (D)ump instruction differs between systems. You must substitute whatever values are reported by the ES and BX registers:

```
C:\>DEBUG
-A 100
xxxx:0100 MOV AH,C0
xxxx:0102 INT 15
xxxx:0104 INT 3
xxxx:0105
-G

AX=00FF  BX=7CED  CX=0000  DX=0000  SP=FFEE  BP=0000  SI=0000  DI=0000
DS=269A  ES=E000  SS=269A  CS=269A  IP=0104   NV UP EI PL ZR NA PE NC
269A:0104 CC            INT     3
-D E000:7CED L A
E000:7CE0                                           08 00 F8                ...
E000:7CF0  0B 00 F6 40 00 00 00                                 ...@...
-Q
```

Starting with the address reported in the ES:BX registers, the third, fourth, and fifth bytes listed after the (D)ump command are the model byte, sub-model byte, and revision number, respectively. In this case they are F8, 0B, and 00.

Table 22.66 is a relatively complete compilation of IBM BIOS ID information. Some systems have had BIOS changes during their life span. One piece of information this table provides is the total number of ST-506 drive types each BIOS supports. These types often are used when installing ST-506 or IDE hard disk drives. If the BIOS of your system is included in table 22.66, you can look up the IBM BIOS Hard Drive Table in Appendix A and establish the exact drive types supported by your system.

Table 22.66 IBM ROM BIOS Model/Submodel/Revisions

System Drive Description	CPU	Clock Speed	Bus Type/ Width
PC	8088	4.77 MHz	ISA/8
PC	8088	4.77 MHz	ISA/8
PC	8088	4.77 MHz	ISA/8
PC-XT	8088	4.77 MHz	ISA/8
PC-XT	8088	4.77 MHz	ISA/8
PC-XT	8088	4.77 MHz	ISA/8
PCjr	8088	4.77 MHz	ISA/8
PC Convertible	80C8	4.77 MHz	ISA/8
PS/2 25	8086	8 MHz	ISA/8
PS/2 30	8086	8 MHz	ISA/8
PS/2 30	8086	8 MHz	ISA/8
PS/2 30	8086	8 MHz	ISA/8
PC-AT	286	6 MHz	ISA/16
PC-AT	286	6 MHz	ISA/16
PC-AT	286	8 MHz	ISA/16
PC-XT 286	286	6 MHz	ISA/16
PS/1	286	10 MHz	ISA/16
PS/2 25 286	286	10 MHz	ISA/16
PS/2 30 286	286	10 MHz	ISA/16
PS/2 30 286	286	10 MHz	ISA/16
PS/2 35 SX	386SX	20 MHz	ISA/16
PS/2 35 SX	386SX	20 MHz	ISA/16
PS/2 40 SX	386SX	20 MHz	ISA/16
PS/2 40 SX	386SX	20 MHz	ISA/16
PS/2 L40 SX	386SX	20 MHz	ISA/16
PS/2 50	286	10 MHz	MCA/16
PS/2 50	286	10 MHz	MCA/16
PS/2 50Z	286	10 MHz	MCA/16
PS/2 50Z	286	10 MHz	MCA/16
PS/2 55 SX	386SX	16 MHz	MCA/16
PS/2 57 SX	386SX	20 MHz	MCA/16
PS/2 60	286	10 MHz	MCA/16
PS/2 65 SX	386SX	16 MHz	MCA/16
PS/2 70 386	386DX	16 MHz	MCA/32
PS/2 70 386	386DX	16 MHz	MCA/32
PS/2 70 386	386DX	16 MHz	MCA/32
PS/2 70 386	386DX	20 MHz	MCA/32

