

COMPUTERFACTS™

MAINTENANCE, TROUBLESHOOTING & UPGRADE DATA

IBM® Personal System/2® Model 25

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CF63001

PROMPT™
PUBLICATIONS

COMPUTERFACTS
ROADMAP



Maintenance



Upgrading



Troubleshooting



Important Note



Power Hazard

WARRANTY WARNING: *Removal of the cover or service work performed by anyone other than a manufacturer's authorized service representative may void the manufacturer's warranty on your computer.*

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PS/2 MODEL 25 SPECIFICATIONS



Brand: IBM Personal System/2
Case dimensions: 15-1/8"H x 9-1/2"W x 12-1/2"D

SYSTEM (CPU)

Construction: System board
Microprocessor: 8086-2
Math coprocessor: 8087 (not installed)
CPU speed: 8 megahertz
Other speeds selectable: None
Random access memory (RAM): 512K standard
RAM expandable on-board to: 640K
Read-only memory (ROM): 64K
Maximum addressable memory: 640K
Memory chip size: Two 256K x 9 bits
Memory chip speed: 120 nanoseconds
Memory configuration: SIP

EXPANSION SLOTS

Slots available: 2 IBM PC XT (62 pins)

POWER SUPPLY

AC switch settings: 115V AC, 60 hertz/230V AC, 50 hertz
Normal input voltage: 115V AC/230V AC
Minimum input voltage: 90V AC/180V AC
Maximum input voltage: 137V AC/265V AC
Maximum input current: 2A/1A
Wattage: 113mA (color monitor)
90mA (monochrome monitor)
System board voltages: +5V, 7A maximum (3A system board)
+12V, 1.7A maximum
-5V, 100mA maximum
-12V, 250mA maximum
Keyboard voltage: +12V, 275mA maximum
Display voltages: +115V, 450mA maximum
+39V, 800mA maximum (monochrome)
+12V, 220mA maximum

FLOPPY DISK DRIVE

Standard with system: 3.5" 720K (formatted capacity)
Drive dimensions: 1-5/8"H x 4"W x 5-9/16"D (third-height)
Drive controller format: RLL
Max drives controlled: Two 3.5" drives or one 3.5" and one 20-megabyte hard disk
Space for added drives: One 3.5" or one 20-megabyte hard disk

HARD DISK DRIVE

Standard with system (in later models): 20-megabyte (formatted capacity)
Disk removable: No
Drive dimensions: 1-5/8"H x 4"W x 6"D (third-height)
Data transfer rate: 261,120 bytes per second
Average access time: 80 milliseconds
Drive controller format: RLL

INPUT / OUTPUT

Serial port: DB25 (25 pins), RS-232 interface, system call COM1
Parallel port: DB25 (25 pins), system call LPT1
Audio ports: Headphone (15 to 35 ohms)
Pointing device port: One (6 pins)
Keyboard: Standard with system, detachable
Keys: 101, with 12 function keys, or 86 (spacesaver)
Video monitor port: 12" color or 12" monochrome
Video modes/display characteristics: MCG, MCGA, CGA (320 x 200 x 256 colors), (640 x 480 x 2 colors)

BUNDLED SOFTWARE

Operating system: None supplied (DOS 3.3 or higher)
Programming languages: ROM Basic
Testing software: Starter Disk



CONFIGURATION RECORD

REAR PANEL CONNECTORS

<i>Port</i>	<i>Installed</i>	<i>Power req.</i>	<i>Purchased from</i>	<i>Date</i>
Keyboard	IBM Keyboard	+12V, 275mA (maximum)	Standard	
Pointing device				
Parallel port				
Serial port				

EXPANSION BOARD CONNECTORS

<i>Slot</i>	<i>Installed</i>	<i>Power req.</i>	<i>Purchased from</i>	<i>Date</i>
Top				
Bottom				

PERIPHERAL DIP SWITCHES

System board version _____

Key serial number _____

Computer serial number _____

AC POWER PROTECTION



The power company supplies good, steady power up to your house or office building, but the power within the building may be subject to all sorts of fluctuations. Protect your system against these fluctuations for longer, trouble-free operation and error-free data.

THE SOURCE

Plug your PS/2 into a grounded 120-volt AC outlet. The outlet should not share a circuit with some power-hungry appliance, such as a refrigerator or air conditioner. When these appliances start up and shut down, they cause power drops and power surges that could wipe out data and damage your system.



Caution: Each AC power cord should plug into its own socket on the surge suppressor or filter. Do not use an extension cord to increase the number of sockets. Instead, buy a suppressor/filter with enough sockets to handle all your pieces of equipment.

INTERFERENCE

If you work near a TV, radio, or amateur broadcasting station, protect against electronic interference with a *Radio Frequency Interference (RFI) filter*. You may also need metallic screenwire or foil "shades" for unshielded internal or external cables or circuitry if they are causing any interference or loss of data. Such shades do not need to be grounded; they work by making RF shadows. If you have installed external devices to your system and they are not operating properly, it may be necessary to use foil or metal to block interference that may be coming from your monitor.

POWER DROPS AND SURGES

Even when you find the perfect outlet, you'll experience an occasional power drop or surge. Various devices are available to protect against these threats. They can be purchased from business computer stores or electronics distributors.

GOOD *Surge suppressor*

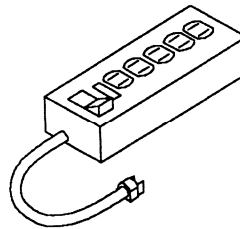
Protects your system against power surges that could damage your computer's components, but does not protect your data in the event of a power outage. Plugs into a grounded 120-volt AC outlet, and your computer plugs into the surge protector.

BETTER *Uninterrupted power supply (UPS)*

Protect both your system and your data from power failure. The UPS is a battery backup system. When the power dips or goes out completely, the UPS kicks in, keeping your computer running for a specified period of time so that you can save your data to disk.

BEST *Full on-line battery backup*

This unit fully conditions the AC power supply from its source to your computer, providing your computer with a steady flow of electricity. Uses a battery-inverter-regulator circuit, which relies on the on-line AC only for battery charging. Connect the battery backup to a grounded 120-volt AC outlet and plug your computer into it.



You can't tell which is which just by looking at these devices. When shopping the magazine ads, read the fine print!



DISASTER RECOVERY PLANNING

Your computer system is a lot more valuable than its original cost. Chances are, you've installed and customized the software on your hard disk and stored valuable data that, if not irreplaceable, would be time-consuming to reconstruct. If your computer failed for any reason, you would suffer not only a loss of money, but also a loss of time and effort. It's essential, then, that you take the necessary steps to protect your system's programs and data files.

HARDWARE

Use the specification sheet and configuration record at the front of this booklet to record all system upgrades and modifications. Log any settings, such as your printer's DIP switches, in the space provided. If you lose your system to theft, fire, or some other disaster, you can use these records to reassemble your system.

SOFTWARE

Before you install any program on your computer, copy the program disks you purchased. Refer to original software documentation for backup copy instructions.

Write-protect the original disks and store them in a cool, dry place away from your computer and away from any magnetic fields. Run the program using the backup copies. If anything happens to those backup copies, you then have the originals to recopy.

If you configure (customize) the software for your own use, make a backup copy of the configured programs. For example, you may add commands to certain programs, choose settings for your printer, or make other changes to the software. If something were to happen to this updated software, the original program disks would not have these settings.

DATA

Your data is the hardest part of your system to replace.

Copy the files you create or modify, at least every week, if not daily. Label the disks with the filenames and the current date so that you know which is the latest version of the file. Again, store the copies away from your computer and other disks in case disaster strikes.

HARD DISK BACKUP

Since a hard disk stores much more data than a floppy disk, it requires special treatment. Perform a full hard disk backup whenever you update or reconfigure your system. Perform daily backups of any data files you modify.

Use this DOS command to back up your hard disk to floppies:

```
C>backup c:\*.* a:/s 1
```

Your subdirectories will be saved with your backup. The command will also build a log file called BACKUP.LOG in the root directory of your hard drive, which you can use to find the backup files quickly.

To restore the backup files from the floppies to your hard drive, use this command:

```
A>restore a: c:\*.* /s
```

Full backups can take a lot of time and can require 50 or more disks. You can make the job easier by:

- Purchasing special software that compresses the data to require fewer disks and less time.
- Backing up after hours, when nothing else needs to be done.
- Purchasing a disk utility program to copy files that are too large to fit on a floppy disk.
- Adding a streaming tape drive to the system to back up files that are too large for floppies.

ROUTINE CARE



The PS/2 Model 25 is durable and will give years of service without special pampering, but you should be aware of the following elements that threaten its performance. Take precautions and perform routine maintenance to keep your computer running right.



Note: See also Safety Precautions, page 8.

STATIC ELECTRICITY

If you work in a very dry environment where your hair stands on end or you get zapped anytime you touch somebody, your computer needs protection against static, which spells danger to electronic equipment. Static electricity may cause your computer not to respond to the keyboard when a key is pressed. To regain keyboard control, press and hold the Ctrl, Alt, and Delete keys, or turn power off and on again. Spray an antistatic solution directly on your computer table and chair. Spray some of the same solution on a soft towel, and gently wipe the keys on your keyboard.

