

Note

Before using this information and the product it supports, be sure to read the general information under "Notices" in topic 2.12.

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About This Manual

This manual contains service and reference information for the IBM (*) ThinkPad (*) 500 Computer.

- The service section includes procedures for isolating problems to a field replaceable unit (FRU), a Symptom-to-FRU Index, and a parts listing.
- The reference section includes safety information, the product description, and locations information.

This manual should be used along with the ThinkPad Computer advanced diagnostic tests to troubleshoot problems effectively.

Important

If you are unfamiliar with IBM ThinkPad 500 safety information, begin by reading "Safety Information" in topic 2.11. Then, continue with the service or reference sections of this manual as required.

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1.0 *ThinkPad 500 Hardware Maintenance Service*

The service section of this manual provides the necessary information for a trained service person to diagnose a failure to the field replaceable unit (FRU). This section includes:

- General checkout
- Undetermined problems
- Various ThinkPad 500 computer tests
- Handling ESD-sensitive parts
- Symptom-to-FRU list
- Parts listing

Subtopics

- 1.1 General Checkout
- 1.2 Undetermined Problems
- 1.3 Checking Power
- 1.4 Diagnostic Aids
- 1.5 Handling ESD-Sensitive Parts
- 1.6 Symptom-to-FRU Index
- 1.7 Parts

1.1 General Checkout

The advanced diagnostic tests are intended to test *only* IBM products. Non-IBM products or modified options can give false errors and invalid responses.

```
+--- Important -----+
|
| If more than one error code appears, diagnose the first error code
| received. The cause of the first error code can cause additional
| false error codes to appear.
|
+-----+
```

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

- Power-off the system and all external devices.
- Check all cables and power cords.

Note: An external diskette drive must be attached to the system to run the diagnostics program from a diskette. If an external diskette drive **is not** attached to the system, do the following.

1. Run the POST (Power-On Self Test).
2. If you receive an error, go to "Symptom-to-FRU Index" in topic 1.6.
3. If you suspect an undetermined problem, go to "Undetermined Problems" in topic 1.2.

- Insert the Advanced Diagnostics diskette into the diskette drive.
- Power-on the system.
- Adjust the brightness and contrast controls.

DID YOU HEAR ONE SHORT BEEP AT THE END OF POST?

Yes No

```
|
|
| +---+
| |002|
| +---+
| Go to "Symptom-to-FRU Index" in topic 1.6.
|
```

```
+---+
|003|
+---+
```

- If you need to bypass an error, press **Esc** or **F1**.
- If you cannot bypass the error, go to "Symptom-to-FRU Index" in topic 1.6.

DID THE ADVANCED DIAGNOSTICS MENU APPEAR SHARP, CLEAR, STABLE, AND THE CORRECT COLOR?

Yes No

```
|
|
| +---+
| |004|
| +---+
| Go to "Symptom-to-FRU Index" in topic 1.6.
|
```

```
+---+
|005|
+---+
```

- Press **0** (**SYSTEM CHECKOUT**), then press **Enter**, and follow the instructions on the screen.

DID THE INSTALLED DEVICES MENU APPEAR?

Yes No

```
|
|
| +---+
| |006|
| +---+
| Go to "Symptom-to-FRU Index" in topic 1.6.
|
```

```
+---+
|007|
+---+
```

IS THE INSTALLED DEVICES MENU CORRECT?

Yes No

```
|
|
| +---+
| |008|
| +---+
| Add the missing device to the menu. If you cannot add the missing
| device to the menu, the device may be defective.
|
```

```
+---+
|009|
+---+
```

IBM ThinkPad 500 HMM
General Checkout

- Press **0** (**RUN TEST ONE TIME**), then press **Enter**.
- Press **Enter** (**SELECT ALL OPTIONS**).
- For the diskette drive test, run 1 through 5 one time each.
- For the hard disk test, select **6** (**RUN ALL TESTS**).
- For display test, select **6** (**RUN TESTS 1 THROUGH 5**).
- If installed, test the external display and keyboard.

DID THE CHECKOUT MENU APPEAR AT THE END OF THE TESTS?

