Printing History

New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by the customer. The dates on the title page change only when a new edition or a new update is published. No information is incorporated into a reprinting unless it appears as a prior update; the edition does not change when an update is incorporated.

Many product updates and fixes do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

Edition 1 ..... December 1992
Edition 2 ..... December 1993

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List of Effective Pages

The List of Effective Pages gives the date of the current edition and of any pages changed in updates to that edition. Within the manual, any page changed since the last edition is indicated by printing the date the changes were made on the bottom of the page. No information is incorporated into a reprinting unless it appears as a prior update.

All ..... December 1993

Safety and Regulatory Information

For your protection, this product has been tested to various national and international regulations and standards. The scope of this regulatory testing includes electrical/mechanical safety, radio frequency interference, ergonomics, acoustics, and hazardous materials. Where required, approvals obtained from third-party test agencies are shown on the product label. In addition, various regulatory bodies require some of the information under the following headings.

Acoustics (Germany)

Laermangabe (Schalldruckpegel L_pA) gemessen am fiktiver Arbeitsplatz bei normalem Betrieb nach DIN 45635, Teil 19: $L_pA = 61$ dB.

Acoustic Noise (A-weighted Sound Pressure Level L_pA) measured at the bystander position, normal operation, to ISO 7779: $L_pA = 61$ dB.

Battery Notices

Warning

This product may contain sealed, lead acid batteries. Replace only with the same type and part number. Recycle used batteries or send them to the following address for proper disposal:

Hewlett Packard Co.
Environmental Health and Safety Department
8000 Foothills Boulevard
Roseville, CA 95678
ATTN: Battery Disposal Coordinator.

Warning

Fire, explosion, and severe burn hazard! Do not crush, disassemble, heat, incinerate, or expose the batteries to water.

IT Power System

Warning

This product has not been evaluated for connection to an IT power system (an AC distribution system having no direct connection to earth according to IEC 950).

High Leakage Current

Warning

To reduce the risk of electric shock, never operate the product with the ground conductor disconnected. An earth connection is essential before connecting the supply. Reliable ground circuit continuity is vital for safe operation of this product.

Installation Conditions (U.S.)

Warning

Please note the following conditions of installation:

An insulated earthing conductor that is identical in size, insulation material, and thickness to the earthed and unearthed branch-circuit supply conductors except that it is green with or without one or more yellow stripes is to be installed as part of the branch circuit that supplies the unit or system. The earthing conductor described is to be connected to earth at the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generator set.

The attachment-plug receptacles in the vicinity of the unit or system are all to be of an earthing type, and the earthing conductors serving these receptacles are to be connected to earth at the service equipment.

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Safety Considerations

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. The following figure shows some of the safety symbols used on the product to indicate various safety considerations.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

Indicates hazardous voltages.

Indicates earth (ground) terminal (sometimes used in manual to indicate circuit common connected to grounded chassis).

Indicates wiring terminal intended for connection of the protective earthing conductor associated with the supply wiring.

Warning

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not done correctly or adhered to, could result in injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

Caution

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not done correctly or adhered to, could damage or destroy part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Preface

This edition of the *CE Handbook* is intended for trained and experienced Hewlett-Packard customer service personnel.

This guide contains technical information about HP 3000 Corporate Business Systems (99x Family) and HP 9000 Corporate Business Servers (890/T500 Family). At the time of publication, these computer system families included the following models:

HP 3000 CS 99x Family

990/992		991/995	
CS 990 CX	CS 990 DX	CS 991 CX	CS 991 DX
CS 992/100 CX	CS 992/100 DX	CS 995/100 CX	CS 995/100 DX
CS 992/200 CX	CS 992/200 DX	CS 995/200 CX	CS 995/200 DX
CS 992/300 CX	CS 992/300 DX	CS 995/300 CX	CS 995/300 DX
CS 992/400 CX	CS 992/400 DX	CS 995/400 CX	CS 995/400 DX
		CS 995/500 CX	CS 995/500 DX
		CS 995/600 CX	CS 995/600 DX
		CS 995/700 CX	CS 995/700 DX
		CS 995/800 CX	CS 995/800 DX

HP 9000 CS 890/T500 Family

890	T500
CS 890	CS T500

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1

Overview

This chapter of the *CE Handbook* gives an overview of the 99x/890/T500.

Chapter Contents:

This chapter covers:

- Product Description.
  - T500/991/995.
  - 890/990/992.
  - Terms Used in this Manual.
- Base Configuration.
- Orientation.
  - SPU Cabinet Internal Layout.
- Operating Procedures.
  - Powering Up.
  - Powering Down.
  - Resetting/Rebooting the Computer.
  - Booting the Operating System.
  - Monitoring Hardware Status.
  - Displaying/Modifying Autostart Flag.
  - Examining the SP Error/Activity Logs.
  - Viewing the Chassis Code and Remote Console Status.
  - Using the OpenView Console.
  - Monitoring the PowerTrust UPS.
  - Securing the Computer.
  - If the Computer Fails ...
  - Configuring a PowerTrust UPS on 890/T500 Systems
  - If AC Power Fails ... (890/T500 Systems WITH Automatic Shutdown)
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  - Accessing PDC Commands.
  - Changing the Autoboot Flag or Hardware Paths.
  - Loading SPU-Specific Firmware.
- Getting the Latest PA-RISC Hardware Manuals Via FTP
  - Requirements:
  - FTP Procedure
  - Print Procedure
  - TIP: Save Time and Prevent Errors with the "printz" Alias
  - Troubleshooting

Product Description

The x9x Family family (99x/890/T500) consists of expandable, high-performance computers which feature a tightly coupled, symmetrical multiprocessing architecture.

The 99x/890/T500 consists of a standalone System Processing Unit (SPU) in a 1.6 meter high system cabinet. All rack-mounted peripherals are separately installed in one or more 1.6 meter Expansion Cabinets.

The base configuration can be expanded by adding additional processors, memory, and I/O for a broad range of system configurations.

In the x9x Family family,

- T500/991/995 are the most current models.
- 890/990/992 are the earlier models.

T500/991/995

The T500/991/995 can be configured with up to eight (99x) or twelve (T500) 90 MHz PA-RISC processors, and 2 GB of main memory. The base configuration consists of one CPU, 128 MB (T500) or 256 MB (991/995) of ECC memory, and 14 half-height HP-PB interface card slots (= 7 full-height slots) for connection to peripherals, networks, and terminals.

T500 Product Models

The T500 runs the HP-UX operating system. The full name of the T500 is the **HP9000 Corporate Business Server Model T500**. The SSP number is A3032A and the product number is A2339A.

991/995 Product Models

The 991/995 runs the MPE/iX operating system. The full name of the 991/995 is the **HP3000 Corporate Business System (CS)**. The product model number (Table 1-1) depends on the number of processors and whether the system has an OpenView console.

The difference between a 991 and a 995 is that the performance on the 991 is lowered through the OS.

Table 1-1. 991/995 Product Models

"DX" Systems (Prod # A3080A)	"CX" Systems (Prod # A3079A)
991 DX (uniprocessor)	991 CX (uniprocessor)
995/100 DX (uniprocessor)	995/100 CX (uniprocessor)
995/200 DX (2-way multiprocessor)	995/200 CX (2-way multiprocessor)
995/300 DX (3-way multiprocessor)	995/300 CX (3-way multiprocessor)
995/400 DX (4-way multiprocessor)	995/400 CX (4-way multiprocessor)
995/500 DX (4-way multiprocessor)	995/500 CX (4-way multiprocessor)
995/600 DX (4-way multiprocessor)	995/600 CX (4-way multiprocessor)
995/700 DX (4-way multiprocessor)	995/700 CX (4-way multiprocessor)
995/800 DX (4-way multiprocessor)	995/800 CX (4-way multiprocessor)
Console is an OpenView PC (included). Includes software for systems and performance management.	Console is a 700/96 terminal (included). Does not include software for systems and performance management.

890/990/992

The 890/990/992 can be configured with up to four 60 MHz PA-RISC processors, and 2 GB of main memory. The base configuration consists of one CPU, 128 MB (890) or 192 MB (990/992) of ECC memory, and 14 half-height HP-PB interface card slots (= 7 full-height slots) for connection to peripherals, networks, and terminals.

890 Product Models

The 890 runs the HP-UX operating system. The full name of the 890 is the **HP9000 Corporate Business Server 890**. The product number is A1826A. An option number specifies the number of processors in an 890 (for example, Option 101 specifies a uniprocessor system).

990/992 Product Models

The 990/992 runs the MPE/iX operating system. The full name of the 990/992 is the **HP3000 Corporate Business System (CS)**. The product model number (Table 1-2) depends on the number of processors and whether the system has an OpenView console.

The difference between a 990 and a 992 is that the performance on the 990 is lowered through the OS.

Table 1-2. 990/992 Product Models

"DX" Systems (Prod # A1809A)	"CX" Systems (Prod # A1811A)
990 DX (uniprocessor)	990 CX (uniprocessor)
992/100 DX (uniprocessor)	992/100 CX (uniprocessor)
992/200 DX (2-way multiprocessor)	992/200 CX (2-way multiprocessor)
992/300 DX (3-way multiprocessor)	992/300 CX (3-way multiprocessor)
992/400 DX (4-way multiprocessor)	992/400 CX (4-way multiprocessor)
Console is an OpenView PC (included). Includes software for systems and performance management.	Console is a 700/96 terminal (included). Does not include software for systems and performance management.

Terms Used in This Manual

The term "99x" is used in this manual to refer to all 990, 991, 992 and 995 systems, both CX and DX. The term "890/T500" is used to refer to the Model 890 and T500 systems. When referring to all systems together, the term "99x/890/T500" or "the system" is used.

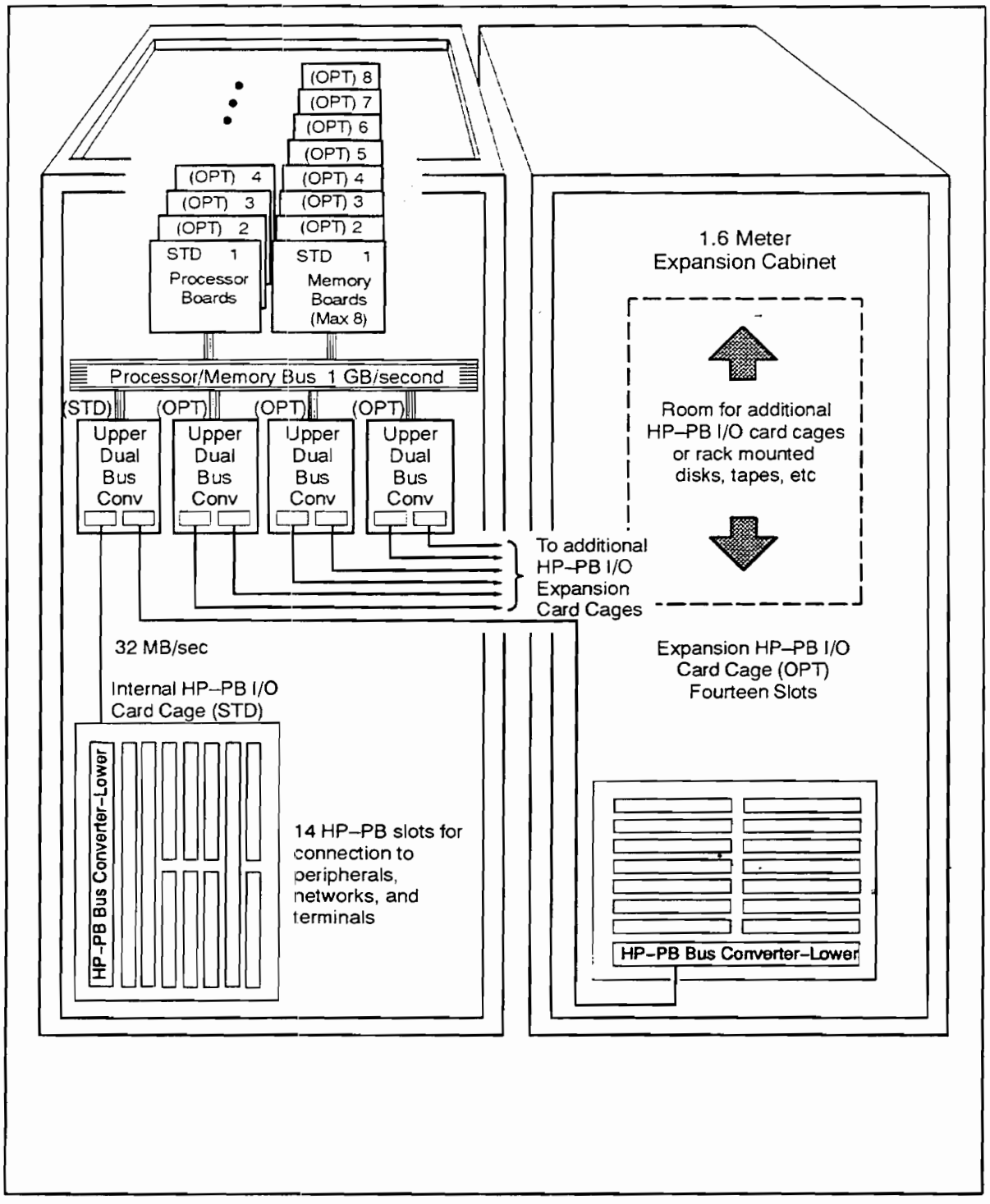
The standard configurations for the 99x/890/T500 systems differ slightly. Throughout this manual, system-specific configurations will be noted where applicable (for example, as **99x Systems Only** or **890/T500 Systems Only**).

Base Configuration

The base 890, T500, 990, 992/100, 991 and 995/100 SPU configuration contains the following hardware components:

- One processor card with floating-point coprocessor
- One service processor (SP) card
- Memory
  - **890/T500 only:** one 128 MB ECC memory card
  - **990/992 only:** 192 MB ECC memory (one 64 MB card and one 128 MB ECC memory card)
  - **991/995 only:** one 256 MB ECC memory card
- One Upper Dual Bus Converter
- One internal HP-PB (HP Precision Bus) I/O card cage which includes the following base configuration cards:
  - One Bus Converter (lower)
  - One LAN/console card (multi-purpose card with connections for 802.3 LAN, internal ThinLAN Transceiver and AUI port, serial link for console terminal, and modem link for remote access)
  - One SCSI interface card
  - **99x only:** one PB-FL fiber link interface card
  - **890/T500 only:** one 16-port MUX card
  - **890 only:** one HP-FL fiber link interface card
  - **990/992 only:** one PBA-IB card
- Modular power supply subsystem and:
  - **890/990/992:** integrated powerfail battery backup system.
  - **991/995:** 3 kva HP PowerTrust Uninterruptible Power System (UPS)
- Console:
  - **99x DX only:** OpenView PC console
  - **890/T500 and 99x CX only:** HP 700/96 console terminal and interconnect cable

Figure 1-1 shows the configuration of the x9x Family.



LG200205_003a

Figure 1-1. x9x Family Configuration

Orientation

This section is a brief orientation to the 99x/890/T500 SPU.

The basic system consists of one SPU cabinet, as shown in Figure 1-2. At the middle right of the cabinet is a cabinet door lock. To open the cabinet door, you insert a hexagonal cabinet key into this lock and turn it counter-clockwise. The cabinet key is included with the computer.

Additional cabinets (called expansion cabinets) are shipped separately. Refer to the *Expansion Cabinet Installation Guide* (HP P/N A1809-90006) for information about installing peripherals in the expansion cabinets.

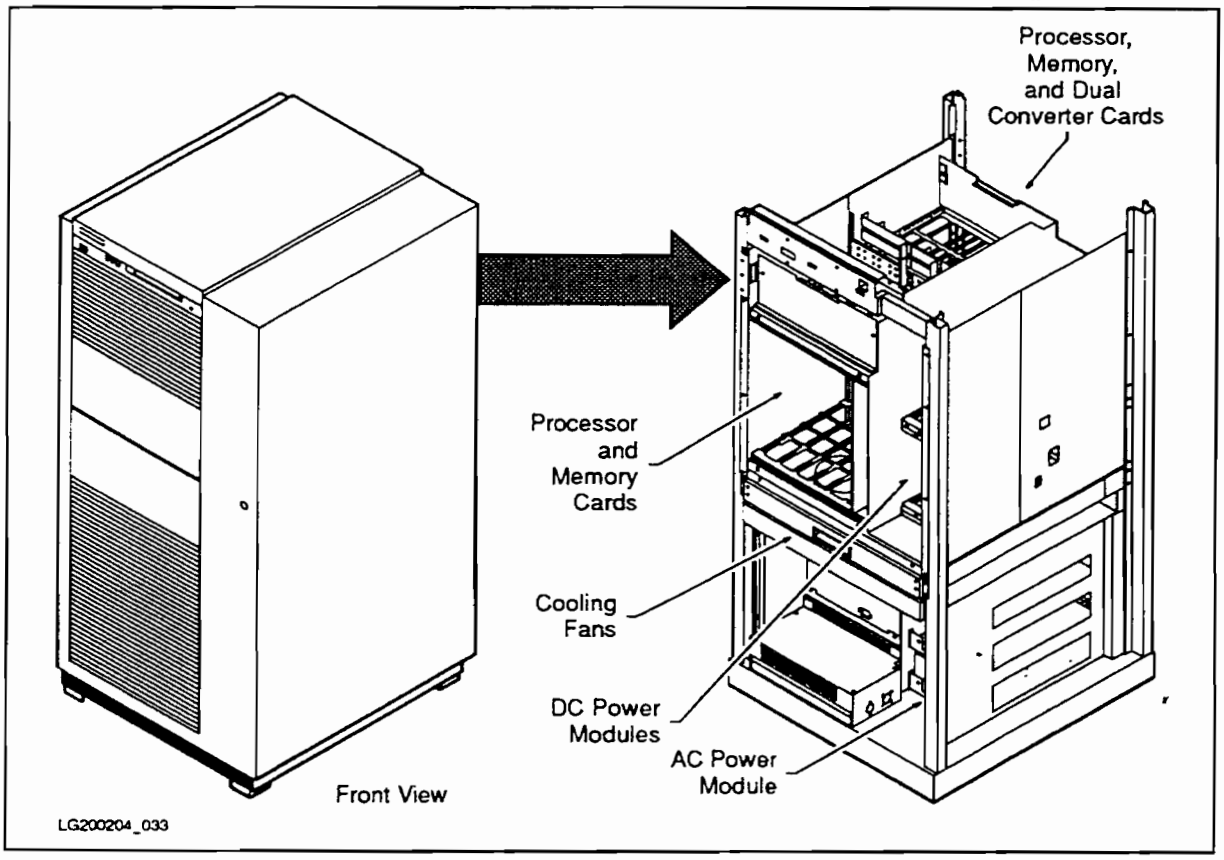


Figure 1-2. SPU Cabinet

SPU Cabinet Internal Layout

The SPU cabinet contains the processor cards, memory cards, bus converter cards, I/O cards, the power supply system, and the cooling fan assembly (see Figure 1-3 and Figure 1-4):

- At the top front of the cabinet is the control panel, with various switches and indicators.
- The top half of the cabinet contains:
  - Processor Memory Bus (PMB) cardcages. There is a front PMB cardcage and a rear PMB cardcage. The PMB cardcages contain processor cards, memory cards, bus converter cards, and a service processor (SP) card.
  - DC-to-DC power modules such as the 5V (65A) 325W modules for memory and BC cards, 5V 130A (650W) modules for processors, and 24V (325W) module for the fans.
  - Miscellaneous Power Module (MPM) for the Service Processor and PMB interface circuits.
- In the middle of the cabinet is the cooling fan tray.
- The bottom half of the cabinet contains:
  - HP-PB cardcage. This cardcage accepts HP-PB I/O cards.
  - AC Front End (ACFE) with the circuit breaker switch. The ACFE includes the AC-to-DC power module (PFC unit).
  - Battery Back-up Unit (BBU).

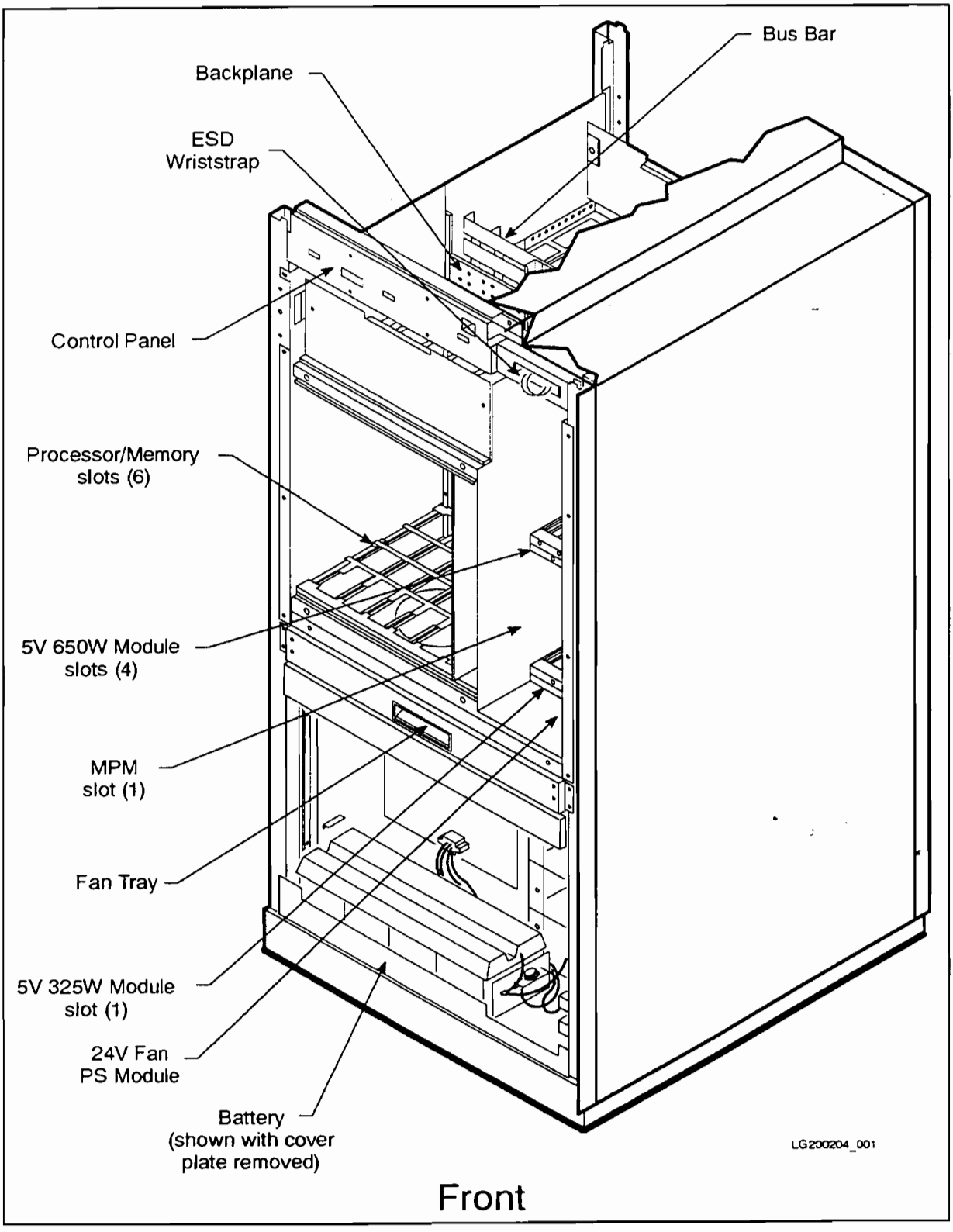


Figure 1-3. SPU Cabinet Internal Layout (Front)

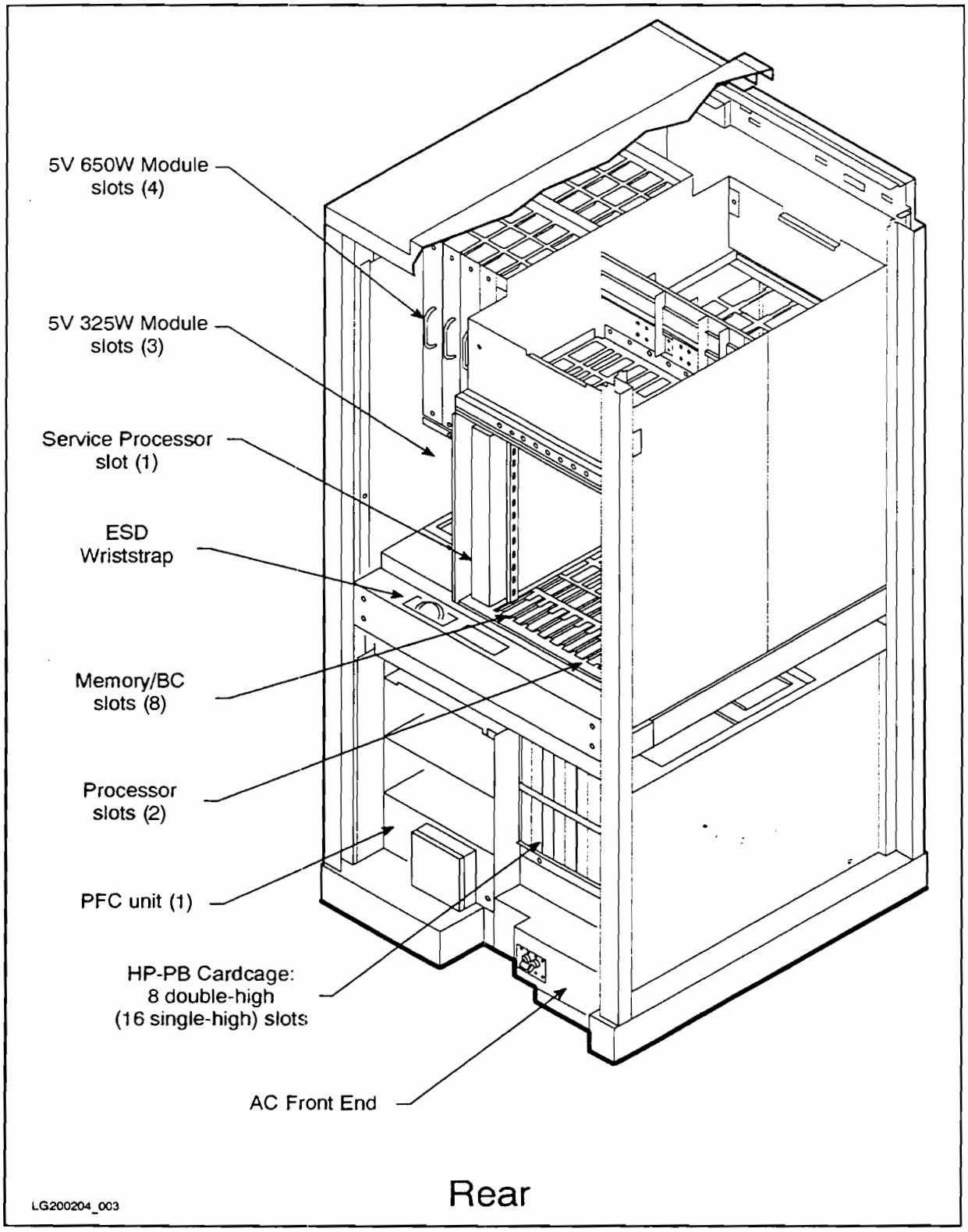


Figure 1-4. SPU Cabinet Internal Layout (Rear)

Operating Procedures

This section gives common operator procedures in a step-by-step form. It is similar to information in the *99x/890/T500 Operator's Guide* (PN A1809-90009).

Powering Up

To power up the computer: (See Figure 1-5.)

1. Verify that the circuit breaker at the rear of the computer is turned off, and that the "Standby-Ready" switch at the top front of the computer is in the "Standby" position. Also verify that the computer cabinet is plugged in.
2. If the computer system includes PowerTrust Uninterruptible Power Systems (UPSs), verify that the computer cabinet is plugged into a PowerTrust UPS. Verify that other units in the system that should be plugged into the UPS are plugged in (for example the system disk); see the *PowerTrust System Guide* (PN 5961-8383) for details.
3. Turn on power to each external HP-PB cardcage by pushing its switch. A pushbutton switch is located on each HP-PB cardcage in the expansion cabinets.
4. Turn on all the external equipment (except the DTC) connected to the computer and expansion cabinets.
5. If there is a power switch located on the front of the expansion cabinet, turn it on.
6. Check all READY or ONLINE indicator lights on the external equipment to be sure that the external equipment is powered up and ready.

Caution

If any of the external equipment has been OFF due to any environmental problems, such as heating or air conditioning failure, allow approximately 30 minutes for the temperature of the equipment to stabilize before turning on the computer.

7. Turn on the console.
   a. (890/T500 and 99x non-DX) Turn on the 700/96 terminal used as the console.
   b. (99x DX only) Turn on the OpenView console and enter `WIN` at the C:\> prompt. In a minute or so, you should see a window labeled "Console ldev-20".
8. Insert the key into the keyswitch in the front panel of the computer and turn it to the Console Unlocked position (the icon of an unlocked padlock).
9. When all external equipment have their READY or ONLINE indicators lit, turn on AC to the computer cabinet by switching on the power switch (circuit breaker) at the bottom rear of computer cabinet.
10. Turn the "Standby-Ready" switch at the top front of computer cabinet to the "Ready" position.
11. After powering up the computer, you should see several LEDs on the front panel light. The front panel indicators turn off and on in various patterns as the computer goes through its startup process. The computer takes several minutes to go through the startup process.

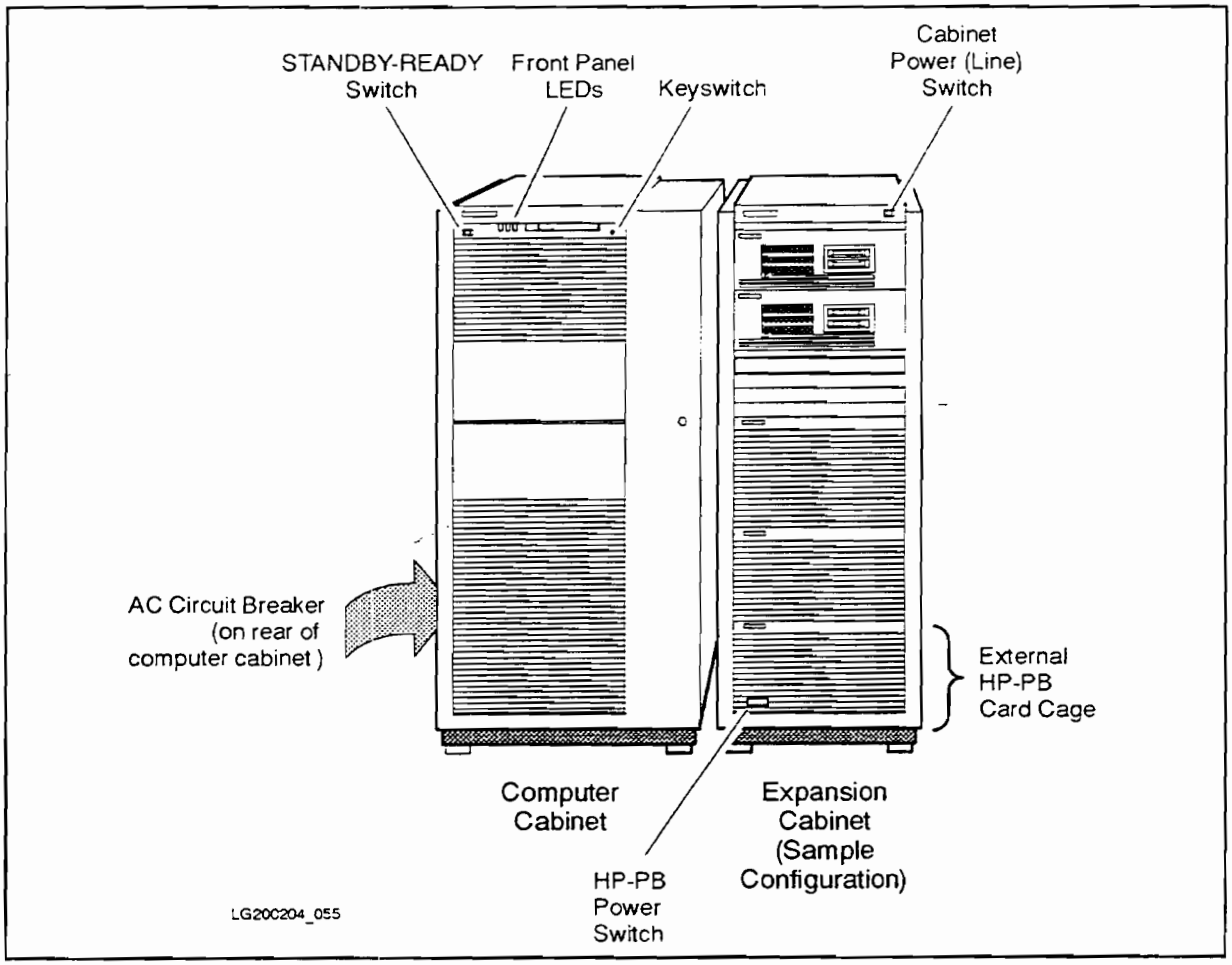


Figure 1-5. Switches and Indicators

Power-Up Problems

If the computer does not seem to power up (if LEDs and indicators on the control panel don't light):

1. Check LEDs on the front panel of the computer for possible problems (see Figure 1-6):

   Line: If this LED is OFF, AC is not being supplied to the computer. Make sure that the AC circuit breaker switch on the lower rear of the cabinet is turned on. Make sure the unit is plugged in. Check to see if a circuit breaker has tripped or if there is a problem with power at the site.