ROM BIOS Date	ID Byte	Sub-Model Byte	Rev	ST506 Types
04/24/81	FF	—	—	—
10/19/81	FF	—	—	—
10/27/82	FF	—	—	—
11/08/82	FE	—	—	—
01/10/86	FB	00	01	—
05/09/86	FB	00	02	—
06/01/83	FD	—	—	—
09/13/85	F9	00	00	—
06/26/87	FA	01	00	26
09/02/86	FA	00	00	26
12/12/86	FA	00	01	26
02/05/87	FA	00	02	26
01/10/84	FC	—	—	15
06/10/85	FC	00	01	23
11/15/85	FC	01	00	23
04/21/86	FC	02	00	24
12/01/89	FC	0B	00	44
06/28/89	FC	09	02	37
08/25/88	FC	09	00	37
06/28/89	FC	09	02	37
03/15/91	F8	19	05	37
04/04/91	F8	19	06	37
03/15/91	F8	19	05	37
04/04/91	F8	19	06	37
02/27/91	F8	23	02	37
02/13/87	FC	04	00	32
05/09/87	FC	04	01	32
01/28/88	FC	04	02	33
04/18/88	FC	04	03	33
11/02/88	F8	0C	00	33
07/03/91	F8	26	02	None
02/13/87	FC	05	00	32
02/08/90	F8	1C	00	33
01/29/88	F8	09	00	33
04/11/88	F8	09	02	33
12/15/89	F8	09	04	33
01/29/88	F8	04	00	33

(continues)

Table 22.66 Continued

System Drive Description	CPU	Clock Speed	Bus Type/ Width
PS/2 70 386	386DX	20 MHz	MCA/32
PS/2 70 386	386DX	20 MHz	MCA/32
PS/2 70 386	386DX	25 MHz	MCA/32
PS/2 70 386	386DX	25 MHz	MCA/32
PS/2 70 486	486DX	25 MHz	MCA/32
PS/2 70 486	486DX	25 MHz	MCA/32
PS/2 P70 386	386DX	16 MHz	MCA/32
PS/2 P70 386	386DX	20 MHz	MCA/32
PS/2 P75 486	486DX	33 MHz	MCA/32
PS/2 80 386	386DX	16 MHz	MCA/32
PS/2 80 386	386DX	20 MHz	MCA/32
PS/2 80 386	386DX	25 MHz	MCA/32
PS/2 90 XP 486	486SX	20 MHz	MCA/32
PS/2 90 XP 486	487SX	20 MHz	MCA/32
PS/2 90 XP 486	486DX	25 MHz	MCA/32
PS/2 90 XP 486	486DX	33 MHz	MCA/32
PS/2 90 XP 486	486DX	50 MHz	MCA/32
PS/2 95 XP 486	486SX	20 MHz	MCA/32
PS/2 95 XP 486	487SX	20 MHz	MCA/32
PS/2 95 XP 486	486DX	25 MHz	MCA/32
PS/2 95 XP 486	486DX	33 MHz	MCA/32
PS/2 95 XP 486	486DX	50 MHz	MCA/32

The ID byte, submodel byte, and revision numbers are in hexadecimal.
None = Only SCSI drives are supported.

Summary of IBM Hard Disk Drives

The tables in this section are a complete reference to all the hard disk drives supplied by IBM in any XT, AT, or PS/2 system. This reference can be useful in determining which types of drives came with each system, and upgrades are possible.

You usually can easily install an upgraded drive of the same interface type in a given system. If I have a PS/2 Model 50Z that came with a 30M MCA IDE hard drive, for example, I easily can upgrade that system to any of the other MCA IDE drives that were available, such as the 120M or 160M units. Because the drives use the exact same interface, it would be a simple plug-in upgrade. Using this information, you can more easily "recycle" hard drives from systems that have since received upgrades.

ROM BIOS Date	ID Byte	Sub-Model Byte	Rev	ST506 Types
04/11/88	F8	04	02	33
12/15/89	F8	04	04	33
06/08/88	F8	0D	00	33
02/20/89	F8	0D	01	33
12/01/89	F8	0D	?	?
09/29/89	F8	1B	00	?
?	F8	50	00	?
01/18/89	F8	0B	00	33
10/05/90	F8	52	00	33
03/30/87	F8	00	00	32
10/07/87	F8	01	00	32
11/21/89	F8	80	01	?
?	F8	2D	00	?
?	F8	2F	00	?
?	F8	11	00	?
?	F8	13	00	?
?	F8	2B	00	?
?	F8	2C	00	?
?	F8	2E	00	?
?	F8	14	00	?
?	F8	16	00	?
?	F8	2A	00	?

