

COVER Book Cover

IBM Personal System/2

Server 85

Hardware Maintenance
Service and Reference

December 14, 1992

Part Number 52G9981

+--- Note -----+
| Before using this information and the product it supports, be sure to |
| read the general information under "Notices" in topic 2.13. |
+-----+

First Edition (December 14, 1992)

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FRONT_1 About This Manual

The Personal System/2 Hardware Maintenance Service and Reference manual contains *both* service and reference information for the IBM Personal System/2 Server 85.

- The service information includes procedures for isolating problems to a FRU, a Symptom-to-FRU Index, and a system parts listing.
- The reference section of the manual includes safety information, general information, product descriptions, and information about the advanced diagnostic tests.
- This manual should be used with the advanced diagnostics tests (found on the Reference Diskettes, Advanced Diagnostic Diskettes, or in the System Programs) to effectively troubleshoot problems.

+--- **Important** -----+
|
| This manual is intended for trained servicers who are familiar with
| PS/2 products. Before servicing a PS/2 product, be sure to review the
| safety information under "Safety Information" in topic 2.10.
|
+-----+

FRONT_2 Related Publication

For more information about other PS/2 products, refer to the *Hardware Maintenance* manual (form number S52G-9971, part number 52G9971).

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1.0 Hardware Maintenance Service

Subtopics

- 1.1 General Checkout
- 1.2 Installed Devices List
- 1.3 Related Service Procedures
- 1.4 Symptom-to-FRU Index
- 1.5 Using the Parts Catalog

1.1 General Checkout

The diagnostic tests are intended to test *only* IBM (*) marketed products. Non-IBM marketed products, prototype cards, or modified options can give false errors and invalid system responses.

Before You Use This Pamphlet: The IBM Personal System/2 (*) Server 85 system is complex. The *Hardware Maintenance Service* is written based on the assumption that you have first familiarized yourself with the background information in the *Hardware Maintenance Reference* part of this manual.

Running Automatic Configuration

Warning: Running Automatic Configuration may alter customized configuration settings. Note the current settings using **View configuration**. If the configuration was customized, restore it to the customized settings after service is complete.

Memory-Address Conflicts: For information on this subject, see "Resolving Memory-Address Conflicts" in topic 2.1.6.

Diagnosing Combined FRUs: If an adapter or device consists of more than one FRU, an error code may be caused by any of the FRUs. Before you replace the adapter or device, remove the FRUs, one by one, to see if the symptoms change.

Using Error Codes: Use the first error code presented on the screen to diagnose the failure. If multiple error codes are presented, diagnose them in the order that they are presented (the multiple errors might be false errors).

If there is not an error code on the screen, see if the error symptom is listed in the Symptom-to-FRU Index.

Erasing the Power-On Password

1. Power-off the system.
2. Move the override jumper JMP1 to connect the center pin and the pin on the opposite end of the connector.
3. Power-on the system to erase the password. Leave the jumper in the new position until the next time you need to erase the password.

System Diskettes and Diagnostic Tests: Run the diagnostic tests from the System Partition on the hard disk drive. If the hard disk drive is not operational, run the tests from the System Diskettes (Reference and Diagnostic).

```
+----+
|001|
+----+
```

- Power-off the system and all external devices.
- Verify the power-on password is inactive.
- Check all cables and power cords.
- Make sure there are no diskettes in the drives.
- Power-on all external devices.
- Power-on the system.

Notes:

1. If you get a POST error code, press the pause key (while the error code is on the screen). Write down any error codes that are displayed, then press F1 to continue.
2. If the system hangs with a POST error presented, go to "Symptom-to-FRU Index" in topic 1.4.

- Check for the following responses:

1. One or two short beeps.
2. Readable instructions or the Main Menu.

DID YOU RECEIVE THE CORRECT RESPONSES?

```
Yes No
|   |
```

```
| +---+
| |002|
| +---+
| Go to "Symptom-to-FRU Index" in topic 1.4.
|
+---+
|003|
+---+
ARE ANY EXTERNAL SCSI DEVICES ATTACHED TO THE SYSTEM?
Yes No
| |
| +---+
| |004|
| +---+
| Go to Step 007.
|
+---+
|005|
+---+
DID THE POWER-ON LIGHT ON ALL OF THE EXTERNAL DEVICES COME ON?
Yes No
| |
| +---+
| |006|
| +---+
| Check the power supply voltages for the failing external device, ref
| to the Hardware Maintenance manual (form number S52G-9971, part
| number 52G9971).
|
+---+
|007|
+---+
DID YOU RECEIVE A POST ERROR CODE?
Yes No
| |
| +---+
| |008|
| +---+
| Go to Step 016.
|
+---+
|009|
+---+
IS THE FIRST POST ERROR CODE WITHIN THE RANGE OF 0208XXXX 190I TO 0247XXXX
190I?
|
IMPORTANT: If your error code is not in the range or if it is not
followed by a 190I, answer No.
Yes No
| |
| +---+
| |010|
| +---+
| Go to Step 016.
|
+---+
|011|
+---+
- Restart the system and verify that the "Enable" and "Disable" settings
are correct. (For more information, go to "SCSI Device Default
Settings" in topic 1.3.4.) If you receive a warning on the screen
regarding the "Keep" and "Remove" settings, follow the instructions on
the screen before continuing.
DID YOU HAVE TO CORRECT ANY OF THE ENABLE AND DISABLE SETTINGS?
Yes No
| |
| +---+
| |012|
| +---+
| Go to "Symptom-to-FRU Index" in topic 1.4. Before you replace any
| SCSI devices, verify there are no duplicate SCSI ID settings.
|
+---+
|013|
+---+
- Restart the system.
DID THE POST ERROR REMAIN?
Yes No
| |
| +---+
| |014|
| +---+
| Continue with Step 016.
```

|
+----+
|015|
+----+

Go to "Symptom-to-FRU Index" in topic 1.4.

+----+
|016|
+----+

- Press **Ctrl+Alt+Del**. When the cursor moves to the upper right, press **Ctrl+Alt+Ins** and check for the following responses:

1. One or two short beeps.
2. Readable instructions or the Main Menu.

DID YOU RECEIVE THE CORRECT RESPONSES?

Yes No

|
+----+
|017|
+----+

Go to "Symptom-to-FRU Index" in topic 1.4.

Note: If you cannot access the hard disk drive, try loading diagnostics from the System Diskettes. This might take up to 10 minutes.

+----+
|018|
+----+

- If you are not at the Main Menu, follow the instructions on the screen to advance to the Main Menu, then press **Ctrl+A** and run system checkout.
- If the test stops and you cannot continue, go to "Undetermined Problem" in topic 1.3.6.

Notes:

1. If the system has incorrect keyboard responses, go to "Keyboard Errors" in topic 1.3.2.
2. If the printer has incorrect responses, go to "Printer Errors" in topic 1.3.3.
3. If the display has problems such as jittering, rolling, shifting, changing colors, or being out-of-focus, go to "Display Self-Test" in topic 1.3.1.
4. If a minimum of 896KB of memory is not active, the diagnostic tests cannot be loaded.

IS THE LIST OF INSTALLED DEVICES CORRECT?

Note: Video Memory and 487SX (option) will not be listed.

Yes No

|
+----+
|019|
+----+

Go to "Installed Devices List" in topic 1.2.

+----+
|020|
+----+

- Run the advanced diagnostic tests.

DID THE TESTS IDENTIFY A FAILURE?

Note: If the test stops and the system hangs, replace the last device being tested.

Yes No

|
+----+
|021|
+----+

Note: If you noticed an error symptom or if you received any POST error codes when the system was powered-on, go to "Symptom-to-FRU Index" in topic 1.4.

You may have an intermittent problem:

- Check for damaged cables or connectors.

- Reseat all adapters, drives, and modules.
- Check the system fans.
- If you did not find a problem, go to "Undetermined Problem" in topic 1.3.6.

+---+
|022|
+---+

Follow the action described on the screen. If that does not correct the problem, go to "Symptom-to-FRU Index" in topic 1.4.

Note: Defective memory might be disabled. If you replace memory, run the memory diagnostic test to enable the replacement memory.

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1.2 Installed Devices List

At the start of the diagnostic tests, the Devices List is displayed. Normally, all adapters and devices installed in the system appear on the list.

- If an adapter or device that appears on the list *is not* installed in the system, use the procedure in "Undetermined Problem" in topic 1.3.6 to find the problem.
- If an adapter or device that *is* installed in the system does not appear on the list, you have one of the following conditions:
 - The DGS files for the missing device are not loaded onto the System Partition (run **Copy an option diskette** using the option diskette).
 - An unrecognizable adapter is installed.
 - The missing device is defective or it requires an additional diskette or service manual.
 - A defective adapter is causing the device to disappear from the list.

If you are sure that the DGS files are loaded and all the options are supported, note which type of device (SCSI or non-SCSI) is missing from the Devices List, then continue.

Subtopics

- 1.2.1 If a Non-SCSI Device is Missing from the Devices List
- 1.2.2 If a SCSI Device is Missing from the Devices List
- 1.2.3 If Both a Non-SCSI Device and a SCSI Device are Missing from the Devices List
- 1.2.4 Memory
- 1.2.5 Finding the Failing Memory

1.2.1 *If a Non-SCSI Device is Missing from the Devices List*

Replace the missing device.

If more than one non-SCSI device is missing, isolate them one at a time until you find the device causing the failure.

Note: If the number of diskette drives shown on the list is incorrect, an error can occur during the tests. If this is the case, restart the system, select **View Configuration** from the Set Configuration menu and verify that the drive information is correct, then continue testing.

If a SCSI Device is Missing from the Devices List

1.2.2 If a SCSI Device is Missing from the Devices List

The system board or the SCSI controller supporting the missing device might be defective. The SCSI controller can be on an adapter or the system board. If more than one SCSI controller is present in the system, isolate each *chain* of devices one at a time.

1. Power-off the system and disconnect any internal and external SCSI devices from SCSI the system board interface (except the default drive).
2. Power-on the system and run **Automatic Configuration**. If the SCSI adapter is not on the Devices List in Advanced Diagnostics, it is defective. If the SCSI system board interface is on the list, run the adapter diagnostic tests.
3. If the SCSI system board interface fails the tests, replace the system board. If the SCSI system board interface passes the tests, an adapter or device might be defective.
4. Reconnect all the devices to the SCSI interface.
5. Use the procedure in "Undetermined Problem" in topic 1.3.6 to find the problem.

If Both a Non-SCSI Device and a SCSI Device are Missing from the Devices List

1.2.3 If Both a Non-SCSI Device and a SCSI Device are Missing from the Devices List

Use the procedure in "Undetermined Problem" in topic 1.3.6 to find the problem.

1.2.4 Memory

Notes:

1. Only *parity* (70ns) memory kits are supported. Minimum operating requirement is one 2MB kit. Total system memory capacity is 64MB.
2. Running either customer or advance diagnostic tests will deallocate defective memory. After you replace defective memory, run the memory diagnostic test to enable the replacement memory. Then, restart the system and rerun the same test to validate the installed memory-module kits.

Run the advanced-memory diagnostic test. If the test does not indicate which memory-module kit failed, or if the system hangs, try running the test from the System Diskettes. If you still cannot identify which memory-module kit failed, continue with the following procedure.

Note: If a screen message appears asking if you have replaced a specific memory module kit, suspect that it is the failing kit.

1.2.5 *Finding the Failing Memory*

Using a known-good kit, exchange each kit, one at a time (within each matched pair), and repeat the memory diagnostic test until you find the defective kit. Replace *only* the defective kits. If the kits are not the problem, suspect the system board.

Note: If the kits are installed in a noninterleaved configuration, you can remove and replace them in any order.

1.3 Related Service Procedures

You are here because you were sent here from another area of this pamphlet, or you want information on the following:

- Display Self-Test
- Keyboard Errors
- Printer Errors
- SCSI Device Default Settings
- Power Supply Check
- Undetermined Problems.

Subtopics

- 1.3.1 Display Self-Test
- 1.3.2 Keyboard Errors
- 1.3.3 Printer Errors
- 1.3.4 SCSI Device Default Settings
- 1.3.5 Power Supply Check
- 1.3.6 Undetermined Problem

1.3.1 Display Self-Test

If the screen is rolling, replace the display assembly. If that does not correct the problem, replace FRUs in the following order until the problem goes away:

1. Display adapter
2. System board

If the screen is not rolling, run the display self-test as follows:

1. Power-off the system unit and display.
2. Disconnect the display signal cable.
3. Power-on the display.
4. Turn the contrast to its maximum position.
5. Turn the brightness control to the center detent position.

Check for the following conditions:

- You should be able to vary the screen intensity by adjusting the contrast and brightness controls.
- The screen should be white or light gray, with a black margin (test margin) on the screen.

Note: The location of the test margin varies with the type of display. The test margin might be on the top, bottom, or one or both sides.

If you do not see any test margin on the screen, replace the display. If there is a test margin on the screen, replace the FRUs, in the following order, until the problem goes away:

Note: Certain adapter failures can cause video problems. Before replacing any FRUs, remove any option adapters to see if the problem disappears.