   CEs should also check for a faulty AC-to-DC power module (PFC unit) by seeing if the red fault light on the PFC unit is lit.

   SP Power: If this LED is OFF, the Service Processor (SP) is not receiving power. If the "Line" LED is ON at the same time, there may be a problem with the power system or the SP.

   Check LEDs on the MPM module and the DC-to-AC (PFC unit) module. If a module has its red LED lit, replace the module. If the MPM is okay and the SP not, replace the SP.

   Battery: (890/990/992 only) If this LED is ON, the battery back-up unit is discharging/charging. Make sure the "Standby-Ready" switch on the top front of the computer is set to the "Ready" position. Make sure that AC power is being supplied to the computer.

   Stopped: If this LED is ON, make sure the "Standby-Ready" switch on the top front of the computer is set to the "Ready" position. Make sure the console keyswitch on the front panel is in the unlocked position. Check for messages on the system console. Check the SP error logs.

2. For more information, see Chapter 5 (Troubleshooting).

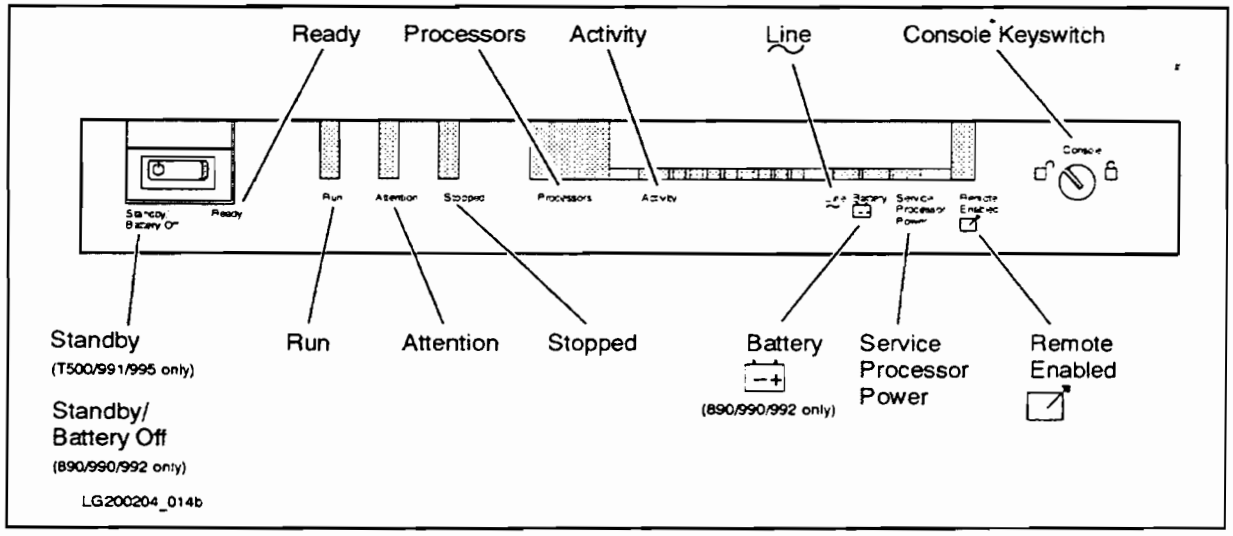


Figure 1-6. Front Panel Indicators and Switches

Powering Down

To power down the computer: (See Figure 1-5.)

1. Shut down the operating system. Consult the OS documentation for the appropriate procedure.
2. Wait until the OS has finished its shutdown routine.
3. Turn the "Standby-Ready" switch on the front panel to the "Standby" position. In this position:
   a. DC power is no longer supplied to PMB cards in the cabinet.
   b. (890/990/992 only) Battery back-up is disabled.
   c. Cabinet still contains AC, high voltage DC, and low-voltage DC bias voltages (for example on the SP card and the HP-PB cardcage) if rear circuit breaker is in ON position.
4. Turn off power to all external HP-PB card cages by pressing the push-button switch on the front of each of them. (Both the computer and the external HP-PB card cage must be powered down before HP-PB cards can be installed or removed.)
5. Turn off power to the expansion cabinet(s) by placing the front power switch to the OFF position.
6. To completely turn off all voltages in the system cabinet, turn off power switch (circuit breaker) at the bottom rear of the cabinet. This switch disconnects the AC line from the cabinet. No lights or fans should remain on.

Resetting/Rebooting the Computer

There are four different ways to "reset" ("reboot") the computer. See Table 1-3.

Table 1-3. Resetting the 99x/890/T500

Command	Accessing	Description	Use
TC (Transfer of Control)	1. (OS should be running; if not, use RE or RS to reset) 2. Enter Control - B at the system console 3. Enter SP 4. Enter TC	Performs OS-specific tasks, then performs a soft boot. A soft boot tests memory non-destructively, preserving troubleshooting data. The computer performs PDC initialization. It does not perform SP initialization.	To reset the system when you want to save troubleshooting data. For example: ■ When the system is "hung" (does not respond to input) and you want to preserve troubleshooting data (for example in preparation for a memory dump).
RS (Reset)	1. Shut down the OS if possible. 2. Enter Control - B at the system console 3. Enter SP 4. Enter RS	Performs a hard boot. A hard boot tests memory destructively; some troubleshooting data is lost. The computer performs PDC initialization. It does not perform SP initialization.	To reset the system when you do not care about saving troubleshooting data. For example: ■ When updating the OS. ■ After changing the console path.
RE (Restart)	1. Shut down the OS if possible. 2. Enter Control - B at the system console 3. Enter SP 4. Enter RE (You can also enter RESTART at a PDC prompt.)	Performs a more complete hard boot than the RS command. Like RS, this hard boot tests memory destructively so that some troubleshooting data is lost. The computer performs both an SP and PDC initialization. Both the SP and the power system are tested. The RESTART command takes more time to execute than does the RS command.	To reset the system COMPLETELY when you do not care about saving troubleshooting data.
Cycling Power	1. Shut down the OS if possible. 2. Turn "Standby-Ready" switch to "Standby" 3. Turn off AC circuit breaker at rear of cabinet. 4. Wait 5 to 10 seconds. 5. Turn on AC circuit breaker. 6. Turn "Standby-Ready" switch to "Ready"	Similar to RESTART.	To reset the system COMPLETELY when you do not care about saving troubleshooting data.

Booting the Operating System

Once the 99x/890/T500 has been configured and the operating system is installed, booting up is largely automatic. The system automatically boots up if the autoboot option is set to true and the boot path is correct. (The autoboot option can be changed with either PDC or ISL commands.)

To boot the operating system:

1. Power up the computer as described earlier in this chapter.
2. Respond to any prompts that ask whether to continue with the boot process. For example:

```
Continue with primary boot path?   ([y]/n/new_<path>)> Y
```

Boot-Up Problems

If you are unable to boot:

1. Follow the procedure for "Power-Up Problems" earlier in this chapter.
2. Check for messages on the system console.
3. Check the status information on the next-to-last line of the system console by entering Control-B.
4. Examine the SP error logs with the DL command at the SP prompt.
5. Make sure the primary boot device (that is, the system disk) is powered up and connected to the 99x/890/T500.
6. Make sure the boot path is correct by using the Boot Menu in the PDC interface. See "Changing the Autoboot Flag or Hardware Paths" later in this chapter.
7. For more information, see Chapter 5 (Troubleshooting).

Note

During boot, the computer will halt with no console display if the following conditions are all true:

- The autostart flag (AF at the SP prompt) is not set.
- A module is de-configured.
- The front panel keyswitch is in the locked position.

If this should happen, recover the console display by putting the front panel keyswitch into the unlocked position.

Monitoring Hardware Status

Table 1-4 shows the state of the switches and indicators during normal operation when the operating system is running. See Chapter 5 (Troubleshooting)

Table 1-4. Normal State of the Front Panel Indicators and Switches

Indicator/ Switch	Normal State
Front "Standby-Ready" switch	"Ready" position.
Run (green LED)	ON for normal operating system (OS) system activity. Flashing for non-OS system initialization activity.
Attention (yellow LED)	OFF. (Will be ON if there is a critical unread message in the SP log.)
Stopped (red LED)	OFF. (Could be ON if user input is required.)
Processors	"01" or greater. (Shows the number of processors which are configured and have passed PDC selftest).
Activity	0 to 10 LEDs lit.
Line	ON.
Battery (890/990/992 only)	(890/990/992) OFF. On rare occasions, this LED may be ON, indicating that the battery is charging/discharging. (In this case, the battery is charging if the "Line" LED is ON; the battery is discharging if the "Line" LED is OFF.)
SP Power	ON.
Remote Enabled	ON or OFF. For maximum security, this should be OFF.
Console Keyswitch	Locked or unlocked. For maximum security, this should be locked unless needed. The keyswitch should be unlocked: ■ While performing installation tasks. ■ To get to any SP messages. ■ During boot, especially if the autostart flag (AF at SP prompt) is not set.

If the yellow Attention LED lights:

1. Look for warning messages on the system console.
2. Look for unread messages in the SP log. See "Examining the SP Error/Activity Logs" which follows.

Displaying/Modifying Autostart Flag

If the autostart flag is set, the computer startup process continues even if processor or memory modules are scheduled to be de-configured (for example if they fail selftest).

If the autostart flag is cleared, the computer startup process halts at the SP prompt if processor or memory modules are scheduled for de-configuration.

The autostart flag described here is different from the autoboot flag which can be modified from the PDC interface. The PDC autoboot flag allows the OS to boot automatically upon power-up.

For more information, see the entry for AF in Chapter 12d (Service Processor)

To display/modify the autostart flag:

1. Make sure that the Console keyswitch on the computer front panel is in the unlocked position.
2. Enter Control-B at the system console.
3. Enter SP to enter the Service Processor interface.
4. Enter AF at the SP prompt.
5. The SP prompts you to set or clear the autostart flag. For example:

```
SP> AF

The Service Processor autostart flag is currently SET (autostart enabled)

Do you wish to CLEAR the flag (y/[n])? N

The Service Processor autostart flag will remain SET.  (autostart enabled)
```

Caution

Do not leave the console in SP mode or AP control mode for long periods of time or during boot. This blocks console messages and can eventually cause the OS to hang or crash. During boot, this can cause a processor selftest failure.

Verifying PMB Card Cage Configuration

You can display and modify the the PMB card cage configuration inside the computer by using the HC command. For each Processor Memory Bus (PMB) slot, the display tells:

- Whether the slot is occupied.
- Which module type resides in the slot (bus converter, memory or processor).
- Whether the module is currently configured IN or OUT of the computer.
- Whether the module is scheduled to be configured at the next boot.

The HC command can be used to configure PMB modules IN or OUT of the computer. The new configuration status becomes effective during the next boot of the computer.

Caution De-configuring PMB cards by accident will interfere with computer operation (degraded performance or inability to boot-up).

The HC command does not show the configuration of I/O interface cards in the HP-PB cardcages.

For more information, see the entry for HC in Chapter 12d (Service Processor)

To display/modify the hardware configuration:

1. Make sure that the Console keyswitch on the computer front panel is in the unlocked position.
2. Enter Control-B at the system console.
3. Enter SP to enter the Service Processor interface.
4. Enter HC at the SP prompt. A sample display looks like this:

```
Host Hardware Configuration:   (D = deconfigure; - = non-existent port)
-------------------------------------------------------------------
|      |                  | Deconfigured      | Ports to be decnf |
| PMB  |                  | Ports             | at next boot      |
| Slot | Board Type       |  0 |  1 |  2 |  3 |  0 |  1 |  2 |  3 |
|------------------------------------------------------------------|
|   0  | Bus Converter    |    |  - |    |  - |    |  - |    |  - |
|   7  | Memory           |    |  D |  - |  - |    |  D |  - |  - |
|  12  | TNT Processor    |    |    |  - |  - |    |    |  - |  - |
|  13  | TNT Processor    |    |    |  - |  - |    |    |  - |  - |
|  14  | TNT Processor    |    |    |  - |  - |    |    |  - |  - |
|  15  | TNT Processor    |    |    |  - |  - |    |    |  - |  - |
-------------------------------------------------------------------
```

Examining the SP Error/Activity Logs

The Service Processor (SP) maintains logs of hardware errors and activity. Three logs are maintained:

- **Activity Log**: records major changes in the state of the computer (for example, power-up and shutdown). Critical entries are displayed in `reverse video`. The information in the Activity Log is useful for determining how far computer operation proceeded before a failure occurred. The Activity Log is circular (once the log is filled to capacity, subsequent entries cause the earliest entries to be deleted).
- **Earliest Error Log**: contains the earliest error entries.
- **Latest Error Log**: contains error entries recorded after the Earliest Error Log is full.
- **SPU Tombstones Log**: contains up to 16 tombstones. A tombstone consists of troubleshooting data generated by an HPMC, LPMC, or Transfer of Control.

The **Error Logs** contain entries for critical and non-critical errors. Critical errors are those which require immediate attention: they usually indicate a failure of hardware or software. Critical errors are shown in `reverse video` in the SP log display.

When a critical error occurs, the yellow "Attention" LED on the front panel is lit to signal the operator. If the status line on system console is enabled, critical errors also cause a message to be displayed there. If the "Attention" LED is lit because of an unread critical-error entry, reading the SP error log will turn off the LED.

The time stamp for the entries is in Universal Time (Greenwich Mean Time).

To examine the SP error or activity logs:

1. Make sure that the Console keyswitch on the computer front panel is in the unlocked position.
2. Enter Control-B at the system console.
3. Enter `SP` to enter the Service Processor interface.
4. Enter `DL` at the SP prompt.
5. To see a record of errors:
   a. If the "Latest Errors" log has entries, enter `L`:
   b. If the "Latest Errors" log has no entries, enter `E` to see the "Earliest Errors" log. (The "Latest Errors" log only has entries if the "Earliest Errors" log is full.)
6. To see a history of system activity, enter `A`
7. At periodic intervals use the `CL` (Clear Log) command at the SP prompt to keep the error and activity logs to a manageable size.

For more information, see Chapter 12d (Service Processor).

Caution

Do not leave the console in SP mode or AP control mode for long periods of time or during boot. This blocks console messages and can eventually cause the OS to hang or crash. During boot, this can cause a processor selftest failure.

Viewing the Chassis Code and Remote Console Status

To see a line of status information on the console (including the four-digit hex code):

1. Make sure that the Console keyswitch on the computer front panel is in the unlocked position.
2. At the system console, enter Control-B to enter Access Port control mode.
3. Look on the next-to-last line of the display for status information. You will see a display like this:

```
TEST     90AA      REMOTE: enabled inactive multiple     ACCESS FAULT: 00
 ^         ^         ^                                      ^
 |         |         |                                      |
 |      Chassis     Status of remote console:              # of password
 |       code        * Current security level (enabled,    faults made while
 |                       disabled, pending, locked)        trying to access
System status          * Current activity (active, inactive) system remotely
(sysstat).             * Current access mode (single, multiple)
Possible states:
OFF, TEST, INIT, WARN,
SHUT, RUN, FAULT, ALL
(ALL = all lights ON
to test indicators).
```

4. On the bottom line of the display, you may see a message reporting that a critical entry has been made to the SP error log, or that there has been a system halt.

Using the OpenView Console

The 99x DX systems use a Vectra-based OpenView Workstation as the system console. For information on operating the OpenView console, refer to the *OpenView Console Manager's Guide* (PN B3118-90002).

Monitoring the PowerTrust UPS

If the system has one or more PowerTrust Uninterruptible Power Systems (UPSs), you can monitor their operation in three ways:

- Check the switches and indicators on the front panel of the PowerTrust UPS.
- (MPE/iX 5.0 and HP-UX 9.04 and later releases). Look at the console. Some messages from the UPS are displayed on the console.
- (MPE/iX 5.0 and HP-UX 9 04 and later releases). Look in a log file. UPS messages are recorded in a system log file. On HP-UX, the log file is /usr/adm/syslog, a text file which can be viewed with vi or another editor. On MPE/iX 5.0, you access the information with LOGTOOL.

For more information, see the *PowerTrust System Guide* (PN 5961-8383) that accompanied the PowerTrust UPS.

Securing the Computer

In addition to the site's normal security procedures, the 99x/890/T500 may require special procedures to disable access to the console. In this case, **accessing the console** means that you can access the Access Port (AP) and Service Processor (SP) commands by entering Control-B.

Another security consideration is the Remote Support Modem, which is supplied with each 99x/890/T500 to allow servicing of the computer from a remote site. (For example, the HP Customer Response Center may use the Remote Support Modem to log on to the computer as a remote console.)

Figure 1-7 shows the paths into the 99x/890/T500 which can be disabled using the procedures in this section.

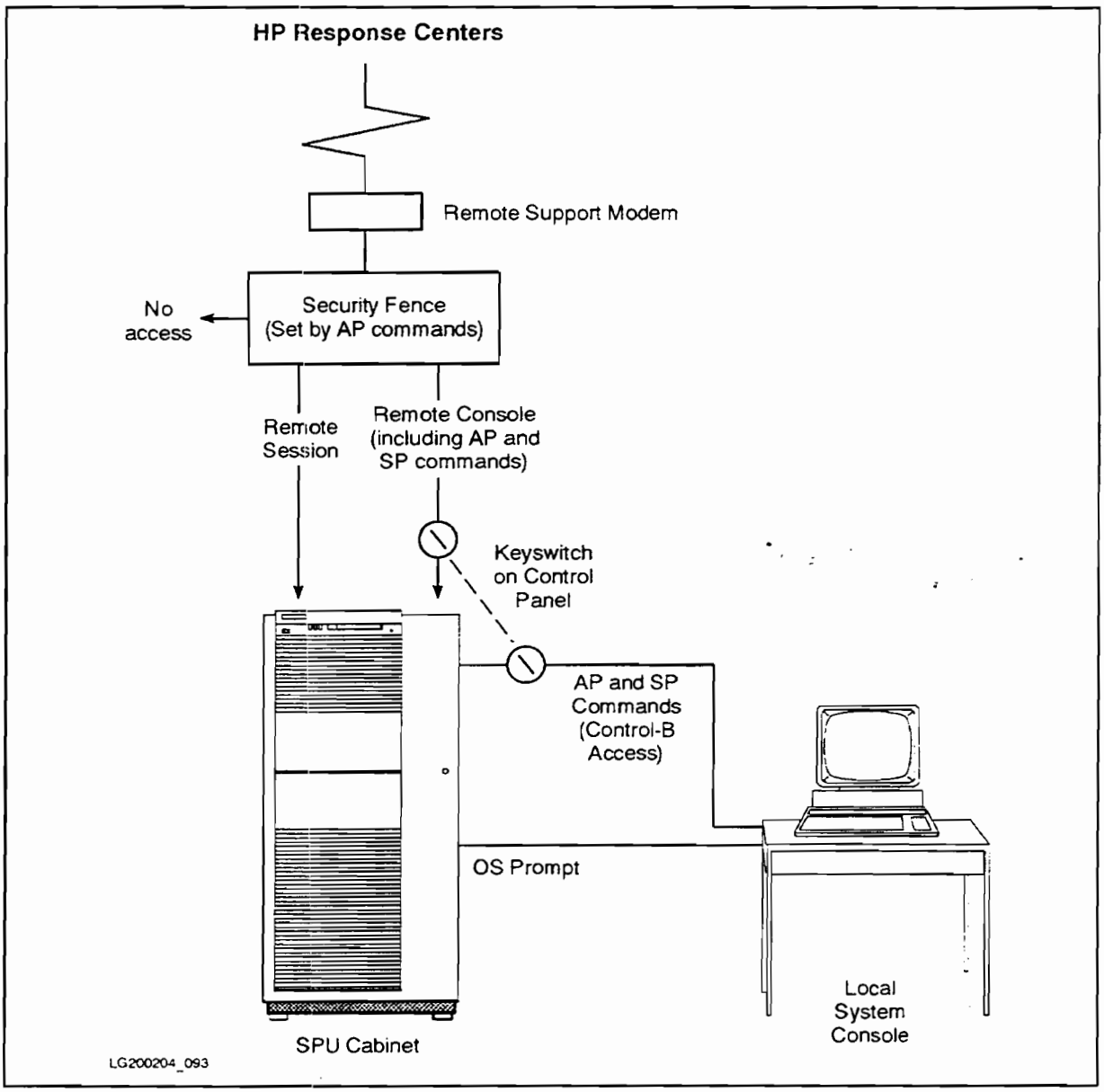


Figure 1-7. Accessing the Console on the 99x/890/T500

Limiting Access from the Local Console Terminal

To limit access from the local console terminal (Control-B access):

1. Put the front panel keyswitch into the locked position.
2. Follow normal OS security procedures. For example, do not leave the local console logged in as root or MANAGER.SYS.

Note

Do not change the key position while the console is in Service Processor (SP) mode (that is, when the console is displaying the SP > prompt). Doing so can cause the console to "hang."

Changing Access Parameters for Remote Support Modem and Remote Console

The 99x/890/T500 provides several levels of security for controlling access to the Remote Support Modem and the remote console. See Figure 1-8.

To change access parameters for the Remote Support Modem and for the remote console (Control-B access):

1. Study Figure 1-8 to determine the controls appropriate for your site. (Recommended settings for MPE/iX with Predictive Support: UR, ER, single access mode, set a password.)
2. If the console is locked, unlock it with the front panel keyswitch. (see Figure 1-6).
3. Enter Control-B at the system console to enter the Access Port control mode.
4. At the AP prompt (CM>) (Control Mode), enter the desired commands.
   a. UR or LR to unlock/lock all access through the remote support modem.
   b. ER or DR to enable/disable remote console access. **Remote console access** means that the remote user is connected in parallel to the local console. The remote user sees the same displays and has access to the same commands as a local operator, including Control-B access to AP and SP commands.
   c. ER to set additional access parameters:
      i. Password for remote console access.
      ii. Number of password faults allowed before remote console access is disabled.
      iii. Single/multiple access mode. With single access mode, only one access to the remote console is permitted. After the one access, the remote console cannot be accessed again. Only remote sessions are permitted. To use the remote port as a remote console once again, the remote console capability must be re-enabled by the local console (ER command)

Note For predictive support to function correctly, the AP should be left in its default state of Remote Operator Access Disabled (DR command).

For more information on AP commands, see Chapter 12c (Access Port)

5. Exit the Access Port by entering CO at the AP prompt.
6. If you want to prevent both local and remote console access (Control-B access), put the front panel keyswitch into the locked position.

   If the keyswitch is in the locked position, error messages sent to the console will not be displayed.

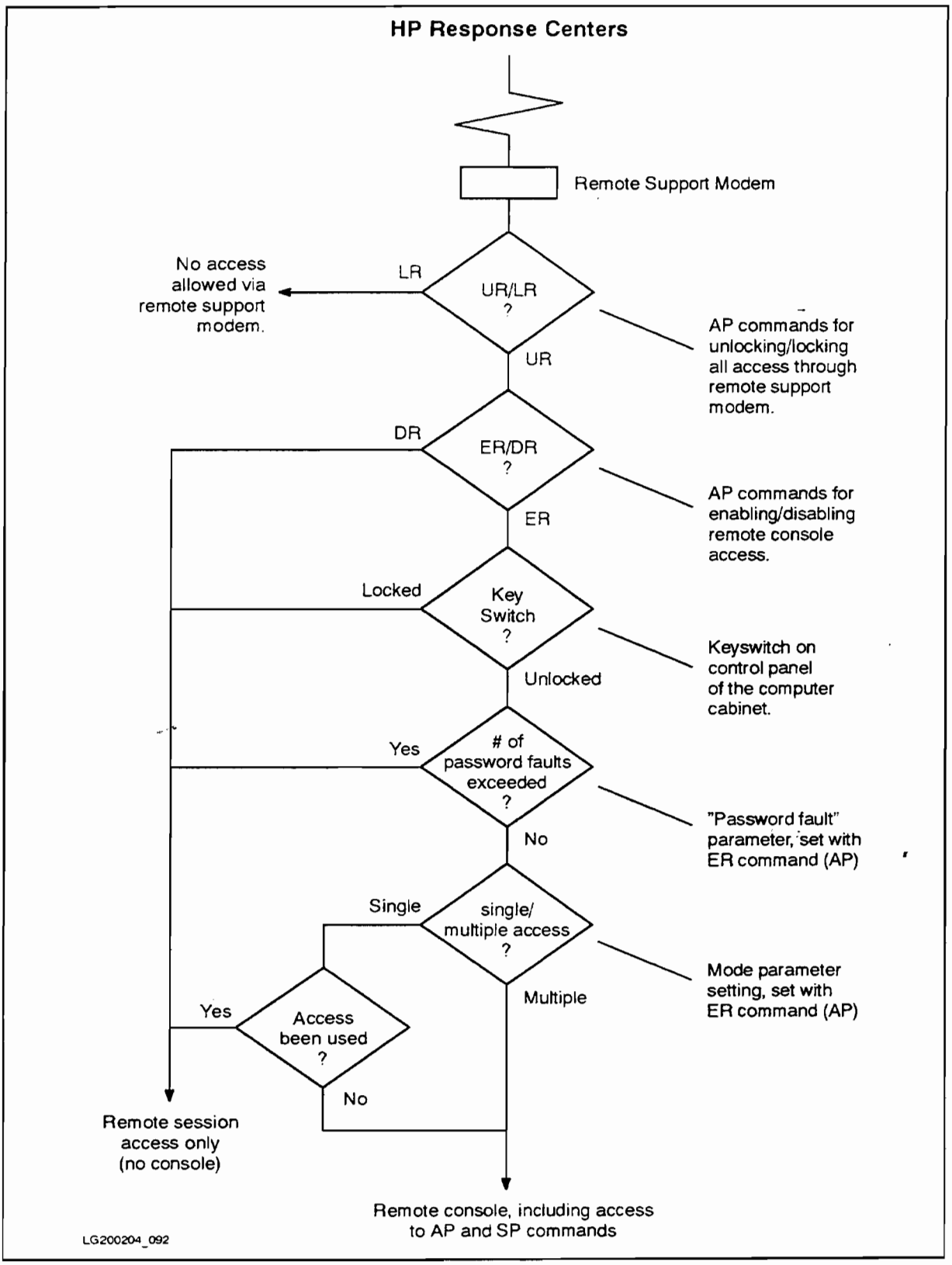


Figure 1-8. Controlling Access through the Remote Support Modem

Configuring a PowerTrust UPS on 890/T500 Systems

On HP-UX 9.04 and later releases, you can use SAM (Peripheral Devices) to modify the UPS configuration. You can specify:

- The serial port(s) to be used for the UPS.
- Whether to activate or deactivate the automatic shutdown feature entirely.
- The parameter shutdown_delay_mins (default = 1 minute). This parameter specifies the number of minutes to wait before initiating shutdown -h following notification that AC power to the UPS is lost. This interval allows the computer to continue operation through brief electrical glitches.

Note

Consider increasing the value of shutdown_delay_mins if the site commonly experiences momentary power interruptions greater than one (1) minute for which recovery of power is expected.

- The parameter shutdown_timeout_mins. This parameter specifies the number of minutes to monitor the shutdown -h operation before initiating reboot with the halt option. In this way a reboot is executed even if the shutdown process hangs.

Note

Consider increasing the value of shutdown_timeout_mins if shutdown(1M) will take longer than 5 minutes (including the 60 second delay by shutdown(1M) after notification of users).

Consider decreasing the value of shutdown_timeout_mins if shutdown(1M) will take less than 5 minutes; small systems can take advantage of this.

For more information on UPS on HP-UX 9.04, see the man pages on ups_mond(1M) and ups_conf(4).

If AC Power Fails ... (890/T500 Systems WITH Automatic Shutdown)

Note If the automatic shutdown feature has been disabled, follow the procedure for 890/T500 Systems WITHOUT Automatic Shutdown.

If AC power fails on an 890/T500 system with a PowerTrust UPS and with the automatic shutdown feature enabled:

1. You will hear an auditory alarm (a single beep every 7 seconds). If desired, you can turn off the auditory alarm by pressing the switch on the PowerTrust UPS labeled "Silence Alarm".

Caution Do NOT press the switch on the PowerTrust UPS labeled "Output On/ Output Off". Pressing this switch would shut off power to the SPU and other units connected to the UPS.

2. With the OS properly configured for UPS, you will see UPS messages on the console. See Appendix A in *PowerTrust System Guide* (PN 5961-8383) for explanations of the messages.
3. The indicators on the PowerTrust UPS front panel labeled "AC Output" and "Battery Power" will be lit.
4. **If AC power does not return** within the time specified by the parameter, shutdown_delay_mins (default = 1 minute), the shutdown(1M) command with the "-h" option is executed. Normal shutdown processing occurs. In case the shutdown process hangs, the reboot command with the halt option is executed after an interval specified by shutdown_timeout_mins (default = 5 minutes).

Caution Do NOT turn off power yourself, no matter what messages you see on the console. Power will be turned off automatically as part of the automatic shutdown. If you turn off power yourself, the system may be powered off automatically as it is rebooting, causing a hard crash.

5. **If the unit comes within approximately two (2) minutes of full battery discharge,** the reboot command with the halt option will execute, as described in the previous item. The PowerTrust UPS will issue three beeps every 7 seconds.

For more information, see the *PowerTrust System Guide* (PN 5961-8383) that accompanied the PowerTrust UPS.

The operating system should have been configured for the UPSs as part of the system installation. See "Configuring a PowerTrust UPS on 890/T500 Systems" which appears later in this chapter.

Automatic shutdown is only supported on HP-UX 9.04 and later releases.

If AC Power Fails ... (890/T500 Systems WITHOUT Automatic Shutdown)

If AC power fails on an 890/T500 system with a PowerTrust UPS and with the automatic shutdown feature disabled:

1. The PowerTrust Uninterruptible Power System (UPS) will supply power to the system from a battery for approximately 15 minutes if the battery is fully charged.
2. You will hear an auditory alarm (a single beep every 7 seconds). If desired, you can turn off the auditory alarm by pressing the switch on the PowerTrust UPS labeled "Silence Alarm".

Caution

Do NOT press the switch on the PowerTrust UPS labeled "Output On/ Output Off". Pressing this switch would shut off power to the SPU and other units connected to the UPS.

3. For systems running HP-UX 9.04 and later releases (with the OS properly configured for UPS), you will see UPS messages on the console. See Appendix A in *PowerTrust System Guide* (PN 5961-8383) for explanations of the messages.
4. The indicators on the PowerTrust UPS front panel labeled "AC Output" and "Battery Power" will be lit.
5. **If you anticipate a long period without AC power,** you may want to shut down your system during the 15 minutes of reserve power:
   a. Follow the usual OS shutdown procedure.
   b. Power off the protected equipment.
   c. Switch the UPS OUTPUT switch to the OFF (0) position.
6. **When the unit comes within approximately two (2) minutes of full battery discharge:** The PowerTrust UPS will issue three beeps every 7 seconds. Prepare for an immediate loss of battery power.

For more information, see the *PowerTrust System Guide* (PN 5961-8383) that accompanied the PowerTrust UPS.

On HP-UX 9.04 and later releases, the operating system should have been configured for the UPSs as part of the system installation. See "Configuring a PowerTrust UPS on 890/T500 Systems" which appears next in this chapter.

If AC Power Fails ... (99x Systems with a PowerTrust UPS)

If AC power fails on a 99x system with a PowerTrust UPS:

1. The PowerTrust Uninterruptible Power System (UPS) will supply power to the system from a battery for approximately 15 minutes if the battery is fully charged.
2. You will hear an auditory alarm (a single beep every 7 seconds). If desired, you can turn off the auditory alarm by pressing the switch on the PowerTrust UPS labeled "Silence Alarm".

Caution

Do NOT press the switch on the PowerTrust UPS labeled "Output On/ Output Off". Pressing this switch would shut off power to the SPU and other units connected to the UPS.

3. For systems running MPE/iX 5.0 and later releases (with the OS properly configured for UPS), you will see UPS messages on the console. See Appendix B in *PowerTrust System Guide* (PN 5961-8383) for explanations of the messages.
4. The indicators on the PowerTrust UPS front panel labeled "AC Output" and "Battery Power" will be lit.
5. **If you anticipate a long period without AC power,** you may want to shut down your system during the 15 minutes of reserve power:
   a. Follow the usual OS shutdown procedure.
   b. Power off the protected equipment.
   c. Switch the UPS OUTPUT switch to the OFF (0) position.
6. **When the unit comes within approximately two (2) minutes of full battery discharge:** The PowerTrust UPS will issue three beeps every 7 seconds. Prepare for an immediate loss of battery power.

For more information, see the *PowerTrust System Guide* (PN 5961-8383) that accompanied the PowerTrust UPS.

On MPE/iX 5.0 and later releases, the operating system should have been configured for the UPSs as part of the system installation.