Yes No

|
|
| +---+
| |010|
| +---+
|

Go to "Symptom-to-FRU Index" in topic 1.6.

+---+

|011|

+---+

DID YOU RECEIVE AN ERROR CODE OR FAILURE SYMPTOM?

Yes No

|
|
| +---+
| |012|
| +---+
|

The Advanced Diagnostics Tests have completed successfully. If you suspect an undetermined problem, go to "Undetermined Problems" in topic 1.2.

+---+

|013|

+---+

DID YOU RECEIVE A 7XX ERROR OR COPROCESSOR FAILURE MESSAGE?

Yes No

|
|
| +---+
| |014|
| +---+
|

Go to "Symptom-to-FRU Index" in topic 1.6.

+---+

|015|

+---+

- If the coprocessor is installed properly, replace it.
- If the problems remains, replace the system board. Press **Func** and **F1** to set the time and date to remove the 16X errors.

1.2 Undetermined Problems

If you have not already done so, go to "Checking Power" in topic 1.3 and check the AC adapter and battery voltages.

If the AC adapter and battery voltages are correct and the problem remains, do the following.

1. Power-off the ThinkPad 500 computer.
2. Remove or disconnect one of the following devices:
 - Any external devices or cables
 - Any PCMCIA (**) device
3. Power-on the ThinkPad 500 computer.
4. If the symptom remains, repeat steps 1, 2, and 3 until you find the failing adapter or device.
5. If this does not solve the problem, replace the system board.

(**) Trademark of the Personal Computer Memory Card International Association.

1.3 Checking Power

To check the system power, do the following.

1. Power-off the system.
2. Remove the battery from the system.
3. Check the battery voltage. The voltage should be 8 Volts dc.

If the voltages **are not** correct, try recharging the battery pack.

If the voltages **are** correct, continue with the next step to test the AC adapter voltage.

4. Power-off the system.
5. Unplug the AC adapter from the system.
6. Measure the voltage at the points shown.

PICTURE 1

Table 1. Correct AC Adapter Voltage Measurement		
V dc	+ Lead	- Lead
+13.5	1	2

If the voltage **is not** correct, replace the AC adapter.

If the voltage **is** correct, go to "Undetermined Problems" in topic 1.2.

1.4 Diagnostic Aids

This section explains the diagnostic aids that are available for troubleshooting problems on the system.

Screens in this section are typical; however, your screens may appear slightly different from those in this manual.

Subtopics

- 1.4.1 Power-On Self Test (POST)
- 1.4.2 Advanced Diagnostics Diskette
- 1.4.3 Loading the Diagnostics Diskette
- 1.4.4 Formatting the Hard Disk Drive (Use Only if Needed)
- 1.4.5 Error Log
- 1.4.6 External Display Self Test

1.4.1 Power-On Self Test (POST)

Each time you power-on the system, POST is initiated. The POST takes up to 90 seconds to complete, depending on the options installed.

The POST checks the following:

- System Board
- Memory
- Display
- Keyboard
- Diskette Drive
- Hard Disk Drive
- Parallel Port
- Serial Port

To start the POST, power-on the system. The following will happen:

1. You will hear one short beep when the POST successfully ends.

If the POST cannot be completed successfully, an error message appears on the display accompanied by the Configuration Utility box requesting the user to press the **Esc** or **Enter** key. When the **Esc** key is pressed, the system bypasses the error and attempts to complete the POST. If the **Enter** key is pressed, the Configuration Utility is shown. The user can then try to correct the error. If a critical error is encountered, the POST is halted.

2. The system attempts to load the operating system as customized. If an operating system is not found, a graphic message (icon) is displayed requesting the user to insert a diskette into the diskette drive and press the **F1 (RESUME = "F1" KEY)** key to resume operation.

1.4.2 *Advanced Diagnostics Diskette*

The Advanced Diagnostics diskette contains diagnostic and utility programs.

The Advanced Diagnostics diskette is intended to test only IBM products. Non-IBM products, prototype cards, or modified options can give false errors and invalid system responses.