1. Display adapter
2. System board
3. Display.

1.3.2 Keyboard Errors

1. Power-off the system.
2. Disconnect the cable from the keyboard.
3. Power-on the system and check the connector for the voltages shown.
All voltages are $\pm 5\%$.

PICTURE 1

If the voltages are correct, replace the keyboard.

If the voltages are not correct, suspect the keyboard cable, then the system board.

1.3.3 Printer Errors

1. Make sure the printer is properly connected and powered-on.
2. Run the printer self-test.

If the printer self-test does not run correctly, the problem is in the printer. Refer to the printer service manual.

If the printer self-test runs correctly, install a wrap plug on the parallel port and run the advanced diagnostic tests to determine which FRU failed.

If the advanced diagnostic tests do not detect a failure, replace the printer cable. If the problem remains, replace the system board.

1.3.4 SCSI Device Default Settings

You are here with a 000174XX error or you want to check the settings (defective devices can also cause incorrect settings).

The optional settings are intended to let the user share devices (usually external) between systems without having to reconfigure the system each time the device is moved. The settings apply to SCSI Presence Error Reporting devices (such as SCSI tape drives and CD-ROM drives, and on some systems, hard disk drives). After a device is in the configuration table, the default settings are "Enable" and "Keep." The only way to remove the device from the configuration table is to manually remove it by changing the settings. Running automatic configuration will not remove it from the configuration.

Enable and Disable Settings: If the user plans to leave the device turned off, or share the device periodically between different systems, that device should be set to "Disabled" (on the systems that will share the device). When disabled, the drive will remain in the configuration but POST will not report a configuration error when the device is removed. For example, before the user temporarily removes a SCSI tape drive, the setting should be changed to "Disabled." When the device is reinstalled and the user no longer chooses to share the device, the setting should be changed back to "Enabled."

Keep and Remove Settings: The only time that you will see the "Keep" and "Remove" options is when the device physically is disconnected from the system. At that time, you have the option of removing the device from the configuration table by changing the setting to "Remove."

Changing the Settings: To change the settings, do the following:

- Select **Set and View SCSI device configuration** from the Set configuration menu.
- Select the appropriate device on the list.
- Press F6 to change the settings.
- Press F10 to save the changes (in configuration).

1.3.5 Power Supply Check

If you received a power supply error code or suspect a power supply problem, do the following.

1. Power off the system.
2. Ensure that the voltage selector switch setting is correct.
 - If the voltage setting **is not** correct, correct it; then verify that the system is operating correctly.
 - If the voltage setting **is** correct, continue with the next step.
3. Disconnect the power cord from the power supply; then remove the system unit cover.
4. Remove the power supply.
5. Connect the power cord to the power supply.
6. Locate the power-good button and power-good light. If necessary, see "Interior View" in topic 2.11.3.
7. Using a small nonmetallic object, press and hold the button. Within 3 seconds, the light comes on and the fan turns.

Note: If the button is pressed rapidly, the light and fan will not respond.

- If either the light or the fan fail to operate properly, replace the power supply.
- If the power supply is good and the problem remains, go to "Undetermined Problem" in topic 1.3.6.

1.3.6 Undetermined Problem

You are here because the diagnostic tests did not identify which adapter or device failed, the Devices List is incorrect, or the system is inoperative. Follow the isolation procedure below (do not isolate FRUs that are known to be good).

If the power-on light is not on, go to "Power Supply Check" in topic 1.3.5. If the power supply is good, do the following:

1. Power-off the system.
2. Remove or disconnect the following (one at a time) until you find the failure (power-on the system and reconfigure each time).

Note: Minimum operating requirements are one 2MB parity kit and the default drive.

- Any external devices
- Surge suppressor device (on the system)
- Modem, printer, mouse, or non-IBM devices
- Any adapter
- Drives
- Memory-Module Kits

3. Power-on the system. If the problem remains, suspect the system board, then the power supply.

1.4 Symptom-to-FRU Index

This index lists error symptoms, error codes, and the possible causes. The most-likely cause is listed first. To diagnose failures, always start with "General Checkout" on page 1; however, you can use this index as a guide to decide which FRUs to bring with you on a service call.

IMPORTANT: Familiarize yourself with *all* of the following information before you use the index.

Subtopics

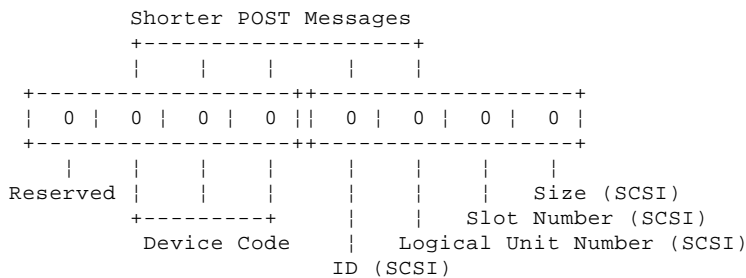
- 1.4.1 POST and Diagnostics
- 1.4.2 Using the Index
- 1.4.3 No-Beep Symptoms
- 1.4.4 Beep Symptoms
- 1.4.5 SCSI Tape Drive Symptoms
- 1.4.6 Miscellaneous Symptoms
- 1.4.7 Numeric Error Codes
- 1.4.8 POST IPL Errors

1.4.1 POST and Diagnostics

These tests usually identify the failing device, but because of the many dependencies, you can be misled by an error code. It is important to understand that all devices in a SCSI chain depend on an open line of communication on the SCSI data bus. Certain conditions can cause misleading error codes to be presented. For example, a short circuit in the bus arbitration logic, on the system board, can cause an inability to read from the SCSI device. In that case, the error code presented would indicate the SCSI device failed when the failure was really on the system board. If the index does not lead you to the cause of the problem, you might have to remove devices, one at a time, to locate the problem. That procedure is in "Undetermined Problem" in topic 1.3.6.

Reading Error Messages: Error messages are displayed on the screen as three, four, five, or eight digits. An "X" in an error message can be any number. The shorter POST errors are highlighted in this index. Some digits will represent different information for SCSI errors versus non-SCSI errors.

The following figure shows which digits display the shorter POST errors. The figure also defines additional SCSI information.



Using the SCSI ID to Help Isolate Failures: Each device on a SCSI chain has a unique SCSI ID. Use the SCSI ID to help pinpoint which device is failing. For example, if diagnostics presents a "U" (size undetermined) as the last digit in the error code, suspect the device that has the SCSI ID indicated in the error code.

Note: Duplicate SCSI ID settings will cause misleading error symptoms or messages.

1.4.2 Using the Index

You can be sent here (from the MAP) under various conditions. Listed below are instructions for those conditions.

Note: If this index does not solve the problem, go to "Undetermined Problem" in topic 1.3.6.

System Does Not Have a POST Error: If you were sent here without a POST error code, go to the appropriate "Symptoms" section.

System Has an I999XXXX POST Error: If the POST error code is in the I999XXXX range, go to "POST IPL Errors" in topic 1.4.8.

System Has a POST Error: If the POST error code is any other range (not I999XXXX) go to "Numeric Error Codes."

Error Range is Not Listed: If the error code range presented is not listed in this index, it may be generated by a device that requires an additional service package. Refer to that service package.

Warning: Some FRUs are sensitive to Electro-Static Discharge (ESD). See "Handling Electrostatic Discharge (ESD) Sensitive Devices" in topic 2.10.3 for specific ESD instructions.

1.4.3 No-Beep Symptoms

Symptom / Error	FRU / Action
Power supply appears to fail at power-on, but if you disconnect optional hard disk drives, the problem goes away (load problem).	Motor-Start Jumper: Remove the motor-start jumper from one or more option drives. (For more information see "Motor-Start Jumper" in topic 2.2.3.4.)
No beep, power-on light does not light, and fan does not run. (See "Undetermined Problem" in topic 1.3.6 before replacing any FRUs.)	Power Supply System Board Any device or adapter
No beep, fan runs, and a 0002XXXX is displayed. (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board Memory System Board
No beep, fan runs, and a 0001XXXX is displayed.	System Board
No beep, fan runs, power- on light lights, system stops during POST with a message on the display. (See "Undetermined Problem" in topic 1.3.6 before replacing any FRUs.)	System Board
No beep, fan runs, power- on light lights, system stops during POST with no message on the display, or an unreadable display. (See "Undetermined Problem" in topic 1.3.6 before replacing any FRUs.)	System Board
No beep and system is otherwise functional	Switch Assembly Indicator Panel Cable System Board

1.4.4 Beep Symptoms

Symptom / Error	FRU / Action
One long and two short beeps (See "Display Self-Test" in topic 1.3.1 before replacing any FRUs.)	Display Adapter System Board Display
One long and one short beep (See "Display Self-Test" in topic 1.3.1 before replacing any FRUs.)	Display Adapter System Board
One or two short beeps and a blank or unreadable display or a blinking cursor (See "Display Self-Test" in topic 1.3.1 before replacing any FRUs.)	Display Adapter System Board Display
Continuous beep (See "Undetermined Problem" in topic 1.3.6 before replacing any FRUs.)	System Board
Repeating short beeps (See "Undetermined Problem" in topic 1.3.6 before replacing any FRUs.)	System Board Keyboard (stuck key)

1.4.5 SCSI Tape Drive Symptoms

Symptom / Error	FRU / Action
The tape is automatically ejected from the drive.	Tape Cassette Tape Drive
The tape sticks or breaks in the drive. (Verify that the tapes used meet ANSI standard X3B5.)	Tape Cassette

1.4.6 Miscellaneous Symptoms

Symptom / Error	FRU / Action
Operating system does not work. (See "POST IPL Errors" in topic 1.4.8 before replacing any FRUs.)	Default Hard Disk Drive
Program loads from the hard disk drive, or a non-system or disk error (with the Reference Diskette in drive A).	Diskette Drive System Board
Display screen changes colors	Display Display Adapter System Board
Power-on light does not light and fan runs	Switch Assembly System Board Power Supply
POST completes and the insert-diskette icon appears on the display.	Verify an operating system has been loaded onto the default hard disk drive.
Memory count displayed does not match memory installed. (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board Memory
One or more keys do not work and system is otherwise functional	Keyboard Keyboard Cable System Board
Intermittent Failures (See "Undetermined Problem" in topic 1.3.6 before replacing any FRUs.)	System Fan Any device or adapter
System will not power-off	Switch Assembly System Board Power Supply
Hard Disk LED stays on.	Hard Disk Drive System Board Power Supply
Hard Disk LED is not working and system is otherwise functional	Switch Assembly System Board

1.4.7 Numeric Error Codes

Symptom / Error	FRU / Action
000102XX, 000103XX 000104XX, 00011XXX	System Board
000107XX, 000110XX (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board Memory System Board
000115XX (If the error occurred during POST/BIOS update procedure, repeat the procedure before replacing a FRU.)	System Board
000118XX (Previously detected error. Run advanced diagnostics.)	System Board Memory
000120XX (A processor self-test error was detected.)	Alternate-microprocessor (if installed) System Board
000130XX (No startable device found.)	Restart the system using a diskette or check for a valid selectable startup sequence
000161XX	Battery Set Configuration System Board
000163XX, 000164XX, 000165XX (If setting configuration does not solve the problem, see "Installed Devices List" in topic 1.2 before replacing any FRUs.)	Set Configuration/Features System Board
000166XX	Any adapter
000167XX (Clock not updating)	Set Configuration/Features System Board
000169XX (If setting configuration does not solve the problem, see "Installed Devices List" in topic 1.2 before replacing any FRUs.)	Set Configuration/Features System Board
000170XX (ASCII console configuration error.)	If the serial port is enabled, verify that the ASCII terminal has been selected.
000171XX 000172XX	System Board
000173XX (CMOS/NVRAM checksum error.)	Battery Set Configuration/Features System Board
000174XX (If Automatic configuration does not solve the problem, run advanced diagnostics. If you have disconnected a SCSI non-hard disk device, see "SCSI Device Default Settings" in topic 1.3.4.)	Settings might be incorrect. See "SCSI Device Default Settings" in topic 1.3.4.
000188XX	Run Automatic configuration.
000194XX (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board Memory System Board
0001XXXX (not listed above)	System Board
00020XXX, 000210XX, 000211XX (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board Memory System Board