Accessing PDC Commands

To access PDC commands:

1. Make sure that the Console keyswitch on the computer front panel is in the unlocked position.
2. Reset the system using the appropriate command (TC, RE, or RS) in Table 1-3. Use TC if the operating system is running.
3. Watch the system console carefully.
4. After the computer has gone through its startup routine (this can take several minutes), you see a display similar to the following on the console:

```
-------------------------------------------------------------------------
                    PDC - Processor Dependent Code
                            Version x.xx
                      (c) Copyright 1990-1993
                     The Hewlett-Packard Company
                         All rights reserved
-------------------------------------------------------------------------
            Total Memory:          192MB
            Total Bus Converters   2
            Total Processors:      2

            Primary Boot Path:      0/52.0.0.0.0.0.0
                                      0 means BC 0 in PMB slot 0
                                     52 means I/O card in HP-PB slot 13
                                      0 means device ID of 0

            Alternate Boot Path:    0/36.0.0.0.0.0.0
            Console/Keyboard Path:  0/44.0.0.0.0.0.0
-------------------------------------------------------------------------
```

5. **If the autoboot flag is enabled,** you see:

```
      Processor is starting the autoboot process.

      To discontinue, press any key within 10 seconds...
```

As soon as you see the above prompt, press a key. (If you do not press a key within several seconds, the system continues with its bootup and you will have to start over again by cycling power or by using the RS or RE command at the SP prompt.)

6. You see:

```
Continue with primary boot path?   ([y]/n/<new_path>)> N
```

When you see the above prompt, press n.

7. You see:

```
Continue with alternate boot path?   ([y]/n/<new_path>)> N _
```

When you see the above prompt, press n.

8. You see:

```
Boot process discontinued. Going to Boot Console User Interface.
```

The PDC Main Menu is then displayed.

Changing the Autoboot Flag or Hardware Paths

At the PDC user interface, you can change the autoboot flag or change hardware paths (primary boot path, alternate boot path, and console/keyboard path). Default boot paths for 99x/890/T500 are shown in Table 1-5 and Table 1-7.

Table 1-5. 99x/890/T500 Default Device Configuration (SCSI System Disk)

Device	I/O Path	Logical Dev. No. (MPE/iX Only)
System disk	0/52.6.0	1
System tape (SCSI)	0/52.0.0	7
System tape (HP-IB)	0/12.0.3	7
System console	0/44.0	20

Table 1-6.
890/T500 Default Device Configuration (Fast/Wide SCSI System Disk)

Device	I/O Path	Logical Dev. No. (MPE/iX Only)
System disk	0/52.6.0	1
System tape (SCSI)	0/36.0.0	7
System tape (HP-IB)	0/12.0.3	7
System console	0/44.0	20

Table 1-7. 99x/890/T500 Default Device Configuration (HP-FL System Disk)

Device	I/O Path	Logical Dev. No. (MPE/iX Only)
System disk	0/52.0	1
System tape (SCSI)	0/36.0.0	7
System tape (HP-IB)	0/12.0.3	7
System console	0/44.0	20

The autoboot flag described here is different from the autostart flag which can be modified from the SP interface. The PDC **autoboot** flag allows the OS to boot automatically upon power-up. The SP **autostart** flag allows the computer startup process to continue even if processor or memory modules are scheduled to be de-configured (for example if they fail selftest).

To change the autoboot flag or hardware paths:

1. Access the PDC main menu, as described in the previous procedure.
2. At the PDC main menu, enter `BO` to access the boot menu. You will see:

```
Main> BO


------- Boot Commands -------------------------------------------------

        Commands Available

        PR Primary:      Boot system using primary boot path.
        AL Alternate:    Boot system using alternate boot path.
        AB Autoboot:     Change the autoboot flag.
        PA Path:         Change a path  (PA <path_type> <new_path>)
                                <path_type>= Pri, Alt, Cons, or Update


        Values stored in Stable Storage:

            Autoboot Flag:              FALSE
            Primary Boot Path:          0/52.0.0.0.0.0.0
            Alternate Boot Path:        0/36.0.0.0.0.0.0
            Console/Keyboard Path:      0/44.0.0.0.0.0.0

        HE  Help:        Display help text on menu selections
        eXit:            Return to previous menu
-------
Boot>
```

3. For most installations, the autoboot flag should be set to TRUE. To set the autoboot flag to TRUE, enter:

   ```
   Boot> AB TRUE
   ```

4. Compare the paths displayed on the Boot menu with the appropriate values for the computer system (see Table 3-5 or Table 3-6). To change the path values, use the PA Path command.

   a. To set the path values for a 99x with a SCSI system disk, enter the following commands:

      i. To set a primary boot path of 0/52.6.0:

         ```
         Boot> PA P 0/52.6.0
         ```

      ii. To set an alternate boot path of 0/52.0.0 (for a SCSI device):

         ```
         Boot> PA A 0/52.0.0
         ```

      iii. To set an alternate boot path of 0/12.0.3 (for an HP-IB device):

         ```
         Boot> PA A 0/12.0.3
         ```

      iv. To set console path of 0/44.0:

```
Boot> PA C 0/44.0
```

b. To set the path values for a 99x with a HP-FL system disk, enter the following commands:

i. To set a primary boot path of 0/52.0:

```
Boot> PA P 0/52.0
```

ii. To set an alternate boot path of 0/36.0.0 (for a SCSI device):

```
Boot> PA A 0/36.0.0
```

iii. To set an alternate boot path of 0/12.0.3 (for an HP-IB device):

```
Boot> PA A 0/12.0.3
```

iv. To set console path of 0/44.0:

```
Boot> PA C 0/44.0
```

5. When you are satisfied with the hardware path values, continue to the next section.
6. If you would like more information on boot commands, access the online help screens by pressing HE:

```
Boot> HE

------- Boot Commands Help -----------------------------------------

Contents:       I.   RECOMMENDED PATHS
                II.  BOOT COMMAND DESCRIPTIONS
                III. WHAT IS A PATH?
                IV.  PATH FORMAT


I.   RECOMMENDED PATHS

                    With SCSI system disk    With HP-FL system disk
Primary:                 0/52.6.0                 0/52.0
Alternate (SCSI dev):    0/52.0.0                 0/36.1.0
Alternate (HP-IB dev):   0/12.0.3                 0/12.0.3
Console:                 0/44.0                   0/44.0
```

Note

In the above help text, the value for Alternate (SCSI dev) on systems with an HP-FL system disk should be 0/36.0.0.

Autoboot

Set autoboot flag TRUE or FALSE. If autoboot is TRUE the system automatically boots when powered up. (More precisely, it loads the software on the primary boot device.) During an autoboot, the process pauses for 10 seconds to allow the operator to stop the boot process.

If the autoboot flag is modified, the new setting takes effect when the system is powered up again.

Syntax: AUTOBOOT <boolean>. For <boolean>:
TRUE = T = 1
FALSE = F = 0

Example: AUTOBOOT TRUE or AB TRUE or AB T

Path

Change/display paths kept in Stable Storage.

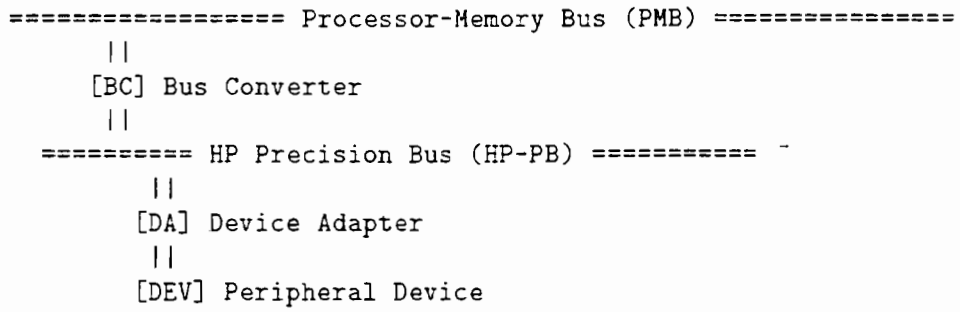
Syntax: PATH [<path_type> [<new_path>]]
<path_type> is one of:
P = primary boot path
A = alternate boot path
C = console path
U = update path
<new_path> = a path description

Examples:

PATH	Displays all paths
PATH A	Displays only alternate path
PATH P 0/52.0	Changes primary path to 0/52.0

III. WHAT IS A PATH?

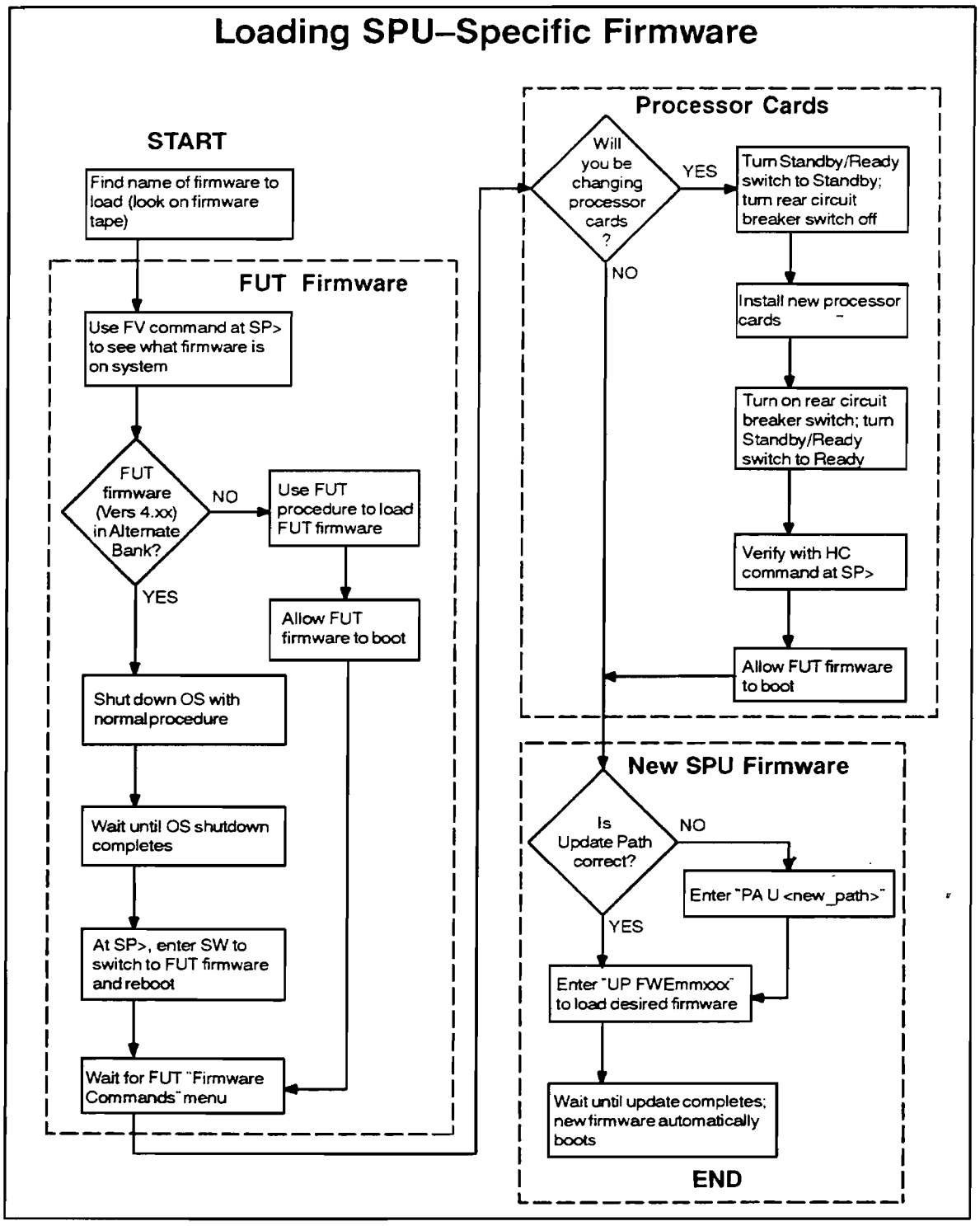
A path is a hardware address, showing the location of a peripheral device in the bus structure. Typical bus structure:



```
IV. PATH FORMAT

On this system, a path has the format:

     BC/DA.DEV

     BC  = The PMB module of the Bus Converter (BC).  This decimal value
           is based on: 1)  the slot number of the BC card.
                        2)  whether the upper or lower connector of
                            the BC card is used.

            BC = (4 * slot number of the BC) + (BC module number)
            BC module number is 0 for the lower connector.
                                2 for the upper connector.

            Examples:
             BC =  0 for BC card in slot 0, lower connector; (4*0)+0 = 0
                =  2 for BC card in slot 0, upper connector; (4*0)+2 = 2
                = 16 for BC card in slot 4, lower connector; (4*4)+0 =16

     DA  = The HP-PB module of the device adapter (DA).
           Equals 4 * HP-PB slot number of the DA (decimal).

     DEV = The ID number of the device, often set on the
           device itself (hexadecimal).

  Example:  4/36.3   (decimal format)
     BC = 4        4/4 = 1.  The BC is in PMB slot 1; module 0.
     DA = 36      36/4 = 9.  The I/O card is in HP-PB slot 9.
     DEV = 3      The ID on the device is set to 3.

Values for BC and DA are expressed in decimal notation.
If there are additional values in the path (for example, to specify
a LAN address), these are expressed in hexadecimal notation.

END
```

Loading SPU-Specific Firmware

The steps for loading SPU-specific firmware are diagrammed in Figure 1-9 and summarized in the cookbook procedure which follows.

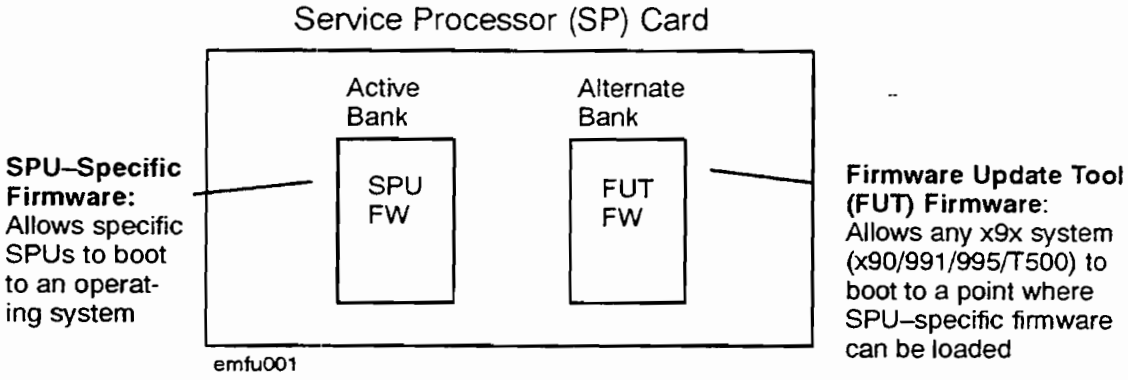


emfu002a

Figure 1-9. Steps for Loading SPU-Specific Firmware Onto the SP Card

Note The following two pages are reprinted from *Firmware Update Quick Reference (x9x Family)* (PN A1820-90003).

This sheet is a quick reference for updating firmware (SP, PDC, and PSCM) on the Service Processor (SP) card in x9x Family computers. For more information, see *x9x Family Firmware Update Guide* (PN A1820-90002).



To load firmware onto an SP card:

1. **Find the name of the firmware you want to load.** To see which versions are available, consult the labels on the Firmware Tape.
2. To see what firmware is on the system, **execute the FV command** at the SP> prompt:

```
Control-B                 /* At the system console
CM> SP                    /* To access the SP> prompt
SP> FV                    /* To display the firmware versions
                        Vers 1.xx = x90 (890/990/992) SPUs
                        Vers 2.xx = T500/991/995 (T500/991/995) SPUs
                        Vers 4.xx = Firmware Update Tool (FUT)
                              xx = Firmware version number
SP> CO                    /* Return to console mode
```

3. **If FUT firmware is NOT already in the Alternate Bank, load FUT firmware.** Follow the procedure in *x9x Family Firmware Update Guide* (PN A1820-90002). (The procedure is very similar to the procedure for loading SPU-specific firmware.) After executing the UP FWEUPxxx command, allow FUT firmware to reboot. Go to step 8 in this procedure.

   NOTE: Always use the Firmware Update Tool (FUT) firmware to load SPU-specific hardware. This ensures that FUT firmware is not overwritten, and that FUT firmware is always available on the alternate bank to facilitate repairs and updates.

4. **If FUT firmware is already in the Alternate Bank,** continue with the procedure.
5. **Use the normal shutdown procedure** for HP-UX or MPE/iX.

   CAUTION: Do not reconfigure processors or memory.

6. After the shutdown completes, **execute the SW command** at the SP> prompt:

```
Control-B                    /* At the system console
CM> SP                       /* To access the SP> prompt
SP> SW                       /* To switch the firmware banks
```

Answer Y to the warning prompt from the SW command.

7. **If you are changing processor cards** as part of an SPU upgrade:
   a. **Turn the Standby/Ready switch on the top front of the system to the Standby position. (WARNING: Be sure that Standby/Ready switch is in Standby position!) Turn OFF the circuit breaker at the rear of the cabinet.**
   b. **Install the new processor cards** following the instructions that accompany them.
   c. **Turn ON the circuit breaker at the rear of the cabinet. Turn the Standby/Ready switch to the Ready position.**
   d. **Use the HC command at the SP> prompt** to verify that the processor cards were properly installed. See the manual that accompanies the upgrade kit.
8. **Allow FUT firmware to boot. Put the firmware tape, DDS, or CD-ROM in the drive.**

   NOTE: Anytime a FUT or PDC menu is not displayed, type a period (.) then Enter.
9. When the Firmware Menu appears again, **check the update path displayed in the menu.** The path should point to the tape, DAT/DDS, or CD-ROM device with the firmware tape mounted. **If the update path is incorrect,** change the firmware update path with the command:

```
Firmware> PA U <new_path>
```

10. **Enter the UPDATE FWEmmxxx command** to load ("update") the desired SPU-specific firmware onto the SP card. (Be sure to spell the file name correctly!)

```
Firmware> UP FWEmmxxx      /* where mm  = CX (for 890, 990, 992) or
                                           TT (for T500, 991, 995)
                                           UP (Firmware Update Tool)
                                  xxx = firmware version number
```

11. **Wait until the update process completes (approximately 10 minutes).** Do NOT interrupt the update process.
12. **The computer automatically does a hard reboot** with the newly loaded firmware as the active firmware.
13. To verify that the desired firmware was loaded, **execute the FV command** at the SP> prompt as described earlier. For detailed information, use the VERIFY command in the PDC Firmware Menu.

** END **

Getting the Latest PA-RISC Hardware Manuals Via FTP

You can get the latest versions of many PA-RISC hardware manuals (including 99x/890/T500 manuals) via FTP. You can then send the downloaded files to your LaserJet printer to get printed copies. This section contains a list of the most recent manuals available, and instructions on how to get them from our server.

Requirements:

- Access to the HP-UX network.
- A password on system 15.0.89.102 (babar). GIVEN IN THIS DOCUMENT.
- Sufficient disk space to hold the desired file:

Table 1-8. Size of Uncompressed Files

Manual	Uncompressed Size
99x/890/T500 CE Handbook (Edition 2)	50? MB
99x/890/T500 SPU Install Guide (Edition 3)	~11.0 MB
99x/890/T500 SPU Operator's Guide (Edition 3)	~4.6 MB
99x/890/T500 Site Prep Guide (Edition 2)	~1.6 MB
99x/890/T500 System Upgrade Guide (Edition 2)	~5.0 MB
99x/890/T500 Firmware Update Guide (Edition 1)	~2.7 MB
99x/890/T500 Firmware Update Quick Reference (Edition 1)	~0.2 MB
A1884A/97A Expansion Cabinet Install Guide (Edition 2)	~1.7 MB
PowerTrust UPS System Guide (Edition 2)	~12.8 MB

- LaserJet printer (the bigger the better).
- A print spooler arrangement large enough to handle the desired .lj files. (The CE Handbook creates a spool file of ~50 MB*).

Some documents can be LONG (500+ pages) with a lot of figures. Therefore, the files are large and the documents take a long time to print.

Note also that copies of Series 700 workstation and X-terminal manuals are available from the babar server.

Please send questions, suggestions, or comments about this procedure to Std HARDWARE / HPG200/04 on HP Desk.

FTP Procedure

1. Use FTP to connect to HP-UX system 15.0.89.102 (babar).

```
ftp 15.0.89.102    (or ftp babar)
```

2. Log on as the user "field". The password is "man92".

```
Name (15.0.89.102:bea): field
Password:  man92
```

3. Change directories to the one that contains the manual you want (see Table 1-9).

```
ftp> cd /manuals/field/x90/ceh
ftp> pwd
257 "/manuals/field/x90/ceh" is current directory.
```

Table 1-9. Manuals for 99x/890/T500 (Emerald/TNT) Systems

Manual	Edition	Directory	File Name
CE H'dbook (99x/890/T500)	2nd Ed	/manuals/field/x90/ceh	ceh2.lj.Z
SPU Install Guide	4th Ed (Nov93)	/manuals/field/x90/inst	x90inst4.lj.Z
SPU Operator's Gd	4th Ed (Nov93)	/manuals/field/x90/oper	x90oper4.lj.Z
Site Prep Guide	2nd Ed (Sep93)	/manuals/field/x90/site	x90site2.lj.Z
System Upgrade Gd	2nd Ed (Nov93)	/manuals/field/x90/sysup	x90sys2.lj.Z
Firmware Update Gd	1st Ed (Sep93)	/manuals/field/x90/fut	x90fut1.lj.Z
Firmware Update QR	1st Ed (Sep93)	/manuals/field/x90/fut	quikref1.lj.Z
Exp Cabinet Install Gd	2nd Ed (Sep93)	/manuals/field/x90/exp	x90exp2.lj.Z
PowerTrust UPS System Gd	2nd Ed (Nov93)	/manuals/field/ups	ups2.lj.Z

4. Make sure that you are in binary file transfer mode:

```
ftp> bin
200 Type set to I.
```

5. Make sure the .lj.Z file is in the directory:

```
ftp> ls
-rw-r--r--   1 master   fieldoc  5054724 Oct 12 10:41 x90ceh.lj.Z
```

(Different manuals have different file names; see above table.)

6. Transfer the file to your system:

```
ftp> get FILENAME.lj.Z
150 Opening BINARY mode data connection for x90ceh.lj.Z (5054724 bytes)
226 Transfer complete.
5054724 bytes received in 12.95 seconds (246.05 Kbytes/s)
```

FILENAME is the file name for the document (for example: "x90inst2"). Note that the complete file name ends in a capital Z.

7. Be sure to log out:

```
ftp> quit
221 Goodbye.
```

Print Procedure

Now you can print out the file. If your printer can print duplex (two-sided), this manual will print out two-sided.

1. On your HP-UX system, enter the following command to automatically uncompress and print out a document. FOLLOW THE SYNTAX EXACTLY!

```
uncompress -c FILENAME.lj.Z | lp -oraw
```

   FILENAME is the file name for the document (for example: "x90inst2"). Remember that HP-UX is case-sensitive and the final Z is a capital Z.

2. After the file is uncompressed (one to several minutes), the manual should begin printing out on your printer. To see if the file is in the print queue, enter the "lpstat" command:

```
lpstat
```

TIP: Save Time and Prevent Errors with the "printz" Alias

One of the biggest hassles of downloadable .lj files is typing in the HP-UX command to uncompress the .lj.Z file and send it to the printer. You can save time and avoid errors by creating an alias.

Once you have created an alias, printing out the .lj.Z files is easy. To print out a file, "cd" to the subdirectory that contains the desired manual and use the printz command. For example:

```
cd manuals/field/x90/oper
printz x90oper.lj.Z
```

The printz command uncompresses the .Z file, then sends the file to the printer.

To activate a "printz" alias:

1. If you are using the Korn Shell (ksh), insert the following line into your .kshrc file in your log-in directory:

```
alias printz="(uncompress -c | lp -oraw) < "
```

2. ** BE SURE TO TYPE THE LINE EXACTLY AS IT APPEARS HERE **

   If you are using the C Shell (csh), insert the following line into your .cshrc file in your log-in directory:

```
alias printz "(uncompress -c | lp -oraw) < "
```

   If you are unfamiliar with "aliases" and .kshrc/.cshrc, ask your local HP-UX guru to do it. It doesn't take long.

3. Once you have modified your .kshrc or .cshrc file, you tell the system to read the file for the change to take effect. The easiest way to do this is to log out, then log in again to your HP-UX machine.

Troubleshooting

PROBLEM: Error Message Says "corrupt input"

PROBLEM: When you try to uncompress and print out the file, an error message says "corrupt input":

```
uncompress -c myfile.lj.Z | lp -oraw
uncompress: corrupt input
```

PROBABLE CAUSE: You may have used ASCII mode for ftp transfer. These files require that you use ftp in the BINARY mode.

SOLUTION: Try downloading the files again with ftp. This time, specify binary mode by typing BIN at the ftp> prompt:

```
ftp> bin
200 Type set to I.
```

PROBLEM: Error Messages, No Printout, Garbage Characters

PROBLEM: Error messages, no printout appears, garbage characters appear in the hardcopy, etc. etc.

POSSIBLE CAUSE: The most common cause of problems is not typing the command in correctly. BE SURE TO TYPE IN THE PARENTHESES AND THE CARET SIGN (<). Remember:

- HP-UX is case-sensitive.
- The final Z is a capital Z.

SOLUTION: Type the command exactly as shown here:

```
uncompress -c FILENAME.lj.Z | lp -oraw
```

FILENAME is the file name for the document (for example: "x90site").

To avoid this problem in the future, activate the printz alias as described above.

PROBLEM: "No such file or directory"

PROBLEM: When you try to ftp the file onto your machine, you get a "No such file or directory" message.

```
ftp> get x90ceh.lj.z
200 PORT command successful.
550 x90ceh.lj.z: No such file or directory.
```

PROBABLE CAUSE: You may not have typed in the final capital Z in the filename. (It is a capital "Z", not a small-letter "z".)

SOLUTION: Try again with a capital Z as the last character in the filename.

2

Specifications

Introduction

This chapter contains regulatory, electrical, physical, and environmental specifications and information for HP 3000 Corporate Business Systems, HP 9000 Corporate Business Servers, the A1884A/A1897 Expansion Cabinet, the external HP-PB I/O card cage, and the PowerTrust Uninterruptible Power System.

The information in this chapter is arranged in the following order:

- Table 2-1. Regulatory Standards
- Table 2-2. SPU Electrical Specifications
- Table 2-3. SPU Physical and Environmental Specifications
- Table 2-4. CS 890/990/992 SPU Configurations Used to Calculate Line Current, Power Consumption, and Heat Dissipation Specifications
- Table 2-5. CS T500/991/995 SPU Configurations Used to Calculate Line Current, Power Consumption, and Heat Dissipation Specifications
- Table 2-6. Expansion Cabinet and HP-PB I/O Card Cage Electrical Specifications
- Table 2-7. Expansion Cabinet and HP-PB I/O Card Cage Physical Specifications
- Table 2-8. HP-PB I/O Card Cage Environmental Specifications
- Table 2-9. A2998A PowerTrust UPS Specifications

Regulatory Standards

The HP 3000 Corporate Business Systems and HP 9000 Corporate Business Servers comply with the regulatory standards listed in Table 2-1.

Table 2-1. Regulatory Standards

Specification		Certification	Country
SAFETY			
	CSA C22.2 No. 950	CSA Certified	Canada
	IEC 950	HP Verified	International
	EN 60 950	HP Verified	European Community
	EMKO-TUE(74)203/91	HP Verified	Nordic Countries
	UL 1950. 1st Ed.	UL Listed	U.S.
EMI			
	FCC Part 15. Subpart B. Class A	HP Verified	U.S.
	EN 55 022 Class A	HP Verified	European Community
	CISPR 22 Class A	HP Verified	International
	VCCI Type 1	VCCI Registered	Japan
EM IMMUNITY			
	pr EN 55101-2 (ESD) 8 KV - Air Discharge 4 KV - Contact Discharge	HP Verified	European Community
	pr EN 55024-3 (pr EN 55101-3) (Radiated Immunity) 3 V/M	HP Verified	European Community

Specifications

Table 2-2 and Table 2-3 list the electrical, physical, and environmental specifications for the SPU. Table 2-4 and Table 2-5 list the configurations used to calculate line current, power consumption, and heat dissipation specifications for the CS 890/990/992 and CS T500/991/995 SPUs.

Note

CS 99x. CS 890, and CS T500 systems require single-phase power (in contrast to 3-phase power). Single-phase power may be obtained in one of two ways:

- **Line-to-neutral:** 200-240V across a phase wire (hot wire) and a neutral wire.
- **Line-to-line:** 200-240V across two different phase wires (hot wires).

In North America. CS 99x. CS 890. and CS T500 systems would have to be supplied line-to-line to obtain 200-240 Volts. Other countries might require line-to-neutral to obtain 200-240 Volts. In neither case is 3-phase power required.

Table 2-2. SPU Electrical Specifications

Description	Specification
Nominal voltage single-phase (line-to-line or line-to-neutral)	200 - 240 VAC. (See note below.)
Voltage tolerance	±10% of nominal voltage
Line frequency/tolerance	50-60 Hz ±5%
Rated input current	24 Amps (maximum at 200 VAC)
Maximum input line current (AC) at present maximum configuration	13.9 Amps (maximum at 200 VAC)
Inrush current	<100 Amps for 1/2 second
Power consumption at present maximum configuration	2727 Watts (maximum)
Power fail carry-over (ride-through)	At least 20 ms. Can be more depending on line and load conditions.
Battery backup time (only with PowerTrust UPS installed)	At least 15 minutes with a fully charged battery
Power line susceptibility	IEEE-587 Category B
Power factor	0.98 Watts/Volt-Amp
Power cord length	10 feet (North America) Not supplied (International)
Electrical receptacle required	NEMA L6-30R 250 Volts 30 Amps (North America)
Service panel circuit breaker required (U.S.)	30 Amp (motor start rating)

Table 2-3. SPU Physical and Environmental Specifications

Description	Specification	
Dimensions:		
Height	63.8 inches (162 cm)	
Width	29.5 inches (75 cm)	
Depth	35.6 inches (90.5 cm)	
Uncrated weight	808 lb (366.5 kg)	
Crated weight	Padded van, 840 lb (381 kg) Air freight, 1005 lb (455.9 kg)	
Maximum point floor loading	400lb (182kg)	
Minimum service access:		
Front	36 inches (91.5 cm)	
Sides	0 inches (0 cm)	
Rear	36 inches (91.5 cm)	
Shock Requirements:		
End use handling	4-inch (10.2 cm), free-fall drop	
Transportation (TYPE 2)	45 *g*, trapezoidal	
(Delta velocity of 100 in/sec)		
Vibration:		
Sinusoidal sweep	5 to 500Hz at 0.5 *g* (0 peak)	
Random operational	5-350Hz	0.0001 g^2/Hz
	350-500Hz	−6 dB/Octave
	500Hz	0.00005 g^2/Hz (≈0.21 G_{rms})
Random non-operational	5-100Hz	0.015 g^2/Hz
	100-137Hz	−6 dB/Octave
	137-350Hz	0.0080 g^2/Hz
	350-500Hz	−6.0 dB/Octave
	500Hz	0.0039 g^2/Hz (≈2.09 G_{rms})
Operating temperature range	41.0° to 104.0° F (5.0° to 40.0° C)	
Recommended operating temperature range	68.0° to 77.0° F (20.0° to 25.0° C)	
Overtemperature shutdown at ambient temperature	>113.0°F (>45.0° C)	

Table 2-3. SPU Physical and Environmental Specifications (Continued)

Description	Specification
Maximum operating rate of temp. change	36° F (20° C) per hour
Non-operating temperature range (storage)	−40.0° to 158.0° F (−40.0° to 70.0° C) Anytime the computer is subjected to a non-operating temperature less than 0° C, it must be allowed to stabilize at its operating temperature range for a period of four hours. This is to allow condensation to evaporate before the computer is turned on.
Operating humidity	15 to 80% R.H. at 104.0° F (40.0° C)
Recommended operating humidity	40 to 60% R.H. at 68.0° to 86.0° F (20° to 30.0° C)
Non-operating humidity (storage)	90% R.H. at 149.0° F (65.0° C)
Operating altitude	10,000 feet (3,000 meters). Note: Derate maximum operating temperature −1.98° F per 1,000 feet over 7,500 feet (−1.1° C per 304.8 meters over 2,286 meters).
Non-operating altitude (storage)	15,000 feet (4,572 meters)
Electrostatic discharge	0 to 15 kV, no effect: 15 kV to 25kV, non-destructive (possible system interruption)
Magnetic field immunity (Maximum level without affecting functionality)	1 Gauss (p-p)
Electromagnetic Immunity pr EN 55101-2 (ESD)	8 KV - Air discharge 4 KV - Contact discharge
Radiated field immunity (14kHz to 1GHz)	No frequencies at a field strength of 10 V/m cause any functional anomalies
Conducted immunity	3 Vrms (30Hz to 50kHz) 1 Vrms (50kHz to 400 MHz)
Heat dissipation at present maximum configuration	2727 Watts maximum (9298 BTU/hour maximum)
Sound power	<7.5 Bels (A-Weighted) below 30° C
Bystander sound pressure (L_pA)	61 dB (A-Weighted) below 30° C

Table 2-4 and Table 2-5 list the **Minimum. Mid. High.** and **Maximum** configurations. Note that the configurations listed in the following tables are field configurations: they do not represent what is shipped from the factory. Also. the listed configurations do NOT include a PowerTrust UPS.