— = This feature is not supported.
?=No information available.

Tables 22.67 through 22.80 list the standard and optional hard drives installed by IBM in its systems, grouped by interface.

Table 22.67 IBM-Installed ST-506/412 Hard Drives Used in the XT, AT, and PS/2 Model 25

Drive form factor	5 1/4	5 1/4	5 1/4	5 1/4	3 1/2
Capacity	10M	20M	20M	30M	20M
Physical/logical interface	ST506	ST506	ST506	ST506	ST506
Average access rate (ms)	85	65	40	40	38
Read-ahead cache (K)	—	—	—	—	—

(continues)

Table 22.67 Continued

Encoding scheme	MFM	MFM	MFM	MFM	RLL
BIOS drive type number	1	2	2	2	36
Cylinders	306	615	615	733	402
Heads	4	4	4	5	4
Sectors/track	17	17	17	17	26
Rotational speed (RPM)	3600	3600	3600	3600	3600
Standard interleave factor	6:1	3:1	3:1	3:1	3:1
Data transfer rate (K/second)	85	170	170	170	260
Automatic head parking	No	No	Yes	Yes	Yes

Table 22.68 IBM-Installed ST-506/412 Hard Drives Used in the XT, AT, and PS/2 Models 50, 60, and 80

Drive form factor	3 1/2	5 1/4	5 1/4
Capacity	20M	44M	44M
Physical/logical interface	ST506	ST506	ST506
Average access rate (ms)	80	40	40
Read-ahead cache (K)	—	—	—
Encoding scheme	MFM	MFM	MFM
BIOS drive type number	30	31	32
Cylinders	611	732	1023
Heads	4	7	5
Sectors/track	17	17	17
Rotational speed (RPM)	3600	3600	3600
Standard interleave factor	1:1	1:1	1:1
Data transfer rate (K/second)	510	510	510
Automatic head parking	No	Yes	Yes

Table 22.69 IBM-Installed XT IDE Drives Used in the PS/2 Models 25, 30, 25 286, and 30 286

Drive form factor	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2
Capacity	20M	20M	30M	30M	45M
Physical interface	IDE	IDE	IDE	IDE	IDE
Logical interface	XT	XT	XT	XT	XT
Average access rate (ms)	80	27	27	19	32
Read-ahead cache (K)	—	—	—	—	—

Encoding scheme	MFM	RLL	RLL	RLL	RLL
BIOS drive type number	26	34	33	35	37
Cylinders	612	775	614	921	580
Heads	4	2	4	2	6
Sectors/track	17	27	25	33	26
Rotational speed (RPM)	3600	3600	3600	3600	3600
Standard interleave factor	2:1	3:1	3:1	4:1	3:1
Data transfer rate (K/second)	255	270	250	248	260
Automatic head parking	No	No	No	Yes	Yes

Table 22.70 IBM-Installed ATA IDE Drives Used in the PS/2 Models 35, 40, and L40

Drive form factor	2 1/2	3 1/2	3 1/2
Capacity	60M	40M	80M
Physical interface	IDE	IDE	IDE
Logical interface	ATA	ATA	ATA
Average access rate (ms)	19	17	17
Read-ahead cache (K)	—	32K	32K
Encoding scheme	RLL	RLL	RLL
BIOS drive type number			—
Cylinders	822	1038	1021
Heads	4	2	4
Sectors/track	38	39	39
Rotational speed (RPM)	3600	3600	3600
Standard interleave factor	1:1	1:1	1:1
Data transfer rate (K/second)	1140	1170	1170
Automatic head parking	Yes	Yes	Yes

Table 22.71 IBM-Installed MCA IDE Drives Used in the PS/2 Models 50Z, 55, 70 386, and P70 386

Drive form factor	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2
Capacity	30M	30M	30M	40M	60M	80M	120M	160M
Physical interface	IDE	IDE	IDE	IDE	IDE	IDE	IDE	IDE
Logical interface	ST506	ST506	ESDI	ESDI	ESDI	ESDI	ESDI	ESDI
Average access rate (ms)	39	27	19	17	27	17	23	16

(continues)