IBM PS/2 Server 85 HML
Numeric Error Codes

000214XX, 000215XX, 000216XX, 000217XX, 000225XX, 000226XX, 000235XX, 000240XX, 000241XX (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board Memory System Board
00024300, 00024400	System Board
000245XX, 000246XX, (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board System Board Memory
00025200, 00025400	System Board
000255XX (See "Memory" in topic 1.2.4 before replacing any FRUs.)	System Board Memory System Board
000291XX, 000292XX, 000293XX, 00029400, (Checksum value mismatch.)	Run Automatic Configuration and rerun Advanced Diagnostics
000295XX, 000296XX (Check for an unsupported memory configuration or memory modules. See "Memory" in topic 1.2.4 for more information.)	System Board Memory System Board
00029800 (Checksum value mismatch. Run Automatic Configuration and rerun advanced diagnostics.)	System Board Memory
0002XXXX (not listed above)	System Board Memory System Board
00030XXX	Keyboard Keyboard Cable System Board
000401XX	System Board
000601XX	Diskette Drive System Board
000602XX (Remove the diskette from the drive.)	Defective Diskette
000604XX (Check for an unsupported diskette drive.)	Diskette Drive
0006XXXX (not listed above)	Diskette Drive System Board
001101XX, 001102XX, 001106XX	System Board Any serial device
001107XX	Communications Cable System Board
001108XX, 001109XX	System Board Any serial device
0011XXXX (not listed above)	System Board
001207XX	Communications Cable Dual Async Adapter/A
001208XX, 001209XX	Dual Async Adapter/A Any serial device
0012XXXX (not listed above)	Dual Async Adapter/A System Board
0014XXXX (See "Printer Errors" in topic 1.3.3 before replacing any FRUs.)	Printer System Board
0024XXXX	System Board

IBM PS/2 Server 85 HML

Numeric Error Codes

	Display Adapter Display
0037XXXX (See "Undetermined Problem" in topic 1.3.6 before replacing any FRUs.)	System Board Hard Disk Hard Disk Cable
004611XX, 004630XX	Multiport/2 Interface Board Multiport/2 Adapter
004612XX, 004613XX, 004640XX, 004641XX	Memory Module Package Multiport/2 Adapter
004650XX	Multiport Interface Cable
0046XXXX	Multiport/2 Adapter Multiport/2 Interface Board Memory Module Package
0075XXXX (See "Display Self-Test" in topic 1.3.1 before replacing any FRUs.)	XGA(*) Display Adapter/A System Board Video Memory Display
0086XXXX	System Board Pointing Device
0096XXXX	SCSI Adapter (with cache) Any SCSI Device System Board
010002XX, 010006XX	Multiprotocol Adapter/A Any serial device
010007XX	Communications cable Multiprotocol Adapter/A
010008XX, 010009XX	Multiprotocol Adapter/A Any serial device
0100XXXX (not listed above)	Multiprotocol Adapter/A System Board

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Symptom / Error	FRU / Action
010102XX, 010106XX, 010108XX, 010109XX	Modem Adapter/A System Board Any serial device
0101XXXX	Modem Adapter/A System Board
0107XXXX	5.25 Inch Diskette Drive 5.25 Inch Diskette Adapter/A
0112XXXX	SCSI Adapter (without cache) Any SCSI Device System Board
0129X300 (DMA arbitration error. If more than one is installed, remove them one at a time to isolate the failure.)	System Board
0129XX00 (not listed above)	Alternate Microprocessor System Board
0141XXXX	Realtime Interface Adapter/A Alternate-microprocessor
0147XXXX, 0148XXXX	Video-Memory Module System Board
0152XXXX	XGA Display Adapter/A Video-Memory Module

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Numeric Error Codes

	System Board
0164XXXX	120MB Internal Tape Drive Diskette Cable System Board
0165XXXX	6157 Streaming-Tape Drive 6157 Tape-Attachment Adapter
0166XXXX, 0167XXXX (For diagnostic information refer to the Token-Ring Network Adapter/A service Information.)	Token-Ring Network Adapter/A System Board
0185XXXX	DBCS Japanese Display Adapter/A System Board
0200XXXX	Image Adapter/A Video-Memory Module System Board
0208XXXX (Verify there are no duplicate SCSI ID settings or invalid Enable and Disable settings.)	Any SCSI Device
0210XXXA 0210XXXB 0210XXXC 0210XXXD 0210XXXE 0210XXXF 0210XXXH 0210XXXI 0210XXXJ 0210XXXU (If the failing device is an external device, check the power supply voltages for that device. Refer to the <i>Hardware Maintenance</i> manual (form number S52G-9971, part number 52G9971).	SCSI Hard Disk Drive (60MB) SCSI Hard Disk Drive (80MB) SCSI Hard Disk Drive (120MB) SCSI Hard Disk Drive (160MB) SCSI Hard Disk Drive (320MB) SCSI Hard Disk Drive (400MB) SCSI Hard Disk Drive (1GB) SCSI Hard Disk Drive (104MB) SCSI Hard Disk Drive (212MB) SCSI Hard Disk Drive (Size Undetermined) SCSI Adapter SCSI Cable
0211XXXX (If the failing device is an external device, check the power supply voltages for that device. Refer to the <i>Hardware Maintenance</i> manual (form number S52G-9971, part number 52G9971).	SCSI Tape Drive SCSI Adapter SCSI Cable
0215XXXC 0215XXXD (If the failing device is an external device, check the power supply voltages for that device. Refer to the <i>Hardware Maintenance</i> manual (form number S52G-9971, part number 52G9971).	SCSI CD-ROM Drive (I) SCSI CD-ROM Drive (II) SCSI Adapter SCSI Cable
0217XXXX (If the failing device is an external device, check the power supply voltages for that device. Refer to the <i>Hardware Maintenance</i> manual (form number S52G-9971, part number 52G9971).	Rewritable Optical Drive SCSI Adapter SCSI Cable
0243XXXX	XGA-2 Display Adapter/A Video Memory Module System Board Display
0259XXXX	SVGA Display Adapter/A System Board Display
I999XXXX (This is usually not a hardware	Default Hard Disk Drive SCSI Adapter

IBM PS/2 Server 85 HML
Numeric Error Codes

failure. Go to "POST IPL Errors"	SCSI Cable
in topic 1.4.8 before replacing	
any FRUs.)	

+-----+-----+

1.4.8 POST IPL Errors

You are here because the system detected an Initial Program Load (IPL) problem. You can correct most of these errors without replacing any FRUs. IPL problems are associated with the following:

- An I999XXXX error is displayed.
- The system powered-on without a POST error, but the operating system does not work.

IPL errors can be caused by any of the following conditions:

- Invalid startup Sequence (the default drive is not in the startup sequence)
- Operating system not found
- Related hardware failure (SCSI interface, hard disk, SCSI cable)
- Unrelated hardware failure (misleading error code due to another problem on the SCSI bus).

Before replacing any FRUs, check the following:

Verifying the Startup Sequence is Valid

1. Start the system from the Reference Diskette and select **Set Features** from the Main Menu.
2. Select **Set Startup Sequence** and see if the default hard disk drive (usually drive 6) is in the startup sequence. If you receive an error message, follow the instructions on the screen, then return here.
3. If the default drive is in the startup sequence, exit from the screen and the Main Menu, then go to step 2 under "Testing the Hard Disk Drive." If the default drive is not in the startup sequence, follow the instructions on the screen, then go to "Testing the Hard Disk Drive."

Testing the Hard Disk Drive

1. Remove the Reference Diskette, power-off the system, then power-on the system. If the "F1" (Insert Diskette) icon appears on the screen, this means no operating system was found. Go to the next step. If the "Not OK" icon appears on the screen, this means that the system cannot access the System Partition. Go to "Updating the System Programs (restoring the partition)."
2. Either install an operating system on a device that is in the startup sequence, or change the startup sequence to include a device that has an operating system, then go to step 3 under "Updating the System Programs."

Updating the System Programs (restoring the partition)

1. Restart the system from the Reference Diskette. Select **Restore configuration** from the system programs and wait for the program to complete running.
2. Power-off the system, remove the Reference Diskette and continue with the next step.
3. Power-on the system, check for the normal power-up sequence and then run the advanced diagnostic tests. If the problem still exists, suspect the hard disk drive.

Notes:

1. If the default startup sequence was customized, restore it to the customized settings after service is complete.
2. If you are not able to correct the problem using the IPL Error section, go to "Undetermined Problem" in topic 1.3.6.

Symptom / Error	FRU / Action
I9990301 (Hard disk drive reset failure.)	Investigate possible hard disk problem.
I9990302 (No operating system found on the default drive.)	Install an operating system.
I9990303 (System Partition start failure.)	Restore the system programs using the Reference Diskette. (See

1.5.1 Example Parts List

Index	System Unit	
32	Cover	90X9288
3	Front Bezel/Logo (R)	92F0317
	Miscellaneous Hardware Kit (AR)	72X8580
	□ Knob Assembly, Hard Disk Drive Support Structure	
	□□ Knob	
	□□ Washer	

1.5.2 System Overview

PICTURE 2

1.5.3 Parts

Index	System Unit	
1	Access Cover	33F8427
2	Rear Bezel	92F0279
3	Power Supply (288 watts)	92F2637
	Power-Supply Ground Strap	33F8418
4	Pedestal with Plate	33F8422
5	Drive Support Structure	92F0280
	Ground spring (for 92F0280)	33F6853
6	Hard Disk Drive Mounting Tray (AR)	85F0013
7	Hard Disk Drive (AR) (See Common Parts)	
	DASD Option Guide	33F8441
8	Drive Retainer	64F4135
9	Front Bezel	64F4137
10	DASD Bezel	64F4136
11	DASD Bezel	33F8425
12	DASD Bezel	33F8425
	2-Feature Bezel	64F0168
	5.25 Inch Diskette Drive Bezel	64F4103
	5.25 Framing Bezel	33F8459
	CD-ROM Drive I & II Bezel	64F0138
	Rewritable Optical Drive Bezel	85F0018
13	Diskette Drive Blank Bezel	33F8437
14	3.5-Inch Diskette Drive Bezel (AR)	64F4149
	3.5-Inch Device Filler bezel	33F8437
15	Indicator Panel	92F0281
16	Indicator Panel Assembly	92F0277
17	Diskette Drive (AR) (See Common Parts)	
18	Base Frame (R)	92F0278
	Keylock Assembly	33F8433
19	System Board (without Memory)	41G9659
20	Display Adapter	
	(See Options and Adapters)	
	Adapter Guide	33F8440
21	System-Board Memory-Module kit:	
	□ 2MB Memory Module Kit (70ns)	92F0102
	□ 4MB Memory Module Kit (70ns)	92F0105
	□ 8MB Memory Module Kit (70ns)	64F3606
22	Indicator Panel Cable	92F0329
	Speaker	33F8444
	I/O Shadowbox Ground Spring	
	(With Thumb Screws)	92F0099
23	Diskette Drive Signal Cable	92F0283
24	SCSI Signal Cable	92F0328
25	Hard Disk Drive Power Cable	
	(See Common Parts)	
	Battery	33F8354
	Misc. Parts Kit	33F8435
	PS/2(*) Screw Kit	92F0141

(*) Trademark of the IBM Corporation.

1.5.4 Common Parts

Diskette Drive

1.44MB Drive	64F0162
Drive Slide (for 64F0162)	64F0156
2.88MB Drive with slide (not supported on all early type 1 systems)	64F0204
Drive Slide (for 64F0204)	64F3197
5.25-Inch Diskette Drive:	
360KB External (4869-001)	72X6759
360KB External (4869-501)	72X6768
1.2MB External (4869-002)	15F7993
1.2MB External (4869-502)	15F7994
1.2MB Internal Drive (with rails)	64F4102
1.2MB Rail kit (for 64F4102)	85F0041
Slide kit (for 64F4102)	85F0040

SCSI Hard Disk Drive

60MB Drive	6128296
80MB Drive	56F8854
104MB Drive	95F4748
120MB Drive	6128298
160MB Drive	56F8851
212MB Drive	95F4749
320MB Drive	85F0011
400MB Drive	85F0012
1GB Drive	92F0089
EMC Bezel and Spring Shield (for 92F0089)	92F0255
SCSI Adapter (with cache)	85F0000
SCSI Adapter (without cache)	85F0002
Terminator, External (for 85F0000)	33F8464
Terminator, Internal (for 85F0000)	34F0025
Terminator, Internal (for 85F0002)	57F2870
Terminator In-Line (any SCSI device space permitting)	92F0142
Terminator Kit (for 56F8894, 6128279, 90X8627, 85F0015, and 92F0269)	92F0143
Drive Power Cable	33F8431
Drive Power Cable (supports two devices)	34F0014

SCSI Tape Drive

Internal SCSI Tape Drive (with Rails)	85F0055
External SCSI Tape Drive	85F0055
Rail Kit (for 85F0055)	34F0041
Framing Bezel (for 85F0055)	64F4138
Cleaning Tape	21F8593
Blank Tape (5 each)	21F8595

CD-ROM Drive

CD-ROM Drive (I)	81F7930
Slide	85F0014
Terminator Kit (for 81F7930)	59F3530
Cleaning Kit (for 81F7930)	59F3562
<input type="checkbox"/> Cleaning Disk	
<input type="checkbox"/> Test Disk	
<input type="checkbox"/> CD Caddy	
CD-ROM Drive (II)	92F0084
Slide	92F0162
Terminator Kit (for 92F0084)	92F0082
Media Kit (No Cleaning Necessary, for 92F0084)	31F4232
<input type="checkbox"/> Test Disk	
<input type="checkbox"/> CD Caddy	
Generic CD-ROM parts:	
Ground Spring	92F0087
CD Caddy	22F9419
Rail Kit	34F0041
Headphones	53F3610