Caution

The values for "Nominal input current" in Table 2-4 and Table 2-5 are based on the configurations noted in the tables. They do not represent maximum nominal input current values for future product upgrades. When selecting power cords and branch circuit breaker protection. use the maximum rated input current of 24 Amps.

Table 2-4.
CS 890/990/992 SPU Configurations Used to Calculate Line Current, Power Consumption, and Heat Dissipation Specifications

PCA	Min	Mid	High	Max
Processors	1[1]	2	3	4
Memory Boards	1	3	6	8
Bus Converters	1	2	3	4
Total input Watts (with Max internal I/O)	1187	1548	2013	2407
Total VA at 200VA	1199	1564	2033	2431
BTUs/hr	4091	5334	6935	8291
Nominal input current at 200V	6.00	7.82	10.17	12.16
Nominal input current at 208V	5.77	7.52	9.78	11.69
Nominal input current at 220V	5.45	7.11	9.24	11.05
Nominal input current at 230V	5.22	6.80	8.84	10.57
Nominal input current at 240V	5.00	6.52	8.47	10.13

1 The maximum number of processors for HP 3000 CS 990 systems is 1.

Table 2-5.
CS T500/991/995 SPU Configurations Used to Calculate Line Current, Power Consumption, and Heat Dissipation Specifications

PCA	Min	Mid	High	Max
Processors (two per processor card)	2[1]	4	8[2]	12[3]
Memory Boards	1	4	8	6
Bus Converters	1	2	3	4
Power Modules	1	1	1	2
PFCs	1	1	1	1
Total input Watts (with Max internal I/O)	1436	1774	2378	2727
Total VA at 200VA	1505	1835	2432	2780
BTUs/hr	4898	6050	8108	9298
Nominal input current at 200V	7.5	9.2	12.2	13.9
Nominal input current at 208V	7.2	8.8	11.7	13.4
Nominal input current at 220V	6.8	8.3	11.1	12.6
Nominal input current at 230V	6.5	8.0	10.6	12.1
Nominal input current at 240V	6.3	7.6	10.1	11.6

1 CS 995/T500 only; the maximum number of processors for HP 3000 CS 991 systems is 1.

2 The maximum number of processors for HP 3000 CS 995 systems is 8.

3 The maximum number of processors for HP 9000 CS T500 systems is 12.

Expansion Cabinet and HP-PB I/O Card Cage Specifications

Table 2-6.
Expansion Cabinet and HP-PB I/O Card Cage Electrical Specifications

Description	Specification
EXPANSION CABINET:	
Input power requirements:	
Voltage	200-240Vac
Frequency	50-60Hz
Current	16A maximum
Heat Dissipation	≈3000W maximum with instruments incorporating front-to-back cooling (≈10.912 BTU/Hr maximum)
Electrical receptacle required	(U.S.) NEMA L6-20R (International) Power cord with no plug is provided.
Battery backup	None
HP-PB I/O CARD CAGE:	
Input power requirements:	
Voltage	Autoranging 200-240VAC
Voltage tolerance	±10%
Voltage unbalance	5%
Frequency	50-60Hz
Frequency tolerance	±5%
Rated input current	
(maximum at 100Vac)	Not supported
(maximum at 200Vac)	3.5A
Total harmonic distortion	5%
Power consumption (maximum)	400W
Battery backup time	At least 15 minutes
Powerfail carry-over	20ms
Electrical receptacle required	IEC 320 (Expansion cabinet PDU receptacle)

Table 2-7.
Expansion Cabinet and HP-PB I/O Card Cage Physical Specifications

Description	Specification
A1884A/A1897A EXPANSION CABINET:	
Height	63.8 inches (162.0 cm)
Width	23.6 inches (60.0 cm)
Depth	35.6 inches (90.5 cm)
Weight	1500 pounds (653.6 kg) maximum
Cooling and access space	24 inches (front and rear)
HP-PB I/O CARD CAGE:	
Height	11.98 inches (30.42 cm) (7 EIA units)
Width	16.73 inches (42.50 cm)
Depth	20.89 inches (53.05 cm)
Weight	55 pounds (24.95 kg)

Table 2-8. HP-PB I/O Card Cage Environmental Specifications

Description	Specification
Temperature Requirements:	
Recommended operating temperature	68.0° to 77.0° F (20° to 25° C)
Operating temperature range	41° to 104° F (5° to 40° C)
Maximum operating rate of change	36° F (20° C) per hour
Non-Operating (storage) temperature range	−40° to 158° F (−40° to 70° C)
Humidity Requirements:	
Recommended operating humidity	40% to 60% R. H.
Operating humidity	15% to 80% R. H. at 104° F (40° C)
Non-Operating (storage) humidity	90% R. H. at 149° F (65° C)
Heat Dissipation:	360 Watts (maximum) (1227 BTU/hour)
Altitude Requirements:	
Maximum operating	10,000 feet (3,000 meters). Note: Derate maximum operating temperature −1.98° F per 1,000 feet over 7,500 feet (−1.1° C per 304.8 meters over 2,286 meters).
Maximum non-operating	15,000 feet (4,572 meters)
Vibration Requirements:	
Operating random (5-500Hz)	≈0.21 G_{rms}
Sinusoidal sweep survival (5-500Hz)	0.5 *g* (0 peak)
Random survival (5-500Hz)	≈2.09 G_{rms}
Shock Requirements:	
End use handling	4 inch (10.2 cm) free-fall drop
Transportation (Delta velocity of 368cm/sec)	30 *g*, trapezoidal
Acoustic Requirements:	
Sound power	4.2 Bels (A-Weighted)
Bystander sound pressure (L_pA)	42 dB (A-Weighted)

Powertrust UPS Specifications

Table 2-9 lists the specifications for the A2998A PowerTrust UPS (Uninterruptible Power System).

Note

Notes for Table 2-9.

[1] Replace fuses only with fuses of the same type and rating.

[2] Battery life is severely shortened if temperature exceeds 25°C (77°F) for extended periods of time.

Table 2-9. A2998A PowerTrust UPS Specifications

Description	Specification
Electrical Specifications	
AC Line Input	
Rated Voltage	200 - 240 VAC
Online	180 - 255 VAC
Maximum	300 VAC
Nominal AC Frequency	50 or 60 Hz
AC Frequency Range:	
50 Hz	47 - 53 Hz
60 Hz	57 - 63 Hz
AC Output	
Rated Power	Up to 3000 VA Up to 3000 W
Loading (% of rated power in normal (not bypass) mode):	
0 - 110%	UPS will operate indefinitely
110 - 130%	UPS will operate up to 5 minutes
>130%	UPS will shut down in <10 seconds
Voltage:	
Normal Mode	223 - 237 VAC
Frequency:	
50 Hz	47 - 53 Hz
60 Hz	57 - 63 Hz
Current:	
Maximum	13 A rms
Crest Factor	≤3 (A peak/A rms)
Waveshape:	True sinewave with <5% Total Harmonic Distortion
Transfer Time	AC failure - approximately 4msec AC restored - 20 second delay returning to AC
Phasing	Phase locked to within 5° of utility AC
Safety Agency Approvals	Agency approvals: UL, CSA, TUV
Fuse[1]	20A 250V UL listed time delay (slow-blow)[1]

Table 2-9. A2998A PowerTrust UPS Specifications (continued)

Description	Specification
Battery	
Type	12V lead acid (20AHr)
Battery Runtime	
20° C or above	≥15 minutes over battery lifetime
New battery	≥15 minutes over full temperature range
Charging Time (20° C or above)	<14 hours
Battery Lifetime (25° C or below)	4 years (approx.)
Environmental Specifications	
Operating Limits	
Operating Temperature[2]	5° to 40°C (41° to 104°F).[2]
Recommended Temperature[2]	20° to 30°C (68° to 86°F)[2]
Humidity	15% to 80% Relative Humidity, non-condensing
Altitude	3,000 meters (10,000 feet)
Non-Operating Limits	
Storage Temperature	
Electronics unit	−40° to 70°C (−40° to 158°F)
Battery box	−15° to 70°C (5° to 158°F)
Humidity	5% to 90% Relative Humidity, non-condensing
Altitude	4,572 meters (15,000 feet)
Physical Specifications - Electronics Unit	
Dimensions packaged:	Height - 41.0cm (16.0in) Width - 57.0cm (22.5in) Depth - 72.5cm (28.4in) Weight - 67.0kg (147.5lbs)
Dimensions unpackaged:	Height - 25.5cm (10.0in) - 6 EIA units Width - 42.5cm (17.0in) Depth - 61.0cm (24.0in) Weight - 61.0kg (135.0lbs)
Physical Specifications - Battery Boxes (2 per 3kVA PowerTrust UPS)	
Dimensions packaged:	Height - 41.0cm (16.0in) Width - 57.0cm (22.5in) Depth - 72.0cm (28.4in) Weight (with batteries) - 65.0kg (143.5lbs) Weight (without batteries) - 23.0kg (51.5lbs)
Dimensions unpackaged:	Height - 12.7cm (5.0in) - 3 EIA units Width - 42.5cm (17.0in) Depth - 61.0cm (24.0in) Weight (with batteries) - 60.0kg (133.0lbs) Weight (without batteries) - 19.0kg (41.0lbs)

Table 2-9. A2998A PowerTrust UPS Specifications (continued)

Description	Specification
Minimum Required Service Access	
Service access space:	Rear - 76.0cm (30.0in) Side - 0.0cm (0.0in) Front - 91.0cm (36.0in)
Communication Specifications	
RS-232 Port pinouts	pin 1: Receive Data pin 2: Transmit Data pins 3-8: Reserved pin 9: Signal Ground
Communication protocol	8 data bits, 1 stop bit, no parity. baud rate is 1200

3

Installation and Maintenance

This chapter summarizes the procedures for installing and maintaining the 99x/890/T500.

Chapter Contents:

This chapter covers:

- Installing the SPU.
- Guidelines for Arranging Components in the Expansion Cabinet.
- Installing an External HP-PB Cardcage
- Preventive Maintenance Procedures.
  - Replacing Air Filters
  - Replacing Lithium Batteries.
  - Forcing a Powerfail Recovery Operation (890/990/992 Systems without a UPS)
  - Forcing a Transfer of Control (TOC).
  - Checking/Clearing Service Processor (SP) Logs.
- Other Maintenance Procedures.
  - Downloading New Firmware (PDC/SP) from a Backup Device.
  - Running the System Exerciser.

Other References:

For complete procedures, see:

- *99x/890/T500 Installation Guide* (PN A1809-90001).
- *99x/890/T500 Expansion Cabinet Installation Guide* (PN A1809-90006).
- *99x/890/T500 External HP-PB I/O Card Cage Installation Guide* (PN A1809-90013)
- *PowerTrust System Guide* (PN 5961-8383)

Installing the SPU

Figure 3-1 shows the main tasks involved in installing the 99x/890/T500.

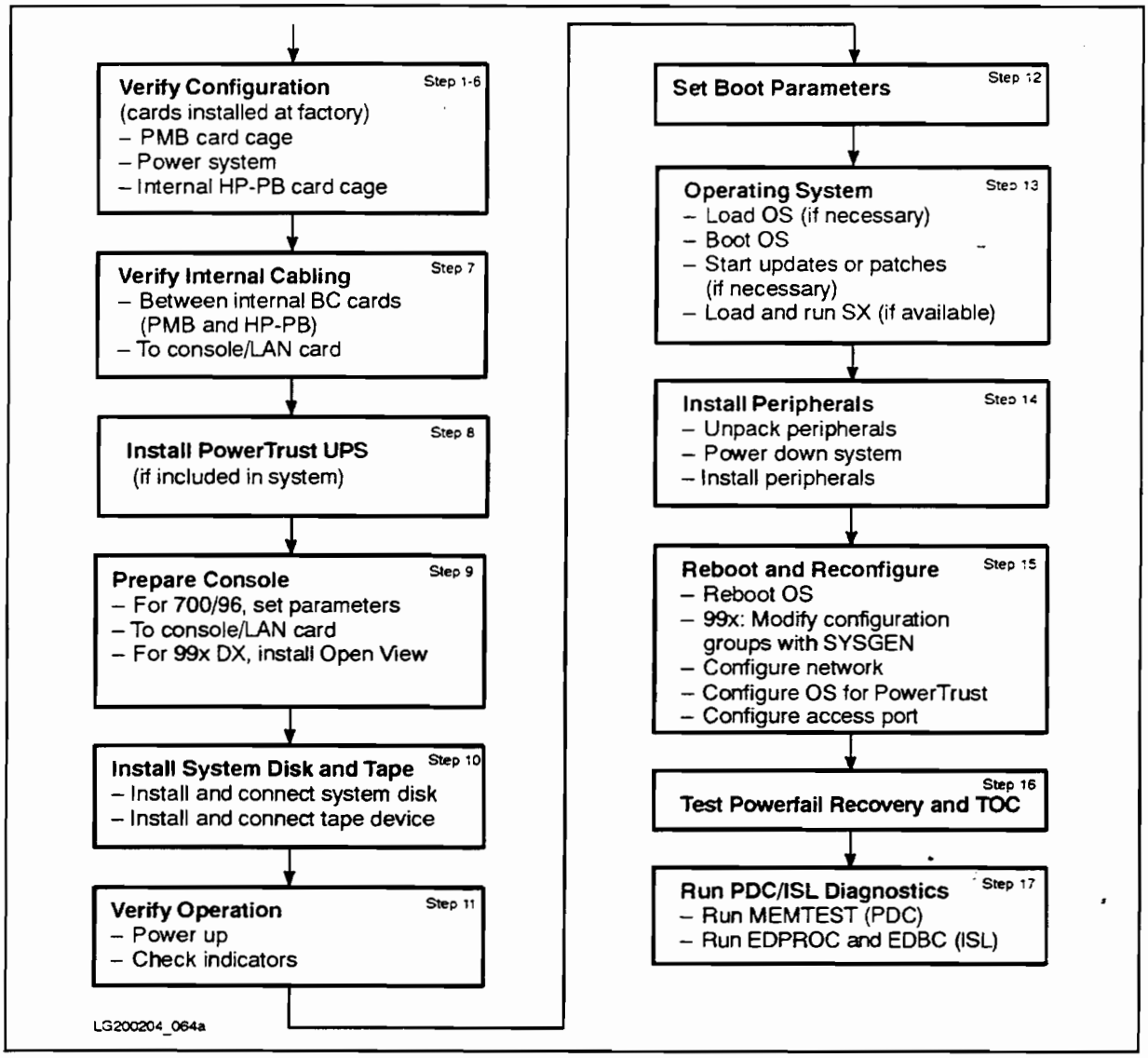


Figure 3-1. Main Tasks in Performing an Installation

The following summarizes the procedures for installing the 99x/890/T500:

1. **Perform site prep tasks**: see *99x/890/T500 Site Preparation Guide* (PN A1809-90002).
2. **Unpack and inspect the system**: see *99x/890/T500 Installation Guide* (PN A1809-90001). (Responsibility of the customer.)
3. **Gain access to the card cages**:
   a. Open cabinet doors.
   b. Remove front card cage cover if necessary.
   c. Remove individual slot shields if necessary.

4. **Install/verify PMB cards:**

   a. Processor cards in this sequence: PMB slots 15, 14, 13, 12, 11, 10, 9, 8 (six processor cards maximum on the T500: four processor cards maximum on other systems).
   b. Bus converter (BC) cards in this sequence: PMB slots 0, 1, 2, 3, 4, 5, 6 (four BC cards maximum).
   c. Service processor (SP) card in the SP slot in rear PMB card cage.
   d. Memory cards in this sequence: PMB slots 4, 6, 8, 9, 10, 11, 12, 13, 14, 7, 5, 3, 2, 1. If one of these slots is occupied, go to the next slot in the sequence.

5. **Install/verify power system:**

   a. Verify that power modules are properly installed:
      i. Slot P10 contains +5 V 130A (650W) power module.
      ii. Slot P12 contains Miscellaneous Power Module (MPM).
      iii. Slot P14 contains +24 V module.
      iv. Slots P6, P7, and P13 contain +5 V 325W (65A) power modules.
      v. Systems with more than 8 processors: Slot P1 contains +5 V 130A (650W) power module.
   b. Verify that input power meets requirements.
   c. Install power cord and plug for European/international locations. (Not necessary for North America.)

6. **Install/verify HP-PB I/O cards:**

   a. BC card (lower port) in double-high slot 14/15.
   b. Console/LAN card in double-high slot 10/11.
   c. 890/T500 only: MUX-16 card in slot 7.
   d. 99x only: PBA-IB card in double-high slot 2/3.
   e. HP-FL system disk:
      i. HP-FL (PB-FL) card in double-high slot 12/13.
      ii. SCSI card in slot 9.
   f. SCSI or Fast/Wide SCSI system disk:
      i. HP-FL (PB-FL) card in double-high slot 8/9.
      ii. SCSI or Fast/Wide SCSI card in slot 13.
   g. Other cards should follow HP-PB guidelines: see Chapter 4 (Configuration):
      i. Power guidelines (so HP-PB cardcage is not overloaded).
      ii. Performance guidelines. Some rules of thumb:
         1) 99x: Install cards for disk drives in higher numbered (higher priority) slots, but below LAN/console card.
         2) 890/T500: install LAN cards in higher numbered (higher priority) slots, but below LAN/console card.

7. **Make/verify internal connections.**

   a. Verify connection of two flat ribbon cables from lower connectors (module 0) on BC card in PMB card cage to the BC card in the HP-PB card cage.
   b. Make/verify connections to the console/LAN card:
      i. To console.
      ii. To Service Processor (SP) card.
      iii. To remote support modem.
      iv. To LAN cable (ThinLAN or ThickLAN). Check/change position of jumper on console/LAN card (INT for ThinLAN; EXT for ThickLAN).

8. **Install PowerTrust UPS.** If the system includes PowerTrust Uninterruptible Power System (UPSs), install it according to the manual *PowerTrust System Guide* (PN 5961-8383) that accompanies it. Install the system cabinet power cables.

9. **Prepare console:**

   a. For 890/T500 and 99x CX: Connect the 700/96 console terminal to the LAN/console card. Set/verify parameters on the console (Baud 9600: Parity/databits none/8: Chk parity NO: EnqAck YES: CS (CB) Xmit NO: RecvPace Xon/Xoff: XmitPace Xon/Xoff).

   b. For 99x DX: install the OpenView Console.

      i. Connect OpenView PC to the LAN/console card with a direct connect cable.

      ii. Connect OpenView PC into the LAN cabling.

      iii. Power up the OpenView PC.

      iv. Enter `WIN` at the C:\> prompt.

Note

Do not run the DTC Manager program on the same PC as OpenView; this configuration is not supported and may not work.

10. **Install system disk and tape device.**

    a. Install system disk and tape device in an A1884A/A1897A expansion cabinet; see *99x/890/T500 Expansion Cabinet Installation Guide* (PN A1809-90006).

    b. Connect system disk to SPU:

       i. For HP-FL system disks: Install the disk module containing the OS into slot 0 of the disk array with the label "System Disk". Connect the system disk to the HP-FL (PB-FL) card in double-high slot 12/13 of the internal HP-PB I/O card cage. (Address 0/52.0).

       ii. For SCSI and Fast/Wide SCSI system disks: Connect the system disk to the SCSI card in slot 13 of the internal HP-PB I/O card cage. (Address 0/52.6.0).

    c. Connect tape device to SPU:

       i. For systems with HP-FL system disks:

          1) For SCSI tape devices, connect the tape device to the SCSI card in slot 9 of the internal HP-PB I/O card cage. (Address 0/36.0.0).

          2) For HP-IB tape devices, connect the tape device to the HP-IB card in slot 3. (Address 0/12.0.3).

       ii. For systems with SCSI system disks:

          1) For SCSI tape devices, connect the tape device to the SCSI card in slot 13 of the internal HP-PB I/O card cage. (Address 0/52.0.0).

          2) For HP-IB tape devices, connect the tape device to the HP-IB card in slot 3. (Address 0/12.0.3).

       iii. For systems with Fast/Wide SCSI system disks:

          1) For SCSI tape devices, connect the tape device to the SCSI card in slot 9 of the internal HP-PB I/O card cage. (Address 0/36.0.0).

          2) For HP-IB tape devices, connect the tape device to the HP-IB card in slot 3. (Address 0/12.0.3).

11. **Verify system operation.**

    a. Make sure console, peripherals, expansion cabinets, and external HP-PB cardcages (if any) are powered up and ready.

b. Power up the computer:
   i. Turn on the circuit breaker switch at the rear of the SPU cabinet.
   ii. Turn the "Standby-Ready" switch on the front panel to the "Ready" position.
c. Enter the PDC user interface.
d. Verify that indicators show normal status.
e. Check the SP error log with the the DL command (SP)
f. Check the autostart flag with the AF command (SP).
g. Check the PMB cardcage configuration with the HC command (SP).

12. **Set boot parameters.**

a. Enter the PDC boot menu.
b. Verify/change autoboot flag.
c. Verify/change default hardware paths. See PDC online help for appropriate values.

13. **Operating system.**

a. Load the operating system if necessary. Some configurations are preloaded at the factory.
b. Boot the operating system.
c. If OS patches are included with the system. install them now.
d. If the System Exerciser (SX) is available. run it to further verify system operation.

14. **Install additional peripherals.**

a. Unpack peripherals.
b. Power down the system.
c. Install additional peripherals in the A1884A/A1897A expansion cabinets: see *99x/890/T500 Expansion Cabinet Installation Guide* (PN A1809-90006).
d. Connect bus converter (BC) cards in the PMB card cage to HP-PB I/O card cages in the expansion cabinets.
e. Make MUX connections and install MDPs (890/T500 only).
f. Make DTC connections to the console/LAN card.
g. Connect other peripherals to HP-PB I/O cards.

15. **Reboot and reconfigure.**

a. Reboot the operating system (OS).
b. 99x: If the hardware configuration (I/O cards. peripherals. etc.) does not match the MPE/iX configuration. modify the MPE/iX configuration. See the listing of default configuration groups in Chapter 4 (Configuration). If necessary, use SYSGEN to modify the configuration group.
c. Configure the network.
d. Configure the OS for the PowerTrust UPS if one is included with the system.
e. Configure Access Port (AP) for a remote console.

16. **Test powerfail recovery (890/990/992 without UPSs) and Transfer of Control (TOC).**

17. (Recommended.) **Run diagnostics:** Run MEMTEST at the PDC interface, then run EDPROC and EDBC at the ISL prompt.

Guidelines for Arranging Components in the Expansion Cabinet

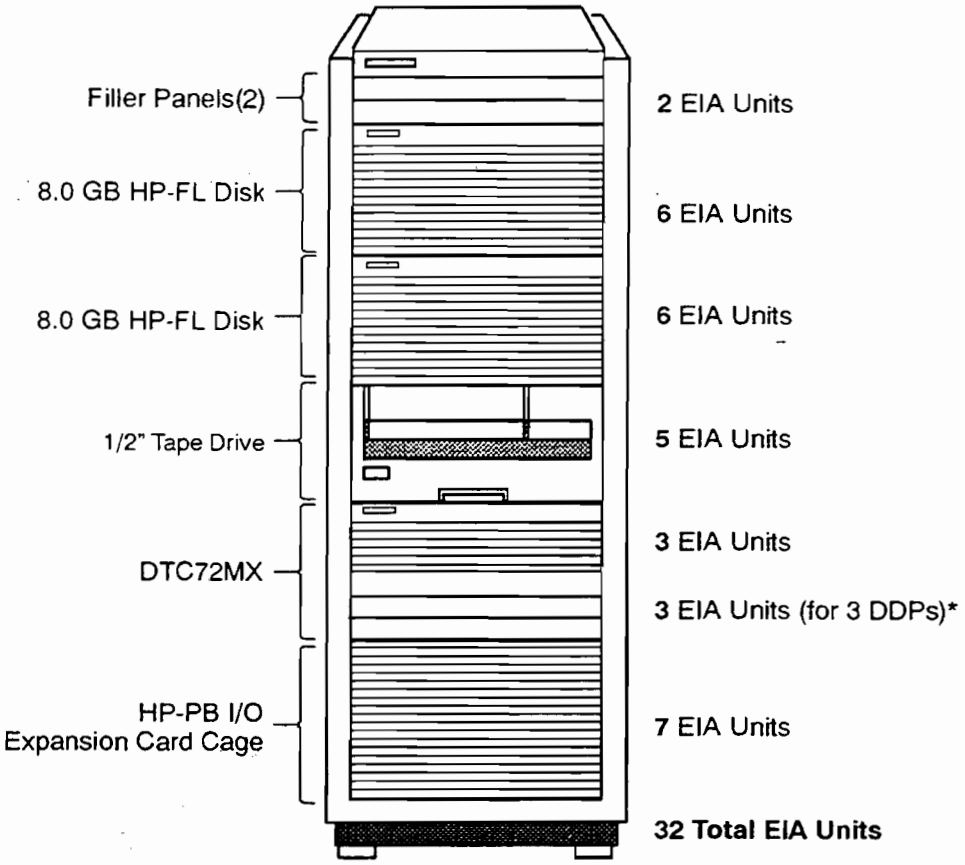
Although the expansion cabinet is designed to accommodate a variety of components mounted in almost any configuration, some basic rules apply to mounting peripherals in the expansion cabinet. These rules allow for weight distribution, accessibility of the components, and cable management inside the rack-mount cabinet. The rules are:

- **General Guidelines:**
  - Always load the cabinet from the bottom up (the top slot is numbered 0, the bottom slot is numbered 32).
  - Leave slots 12 through 24 open until the last. If forced to use these slots, fill them from 12 downward. (Slots 12 through 24 should be used for devices requiring operator access.)
  - If the optional A2998A 3kVA PowerTrust UPS (Uninterruptible Power System) is to be installed, it must be installed at the bottom of the expansion cabinet before all other components or peripherals are installed.
  - Cluster SCSI devices together to ensure the .5M SCSI cable will accommodate all SCSI devices.
  - Install DAT drives (e.g., C2463) in the operator area (slots 12 through 24) for ease of operator access.
- **Product-Specific Guidelines:**
  - Stack devices using the following priority numbers (number 1 is highest priority, that is, first to go on the bottom):
    1. A2998A 3kVA PowerTrust UPS (Uninterruptible Power System)
    2. HP-PB I/O card cage
    3. C2462 1.3GB disk drive without DATs
    4. J2070AZ DTC72MX
    5. A7980SX SCSI Tape Drive
    6. C2463 1.3GB disk drive with DATs (requires slots 12 through 24; if more space is needed, use slots 12 to 0).
- Two filler panels must be at the bottom of the cabinet if an A2252B/54B HP-FL disk array system is the bottom-most racked device in the cabinet. The filler panels will allow ample space for cables coming into the bottom of the cabinet.
- Any cabinet containing an HP-PB I/O card cage must be power-protected by either an HP A2998A PowerTrust UPS or a customer-provided power protection solution.

These rules are noted in case the customer wants to add any optional equipment or change the position of the components in the cabinet. Figure 3-2 shows an example of an expansion cabinet configuration.

Warning

To prevent cabinet instability, the installation of an HP 7980SX requires the installation of three (3) counter-ballast weights (C2786-60017 at 13.61 kg each). If the A2998A PowerTrust UPS is installed at the bottom of the cabinet containing the 7980SX, the counter-ballast weights are not required.



Qty	P/N	Description
1	C2786A	1.6-Meter Standalone Expansion Cabinet
2	C2259HA	8.0-GB HP-FL Disk
1	7980SX	1/2" SCSI Tape Drive
1	J2070AZ	DTC72MX
1	Option 003	72 RJ45 Distribution Ports
1	Option 1AC	Rack Mounting Kit
1	A1828A	HP-PB I/O Card Cage

*DDP—Direct Distribution Panel

LG200205_014c

1.6 Meter Standalone Expansion Cabinet Configuration Example

Figure 3-2. Expansion Cabinet Configuration Example

See *99x/890/T500 Expansion Cabinet Installation Guide* (PN A1809-90006) (Appendix A. "HP 3000 Configuration Information." and Appendix B. "HP 9000 Configuration Information.") for more information about cabinet configurations.

Installing an External HP-PB Cardcage

The following summarizes the procedures for installing the an external HP-PB cardcage for the 99x/890/T500. For the complete procedure. see *99x/890/T500 External HP-PB I/O Card Cage Installation Guide* (PN A1809-90013).

1. Plan configuration of HP-PB cards.
2. Turn off power to all units.
3. Place the HP-PB I/O Cardcage into the expansion cabinet.
4. Insert HP-PB I/O cards into the cardcage.
5. Install cabling (see Figure 3-3):
   a. Cables from HP-PB I/O cards to peripheral devices.
   b. Flat ribbon cables from HP-PB cardcage to Bus Converter card in the SPU cabinet.
   c. Power cable.
6. Power up all units.
7. For HP 3000 systems, use SYSGEN to add paths and devices to configuration.
8. For HP 9000 systems, use `ioscan` (1M) to display hardware configuration.

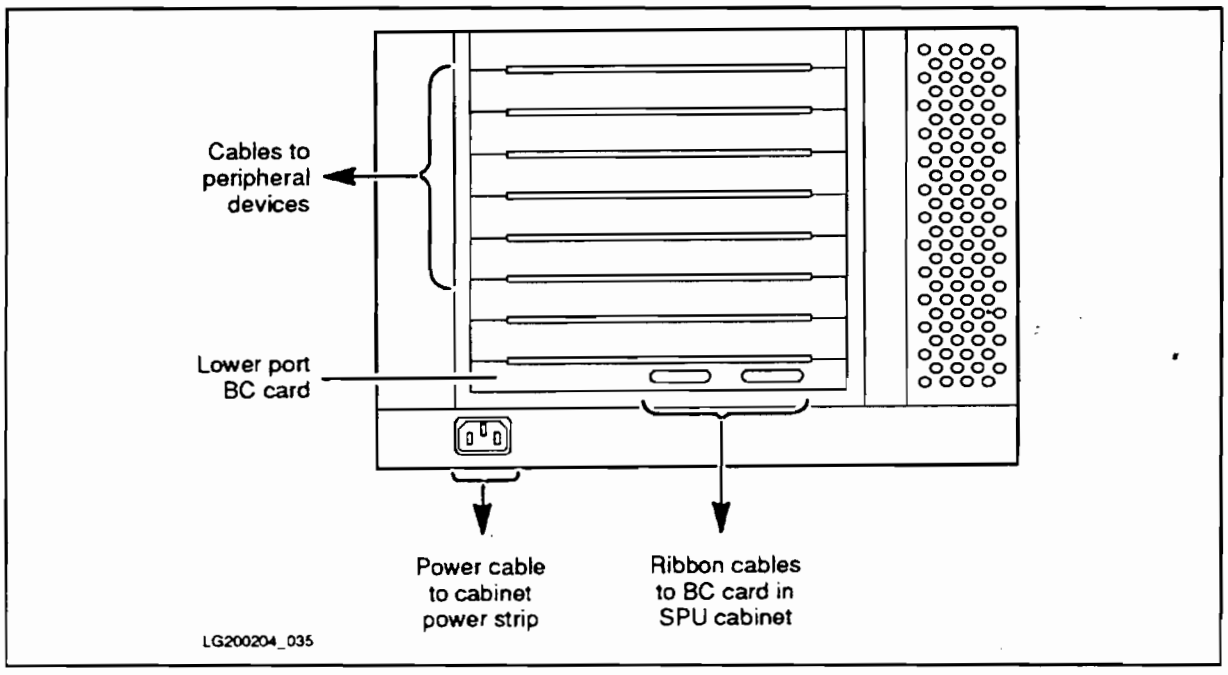


Figure 3-3. Cabling for the External HP-PB Cardcage

Preventive Maintenance Procedures

Preventive maintenance should be scheduled for once a year. Several of the preventive maintenance procedures require that the system be brought offline.

This section describes preventive maintenance procedures for the 99x/890/T500:

- Replacing Air Filters
- Replacing Lithium Batteries.
- Forcing a Powerfail Recovery Operation (890/990/992 Systems without a UPS)
- Forcing a TOC (Transfer of Control).
- Checking/Clearing Service Processor (SP) Logs.

Replacing Air Filters

Two metal air filters are located on rails on top of the PMB/power supply cardcages. Metal filters should not be cleaned; when they become dirty they should be replaced.

Filters should be replaced every 6 months in environments with a lot of dust or particulate matter (for example, in computer rooms containing printers).

On early shipments, air filters are made of plastic. When the plastic filters become dirty, they should be replaced with metal filters (metal filters provide better EMI protection).

To remove an air filter:

1. Open the rear cabinet door.
2. Look for the air filters on top of the PMB/power supply cardcages.
3. Lift upward on the air filter, using the tab in the middle front of the filter.
4. Pull the air filter upward and outward to remove it.

Note Do not spray oils or adhesives on these filters.

To replace an air filter:

1. Reverse the above procedures. The arrows on the filters indicate the direction of air flow: they should point DOWN.

Replacing Lithium Batteries

The 99x/890/T500 contains two lithium batteries on the Service Processor (SP) card. The batteries have an estimated life of 10 years.