HEAT

Extreme temperatures can damage your computer or prevent it from operating as it should. Store your computer in a room that stays between 60 and 80 degrees fahrenheit, and keep the computer's ventilation holes clear.

BRIGHTNESS

Adjust the brightness of your monitor to a moderate level. If you keep it too bright, you'll scorch the screen. If you're having trouble reading the screen, try turning down the lights and closing the shades first. A glare proof screen can be purchased to attach to the monitor.

MOISTURE

If you must drink some beverage while you're working at your computer, keep it away from your computer and keyboard. If you move your computer from a cool,

dry area to a warm, moist one, wait for the condensation to dry from the screen, then wait at least one hour before operating the computer.

WHEN THERE'S A SPILL...

If you dump your soda on the keyboard, all is not lost if you'll work quickly. Unplug the computer immediately from the AC power. Turn the keyboard over to let the liquid drain. Then dunk it in a bucket or tub of water (distilled is best, but not worth waiting on a trip to the store), and let it drain and air dry.

DUST AND DIRT

Store your computer in the least dusty room you can find, and clean the room regularly. Special dust covers are available commercially for when the computer is not in use. Keep your computer and the area around it clutter-free, and don't eat or smoke near your computer. You can clean keyboards, printed circuit boards, and printers using a hand-held vacuum with a small nozzle and a soft brush. Unplug the computer before cleaning, and be careful not to bend any electrical parts. Clean your mouse, monitor screen, and keyboard at least twice a month.

MAGNETISM

Your computer stores information magnetically on disks. Keep disks away from magnetic materials such as refrigerator magnets, speaker magnets, and even your computer screen, because even small magnets can scramble the data.

JOLTS

Be careful when moving your computer. If you drop it from as little as one inch, the read/write head can come crashing down on your hard disk, wiping out valuable data and damaging the disk. If your computer does not automatically "park" the head over a data-free area on the disk, buy a program that does.



DISASSEMBLY



SAFETY PRECAUTIONS

- Perform only those tasks you are *qualified* to perform.
- Don't touch anything until you are sure there are no *shock hazards* between exposed metal surfaces, cable shields, and circuit commons. Some devices (video monitor, printer) may have one of the AC wires connected to the power supply shield or to ground. Do not connect any such device to any other until you've eliminated the shock hazards. An isolation transformer can reduce the hazard.
- Before you connect any device to AC power, make sure the *voltage* of the AC outlet is appropriate for that device. Match the fuse box information to power label information on the unit.
- If your AC cord has a *three-prong grounding* plug, use it; don't bypass this important safety device. Use only undamaged AC cords. Do not allow anything to pinch the AC cord. Heat may be generated if the AC cord is coiled.
- *Unplug* the unit before installing, removing, or cleaning any circuitry or component.
- Avoid power leakage and static discharge through any *soldering* tool tip. Also, avoid overheating components when soldering them.
- Use only *test equipment* that draws minimal power from the circuit under test, and produces no static discharge danger. Use a volt meter that has a high ohms-per-volt rating and use an oscilloscope that has isolation probes.
- Avoid aerosols, sprays, or liquids that may excessively chill a component or produce static charges. Sudden *chilling* can crack circuit elements.
- *Static electricity* can damage low-voltage components. Use an anti-static wrist strap when working on components.

TO REMOVE THE BOTTOM COVER

1. Turn off the computer and any peripherals, unplug them from the AC power source, and remove all cables from the computer. Make sure keyboard is unlocked.
2. Lay the computer face down on a soft protected surface.
3. Remove two screws securing the tilt mechanism and remove the tilt mechanism.
4. Remove two screws from the cabinet back. Lift the bottom cover up and swing it out and down. The system board is now accessible.

When reinstalling the bottom cover, be sure all cables are reconnected and not pinched as the cover is closed. The slots in the bottom cover must engage with the pins in the display unit. Move the cables and connectors as needed to reinstall the tilt mechanism without obstruction.

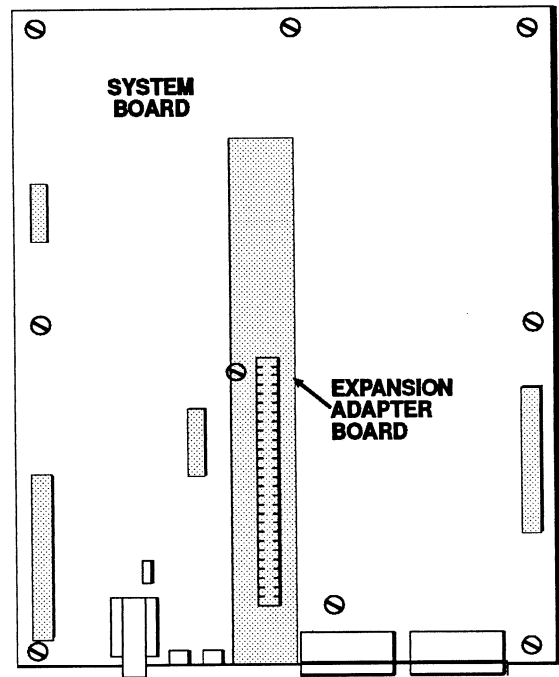
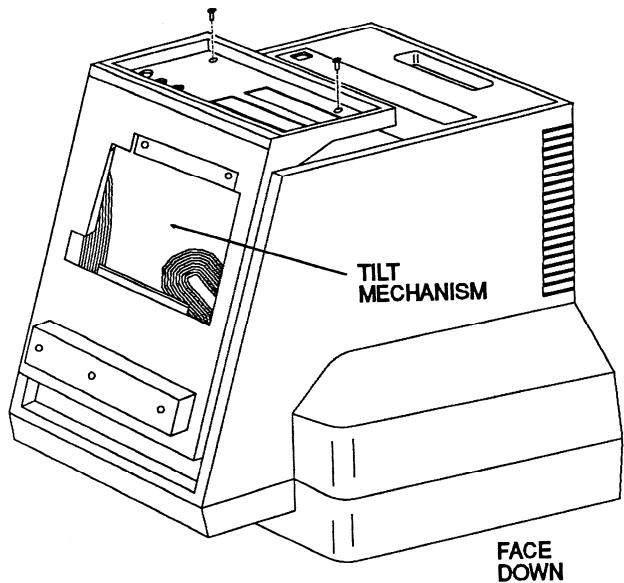


WARNING: If operating the computer while open, connect a clip lead from a bare metal point on the rear panel to the subchassis frame to maintain continuity of ground.

TO REMOVE THE SYSTEM BOARD

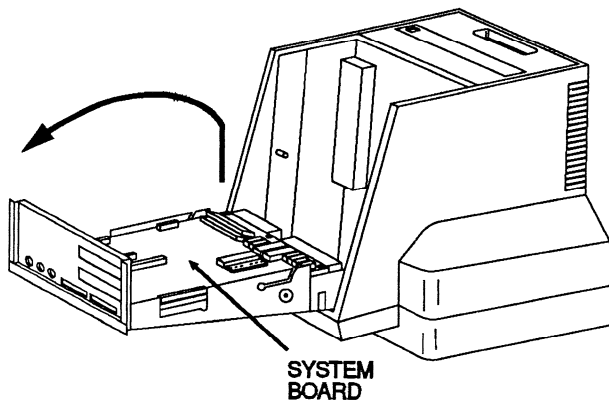
1. Remove the bottom cover and take antistatic precautions.
2. Check to see if any adapter boards are present. If any are present remove the screws from the rear panel and rock the board from side to side to remove.
3. Disconnect all connectors to the system board.
4. Remove the nine screws securing the system board.
5. Remove the screw securing the expansion adapter board plastic mounting to the rear panel.
6. The system board can now be removed.

DISASSEMBLY



TO REMOVE THE EXPANSION ADAPTER BOARD

1. Remove the bottom cover, remove the screw from the back panel, the screw from the system board, and take antistatic precautions.
2. Disconnect the expansion adapter board from the system board and remove the expansion adapter board from its plastic mounting.

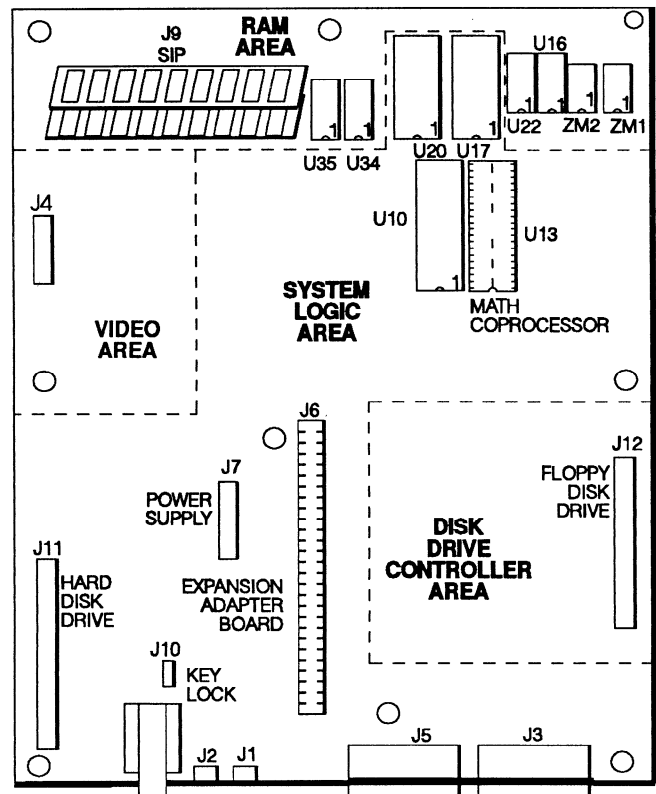
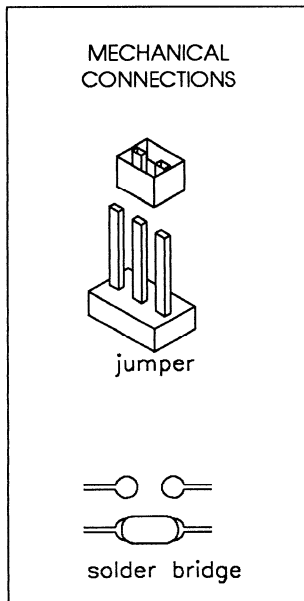


TO REMOVE THE DISK DRIVE

1. Remove the bottom cover and take antistatic precautions before proceeding.
2. Disconnect the disk drive connector through the tilt mechanism hole.
3. Remove two screws securing the disk drive to the side of the bottom cover, and pull out the disk drive.