1.4.3 *Loading the Diagnostics Diskette*

To load the diagnostics diskette, insert the Advanced Diagnostics diskette into the diskette drive and power-on the system.

Subtopics

1.4.3.1 Accessing the Diagnostic Tests

1.4.3.1 *Accessing the Diagnostic Tests*

To access diagnostic tests from the SELECT AN OPTION Menu, do the following.

1. Select **0 (SYSTEM CHECKOUT)**, then press **Enter**.
2. At the Installed Devices menu, press **(Y)**, then press **Enter**.
3. The **SYSTEM CHECKOUT** menu is then displayed.
4. Select **0** or **1** from the **SYSTEM CHECKOUT** menu.
5. Select the device to be tested.

1.4.4 Formatting the Hard Disk Drive (Use Only if Needed)

Hard disk drives normally contain tracks in excess of their stated capacity to allow for defective tracks. The user is notified by a diagnostic message when the defect limit has been reached and service is recommended.

The Advanced Diagnostics Format program is different from the operating system format program. Before the customer can transfer information from the backup diskettes to the hard disk drive, the hard disk drive must be formatted using the operating system format program. Have the customer refer to the operating system manual for a description of the hard disk preparation commands.

Warning: All data on the selected hard disk drive will be destroyed during a format operation or surface analysis.

After formatting the hard disk drive, copy the System files from the Diagnostics diskette to the hard disk drive. To do this, see "Restoring the TP500 Subdirectory" in topic 2.6.

1.4.5 Error Log

Use the following steps to create an error log, run the diagnostic tests, and automatically record any error messages in an error log. This procedure is normally used to diagnose an intermittent problem.

Note: The errors must be logged to a diskette drive or to a printer. If recording errors on a diskette, use a copy of the Advanced Diagnostics diskette that is not write-protected. **Do not run any diskette tests when logging to a diskette drive. Do not run a parallel port test when logging to a printer.**

Subtopics

- 1.4.5.1 Creating the Error Log
- 1.4.5.2 Starting the Test
- 1.4.5.3 Display the Error Log

1.4.5.1 *Creating the Error Log*

1. Insert the Advanced Diagnostics diskette into the diskette drive.
2. Press **0** (**SYSTEM CHECKOUT**), then **Enter**.
3. Depending on the options installed in the system, questions about attached devices may appear on the display. Answer as required; then press **Enter**.
4. Press **Y** or **N** (**IS THE LIST CORRECT (Y/N)?**), then **Enter**.
5. Press **2** (**LOG UTILITIES**), then **Enter**.
6. Press **0** (**START ERROR LOG**), then **Enter**.
7. Press **0** or **1** (**LOG TO DISKETTE, OR PRINTER (0/1)?**), then **Enter**.
8. If you are logging to diskette, press **A** (**ENTER THE DRIVE ID FOR ERROR LOG?**), then **Enter**.
9. Press **9** (**END LOG UTILITIES**), then **Enter**.

1.4.5.2 Starting the Test

1. Press **1** (**RUN TESTS MULTIPLE TIMES**), then **Enter**.
2. Select the device you suspect has a failure, then press **Enter**.
3. Select the number of times the test is to be run; then press **Enter**.
4. Press **N** (**WAIT EACH TIME AN ERROR OCCURS (Y/N)?**), then **Enter**.
5. Follow any instructions on the display and select all available tests.

Note: Do not press any keys during the keyboard test.

6. To end (**RUN TEST CONTINUOUSLY**), press and hold the **Ctrl** key; then press the **Pause** key. The system will complete testing and return to the Installed Devices menu.

1.4.5.3 *Display the Error Log*

1. Depending on the options installed in the system, questions about attached devices will appear on the display. Answer as required; then press **Enter**.
2. Press **Y** or **N** (**IS THE LIST CORRECT (Y/N)?**), then **Enter**.
3. Press **2** (**LOG UTILITIES**), then **Enter**.
4. Press **2** (**DISPLAY LOG**), then **Enter**.
5. Press **A** (**ENTER THE DRIVE ID FOR ERROR LOG?**), then **Enter**.
6. If no errors occurred, the Log Utilities menu appears. If errors are displayed, go to "Symptom-to-FRU Index" in topic 1.6.