When the voltage of the lithium batteries is low (below approximately 2.1 Volts), the yellow ATTENTION LED is lit on the front panel and a low-battery log entry appears in the SP error log. A low-battery entry will be written to the SP log after each cold power on of the system

The batteries are in parallel, so no data will be lost if you replace the batteries one at a time.

To remove and replace a lithium battery:

1. Turn off the circuit breaker on the SPU cabinet, and turn the power switch on the front panel to the "Standby/Battery Off" position.
2. Remove the Service Processor (SP) card from the PMB cardcage.

Caution

Lithium batteries may explode if mistreated. Do not use metal pliers when removing or replacing lithium batteries.

Do not recharge, disassemble, or dispose of lithium batteries in fire. Dispose of used batteries according to the manufacturer's instructions.

Replace batteries with HP Part Number 1420-0353. Using replacement batteries other than the ones recommended may present a risk of fire or explosion.

3. Remove the first battery:
   a. Slide a non-conductive tool between the battery and the battery holder in the slots provided in the sides of the battery holder.
   b. Push down on the non-conductive tool to pop the battery out of the holder.
4. Install the replacement battery. Observe the polarity markings on both the battery holder and the SP card.
5. Repeat the procedure for the other battery to be replaced.

Caution

Replace only one battery at a time. Do NOT remove both batteries at the same time. If you remove both batteries at the same time, you will lose data stored in battery-backed memory and THE SP CARD WILL HAVE TO BE REPLACED!

The following data may be lost: SP logs and SP configuration information, real-time clock, architected Stable Storage, and Non-Volatile Memory (NVM).

6. Measure the battery voltage across the battery holders. Measured voltage should be 2.7 Volts or higher.
7. Replace the card in the PMB cardcage.
8. Turn on the SPU circuit breaker and put the power switch on the front panel into the "Ready" position.
9. Perform a normal boot-up.

Forcing a Powerfail Recovery Operation (890/990/992 Systems without a UPS)

Note This section applies only to 890/990/992 systems without an Uninterruptible Power System (UPS).

To force a powerfail operation:

1. Enter the PS command at the SP> prompt to make sure that battery back-up is connected and the power switch on the front panel is in the "Ready" position.
2. Switch off the circuit breaker on the lower rear of the SPU cabinet.
3. The power system should enter the "powerfail state." Verify that:
   a. The "Battery" LED on the front panel of the SPU should light.
   b. The "Line" LED on the front panel should NOT be lit.
   c. The "Service Processor " LED on the front panel should remain lit.

Forcing a Transfer of Control (TOC)

To force a Transfer of Control (TOC):

1. Enter Control-B at the system console to obtain the Access Port Control Mode (CM) prompt.
2. At the CM prompt, enter SP to enter the Service Processor (SP) mode.
3. At the SP prompt, enter TC.

Checking/Clearing Service Processor (SP) Logs

To examine the SP error or activity logs:

1. Enter Control-B at the system console.
2. Enter SP to enter the Service Processor interface.
3. Enter DL at the SP prompt.
4. To see a record of errors:
   a. If the "Latest Errors" log has entries, enter L:
   b. If the "Latest Errors" log has no entries, enter E to see the "Earliest Errors" log. (The "Latest Errors" log only has entries if the "Earliest Errors" log is full.)
5. To see a history of system activity, enter A
6. Take whatever corrective action is required.
7. At least several times a year, use the CL (Clear Logs) command at the SP prompt to keep the error and activity logs to a manageable size.

For more information, see Chapter 12d (Service Processor).

Other Maintenance Procedures

Downloading New Firmware (PDC/SP) from a Backup Device

See the procedure in Chapter 1 (Overview). See also Chapter 12a (PDC).

Running the System Exerciser (SX)

The System Exerciser (SX) program exercises individual subsystems (CPU, memory, and disks), provides feedback to the user about the current state of the exercisers being run, and displays resulting errors on a log screen. In addition, an online help feature provides context-sensitive information (selectable via softkeys) about using and monitoring the exercisers, and interpreting error messages.

Note

The System Exerciser (SX) has been updated for HP-UX 9.04 and MPE/iX 4.5. The updated version of SX will run on the 99x/890/T500. The updated version is available on the patch machine. Refer to "Obtaining the SX Program and Documentation" in Chapter 6, Diagnostics for information about getting the SX program and manual.

SX can be used to:

- Stress a system to reproduce intermittent problems.
- Serve as a test load for a system.
- Help verify the functionality (go/nogo) of newly installed systems.

The SX program runs while the system is online, and will not corrupt other processes or data.

Running SX

To run SX, refer to the manual appropriate to your system:

Installing and Operating the HP 3000 PA-RISC System Exerciser

Installing and Operating the HP 9000 PA-RISC System Exerciser

Refer to "Obtaining SX Documentation" in Chapter 6, Diagnostics for information about getting the SX manuals.

4

Configuration

This chapter describes how to configure the processor, memory, and I/O subsystems on 99x/890/T500.

Chapter Contents:

This chapter covers:

- Maximum Hardware Configurations.
- Default PMB Configuration.
  - Processor Cards.
  - Bus Converter (BC) Cards.
  - Service Processor (SP) Card.
  - Memory Cards.
  - PBA-IB Card (Series 99x Only)
- Default Power System Configuration.
- Default HP-PB I/O Configuration.
- Planning the HP-PB Configuration.
  - Configuring I/O for System Performance (99x Only).
  - Power and Space Budgeting for the HP-PB Cardcage.
- Configuring the Console
  - The 700/96 Terminal as Console (890/T500 and 99x CX)
  - OpenView Console (99x DX Only).
- MPE/iX Configuration and SYSGEN.
  - Configuring MPE/iX for the PowerTrust UPS
  - Configuring the Remote Console
  - Default Configuration for 99x with SCSI Boot Device (CONFG99x)
  - Default Configuration for 99x with HP-FL Boot Device (ALINK99x)
- Configuring the Remote Support Modem.

For information on interface and network cards (for example SCSI cards), see Chapter 11 (Interface Cards).

Maximum Hardware Configurations

- Table 4-1 shows the maximum hardware configurations supported on the 991/995.
- Table 4-2 shows the maximum hardware configurations supported on the 990/992.
- Table 4-3 shows the maximum hardware configurations supported on the T500.
- Table 4-4 shows the maximum hardware configurations supported on the 890.

Table 4-1. Maximum Supported Hardware Configuration (991/995)

	991/995 CX and DX (All Models)
MPE/iX Release Support	Rel. 5.
User license: Standard/Optional	100/160. 256. 384. Unlimited (UL)
Typical users	200-580 (991 & 995/100). 325-775 (995/200). 425-945 (995/300). 500-1050 (995/400 & 500). 650-1200 (995/600 & 700). 800-1300 (995/800)
Max. connected workstations/terminals	2700
Maximum memory card per SPU[3]	8
Maximum dual bus-converter cards	4
HP-PB I/O card cages[2]: Intrnl/Extrnl	1/7
HP-PB Slots per HP-PB I/O card cage	14
Memory (MB): Minimum/Maximum	256/2048
Maximum disk storage: Total = 2040 GB PB-FL[5] - 255[4] spindles x 8 GB	2040
Maximum disks: Total = 255[4] - PB-FL[5] - SCSI - PBA-IB[6]	 255 255 48
Maximum backup devices - SCSI (DDS) - PBA-IB (HP-IB)/SCSI (tape drive) - Optical SCSI - 1/2-inch cartridge (3480 compatible)	 8 8 3 8 transports
Maximum printers - system PBA-IB (HP-IB) - serial - system SCSI - line	 8 250 4 16
Max. number of devices per I/O card - per PBA-IB (HP-IB) - per PB-FL - per SCSI	 6 8 7
Maximum DTCs	120
Max. cards per HP-PB I/O card cage - PBA-IB (HP-IB) cards - PB-FL (HP-FL) cards - SCSI cards	 2 5 5
Maximum network links per system - 802.3 LANIC[1] - 802.5 Token Ring	 2 1
Maximum PSI cards per system[7]	8

[1] First 802.3 LANIC standard on LAN/Console card.
[2] First HP-PB I/O card cage is internal to the SPU cabinet. seven additional card cages can be added to the 1.6 m Expansion Cabinet.
[3] Memory cards available: 64 MB. 128 MB. 256 MB.
[4] Configurations exceeding 128 disks must be factory approved.
[5] This is a new FL interface. not PBA-FL.
[6] Not supported as LDEV 1.
[7] PSI (Programmable Serial Interface) cards are the hardware components for the SNA Link. BSC Link. and NS Point-To-Point 3000 products.

Table 4-2. Maximum Supported Hardware Configuration (990/992)

	990 DX, 992/100 DX 990, 992/100	992/200 DX, 992/200	992/300 DX, 992/300	992/400 DX, 992/400
MPE/iX Release Support	Rel. 4.0	Rel. 4.0	Rel. 4.0	Rel. 4.0
User license: (UL=unlimited) Standard/Optional	160/UL	UL/UL	UL/UL	UL/UL
Typical users	200 - 580	325 - 775	425 - 945	500 - 1000
Maximum connected workstations	2300	2300	2300	2300
Maximum memory card per SPU[3]	8	8	8	8
Maximum dual bus-converter cards	4	4	4	4
HP-PB I/O card cages[2]: Internal/External	1/7	1/7	1/7	1/7
HP-PB Slots per HP-PB I/O card cage	14	14	14	14
Memory (MB): Minimum/Maximum	192/2048	256/2048	256/2048	256/2048
Maximum disk storage: Total = 691 GB - PB-FL - 128 spindles x 5.4 GB	691	691	691	691
Maximum disks: Total = 128[4] - PB-FL - SCSI - PBA-IB	128 128 48	128 128 48	128 128 48	128 128 48
Maximum backup devices - SCSI (DDS) - PBA-IB (HP-IB) (tape drive) - Optical SCSI - 1/2-inch cartridge (3480 compatible)	8 8 3 8 transports	8 8 3 8 transports	8 8 3 8 transports	8 8 3 8 transports
Maximum printers - system PBA-IB (HP-IB) - serial - system SCSI - line	8 250 4 16	8 250 4 16	8 250 4 16	8 250 4 16
Maximum number of devices per I/O card - per PBA-IB (HP-IB) - per PB-FL - per SCSI	6 8 7	6 8 7	6 8 7	6 8 7
Maximum DTCs	120	120	120	120
Maximum cards per HP-PB I/O card cage - PBA-IB (HP-IB) cards - PB-FL (HP-FL) cards - SCSI cards	2 5 5	2 5 5	2 5 5	2 5 5
Maximum network links per system - 802.3 LANIC[1] - 802.5 Token Ring	2 1	2 1	2 1	2 1
Maximum PSI cards per system	8	8	8	8

[1]First 802.3 LANIC standard on LAN/Console card
[2]First HP-PB I/O card cage is internal to the SPU cabinet. seven additional card cages can be added to the 1.6 m Expansion Cabinet
[3]Memory cards available: 64 MB, 128 MB, 256 MB
[4]Configurations exceeding 96 disks must be factory approved

Table 4-3. Maximum Hardware Configuration (T500)

Item	Max. Limits	Specs.	Notes
Processor Boards	8 per SPU	90 Mhz	One processor in base configuration
Memory Capacity	2 GB		128 MB board in base config.
Memory Boards	8 per SPU	64, 128, 256 MB	Use (8) 256 MB boards to reach 2 GB max configuration
Dual Bus-Convrtrs	4 per SPU		1 in base config: 2 HP-PB I/O Cardcages per Dual BC
HP-PB I/O Slots Internal to SPU In Expansion Modules	112 Total 14 98 slots		All slots are HP-PB 8 single-high slots unused in base configuration 14 single-high slots per HP-PB Exp. I/O Cardcage Mod.
HP-PB Cardcages Internal to SPU External Modules	 1 7	32 MB/S peak	21 MB/S sustained. Max. 256 MB/S peak with 8 cardcages Linked to SPU via 10 meter cable-pair
Disk Capacity HP-FL Disk Array HP-FL Independent SCSI HP-IB	1300 GB Total 1300 GB 326 GB 168 GB 8 GB		 2.7 GB or 5.4 GB increments This limit includes disk arrays in independent mode 12 disks, 3 interfaces
Disk Devices HP-FL HA Arrays HP-FL Ind Mode Arr. SCSI HP-IB	250 Total 240 48 84 12	Up to 5 disks/drive	Contact Sales Center if customer wants > 130 disk addrs's 1 HP-FL "disk dev." used for each High Avail.(HA) array 1 HP-FL "disk device" used for each disk in the array Includes CD-ROM and optical disks
Optical Libraries	20 Library Units		2000 GB Max capacity w/C1705A 100 GB Libraries 4 SCSI addresses (disk devices) per C1705A.
Printers LAN Connected SCSI Serial Centronics	 250 8 250 20		 Connected via MUX or DTC port
Tape Drives SCSI HP-IB	24 16 8		
Term.Connections MUX Connections DTC Connections DTC Units	4500 Total 2048 4500 150		Contact the Sales Center if the customer requires more than 3000 terminal connections. Available with 16 or 72 Ports
Network Links LAN (802.3) Token Ring (802.5) X.25 SNAplus Link FDDI	 10 5 12 12 3	 10 Mbit/S 4 or 16 MB/S 64 KB/S 256 LU 100 Mbit/S	 LAN/Console card + 9 additional single-high J2146A cards Single-high card size Single-high card size: 256 virtual circuits/card: 1024 VCs/SPU Single-high card size: max 256 LU per SPU Double-high card size
I/O Cards HP-FL SCSI HP-IB 8 Channel MUX 16 Channel MUX 32 Channel MUX	 40 20 9 64 64 64	 5 MB/S 5 MB/S 1.5 MB/S	 Double-high card size Single-high card size Single-high card size Single-high card size Single-high card size Single-high card size

Table 4-4. Maximum Hardware Configuration (890)

Item	Max. Limits	Specs.	Notes
Processor Boards	4 per SPU	60 Mhz	One processor in base configuration
Memory Capacity	2 GB		128 MB board in base config. Powerfail min.: 128 MB for 1 or 2 CPUs; 192 MB for 3 CPUs; 256 MB for 4 CPUs
Memory Boards	8 per SPU	64, 128, 256 MB	Use (8) 256 MB boards to reach 2 GB max configuration
Dual Bus-Convrtrs	4 per SPU		1 in base config: 2 HP-PB I/O Cardcages per Dual BC
HP-PB I/O Slots Internal to SPU In Expansion Modules	112 Total 14 98 slots		All slots are HP-PB 8 single-high slots unused in base configuration 14 single-high slots per HP-PB Exp. I/O Cardcage Mod.
HP-PB Cardcages Internal to SPU External Modules	 1 7	32 MB/S peak	21 MB/S sustained. Max. 256 MB/S peak with 8 cardcages Linked to SPU via 10 meter cable-pair
Disk Capacity HP-FL Disk Array HP-FL Independent SCSI HP-IB	600 GB Total 600 GB 150 GB 100 GB 8 GB		 2.7 GB or 5.4 GB increments This limit includes disk arrays in independent mode 12 disks, 3 interfaces
Disk Devices HP-FL HA Arrays HP-FL Ind Mode Arr. SCSI HP-IB	112 Total 112 112 84 12		 1 HP-FL address used for each High Avail.(HA) array 1 HP-FL address used for each disk in the array; each disk adds to total devices count
Optical Libraries	20 Library Units		2000 GB Max capacity w/C1705A 100 GB Libraries 5 SCSI addresses per C1705A.
Printers LAN Connected SCSI Serial Centronics	 250 8 50 20		
Tape Drives SCSI HP-IB	24 16 8		
Term.Connections MUX Connections DTC Connections DTC Units	4500 Total 1024 4500 150		Contact the Sales Center if the customer requires more than 3000 terminal connections. Available with 16 or 48 Ports
Network Links LAN (802.3) Token Ring (802.5) X.25 SNAplus Link FDDI	 5 5 12 12 2	 10 Mbit/S 4 or 16 MB/S 64 KB/S 256 LU 100 Mbit/S	 LAN/Console card + 4 single-high J2146A cards Single-high card size Single-high card size Single-high card size: max 256 LU per SPU Double-high card size
I/O Cards HP-FL SCSI HP-IB 8 Channel MUX 16 Channel MUX	 14 20 9 64 64	 5 MB/S 5 MB/S 1.5 MB/S	 Double-high card size Single-high card size Single-high card size Single-high card size Single-high card size

Default PMB Configuration

The 99x/890/T500 system is preconfigured at the factory and shipped with all cards that have been ordered as part of the system. None of the cards have any jumpers or switches to set.

This section describes the location of the cards in the Processor Main Bus (PMB) card cage. (See Figure 4-1, Figure 4-2, and Figure 4-3). Use this information to verify that PMB cards have been correctly installed in the system.

Processor Cards

Processors must be installed according to the following rules:

1. PMB card slot 15 is reserved for the first processor card.
2. Use the following sequence for installing additional processor cards: PMB slots 14, 13, 12, 11, 10, 9, 8 (four processor cards maximum).

If a processor card is installed in slots 8 through 11, an additional +5 V 130A (650W) power supply (PN 0950-2229) must be installed in slot P1.

Caution Do not handle the processor card or daughterboard by the cooling fins. Applying pressure to these fins may cause the ceramic to crack.

Configuration Limits for T500 Computers with 8+ CPUs

If more than 8 CPUs are configured for a T500 computer, the number of memory and/or BC cards must be reduced due to PMB slot limitations. Refer to Table 4-5 for configuration combinations.

The table shows the maximum number of CPUs that can be configured in the T500 cabinet for a given number of memory cards and BC cards.

Table 4-5. Model T500 Configuration Limits for CPU, Memory, and BC Cards

# of BC Cards	# of Memory Cards							
	1	2	3	4	5	6	7	8
1	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs
2	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs	12 CPUs
3	10 CPUs	10 CPUs	10 CPUs	10 CPUs	10 CPUs	10 CPUs	10 CPUs	10 CPUs
4	8 CPUs	8 CPUs	8 CPUs	8 CPUs	8 CPUs	8 CPUs	8 CPUs	8 CPUs

Bus Converter (BC) Cards

Bus Converter cards must be installed according to the following rules:

1. PMB card slot 0 is reserved for the first bus converter card.
2. Use the following sequence for installing additional bus converter cards: PMB slots 1, 2, 3, 4, 5, and 6 (four BC cards maximum).

Service Processor (SP) Card

Each system must contain one Service Processor (SP) card located in a dedicated PMB slot (slot SP in the rear card cage).

Note

For information on determining hardware paths for PMB cards, see "Changing the Autoboot Flag or Hardware Paths" in Chapter 1.

Memory Cards

Memory cards must be installed according to the following rules:

1. PMB card slot 4 can be used for the first memory card: use slot 6 if 4 contains a bus converter card.
2. PMB card slot 6 can be used for the second memory card: use slot 8 if 6 contains a bus converter or memory card.
3. Use the following sequence for installing additional memory cards: PMB slots 9, 10, 11, 12, 13, 14, 7, 5, 3, 2, and 1.

Caution

Minimum memory for T500/991/995 and 890/990/992 systems with a UPS: 128MB for 890/T500, 256MB for T500/991/995.

Minimum memory for 890/990/992 systems without a UPS: For powerfail recovery to function properly on these systems, a minimum amount of memory must be installed in the system:

- 890/990/992 systems with **one or two** processors: 128MB of memory
- 890 systems with **three** processors: 192MB of memory
- 890 systems with **four** processors: 256MB of memory
- 990/992 systems with **three or four** processors: 256MB of memory

Failure to meet the minimum memory requirements will result in lost data during a powerfail recovery.

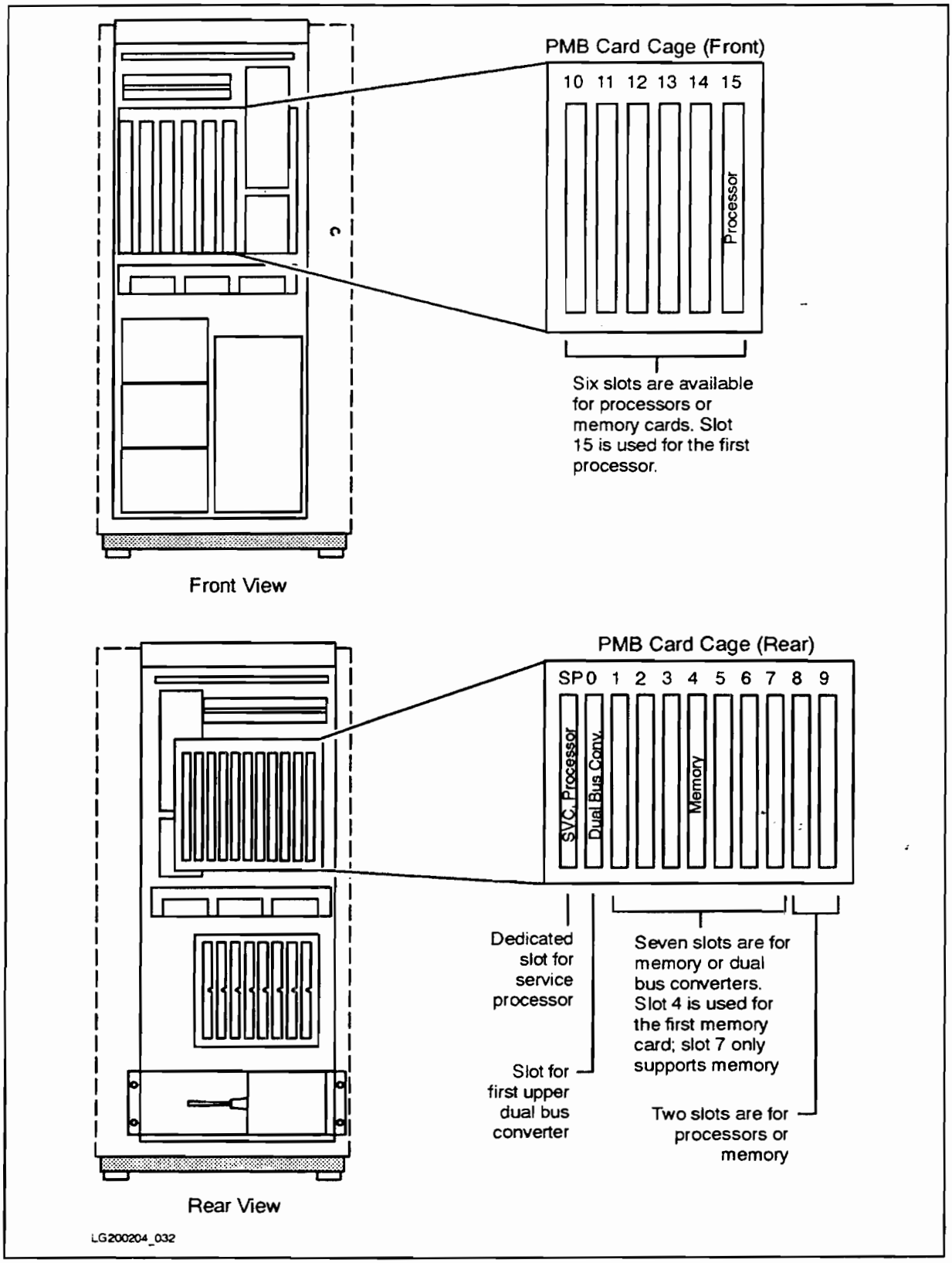


Figure 4-1. Processor Main Bus (PMB) Card Cage Card Locations

Minimum Recommended Memory (T500 Only)

Table 4-6 shows the recommended minimum memory for each CPU configuration. The recommended minimum is the least amount of memory necessary to achieve satisfactory performance under normal workloads. It may be necessary or desireable to increase the actual memory in the configuration to achieve optimum performance for a specific application workload.

Table 4-6. T500 Minimum Recommended Memory

# of CPUs	Recommended Minimum
1	256 MB
2	384 MB
3	512 MB
4	640 MB
5	768 MB
6	896 MB
7	1024 MB
8	1152 MB
9	1280 MB
10	1408 MB
11	1536 MB
12	1664 MB

Memory Interleaving

99x/890/T500 systems support memory interleaving to improve system performance. The system automatically configures memory for interleaving and no special procedures are necessary.

Default Power System Configuration

Power modules have been pre-installed at the factory. To verify their installation, check the following. See Figure 4-2 and Figure 4-3.

- Slot P10 contains +5 V 130A power module.
- Slot P12 contains Miscellaneous Power Module (MPM).
- Slot P14 contains +24 V module.
- Slots P6, P7, and P13 contain +5 V 325W (65A) power modules
- Systems with more than 8 processors: Slot P1 contains +5 V 130A (650W) power module.

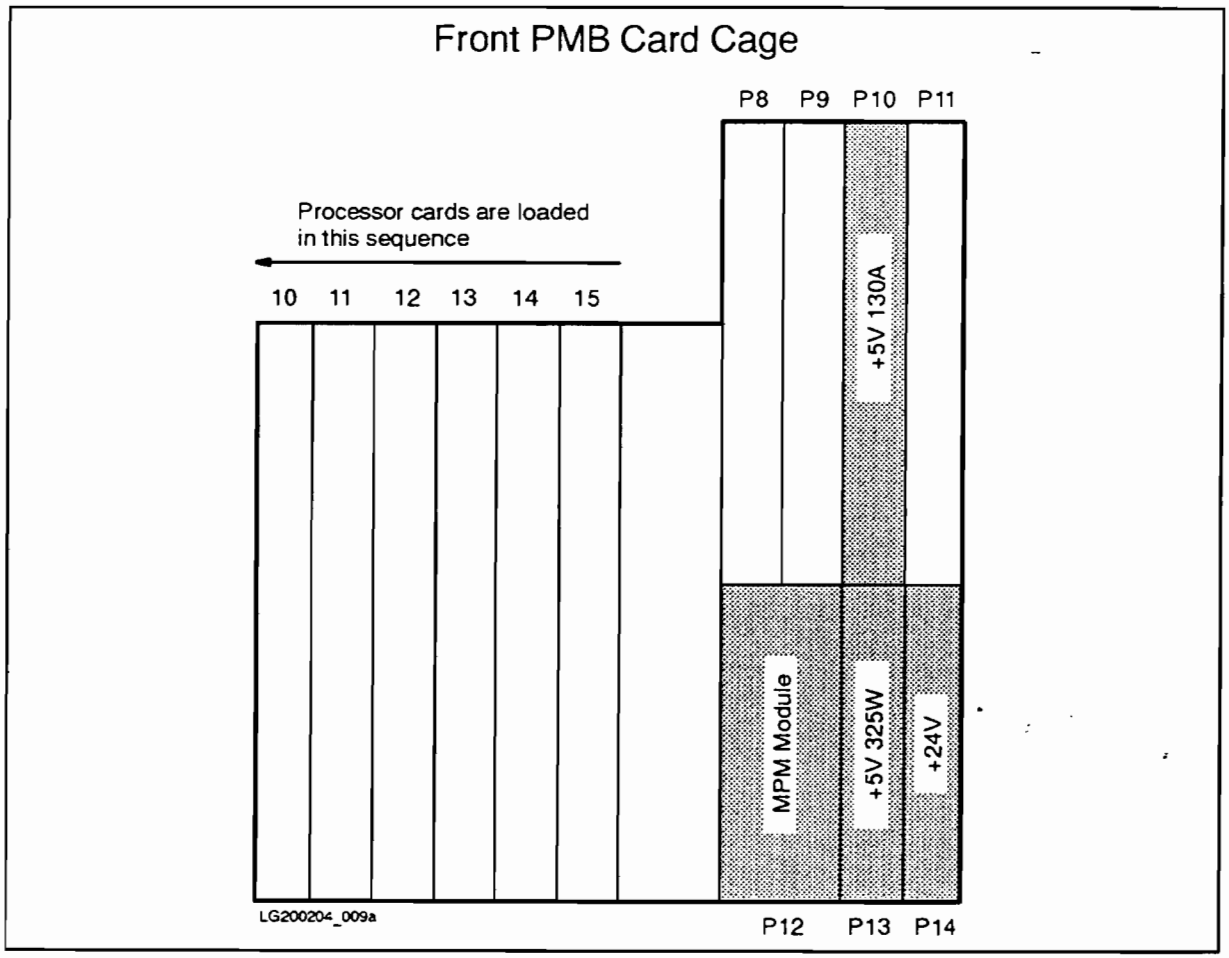


Figure 4-2. Power Modules and PMB Cards in the Front Card Cage

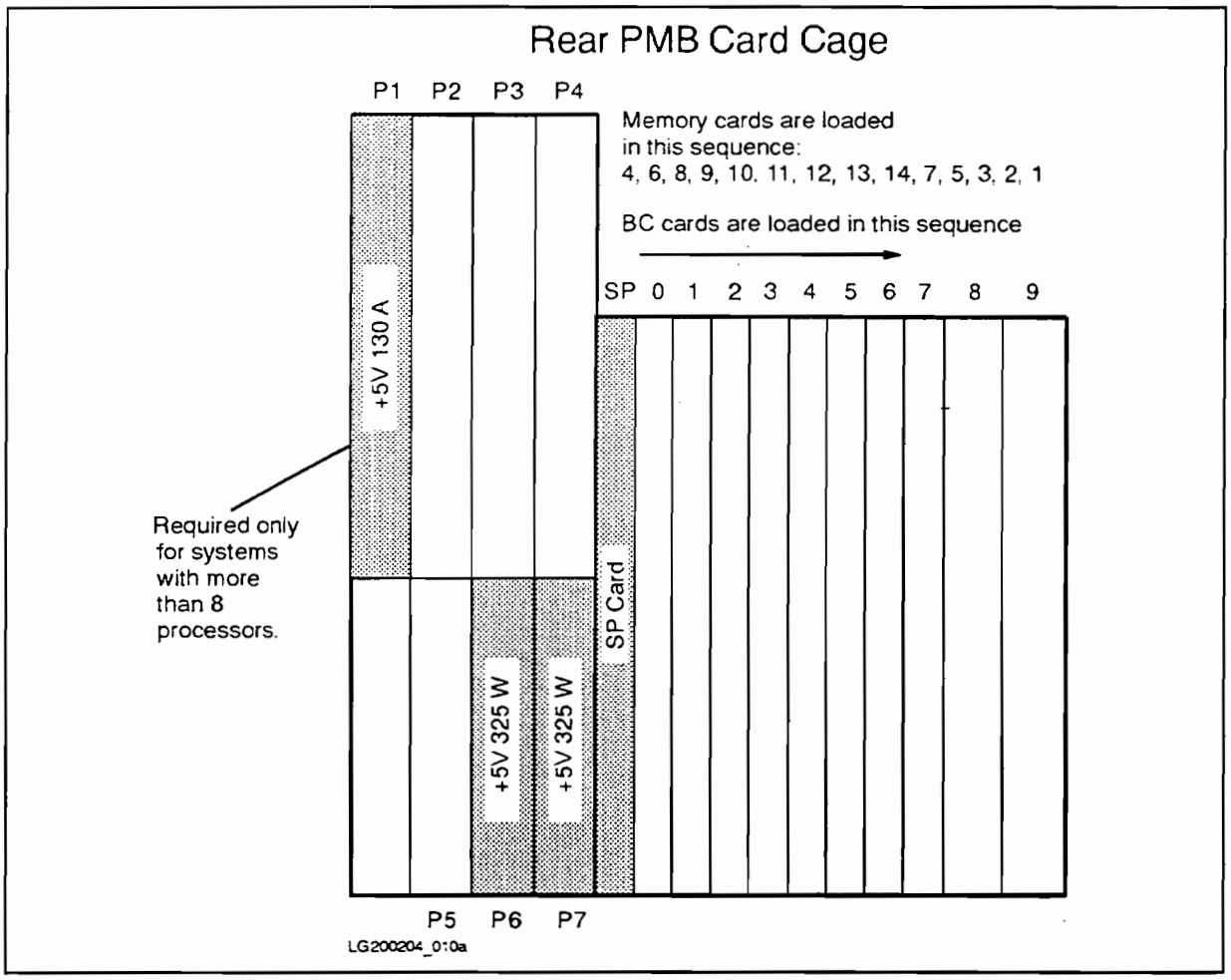


Figure 4-3. Power Modules and PMB Cards in the Rear Card Cage

Default HP-PB I/O Configuration

One HP-PB I/O card cage is located in the base of the SPU system cabinet. Figure 4-4 shows the minimum I/O cards installed in the Series 991/995.

- Minimum configuration for the Model 890/T500 is similar, except that it has a MUX-16 card in slot 7. Also, the T500 base configuration does not include a PB-FL card.
- Minimum configuration for the the Series 990/992 is similar to that of the Series 991/995, except that the 990/992 has a PBA-IB card in double-high slot 2/3.