SYSTEM LAYOUT



MECHANICAL SELECTIONS



When fitting expansion or accessory boards into slots on the expansion adapter board, you may need to set switches or jumper connections to select options on the added board.

Place the jumpers as specified by the accessory manufacturer. Then check that the system works as intended, and log the changes in selections.

ELECTRONIC SELECTIONS



When starting up the system or setting defaults for new software or boards, you make electronic selections that change the startup sequences of the computer's operating system.

Once you are comfortable with the selections you have made, log your choices for each board or software package. Later installations may require you to refer to these selections or to reconcile conflicting selections.

Serial port rate, stop bits, and parity are examples of choices that may need to be revised from time to time. Being able to refer to electronic selections will save setup time when you change hardware such as serial printers or modems.

SYSTEM LAYOUT



- The list of socketed ICs provided here will help you identify these chips for ordering replacements. Type numbers may or may not be printed on the devices.
- Check the layout shown here against your own machine, as minor differences from machine to machine occur during production.

SOCKETED INTEGRATED CIRCUITS

Item	Type	Function
U10	P8086-2	Microprocessor
U13	--	Math Coprocessor
U16	HM50464P-12	Part of 128K RAM
U17	S63256D	ROM
U20	S63256D	ROM
U22	HM50464P-12	Part of 128K RAM
U34	HM50464P-12	Part of 128K RAM
U35	HM50464P-12	Part of 128K RAM
ZM1	M3764A-15	Part of 128K RAM
ZM2	M3764A-15	Part of 128K RAM

J4 VIDEO

Pin	Signal
1	Analog Ground
2	Red
3	Analog Ground
4	Green
5	Analog Ground
6	Blue
7	Analog Ground
8	Signal Ground
9	Horiz Sync
10	Signal Ground
11	Vert Sync
12	Signal Ground
13	Monitor Sense 0
14	Monitor Sense 1

J7 POWER SUPPLY

Pin	Signal
1	Power Good
2	Ground
3	+12VDC
4	-12VDC
5	Ground
6	Ground
7	Ground
8	Ground
9	-5VDC
10	+5VDC
11	+5VDC
12	+5VDC

J11 HARD DRIVE

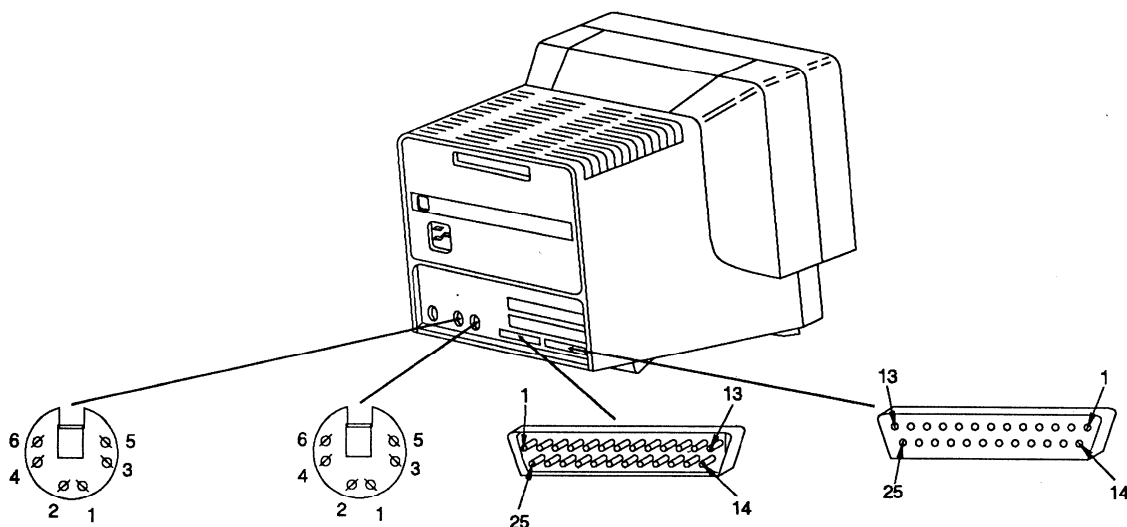
Pin	Signal
1	Reset Drive
2	Disk
3	Data0
4	Ground
5	Data1
6	Ground
7	Data2
8	Ground
9	Data3
10	Ground
11	Data4
12	Ground
13	Data5
14	Ground
15	Data6
16	Ground
17	Data7
18	Ground
19	I/O Read
20	Ground
21	I/O Write
22	Ground
23	Disk Cylinder Select
24	Ground
25	Address0
26	Ground
27	Address1
28	Ground
29	Address2
30	+5VDC
31	Reserved
32	+5VDC
33	DACK3
34	Ground
35	DRQ3
36	Ground
37	IRQ5
38	Ground
39	I/O Ch Rdy
40	+12VDC
41	Spare
42	+12VDC
43	Spare
44	+12VDC

J12 DISK DRIVE

Pin	Signal
1	Signal Ground
2	Reserved
3	Signal Ground
4	Reserved
5	Signal Ground
6	Not Connected
7	Signal Ground
8	Index
9	Signal Ground
10	Motor Enable 1
11	Signal Ground
12	Drive Select 0
13	Signal Ground
14	Drive Select 1
15	Signal Ground
16	Motor Enable 0
17	Signal Ground
18	Direction
19	Signal Ground
20	Step
21	Signal Ground
22	Write Data
23	Signal Ground
24	Write Enable
25	Signal Ground
26	Track 0
27	Signal Ground
28	Write Protect
29	Signal Ground
30	Read Data
31	Signal Ground
32	Head 1 Select
33	Signal Ground
34	Diskette Change
35	Ground
36	Ground
37	Ground
38	+5VDC
39	Ground
40	+12VDC



EXTERNAL CONNECTIONS



KEYBOARD

Pin	Signal
1	Keybd Data
2	Not Connected
3	Ground
4	+5VDC
5	Keybd Clock
6	Not Connected
Shield	Frame Ground

POINTING DEVICE

Pin	Signal
1	Data
2	Not Connected
3	Ground
4	+5VDC
5	Clock
6	Not Connected
Shield	Frame Ground

SERIAL PORT (DB25)

Pin	Signal
1	Not Connected
2	Transmit Data
3	Receive Data
4	Request To Send
5	Clear To Send
6	Data Set Ready
7	Signal Ground
8	RLSD
9	Not Connected
10	Not Connected
11	Data Terminal Ready
12	Not Connected
13	Not Connected
14	Not Connected
15	Not Connected
16	Not Connected
17	Not Connected
18	Not Connected
19	Not Connected
20	Data Terminal Ready
21	Not Connected
22	Ring Indicator
23	Not Connected
24	Not Connected
25	Not Connected