1.4.6 *External Display Self Test*

Be sure the display has been turned on for at least 5 minutes before you start the display self test.

Note: This test works only on IBM displays.

Run the test as follows:

1. Power-off the system.
2. Disconnect the display cable from the system.
3. Power-on the display.
4. Adjust the contrast control to maximum.
5. Adjust the brightness control to its middle position.
6. The image on the display should be white in the center with a black strip, 2 to 20 mm (0.08 to 0.79 in.), on one or both sides. Some shading may occur near the edges.

1.5 Handling ESD-Sensitive Parts

Many products use parts that are known to be sensitive to electrostatic discharge (ESD). To prevent damage when you work with ESD-sensitive parts, observe the following instructions. Do these in addition to taking all the usual precautions, such as switching off (O) the power before removing logic cards.

- Keep the ESD-sensitive part in its original shipping container (a special ESD bag) until you are ready to install the part into the machine.
- Make the least possible movements with your body to prevent an increase of static electricity from clothing fibers, carpets, and furniture.
- Put the ESD wrist strap on your wrist. Ensure the machine is turned off (O). This discharges any static electricity in your body to the machine frame.
- Hold the ESD-sensitive part by its edge connector shroud (cover). *Do not touch its pins.* If you are removing a pluggable module, use the correct tool.
- Do not place the ESD-sensitive part on the machine cover or on a metal table. If you need to put down the ESD-sensitive part for any reason, first put it into its special bag.

Note: Machine covers and metal tables are electrical grounds. They increase the risk of damage because they make a discharge path from your body through the ESD-sensitive part (large metal objects can be discharge paths without being grounded).

- Prevent ESD-sensitive parts from being accidentally touched by other personnel, such as CSRs or customers. Reinstall machine covers when you are not working on the machine.
- If possible, keep all ESD-sensitive parts in a grounded metal cabinet (case).
- Be extra careful while working with ESD-sensitive parts when cold-weather heating is used because low humidity increases static electricity.

1.6 Symptom-to-FRU Index

The Symptom-to-FRU Index lists symptoms, errors, and the possible causes. The most likely cause is listed first. Use this index to help you decide which FRUs to have available when servicing a ThinkPad 500 computer.

In the following error codes, X can be any number.

```
+--- Note -----+
|
| For IBM devices not supported by ThinkPad 500 diagnostic code, refer
| to the manual for that device.
|
+-----+
```

Subtopics

- 1.6.1 Numeric Error Codes
- 1.6.2 No-Beep Symptoms
- 1.6.3 Beep Symptoms

1.6.1 Numeric Error Codes

Symptom/Error	FRU/Action
02X, 101, 107	Battery AC Adapter Memory Option System Board
102, 103, 104, 106, 108, 109, 190 (Press Func and F1 to set the time and date and remove any 16X errors.)	System Board
111	Memory Option
161, 163	Set Configuration Battery System Board
162	Any Device (Check the installed devices list for a missing device) System Board
1XX (not listed above)	System Board
2XX	Memory Option
3XX	Keyboard System Board
6XX	Diskette Drive System Board
9XX, 10XX	Any External Parallel Device System Board
11XX, 12XX	Any External Serial Device PCMCIA Device System Board
17XX	Hard Disk System Board
24XX	Display System Board
86XX	Keyboard System Board

1.6.2 No-Beep Symptoms

Symptom/Error	FRU/Action
Blank screen	Battery AC Adapter Memory Option System Board
Diagnostic tests hang	Battery AC Adapter Memory Option System Board
Blinking cursor only	Diskette Drive System Board
No beep or continuous beeps (See "Checking Power" in topic 1.3 before replacing any FRUs.)	System Board Memory Option
C: prompt	Diskette Drive
Diskette drive bypassed	Diskette Drive
Can't read diskette	Diskette Drive
Hard disk problem	Hard Disk
Printer problem	Check Configuration Parallel Port System Board
Communication or plotter problem	Check Configuration Serial Port PCMCIA Device System Board