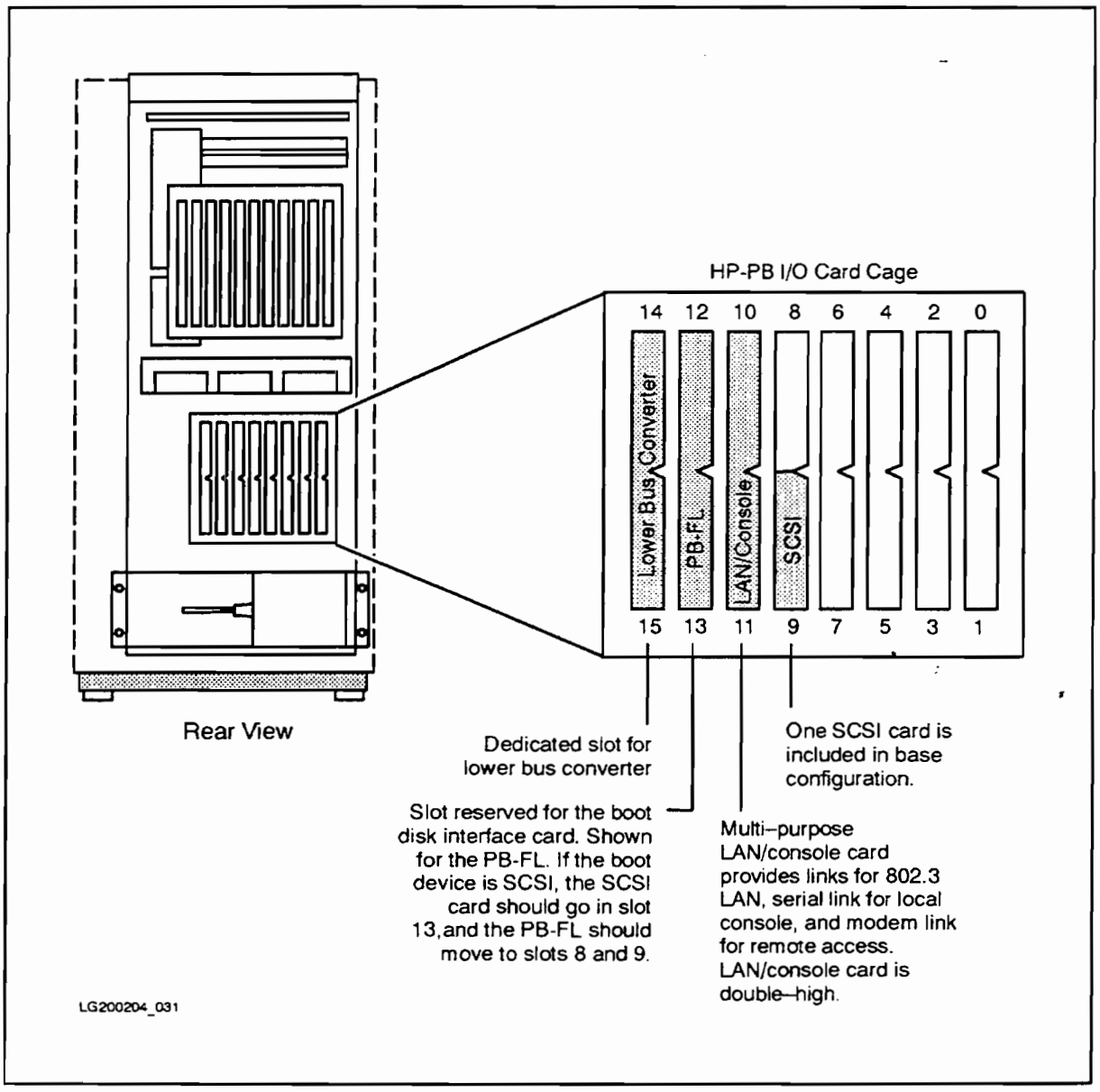


Figure 4-4. HP-PB I/O Card Cage Slots 991/995)

Check to make sure that I/O cards have been properly installed at the factory:

- BC card (lower port) in double-high slot 14/15.
- Console/LAN card in double-high slot 10/11.
- **890/T500 only**: MUX-16 card in slot 7.
- **990/992 only**: PBA-IB card in double-high slot 2/3.
- **HP-FL system disk**:
  - HP-FL (PB-FL) card in double-high slot 12/13.
  - SCSI card in slot 9.
- **SCSI or Fast/Wide SCSI system disk**:
  - HP-FL (PB-FL) card in double-high slot 8/9.
  - SCSI card in slot 13 or Fast/Wide SCSI card in slot 12/13.
- Other cards should follow HP-PB guidelines.

Note

The Fiber-Optic Link card for the 99x/890/T500 is called by several different names:

- *HP-FL card* on the 890/T500.
- *PB-FL card* on the 99x
- *Fiber-Optic Link* on the card itself.

PBA-IB Card (Series 99x Only)

All supported I/O cards (connecting to peripherals) are Precision Bus (PB) cards with the exception of the HP-IB card on the Series 99x which is a CIO card. In order to support the CIO HP-IB card on the Precision Bus, a Precision Bus Adapter (PBA) must be used. The PBA combines the CIB adapter and physical bus adapter into a single, double-high card. Only one CIO HP-IB can be connected to each PBA.

The A1809-60095 is the only PBA-IB card supported on the 99x You should not use a PBA-IB card designed for xx7 systems. The xx7 PBA-IB cards will cause system hangs during tape backup, and are not supported for boot disks.

Planning the HP-PB Configuration

This section provides information for planning the configuration of I/O cards in the HP-PB card cage. Two sets of guidelines of provided:

- Configuring I/O for System Performance.
- Power and Space Budgeting for HP-PB Cardcage.

Note

HP-PB Slot Priority:

On HP-PB. the higher the slot number. the higher the priority. However. priority is not that important. since each module can get one transaction during each transaction interval. Rules of thumb:

- **99x:** Install cards for disk drives in higher numbered (higher priority) slots. but below LAN/console card.
- **890/T500:** Install LAN cards in higher numbered (higher priority) slots. but below LAN/console card.

Configuring I/O for System Performance (99x Only)

The maximums stated in this table are to optimize system performance. These values should not be confused with the maximum number of cards supported.

To optimize system performance, the following HP-PB I/O guidelines are recommended (Table 4-7).

Table 4-7. Performance Guidelines (99x)

I/O Card	Slot Height	Maximum I/O Cards per HP-PB Card Cage	Maximum Devices per I/O Card	Maximum I/O Cards per System
HP-FL (PB-FL)	double-high	5[1]	5	Refer to "Power Budget Worksheet"
SCSI	single-high	5[1]	5	Refer to "Power Budget Worksheet"
PBA-IB	double-high	2	4	Refer to "Power Budget Worksheet"
802.3 LANIC	single-high	N/A	N/A	2[2]
802.5 Token Ring	single-high	N/A	N/A	1
LAN/Console	double-high	N/A	N/A	1
PSI	single-high	N/A	N/A	8

[1] A maximum of 5 connections for SCSI and a maximum of 5 connections for HP-FL (PB-FL). Remaining slots can be used for any other non-disk activity as long as power limits are not violated. This limit applies to single disks as well as disk arrays.

[2] First 802.3 LANIC standard on LAN/Console card.

Boot disk - system performance may be enhanced by separating system software and user data on separate disk arrays.

Note

HP recommends against putting printers on the same HP-IB card with a system disk. This configuration has been reported to cause some data corruption on the system disk.

Power and Space Budgeting for the HP-PB Cardcage

Because of power and space constraints, there are limits on the number and type of HP-PB cards supported by an HP-PB cardcage. These limits apply both to an internal HP-PB cardcage in the SPU cabinet, and to an external HP-PB cardcage in an expansion cabinet.

The HP-PB cards in an HP-PB cardcage must:

- Not require more than 14 single-high slots. (One double-high card = two single high cards.)
- Not exceed the power available at each voltage:
  - 71.64W at +12V.
  - 161.58W at +5V.
  - 23.64W at −12V.
- Not exceed the total power available (222.82W).

Power Budgeting Worksheets

To see whether a configuration of HP-PB cards is supported, use the worksheets on the following pages:

- For the 99x, use Table 4-9.
- For the 890/T500, use Table 4-10.

The two systems only differ in the types of HP-PB cards supported. Power requirements are the same.

Directions for the Worksheets

For each HP-PB cardcage, fill out a worksheet:

1. For each type of HP-PB card, enter the proposed number of cards in the column labeled "Qty".
2. For each type of HP-PB card, multiply the number in the "Qty" column by the value given in each of the three "Power Req./Card" columns. Put the results in the appropriate "Total Power Required" column.
3. Add the values in each column (+12V column, +5V column, and −12V column). Put the results in the row labeled "Sum of power used per voltage". Compare these results with the three voltage power limits.
4. Add the power required for each voltage (+12V, +5V, and −12V) to get a grand total of all the power required. Put the result in the row labeled "Total power used for +12V, +5V, −12V". The total power used for all three voltages must not exceed 222.82 watts.
5. For each type of HP-PB card, multiply the number in the "Qty" column by the value in the "Slots/Card" column. Put the result in the column labeled "Total Slots Used." (This number represents the number of *single-high* slots used.)
6. Add the values in the "Total Slots Used" column. Put the result in the entry at the bottom of that column. The total number of single-high slots used must not exceed 14.

Caution An HP-PB card configuration must meet TWO sets of power limitations:

- Power limits for specific voltages.
- Total power limit for the card cage power supply (222.82W).

Example

Table 4-8 shows an example of using the worksheet for the 99x.

Note

Information entered by the service person is shown in *italics*. An *OK* in a box means that the value in the box is under the recommended limit.

Table 4-8. HP-PB Power Budgeting Worksheet (99x): EXAMPLE

I/O Card	Qty	Power Requirements per I/O Card (watts)			Total Power Required (watts)			Slots/ Card	Total Slots Used
		+12V	+5V	−12V	+12V	+5V	−12V		
LAN/Console[1] (ThinLAN)	*1*	0.40	14.20	0.40	*0.40*	*14.20*	*0.40*	2	*2*
LAN/Console (Ethertwist or ThickLAN)		6.60	14.20	0.40				2	
HP-FL (PB-FL) [1]	*3*	0.48	19.65	0.60	*1.44*	*58.95*	*1.80*	2	*6*
SCSI[1]	*2*	0.00	4.50	0.00	*0.00*	*9.00*	*0.00*	1	*2*
PBA-IB[1] (HP-IB)	*1*	1.13	27.50	0.66	*1.13*	*27.50*	*0.66*	2	*2*
802.3 LAN	*1*	6.00	10.65	0.00	*6.00*	*10.65*	*0.00*	1	*1*
802.5 Token Ring		0.00	8.30	0.00				1	
PSI		.98	12.00	1.07				1	
Sum of power used per voltage: (Must not exceed total below)					*8.97 (OK)*	*120.30 (OK)*	*2.86 (OK)*	Total slots used *13 (OK)* (Must not exceed 14)	
Maximum power available per voltage in HP-PB I/O card cage					71.64	161.58	23.64		
Total power used for +12V, +5V, −12V (Must be less or equal to 222.82 watts)					*132.3 (OK)*				
[1] I/O cards included in base configuration.									

Power Budget Worksheet for the 99x HP-PB Cardcage

Table 4-9. HP-PB Power Budgeting Worksheet (99x)

I/O Card	Qty	Power Requirements per I/O Card (watts)			Total Power Required (watts)			Slots/ Card	Total Slots Used
		+12V	+5V	−12V	+12V	+5V	−12V		
LAN/Console[1] (ThinLAN)		0.40	14.20	0.40				2	
LAN/Console (Ethertwist or ThickLAN)		6.60	14.20	0.40				2	
HP-FL (PB-FL) [1]		0.48	19.65	0.60				2	
SCSI[1]		0.00	4.50	0.00				1	
PBA-IB[1] (HP-IB)		1.13	27.50	0.66				2	
802.3 LAN		6.00	10.65	0.00				1	
802.5 Token Ring		0.00	8.30	0.00				1	
PSI		.98	12.00	1.07				1	
Sum of power used per voltage: (Must not exceed total below)								Total slots used _____ (Must not exceed 14)	
Maximum power available per voltage in HP-PB I/O card cage					71.64	161.58	23.64		
Total power used for +12V, +5V, −12V (Must be less or equal to 222.82 watts)									

[1]I/O cards included in base configuration.

Power Budget Worksheet for the 890/T500 HP-PB Cardcage

Table 4-10. HP-PB Power Budgeting Worksheet (890/T500)

I/O Card	Qty	Power Requirements per I/O Card (watts)			Total Power Required (watts)			Slots/ Card	Total Slots Used
		+12V	+5V	−12V	+12V	+5V	−12V		
LAN/Console[1] (ThinLAN)		0.40	14.20	0.40				2	
LAN/Console (Ethertwist)		6.60	14.20	0.40				2	
8-Port MUX 40299B		1.92	7.00	1.56				1	
16-Port MUX J2092A, J2093A, J2094A		3.60	8.50	1.80				1	
32-Port MUX J2096A		1.50	8.00	1.50				1	
802.3 LAN J2146A		6.00	10.65	0.00				1	
SCSI/Cent Intfc[1] 28655A		0.00	4.50	0.00				1	
HP-IB Interface 28650B		0.00	10.50	0.00				1	
HP-FL Interface[2] 28615A		0.48	19.65	0.60				2	
Fast/Wide/ Differential SCSI Interface 28696A		1.44	25.5	0				2	
X.25 36960A		0.96	9.55	0.96				1	
SNAplus Link J2220A		0.96	9.55	0.96				1	
FDDI J2156A		0.00	18.50	0.00				2	
802.5 Token Ring J2166A		0.00	8.30	0.00				1	
Sum of power used per voltage: (Must not exceed total below)								Total slots used _____ (Must not exceed 14)	
Maximum power available per voltage in HP-PB I/O card cage					71.64	161.58	23.64		
Total power used for +12V, +5V, −12V (Must be less or equal to 222.82 watts)									

[1] *I/O cards included in base configuration.*
[2] *HP-FL card included in base configuration for 890 but not for T500.*

Configuring the Console

The console shipped with the Model 890/T500 and the 99x CX is a 700/96 terminal.

The console shipped with the Series 99x DX is an OpenView Console PC.

Procedures for installing these two different consoles follow.

The 700/96 Terminal as Console (890/T500 and 99x CX)

The 700/96 terminal should be connected to the console/LAN card as described in the *99x/890/T500 Installation Guide* (PN A1809-90001).

Configure the 700/96 terminal as shown:

Datacomm Configuration Parameters:

Baud Rate:	9600
Parity/Databits:	None/8
Chk Parity:	NO
EnqAck:	YES
CS (CB)Xmit:	NO
RecvPace:	Xon/Xoff
XmitPace:	Xon/Xoff

Configuration parameters that are not mentioned can be set to any value and do not affect the operation of the Console/LAN card or the system.

OpenView Console (99x DX Only).

The OpenView Console is a Vectra 386-based OpenView Workstation supplied with the necessary software to act as the system console. The OpenView Console provides a windows-based. PC environment which allows system operators to monitor the Corporate Business System via icons.

The PC software is preloaded on the internal hard disk at the factory prior to shipment.

Note

Continuous Power Source Recommended:

To ensure maximum availability of the OpenView Console in the event of power fluctuation or interruption, a continuous power source is recommended for the OpenView Console PC.

Note

Do not run the DTC Manager program on the same PC as OpenView; this configuration is not supported and may not work.

MPE/iX Configuration and SYSGEN

During system installation, you can run SYSGEN to generate a CONFIG group of files for subsequent boots. The CONFIG group of files determines the I/O configuration at system startup (unless a different group is specified with the START command).

To generate a CONFIG group of files, use the appropriate configuration group supplied with the system (see Table 4-11).

Table 4-11. Configuration Groups Supplied With the 99x

Name	Description
CONFG990 CONFG991 CONFG992 CONFG995	Default configuration for a 99x using a SCSI boot device.
ALINK990 ALINK991 ALINK992 ALINK995	Default configuration group for a 99x using an HP-FL (= Fiber Link = PB-FL) boot device.

For many installations, the factory-supplied configuration group will be sufficient and will not need to be modified; it can be saved as is, with the name of CONFIG.

You will need to modify the configuration files if the system requires LDEVs that are not specified in the configuration group. SYSGEN allows you to add or delete entries in the configuration files. Although deleting unneeded entries is not necessary, it reduces the number of WARNING messages displayed when the system is started up.

For complete instructions on using SYSGEN, see the *MPE/iX System Configuration Manual* (HP part number 32650-90042).

To create the CONFIG group:

1. Call up the SYSGEN program:

   ```
   :SYSGEN
   ```

2. Assign the appropriate configuration group as the base group (see Table 4-11). For example:

   ```
   sysgen> BA CONFG990
   ```

   (Instead of CONFG990, you can specify CONFG991, CONFG992, CONFG995, ALINK990, ALINK991, ALINK992, or ALINK995.)

3. Activate the I/O Configurator by entering:

   ```
   sysgen> IO
   ```

4. List all LDEVs predefined in the configuration group:

   ```
   io> LDEV
   ```

5. Review the lists of predefined LDEVs and determine if all LDEVs required for this installation are included in the list. Table 4-12 through Table 4-15 list entries for the different configuration groups.

Steps 6 and 7 show how to add paths and devices. For complete instructions, see the *MPE/iX System Configuration Manual* (HP part number 32650-90042).

6. To add a path (for device adapter or a bus converter), use the APATH command. For example, to add paths for a bus converter (HPA1809-60005) in PMB slot 1 (paths of 4 and 6), enter:

   ```
   io> APATH 4 HPA1809-60005
   io> APATH 6 HPA1809-60005
   ```

   To add the path 4/52 for an HP-FL (PB-FL) device adapter, enter:

   ```
   io> APATH 4/52 HP28616A
   ```

   (Table 4-12 through Table 4-15 list ID numbers used for many devices, device adapters, and bus converters.)

7. To add devices, use the ADEV command. For example, to add an HP 7937FL disk drive at path 4/52.0:

   ADEV using keyword syntax:

   ```
   io> ADEV LDEV=23 PATH=4/52.0 ID=HP7937FL
   ```

   ADEV using positional syntax:

   ```
   io> ADEV 23 4/52.0 HP7937FL
   ```

8. Temporarily save ("hold") the changes you have just made so you can exit the I/O Configurator:

   ```
   io> HOLD
   ```

9. Exit the I/O Configurator:

   ```
   io> EXIT
   ```

10. Keep the files from the configuration group into the CONFIG.SYS group. CONFIG.SYS is the default group when the system is subsequently started.

    ```
    sysgen> K CONFIG
    ```

11. Exit the SYSGEN program:

    ```
    sysgen> EXIT
    ```

12. If the configuration group was modified, the system must be shut down, reset, and re-started as follows:

    a. Shut down the system by entering:

       : CTRL A
       =SHUTDOWN

    b. To reset the system, enter:

       : CTRL - B

    c. Enter SP

    d. Enter RS

e. If the autoboot flag is set, you will see:

```
Processor is starting the autoboot process.

To discontinue, press any key within 10 seconds ... discontinued.
```

As soon as you see the above prompt, press a key. (If you do not press a key within several seconds, the system continues with its bootup and you will have to start over again by resetting the system).

f. The computer will prompt you:

```
Continue with primary boot path?   ([y]/n/,new_path>) >
```

i. Answer Y if the operating system and ISL are installed on the system disk (This is the normal condition after initial installation).

ii. Answer N if the operating system and ISL are NOT installed on the system disk. You will be taken to the PDC main menu. Type the command ALTERNATE to boot from the alternate boot path (the tape drive).

g. You will see:

```
Trying boot path 0/52.0.0.0.0.0.0 ...

Booting ...

Interact with ISL? (y/[n])> Y
```

Answer Y to the prompt. The ISL prompt now appears. You will see:

```
MMSAVE Version n.nn
DUMPAREA protected, proceeding to ISL without memsave
ISL loaded
ISL Revision v.uu.ff Month Day, Year
ISL>
```

h. To restart the system, enter:

```
ISL> START NORECOVERY
```

Configuring MPE/iX for the PowerTrust UPS

If the system has a PowerTrust Uninterruptible Power System (UPS), you should configure MPE/iX as described in Chapter 3 (Installation and Maintenance) and in *PowerTrust System Guide* (PN 5961-8383).

To configure a PowerTrust UPS, you assign it an LDEV number with NMMGR. Any LDEVs to be used by UPSs should NOT be defined in the configuration group for the system: the UPS LDEVs will be added to the configuration by NMMGR.

The default configuration groups leave the LDEV 22 undefined and hence suitable for use with UPSs.

If you are using more than one PowerTrust UPS, you should assign them additional LDEV numbers. If the LDEV numbers you choose are currently defined in the configuration group, you will have to delete them using SYSGEN. Follow the procedure given at the beginning of this appendix.

If you are adding a UPS to an existing 890/990/992 system, you will also have to delete LDEV numbers from the configuration using SYSGEN.

Configuring the Remote Console

This section describes the correct configuration for the 99x remote console. The remote console port is used by the Response Center to view the contents of the support processor. HP Predictive can also use this port when it is correctly configured.

Note

MPE/iX 5.0 and later releases should have LDEV 21 properly set for the remote console, so you should not have to perform this procedure.

Earlier releases may or may not have LDEV 21 properly set.

The Problem

The former default configuration for LDEV 21 specified an HPC2204A "Bifocus" disk drive. Since remote console and HP Predictive Support can use LDEV 21 as the dial up port, it is important for this port to be configured correctly. The default configuration will cause Predictive Support to abort with the following error messages on the console:

```
CTL(17) Cannot FOPEN port on LDEV 21 (FSERR 56)
CTL(7)  Terminating Transfer Attempt
```

To fix this, the default configuration for LDEV 21 for the 99x has to be changed to HP28639-60001 console terminal.

Procedure

To change an improper configuration for LDEV 21:

1. Call up the SYSGEN program:

   ```
   : SYSGEN
   ```

2. Activate the IO Configurator by entering:

   ```
   sysgen> IO
   ```

3. Use the LD command to list the current parameters for LDEV 21:

   ```
   io> LD 21
   ```

   You will see:

   ```
   LDEV:    21  DEVNAME:          OUTDEV:       0   MODE:
     ID: HPC2204A                 RSIZE:      128   DEVTYPE: DISC
   PATH: 0/36.0                   MPETYPE:      4   MPESUBTYPE:  3
   CLASS: DISC     SPOOL
   ```

4. Use the MD command to modify the parameters for LDEV 21:

   ```
   io> MD 21 id=HP28639-60001-CONSOLE-TERMINAL path=0/44.1
   ```

5. Use the LD command to verify the change:

   ```
   io> LD 21
   ```

You will see:

```
LDEV:    21  DEVNAME:                    OUTDEV:  21    MODE:    JAID
  ID: HP28639-60001-CONSOLE-TERMINAL RSIZE:   40    DEVTYPE: TERM
PATH: 0/44.1                           MPETYPE: 16    MPESUBTYPE: 0
```

6. Use the LP command to verify that the PMGR and LMGR are correct:

   ```
   io> LP 0/44.1
   ```

   See xref emscboot> through Table 4-15 for the correct values.

7. Use the HOLD command to save the changes you have made:

   ```
   io> HOLD
   ```

8. Use the EXIT command to exit the I/O Configurator:

   ```
   io> EXIT
   ```

9. Use the KEEP command to keep the files from the configuration group to the CONFIG.SYS group:

   ```
   sysgen> KEEP CONFIG
   ```

10. Exit the SYSGEN program:

    ```
    sysgen> EXIT
    ```

After the configuration is changed complete these additional steps:

1. Use NMMGR to set the modem type:
   a. Open Config.
   b. DTS.
   c. Go To User Port.
   d. Set the modem type as appropriate.
   e. Save Data.
2. Validate DTS/LINK in NMMGR.
3. Cross-validate the configuration in SYSGEN by entering SYSGEN. Make sure there are no new conflicts.
4. Create a new CSLT in SYSGEN. This saves the changes permanently.
5. An Update is not necessary. However, after the configuration group is modified, the system must be shut down, reset, and restarted as follows:
   a. Shut down the system by entering:

      : CTRL A
      =SHUTDOWN

   b. To reset the system, enter:

      : CTRL - B

   c. Enter SP

d. Enter RS

e. If the autoboot flag is set, you will see:

```
Processor is starting the autoboot process.

To discontinue, press any key within 10 seconds ... discontinued.
```

As soon as you see the above prompt, press a key. (If you do not press a key within several seconds, the system continues with its bootup and you will have to start over again by resetting the system).

f. The computer will prompt you:

```
Continue with primary boot path?   ([y]/n/,new_path>)->
```

i. Answer Y if the operating system and ISL are installed on the system disk (This is the normal condition after initial installation).

ii. Answer N if the operating system and ISL are NOT installed on the system disk. You will be taken to the PDC main menu. Type the command ALTERNATE to boot from the alternate boot path (the tape drive).

g. You will see:

```
Trying boot path 0/52.0.0.0.0.0.0 ...

Booting ...

Interact with ISL? (y/[n])> Y
```

Answer Y to the prompt. The ISL prompt now appears. You will see:

```
MMSAVE Version n.nn
DUMPAREA protected, proceeding to ISL without memsave
ISL loaded
ISL Revision v.uu.ff Month Day, Year
ISL>
```

h. To restart the system, enter:

```
ISL> START NORECOVERY
```

Default Configuration for 99x with SCSI Boot Device (CONFG99x)

Internal HP-PB Cardcage #1 - BC 0

slot#/path		slot#/path
13/52	28642A SCSI	12/48
11/44	28639-60001 CONS/LAN	xxxxxxxxxxxxxxxxxxxxxxxx 10/40
9/36	28616A HP-FL (PB-FL)	xxxxxxxxxxxxxxxxxxxxxxxx 8/32
7/28		6/24
5/20		4/16
3/12	PBA-IB (990/992 only)	xxxxxxxxxxxxxxxxxxxxxxxx 2/8
1/4		0/0

External HP-PB Cardcage #1 - BC 2

slot#/path		slot#/path
13/52	28642A SCSI	12/48
11/44	28642A SCSI	10/40
9/36		8/32
7/28		6/24
5/20		4/16
3/12		2/8
1/4		0/0

Legend: "xxxxxx" denotes a slot occupied by double-width card.
Spaces denote an empty slot.

Table 4-12.
99x Default Configuration for SCSI Boot Device: Internal HP-PB Cardcage (CONFG99x)

I/O Path	Ldev #	ID	Type	Pmgr	Pmgrpri	Lmgr	Maxios
0		HPA1809-60005	BC	BUS_CONV_MGR	2		0
0/12		HPA1809-60095[1]	CA	SPECTRUM_CIO_CAM	6		0
0/12.0		HP27113A	DA	HPIB_DAM	6		0
0/12.0.1	9	HP2566A	LP	CIPER_DM	10	LDEV_MGR	0
0/12.0.3	8	HP7980A	TAPE	TAPE_7968_DM	10	LDEV_MGR	0
0/12.0.6	19	HP2680A	PP	PP_DM	10	LDEV_MGR	0
0/24		HP28642A-SCSI	DA	SCSI_DAM	6		0
0/36		HP28616A	DA	NIO_ALINK_DAM	6		0
0/36.1	23	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
0/44		HP28639-60001-CONSOLE/LAN	DA	LAN_8023_DRIVER	6		0
0/44.0	20	HP28639-60001-CONSOLE-TERMINAL	TERM	CDM_CONSOLE_DM	9	TIO_TLDM	0
0/44.1	21[2]	HP28639-60001-CONSOLE-TERMINAL	TERM	CDM_CONSOLE_DM	9	TIO_TLDM	0
0/52		HP28642A-SCSI	DA	SCSI_DAM	6		0
0/52.0		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.0.0	7	HPC1300S	TAPE	SCSI_TAPE_DM	10	LDEV_MGR	0
0/52.1		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.2		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.3		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.3.0	4	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
0/52.4		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.4.0	3	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
0/52.5		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.5.0	2	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
0/52.6		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.6.0	1	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
0/52.8		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.8.0	6	HP2567B	LP	SCSI_DISC_DM	10	LDEV_MGR	0
0/52.9		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/52.9.0	10	HPC1503B	TAPE	SCSI_TAPE_DM	10	LDEV_MGR	0

1. (Releases prior to MPE/iX 5.0) In the default configuration group, the ID may incorrectly be given as HPA1700-60001. Use SYSGEN to change the ID to HPA1809-60095.
2. (Non-preloaded and preloaded systems shipped before March 15, 1993) In the default configuration group, LDEV 21 is incorrectly assigned to an HPC2204A disk. To use the remote support modem, call up the SYSGEN program to assign LDEV 21 to a HP28639-60001-CONSOLE-TERMINAL, and change the I/O path to 0/44.1 (see procedure earlier in the chapter). Change other values to those shown in Table 4-12.

Table 4-13.
99x Default Configuration for SCSI Boot Device: External Cardcage (CONFG99x)

I/O Path	Ldev #	ID	Type	Pmgr	Pmgrpri	Lmgr	Maxios
2		HPA1809-60005	BC	BUS_CONV_MGR	2		0
2/44		HP28642A-SCSI	DA	SCSI_DAM	6		0
2/44.3		PSEUDO	DA	TRANSPARENT_MGR	6		0
2/44.3.0	34	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
2/44.4		PSEUDO	DA	TRANSPARENT_MGR	6		0
2/44.4.0	33	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
2/44.5		PSEUDO	DA	TRANSPARENT_MGR	6		0
2/44.5.0	32	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
2/44.6		PSEUDO	DA	TRANSPARENT_MGR	6		0
2/44.6.0	31	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
2/52		HP28642A-SCSI	DA	SCSI_DAM	6		0
2/52.4		PSEUDO	DA	TRANSPARENT_MGR	6		0
2/52.4.0	28	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
2/52.5		PSEUDO	DA	TRANSPARENT_MGR	6		0
2/52.5.0	27	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0
2/52.6		PSEUDO	DA	TRANSPARENT_MGR	6		0
2/52.6.0	26	HPC2474R	DISC	SCSI_DISC_DM	8	LDEV_MGR	0

Default Configuration for 99x with HP-FL Boot Device (ALINK99x)

Internal HP-PB Cardcage #1 - BC 0

slot#/path			slot#/path
13/52	28616A HP-FL (PB-FL)	xxxxxxxxxxxxxxxxxxxxxxxx	12/48
11/44	28639-60001 CONS/LAN	xxxxxxxxxxxxxxxxxxxxxxxx	10/40
9/36	28642A SCSI		8/32
7/28		-	6/24
5/20			4/16
3/12	PBA-IB (990/992 only)	xxxxxxxxxxxxxxxxxxxxxxxx	2/8
1/4			0/0

External HP-PB Cardcage #1 - BC 2

slot#/path			slot#/path
13/52	28616A HP-FL (PB-FL)	xxxxxxxxxxxxxxxxxxxxxxxx	12/48
11/44	28616A HP-FL (PB-FL)	xxxxxxxxxxxxxxxxxxxxxxxx	10/40
9/36			8/32
7/28			6/24
5/20			4/16
3/12			2/8
1/4			0/0

Legend: "xxxxxx" denotes a slot occupied by double-width card.
Spaces denote an empty slot.

Table 4-14.
99x Default Configuration for HP-FL Boot Device: Internal HP-PB Cardcage (ALINK99x)

I/O Path	Ldev #	ID	Type	Pmgr	Pmgrpri	Lmgr	Maxios
0		HPA1809-60005	BC	BUS_CONV_MGR	2		0
0/12		HPA1809-60095[1]	CA	SPECTRUM_CIO_CAM	6		0
0/12.0		HP27113A	DA	HPIB_DAM	6		0
0/12.0.1	9	HP2566A	LP	CIPER_DM	10	LDEV_MGR	0
0/12.0.3	8	HP7980A	TAPE	TAPE_7978_DM	10	LDEV_MGR	0
0/12.0.6	19	HP2680A	PP	PP_DM	10	LDEV_MGR	0
0/24[3]		HP28616A	DA	NIO_ALINK_DAM	6		0
0/24.1[3]	23	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
0/36		HP28642A-SCSI	DA	SCSI_DAM	6		0
0/36.0		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/36.0.0	7	HPC1300S	TAPE	SCSI_TAPE_DM	10	LDEV_MGR	0
0/36.8		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/36.8.0	6	HP2567B	LP	SCSI_DISC_DM	10	LDEV_MGR	0
0/36.9		PSEUDO	DA	TRANSPARENT_MGR	6		0
0/36.9.0	10	HPC1503B	TAPE	SCSI_TAPE_DM	10	LDEV_MGR	0
0/44		HP28639-60001-CONSOLE/LAN	DA	LAN_8023_DRIVER	6		0
0/44.0	20	HP28639-60001-CONSOLE-TERMINAL	TERM	CDM_CONSOLE_DM	9	TIO_TLDM	0
0/44.1[2]	21[2]	HP28639-60001-CONSOLE-TERMINAL	TERM	CDM_CONSOLE_DM	9	TIO_TLDM	0
0/52		HP28616A	DA	NIO_ALINK_DAM	6		0
0/52.0	1	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
0/52.1	2	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
0/52.2	3	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
0/52.3	4	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
0/52.4	5	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0

1. (Releases prior to MPE/iX 5.0) In the default configuration group, the ID may incorrectly be given as HPA1700-60001. Use SYSGEN to change the ID to HPA1809-60095.
2. (Non-preloaded and preloaded systems shipped before March 15, 1993) In the default configuration group, LDEV 21 is incorrectly assigned to an HPC2204A disk. To use the remote support modem, call up the SYSGEN program to assign LDEV 21 to a HP28639-60001-CONSOLE-TERMINAL, and change the I/O path to 0/44.1 (see procedure earlier in the chapter). Change other values to those shown in Table 4-14.
3. In the default configuration group, the I/O path is incorrectly assigned to 0/24 and 0/24.1. If you are using these entries, use SYSGEN to change them to 0/28 and 0/28.1.