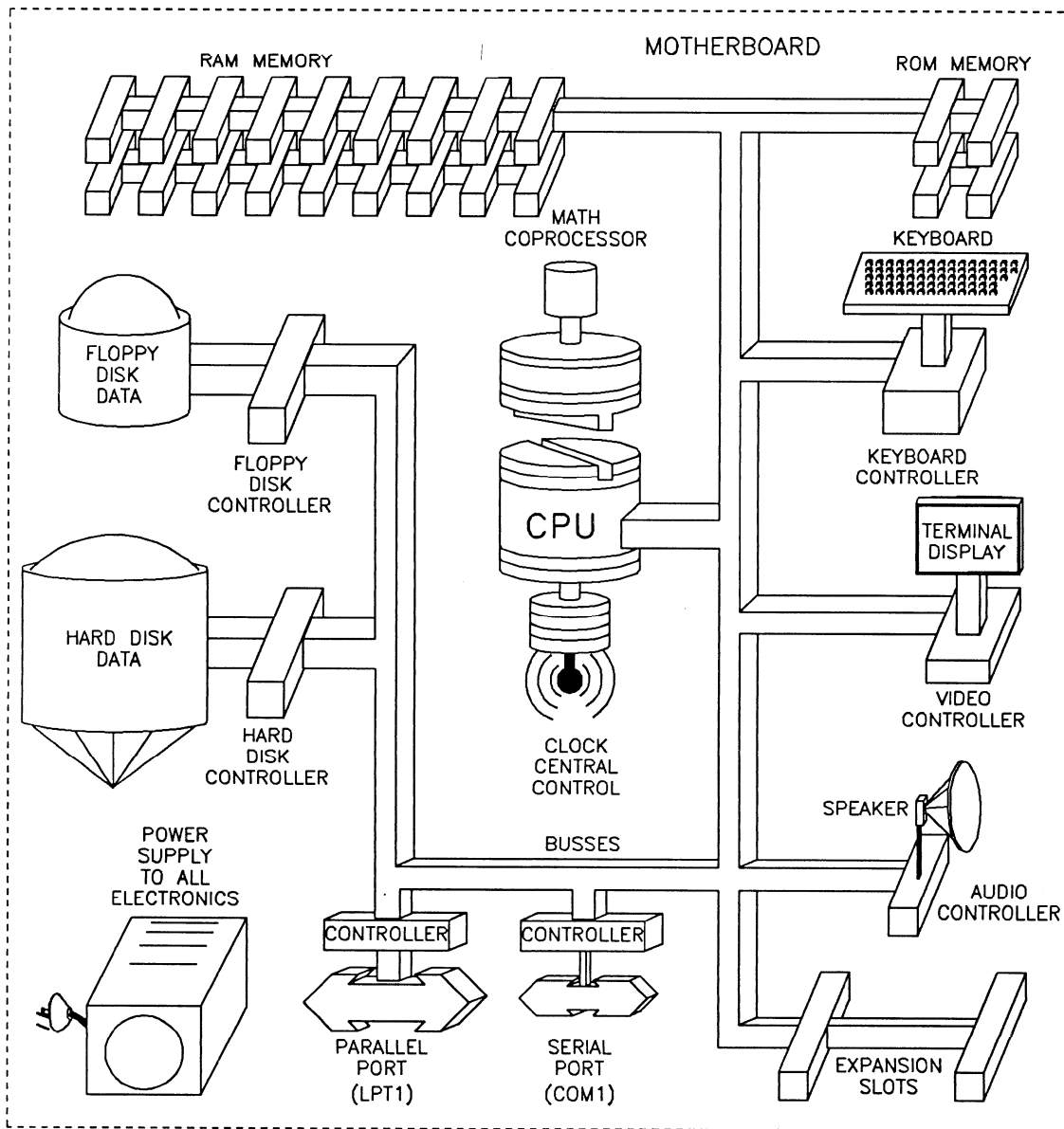
PARALLEL PORT (DB25)

Pin	Signal
1	Strobe
2	Data0
3	Data1
4	Data2
5	Data3
6	Data4
7	Data5
8	Data6
9	Data7
10	Acknowledge
11	Busy
12	Paper End
13	Select
14	Auto Paper Feed Ext
15	Error
16	Initialize
17	Select In
18	Ground
19	Ground
20	Ground
21	Ground
22	Ground
23	Ground
24	Ground
25	Ground

EXPANDING THE SYSTEM

THE BIG PICTURE...

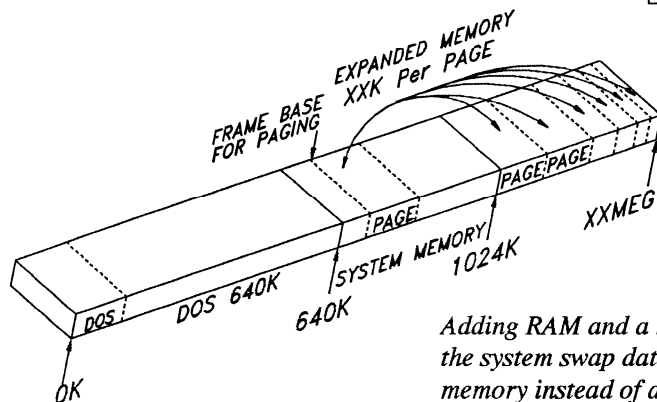
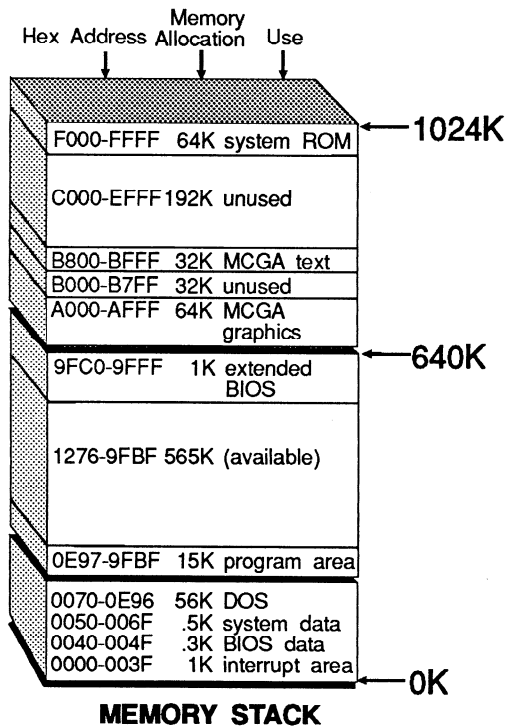
The CPU processes only one thing at a time. It cycles through the system at a predetermined clock speed and gives attention in turn to all the devices shown below. Bottlenecks or problems at any point can slow the throughput of data. When you upgrade, select replacements or enhancements that relieve those bottlenecks.





EXPANDING THE SYSTEM

For a quick look at how much memory you have to work with--regular, extended, and expanded (EMS)--type **chkdsk** or **mem** (DOS 4.0).



Adding RAM and a memory manager lets the system swap data pages in and out of memory instead of accessing the much slower disk.

TAKE INVENTORY

Before you upgrade, or while troubleshooting poor system performance, look at these files for a reminder of how your system is set up:

- **AUTOEXEC.BAT** Shows what commands you've asked DOS to execute automatically at system startup, and tells where they're located.
- **CONFIG.SYS** Shows the device drivers the system is using, how memory is allocated, and the settings that you can change to control system performance.

Chances are, your computer came from the store with **AUTOEXEC.BAT** and **CONFIG.SYS** already set up. You probably selected additional options for them while installing your application programs. To view these files, go to the system prompt and press type **autoexec.bat** or type **config.sys**. If you need to create them from scratch, follow the instructions in your system manual.

Before you alter either of these files, copy the file under another name to save the current settings in case your changes don't work out. Also read about these files in your system manual to learn all the options you have and to help you reset the options when you upgrade.

Hint: Be aware that a graphical user interface like Windows modifies **CONFIG.SYS** to maximize its own performance. You'll need to work within its settings to also meet your needs.

Device drivers are programs that let your system talk to its attached peripherals. Don't be satisfied with the device drivers that came installed with your computer. Your local PS/2 users group is a good place to get advice about the other options you have.

EXPANDING THE SYSTEM



POWER CONSUMPTION

Consider the total power consumption of all cards in the system before adding another. If you have logged the power supply requirements of each installed card in your configuration record, simple addition will tell you how much power your present configuration is drawing. When you need more power than IBM's standard power supply can furnish (see specs page 3), change to a power supply with a higher ampere rating.

When the needed power exceeds the power supply rating, many power supplies will shut off rather than malfunction or damage circuitry. If you reduce power consumption by removing an accessory board or two, such a power supply will function normally.

INSTALLING BOARDS



Static Danger: Static electricity can ruin an expansion or enhancement board. Take the following precautions to keep that from happening. Wear an anti-static wrist strap and work on an anti-static surface if possible. The boards often come in anti-static packaging. To even out the static charge on all the items that will contact the board, don't take the board out of its protective wrapper until you've touched the wrapper and the power supply case at the same time.

Most boards are shaped so that you can connect them in only one way, but there are exceptions. To avoid damage, always follow the manufacturer's instructions, especially if the board can be installed backward.

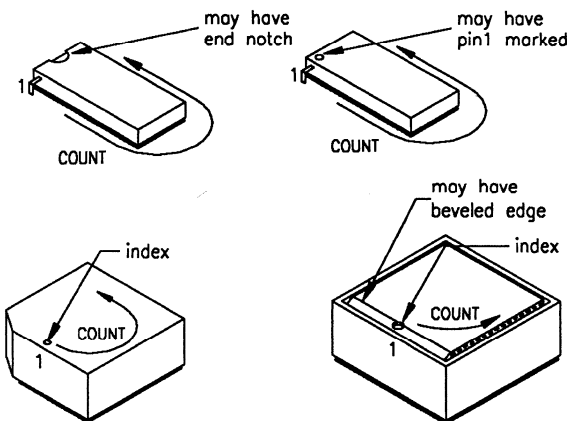
When upgrading or inspecting a system, identify the Integrated Circuit (IC) and connector orientation by their markings. Make sure the pin 1 markings on the circuit board match the marks on the ICs and connectors. Note any that do not match so that you do not reassemble them wrongly.

Pin 1 of dual-inline-pins (DIP) flat cable connectors or board edge connectors may be unmarked, relying on the cable marking to identify connections. If no mark identifies pins on the connector, check the cable color for the proper connection. Most other types of connectors can be connected in only one way.