1.6.3 Beep Symptoms

Symptom/Error	FRU/Action
One long and one short beep	Memory Option
Two long beeps, 3 short beeps, and a blank screen	External Display, if installed External Display Power Cord LCD Assembly System Board
Multiple short beeps	Keyboard (stuck key)
One short beep with a display problem	External Display, if installed External Display Power Cord LCD Assembly
One long and multiple short beeps	External Display, if installed External Display Power Cord LCD Assembly
Display problems	External Display, if installed External Display Power Cord LCD Assembly
LCD contrast not adjustable	LCD Assembly System Board
Keyboard problems	Keyboard System Board
Printer problems	Keyboard System Board

1.7 Parts

PICTURE 2

<i>Index</i>	<i>System Unit FRUs</i>	
1	Keyboard Assembly	59G7920
2	LCD Assembly	59G7919
3	Power Button	59G7937
4	Power Card	52G7922
5	System Board	52G7290
	System Board Bracket	52G7951
6	85MB Hard Disk	59G7915
6	170MB Hard Disk	59G7917
7	Base Cover Assembly (R)	52G7921
	Connector Door	59G7936
8	Rechargeable Battery (self charging)	59G7924
8	Rechargeable Battery	59G7946
9	Diskette Drive/Serial Cable (External)	59G7925
	Diskette Drive/Serial Cable (Internal)	59G7952
	Hard Disk Cable (Internal)	59G7927
10	Video Cable	59G7926
11	AC Adapter	59G7923
	External Diskette Drive	59G7918
	Tools and Miscellaneous	
	Screw Pack	59G7944

2.0 ThinkPad 500 Hardware Maintenance Reference

This section of the manual provides the reference information for the ThinkPad 500 computer. This section includes:

- Product overview
- Product description
- Setup options
- Utilities
- Restoring the TP500 Subdirectory
- Configuration utility information
- System memory information
- Special tool requirements
- Specifications
- Locations
- Safety information

Subtopics

- 2.1 Product Overview
- 2.2 Product Description
- 2.3 Setup Options
- 2.4 Starting Setup
- 2.5 Utilities
- 2.6 Restoring the TP500 Subdirectory
- 2.7 System Memory
- 2.8 Special Tools
- 2.9 Specifications
- 2.10 Locations
- 2.11 Safety Information
- 2.12 Notices

2.1 Product Overview

The ThinkPad 500 computer is a light-weight, portable computer with a PCMCIA Type II slot which allows connectivity to a wide variety of options by inserting a card.

The portability of the ThinkPad 500 computer allows you to operate the computer while walking or sitting. It is ideally suited to the mobile professional who requires a portable computer for work. A rechargeable battery supplies up to 3 hours of operating time.

2.2 Product Description

The ThinkPad 500 computer has the following standard features.

- Power Management
- 128 bytes Complimentary Metal-Oxide Semiconductor (CMOS)
- 128KB Read Only Memory (ROM)
- 512KB Video Random Access Memory (RAM)
- 4MB (RAM)
- 486SLC2 25/50 Microprocessor (with 16KB of cache memory)
- Audio
- Batteries
- Enhanced Parallel Port
- External Diskette Drive
- External Diskette Drive/Serial Cable
- Hard Disk Drive (85MB or 170MB)
- Keyboard (with numeric keypad)
- LCD Display
- PCMCIA Connectivity
- TrackPoint II (*) Pointing Stick
- Video Adapter Cable

(*) Trademark of the IBM Corporation.