Table 22.71 Continued

Read-ahead cache (K)	—	—	—	32K	—	32K	—	32K
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL	RLL	RLL
BIOS drive type number	33	33	—	—	—	—	—	—
Cylinders	614	614	920	1038	762	1021	920	1021
Heads	4	4	2	2	6	4	8	8
Sectors/track	25	25	32	39	26	39	32	39
Rotational speed (RPM)	3600	3600	3600	3600	3600	3600	3600	3600
Standard interleave factor	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	750	750	960	1170	780	1170	960	1170
Automatic head parking	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Table 22.72 IBM-Installed ESDI Drives Used in the PS/2 Models 60 and 80

Drive form factor	5 1/4	5 1/4	5 1/4
Capacity	70M	115M	314M
Physical/logical interface	ESDI	ESDI	ESDI
Average access rate (ms)	30	28	23
Read-ahead cache (K)	—	—	—
Encoding scheme	RLL	RLL	RLL
BIOS drive type number	—	—	—
Cylinders	583	915	1225
Heads	7	7	15
Sectors/track	36	36	34
Rotational speed (RPM)	3600	3600	3283
Standard interleave factor	1:1	1:1	1:1
Data transfer rate (K/second)	1080	1080	930
Automatic head parking	Yes	Yes	Yes

Table 22.75 PS/2 Processor/Coprocessor Upgrades

Description	Part Number	Price
16MHz 387SX Math Coprocessor	27F4676	$84
25MHz 486DX Power Platform	6450876	1,900
25MHz 487SX Chip Upgrade	6451243	840
25MHz 486SX Processor Complex	6450759	665
33MHz 486DX Processor Complex	6451094	985
33MHz 486DX Processor Complex	6451094	935
33MHz 486DX Processor Complex	6451094	935

Table 22.73 IBM-Installed SCSI Drives Used in the PS/2 Models 56, 57, 65, P75, 80, 90, and 95

Drive form factor	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2
Capacity	60M	80M	120M	160M	320M	400M
Physical/logical interface	SCSI	SCSI	SCSI	SCSI	SCSI	SCSI
Average access rate (ms)	23	17	23	16	12.5	11.5
Read-ahead cache (K)	32K	32K	32K	32K	64K	128K
SCSI transfer mode	Async	Async	Async	Async	Sync	Sync
Encoding scheme	RLL	RLL	RLL	RLL	RLL	RLL
BIOS drive type number	—	—	—	—	—	—
Cylinders	920	1021	920	1021	949	1201
Heads	4	4	8	8	14	14
Sectors/track	32	39	32	39	48	48
Rotational speed (RPM)	3600	3600	3600	3600	4318	4318
Standard interleave factor	1:1	1:1	1:1	1:1	1:1	1:1
Data transfer rate (K/second)	960	1170	960	1170	1727	1727
Automatic head parking	Yes	Yes	Yes	Yes	Yes	Yes

Table 22.74 Standard PS/2 Accessories

Description	Part Number	Price	Notes
PS/2 mouse	6450350	$101	2-button mouse
Trackpoint	1397040	95	Mouse/trackball
Dual serial adapter/A	6451013	231	For 50-95, NS16550, 9-pin plug
Serial/parallel adapter	6450215	161	25-40 (not L40), NS16450, 9-pin
Floor stand	95F5606	45	Vertical mount for 35 LS/SX

Notes
For Model 55, 65
70-Axx, trade in 386DX-25
90/95, CPU only
90/95, trade in 486SX-20
90/95, trade in 486SX-20
90/95, trade in 486SX-25
90/95, trade in 486DX-25

(continues)