Options and Adapters

300/1200 Modem Adapter/A	34F0006
Communications Cable (for 34F0006)	8285985
300/1200/2400 Modem Adapter/A	65X1253
Communications Cable (for 65X1253)	94X1540
3270 Connection	74F3464
36/38 Emulation Adapter	69X6294
6157 Tape Adapter	37F6718
80486SX-ODP 66/33-MHz Microprocessor	92F2582
ActionMedia(**) II Display Adapter	69F9731
ActionMedia II Display Adapter/A 2MB	69F9733
ActionMedia II Capture Option	69F9735

Common Parts

Action Media II Video Cable	69F9737
Audio/Video Capture Cable	69F9736
Action Media II CD-ROM Cable	69F9747
Baseband Card	72X8102
Baseband Cable	72X8107
Broadband Card	72X8106
Double Byte Character Set (DBCS)	
Display Adapter (Japan)	07G0446
Display Adapter (Taiwan)	07G1459
Dual Async Adapter/A	34F0008
Image Adapter/A	07F2508
Video-Memory Module (512KB) (for 07F2508)	07F4401
Video-Memory Module (1MB) (for 07F2508)	07F4402
XGA Display Adapter/A	75X5886
XGA-2 Display Adapter/A	87F4774
Video-Memory Module (for 75X5886)	75X5894
Pageprinter Adapter	75X8213
PS/2 Screw Kit	94F0141
Realtime Interface Coprocessor	
Portmaster(*) Adapter/A	53F2603
512KB Memory Module Package (for 53F2603)	53F2656
1MB Memory Module Package (for 53F2603)	53F2660
2MB Memory Module Package (for 53F2603)	53F2664
RS232 Interface Board (for 53F2603)	53F2612
RS422 Interface Board (for 53F2603)	53F2615
Multiprotocol Adapter/A	85F0004
Printer Accessory Kit	1183003
SCSI Adapter (with cache)	85F0003
SCSI Adapter (without cache)	85F0002
SVGA Display Adapter/A	39G3298
Token-Ring Busmaster Adapter/A	74F4149
Token-Ring Network Adapter/A	25F8302
Token-Ring Adapter/A RPL Module	83X9180
Token-Ring 16/4 Adapter/A	71F9145
Token-Ring 16/4 Adapter/A RPL Module	93F0333

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(**) Trademark of the Intel Corporation.

Options and Adapters (continued)

Realtime Int. Coprocessor Multiport/2	09F1888	
8-port RS232-C Electrical Interface Board (for 09F1888)		
(for 09F1888)	91F7974	
4-port RS232-C Electrical Interface Board		
(for 09F1888)	91F7976	
Electrical Interface Board (for 09F1888)	91F7966	
512KB Memory Module Package (for 09F1888)	16F2267	
Multiprotocol Interface Cable		
(for 09F1888)	00F5524	
4+4-port RS232-C RS422-A		
Screen Reader Keypad	1393515	
Screen Reader Keypad Cable	72X8537	
5.25-Inch External Diskette Adapter/A		
(1.2MB or 360KB)	15F7996	
3.5-Inch 127MB Rewritable Optical Drive	85F0015	
Drive Mounting Slide (for 85F0015)	85F0022	
Objective Lens Cleaning Cartridge (for 85F0015)		85F0043
Prism Lens Cleaning Cartridge (for 85F0015)	85F0054	
3.5-Inch 127MB Enhanced Rewritable		
Optical Drive	92F0269	
Mounting Tray (for 92F0269)	92F0269	
Drive Bezel Assembly (for 92F0269)	92F0155	
Rewritable Optical Cartridge (for 92F0269)		
(Supply Item)	85F0025	
Lens Cleaner Cartridges	85F0054	

Keyboard Cable and Mouse

Keyboard Cable Assembly 0.9 m (3 ft.)	61X8898
Keyboard Parts Kit	33F8174
Mouse	61X8923
<input type="checkbox"/> Mouse Ball and Pop-Off Retainer	33F8461
<input type="checkbox"/> Mouse Ball and Twist-Off Retainer	33F8462

Space-Saving Keyboards (84/85 Key)

Canadian French	1396046
Latin-American Spanish	1396047
U.S. English	1393290
Cable Assembly, External	1393082

DBCS Japanese Keyboards

Space Keyboard (89 Key)	65X1121
Space Keyboard (106 Key)	79F0167
Enhanced Keyboard (116 Key)	94X1110
Host-Connect Keyboard (124 Key)	94X1220
DBCS Keyboard Cable	79F5443

Enhanced Keyboards (101/102 Key)

Arabic	1391490
Belgian	1391414
Canadian French	1392011
Cyrillic	1393866
Danish	1391407
Dutch	1391511
French	1391402
German	1391403
Greek	1393285
Hebrew	1391408
Italian	1391404
Latin-American Spanish	1392015
Norwegian	1391409
Portuguese	1391410
Russian/Cyrillic	1395622
Spanish	1391405
Swedish/Finish	1391411
Swiss	1391412
Swiss/French	1395881
Swiss/German	1395882
Turkish	1393286
U.K. English	1391406
U.S. English (E/ME/A use only)	1396790
U.S. English	1392090
Yugoslavian	1393669

Host-Connected Keyboards (122 Key)

Austrian/German	1396902
Belgian	1396903
Canadian French	1397051
Cyrillic	1396916
Danish	1396904
Dutch	1396905
French	1396990
Greek	1396917
Icelandic	1396941
Italian	1396908
Latin-American Spanish	1397052
Norwegian	1396909
Portuguese	1396910
Spanish	1396911
Swedish/Finish	1396906
Swiss/French	1396912
Swiss/German	1396913
Turkish	1396921
U.K. English	1396914
U.S. English (E/ME/A use only)	1397025
U.S. English	1397050
Yugoslavian	1396920

Tools and Miscellaneous

Tri-Connector Wrap Plug	72X8546
Wrap Plug (for Tape Attachment Adapter)	59X4115
Wrap Plug (for Token-Ring Network Adapter/A)	6165899
Wrap Plug (for Real-time Interface Co-Processor Multiport/2) 78-pin	16F2478
Wrap Plug (for Multiport Interface Cable) Direct Connect 25-pin, Ports 0 and 1	6425494
Wrap Plug (for Multiport Interface Cable) Direct Connect 25-pin, ports 2 through 7	09F1799
Plastic Envelope (For Wrap Plug)	6138013
Data Migration Facility	61X8936
Key Cap Removal (Keyboard) Tool	6110464
Video Memory Removal Tool	79X5893
Video Memory Insertion Tool	07F2518

8503 Monochrome Display (with Tilt /Swivel Stand)

110/120 V ac	68X3045
220/240 V ac (Northern Hemisphere)	68X3046

Common Parts

220/240 V ac (Southern Hemisphere)	72X7878
Tilt /Swivel Stand	68X3061
8504 Monochrome Display (with Tilt /Swivel Stand)	
110/120 or 220/240 V ac (Universal Model)	44F9807
8506 Monochrome Display (with Tilt /Swivel Stand)	
110/125 V ac (US/Canada)	39F8087
110/125 or 200/240 V ac (Northern Hemisphere)	39F8088
110/125 or 220/240 V ac (Southern Hemisphere)	39F8089
8507 Monochrome Display (with Tilt /Swivel Stand)	
110/120 or 220/240 V ac (Universal Model)	6247808
8512 Color Display (without Tilt /Swivel Stand)	
110/120 V ac	61X8924
220/240 V ac (Northern Hemisphere)	61X8928
220/240 V ac (Southern Hemisphere)	61X8927
Tilt /Swivel Stand	61X8925
8513 Color Display (with Tilt /Swivel Stand)	
110/120 V ac	68X3088
220/240 V ac (Northern Hemisphere)	72X7870
220/240 V ac (Southern Hemisphere)	72X7877
Tilt /Swivel Stand	68X3061
8514 Color Display (without Tilt /Swivel Stand)	
110/120 V ac	75X5945
220/240 V ac (Northern Hemisphere)	75X5946
220/240 V ac (Southern Hemisphere)	75X5947
Tilt /Swivel Stand	75X5907
8515 Color Display (with Tilt /Swivel Stand)	
Model 001 (90/137 V ac, U.S. and Canada) with	
Tilt /Swivel and packaging set	38F3911
Model 002 (90/265 V ac, Universal voltage) with	
Tilt /Swivel and packaging set	38F3912
Model A01 (90 V ac) with	
Tilt /Swivel and packaging set	38F3913
Shipping material:	16F0188
<input type="checkbox"/> Box	
<input type="checkbox"/> Front cushion	
<input type="checkbox"/> Rear cushion	
Power cable, 1.8 m (6 ft), U.S.	38F3968
Alternative to part number 38F3968 above	6952301
8516 Color Display	
Model 001	44F9759
Model 002	70F9129
Model 004	70F9132
8518 Color Display	
Refer to the Model 8518 <i>Hardware Maintenance Service</i> for part and service information.	
9515 Color Display	
Refer to the Model 9515 <i>Hardware Maintenance Service</i> for part and service information.	
9517 Color Display	
Refer to the Model 9517 <i>Hardware Maintenance Service</i> for part and service information.	
9518 Color Display	
Refer to the Model 9518 <i>Hardware Maintenance Service</i> for part and service information.	

Supplemental Parts Catalog:



PICTURE 3

1.5.5 Power Cords

Index Power Cords

	Display Power Cord, for:	
1	Colombia, U.S., Venezuela	68X3071
	System Unit Power Cord, for:	
1	Colombia, U.S., Venezuela	62X1045
	System Unit Power Cord, for:	
2	Hong Kong, Singapore, U.K.	14F0033
	System Unit Power Cord, for:	
3	France, Germany, Spain	13F9979
	System Unit Power Cord, for:	
4	Italy, Chile	14F0069
	System Unit Power Cord, for:	
5	Australia, New Zealand, New Guinea, Papua	13F9940
	System Unit Power Cord, for:	
6	Denmark	13F9997
	System Unit Power Cord, for:	
7	Israel	14F0087
	System Unit Power Cord, for:	
8	Bangladesh, Pakistan, South Africa, Sri Lanka	14F0015
	System Unit Power Cord, for:	
9	Switzerland	14F0051
	System Unit Power Cord, for:	
10	Thailand	1838574
	System Unit Power Cord, for:	
	Japan	79F2755

2.0 Hardware Maintenance Reference

Subtopics

- 2.1 Product Description
- 2.2 Option Compatibility
- 2.3 Operating Requirements
- 2.4 System Diskettes (Reference, Diagnostic, and POST/BIOS Update)
- 2.5 The System Partition
- 2.6 Using ASCII Terminals
- 2.7 Miscellaneous System-Related Information
- 2.8 Specifications
- 2.9 Special Tools
- 2.10 Safety Information
- 2.11 Locations
- 2.12 Grounds
- 2.13 Notices

2.1 Product Description

The IBM Personal System/2 Server 85 uses the IBM Micro Channel (*) architecture. The features of the Server 85 are:

- SVGA Display Adapter/A or XGA-2 Display Adapter/A
- Security
 - Cover lock
 - Power-on password
- System board
- Alternate-microprocessor socket for the 80486SX-ODP 66/33-MHz microprocessor
- 64 byte complementary metal-oxide semiconductor (CMOS) random access memory (RAM) with real-time clock and 8KB (1KB equals approximately 1000 bytes) CMOS RAM extension.
- Shipped with a minimum of 8MB (1MB equals approximately 1 000 000 bytes) of random access memory (RAM). (64MB total system memory capacity.) Minimum required memory is 2MB.
- Eight 32-bit expansion slots
 - Six 32-bit expansion slots with matched-memory extension
 - One 32-bit expansion slot with auxiliary-video extension
 - One 32-bit expansion slot with base-video extension
- Serial-port connector
- Parallel-port connector
- Diskette-drive controller
- Battery (to keep CMOS RAM active when power is off)
- Keyboard connector
- Pointing-device connector
- POST/BIOS update support
- Power supply
 - Switchable to the 100-125 V ac or the 200-240 V ac range
 - 50 or 60 Hz
- Speaker
- Small Computer System Interface (SCSI) internal and external connectors
- 84, 101/102, or 122-key keyboard
- SCSI fixed disk drive (hard disk drive)
- Diskette drive.

(*) Trademark of the IBM Corporation.

Subtopics

- 2.1.1 Security
- 2.1.2 Override Jumper
- 2.1.3 System Features
- 2.1.4 Video
- 2.1.5 System Memory
- 2.1.6 Resolving Memory-Address Conflicts
- 2.1.7 Selectable Drive-Startup Sequence

2.1.1 Security

Subtopics

2.1.1.1 Cover Lock

2.1.1.2 Power-on Password

2.1.1.3 Keyboard Password

2.1.1.1 *Cover Lock*

The cover lock is on the front panel of the system unit. The front bezel and side cover cannot be removed without the user's key.

If the keys for the cover lock are lost, order a new cover-lock assembly (see "Using the Parts Catalog" in topic 1.5).