If you have a choice of slots to use for the board, choose the slot that keeps the board farthest from other circuits. This prevents overheating and short circuits.

HOW TO FIND PIN 1

The pin numbers increase as you move counterclockwise from pin 1. Different kinds of ICs have different clues to tell you where pin 1 is located. Look for these marks:





EXPANDING THE SYSTEM

INSTALLING CHIPS



Caution: When buying replacement ICs, make sure the type number, speed, and power are equivalent. Also, be sure the shape of each new IC is the same as the original, so that they can be exchanged in the same mounting style.

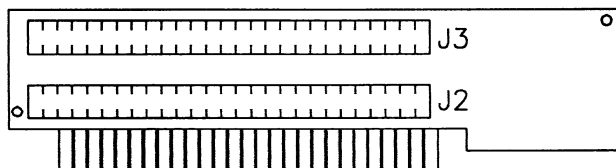
Replacement chips are available for the most common system boards. The socketed chips of the PS/2 Model 25 are listed in the System Layout section. You must be able to identify the chips in order to replace them. An IBM sales and service center can help, if you describe the numbers on the chip, the number printed next to the chip on the system board (e.g., U10), the board version number (stamped or stickered on the system board), the shape of the chip, and the number of pins.

If the pins are soldered into the board, or do not go into the board but are soldered to the top of the board (surface mounted), they must be removed with special equipment. If the IC is socketed, not soldered, it is easier to replace suspected ICs with known good ICs and there is less danger of damaging the good replacement.

The pins of new dual-inline-pins (DIP) ICs are flared. To fit the chip into the socket, set one side's pins in the socket, press gently to that side, then rock the other side into the socket.

J2 AND J3 EXPANSION ADAPTER BOARD

Pin	Signal	Pin	Signal
A1	IO Ch Check	B1	Ground
A2	Data7	B2	Reset Drive
A3	Data6	B3	+5VDC
A4	Data5	B4	Interrupt Req2
A5	Data4	B5	-5VDC
A6	Data3	B6	Direct Mem Req2
A7	Data2	B7	-12VDC
A8	Data1	B8	Reserved
A9	Data0	B9	+12VDC
A10	IO Ch Rdy	B10	Ground
A11	Address Enable	B11	Mem Write
A12	Address19	B12	Mem Read
A13	Address18	B13	IO Write
A14	Address17	B14	IO Read
A15	Address16	B15	Direct Mem Ack3
A16	Address15	B16	Direct Mem Req3
A17	Address14	B17	Direct Mem Ack1
A18	Address13	B18	Direct Mem Req1
A19	Address12	B19	Mem Ref
A20	Address11	B20	Clock
A21	Address10	B21	Interrupt Req7
A22	Address9	B22	Interrupt Req6
A23	Address8	B23	Interrupt Req5
A24	Address7	B24	Interrupt Req4
A25	Address6	B25	Interrupt Req3
A26	Address5	B26	Direct Mem Ack2
A27	Address4	B27	Transmission Complete
A28	Address3	B28	Address Latch Enable
A29	Address2	B29	+5VDC
A30	Address1	B30	Oscillator
A31	Address0	B31	Ground



EXPANDING THE SYSTEM



ASSESSING YOUR NEEDS

The PS/2 Model 25 is the most basic model in IBM's PS/2 lineup. It's designed for the student and homeowner with modest data processing needs. As such, it has some definite limitations when it comes to upgrades. But there's a lot that can be done to maximize the computer's performance before you have to move up to a more powerful model.

You have two expansion slots to work with: one full size and one half size. This makes the Model 25 compatible with any upgrades available for the IBM PC XT, with the added bonus that the Model 25 runs under a faster processor (the 8086 chip instead of the 8088) at a higher clock speed (8 MHz instead of 4.77). You also have three ports to work with: one parallel, one serial, and one for a pointing device such as a mouse.

Because of the limited number of slots and ports in the Model 25, you need to consider carefully the tradeoffs between the benefits of possible enhancements and their potential for tying up those slots and ports.

RECOMMENDATIONS

- To get the most out of your expansion slots, purchase a *multifunction board* that includes expanded memory, a serial port, a parallel port, a game port, and a clock--and uses only one expansion slot.
- Consider adding an *external line switch* to an existing port. This lets you connect more than one device to the port (a joystick, for example), and you simply switch to the device you need.
- Add a *clock* for convenience, especially if you spend a lot of time revising drafts or updating spreadsheets or databases. Then DOS will automatically attach the correct dates and times to your files as you revise them, and you'll be able to tell which draft is the most recent. Without a clock, you must remember

to enter the date and time every time you start up the computer.

The chart on the next page is to help you figure out which other upgrades would most benefit the applications you use or would like to use. The chart is followed by specific upgrades suited to the Model 25.

CLUES TO SYSTEM BOTTLENECKS

Hard disk light flashes frequently--The system is accessing the disk a lot, and could use a disk cache program and more RAM so that it could avoid the frequent trips to the disk.

Screen takes a long time to "repaint" lines--Noticeable when you scroll through a document or move from page to page in a desktop publishing program. Your microprocessor may be overloaded with the graphic input; a video card carrying its own microprocessor may help but is not a practical option with your system.

The printer takes forever to print while you wait--You can set up a print spooler in expanded memory, or set up a virtual disk to hold the files so that you can work on other things while they print. Or you can get a print buffer that has its own RAM.

The cursor lags way behind your typing speed--Your document may be too large, or your word processor takes up too much memory. You could add memory and/or upgrade to a faster CPU. Or you could switch to a smaller editor.

Your spreadsheet slows to recalculate every time you change a cell--A math coprocessor would speed the calculations so that you'd hardly notice a delay.

You get "disk full" messages a lot--The bells and whistles on the new software applications take their toll on your disk space. It may be time to upgrade to a larger capacity disk drive, keep some of your files on floppy disks, or use special file compression programs.

You get "insufficient memory" messages a lot--Do some housekeeping to clear out programs you don't need, and check your system configuration memory allocations. You may need to add memory and use memory management software.

In general, any time you have to sit and wait on the computer--That's an indication of a bottleneck somewhere in the throughput of data. Reevaluate your settings in CONFIG.SYS and look for possible hardware upgrades.

You've upgraded everything imaginable, and you still have to wait--Time for a more powerful computer...or more patience.



SUGGESTED UPGRADES

<i>Applications</i>	<i>To Process Faster</i>	<i>To Handle More Data</i>	<i>To Get Better Graphics/Printing Faster</i>	<i>Popular Software</i>
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WORD PROCESSING

Simple correspondence	(not essential)	(not essential)	NLQ or LQ printer	Q&A Write, PC-Write
Long manuscripts (articles, books)	More RAM Mouse	Larger hard disk & faster controller	NLQ or LQ printer EGA or VGA monitor & video board; 2-page display	Microsoft Word, WordPerfect
Desktop publishing (flyers, menus, newsletters)	Mouse	Larger hard disk & faster controller	Laser printer; color printer EGA or VGA color monitor & video board	PC PageMaker, Ventura Publisher
Graphical user interface (also usable by other applications in this chart)	More RAM Mouse	Larger hard disk & faster controller	EGA or VGA monitor & video board	Windows, DesqView, GEM

SPREADSHEETS

Personal finances	(not essential)	(not essential)	EGA or VGA monitor & video board	PC-Calc, Quicken
Production schedules, complex cost estimates	Math coprocessor Mouse	More RAM	EGA or VGA monitor & video board	Lotus 1-2-3, Microsoft Excel

COMMUNICATION

Modem communication	Autodial; high speed DMA software	Larger hard disk & faster controller	(not essential)	ProComm, Crosstalk, PC Anywhere
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SUGGESTED UPGRADES



<i>Applications</i>	<i>To Process Faster</i>	<i>To Handle More Data</i>	<i>To Get Better Graphics/Printing Faster</i>	<i>Popular Software</i>
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DATABASE

Mailing list	More RAM	Larger hard disk & faster controller	NLQ or LQ printer	PC-File, Q&A, Reflex, Rapidfile
Research data management	More RAM Faster hard drive	Faster hard drive		dBASE IV, dBASE III Plus, FoxPro, Paradox, R:Base, Double Helix
Accounting package		Larger hard disk & faster controller	NLQ or LQ printer	Oracle

GRAPHICS

Games	(not essential)	Larger hard disk & faster controller	VGA color monitor	Flight Simulator
Graphs & charts		Larger hard disk & faster controller	VGA color monitor Laser printer & more RAM	Harvard Presentation Graphics, Freelance Plus
Draw & paint programs	Mouse More RAM	Larger hard disk & faster controller	VGA color monitor Color printer Laser printer	Corel Draw PC Paintbrush Plus

TECHNICAL

Statistical number crunching	Math coprocessor More RAM	Larger hard disk & faster controller	NLQ or LQ printer	Stata, SAS, SPSS
Software development	Subroutine library	Larger hard disk & faster controller	NLQ or LQ printer	Microsoft C, Microsoft Macro Assembler, Turbo Pascal
CAD/CAE	Math coprocessor; digitizing tablet; mouse; more RAM	Larger hard disk & faster controller	PGA monitor & video board	Autosketch Generic CAD



SUGGESTED UPGRADES



Model 25 does not have the 32-bit Micro Channel Architecture (MCA) of the other models in the PS/2 line. Be sure the expansions and software you purchase are specifically for the Model 25.