Table 22.75 Continued

Description	Part Number	Price
50MHz 486DX Processor Complex	6450757	$3,255
50MHz 486DX Processor Complex	6450757	3,200
50MHz 486DX Processor Complex	6450757	3,200
50MHz 486DX Processor Complex	6450757	2,800
50MHz 486DX2 CPU only	32G3374	665
50MHz 486DX2 Processor Complex	32G3491	1,335
50MHz 486DX2 Processor Complex	32G3491	935
50MHz 486DX Enhanced Complex	6451269	4,880
50MHz 486DX Enhanced Complex	6451269	4,825
50MHz 486DX Enhanced Complex	6451269	4,825
50MHz 486DX Enhanced Complex	6451269	4,425
50MHz 486DX Enhanced Complex	6451269	2,295
50MHz 486DX Enhanced Complex	6451269	3,825
50MHz 486DX Enhanced Complex	6451269	3,495
66MHz 486DX2 CPU only	32G3690	899
66MHz 486DX2 Processor Complex	32G3383	2,055
66MHz 486DX2 Processor Complex	32G3383	2,000
66MHz 486DX2 Processor Complex	32G3383	2,000
66MHz 486DX2 Processor Complex	32G3383	1,600
66MHz 486DX2 Processor Complex	32G3383	1,000
Processor Complex 256K Cache	6451095	1,595

Table 22.76 PS/2 Memory Modules and Adapters

Description	Part Number	Price	Notes
ISA 8-Bit Memory Adapters			
Expanded memory adapter (XMA)	2685193	$1,395	2M RAM, LPT port, XT/AT/30
ISA Bus 16-Bit Memory Adapters			
0-12M multifunction adapter	30F5364	495	COM/LPT port, 30 286
All ChargeCard	34F2863	495	Memory manager for 25/30 286
3M expanded memory adapter	34F2864	1,830	ChargeCard, 0-12M card, 3M RAM
4M expanded memory kit	34F2866	1,285	ChargeCard, 4M system-board RAM

Notes
90/95, trade in 486SX-20
90/95, trade in 486SX-25
90/95, trade in 486DX-25
90/95, trade in 486DX-33
90/95, CPU only
90/95, trade in 486SX-20
90/95, trade in 486DX-33
90/95, trade in 486SX-20
90/95, trade in 486SX-25
90/95, trade in 486DX-25
90/95, trade in 486DX-33
90/95, trade in 486DX-50
90/95, trade in 486DX2-50
90/95, trade in 486DX2-66
90/95, CPU only
90/95, trade in 486SX-20
90/95, trade in 486SX-25
90/95, trade in 486DX-25
90/95, trade in 486DX-33
90/95, trade in 486DX2-50
External Cache for 486DX

Description	Part Number	Price	Notes
MCA Bus 16-Bit Memory Adapters			
1-8M 80286 memory optional/85ns	6450685	$410	1M, EMS 4.0 for 50/55/60/65
2-8M 80286 memory optional/85ns	6450609	330	2M, EMS 4.0 for 50/55/60/65
MCA Bus 32-Bit Adapters			
2-14M enhanced adapter/85ns	87F9856	480	2M, for 70/P70/80
4-14M enhanced adapter/85ns	87F9860	600	4M, for 70/P70/80
Memory Module Kits (SIMMs)			
25 system board memory/120ns	78X8955	40	128K kit (6 chips) for 25

(continues)

Table 22.76 Continued

Description	Part Number	Price	Notes
512K memory module kit/120ns	30F5348	$140	2-256K SIMMs for 30F5364/1497259, 25/30 286 system board
2M memory module kit/120ns	30F5360	250	2-1M SIMMs for 30F5364/ 1497259, 34F2866 25/30 286 system board
1M memory module kit/85ns	6450603	80	1M SIMM for 6450605/ 6450609, 6450685/ 34F3077/34F3011, 50Z/55/65/70 386 (Not Axx/Bxx)/P70 386
2M memory module kit/85ns	6450604	150	2M SIMM for 6450605/ 6450609, 6450685/ 34F3077/34F3011, 50Z/55/65/ 70 (Not Axx/Bxx)/P70 386
4M memory module kit/85ns	87F9977	290	4M SIMM for 35/40/55/65 34F3011/34F3077
2M memory module kit/80ns	6450608	150	2M SIMM for 35/40/70 -Axx/Bxx
8M memory module kit/80ns	6450129	590	8M SIMM for 35/40
2M memory module kit/70ns	6450902	160	2M SIMM for 57/90/95
4M memory module kit/70ns	6450128	295	4M SIMM for 57/P75/90/95
8M memory module kit/70ns	6450130	695	8M SIMM for 35/40/57/P75 /90/95
2M memory module kit/80ns	79F0999	215	2M CMOS SIMM for L40 (keyed)
4M memory module kit/80ns	79F1000	400	4M CMOS SIMM for L40 (keyed)
8M memory module kit/80ns	79F1001	785	8M CMOS SIMM for L40 (keyed)
1M system board kit/80ns	6450375	528	1M card for 80-041
2M system board kit/80ns	6450379	150	2M card for 80 (except Axx)
4M system board kit/80ns	6451060	280	4M card for 80-A21/A31