2.1.1.2 Power-on Password

A power-on password denies access to the system by an unauthorized user when the system is powered-on. If a power-on password is active, the password prompt (which resembles a small key) appears on the screen each time the system is powered-on. Access to the system occurs when the proper password is entered.

Note: In the Unattended Start Mode, the power-on password prompt does not appear on the screen and the keyboard is locked.

To service a system with an active and unknown power-on password, power-off the system and do the following:

1. Locate the override connector (JMP1) on the system board.
2. Move the override jumper (on JMP1) so that it connects the center pin and the pin on the opposite end of the connector.
3. Power-on the system.

The system detects the change and the password is erased from memory. Leave the jumper in that position until the next time you need to reset the password.

To reinstall a password, the user must start the system programs, select **Set features** from the Main Menu, and follow the instructions.

2.1.1.3 Keyboard Password

Setting the keyboard password lets you lock the keyboard without powering-off the system. When using KP.COM or the unattended start mode, the power-on password is the keyboard password if the keyboard password has not been changed.

Notes:

1. To use the keyboard-password program, IBM Disk Operating System (DOS) must be installed on the hard disk. If DOS is not installed, refer to the documentation that came with the operating system installed in the system for instructions for the keyboard-password program.
2. The keyboard password is available only through the DOS prompt, not from within a program.
3. The keyboard password does not lock a mouse or any pointing device.

To set a keyboard password that is different from the power-on password, do the following.

1. Insert the backup copy of the Diagnostic Diskette into the primary diskette drive.
2. At the DOS prompt (usually C>) type A: and press **Enter**.
3. Type

UNINSTALL

and press **Enter**.

4. Select **Install KP.COM**, and follow the instructions on the screen.
5. Remove the Diagnostic Diskette from drive A after the file is copied.
6. Press **F3**

- To lock the keyboard, type

KP

and press **Enter**. When you hear a beep, the keyboard is locked.

- To unlock type the keyboard password and press **Enter**. When you hear a beep, the keyboard is locked.
- To change the keyboard password, type

KP /C

and press **Enter**; then follow the instructions on the screen.

- To deactivate the keyboard password, turn off the computer.

2.1.2 Override Jumper

The override jumper on the system board is most often used to erase a power-on password. However, the same jumper also has multiple purposes. If you move the jumper *with the system powered-off*, then power-on the system, it has the following effects on the system:

Power-on Password: If the system has a power-on password, that password is erased when the system is turned on (after moving the jumper).

Unattended Start Mode (server mode): If the system is in the unattended start mode, and then you power-off the system and move the jumper, the unattended start mode is *not* restored when you power-on the system. Once you move the jumper, both the power-on password and the unattended start mode are erased. Because a power-on password is required for the unattended start mode, you must reset both features. To do this, select **Set features** from the Main Menu of the system programs, then select **Set password and unattended start mode** and follow the instructions.

To activate the override feature, move the override jumper so that it connects the center pin and the opposite end of the connector. The next time you power-on the system, the override is activated. Leave the override jumper in that position until the next time you need to use the override feature.

2.1.3 System Features

The major features of the system are:

- Alternate-microprocessor socket
- CMOS RAM
- Basic Input/Output System (BIOS)
- Power-On Self-Test (POST)
- Display adapter
- Serial-port connector
- Parallel-port connector
- Diskette-drive controller
- Keyboard connector
- Pointing-device connector
- SCSI interface.

Subtopics

2.1.3.1 CMOS RAM and CMOS RAM Extension

2.1.3.2 POST and BIOS

2.1.3.1 CMOS RAM and CMOS RAM Extension

CMOS RAM provides 64 bytes of storage. Fifty bytes are used to store system configuration and security information. The real-time clock uses the remaining 14 bytes to track the date, time, and battery level. An 8KB CMOS RAM extension stores additional configuration and system-status information.

The data stored in the CMOS RAM and CMOS-RAM extension is kept active by the battery when the system is powered-off. If the stored data is lost due to a depleted or removed battery, you can restore the data by using one of the following methods:

- If the user has a customized configuration that uses settings other than the default, run **Restore configuration** from the system programs stored on the default hard disk drive.
- If default configuration settings are used, run **Automatic configuration** from the system programs stored on the hard disk drive.

2.1.3.2 POST and BIOS

The systems use EPROMs to store the Power-On Self-Test (POST) and Basic Input/Output System (BIOS) code.

At power-on, the first stage of POST performs the following functions:

- Checks the basic system-board and alternate-microprocessor functions
- Initializes the video function
- Checks the memory subsystem
- Verifies that the default hard disk drive is functioning
- Verifies that the default diskette drive is functioning
- Checks the IML image.

The second stage of POST performs additional tests of the hardware and initializes the system. When the second stage of POST is complete, system control is given to the operating system.

System Programs: The system also includes the System programs and the customer and advanced diagnostic programs. These System programs are stored in a protected partition on the default hard disk. The programs are loaded onto the hard drive when the system is manufactured. The partition is not affected when the drive is formatted using the operating system format command.

Replacing the Default Hard Disk Drive: If you replace the default hard disk drive, you must recopy all of the system programs onto the replacement hard disk drive. To recopy the programs:

1. Start the system using the customer's *backup copy* of the current System Partition.
2. Select **Backup/Restore system programs** from the Main Menu.
3. Run the **Restore the System Partition** option to load the system programs and the customer and advanced diagnostic programs onto the default hard disk drive.

Notes:

1. If the user's backup copy of the System Partition is incomplete, you will not restore the entire System Partition. If this occurs, get the option diskettes and use **Copy an option** to recopy the option files onto the System Partition.
2. If customer's operating system has not been loaded, the Insert-Diskette icon will appear on the screen.

2.1.4 Video

The video subsystem is on a display adapter installed in the system unit.
The video modes supported, varies with the type of adapter installed.

Subtopics

- 2.1.4.1 SVGA Display Adapter/A
- 2.1.4.2 XGA-2 Display Adapter/A
- 2.1.4.3 Non-IBM Displays
- 2.1.4.4 Parallel Port
- 2.1.4.5 Diskette-Drive Controller
- 2.1.4.6 Keyboard Connector and Pointing-Device Connector

2.1.4.1 SVGA Display Adapter/A

This adapter supports the VGA mode and drives analog displays equipped with a 15-pin, direct-drive analog interface. For additional information see "Graphics Modes."

The adapter comes with four video-memory modules (512KB) installed. When the system is powered-on, the graphics array is in the VGA mode. In this mode, all VGA alpha-numeric text, and all-points-addressable (APA) graphics video modes are supported. The maximum resolution in the VGA compatibility mode is 720-by-400 picture elements (PELS) in the text mode, and 640-by-480 PEELS in the graphics mode. A maximum of 256 colors or 64 shades of gray are supported in VGA mode. Composite video is not supported.

This adapter drives analog displays equipped with a 15-pin, direct-drive analog interface.

The graphics array is in the SVGA mode only when enabled by the DOS Adapter Interface or video device driver (example: Microsoft Windows (**), OS/2 (*), and Presentation Manager (*) device drivers).

Graphics Modes: The following are examples of the resolutions that are available with the SVGA Display Adapter/A.

Resolution	Frame Rate (Hz)	Line Rate (KHz)	I/NI	IBM Display Support (Model)
640x480	60	31.6	NI	7544, 7554, 8503, 8504, 8507, 8512, 8513, 8514, 8515, 8516, 8517, 8518
640x480	72(1)	37.9	NI	
640x480	75	39.4	NI	9515, 9517, 9518
800x600	56(2)	35.2	NI	
800x600	60(2)	37.9	NI	
1024x768	43.5	35.6	I	8507, 8514, 8515, 8516, 7554, 8517

(1) Video Electronics Standards Association (VESA) Standard
(2) VESA Guideline
I = Interlaced
NI = Non-Interlaced

(**) Trademark of the Microsoft Corporation.

(*) Trademark of the IBM Corporation.

2.1.4.2 XGA-2 Display Adapter/A

This adapter is a high-resolution display adapter that supports a wide variety of display resolutions and refresh rates. For additional information see "Graphics Modes."

The XGA-2 Display Adapter/A has 1MB of video random access memory (VRAM). (MB equals approximately 1 000 000 bytes.)

This adapter drives analog displays equipped with a 15-pin, direct-drive analog interface.

Option Diskette: An Option Diskette is supplied with the XGA-2 Display Adapter/A. It contains test procedures and configuration data for the adapter.

Display Adapter Compatibility: The XGA-2 Display Adapter/A (with a display attached) is the default VGA source when a display is not attached to the system unit display connector, or to an XGA-2 Display Adapter/A installed in the base video extension slot. In this case a display adapter using the auxiliary video extension slot does not display VGA video.

Video Palette Initialization: When the XGA-2 Display Adapter/A is installed, the video palette is initialized for the attached color or monochrome display.

Graphics Modes: The following are examples of the resolutions that are available with the XGA-2 Display Adapter/A.

The software supplied with the adapter automatically sets IBM displays to the best possible resolution and refresh rate.

Resolution	Frame Rate (Hz)	Line Rate (KHz)	I/NI	IBM Display Support (Model)
640x480	60	31.6	NI	7544, 7554, 8503, 8504, 8507, 8512, 8513, 8514, 8515, 8516, 8517, 8518
640x480	72(1)	37.9	NI	
640x480	72	37.8	NI	
640x480	75	39.4	NI	9515, 9517, 9518
800x600	56(2)	35.2	NI	
800x600	60(2)	37.9	NI	
800x600	72(1)	48.1	NI	
800x600	75	50.0	NI	
1024x768	43.5	35.6	I	8507, 8514, 8515, 8516, 7554, 8517
1024x768	60(2)	48.4	NI	
1024x768	70	57.0	NI	8517
1024x768	70(1)	56.5	NI	
1024x768	72	58.1	NI	9517
1024x768	75	61.1	NI	9515
1280x1024	50	53.4	I	
(1) Video Electronics Standards Association (VESA) Standard				
(2) VESA Guideline				
I = Interlaced				

| NI = Non-Interlaced |

-----+
Specifications: The power requirements for the XGA-2 Display Adapter/A are:

Amps	Watts	Volts
1.5	6.0	+5.0

Environment

- Temperature:
 - Operating: 0°C to 55°C (32°F to 131°F)
- Humidity:
 - Operating: 10% to 90% (non-condensing)

2.1.4.3 Non-IBM Displays

Supported resolutions, which are not available on IBM displays, are available using some non-IBM displays. These displays range in capability from low cost-low function to high cost-high function. Most of these displays respond as an IBM 8514 display when the software supplied with the SVGA Display Adapter/A or the XGA-2 Display Adapter/A is used. As a result, IBM 8514 resolutions and refresh rates are used as default.

The software supplied with the XGA-2 Display Adapter/A and available for the SVGA Display Adapter/A allow you to override the default screen resolution. If you do override the default screen resolution, with a resolution which does not meet or exceeds the capability of the attached display, unpredictable results might occur.

Warning: Some multisync displays may appear to function correctly; however, damage may occur over time.

Notes:

1. You must only select resolutions which are suitable for the display attached to the adapter installed in the system.
2. The use of the resolution override should be avoided if the display attached to the adapter is to be changed frequently with displays of varying characteristics.

Both display adapters along with certain IBM displays, computers and some software has been certified to meet the International Standards Organizations (ISO) standard 9241/3. IBM cannot guarantee that all non-IBM displays attached to these adapters will provide acceptable front of screen characteristics or meet other health and safety standards.

2.1.4.4 Parallel Port

The parallel port allows the attachment of devices that accept eight bits of parallel data at standard transistor-transistor logic (TTL) levels. The port has a 25-pin, D-shell connector and is designed primarily for printers. However, the port can be used as an input/output port for any device or application that matches the input/output capabilities of the port. When adapters with additional parallel ports are installed, the system supports four devices, each addressed separately as PARALLEL 1, PARALLEL 2, PARALLEL 3 or PARALLEL 4. Conflicts occur when using multiple devices if two or more devices are addressed the same. Select the **Set configuration** option from the system programs on the hard disk drive. Select **View configuration** to verify that no lines are addressed the same.

Note: If a conflict occurs, an asterisk appears next to the conflicting address.

2.1.4.5 Diskette-Drive Controller

The diskette-drive controller is on the system board. The controller connects to the diskette drives through a 34-pin cable connector (the connector on the system board is a 44-pin cable-connector). Signals and voltages are supplied through the diskette-drive cable that plugs into the connector. These signals and voltages can operate a maximum of three devices (one can be a 5.25-inch device).

2.1.4.6 Keyboard Connector and Pointing-Device Connector

The two 6-pin connectors on the rear of the system board are for a keyboard and a pointing device (mouse). The keyboard connector is marked on the back panel of the system unit with a keyboard symbol. The pointing device connector is marked with a mouse symbol. The interface logic is the same for both and they are interchangeable.

2.1.5 System Memory

The figure below shows the location of the memory-module-kit connectors B1 to A4 on the system board.

PICTURE 4

The system board has eight connectors for system-board memory-module kits. The system supports up to 64MB of memory on the system board, but the amount of memory accessed may be limited by the operating system.