DISK DRIVE OPTIONS

- Internal 3.5" 30M (megabyte) hard disk drive
- External 5.25" 360K floppy disk drive (will not read 1.2M disks even if formatted at 360K)
- External 5.25" 1.2M floppy disk drive
- External 5.25" 200M optical disk drive

The Model 25 has room for two internal 1/3-height drives. If you purchased your Model 25 recently, you probably already have a hard drive. If you don't, that's the first logical upgrade. The 5.25" external drives are useful if you have lots of files already stored on 5.25" disks or if you want to be compatible with another computer that has only 5.25" drives. The optical disk drive is a WORM (write once read many) drive particularly useful for storing quantities of files for reference.

Each of these options requires an adapter card, preferably with its own power supply. The optical disk drive's adapter card can run two drives, so the second drive doesn't need its own controller.

MEMORY OPTIONS

- 128K memory expansion
- 2M expanded memory adapter

Increasing memory capacity (RAM) lets you store more information where the computer can use it, without retrieving it from a disk, and take advantage of RAM cache and virtual disk enhancements. But you'll also need to install a memory manager (...EMM.SYS) to let your system know that it has that extra memory above 640K.

KNOW YOUR ROM DATE?

Your friends will be impressed that you know the date of your ROM chip, and you'll know whether that chip can support the latest upgrade options. The announced ROM date for the Model 25 is 06-26-87. Run this short BASIC program to confirm the ROM date for your system:

```
10 DEF SEG=&HF000
20 FOR X=&HFFF5 TO &HFFFD
30 PRINT CHR$(PEEK(X));
40 NEXT
```

SPEEDUP OPTIONS

- Accelerator board
- Math coprocessor IC 8087

Accelerator boards give your system the power of more advanced computers without the cost. Look for PC XT-compatible accelerator boards that include expanded memory. Boards are available that can make your computer run like an 80286 or 80386-based system. A math coprocessor is especially useful to speed calculations with decimal numbers.

VIDEO OPTIONS

- EGA adapter
- VGA adapter

The Model 25 comes with MCGA (Multicolor Graphics Array) on the system board, which is compatible with CGA (Color Graphics Adapter). Although the MCGA uses a subset of VGA (Video Graphics Array), it is not VGA-compatible. The on-board MCGA adapter already gives you color and high resolution, so although EGA and VGA adapters are available, they may not be worth giving up an expansion slot for.

SUGGESTED UPGRADES



PRINTER OPTIONS

- Dot matrix printer, with a range of 9 pins (draft quality) to 24 pins (near letter quality) on the print heads, and the capability of printing graphics.
- Daisywheel printer, which gives good letter quality but can't print graphics. Font styles are changed by changing the daisywheel, which can be inconvenient if you do it often.
- Laser printer (cartridge or Postscript) for the best quality text and graphics. The more expensive option, but versatile, especially for desktop publishing.
- Printer buffer (internal or external), to hold files in the printer while they are being printed, freeing up the computer for other work.
- Desk plotter, to print charts and graphs in color for presentations (should be HPGL compatible).

Printers come in a wide range of prices and capabilities. Choose the best you can afford for the applications you are using.

COMMUNICATION OPTIONS

- Internal or external modem

Modems are handy for tying into mainframe computers or for sending messages long-distance through networks. They come in various baud rates, from 300 to 2400 baud, which represents how fast they can transfer data over phone lines. You will need communications software to go with the modem.

- ARCNET or Ethernet adapters, with boot ROM socket

These adapters will let you network with other computers in a local area network (LAN). Networking software is needed to go with the adapters.

OTHER OPTIONS

- Voice recognition board and speech synthesizer, lets the computer accept voice commands and speak the output, useful for the visually impaired and for artificial intelligence applications.
- Sound board, for several sound channels and speech capability
- Joystick or trackball, alternatives to a mouse, attach to the pointing device port.
- Digitizing tablets and scanners, varying in price and dots-per-inch resolution. Useful for quick input of graphics and text from other printed materials.

TO INSTALL INTERNAL OPTIONS



Warning: You can damage the system unit by inserting incorrectly sized adapters. They must be IBM PC XT compatible and not thicker than .8". The adapter inserted in the top expansion slot must not be longer than 8"; the one inserted in the bottom slot must be no longer than 13.2".

Remove the metal plate from the rear panel before installing expansion adapters. Installed adapters prevent access to the memory expansion and 8087 math coprocessor IC sockets, so install the adapters last.

The 128K memory consists of two 16-pin and four 18-pin ICs. Insert the ICs into sockets on the system board. Avoid bending the pins, and make sure the notch is correctly positioned.



TROUBLESHOOTING

KEEP GOOD RECORDS

When you first connect and test your computer, document the steps and screen messages, and note the sounds as the system starts up. This record is a good first entry to a log book history of your computer's performance and problems.

Log even your system's minor mechanical problems. If a key binds or the keycap flies off, you may want to fix the problem immediately. But if a character sometimes repeats as you key it in, you may want to hold off correcting the problem until it occurs frequently or is combined with other problems. A log will remind you of all known problems.

WARNING SIGNS

Following are some of the common warnings that the computer is headed for trouble.

- **Startup messages:** Your computer will display messages as it starts up. A change in these messages may reveal impending failure. The top of the screen will show a memory value, such as 640 K, at startup. When you change the startup sequence, this will change. Be mindful of the amount of memory your system says it has. If the amount of memory or the exact wording of the message changes, it may be a sign of trouble.
- **Power-up time:** If it takes your computer longer and longer to boot up, the system may be in trouble. You may have a flaw in your startup disk or drive, your power supply may be weak or damaged, or your cable connections may be loose. This change may be gradual and difficult to notice.
- **Fan noise:** Listen to your computer; how it sounds may be a good indication of how well it's doing. If

you hear the power supply fan, you know your power supply is connected and supplying power to the fan.

- **Disk drive noise:** You may not hear your hard drive over the sound of your fan. If you don't normally hear the drive, but you hear it now, that could be a sign of trouble. Disk drives make characteristic noises when reading a disk. If the drive chatters during operation, the drive may be drifting off radial adjustment, or the disk may be failing.
- **Power supply noise:** Some power supplies have relays that tick softly as the supply energizes. If your computer fails and you don't hear the expected tick when you power up, suspect your power supply.
- **Electronic noise:** The interference signature of a computer can be watched or listened to for changes from what has been noted before. Circuit operation causes broadcast signals that are filtered or shielded to prevent interference with commercial stations. This faint signal can still be picked up by a nearby TV or an AM radio held near the computer, and will have a characteristic pattern or sound as the circuits are activated during power-up. The signal evens out as all parts of the system are energized. The signal may be heard as noise on some AM station settings and as tones on other stations. The PS/2 has strongest signals near the high end of the AM band (1600kHz). The startup voice will be most pronounced near the power supply.

If the characteristic signals of your system are present but seem different than normal, run diagnostic software while the system still works. If the signals are missing, suspect the power supply.



PS/2 STARTUP

A power-on self test is performed automatically each time you turn the computer on. You can also perform other tests with the Starter Disk. You will need a blank formatted disk for each disk drive.

Boot up the system as described on this page. After the screen menu comes up, press Enter and the Starter Disk Main Menu will be displayed. From the Starter Disk Main Menu choose Services by typing 2 and pressing Enter. Select the System Checkout option from the menu.

The system checks out properly if no error messages are received. If you do receive an error message, refer to the list of error messages on the next two pages to help you isolate the problem.

You may be instructed to press the F1 key after some system errors, but be sure to record the error before pressing F1. If you need to seek technical assistance, take along your log of symptoms and error messages.

DIAGNOSTIC SOFTWARE

You can purchase system diagnostic software to check most circuits (including some accessory boards) of a system that is still able to read a disk. Some examples are:

- SpinRite II: for hard disk drives, Gibson Research Corporation.
- PC Tools: for disk file maintenance and recovery, Central Point.

Use the diagnostic software at the first sign of trouble, so that problems can be corrected before the system shuts down completely.

BOOTING UP THE PS/2 MODEL 25

With the Starter Disk in the disk drive, boot the system by turning on the system unit or by pressing the Ctrl, Alt, and Del keys at the same time. With two drives, the left disk drive is Drive A. Switch on the system unit power. The system should run a self test, beep once, and display the following:

IBM

IBM PERSONAL SYSTEM/2 MODEL 25

Starter Disk

(c) Copyright IBM Corporation, 1987

Press Enter (<-) to Continue

If this message is not displayed, check that you inserted the Starter Disk, and that the brightness and contrast adjustments are at their middle setting. Then refer to Other Symptoms in the troubleshooting chart on page 26.

If the message displayed properly, press the Enter key and see the following message:

IBM PERSONAL SYSTEM/2 MODEL 25

STARTER DISK

Version 1.XX

(c) Copyright IBM Corporation, 1987

STARTER DISK MAIN MENU

1. LEARNING ABOUT YOUR SYSTEM

2. SERVICES

System Checkout

Format Disk

Copy Disk

Set Time and Date

Select a Number and Press ENTER

ESC = Quit

Menu selections will step you through any of the tasks you choose.