Table 4-15.
99x Default Configuration for HP-FL Boot Device: External Cardcage (ALINK99x)

I/O Path	Ldev #	ID	Type	Pmgr	Pmgrpri	Lmgr	Maxios
2		HPA1809-60005	BC	BUS_CONV_MGR	2		0
2/44		HP28616A	DA	NIO_ALINK_DAM	6		0
2/44.0	31	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
2/44.1	32	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
2/44.2	33	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
2/44.3	34	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
2/52		HP28616A	DA	NIO_ALINK_DAM	6		0
2/52.0	26	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
2/52.1	27	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0
2/52.2	28	HPC2204A	DISC	EAGL_DISC_DM	8	LDEV_MGR	0

Configuring the Remote Support Modem

The 99x/890/T500 permits remote support and a remote console. These functions require:

- Access Port (AP) circuitry located on the Console/LAN card.
- A properly configured remote support modem.
- A cable for the remote support modem.

This section explains how to configure remote support modems.

The recommended remote support modem is an HP 50759A modem (Support Link). Other modems can also be used.

The recommended cable is an HP 92219Q cable. The HP 40233A cable can also be used. For V.22bis/V.25bis applications, the A1703-63006 modem cable is available (see "Modem Cable Pin-out" later in this chapter).

Note

Table 4-16 and Table 4-17 contain the latest recommendations from the Predictive Support team. These settings have been tested and will work for Predictive Support.

The rest of this section contains reference information and recommendations that were compiled earlier by another group. Some of the recommendations later in the chapter are different than the Predictive Support recommendations.

Section Organization:

This section is organized as follows:

- Modem Settings for MPE/iX and HP-UX (Predictive Support)
- Quick Reference.
- General Guidelines.
- Configuring Individual Modems
  - HP 50759A (Support Link) Modem
  - HP 50759B (Support Link) Modem
  - HP 37212B Modem
  - Hayes Smartmodem 2400
  - Black Box V.32 Plus (Version 2.01.01)
  - Multitech MT224EH7
- Modem Cable Pin-out.
- Console/LAN Card-Modem Line Behavior.

Modem Settings for MPE/iX and HP-UX (Predictive Support)

Table 4-16 and Table 4-17 contain the latest recommendations from the Predictive Support team. These settings have been tested and will work for Predictive Support.

The rest of this section contains reference information and recommendations that were compiled earlier by another group. Some of the recommendations later in the chapter are different than the Predictive Support recommendations.

Table 4-16. Predictive Modem Switch Settings for MPE/iX

Modem Model	Settings
HP 50759A (Support Link)[1]	X1, X2, X4, S4, S8: Down All others: Up
HP 50759B (Support Link)[2]	S2, S3, S4, S7, S8, S9, S12, S16: Down All others: Up
HP 37212B[3]	S3, S11, S12: Up (1) All others: Down (0)

1 The HP 50759A (Support Link) modem has one bank of 8 switches (S switches) and one bank of 4 switches (X switches).

2 The HP 50759B modem has one bank of 16 switches (S switches).

3 The HP 37212B modem has one bank of 12 switches (S switches).

Table 4-17. Support Watch (Predictive) Modem Switch Settings for HP-UX

Modem Model	Settings
HP 50759A (Support Link)[1]	X1, X2, X4, S3, S8: Down All others: Up
HP 50759B (Support Link)[2]	S2, S3, S4, S7, S8, S9, S12, S16: Down All others: Up
HP 37212B[3]	S11, S12: Up (1) All others: Down (0)

1 The HP 50759A (Support Link) modem has one bank of 8 switches (S switches) and one bank of 4 switches (X switches).

2 The HP 50759B modem has one bank of 16 switches (S switches).

3 The HP 37212B modem has one bank of 12 switches (S switches).

For more information, consult:

- **MPE/iX:** *MPE/iX Predictive Support Handbook*, part number 50779-90002.
- **HP-UX:** *HP Support Watch User's Guide*, part number H5169-90005.

The information in Table 4-16 and Table 4-17 is more current than the information contained in those two manual.

Quick Reference

Table 4-18 is a quick reference table on some modems used as remote support modems. For more details see the rest of the section.

Table 4-18. Settings for Remote Support Modem (Quick Reference)

Modem Model	Settings
HP 50759A (Support Link)	X1, X2, X3, X4, S8: Down S1, S3, S4, S5, S6: Up S2, S7: Do not care
HP 50759B (Support Link)	S2, S3, S4, S7, S8, S9, S12, S16: Down All others: Up
HP 37212B	S1, S2, S4, S5, S6, S7, S10: Down (0) S3, S8, S9, S11, S12: Up (1)
Hayes Smartmodem 2400	S3, S9, S10: Down S1, S4, S5, S6, S7: Up S2: Do not care
Black Box V.32 Plus (Version 2.01.01)	`AT&D2&S1&C1&R` (See rest of section.)
Multitech MT224EH7	X1, X4, S3, S7, S8: Down S1, S2, S4, S5, S6, X2, X3: Up (See rest of section.)

General Guidelines

General hints for configuring remote support modems:

- The modem must be set up to respond to DTR.
- CTS should follow RTS.
- DSR must follow OH, not DCD.
- For Bell mode, the modem should disregard RTS.
- Set both local and remote modems to either:
  - The same compression mode, OR
  - To NO data compression.

  If you have problems connecting two modems, a frequent cause is that one modem is enabled for an MNP level and the other modem is set for no data compression.

If the modem sends up modem dialog with all signals asserted, the user may be logged off immediately when a password is enabled for the Access Port (AP). This can be corrected by setting the modem so it does not report connection status via the data path.

Configuring Individual Modems

This section gives configuration information for five different modems.

HP 50759A (Support Link) Modem

Supported modes:

- Bell
- CCITT_OM
- CCITT_AM
- CCITT_BIS_OM
- CCITT_BIS_AM

Supported cables:

- HP 92219Q - Bell. CCITT_OM. CCITT_AM
- A1703-63006 - CCITT_BIS_OM. CCITT_BIS_AM

Auto-dial modes: Hayes

This modem is the standard HP Support Link. It supports V.22bis line discipline. but does not support V.25bis auto-dialing. In order for V.22bis answer mode to work properly, DSR must follow OH. Data Compression should be set *OFF*. Setting data compression *ON* can cause problems when connecting to other modems that do not have data compression.

Settings

Two sets of configuration switches on the HP 50759A are on the underside of the modem. One set (Set S) consists of eight switches. The other set (Set X) consists of four switches. See Figure 4-5.

Configure the modem by setting these switches to either of two positions: `UP` or `DOWN` (depressed).

Note

A firmware upgrade that involves replacing two chips for MPE and MPE/iX systems is not necessary for HP-UX systems. If the upgrade is installed. there is no effect on the modem's switch settings.

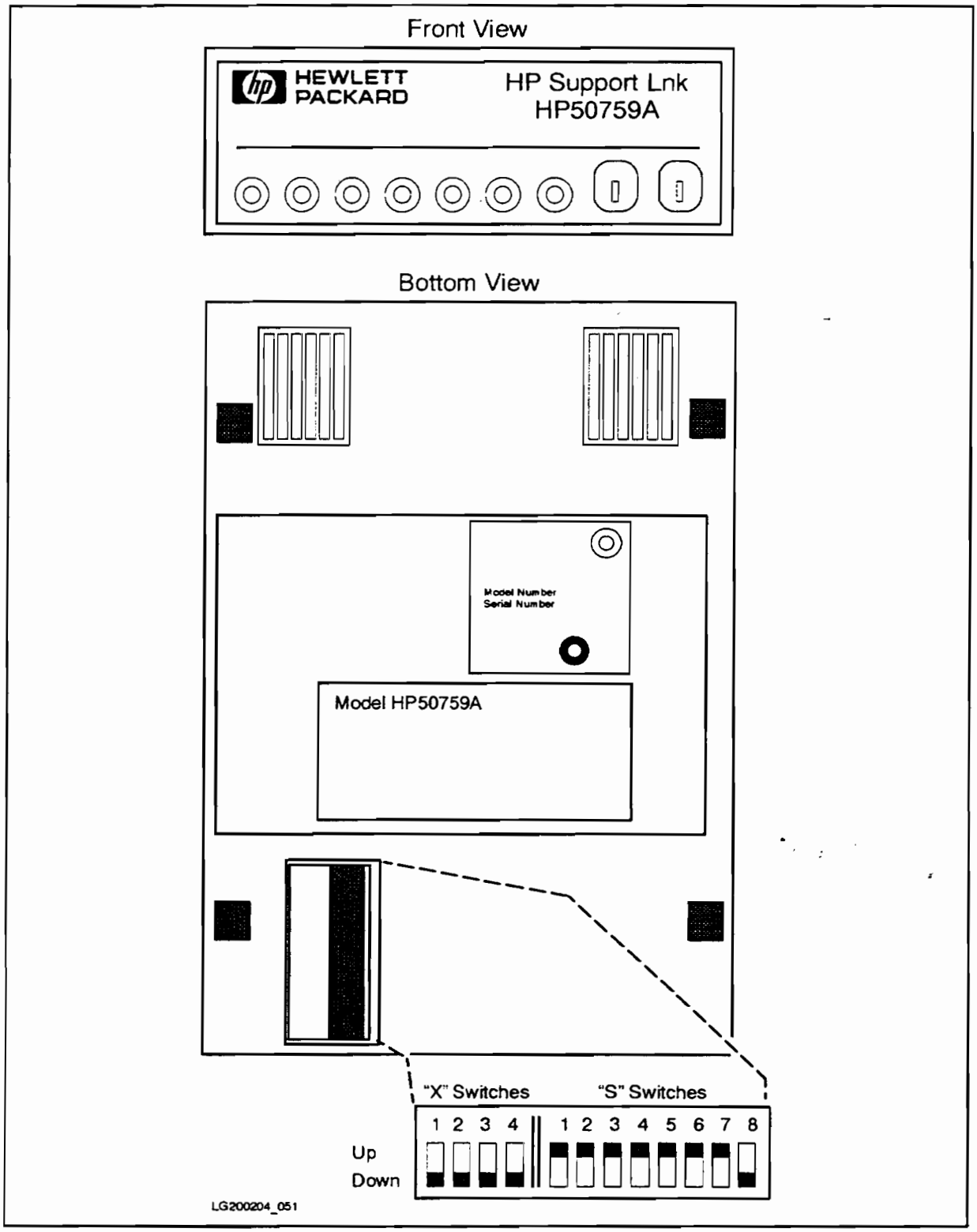


Figure 4-5. Configuration Switches on the HP 50759A Modem

Table 4-19. 8-Position DIP Switch Option Settings (Set S)

Switch	Position	Description	Option Command
S1	up	DTR Normal	&D2
S2	xx	Verbose Responses	V1
S3	up	Suppress Responses	&Q0
S4	up	Enable Echo of commands	E1
S5	up	Enable Auto-Answer	S0=1
S6	up	DCD/DSR Normal	&C1 &S1
S7	xx	Depends on phone line	
S8	down	Enable Command Mode	

Note xx means "do not care."

Table 4-20. 4-Position DIP Switch Option Settings (Set X)

Switch	Position	Description	Option Command
X1	down	CTS Normal	&R0
X2	down	DSR Follows OH	&S1
X3	down	Use HP Defaults	&E0 &E3 &E6 &E10 &E14 SBA1
X4	down	No ENQ/ACK Pacing	&E8

An AT1517 command (that is. ATL5L7) should have the following output:

```
B0 E1 M1 Q0 V1 X0 &E0 &E3 &E6 &E8 &E10 &E14 &Q0
$MB2400 $SB2400 $BA1 &W1

&A0 $A0 &B0 &BS1 &C1 &D2 $D0 $F1 &G0 &I0 &M0 $MI0 &R0 $R0 &S1 &T5
&V1 &W1

OK
```

HP 50759B (Support Link)

The HP 50759B modem has one bank of 16 switches (S switches). For both HP-UX and MPE/iX:

```
S2, S3, S4, S7, S8, S9, S12, S16: Down
All others: Up
```

HP 37212B Modem

Supported modes:

- Bell
- CCITT_OM
- CCITT_AM
- CCITT_BIS_OM
- CCITT_BIS_AM

Supported cables:

- HP 92219Q - Bell, CCITT_OM, CCITT_AM
- A1703-64006 - CCITT_BIS_OM, CCITT_BIS_AM

Auto-dial modes: None

It is best to use this modem in CCITT mode because it causes the Access Port to hang up if used in Bell mode at 1200 baud. It can be used in Bell mode at 2400 baud, or either 1200 or 2400 in CCITT mode. This modem can not be dialed with either Hayes or V.25BIS auto-dial protocols.

Settings

Configuration switches on the HP 37212B are on the rear of the modem. See Figure 4-6.

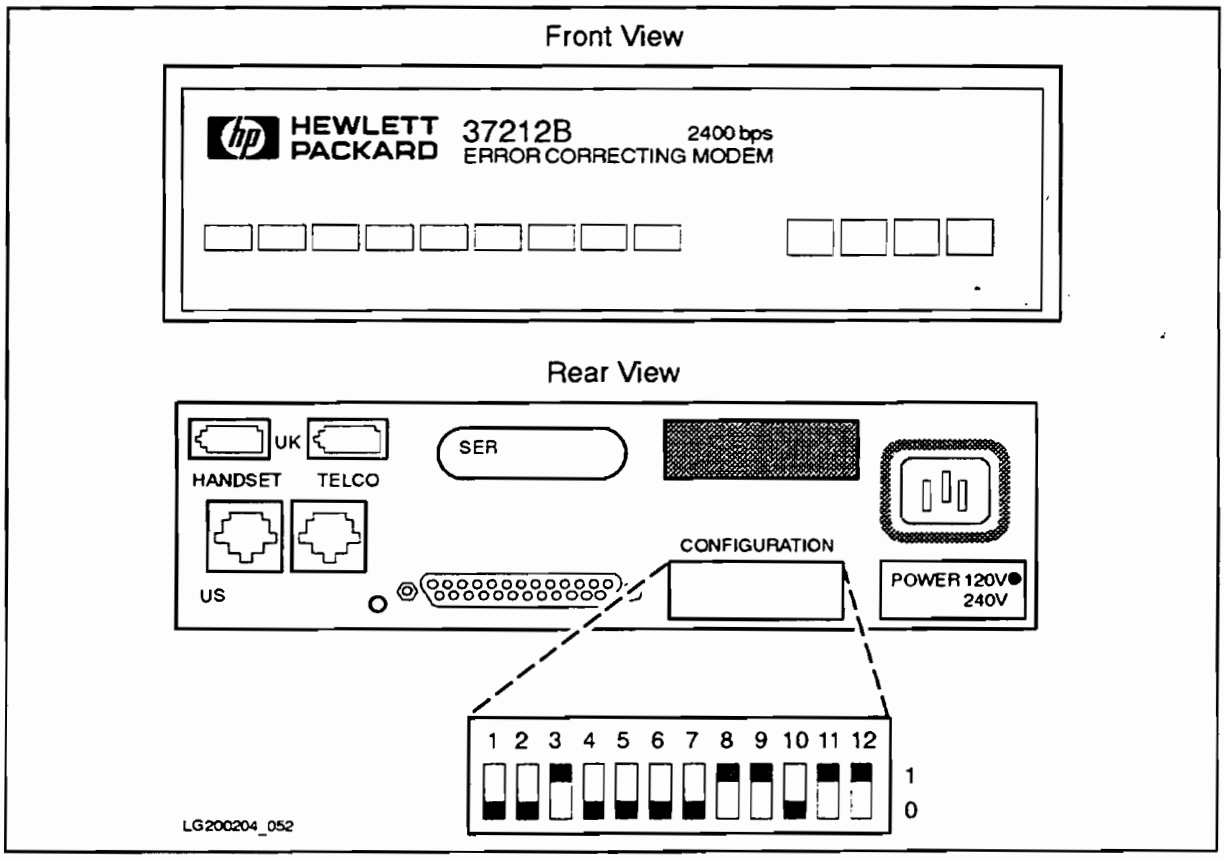


Figure 4-6. Configuration Switches on the HP 37212B Modem

Configure the modem by setting these switches to either of two positions: UP (1) or DOWN (0).

Table 4-21. Settings for the HP 37212B Configuration Switches

Switch	Position	Name
S1	down	Computer mode
S2	down	operation (HP
S3	up	command set)
S4	down	Primary channel
S5	down	1 start, 8 data and 1 stop
S6	down	
S7	down	Error correction disabled
S8	up	No Flow control
S9	up	
S10	down	DSR/CTS/CD to RS-232-C definition
S11	up	
S12	up	DTR behaves to RS-232-C definition

Note

Although this modem claims to be able to dial using V.25bis, it only uses the V.25bis line discipline. The command set does not match the set specified in the V.25bis specification.

Hayes Smartmodem 2400

Supported modes:

- Bell
- CCITT_OM
- CCITT_AM

Supported cables:

- Must use 92219Q modem cable.

Auto-dial modes: Hayes.

This modem drives circuit 111 (Pin 23) instead of using it as an input. With either cable (92219Q or A1703-63006) the same line is driven by the Console/LAN card and the modem.

Caution

This modem should not be used because all HP cables connect circuit 111 to the modem. If this modem is connected, circuit 111 will be driven by both the Console/LAN card and the modem. In the past, this modem was used with the CIO-based AP card and encountered the same problem.

Turn off all data compression modes.

Settings

The Hayes defaults for the modem lines must be changed to the following:

Table 4-22. Switch Option Settings

Switch	Position	Description	Option Command
S1	up	DTR normal	AT&D3&W
S2	xx		
S3	down	Result codes disabled	ATQ1&W
S4	up	Characters echoed	ATE1&W
S5	up	Auto-Answer enabled	ATS0=1&W
S6	up	Detect Carrier	AT&C1&S1&W
S7	up	RJ-11	AT&J0&W
S9	down	CCITT	ATB0&W
S10	down	Return to command state	AT&D3&W

Note

xx means "do not care."

Black Box V.32 Plus (Version 2.01.01)

Supported modes:

- Bell
- CCITT_OM
- CCITT_AM

Supported cables:

- Must use 92219Q modem cable.

Auto-dial modes: Hayes.

This modem does not work with v.22bis because it does not supply 112 and because the sense of 111 is backwards (TRUE means low speed. FALSE means high speed). The problem that 111 is backwards can be remedied by configuring the modem to ignore 111. Change so that DTE Fallback is *Disabled*. This is the factory default. Not supplying 112 means that the Console/LAN card always thinks it is running at the lower speed. If you set the speed for twice the desired speed, then it will work at the desired speed. It is best not to use this modem with any of the CCITT bis protocols.

Settings

The Black Box defaults for all of the modem lines are incorrect and must be changed before this modem will work properly. To do this from the front panel, go into the Change DTE Parameters and set the following:

Responds to DTR
DSR is Normal
DCD is Normal
CTS follows RTS

This can be done with the following AT command: `AT&D2&S1&C1&R`

For Hayes dialing, make certain that the AT command set is enabled. It is normally good to disable status messages to the host by using the `ATQ1` command.

The current configuration can become the power-on configuration by using the `AT&W` command.

This modem does not do any rate shifting. So the DTE rate and the DCE rate must be the same.

This modem seems to work in AP mode with the protocol set to either Bell or CCITT. It does not work with the modem protocol set to CCITT_BIS. Make certain to configure the modem to ignore 111, or configure the Access Port to set FS low. It also seems to work fine in normal mode (i.e. under host control).

Multitech MT224EH7

Supported modes:

- Bell
- CCITT_OM
- CCITT_AM
- CCITT_BIS_OM
- CCITT_BIS_AM

Supported cables:

- HP 92219Q - Bell, CCITT_OM, CCITT_AM
- A1703-64006 - CCITT_BIS_OM, CCITT_BIS_AM

Auto-dial modes: Hayes, V.25bis.

Note

The version of the modem has a problem when dialing with V.25bis: if the number that is dialed is busy, DSR does not drop. This same problem causes V.25bis error indications to be improperly decoded, meaning that the modem time-out timer must expire before we know that the attempt failed. This also means that multiple dialing attempt always fails. If the DSR jumper is set so that DSR follows DCD, this problem goes away.

Settings

The configuration of the hardware switches on the modem are:

8-position DIP-Switch ("S" switches):

```
Switch:   1    2    3    4    5    6     7    8
-------------------------------------------------
         UP   UP  DOWN   UP   UP   UP   DOWN  DOWN
```

4-position DIP-Switch ("X" switches):

```
Switch:   1    2    3    4
-----------------------------
        DOWN  UP   UP  DOWN
```

For Hayes mode to work correctly, **AT&R0** must be set so that it drops CTS when the connection goes down. For Hayes, **AT$V0** must be set. For V.25bis dialing, **VT$V1** and **AT$BA1** must be set.

Hayes dialing parameters:

```
B0 E1 M1 Q0 R0 V1 X0 &E1 &E4 &E6 &E8 &E10 &E13 &E15
$MB2400 $SB2400 $BA1 &W0

S0   S2   S3   S4   S5   S6   S7   S8   S9   S10  S11  S12  S24  S25  S30
001  043  013  010  008  002  030  002  006  007  070  050  020  000  000

$A0 &A0 &B0 &BS1 &C1 $D0 &D2 #DB0 $EB0 $F1 &G0 #L0 $MI0 &M0
&P0 #P2 &Q0 &Q3 $R0 &R1 &S1 $T1 &T4 $V0 $VD0 &X0 Y0
$MB2400 $SB2400 $BA1 &W0
```

```
OK
```

For V.22bis auto-answer, internal jumper DSR must be set so that DSR follows OH. The factory default is for DSR to follow CD. This is different from the Support Link where the factory default was for DSR to follow OH. There does not seem to be an AT command that does this.

V.25bis dialing parameters:

```
B0 E1 M1 Q0 R0 V1 X0 &E1 &E4 &E6 &E8 &E10 &E13 &E15
$MB2400 $SB2400 $BA1 &W0

S0   S2   S3   S4   S5   S6   S7   S8   S9   S10  S11  S12  S24  S25  S30
001  043  013  010  008  002  030  002  006  007  070  050  020  000  000

$A0 &A0 &B0 &BS1 &C1 $D0 &D2 #DB0 $EB0 $F1 &G0 #L0 $MI0 &M0
&P0 #P2 &Q0 &Q3 $R0 &R1 &S1 $T1 &T4 $V1 $VD0 &X0 Y0
$MB2400 $SB2400 $BA1 &W0
VAL
```

To modify a MT224E7B:

- Open modem and change the DSR jumper.
- Set switches on the bottom of the box to above.
- Send AT&R0
- For Hayes dialing, send **AT$V0**.
- For V.25bis dialing, send **AT$V1**.

Modem Cable Pin-out

The following pin-out is for the 92219Q cable. the cable recommended for connecting the remote support modem to the Console/LAN card.

Table 4-23. Pin-out for 92219Q Cable

Computer End	Signal	Modem End
2	TD	3
3	RD	2
8	RTS	4
22	CTS	5
20	DSR	6
6	DTR	20
9	RI	22
4.5	DCD	8
23	FS	23
7	GROUND	7

For the A1703-63006 cable, the pinout is the same except that pin 9 on the computer end is routed to pin 12 on the modem end and that line functions as Rate Select (RS). This cable is used with V.22bis/V.25bis applications.

Console/LAN Card-Modem Line Behavior

CCITT Mode AP protocol 0

This protocol is known as HP-UX CCITT. The card waits for RI before raising DTR. It also raises RTS when it raises DTR. If DSR does not come up within 25 seconds, DTR goes back down. The connection also depends on CTS and DCD. DCD can drop for up to 400ms before the connection will drop. CTS must stay high always. Once CTS drops, the connection starts to drop. A new connection cannot occur until DSR, DCD and CTS all drop. FS can be programmed to either state via the `CA` command.

Bell Mode AP protocol 1

This is sometimes called Bell simple protocol. It raises DTR when it can accept a connection. The connection is valid when it sees DCD. It drives RTS whatever it was when Remote is enabled (usually, RTS is low) and does not look at DSR or CTS. When a disconnect is done, DCD must drop before a new connection can be made (i.e. it will not raise DTR until DCD drops).

CCITT_BIS Mode AP protocol 2

This protocol is CCITT V.22bis. It requires the special cable A1703-63006 which is just like the 92219Q cable with the exception that pin 9 on the computer end is routed to pin 12 (RS) rather than pin 22 (RI). DTR is raised whenever a connection is allowed. RTS follows DSR. A connection is established when DSR is high. CTS can drop for an indefinite amount of time without dropping the connection. The card will not send data to the modem when CTS is low. DCD can drop for up to 400ms before the connection is dropped. Once the connection is dropped, DSR, DCD and CTS must all go low before a new connection can be made. RS controls what speed the card sends to the modem. If RS is high, the programmed baud rate is used. If RS is low, half of the programmed baud rate is used. If you use the 92219Q cable, the baud rate will most certainly be half the programmed baud rate, since RI will almost always be down. FS can be programmed to either state via the `CA` command.

5

Troubleshooting

This chapter describes how to troubleshoot the 99x/890/T500.

Chapter Contents:

This chapter covers:

- General Troubleshooting.
  - Major Phases of System Startup.
  - Troubleshooting Strategy.
  - SPU Conditions: Messages and Indicator States.
  - Minimum System Configuration.
  - Troubleshooting the OpenView Console.
  - Recovering from Failures on the 890/T500.
  - Recovering from Failures on the 99x.
- Console Messages and Codes.
  - Chassis Codes.
  - Access Port (AP) Messages.
  - Interpreting SP Prompts.
  - Reading the Service Processor (SP) Log.
- Indicators.
  - Indicators and Switches on the Front Panel.
  - Service Processor (SP) Indicators.
  - SP Indicator Grid.
  - PSCM Hex Digit Display ("Power").
  - LEDs on PMB and HP-PB Cards.
  - Power Module LEDs.
  - Expansion Cabinet Indicators.
- Decoding HPMCs (Tombstones)
  - HPMC Concepts.
  - HPMCs on the x9x Family.
  - Sample Tombstone.
  - Cookbook for Decoding HPMCs.
  - HPMC Examples.
  - Using MEMDIAG to Decode Memory Addresses.

General Troubleshooting

The first part of this chapter covers troubleshooting the system as a whole:

- Major Phases of System Startup.
- Troubleshooting Strategy.
- SPU Conditions: Messages and Indicator States.
- Minimum System Configuration.
- Troubleshooting the OpenView Console.
- Recovering from Failures on the 890/T500.
- Recovering from Failures on the 99x.

Major Phases of System Startup

Table 5-1 shows the major phases of system startup and the displays that indicate normal completion of each phase.

For more details, see the following sections in this chapter.

Table 5-1. Indicator States During Startup Phases

Phase	Indications that the Phase Completed[1]
1. Power On	■ "Line" and "SP Power" LEDs on front panel are ON. ■ Fans in rear of cabinet turn ON.
2. SP/PSCM Selftests; PMB Initialization	■ Console displays message: "Service Processor: Finished initialization." ■ "Processor" front panel indicator no longer displays SP selftest numbers (for example 1 to 51). ■ Indicator grid on the SP card shows: □ "ST" is OFF. □ "CK" flashes ON and OFF at one second intervals. ■ Fans in front of cabinet turn ON.
3. PDC-based Selftest	Console shows initial PDC display and boot message.
4. IPL Boot Attempt	Hex code = CE00 (console banner)
5. ISL Boot Attempt	ISL message
6. OS Boot Attempt	Login message
7. OS Run Time	■ System prompt. ■ Green front panel LED is solid ON (not flashing).
8. OS Shutdown	Console displays OS messages. Red front panel LED is ON.

1 For messages to display on the console terminal, the console keyswitch on the front panel must be in the unlocked position

System Indicators

Figure 5-1 shows the relationship of the system indicators to the power system and to the Service Processor.

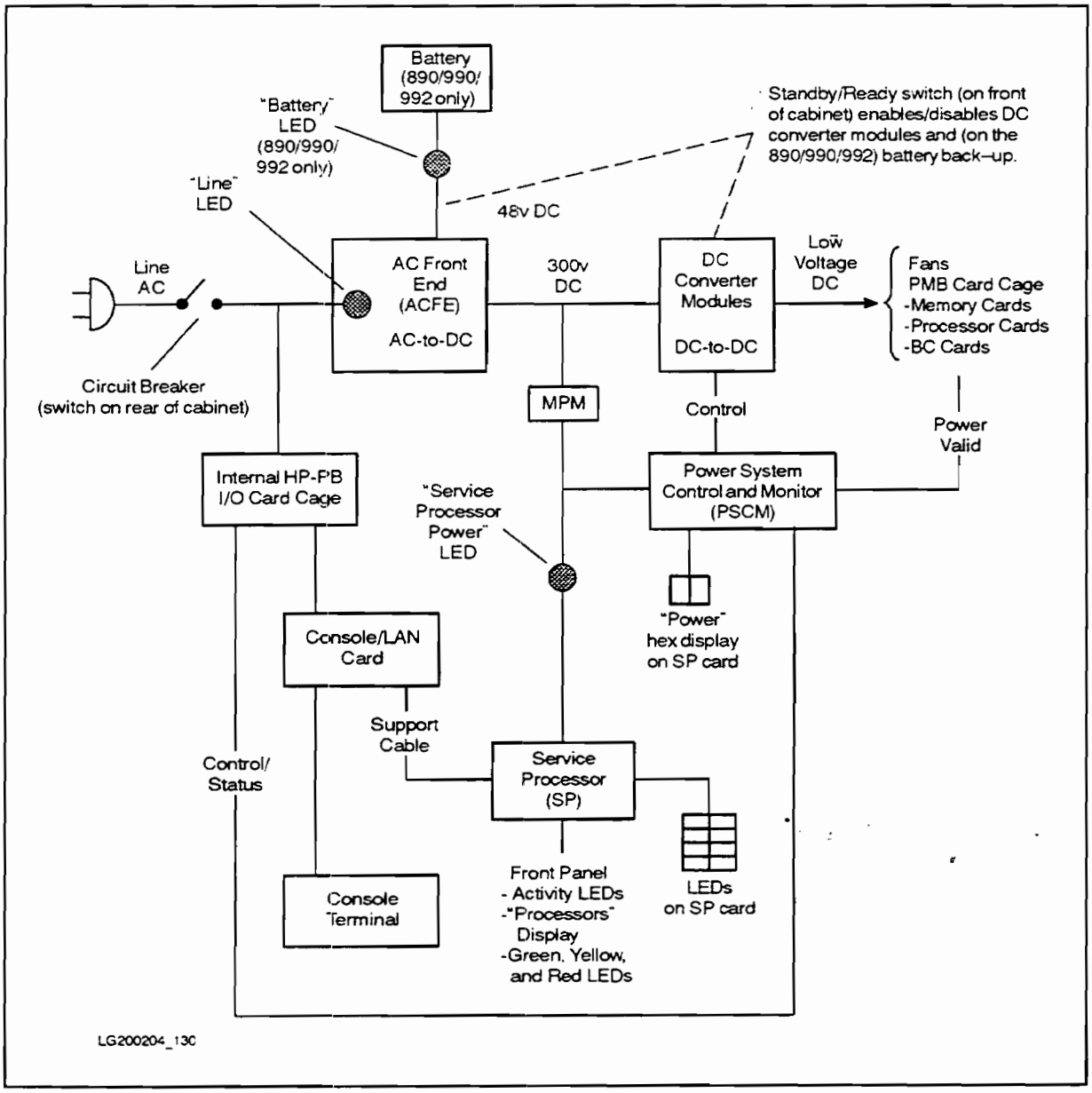


Figure 5-1. System Indicators and the Power System/SP

SP/PSCM Start Up

Table 5-2 covers the beginning phases of system initialization.

Table 5-2. SP/PSCM/Console-LAN Card Start-Up

Phase	Description	Indicators[1]
1. Power On (several seconds)	No PSCM or SP logic is alive. No user access to SP prompt.	■ No lights on SP. ■ Green "Run" LED on front panel is OFF. ■ No message on console. ■ Fans in rear of cabinet turn ON.
2.SP/PSCM/ Console-LAN Card Initial Selftests (~ 1.5 min)	SP, PSCM, and Console/LAN card run their selftests in parallel. No user access to SP prompt. If SP fails its selftest: ■ For selftest failures past ST 5, the bottom line of the console displays the selftest error number (SP Version 1.6 and above.) On SP Version 1.5x and below for most ST failures, the console displays the failing ST number plus 100. ■ Red front panel LED ON indicates the test detected the failure (except for SP bus tests). ■ Yellow front panel LED should go ON 2 minutes later. ■ Failing selftest # displayed on "Processors" display, on Activity LEDs, and on bulkhead of SP card. ■ PSCM firmware is never downloaded. If PSCM fails its selftest, SP error log contains a critical entry. The number of failing PSCM selftest appears on hex display on SP bulkhead. If the Console/LAN card or connection is non-functional, nothing appears on the console. The system can continue to boot, however in two cases: ■ If the autoboot and autostart flags are set. ■ If the autoboot flag is set and there is no configuration change this boot.	■ "Service Processor Power" LED on front panel is ON. ■ Bottom line of console display shows # of SP selftest currently executing (SP Version 1.6 and above). ■ "Power" hex display on SP bulkhead shows # of the PSCM selftest currently executing (00, 01, 02, etc.). ■ Green front panel "Run" LED flashes ON as each SP selftest section executes and OFF between sections. ■ "Processors" and "Activities" displays on front panel show number of SP selftest currently executing. ■ Amber LED on Console/LAN card goes ON. After the card passes its selftest (about 10 seconds), the LED goes OFF. ■ After Console/LAN card completes its selftest, console displays a message: "Connecting to Service Processor."
3. PSCM Final Selftests (< 30 sec)	After both SP and PSCM execute the initial sections of their selftests, the SP downloads firmware to the PSCM. PSCM then executes the final portion of its selftests. Selftest errors are reported as in previous step.	■ PSCM hex display on SP bulkhead shows "18" while waiting for SP to download its firmware. Display shows "D1" while firmware is being downloaded.