Subtopics

2.1.5.1 Memory Requirements and Limitations

2.1.5.2 Types of Memory Configurations

2.1.5.1 Memory Requirements and Limitations

Whenever memory is added or removed from the system, run **Automatic configuration** from the Main Menu of the system programs.

Note: If memory fails, and the customer runs diagnostics, the defective memory is disabled. When you run diagnostics, the system will indicate the amount of memory that is enabled.

After the defective memory is replaced, run the advanced diagnostic memory test to enable the *replacement* memory.

2.1.5.2 Types of Memory Configurations

- *Interleaved* configurations require memory kits to be installed in one or more A connectors and one or more B connectors. If an equal amount of memory is installed in the A connectors and B connectors, all memory access is interleaved and system performance is improved.
- *Noninterleaved* configurations do not require matched pairs of memory-module kits. Noninterleaved memory runs less efficiently than interleaved memory, but will function with mixed sizes of memory.

The system supports interleaved, or noninterleaved, or a combination of both memory configurations. Only parity memory-module kits (70ns) are supported. Refer to "Using the Parts Catalog" in topic 1.5 for a complete list of supported memory module kits.

Some memory errors will cause a blank display screen. If the display screen is blank, a POST error code cannot be displayed.

Memory errors and how the memory blocks are deallocated varies with the type of memory configuration. It is not necessary to understand this to service the system; however, the information is available in the model-specific *Technical Reference* manual.

2.1.6 Resolving Memory-Address Conflicts

The automatic configuration program might change the memory-address space used by some hardware and software options. The new address might conflict with addresses defined for use through the expanded memory specification (EMS). (EMS memory is used only in the DOS environment.)

If a memory conflict exists, one or more of the following could occur:

- The system cannot load the operating system.
- The system is disabled.
- An application does not operate or it returns an error.
- Screen messages indicate that a memory-address conflict exists.

You can resolve these conflicts in one of the following ways:

- Change the software configuration (primary method).
- Change the system configuration (alternative method).

Subtopics

2.1.6.1 Changing the Software Configuration

2.1.6.2 Changing the System Configuration

2.1.6.1 *Changing the Software Configuration*

The best method of resolving memory-address conflicts is to change the software configuration by changing the addresses defined by the EMS driver.

For conflicts caused by XMA2EMS (DOS 4.0) or EMM386 (DOS 5.0) in the CONFIG.SYS file, refer to the DOS documentation. For conflicts caused by an expanded-memory manager other than the one supplied with DOS, refer to the memory manager documentation.

Note: To view the addresses used by the installed hardware and software options, go to the Main Menu, select **Set configuration** then select **Display memory map**.

2.1.6.2 *Changing the System Configuration*

An alternate method of resolving memory-address conflicts is to change the address of the conflicting hardware option by using **Change configuration** from the **Set configuration** program. Before changing adapter addresses, identify the addresses used by the EMS driver. Then set the adapter to addresses that do not conflict.

Note: These conflicts can occur because the automatic configuration program sets up only the hardware. It does not consider the operating system or application requirements. If you run automatic configuration after changing an address, the addresses you changed will be set back to their default values.

2.1.7 Selectable Drive-Startup Sequence

The selectable drive-startup sequence allows the user to control the startup sequence of the drives in the system. Each time the system is powered-on, it checks the drives as it looks for the operating system. The order in which the system checks the drives is the *drive-startup sequence*.

In most cases, there is no need to change the *default* drive-startup sequence. However, if the user is working with multiple hard disk drives, multiple operating systems, different size diskette drives, or they are planning to do remote program load (RPL) from a drive in a network server, they might want to change the drive-startup sequence.

The default sequence checks the primary diskette drive for a startable diskette. If one is present, the operating system or program is loaded from the diskette. If not, the system checks the primary hard disk for an operating system. If one is present, the operating system is loaded from that hard disk drive. If not, the system displays the diskette and F1 prompts.

If the system is started from a diskette, the drive containing the diskette becomes drive A, regardless of the defined sequence. The user can choose the startup order of up to four drives, and also *customize* the startup sequence by changing the order in which the system checks the drives. By making this change, the user decides which four drives are the first drives to be checked, and also the order in which the system checks them. When the startup sequence is changed, the drive letters might also be changed. The operating system assigns the drive letters when the system starts. The assignment of the subsequent drive names will vary with the operating system or the device drivers used.

Warning: If startup sequence is changed, you must be extremely careful when you do write operations (such as copying, saving, or formatting). The customer's data or programs can be overwritten if you select the wrong drive.

To change the startup sequence, do the following:

1. Start the system programs from the hard disk.
2. Select **Set features** from the Main Menu.
3. Select **Set startup sequence** and follow the instructions on the screen.

Subtopics

2.1.7.1 Example: Default Startup Sequence

2.1.7.2 Example: Changing the Startup Sequence

2.1.7.1 Example: Default Startup Sequence

The example below shows the default startup sequence for the system.

Startup Number	Device
1...	[2.88MB 3.5-inch Diskette Drive 0]
2...	[SCSI hard disk slot 1 (ID, LUN)...:6,0]
3...	[Not selected]
4...	[Not selected]

Note: The number of selections and device types you see on this screen varies with the number of devices installed in the system.

2.1.7.2 Example: Changing the Startup Sequence

Assume the following drives are installed in the system:

- Diskette Drives
 - 3.5-inch diskette drive (primary diskette drive)
 - 3.5-inch diskette drive (second diskette drive)
 - 5.25-inch diskette drive (third diskette drive)

- Hard Disk Drives
 - 104MB hard disk drive (primary hard disk drive) divided into two partitions.

If you want to start the system from a 3.5-inch diskette, a 5.25-inch diskette, or the hard disk drive, you can define the startup sequence as follows:

Startup Number	Device
1...	[2.88MB 3.5-inch Diskette Drive 0]
2...	[1.2MB 5.25-inch Diskette Drive 2]
3...	[SCSI hard disk slot 1 (ID, LUN)...:6,0]
4...	[Not selected]

In this example, the system looks for a startable diskette in the primary 3.5-inch diskette drive, and then looks for a startable diskette in the 5.25-inch diskette drive. If there is not a startable diskette in either drive, the system loads the operating system from the System Partition on the hard disk drive.

2.2 Option Compatibility

The systems support many of the 16-bit and 32-bit adapters that are designed for IBM PS/2 Micro Channel architecture computers. Most adapters can be plugged into any of the eight expansion slots. The exceptions are adapters that have:

- Matched-memory extension (cannot be installed in slot 7)
- Base-video extension (cannot be installed in slot 7)
- Auxiliary-video extension (*must* be installed in slot 7)

Note: The factory-installed video adapter is in slot 5

For supported options, see "Using the Parts Catalog" in topic 1.5.

Subtopics

- 2.2.1 Drive and Diskette Compatibility
- 2.2.2 SCSI Hard Disk Drives and Devices
- 2.2.3 SCSI ID Numbers
- 2.2.4 Terminators

2.2.1 Drive and Diskette Compatibility

The following provides information concerning the identification of diskette drives.

Diskette Drive	Identifying Mark
3.5-Inch 720KB	None
3.5-Inch 1.44MB	1.44 on the Eject Button
3.5-Inch 2.88MB	2.88 on the Eject Button

The following addresses the compatibility of diskettes to diskette drives.

Diskette Capacity	720KB Drive	1.44MB Drive	2.88MB Drive
1.0MB	Read/Write	Read/Write	Read/Write
2.0MB	Not Compatible	Read/Write	Read/Write
4.0MB	Not Compatible	Not Compatible	Read/Write

Note: Install drives designed only for this system. Use of drives not designed for this system might cause intermittent problems.

2.2.2 SCSI Hard Disk Drives and Devices

The systems are shipped with at least one Small Computer System Interface (SCSI) hard disk drive and a SCSI controller intergrated on the system board. Up to five SCSI internal devices can be installed inside the system (all attached to the same controller). The default hard disk drive has the System programs preloaded in a protected partition. Up to three additional SCSI adapters can be installed in the system. Each additional SCSI adapter can support up to seven external SCSI devices.

The hard disk drives automatically position and lock the read/write heads in nondata areas when the system is powered-off.

2.2.3 SCSI ID Numbers

Each SCSI device connected to a SCSI controller must be assigned, at the time of installation, a unique SCSI identification number (SCSI ID). The SCSI controller and the SCSI devices attached to that controller are referred to as a SCSI chain (the system can support more than one SCSI chain). When changing drives, be sure to see "SCSI Device Cabling and Terminators" in topic 2.2.4.1. For in-depth information about SCSI, refer to the "IBM SCSI Architecture and Implementation" book (form number GG24-3507-XX).

Subtopics

- 2.2.3.1 Selecting a SCSI ID Priority
- 2.2.3.2 Determining the SCSI ID of an existing device
- 2.2.3.3 Setting the SCSI ID
- 2.2.3.4 Motor-Start Jumper

2.2.3.1 *Selecting a SCSI ID Priority*

The SCSI ID (6, 5, 4, 3, 2, 1, or 0) available for a device depends on which IDs are already assigned to devices in the same SCSI chain. For example, if there is already one device in the SCSI chain assigned SCSI ID 6, no other SCSI devices (in that chain) can be set to SCSI ID 6.

The ID you choose determines the priority of the device. A fixed-media read and write device, such as a hard disk drive, should be assigned a high-priority ID such as 6 or 5.

Note: The default drive with the system programs loaded is usually SCSI ID 6.

Removable-media devices (CD-ROM, optical drive, or a tape drive), should be assigned a priority ID of 4, 3, 2, 1, or 0 (an ID below that of the fixed-media devices).

In general, a low-priority or mid-priority device should not be assigned a SCSI ID higher than a high-priority device.

2.2.3.2 Determining the SCSI ID of an existing device

At the time of installation, a SCSI device should be labeled indicating the SCSI ID assigned to that device. If the device is not labeled, or you need to verify the SCSI ID, you can either decipher the jumper or switch settings (explained later), or you can do the following:

1. Power-on the system and access the Main Menu of the system programs.
2. Select **Set configuration** from the Main Menu, then select **Set and view SCSI device configuration**.

The SCSI ID for each installed SCSI device is displayed on the line that begins with **Device Address**. The ID appears in a set of two numbers separated by a comma (for example: **6, 0**). The first number (in this example: **6**) is the ID assigned to the installed SCSI device.

The ID for the SCSI adapter begins with the words **SCSI Address** or **SCSI Adapter Address**.

If there are no devices connected to a SCSI adapter, the screen will show only the slot that the SCSI adapter is installed in and the ID assigned to the adapter.

2.2.3.3 Setting the SCSI ID

SCSI devices have either switches or jumpers to set the SCSI ID. All FRU hard disk drives are shipped preset to SCSI ID 6. The type of hardware used and the location of the jumpers or switches varies from device to device.

To set the SCSI ID on a device that has switches, do the following:

- Refer to the switches in the figure below.
- Refer to the table to determine how the switches should be set for the SCSI ID you selected.
- Using a ballpoint pen, set switches 1, 2, and 3 to correspond to the SCSI ID you selected.
- Switch 4 is always set to "on."

PICTURE 5

The following table shows how switches 1, 2, and 3 are set for IDs 6 through 0.

PICTURE 6

Notes:

1. If present, switch five is always on, and switch six is always off.
2. On external SCSI devices that have a rotary switch to set the SCSI ID, set the switches or jumpers on the FRU device *inside the external cover* to zero (off) to enable the rotary switch.

To set the SCSI ID on a device that has jumpers, do the following:

- Refer to the pins in the figure below.
- Refer to the table to determine where the jumpers should be plugged to set the SCSI ID you chose.
- Move the jumpers to correspond to the SCSI ID you selected.

PICTURE 7

The following table shows how the jumpers are positioned for IDs 6 through 0.

SCSI ID	Jumpers	SCSI ID	Jumpers
	1 2 3		1 2 3
6	:	2	: :
5	:	1	: :
4	: :	0	: : :
3	:		
Value	1 2 4		1 2 4

2.2.3.4 Motor-Start Jumper

The jumper in position 4 (illustrated above) is the motor-start jumper. If the jumper is in place, the hard disk drive motor starts instantly when you power-on the system. If the jumper is not in place, POST starts the drive (sequentially). Some 320MB and 400MB drives are shipped in the system with the motor-start jumper in place to reduce POST time. If other large-capacity drives are added to the system, and they are set to start instantly (at power-on), the power supply might shut down. If this happens, it means that the total motor start surge current (of a multiple drive start-up) exceeds the reserve-current capacity of the power supply. You may have to remove the motor-start jumper from the option drives so that POST starts them in sequence.

Note: Original Equipment Manufacturer (OEM) drives may have a jumper or a switch to set the motor-start mode.

2.2.4 Terminators

Even though the system can *appear* to be operating correctly with or without terminators installed, it is *not* actually operating correctly. The SCSI bus can operate at data rates up to 5MB per second. Because of the high speed, the bus must be terminated properly, at *both ends*, with resistors (terminators) or you eventually *will* have problems.