To use software, refer to the manuals supplied with the software.

To run ROM BASIC, startup the system unit without the Starter Disk in the disk drive. Press the F1 key when prompted to insert a disk.



TROUBLESHOOTING

<i>Startup Test Message Code</i>	<i>Location of Error</i>	<i>Service</i>
(XX = any number)		
1XX (except 199)	System board	System unit
199	Installed devices list	(1)
2XX (except 205)	Memory address	System unit
205	Memory error	System unit (2)
301	Keyboard or system unit	(3)
302 - (without hard drive)	System unit	System unit
302 - (with hard drive)	System unit keylock is locked	(4)
5XX	Display	System unit
6XX	Disk error or Starter Disk program will not load	(5)
7XX	Math coprocessor	System unit
9XX	Parallel port	System unit
10XX	Alternate parallel	System unit
11XX	Serial port	System unit
12XX	Alternate serial	System unit
13XX	Joystick	Joystick or system unit
14XX	Printer	Printer
15XX	SDLC	System unit
17XX	Hard drive	System unit
20XX	BSCA	System unit
21XX	Alternate BSCA	System unit
30XX (Except 3015 or 3042)	Network failure	System unit
3015 or 3042	Network failure	Network
31XX (Except 3115 or 3142)	Network failure	System unit
3115 or 3142	Network failure	Network
84XX	IBM Personal System/2 speech option failure	System unit and speech control assembly

TROUBLESHOOTING



<i>Startup Test Message Code</i>	<i>Location of Error</i>	<i>Service</i>
ROM Error	--	System unit
Parity Check 1	--	System unit
Parity Check 2	--	System unit
(1) <i>Internal devices (except the option adapters)</i>: if an internal device is missing from the list, the system unit must be serviced. <i>External devices and the option adapters</i>: if an external device is missing from the list, refer to the troubleshooting instructions supplied with the device. If the instructions are not available, the device must be serviced. (2) Applies to the 128K expansion option; the system can be used with reduced memory by pressing the F1 key. (3) Check that the keyboard is connected and that no keys are being held down. Then switch the system unit off, wait 20 seconds and switch the system unit back on. If the 301 error is still received, switch the system unit off, plug the keyboard cable into the pointing device connector, and switch the system unit back on. If the 301 error is cleared, the system unit		
must be serviced. If the 301 error is still received, the system unit, the keyboard, and the keyboard cable must be serviced. (4) Unlock the keylock and press the F1 key. If the keylock is unlocked, the system unit must be serviced. (5) Check that you are using a copy of the Starter Disk and that it is inserted correctly into the disk drive. Try again; if the program will not load, the system unit must be serviced. If you see a 6XX error message with a 5-1/4 inch external disk drive attached, switch off the external disk drive and the computer. Insert copy of the Starter Disk into drive A, switch on the computer, and perform the System Checkout. If a 6XX error is still received, the system unit must be serviced. If a 6XX error is not received, the external disk drive must be serviced.		



TROUBLESHOOTING

<i>Other Symptoms</i>	<i>Service</i>
No beep during self test	System unit
More than one beep during self test	System unit
Continuous beep	System unit
No keyboard keys work	System unit, keyboard, keyboard cable
Some keyboard keys work	Keyboard and keyboard cable
Blank screen	System unit
Cursor not displayed	System unit
Only cursor displayed	System unit
Unreadable screen	System unit
Display problems	System unit
Tests stop and unable to continue	System unit
Printer error or problems	(1)
Keylock does not lock keyboard	System unit
Any other error message	System unit
(1) Check the printer connections, the printer power, printer switched on, and proper adjustment of printer. Check the printer instructions and run self-test. If the	printer self-test is correct, service the system unit. If there is still a problem, seek technical assistance.

TROUBLESHOOTING



TROUBLESHOOTING STRATEGY

When a computer fails, the system will have operated from power-up to the point of failure. Determining how far along the system worked before failing is the key to isolating the problem.

First, limit the number of components in the system. Remove any peripheral devices, and test the system without those devices. If the system works fine without one of those devices connected, you know that device, or the circuit operating it, is causing the problem.

If the peripherals are not causing the problem, then start from the point at which the system failed and work backward. Trace the problem back to its source, isolate it, and eliminate it. Retest the system. If it fails again, continue to work back from the point of failure.

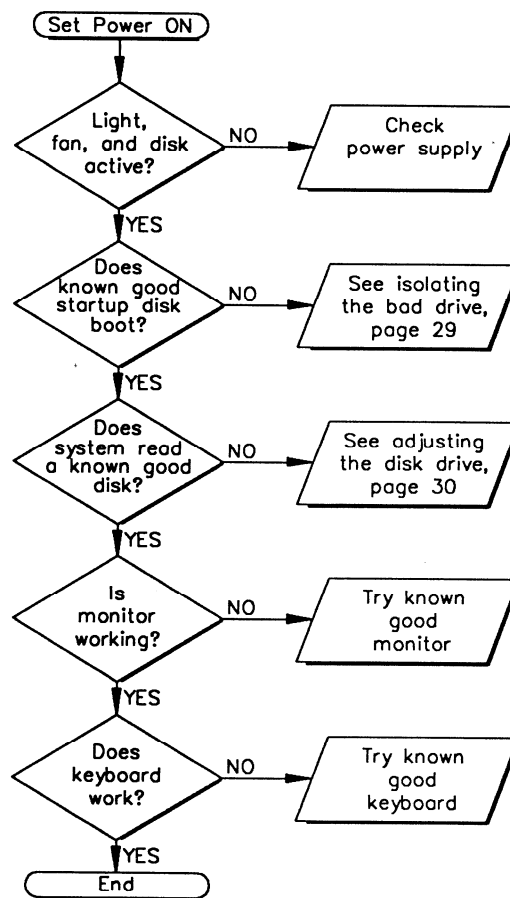
SAFETY PRECAUTIONS



Hazardous AC voltages are present in your computer and in any AC powered peripherals. Opening cases can expose dangerous AC power; unplug the unit before working on it.

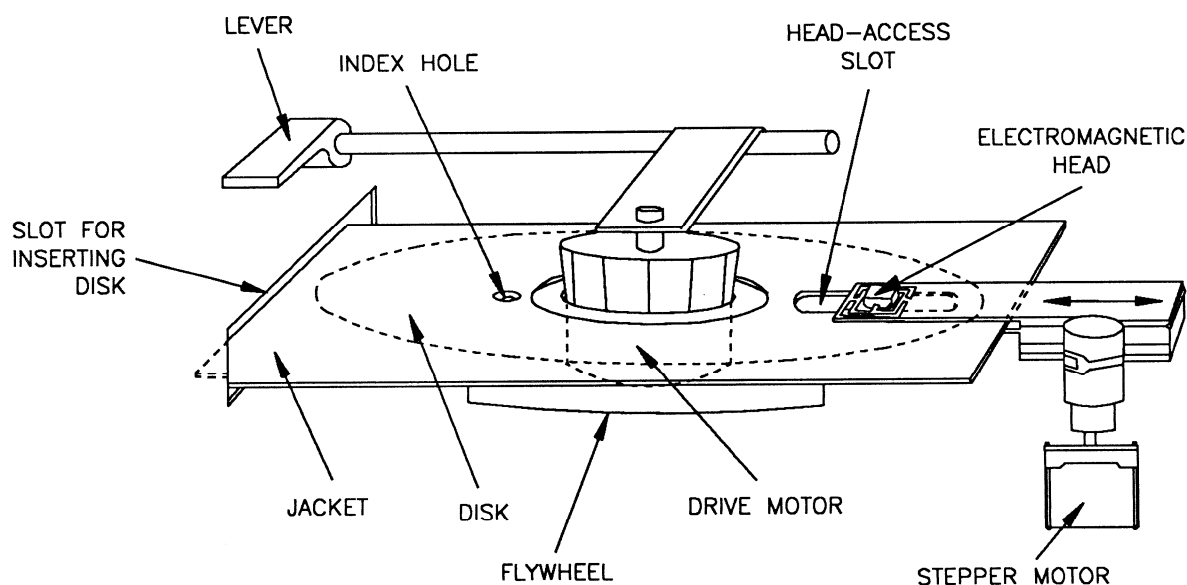
Be especially careful when working with a CRT or some other types of displays. These displays may have high-voltage DC even when the AC power cord is disconnected. You must connect the contact under the rubber boot on the CRT to ground before starting work. Do not touch or allow metal to contact the CRT glass or socket. Wear safety glasses and handle the CRT carefully to avoid dangers from implosion.

WARNING: *Opening the case may void the warranty. Some accessories may require installation by a technician to keep the warranty valid. Perform only the tasks that you're qualified for.*





DISK DRIVE PROBLEMS



PARK BEFORE YOU MOVE

Don't move your computer without first parking the heads. Parking moves the hard disk heads to an area of the disk that is not used for data storage, so that they don't come crashing down on your data during the move.

To park the heads:

Insert the Starter disk into the hard drive and boot the system by pressing Ctrl, Alt, and Del at the same time. Press Enter when the title screen appears.

Press 2 for SERVICES and press Enter. Press Enter again.

Press 3 for PREPARE SYSTEM FOR MOVING and press Enter.

Turn off the computer, insert a blank disk into the drive, and you're ready to move.