2.3 Setup Options

The ThinkPad 500 has two setup options that allow you to specify how the computer operates. The setup programs and the elements they control are:

Standard-System Parameters Setup

- Time
- Date
- Password
- Diskette drive
- Hard disk drive
- Cache
- Parallel port

Power Management Setup

```
+--- Important -----+
|
| Before using the power saving features, be sure to read and observe
| the following precautions:
|
|  If you enter Suspend or Hibernate mode with a diskette inserted in
| the diskette drive, the same diskette must be placed back in the
| drive before attempting to resume normal operation.
|  If you enter Suspend or Hibernate mode with a PCMCIA card inserted
| in the PCMCIA slot, the same PCMCIA card must be placed back in
| the slot before attempting to resume normal operation.
|
| Hibernate mode does not save/restore the status of PCMCIA cards.
| When you resume normal operation from Hibernate mode, the PCMCIA
| card is no longer configured and will not be recognized by the
| system.
|  If the system is connected to a Local Area Network (LAN) that
| periodically polls for station activity, the LAN-connection may be
| terminated while the system is in Suspend or Hibernate mode. Any
| further attempt to access the network results in a brief delay and
| the system appears to hang (up to 1 minute, depending on the
| network). After the delay, an error is displayed. Follow the
| instructions on the screen to restore normal operation.
|  Any software program that was running over the LAN is not
| re-entered when you resume normal operation from Hibernate or
| Suspend modes.
|
+-----+
```

- Doze
- Auto suspend
- Suspend mode
- Power switch
- Auto hibernate
- LCD display
- Hard disk timeout
- Serial and parallel port
- Resume modem ring
- Alarm clock wakeup
- Microprocessor speed

2.4 Starting Setup

Press the key combination for the setup program you want to start.

Key Combination **Setup Program**

Ctrl + Alt + F3 System Parameters setup. (Must be started at the DOS prompt.)

Func + F3 Power Management setup. (Can be started at any time after the system is powered on.)

Press **Esc** to exit.

2.5 Utilities

The system is configured with a number of utility programs. These programs provide added function that enhance the usability of the system. It is recommended that you backup these programs to prevent loss of data. Use the INTRO program shipped with the system to backup the utilities. The utility programs are:

SIMUL Allows you to enable/disable simultaneous display on both the LCD and external monitor.

Note: The system **will not** enter Suspend/Resume while in the Simultaneous mode. You must exit Simultaneous mode before Suspend/Resume is allowed. Also, the Func + F7 function is not recognized until you exit Simultaneous mode.

EPP2 Provides Enhanced Parallel Port Utility. This utility needs to be added to the AUTOEXEC.BAT and CONFIG.SYS if the option attached to the parallel port supports the enhanced parallel port mode.

PHDISK Prepares the hard disk drive for the hibernation feature, including formatting and the marking of defective areas. A partition is reserved on the hard disk drive to save data before the system enters Hibernation mode.

```
+--- Important -----+
|
| Run the PHDISK utility if you change the operating
| environment, reformat the hard disk drive, or add additional
| memory.
|
+-----+
```

PCMCIA Drivers

IBM22SS01.SYS and PCMCIA.SYS provides the ability to use PCMCIA cards in an OS/2 (*) environment.

Phoenix (**)**CARD Manager Plus**

Provides support for PCMCIA cards in a DOS or Windows (**) environment.

(*) Trademark of the IBM Corporation.

(**) Trademark of Phoenix Technologies, Ltd.

(**) Trademark of the Microsoft Corporation.

2.6 Restoring the TP500 Subdirectory

The TP500 subdirectory on the Diagnostics diskette and hard disk drive contains the following:

- Installation utilities
- Introductory program
- PCMCIA utilities
- Other utilities
- OS/2 PCMCIA drivers

If the hard disk drive is reformatted or the files in the TP500 subdirectory on the hard disk drive are corrupted, copy the TP500 subdirectory on the Diagnostics diskette to the hard disk drive. To create a TP500 subdirectory on the hard disk drive and copy the files, do the following:

```
+--- Important -----+
|
| The following is required to complete this procedure:
|
|  DOS or OS/2 must be installed on the hard disk drive.
|  An external diskette drive must be attached to the system.
|
+-----+
```

1. Power-on the system.
2. At the DOS prompt, type

```
md c:\TP500
```

then press **Enter**. A TP500 subdirectory is created on the hard disk drive.

3. Insert the Diagnostics diskette into the diskette drive.
4. Type

```
copy a:\TP500\*. * c:\TP500\*. *
```

then press **Enter**. The files are copied from the TP500 subdirectory on the Diagnostics diskette to the TP500 subdirectory on the C drive.