If you do not terminate the SCSI bus correctly, you can experience intermittent errors. For example, if a terminator is *missing*, the result might be poor signal quality or improper (higher) voltages. Intermittent errors can lead to solid failures if the SCSI devices are exposed to continuous excessive voltages.

If you have *too many* terminators installed, for example, three internal hard disk drives, each with a terminator, the result might be a drop in voltages to a point where devices will not operate, or they operate intermittently.

Subtopics

2.2.4.1 SCSI Device Cabling and Terminators

2.2.4.2 SCSI Adapter Terminators

2.2.4.1 SCSI Device Cabling and Terminators

Internal SCSI Devices: Internal SCSI devices attach to a SCSI controller through a cable 1 . The system supports multiple internal SCSI devices and uses a cable with multiple connectors. If there is only one internal SCSI hard disk drive installed, it is connected to the last connector on the cable. Because that device is the last device in the SCSI chain, it is the only internal SCSI device that requires a terminator 2 .

Notes:

1. The SCSI controller on the system board **does not** require a terminator on the system board end of the SCSI chain.
2. Terminators vary depending on the device. You might see a single in-line cable terminator, one or more resistor terminators (in various sizes) on the circuit board of the device, or a pin-jumper on the circuit board. All terminators are labeled T-RES. Store any extra terminators with the system in case they are needed in the future.

External SCSI Devices: External SCSI devices are attached through a series of cables outside of the system. The first external device attaches to the SCSI controller port through a 60-pin to 50-pin cable 3 . Additional external SCSI devices link together through a 50-pin to 50-pin cable 4 . The last device in the chain requires a 50-pin block terminator 5 (in the lower connector).

PICTURE 8

2.2.4.2 SCSI Adapter Terminators

SCSI adapter terminator requirements and locations vary depending on the following:

Type of SCSI Adapter Installed: The type 1 SCSI adapter has a connector 1 (on one side) for a 20-pin terminator. Originally, only SCSI adapters without pluggable cache used the 20-pin side terminator. The newest level SCSI adapters use the 20-pin side terminator whether they have pluggable cache or not. Type 1 adapters do not require any other terminator.

The type 2 SCSI adapter *does not* have a connector on one side for a terminator. Instead, type 2 SCSI adapters use a 50-pin internal terminator 2 and a 60-pin external terminator 3.

SCSI Configuration: Adapter terminator requirements vary depending on whether the SCSI devices installed are internal, external, or both.

Use the figures and the table below to determine SCSI adapter terminator requirements.

PICTURE 9

SCSI Adapter Type Installed	Only Internal Devices Installed	Only External Devices Installed	Internal and External Devices Installed	Terminator Location (as shown above)
1	<input type="checkbox"/>			1
1		<input type="checkbox"/>		1
1			<input type="checkbox"/>	None
2	<input type="checkbox"/>			3
2		<input type="checkbox"/>		2
2			<input type="checkbox"/>	None

Table 1. Adapter Terminator Locations

2.3 *Operating Requirements*

This section describes the operations that occur from the time the system is powered-on until the minimum operating requirements have been met.

Subtopics

2.3.1 Power Supply

2.3.1 Power Supply

The power supply can be *manually* switched to support either the 100-125 V ac range or 200-240 V ac range. The ac input is converted to dc outputs that supply the system with proper operating voltages.

When the system is powered-off for 8 seconds or more and then powered-on, the power supply generates a 'power good' signal that resets system logic. The presence of the 'power good' signal turns on the green power-on light on the front of the system indicating that the power supply is functioning correctly.

2.4 System Diskettes (Reference, Diagnostic, and POST/BIOS Update)

If the hard disk drive is not operational, you can run the system programs from the System Diskettes (Reference Diskette, Diagnostic Diskette, and POST/BIOS Update Diskette).

The Reference Diskette contains the system programs, the Diagnostic Diskette contains the testing programs, and the POST/BIOS Update Diskette contains the POST/BIOS Update Utility and the POST/BIOS Image.. The Diagnostic Diskette is not startable. To run the Advanced Diagnostics from the Diagnostic Diskette, start the system from the Reference Diskette. When the Main Menu appears, press **Ctrl+A** and follow the instructions on the screen.

2.5 The System Partition

When you install new System Diskettes onto the hard disk, they write over all existing files (including option files). The new System Diskettes provide new system programs but they do not have the option files; therefore, after completing the following process, you must reinstall the option files.

Subtopics

- 2.5.1 Installation Requirements
- 2.5.2 Backing Up the Current System Partition
- 2.5.3 Installing a New Version of the System Programs
- 2.5.4 Installing a POST/BIOS Update Diskette
- 2.5.5 POST/BIOS Update Diskette Power-Failure Problem Recovery

2.5.1 Installation Requirements

Notes:

1. Before you install the new version of the System Diskettes, tell the customer that the installation takes up to one hour.
2. Follow all of the instructions in order.

You will need the following:

- A pen or pencil and a blank sheet of paper.
- The original option diskettes for *all* the options installed in the system. If the customer does not have all of the option diskettes, use a current backup of the System Partition.
- As many as four blank 2.0MB diskettes that are not write protected.

2.5.2 Backing Up the Current System Partition

In this step, you will be saving any customized configuration information on the System Partition.

Note: This procedure saves a customized configuration (1). It does not save a customized selectable drive-startup sequence. If a customized selectable drive-startup sequence exists on the system, you must reset that sequence after you complete this procedure.

1. Power-on the system (without a diskette in the drive).
2. Wait until the POST finishes (system beeps). Press **Ctrl+Alt+Del**. When the cursor moves to the top-right corner of the screen, press **Ctrl+Alt+Ins**.
3. Select **Set configuration** from the Main Menu of the system programs. Then select **Backup configuration**, and press **Enter**. When the backup configuration is completed, continue with the next step.
4. Select **View configuration** and use the **Print Screen** key (if you have a printer) or make a note of any option adapters in the system. (This is a precautionary step in case you need this information later.)
5. If the user has not changed the **Set and View SCSI device configuration** screen, go to step 7. If the user has made a change to the **Set and View SCSI device configuration** screen (or if you are not sure), continue with the next step.
6. To record the changes that have been made to the **Set and View device configuration** screen:
 - a. Select **Set features** from the Main Menu of the system programs and press **Enter**.
 - b. Select **Set startup sequence** and press **Enter**.

Note: An informational warning screen appears. Read the information and then press **Enter**.
 - c. Press the **Print Screen** key (if you have a printer), or use a pencil and paper, to record the current selectable drive-startup sequence. Then return to the Main Menu of the system programs.
7. From the Main Menu, select **Backup/Restore system programs**. Then select **Backup the System Partition**, and press **Enter**.
8. Get two blank 2.0MB diskettes, and label the diskettes with the following information:
 - First diskette: "Backup Copy of the System Partition-Server 85 Reference Diskette"
 - Second diskette: "Backup Copy of the System Partition-Server 85 Diagnostic Diskette"
 - Both diskettes: Write in the version level of the system programs (found on the screen).
9. Insert the diskette labeled "Backup Copy of the System Partition-Server 85 Reference Diskette" into the primary diskette drive and follow the instructions on the screen. The system prompts will tell you when to insert the second diskette.

Warning: The backup copy you are making includes the option files as well as the system programs. If several options are installed in the system, the system programs and the option files might not fit on one diskette. If this happens, you will receive a message on the screen (before the backup process has completed) indicating that the diskette is full. If you receive this message, you will not be able to make a copy on the entire System Partition. (You will have all system programs, but not all the option files.) If you need to restore the backup copy that you are now making onto the System Partition, you will need all the option diskettes to complete the procedure. If you attempt to restore the System Partition without using all the option diskettes, some of the options might not be usable.
10. When the copy is completed, remove the diskette.

(1) Customized configuration: A system configuration that users create using the change configuration feature of the system programs. For example, the user may have changed the serial port default value, or changed a token ring address location.

2.5.3 Installing a New Version of the System Programs

Note: If instructions are included with the new System Diskettes, use those instructions rather than these.

To install the new System Programs on to a existing partition, do the following.

1. Make a backup copy of the current System Partition. If necessary, go to "Backing Up the Current System Partition" in topic 2.5.2 and complete those instructions. Then return here and continue with the next step.
2. Power-on the system, then insert the new Reference Diskette into the primary diskette drive. This diskette contains the new system programs.
3. Power-on the system.
4. When the Main Menu of the Reference Diskette appears, select **Update system programs** from the Main Menu, and follow the instructions on the screen.

Note: If a screen message appears asking you to make a backup copy of the System Partition, ignore the screen message. You will make a backup copy later in this procedure.

5. If you *do not* need to reset the selectable drive-startup sequence, go to {SYS4} If you *do* need to reset the sequence, do the following:
 - a. Select **Set features** from the Main Menu, then select **Set startup sequence**.
 - b. Use the information that you recorded in 6c in topic 2.5.2, and reset the sequence.
 - c. Return to the Main Menu.
6. Make a new backup copy of the system partition. If necessary, see "Backing Up the Current System Partition" in topic 2.5.2.

2.5.4 Installing a POST/BIOS Update Diskette

The POST/BIOS Update Diskette is used to update POST and BIOS files in the system. To install the update diskette:

1. Power-off the system.
2. Remove all media from the system.
3. Insert the POST/BIOS Update Diskette in drive A.
4. Power-on all attached devices; then power-on the system.
5. Follow the instructions on the screen until you have completed the update procedure.

Note: If a power failure occurred during the POST/BIOS Update Diskette installation procedure, and you were unable to complete the procedure, do the following:

1. Power-off the system. Wait about 20 seconds, then power-on system and repeat the update diskette installation procedure.
2. If you still cannot start or complete the update diskette installation procedure, go to "POST/BIOS Update Diskette Power-Failure Problem Recovery" in topic 2.5.5.

2.5.5 POST/BIOS Update Diskette Power-Failure Problem Recovery

Use the following instructions **only** if a power failure occurred during the POST/BIOS Update Diskette installation procedure.

1. Power-off the system.
2. Locate the connector (jumper) labeled JMP5 on the system board.
3. Move jumper JMP5, to connect the center pin and the pin on the opposite end of the connector. If necessary, see "Locations" in topic 2.11. After you move it, leave the jumper in the new position.
4. Go to "Installing a POST/BIOS Update Diskette" in topic 2.5.4 and follow the update diskette installation procedure to completion.

2.6 Using ASCII Terminals

This system supports the following ASCII display stations, when attached to the system board serial connector: 3151, 3161, 3162, 3163, and 3164. However, there are physical differences among the ASCII terminals that affect the system setup.

Notes:

1. Not all operating systems will support an ASCII terminal.
2. Beginners All-Purpose Symbolic Instruction Code (BASIC) language is not supported when using an ASCII terminal.
3. High-resolution graphics are not available when using an ASCII terminal.

Subtopics

- 2.6.1 ASCII Terminal Setup and Menu Selection
- 2.6.2 ASCII Terminal Configuration

2.6.1 ASCII Terminal Setup and Menu Selection

Use the setup instructions supplied with the ASCII terminal. As you are using those instructions, you will need to know the following information:

- Use a null-modem cable or a null-modem connector 1 with the communication cable 2 when attaching the ASCII terminal 3 to the serial connector on the computer.

PICTURE 10

- If the ASCII terminal has a test switch next to the keyboard connector, make sure it is in the normal position.

When using the system programs and defining the setup values on the ASCII terminal, be sure the machine mode matches the actual terminal you are installing. For example, if you are installing a 3151 ASCII Display Station, the Machine Mode on the Setup Menu must be set to IBM3151. When the setup values correctly match the terminal type, the machine is considered to be in the *native machine mode*.

Set the Communication values on the terminal as follows:

Line Speed (bps)	9600
Word Length (bits)	8
Parity	No
Stop Bit	1

Notes:

1. When using the system programs, do not install an emulation cartridge unless it will support native machine mode.
2. The terminals designed for countries where English is not the native language must support the ISO 8859/1.2 code page. Some of the terminals require a cartridge to support this code page. Check the documentation that came with the terminal to see if the terminal requires a cartridge.

2.6.2 ASCII Terminal Configuration

When using an ASCII terminal, you must define the setup values so that the display station can correctly communicate with the system.

Subtopics

2.6.2.1 Console Selection

2.6.2.2 Error Messages

2.6.2.3 Operations

2.6.2.1 Console Selection

This system has a Set Console utility program that lets you tell the system you are using an ASCII terminal.

Without the Set Console utility program, the system will use the default values shown. The ASCII terminal values must match these values. Complete the following steps to use an ASCII terminal.

Before you make these selections in the Set Console utility program, make sure that you have an ASCII terminal *attached* to the system.

1. Start the system programs.

Note: If you start the system programs from an ASCII terminal, power-on the terminal then the system. Press and hold **Ctrl**. Then press and release **C+A+D**. When the cursor moves to the top-right corner of the screen, press **Ctrl+i**.

2. Select **Set features** on the system programs Main Menu.
3. Select **Set console** on the Set Features Menu.
4. Select **ASCII terminal** on the Set Console Menu.