Your disk drive is one of the busiest parts of your system, so it's one of the most common components to suffer electronic and mechanical failure.

PRELIMINARY CHECKS

If your disk drive is silent, unusually noisy, or just fails to load programs or data, the problem may be nothing more than a loose connection or a faulty disk. Check the following elements before you get into any in-depth troubleshooting:

- Are the drive cable leads and connectors clean and undamaged?
- Are the drive cable connectors firmly connected?
- Does the disk you're trying to use operate successfully in a working computer?
- Hard drive: If a hard drive slows or reports errors, back up the remaining files and reformat the disk. Then, if the reformat is good, restore the files.

DISK DRIVE PROBLEMS



ELECTRICAL OR MECHANICAL?

Mechanical misadjustments account for a high percentage of disk drive failures and are reasonably simple to correct.

If the drive fails gradually, the failure is likely to be mechanical. But if a drive fails suddenly, and cannot read the last file it wrote, although the file does read on another drive, the failure may well be electronic. Electrical failure is often not practical to repair, and replacing the drive may be more cost effective.

If the failing drive is a hard drive, and periodic backup-reformat-restore has not improved operation, a cleanroom is needed for repair. Floppy drives, however, can usually be mechanically adjusted with readily available testing and adjustment programs, test disks, and common tools.

ISOLATING THE BAD DRIVE

The first step in troubleshooting disk drive failures is to isolate the failing drive. Either replace the drive with a known good one or move the suspect drive to a working system.

- If the good drive fails to work in the troubled system, or the suspect drive works in a good system, you know the drive is good; the drive interface may be defective.
- If the suspect drive fails to work in a working system or the replacement drive works in the suspect system, the drive is the problem.

If your computer has two compatible drives, swap the two drives within the system to see if the problem changes with the drive or stays with the location.

- If the problem stays with the location, the cables and controllers are suspect.

If your system has different drive types (manufacturer, disk size/capacity) substitute a replacement disk drive for the malfunctioning disk drive, or try the problem drive in a known working computer.



When exchanging drives, exchange the jumpers (movable shorting connectors), switches, and connectors as well. The connections used by the system to identify and activate individual drives must be set to match each drive to the position the drive is mounted in. If connections are set wrong, the computer may not be able to activate or communicate with the drive.

Follow these steps to remove and exchange disk drives.

- Mark the drive that is expected to activate (boot) first. Mark each connector at the drive most easily removed, before removing it, and mark the drive to match.
- Remove the drive and inspect it for switches and jumpers. These configuration devices are usually at the back of the drive and often can be reached while the drive is installed. Mark the switches and write down the jumper connections well enough to be able to restore them after the drive swap.



DISK DRIVE PROBLEMS

- Remove the second drive and inspect it for the same switches/connectors identified on the first drive removed. Again document the configuration for later restoration.
- Change the configuration of the drive that is not the boot drive to make it like the drive that is the boot drive. (Make B look like A.) Install the reconfigured drive in the boot position (opposite from where it was removed), connecting the computer with the cables that go to the boot location.
- Put a good Starter Disk in the drive and turn the computer on. If the system boots with the drive in the boot location, replace or repair the drive removed from that position.
- If the drive does not boot, try the drive in a working system. If the drive works in a good system, repair or replace the main system board. If the drive does not work in the good system, both the drives from the defective system may be bad.
- Index delay: a sensor position or electronic delay circuit that sets the time between a disk rotation point and the time to start counting sectors
- Spindle speed
- Data window (rarely adjustable)

Adjustment failures on the PS/2 3-1/2 inch disk drive will probably be radial adjustment or, if heads have been replaced, azimuth adjustment.

Track 00, index, and azimuth can be checked by disk test programs with precision recorded test disks. Adjustments should be made in the order specified by the test program, to the tolerance set by the program.

Pressure adjustment (repositioning of the spring pressing the heads toward the disk) should never need to be changed from the factory setting.

Spindle speed and radial tracking can be adjusted with simple mechanical manipulations as described next.

ADJUSTING THE DISK DRIVE

When you're sure the drive is bad, you can install the suspect drive as the second drive in a good system and begin testing the drive to determine whether it's out of adjustment.

Disk drive test programs are commercially available to help you check the following:

- Head radial: the position of the head on a line from hub to rim
- Head azimuth: the twist of the head face to hold head gap square to disk rotation
- Track 00 detector position: a sensor that activates when the disk head is within one track of the outermost track position

SPINDLE SPEED

The floppy disk is clamped to the hub of a flywheel. When the drive door is closed and the drive is activated the flywheel is accelerated to a precise 300 RPM. A speed error may be caused by disk drag, misadjustment, or a speed feedback loop failure.

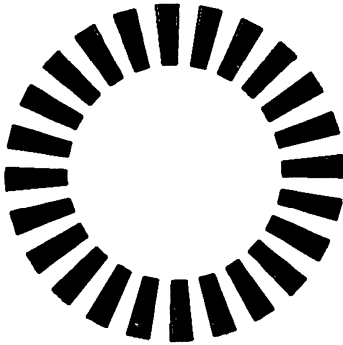
If there is only one speed adjustment, the speed should change within a narrow range around the correct speed for the drive. If there are two adjustments, often one will set the target speed and the other will set the rate and swing of correction (search).

Speed can be checked by attaching a strobe disk to the flywheel and watching it under fluorescent light. For a

DISK DRIVE PROBLEMS



drive test program speed check, use a formatted but empty test disk. If the drive speed is correct, the pattern should look like this:



Note: The control marked Speed may be a data window adjustment (valid bit value interval) not affecting rotation (index interval). If the speed needs adjusting, try this control. If the control works, set speed for 300 RPM, +/- 10 RPM. If speed is not changeable, replace the drive.

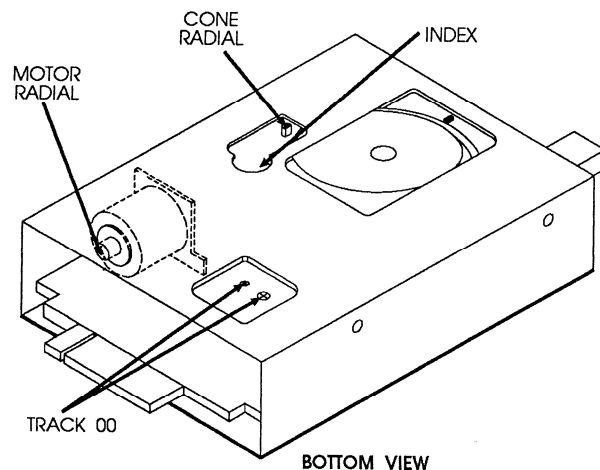
RADIAL TRACKING

An unprotected commercially duplicated program can be used as a test disk for disk read functions. First test the drive for physical damage to a test disk by trying to read a disk copied by another drive. After the read test on the bad drive, read the disk on the drive that made the copy.

If the copy is still readable, try the commercially duplicated program as the test disk in the drive to be aligned. Be sure the write protect switch is set to protect the disk.

To adjust the radial:

- If the drive does not read, move the head toward or away from the spindle.
- Move the head away from the spindle by loosening the motor radial screw slightly and tightening the motor radial screw until snug. Overtightening may damage the motor radial cone.
- Move the head away from the spindle by loosening the motor radial screw slightly and tightening the cone radial screw until snug.
- Adjust the head until the drive reads correctly.
- Glue the cone and radial screws when adjustment is completed.



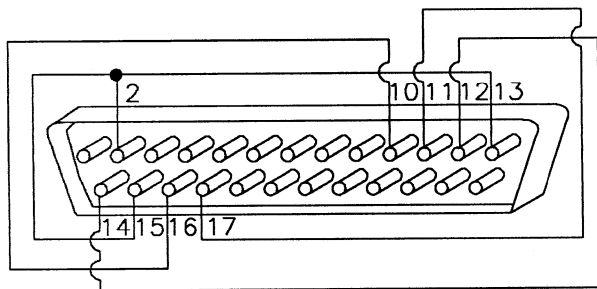
If the drive still will not read the test disk, the problem may be electronic, in which case you may want to replace the drive.



INPUT/OUTPUT PROBLEMS

TESTING THE PARALLEL PORT

To determine if a problem is in the computer or in a peripheral device connected to the parallel port, use a loopback connector. To make the loopback connector, purchase a male 25 pin "D" connector (DB25M) and solder wires to the following pins: pin 2 to pins 13 and 15, pin 12 to pin 14, pin 10 to pin 16, and pin 11 to pin 17.



Plug the loopback connector to the parallel port connector on the back panel. Turn on the computer and load Basic. Enter and run the following Basic program:

```
10 CLS
20 LOCATE 1,1
30 OUT 888,0:OUT 890,0
40 PRINT"A=";INP(888)
50 PRINT"B=";INP(889)
60 PRINT"C=";INP(890)
70 OUT 888,255:OUT 890,255
80 PRINT"D=";INP(888)
90 PRINT"E=";INP(889)
100 PRINT"F=";INP(890):GOTO 20
```

The program writes to and reads from the interface locations and displays the following message:

```
A=0
B=55
C=224
D=255
E=207
F=255
```

If the numbers *are* as listed here, check the device connected to the parallel port.

SYMPTOM LOG