Table 22.77 PS/2 Floppy Drives, Adapters, and Cables

Description	Part Number	Price	Notes
5 1/4-Inch Floppy Drives			
5 1/4-inch external 360K drive	4869001	$489	For all PS/2s
5 1/4-inch external 1.2M drive	4869002	509	For 50-95, requires 6451007
5 1/4-inch internal 1.2M drive	6451006	365	For 60/65/80
5 1/4-inch internal 1.2M slim drive	6451066	310	For 35/40/57/90/95

Description	Part Number	Price	Notes
3 1/2-Inch Floppy Drives			
3 1/2-inch internal 720K drive	78X8956	$180	For 25 S/N < 100,000
3 1/2-inch internal 720K 1/3-height drive	6451056	159	For 25 S/N > 100,000
3 1/2-inch internal 720K 1/3-height drive	6451027	159	For 30-001
3 1/2-inch internal 1.44M 1/3-height drive	6451063	263	For 25-006/G06
3 1/2-inch internal 1.44M drive	6450353	263	For 30-E01/50-80, not 55/P70 386
3 1/2-inch internal 1.44M slim drive	6451130	263	35/40/57, not L40, media-sense
3 1/2-inch internal 1.44M 1/3-height drive	6451072	263	50-95, not 55/P70/30-E01
3 1/2-inch internal 2.88M slim drive	6451106	325	35/40/57, not L40, media-sense
Floppy Disk Drive Adapters			
5 1/4-inch external drive adapter	6450244	72	360K for 25-40, not L40
5 1/4-inch external drive adapter/A	6450245	72	360K for 50-80, not 55/P70 386
5 1/4-inch floppy disk drive adapter/A	6451007	216	For 1.2M/360K in 50-95
Cables and Miscellaneous			
5 1/4-inch external 360K cable	6451033	21	For 30-001/021 external drive
5 1/4-inch external 360K cable	27F4245	18	For 30-Exx external drive
5 1/4-inch external drive adapter cable	6451124	40	For 35/40 and 4869001
External storage device cable	23F2716	101	P70 360K, P75 360K/1.2M
3 1/2-inch internal drive kit	6451037	30	Cable/Bezel for 6451353
3 1/2-inch internal 1/3-height drive kit	6451034	25	Cable/Bezel for 6451072
3 1/2-inch internal 1/3-height drive kit B	6451035	30	For 6451026 in 55 LS
Drive upgrade kit for 35 LS	6451127	45	For 6451130/6451106/ 6451066
IBM Preformatted Floppy Disks			
5 1/4-inch 10 360K disks	6023450	44	Cardboard slipcase
5 1/4-inch 10 360K disks with case	6069769	45	Plastic library case/stand
5 1/4-inch 10 1.2M disks	6109660	54	Cardboard slipcase

(continues)

Table 22.77 Continued

Description	Part Number	Price	Notes
IBM Preformatted Floppy Disks			
5 1/4-inch 10 1.2M disks with case	6109661	$55	Plastic library case/stand
3 1/2-inch 10 720K disks with case	6404088	33	Plastic library case/stand
3 1/2-inch 10 1.44M disks with case	6404083	50	Plastic library case/stand
3 1/2-inch 10 2.88M disks with case	72X6111	99	Plastic library case/stand