2.7 System Memory

The system memory consists of 4MB RAM on the system board, expandable up to 12MB using a single 88-pin dynamic random-access memory (DRAM) card. 4MB and 8MB DRAM cards are supported.

2.8 Special Tools

The following special tools are required to service this system:

- A meter similar to the Triplet (***) Model 310 (IBM P/N 9900167).
- Wrap Plug, P/N 9900769 (for Parallel Port)
- Wrap Plug, P/N 72X8546 (for Serial Port)

(***) Trademark of the Triplet Corporation.

2.9 Specifications

Size

- Height (top cover closed): 41.64mm (1.63 in.)
- Width: 256.7 mm (10.11 in.)
- Depth: 183.7 mm (7.23 in.)

Weight

- 1.73 kg (3.8 lb.) with 85MB hard disk drive, and battery.

Environment

- Air Temperature:
 - System on: 5°C to 40°C (41°F to 104°F)
 - System off: -31°C to 60°C (-25°F to 140°F)
- Humidity:
 - System on/off: 8% to 80% (non-condensing)
- Altitude (non-pressurized)
 - System on/off: -60 m to 3,000 m (-200 ft to 10,000 ft)

AC Adapter Input Voltage

- Minimum: 90 V ac
- Maximum: 137 V ac

2.10 *Locations*

Subtopics

2.10.1 Front View

2.10.2 Back View and External Connections

2.10.3 System Board

2.10.1 Front View

- 1 Top Cover Release Latches
- 2 Contrast Control Buttons
- 3 Brightness Control Buttons
- 4 On/Off Button
- 5 PCMCIA Eject Button
- 6 PCMCIA Slot
- 7 Pointing Stick
- 8 Right Button (pointing stick)
- 9 Memory Card Access Panel
- 10 Left Button (pointing stick)
- 11 Battery
- 12 Status LEDs

PICTURE 3

2.10.2 Back View and External Connections

- 1 Speaker
- 2 Diskette Drive Connector
- 3 Serial Connector
- 4 Power Cord
- 5 AC Adapter
- 6 AC Adapter Connector
- 7 External Video Adapter Cable
- 8 I/O Port Connector

PICTURE 4

2.10.3 System Board

- 1 Pointing Device Connector
- 2 Hard Disk Drive Connector
- 3 Keyboard Connector
- 4 Sense Connector
- 5 Wobble Connector
- 6 LED Connector
- 7 Power Card Connector
- 8 LCD Data Connector
- 9 Parallel Port Connector
- 10 PCMCIA Connector
- 11 IC DRAM Card Socket
- 12 External Display Connector
- 13 LCD Power Connector
- 14 Diskette Drive/Serial Port Connector

PICTURE 5

2.11 Safety Information

The following section contains the safety information that you need to be familiar with before servicing an IBM product.

Subtopics

- 2.11.1 General Safety
- 2.11.2 Electrical Safety
- 2.11.3 Safety Inspection Guide
- 2.11.4 Handling Electrostatic Discharge-Sensitive Devices

2.11.1 General Safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- 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.
- Place 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.
- 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 clothing or fasten it with a nonconductive clip, 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:
 - Hammering
 - Drilling
 - Soldering
 - Cutting wire
 - Attaching springs
 - Using solvents
 - Working in any other conditions that might be hazardous to your eyes
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

2.11.2 Electrical Safety

Observe the following rules when working on electrical equipment:

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
 - Performing a mechanical inspection
 - Working near power supplies
 - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-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 powered-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.**

2.11.3 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
- Mechanical hazards, such as loose or missing hardware

The guide consists of a series of steps presented in a checklist. Begin the checks with the power off, and the power cord disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power-off the system. Disconnect the power cord.
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 "Parts" in topic 1.7.
 - 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.

2.11.4 Handling Electrostatic Discharge-Sensitive Devices

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

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

When handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

Note: The use of a grounding system is desirable but not required to protect against ESD damage.

- Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
- Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
- Use the round ground-prong of the AC plug on AC-operated systems.

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