The values must be:

Baud rate	9600
Bits per character	8
Parity	None
Stop bits	1

Note: These instructions assume that you have already set the terminal to the same values described in "ASCII Terminal Setup and Menu Selection" in topic 2.6.1.

Any time you change the ASCII terminal values, you also must update the system values to match it. The baud rate should always be 9600 or above. If you set the baud rate below 9600, system performance will be slow.

2.6.2.2 *Error Messages*

If you get a 161 or 173 error during POST, the selection you made in the Set Console utility program is no longer valid. When this happens, the system will look for a video adapter. If it finds one, the keyboard and display will be used as a console. If it does not find one, the ASCII terminal will be used as a console.

Also, if you get a 170 error, the console selection conflicts with the serial port settings. (Example: the ASCII Console is selected, but COM1 is disabled.)

2.6.2.3 Operations

Some of the ASCII terminal operations are listed below.

Configuration When you run the system programs or diagnostic programs from the ASCII terminal, the terminal values might change. Check the terminal values. If they have changed, reset them.

Utilities To start the system programs when using an ASCII terminal, follow the instructions that came with the operating system. When the cursor moves to the top-right corner of the screen, press **Ctrl+i**.

Diagnostics When an ASCII terminal is selected as the system console, the following will not appear on the diagnostic installed device list:

- Keyboard
- Mouse
- System board async port
- Video displays.

2.7 Miscellaneous System-Related Information

This section contains miscellaneous system-related system information that will aid you in trouble shooting.

Dumping Extended Diagnostic Data Information: In cases where the system appears to have an undetectable intermittent failure, analyzing the extended data information will help find the cause of the failure. The support center may request that you dump this information onto a diskette. Dump only the extended data by request of the support center. To dump the extended data, do the following:

- Format a scratch 2MB diskette.
- Restart the system from the Reference Diskette (*do not* start from the System Partition or you will copy the data to the System Partition).
- From the Main Menu, select **Set Configuration** and choose **Change configuration**.
- Remove the Reference Diskette from the drive.
- Insert the formatted 2MB diskette into the primary diskette drive.
- Press F10 (this starts the bit-dump and writes two files onto the diskette).
- After the screen message indicates that the process is complete, remove the diskette from the drive and insert the Reference Diskette.
- Send the diskette to the support center that requested it.

PS/2 Displays: If you experience problems with a PS/2 display, and the Advanced Diagnostic video test and the display self-tests do not indicate a problem, consider the location of the display and any surrounding devices. Certain fluctuating low-frequency magnetic fields can cause the screen to distort, jitter, or roll. These magnetic fields are generally present around transformers, small appliances and even nearby florescent lighting fixtures. If you experience this problem, you may have to move the device or the display. Displays that are too close to each other (less than 12 inches) could cause similar problems.

Note: Because of the differences in the Earth's magnetic fields, displays are designed to be used in a specific hemisphere. For example, if a display marketed for use in the Southern Hemisphere is relocated to far northern latitudes (Australia to Norway) the colors will probably be distorted. The parts catalog in the Hardware Maintenance Service pamphlet lists FRU numbers and model numbers for Northern and Southern Hemisphere displays.

You should avoid moving a color display *while it is powered-on*. The movement can result in some screen discolorations. If this happens, to correct the colors, power-off the display for twenty minutes (the display will automatically demagnetize the screen after it is off for twenty minutes).

It is possible for a display to cause diskette drive read/write errors if the drive and the display are too close. Distance between displays and diskette drives should be at least 3 inches.

Surge Suppressors: External surge suppressors are not required on PS/2 systems. The systems are designed to resist typical power surges. More severe surge levels are possible, but the probability is quite low. A defective external surge suppression device can cause intermittent system failures. No design or performance standards have been established for these devices and there is no easy way to test them. If the system has undetectable intermittent failures and there is a surge suppressor installed, try operating the system without the surge suppressor.

Uninterruptible Power Devices: Uninterruptible power devices are designed to supply continuous power to the system in the case of a power outage. They are usually used only when the potential loss of data or use is unacceptable.

Numerous devices of this type are available, but not all of them produce an AC sine-wave voltage. PS/2 systems require sine-wave. If the uninterruptible power device is defective or the wrong type, the result could be undetectable intermittent failures.

2.8 Specifications

Size

- Height: 501 mm (19.75 in.)
- Depth: 508 mm (20.0 in.)
- Width: 203 mm (8.0 in.)

Weight

- Minimum configuration: 22 kg (50 lb)
- Maximum configuration: 30 kg (67 lb)

Environment

- Temperature
 - System on: 10° to 35° C (50° to 95° F) 0 to 914m (0 to 3000 ft.)
 - System on: 10° to 32° C (50° to 90° F) 0 to 2133m (0 to 7000 ft.)
 - System off: 10° to 43° C (50° to 110° F)
- Humidity
 - System on: 8% to 80%
 - System off: 8% to 80%
- Maximum altitude: 2134 m (7000 ft)

Heat Output

- Approximate heat output in British Thermal Units (BTU) per hour
 - Minimum configuration - 205 BTU (60 watts)
 - Maximum configuration - 1637 BTU (480 watts)

Electrical

- Input voltage (sinewave input is required)
 - Low Range:
 - Minimum: 90 V ac
 - Maximum: 137 V ac
 - High Range:
 - Minimum: 180 V ac
 - Maximum: 265 V ac
- Input kilovolt-amperes (kVA)
 - Minimum Configuration (as shipped from IBM) - Approximately 0.1 kVA
 - Maximum Configuration - Approximately 0.67 kVA.

2.9 Special Tools

The following special tools are required to service the systems:

Wrap Plug

Use the Tri-Connector Wrap Plug during advanced diagnostic tests of the parallel and serial ports.

PICTURE 11

Volt-Ohm Meter

Use a meter similar to the Triplet Model 310 to test voltages. (2)

(2) Manufactured by Triplet Corporation, Bluffton, Ohio 45817,
U.S.A.

2.10 Safety Information

The following section contains the safety information required to service a PS/2 product. Familiarize yourself with this information before servicing a PS/2 product.

Subtopics

- 2.10.1 General Safety
- 2.10.2 Safety Inspection Guide
- 2.10.3 Handling Electrostatic Discharge (ESD) Sensitive Devices
- 2.10.4 Electrical Safety

2.10.1 General Safety

Use these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during maintenance and after completing it.
- When lifting any heavy object:
 1. Ensure you can stand safely without slipping.
 2. Distribute the weight of the object equally between your feet.
 3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
 4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*
- Do not perform any action that causes hazards to the customer or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Put removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your tool case away from walk areas so that other people will not trip over it; for example, put it under a desk or table.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside other clothing or fasten the necktie with a clip, preferably nonconductive, approximately 8 centimeters (3 inches) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

Remember: A metal object lets more current flow if you touch a live conductor.

- Wear safety glasses when you are:
 - Using a hammer to drive pins or similar parts
 - Drilling with a power hand-drill
 - Using spring hooks or attaching springs
 - Soldering parts
 - Cutting wire or removing steel bands
 - Cleaning parts with solvents, chemicals, or cleaning fluids
 - Working in any other conditions that might be hazardous to your eyes.
- After maintenance, reinstall all safety devices such as shields, guards, labels, and ground wires. Exchange any safety device that is worn or defective for a new one.

Remember: Safety devices protect personnel from hazards. You destroy the purpose of the devices if you do not reinstall them before completing your service call.

- Reinstall all covers correctly before returning the machine to the customer.

2.10.2 Safety Inspection Guide

The intent of this inspection guide is to assist you in identifying potentially unsafe conditions on these products. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This guide addresses only those items. However, good judgment should be used to identify potential safety hazards due to attachment of non-IBM features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power: primary voltage on the frame can cause serious or fatal electrical shock.
- Explosive hazards, such as a damaged CRT face or bulging capacitor, can cause serious injury.
- Mechanical hazards, such as loose or missing hardware, can cause serious injury.

The guide consists of a series of steps presented in a checklist. Begin the checks with the power off and the power cord removed from the power receptacle.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power off the system. Disconnect the power cord from the electrical outlet.
3. Check the power cord for:
 - a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
 - b. The power cord should be the appropriate type as specified in "Power Cords" in topic 1.5.5.
 - c. Insulation must not be frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

2.10.3 Handling Electrostatic Discharge (ESD) Sensitive Devices

Any part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD).

Note: Use product-specific ESD procedures when they exceed the requirements noted here.

ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge. The use of a grounding cord system is desirable but not required to protect against ESD damage. The ESD grounding wrist band must be worn against the skin. Select the grounding cord system to provide protection for the specific service requirement. If an ESD-sensitive part is swapped, the mat must be used to provide an ESD-safe work surface to protect the part removed from the system. The mat might not be required for a simple insertion. The mat can be used as an ESD-protective container for swapping parts between systems. Use the mat with the BLACK side up.

The ESD ground clip can be attached to any frame ground, ground braid, or green wire ground. For systems that are double-insulated, or battery-operated, an ESD common ground or reference point should be used. The round ground-prong on the AC plug can be used on AC-operated systems. Coax or connector-outside shells can be used on double-insulated or battery-operated systems.

ESD-sensitive parts must not touch any part of your clothing. Most clothing is insulative and retains a charge *even when you are wearing a wrist band*. Avoid contact with other people when handling ESD-sensitive parts. Keep ESD-sensitive parts in protective packages until they are inserted into the product.

2.10.4 Electrical Safety

Observe the following rules when working on electrical equipment:

- Find the room emergency power-off (EPO) switch or disconnecting switch. If an electrical accident occurs, you can then operate the switch quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power:
 - Before doing a mechanical inspection
 - Before working near power supplies
 - Before removing or installing main units
- Before you start to work on the machine, unplug its power cable. If you cannot unplug the cable, ask the customer to switch off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
 - Ensure that another person, familiar with the power-off controls, is near you.

Remember: Another person must be there to switch off the power, if necessary.

CAUTION:

Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents. Use only approved tools and testers.

- Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

Remember: There must be a complete circuit to cause electrical shock. By observing the above rule, you may prevent a current from passing through your body.

- When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.

CAUTION:

Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

- Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been switched off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
- Do not service the following parts *with the power on* when they are removed from their normal operating places in a machine:
 - Power supply units
 - Pumps
 - Blowers and fans
 - Motor generators

and similar units. (This practice ensures correct grounding of the units.)

- If an electrical accident occurs:
 - **Use caution; do not become a victim yourself.**
 - **Switch off power.**
 - **Send another person to get medical aid.**

2.11 Locations

Subtopics

- 2.11.1 Front View
- 2.11.2 Rear View
- 2.11.3 Interior View
- 2.11.4 Internal Cables
- 2.11.5 System Board

2.11.1 Front View

- 1 Power-on light
- 2 Power switch
- 3 Hard disk in-use light
- 4 Type, model and serial number
- 5 Diskette drive in-use light
- 6 Diskette drive (bay 0)
- 7 Diskette-eject button
- 8 Option diskette drive (bay 1)
- 9 Option SCSI or non-SCSI device (bay 2)
- 10 Option SCSI device bay
- 11 Option SCSI device bay
- 12 Cover lock.

PICTURE 12

2.11.2 Rear View

- 1 Expansion slots
- 2 External SCSI connector
- 3 Parallel port
- 4 Serial port
- 5 Pointing-device connector
- 6 Keyboard connector
- 7 Power-cord connector
- 8 Type, model and serial number
- 9 Voltage-select switch.

PICTURE 13

2.11.3 Interior View

- 1 SCSI device internal cable
- 2 Expansion slots
- 3 Adapter retainer and ground assembly
- 4 Display Adapter
- 5 System board
- 6 Power supply
- 7 Power-good light
- 8 Power-good button
- 9 Internal SCSI Device power cable
- 10 SCSI or non-SCSI option device (bay 2)
- 11 Option SCSI device bays
- 12 SCSI hard disk drive
- 13 Drive retainer
- 14 Option diskette drive (bay 1)
- 15 Diskette drive (bay 0).

PICTURE 14

2.11.4 Internal Cables

This diagram shows the arrangement of the cables that connect the various devices.

- 1 Information-panel cable
- 2 SCSI-internal cable (signal)
- 3 Internal SCSI device cable connector
- 4 System board
- 5 Power supply
- 6 Device power cables
- 7 Diskette-drive cable (signal & power).

PICTURE 15

2.11.5 System Board

- 1 32-bit expansion slots
(video extensions J9, J11)
- 2 Internal SCSI connector
- 3 External SCSI connector
- 4 Parallel port
- 5 Serial port
- 6 Pointing-device connector
- 7 Keyboard connector
- 8 Memory-module connectors
- 9 Recovery jumper (JMP5)
- 10 Power-supply connector
- 11 Alternate-microprocessor socket
- 12 Diskette-drive cable connector
- 13 Override jumper connector (JMP1)
- 14 Indicator Panel connector

PICTURE 16

2.12 Grounds

- 1 Screws
- 2 Expansion slot screws
- 3 Chassis ground
- 4 Primary ground
- 5 Power-cord connector.

PICTURE 17

2.13 Notices

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