Table 22.78 PS/2 Hard Disks, Adapters, and Cables

Description	Part Number	Price	Notes
IDE Hard Disk Drives			
20M 3 1/2-inch 80ms IDE drive	78X8958	$ 787	For 25
20M 3 1/2-inch 27ms IDE drive	6451075	787	For 25-xx6, Req 6451071
30M 3 1/2-inch 19ms IDE drive	6451076	695	For 25-xx6, Req 6451071
40M 3 1/2-inch 17ms IDE drive	6451047	290	For 55 LS
40M 3 1/2-inch 17ms IDE drive	6451073	290	For 35/40
80M 3 1/2-inch 17ms IDE drive	6451043	425	For 55 LS
80M 3 1/2-inch 17ms IDE drive	6451074	340	For 35/40
SCSI Hard Disk Drives			
60M 3 1/2-inch 23ms, 32K cache	6451049	1,000	Async, 1.25M/sec Xfer rate
80M 3 1/2-inch 17ms, 32K cache	6451045	340	Async, 1.25M/sec Xfer rate
120M 3 1/2-inch 23ms, 32K cache	6451050	1,670	Async, 1.5M/sec Xfer rate
160M 3 1/2-inch 16ms, 32K cache	6451046	580	Async, 1.5M/sec Xfer rate
320M 3 1/2-inch 12.5ms, 64K cache	6451234	1,625	Sync, 2.0M/sec Xfer rate
400M 3 1/2-inch 11.5ms, 128K cache	6451235	1,835	Sync, 2.0M/sec Xfer rate
IG 3 1/2-inch 11ms, 256K cache	0451052	5,000	Sync, 2.0M/sec Xfer rate

Description	Part Number	Price	Notes
SCSI Host Adapter			
SCSI adapter/A	6451109	$375	16-bit bus master
SCSI adapter/A with 512K cache	6451133	750	32/16-bit bus master
SCSI external terminator	6451039	110	For adapter with cache
Cables and Miscellaneous			
Fixed disk drive kit A	6451071	65	Installation kit for 25-xx6
Fixed disk upgrade kit/35	6451128	15	For 6451073/ 6451074 in 35 LS
SCSI installation kit A	6451053	90	For 3 1/2-inch drive in 60/65/80
Fixed disk drive kit D	6451120	20	For 60/120M drives in 90/95
SCSI card to option cable	6451139	220	Includes terminator, replaces 6451041
SCSI option to option cable	6451042	90	Connect external options
CD-ROM Drives			
Internal 600M CD-ROM drive	6451113	1,250	Requires SCSI adapter
External 600M CD-ROM drive	3510001	1,550	Requires SCSI adapter
CD-ROM installation kit/A	6450847	35	Install in 5 1/4-inch bay
3 1/2-inch 128M rewritable drive	6450162	1,795	Requires SCSI adapter
Optical drive kit A	6451126	29	For 6450162 in 60/ 80 (non-SCSI)
3 1/2-inch rewritable cartridge	38F8645	70	128M cartridge for 6450162
3 1/2-inch rewritable cartridge	38F8646	315	5-128M cartridges for 6450162
8mm Tape Backup Drives and Accessories			
2.3G internal SCSI drive	6451121	6,500	For 95/3511, requires SYTOS
2.3G external SCSI drive	6451121	6,915	Requires SCSI adapter and SYTOS
SCSI cable for external drive	31F4187	315	Connects tape drive to system

(continues)

Table 22.78 Continued

Description	Part Number	Price	Notes
8mm Tape Backup Drives and Accessories			
SCSI device-to-device cable	31F4186	$78	Chains tape to other devices
8mm data cartridge	21F8595	29	Stores 2.3 gigabytes
8mm cleaning cartridge	21F8593	40	For cleaning heads
SYTOS plus V1.3 for DOS	04G3375	150	Data compression
SYTOS plus V1.3 for OS/2 PM	04G3374	195	Data compression, FAT/HPFS
SCSI Expansion Units			
3510 external SCSI storage unit	35100V0	360	1 half-height, 3 1/2-inch, 5 1/4-inch bay
3511 external SCSI storage unit	3511003	3,845	7 bays, 3 1/2- and 5 1/4-inch, 320M drive

Table 22.79 PS/2 Video Displays and Adapters

Description	Part Number	Price	Notes
Analog Displays			
8504 12-inch VGA mono display	8504001	$245	640×480
8507 19-inch XGA mono display	8507001	600	1024×768
8604 16-inch XGA mono display	8604001	850	1024×768
PS/1 color display upgrade	1057108	699	Upgrade for mono systems
8512 14-inch color display	8512001	365	640×480, .41mm stripe
8513 12-inch VGA color display	8513001	665	640×480, .28mm dot, stand
8514 16-inch XGA color display	8514001	1,035	1024×768, .31mm dot, stand
8515 14-inch XGA color display	8515021	635	1024×768, .28mm dot, stand
8518 14-inch VGA color display	8518001	535	640×480, .28mm dot, stand
8516 14-inch XGA touch screen	8516001	1,200	1024×768, .28mm dot, stand
Analog Display Adapters			
XGA adapter/A	75X5887	210	1024×768, for 55-95 (not 60/P70)
Video memory expansion option	75X5889	60	512K Video RAM for XGA

Description	Part Number	Price	Notes
Analog Display Adapters			
8514/A display adapter	1887972	$980	1024×768×16, for 50-80 (not P70)
8514/A memory expansion kit	1887989	283	1024×768×256 colors
Miscellaneous Display Accessories			
Display Stand for 8512	1501215	36	Tilt-swivel stand
TouchSelect for 12-inch displays	91F7951	670	Adds Touch screen to 8513
Privacy filter for 8512	1053405	154	Prevents side view of display
Privacy filter for 8513	1053401	154	Prevents side view of display
Privacy filter for 8514	1053402	154	Prevents side view of display
Privacy filter for 8515	1053403	154	Prevents side view of display

Table 22.80 PS/2 Network Adapters and Accessories

Description	Part Number	Price	Notes
ISA Bus Token-Ring Network (TRN) Adapters			
TRN Adapter II	25F9858	$395	4Mbps for 25-40 (not L40)
TRN 16/4 adapter	25F7367	895	16/4Mbps for 25-40 (not L40)
TRN 16/4 trace & performance	74F5121	1,220	16/4Mbps for 25-40 (not L40)
MCA Bus Token-Ring Network (TRN) Adapters			
TRN adapter/A (full-length)	69X8138	395	4Mbps, for 50-95
TRN adapter/A (half-length)	39F9598	448	4Mbps for P70/75 (and 50-95)
TRN 16/4 adapter/A	16F1133	895	16/4Mbps for 50-95
TRN 16/4 adapter/A (half)	74F9410	895	16/4Mbps, 50-95, 80 percent faster
TRN 16/4 trace & perf./A	74F5130	1,220	16/4Mbps for 50-95
TRN 16/4 busmaster server/A	74F4140	1,030	16/4Mbps for 50-95 servers only
MCA Bus EtherNet Network Adapters			
PS/2 EtherNet adapter/A	6451091	575	10Mbps for 50-95, including boot ROM

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Table 22.80 Continued

Description	Part Number	Price	Notes
Miscellaneous Network Adapter Accessories			
TRN adapter cable	6339098	$36	Connect card to LAN
TRN L-shaped connector cable	79F3229	50	For 74F9410 and P70/75
TRN 8230 4Mbps media filter	53F5551	55	For unshielded twisted pair
TRN adapter II boot ROM	83X7839	99	EPROM for 25F9858
TRN adapter/A boot ROM	83X8881	96	EPROM for 69X8138/ 39F9598
TRN 16/4 adapter/A boot ROM	25X8887	99	EPROM for 25F7367/ 16F1133

Summary

This chapter has presented information about the PS/2 line of systems from IBM, including information about all the various PS/2 models and submodels, from low-end to high-end systems. The low-end PS/2 systems—the PS/2 Models 25, 30, PS/1, 25 286, 30 286, 35 SX, 40 SX, and L40 SX—are based closely on the original PC line and include the standard ISA-type of expansion slots. The higher-end PS/2 Models 50, 50Z, 55 SX, 57 SX, 60, 65 SX, 70 386, P70 386, P75, 80, 90, 95, and their respective submodels use the newer MCA slot design, which is dramatically different from the original ISA bus. The newest Models 53, 56, 57, 76 and 77 indicate IBM's trend away from proprietary graphics chips and buses. The eventual merging of the ValuePoint line into the PS/2 line will provide customers with a choice of buses along with excellent performance and value.