1 For messages to display on the console terminal, the console keyswitch on the front panel must be in the unlocked position

SP/PSCM/Console-LAN Card Start-Up (Continued)

Phase	Description	Indicators[1]
4. SP User Interaction (time depends on user)	User can enter commands at "(SPU Power Control) SP>" prompt if PMB power is not enabled (if Standby/Ready switch on front panel is in "Standby" position, or if the DN SP command has been executed).	If PMB power is not enabled, console displays "(SPU Power Control) SP>" prompt.
5. PMB Initialization (~ 20 sec)	PMB power is turned on. SP runs the final sections of its selftests (sections 37 to 51). Selftest failures are reported as in phases 2 and 3. SP checks which PMB cards are present and compares it with the previous configuration. The SP also checks for scheduled configuration changes made with the HC command (SP). If configuration has not changed, SP allows the user 10 seconds to interrupt the boot process then continues boot. If configuration has changed, SP notifies user with messages on console. If autostart flag is set, the SP allows user 10 seconds to interrupt the boot process; after 10 seconds, the SP continues boot. If autostart flag is not set, the SP waits for user input.	■ After selftests are completed, indicator grid on the SP card shows: □ "ST" is OFF. □ "CK" flashes ON and OFF at one second intervals. ■ After selftests are completed, fans in front of cabinet turn ON. ■ Console messages about changes to PMB configuration. ■ Console message to press any key within 10 seconds to cancel boot. ■ If user interaction is chosen, console displays "(SPU Configuration) SP>" prompt. ■ If faults occur, console displays "(Fault) SP>" prompt. ■ Console message: "Service Processor: Finished initialization. Starting PDC boot process ... ". This message signals that the phase has successfully completed and that the processors have been started.
6. PDC Selftests (~ 7 min or more depending on amount of memory)	Processors begin running. PDC selftests verify sufficient functionality to ensure that the OS can be loaded. After selftests complete, the user can access the PDC interface and enter PDC commands. If the PDC autoboot flag is set, PDC allows the user 10 seconds to interrupt the boot process before proceeding. If defective processors are detected, PDC marks them for de-configuration. SP then reboots the SPU. If defective memory banks are detected, PDC de-allocates the memory and continues the boot if the autostart flag is set. If the autostart flag is not set, PDC does not continue the boot.	■ PDC displays progress messages on the console using the close console path (CCP). ■ After selftests complete, console shows initial PDC display and boot prompts.

1 For messages to display on the console terminal, the console keyswitch on the front panel must be in the unlocked position

Power System Timeline (Power-On)

This section describes in more detail the behavior of the power system during a normal "Power-On" phase.

TIME	INDICATIONS
0:00	1. Operator switches on AC power (rear circuit breaker). 2. Yellow "Warning" indicator and internal fan on PFC unit turn on. 3. Green "Line" indicator on Control Panel is on.
0:12	1. HVDC from PFC unit comes up. Green "On" LED on PFC is fully ON, and yellow "Warning" LED on PFC is flashing (indicating input commands not yet received from PSCM). 2. System fans start at low speed. 3. Power Converter's yellow "Off" indicators turn on. (MPM shows red "Fault" momentarily). 4. 24V fan power converter still has all LEDs off (even though output is up). 5. SCSI card green LED turns on. (Console/LAN card yellow LED turns ON for about 10 seconds, then turns OFF.) 6. Control Panel has green "Service Processor Power" indicator on. 7. SP indicators come on with start-up sequence of codes, showing SP selftest currently being executed. Selftest codes are also displayed on "Processors" display on front panel. 8. PSCM begins short self-test code sequence 00, 01, 02, 03, and so on.
0:27	PSCM shows code "18" (waiting for SP to download the firmware).
1:27	PSCM shows code "D1" (start downloading firmware) if the SP successfully completes its selftest.
1:43	PSCM main selftest (stops on error).
1:44	1. Power system turns on (Standby/Ready switch in "Ready" position: the DN SP command has not been executed.) 2. PFC unit yellow "Warning" goes off (or fully on with deeply discharged battery). 3. Green "On" indicators of all Power Converters come on. 4. Fan speed is full (audible noise increase) 5. PON asserted to PMB (PFW-deasserted). System startup initiated. 6. PSCM shows flashing 00 status code (if no errors).

Battery Back-up Timeline (AC Is Lost)

This section describes the behavior of the power system when AC is lost and battery back-up is activated. (**Applies only to 890/990/992 systems without a UPS.**)

1. AC power is lost (for example, operator switches rear circuit breaker to "Off" position).
2. PFC unit shows flashing green "On" indicator.
3. +5P and +5S power converters are turned off by PSCM and show yellow "Off" indicators.
4. MPM shows one green indicator and one yellow indicator.
5. 24V power converter and +5B power converters show green "On."
6. Fan speed is reduced, four fans are shut down, and audible noise decreases.
7. Control Panel "Line" LED goes off and "Battery" LED turn on.
8. "Service Processor Power" LED remains "On."

After SP Selftest

Table 5-3 and Table 5-4 show the normal states of the SPU indicators and switches after the SP selftest has executed.

Front panel summary:

- RUN should be flashing or ON.
- LINE and SP POWER should be ON.
- ATTENTION and REMOTE ENABLED may be ON or OFF.

Table 5-3. Normal State of the Front Panel Indicators and Switches

Indicator/ Switch	Normal State
Front "Standby-Ready" switch	"Ready" position.
Run (green LED)	ON for normal OS system activity. Flashing for non-OS system initialization activity.
Attention (yellow LED)	OFF. (Will be ON if there is a critical unread message in the SP log.)
Stopped red LED)	OFF. (Could be ON if user input is required.)
Processors	"01" or greater. (Shows the number of processors which are configured and have passed PDC selftest).
Activity	0 to 10 LEDs lit. (See Table 5-15.)
Line	ON.
Battery (890/990/992 only)	(890/990/992) OFF. On rare occasions, this LED may be ON, indicating that the battery is charging/discharging. (In this case, the battery is charging if the "Line" LED is ON; the battery is discharging if the "Line" LED is OFF.)
SP Power	ON.
Remote Enabled	ON or OFF. For maximum security, this should be OFF.
Console Keyswitch	Locked or unlocked. For maximum security, this should be locked unless needed. The keyswitch should be unlocked: ■ While performing installation tasks. ■ To get to any SP messages. ■ During boot, especially if the autostart flag (AF at SP prompt) is not set.

Table 5-4.
Normal States of Indicators Inside the SPU Cardcage (After Passing Selftests)

Indicators	State
Indicator grid at top of SP card bulkhead	ST not lit: CK flashes ON and OFF at one second intervals. For other SP indicators. see Table 5-17.
Hexadecimal digit display labeld "Power" at bottom of SP card bulkhead (PSCM codes).	Flashing hex codes. "Selftest" indicator is OFF. If the yellow ATTENTION LED on the front panel is lit and this display flashes anything other than double zeros, check the SP error log (described later in this chapter).
LEDs on power modules and AC Front End (ACFE)	Green "ON" LEDs are lit (after SP turns on main DC power).
LEDs on Bus Converter (BC) cards in both the PMB and HP-PB cardcages.	Green "CONNECTED" LEDs are lit.
LEDs on HP-PB cards	Should indicate that the card passed selftest.

Troubleshooting Strategy

Table 5-5 is a system troubleshooting guide for the 99x/890/T500 hardware. The table summarizes the sequence of events from system power-on to a running OS, showing symptoms of possible error states and the recommended action for recovery. If a procedure recommends that more than on part be replaced, replace the parts one at a time in the recommended order and test to see if the problem is solved.

Table 5-5. System Troubleshooting Guide

Phase	Symptom	Suggested Action
1. **DC POWER ON**		
a. **Computer does not seem to power up.**	Possible symptoms: ■ "Line" or "SP Power" LEDs may be OFF. ■ "Battery" LED may be ON. ■ "STOPPED" LED may be ON. ■ Fans in rear of cabinet may be OFF.	Check LEDs on the front panel: **Line**: If this LED is OFF, AC is not being supplied to the computer. Make sure that the AC circuit breaker switch on the lower rear of the cabinet is turned on. Make sure the unit is plugged in. Check to see if a circuit breaker has tripped or if there is a problem with power at the site. Also check for a faulty AC-to-DC power module (PFC unit) by seeing if the red fault light on the PFC unit is lit. **SP Power**: If this LED is OFF, the Service Processor (SP) is not receiving power. If the "Line" LED is ON at the same time, there may be a problem with the power system or the SP. Check LEDs on the MPM module and the DC-to-AC (PFC unit) module. If a module has its red LED lit, replace the module. If the MPM is okay and the SP not, replace the SP. **Battery**: **(Only applies to 890/990/992 systems without UPSs)** If this LED is ON, the battery back-up unit is discharging/recharging. Make sure the "Standby-Ready" switch on the top front of the computer is set to the "Ready" position. Make sure that AC power is being supplied to the computer. **Stopped**: If this LED is ON, make sure the "Standby-Ready" switch on the top front of the computer is set to the "Ready" position. Make sure the console keyswitch on the front panel is in the unlocked position. Check for messages on the system console. Check the SP error logs.

Table 5-5. System Troubleshooting Guide (continued)

Phase	Symptom	Suggested Action
b. **Failure to establish a complete connection to console.**	Possible symptoms: ■ Amber LED on console/LAN card is ON. ■ SP and PDC messages are not displayed on console. ■ Message on console saying that console/LAN card failed selftest.	Check messages on console. If no messages, check to see if SP passed its selftest (the "CK" light in the indicator grid on the SP card should be flashing). If the SP did not pass its selftest, replace it. Check console/LAN card, cable to SP, and connectors. Replace if defective. Make sure console terminal is correctly configured. See Chapter 4 (Configuration).
2. **SP SELFTEST/INIT.**	■ Red "Stopped" LED on front panel is ON for all SP STs except SP bus tests. ■ "Processor" front panel indicator displays an unchanging SP selftest number. ■ (SP Version 1.6 and above): Lowest line of console also displays an unchanging SP selftest number. ■ Top indicator grid on the SP card shows "ST" to be ON. ■ Fans in front of cabinet are OFF. ■ Message on console saying that SP failed selftest.	Decode the SP selftest number shown on the "Processor" indicator on the front panel or on the bottom line of the system console. See Table 5-19. Most likely solution is to replace the SP card. (You can also obtain the SP selftest number if the by adding the numbered squares on the top indicator grid on the SP if the square labeled "ST" is lit.)
3. **PDC-BASED SELFTEST**		
a. CPU Selftests	Hex code = 1*n*00 - 4*n*99	Decode hex code with Table 5-10. In most cases, replace processor *n* where *n* + 8 = processor slot number.
b. PMBI Selftests	Hex code = 5*n*01 - 5*n*0F	Try replacing processor *n* where *n* + 8 = processor slot number.
c. Memory Selftests	Hex code = 7*n*00 - 7*n*FF	PDC de-allocates the bad bank of memory. Look at the PMB configuration with the HC command (SP) to see which memory bank has been de-allocated and replace the corresponding memory card.)
4. **IPL BOOT ATTEMPT**	Hex code = A008 IODC Error Status message on console	Attempt to boot from another device. Replace I/O card you attempted to boot from. Replace boot device attached to I/O card.

Table 5-5. System Troubleshooting Guide (continued)

Phase	Symptom	Suggested Action
5. **ISL BOOT ATTEMPT**	Hex code = 800x	Change boot path address to match device address.
	Hex code = C5x0	Primary path initialization failed. Reboot from alternate path.
	Hex code = C7xx	Alternate or other path initialization failed. Reboot from primary path.
6. **OS BOOT ATTEMPT**		
7. **OS RUN TIME**		
a. Degraded Performance.	■ Normal run-time indicators. ■ System responds to one or more programs/users. ■ Other programs/users cannot seem to get a response. ■ System seems SLOW ...	See Table 5-7 (HP-UX) or Table 5-9 (MPE/iX).
b. System Hang.	■ The machine is running (the green RUN light is lit), but no one can access the system. ■ The system console may or may not be hung.	See Table 5-7 (HP-UX) or Table 5-9 (MPE/iX).
c. System Interruption.	■ All user activity stops. ■ Red STOPPED LED is lit.	See Table 5-7 (HP-UX) or Table 5-9 (MPE/iX).

SPU Conditions: Messages and Indicator States

Table 5-6 shows the messages and LED indicator states generated by different SPU conditions.

Table 5-6. Messages and Indicator States

Grn	Yel	Red	SPU Status	Hex Code	SPU Condition	Console Message	Last entry in SP log
Bl[1]			Cons/LAN power-up default	Cons/LAN power-up default	SPU is running its selftest. Test #s displayed on SP LEDs and "# Procs" on front panel.	Connecting to SP msg. from AP	Previous state
	De[2]	ON	Cons/LAN default	Cons/LAN default	SP ST detected a failure.	SP selftest failure xxx.	Previous state
	De[2]		Cons/LAN default	Cons/LAN default	SP ST hung due to failure.	SP failed to connect msg.	Previous state
	ON	ON	INIT	Blanked	Stopped for operator action.	(Power) SP > prompt.	Depends on SPU's history.
Bl[1]			INIT	Blanked	SP starts powerfail recovery.	Msg from SP.	AC off time
Bl[1]			INIT	Blanked	Main DC power on. host not yet running.	Msg from SP.	Depends on SPU's history.
Bl[1]			INIT	Blanked	RS command entered.	Msg from SP.	Failure type
Bl[1]			INIT	Blanked	SP checks configuration, starts clocks. etc.	Msg from SP.	Depends on SPU's history.
			OFF	1xxx-5xxx	Only used during host selftest.	ST forward prog msg.	OFF
ON	ON	ON	ALL	1xxx-5xxx	Only used during host selftest.	ST forward prog msg.	ALL
Bl[1]			TEST	1xxx-5xxx	Host is running early selftest.	ST forward prog msg.	TEST
	ON	ON	FAULT	1xxx-5xxx	Uniprocessor host early ST hung and SP detected timeout.	SP status line msg.	All proc failed
Bl[1]			TEST	1xxx-5xxx	Host is running other parts of ST.	ST forward prog msg.	TEST
		ON	FAULT[3]	1xxx-5xxx	Host ST failed after early ST, processor detects failure.	SP status line msg., ST msg.	FAULT[3]
Bl[1]			INIT	Cxxx	PDC. ISL. ISL utilities, OS starting, OS powerfail recovery	Msg from host S/W.	INIT
Bl[1]			INIT	Cxxx	Stopped at a PDC or ISL prompt for operator input.	Msg from host S/W.	INIT
ON			RUN	FwxF	OS running. no warnings.	Msg from OS.	RUN
ON	ON		WARN	Ewxx	OS running with warnings detected by host.	Msg from OS.	WARN
ON	ON		WARN	FwxF	OS running with warnings detected by SP[4]	SP status line msg.	RUN
		ON	SHUT	Dxxx	OS is shutting down the SPU.	Msg from OS.	SHUT
	ON	ON	FAULT	Various	HPMC.	Msg from host S/W.	FAULT
	ON	ON	FAULT	FwxF	SPU has stopped and SP logged stale system status (SysStat).	SP status line msg.	RUN

1 Bl = Blinking

2 De = Delay = ON 2 minutes after failure

3 Multi-processor: monarch deconfigures bad processor and reboots. Uniprocessor: SP sets the Fault state.

4 Caused by an unread critical log entry. One possible warning: detected processor failure during boot, autostart flag is set. and operator has not read the log.

Minimum System Configuration

One tactic in troubleshooting is to reduce the system to the minimum configuration required to boot the OS. For the 99x/890/T500, the minimum system configuration consists of:

- PMB Cardcage:
  - One processor card.
  - One bus converter (BC) card.
  - One Service Processor (SP) card.
  - 128 MB of memory. (MPE/iX will provide little functionality with 128 MB. For more functionality, use the suggested minimum of 256 MB for the 991/995 or 192 MB for the 990/992.)
- Power modules:
  - One +5V 325W "System" power module.
  - One +5V 325W "Back-Up" power module
  - One +5V 130A (650W) "Processor" power module. (For systems with more than 8 processors, two of these power modules are required.)
  - One +24V "Fan" power module.
  - One Miscellaneous Power Module (MPM).
- HP-PB Cardcage:
  - Lower bus converter (BC) card.
  - Console/LAN card.
  - Appropriate I/O cards for primary and alternate boot devices (for example, SCSI or HP-FL cards).
- Peripherals:
  - System console.
  - Primary boot device.
  - Alternate boot device.

Troubleshooting the OpenView Console

The 99x DX uses a Vectra-based OpenView Workstation as the system console. For information on troubleshooting the OpenView console, refer to the *OpenView Console Manager's Guide* (PN B3118-90002).

Recovering from Failures on the 890/T500

This section summarizes the operator procedures for recovering from HP-UX system interruptions. For more details, see *99x/890/T500 Operator's Guide* (PN A1809-90009). Table 5-7 summarizes the symptoms and recovery procedures for the main types of system interruptions.

Table 5-7. System Interruptions: Symptoms and Solutions (890/T500)

Interruption Type	Symptoms	Recovery Procedure
Performance problem	1. System responds to one or more programs/users. 2. Other programs/users cannot seem to get a response. 3. System seems SLOW ...	1. See if any active processes are making heavy use of computer resources. (For example, a massive compilation or a real time process.) 2. Check another terminal to verify that the problem is not just a console hang. 3. Check for deconfigured processor, memory, or BC modules with the HC command (SP). 4. Check for LPMCs using LOGTOOL. Check for single-bit memory errors using LOGTOOL-Memrpt.
System Hangs	1. The machine is running (the green RUN light is lit). but no one can access the system. 2. The system console may or may not be hung.	1. If possible, wait about 15 minutes to see if the computer is really hung or if it has performance problem. With some performance problems, a computer may not respond to user input for 15 min. or longer. 2. If the computer is really hung, perform a soft reboot on the machine by issuing a "TC" command at the SP prompt. (Do NOT use the "RS" command if possible; "RS" may destroy important troubleshooting information.) 3. Save the core dump file and call the HP Response Center to have it analyzed.
System panic	1. All user activity stops. 2. Core file saved to dump device. 3. Computer attempts to reboot HP-UX. 4. System panic message on console (usually). 5. Red STOPPED LED is lit if reboot fails.	1. If an HPMC tombstone appears on the console, copy or print out the "Machine Check Parameters" fields, as well as all information that follows it. 2. Record system panic message on console. 3. If panic message indicates a peripheral, check the device's cabling, power, address and online status. Record error status on device's display. Cycle power on the device (power off then power on). 4. If panic message indicates an I/O card or internal computer problem, gather troubleshooting information, reboot, and call the HP Response Center: a. Record the sequence of 4-digit codes at bottom of console display (Press Control-B first). b. If yellow "Attention" LED is lit, record the most current entries in the SP error logs (enter the DL command at the SP prompt). 5. If panic message indicates a problem with the file system, LAN, or LVM, consult *Solving HP-UX Problems* or *Error Message Catalog (HP-UX)*. 6. If the system does not reboot by itself, reboot the computer with the TC or RS command at the SP> prompt. (See Table 1-3.)

Table 5-8. System Interruptions: Symptoms and Solutions (890/T500) (cont'd)

Interruption Type	Symptoms	Recovery Procedure
High Priority Machine Checks (HPMCs)	1. All user activity stops. 2. HPMC tombstone displayed on console. 3. May display an HPMC message and stop (HPMC> prompt). 4. May try to reboot and display a system panic message. 5. Red STOPPED LED is lit if reboot fails.	1. If computer does not reboot, record the sequence of 4-digit codes at bottom of console display. (Press Control-B first.) 2. If you are at the HPMC> prompt, record information from the HPMC tombstone for the processor that failed: a. Enter the PDC command TOMB. b. Enter the PDC command DISPLAY *n* (where *n* is the slot # of the processor with the most current HPMC). c. Copy or print out the "Machine Check Parameters" fields, as well as all information that follows it. 3. If there is a system panic message on console, record it. 4. If yellow "Attention" LED is lit, examine the SP error logs with the DL command at the SP prompt. 5. If the system does not reboot by itself, reboot the computer with the TC or RS command at the SP> prompt. (See Table 1-3.)

Note

For further information on HP-UX system panics and memory dumps, refer to:

- Chapter 3 in *99x/890/T500 Operator's Guide* (PN A1809-90009).
- *Solving HP-UX Problems* (PN B1862-90010).
- *Error Message Catalog (HP-UX)* (PN B1862-90004). In particular, refer to Chapter 3 (Error Messages Containing the Word "Panic").

Recovering from Failures on the 99x

This section summarizes the operator procedures for recovering from MPE/iX system interruptions on the 99x. For more details, see *99x/890/T500 Operator's Guide* (PN A1809-90009).

Note This section assumes that AUTORESTART/iX is not installed or enabled. Users of that product should refer to the AUTORESTART/iX User's Guide Part Number 36375-90001.

Although the specific recovery procedures are different for the different types of system interruptions, the basic steps are:

1. Record troubleshooting data. For example:
   a. Four-digit error/status codes on the bottom of the console display (after pressing Control-B).
   b. Error messages from the console (HPMC tombstone in the case of an HPMC).
   c. The status of the indicators on the front panel of the computer.
   d. If yellow "Attention" LED is lit, examine the SP error logs with the DL command at the SP prompt.
2. Perform a Transfer of Control (TC) if possible.
3. If the Transfer of Control is successful, take a memory dump.

Table 5-9 summarizes the symptoms and recovery procedures for the different types of system interruptions.

Table 5-9. System Interruptions: Symptoms and Solutions (99x)

Interruption Type	Symptoms	Recovery Procedure
Performance problem	1. System responds to one or more programs/users. 2. Other programs/users cannot seem to get a response. 3. System seems SLOW ...	1. See if any active processes are making heavy use of computer resources. (For example, a massive compilation or a real time process.) 2. Check another terminal to verify that the problem is not just a console hang. 3. Check for deconfigured processor, memory, or BC modules with the HC command (SP). 4. Check for LPMCs using LOGTOOL. Check for single-bit memory errors using LOGTOOL-Memrpt. 5. Other possibilities: software throttling value wrong (99x only), floating point failure.
System abort	1. System halts ("System Halt 7" message). 2. All user activity stops. 3. System abort message on console (usually). 4. Red STOPPED LED is lit. 5. Sequence of 4-digit codes at bottom of console display. (Press Control-B first.)	1. Record entire system abort message on console. 2. Record the sequence of 4-digit codes at bottom of console display. (Press Control-B first.) 3. If yellow "Attention" LED is lit, examine the SP error logs with the DL command at the SP prompt. 4. Take a memory dump. 5. Restart the system when dump is finished.
Monitor halt	1. System halts 2. All user activity stops. 3. No message on console (usually). 4. Red STOPPED LED is lit. 5. Sequence of 4-digit codes at bottom of console display. (Press Control-B first.) One of the codes is Bx00.	1. Record error message on console if one appears. 2. Record the sequence of 4-digit codes at bottom of console display. (Press Control-B first.) 3. If yellow "Attention" LED is lit, examine the SP error logs with the DL command at the SP prompt. 4. Take a memory dump. 5. Restart the system when dump is finished.
High Priority Machine Check (HPMC)	1. System halts. 2. All user activity stops. 3. HPMC error message on console. 4. Red STOPPED LED is lit.	1. Record the sequence of 4-digit codes at bottom of console display. (Press Control-B first.) 2. Record information from the HPMC tombstone for the processor that failed: a. Enter the PDC command TOMB, b. Enter the PDC command DISPLAY *n* (where *n* is the slot # of the processor). c. Copy or print out the "Machine Check Parameters" fields, as well as all information that follows it. 3. If yellow "Attention" LED is lit, examine the SP error logs with the DL command at the SP prompt. 4. Take a memory dump. (If the computer did not respond to TC and you had to perform an RS hard boot, do not bother to take a memory dump.)
Hardware Failure	1. The 4-digit code on the system console does not begin with an "F." (Press Control-B first.) 2. Red STOPPED LED is lit. 3. Symptoms do not indicate a system abort, monitor halt, or HPMC.	1. Copy down the states of the status lights on the computer front panel. 2. Record the sequence of 4-digit codes at bottom of console display. (Press Control-B first.) 3. Call the Response Center (HW Assistance).
System Hang	1. The machine is running (the green RUN light is lit), but no one can access the system. 2. The system console may or may not be hung. 3. The Control-A ("=" prompt) may or may not be functioning. 4. The hex display typically displays one of two possible states: a. F0FF/FFFF (the hex display alternates between F0FF and FFFF). b. FAFF/FFFF (the hex display alternates between FAFF and FFFF).	1. Halt the machine by issuing a "TC" command. (Do NOT do a "=SHUTDOWN" command first. Do NOT use the "RS" command. Either of these commands may destroy important troubleshooting information.) 2. If yellow "Attention" LED is lit, examine the SP error logs with the DL command at the SP prompt. 3. Take a memory dump. 4. Restart the system as soon as the dump is finished.

Taking a Memory Dump (99x)

As part of the recovery procedure for MPE/iX, you may need to perform a memory dump. For a more detailed description, see *99x/890/T500 Operator's Guide* (PN A1809-90009).

To perform a memory dump:

1. Do a Transfer of Control (TC):
   a. Type CTRL-B to get to `CM >` prompt on console.
   b. 99x systems only: Type `SP` to get to `SP >` prompt.
   c. Type "TC" and hit RETURN key.
   d. If Autoboot is enabled, hit any key to interrupt it.
2. Boot from Primary Boot Path:
   a. Type "yes" to the "Interact with IPL" prompt.
3. Perform a memory dump:
   a. Mount the appropriate media on the ALTPATH tape drive and put the drive online. For example, a DDS or a known good 2400' reel of tape (with a write ring)
   b. At `ISL >` prompt, type "DUMP" command.
   c. Enter appropriate site and problem data at "Enter Dump Name" prompt.
4. Restart the operating system:
   a. At "ISL >" prompt, type "START" or "START NORECOVERY" as desired.
   b. Resume normal system processing.

   If you are reluctant to let users on the system until the Response Center engineer approves further processing, call the Response Center. Report your concern to the Response Center coordinator and request a Priority One code.
5. Process the memory dump:
   a. Mount the first dump tape on the tape drive.
   b. Log on as MGR.TELESUP.DAT.
   c. Type "DAT" to initiate the Dump Analysis Tool (DAT) program.
   d. Type "GETDUMP xxxxx" at the DAT program prompt (where xxxx is the 5 character dump identifier name.
   e. Reply to the tape I/O request at the system console.
   f. When all tapes are read in, EXIT the DAT utility.
6. Call the Response Center and report the problem.

Console Messages and Codes

This part of the chapter tells how to interpret messages and codes that appear on the system console:

- Chassis Codes.
- Access Port (AP) Messages
- Interpreting SP Prompts.
- Reading the Service Processor (SP) Log.

Chassis Codes

Chassis codes (hex codes, error/activity codes) consist of four hexadecimal digits. The chassis codes appear on the next-to-bottom line on the system console (after the operator has pressed Control-B).

You can use chassis codes:

- To monitor the progress of the system as it passes through initialization and boot-up.
- To troubleshoot hardware errors encountered during PDC selftest and system initialization.
- To verify system activity while the OS is running.
- To troubleshoot some HPMCs.

During each stage of PDC selftest and system initialization, a chassis code is displayed. If the stage completes successfully, a new chassis code is displayed. If the system halts, the chassis code shows the selftest or other operation that was being performed when the system halted.

After the PDC selftest, the IPL boot routine and ISL program execute. The IPL boot routine initializes the console and boot device paths and boots the IPL program into main memory offline. The purpose of the ISL program is to load the operating system. (It can also launch standalone processor, memory, and bus converter diagnostics)

If the system halts following an HPMC, a chassis code may be displayed.

When the OS is executing, chassis codes indicate system activity. HP-UX systems indicate system activity by displaying the hex number:

```
F       U         N       F

where
     "F"  is always displayed in the first and last digits.
      U   is the exact number of processes in the run queue.
      N = number of processors configured by HP-UX.
```

MPE/iX systems indicate system activity by flashing the hex number between FFFF and:

```
F       U         F       F

where
     "F"  is always displayed in the first, third, and fourth digits.
      U   is a hex number from 0 to A, representing the % of CPU utilized
          (U times 10 = % utilization of CPU).
```

Format of Chassis Codes

Chassis codes consist of four hexadecimal digits:

```
SLOT #: for non-processor errors,
indicates the PMB slot of the card involved.

PROCESSOR #: for processor errors,
indicates the processor involved.
                                        890/990/992
   On the 890/990/992:              Slot  Proc      Slot Proc
   Processor # plus 8 equals         15 =  7         11 = 3
   the PMB slot #.                   14 =  6         10 = 2
                                     13 =  5          9 = 1
                                     12 =  4          8 = 0

                                        T500/991/995
   On the T500/991/995:             Slot  Proc      Slot Proc
   Decode processor # with the       15 =  E,F       11 = 6,7
   table on the right.  Note that    14 =  C,D       10 = 4,5
   two processors can be located     13 =  A,B        9 = 2,3
   on the same processor card.       12 =  8,9        8 = 0,1

   SLOT # or PROCESSOR #
           |
           v

 D0        D1        D2        D3

  ^                  ^         ^
  |                  |         |
  |                  +--------------"MINOR CODE": gives more specific
"MAJOR CODE": indicates the            information on the error.  For
subsystem or phase in which            memory ST failures, D2 = slot #
the error occurred:                    of memory card and D3 = memory bank #.

1  Early ST (CPU/FP)
2  Early ST (cache/TLB)
3  Proc-Dependent Hardware
4  Late ST (processor)
5  Late ST (PMBI chip on proc)
6  -
7  Memory ST
8  IO device test/initializations (BC)
9  Console initialization (device or path error)
A  Boot device initialization (device or path error)
B  OS panic.
C  System initialization (IPL, ISL errors)
D  OS errors
E  OS warning or HW in degraded mode
F  OS activity code
```

Table 5-10. Chassis Codes (Hex Codes, Error/Activity Codes)

Chassis Code	Description
Early Selftest (CPU/FP)	
1x00-1x3F	Unexpected traps
1x40-1x4F	CPU tests
1x50-1x5F	FPU tests
Early Selftest (Cache/TLB)	
2x10-2x1F	Cache tests and initialization
2x20-2x2f	DCache tests and initialization
2x30-2x3F	TLB tests and initialization
2x40-2x4f	Cache Load errors
Processor Dependent Hardware (PDH)	
3x00-3xFF	PDH tests and initialization (unused)
Late Selftest (Processor)	
4x10-4x1F	TLB tests
4x20-4x2F	CMUX tests
4x30-4x3F	Cache Error tests
4x40-4x4F	Store Buffer tests
4x50-4x5F	Hashing Tests
4x61	DTLB Locked entries
4x71	ITLB Locked entries
Bus Errors and diagnostics	
5x01-5x0F	PMB Interface (PMBI) chip test (PMBI is on processor card)
5x10	Not enough arbitration lines
5x20	PMBI slave address (SADD) error.
5x3F	HPMC due to bus error

Note

The second digit in the hex codes (shown as "x" in the table) refers to the slot number or processor number for the error/activity in question.

For processor-related errors, the "x" refers to the **processor number**. Decode this using the tables on the previous page.

For non-processor errors, the "x" refers to the PMB slot number.

Chassis Codes (Hex Codes, Error/Activity Codes)

Chassis Code	Description
Memory	
7xsb	Memory selftests. (x = processor # of processor doing the testing: s = slot # of memory card: b = memory bank #.)
7xF0	Generic critical memory error.
7xFD	More than eight memory errors.
7xFE	All memory deconfigured.
7xFF	No memory found.
IO Device Codes	
8x00-8xFF	IO Device tests and initialization
Console Initialization Errors	
9x00-9xFF	Console device initialization
Boot Device Initialization Errors	
Ax00-AxFF	Boot device initialization
OS Panic	
Bx00-BxFF	OS panics
System Initialization Codes	
Cx00-CxFF	System initialization
OS Errors	
Dx00-DxFF	OS errors
OS Info/Warnings	
Ex00-ExFF	OS running, hardware in degraded mode. May also indicate an OS warning.
OS Activity	
F000-FFFF	HP-UX displays F*u*nF, where *u* = exact # of processes in run queue. *n* = # of processors configured by HP-UX. MPE-XL flashes two numbers: FFFF and F*u*FF where *u* represents % of CPU utilized (*u* times 10 = % utilization of CPU).

Viewing the Chassis Code and Status Line

To see a line of status information on the console (including the four-digit hex code):

1. Make sure that the Console keyswitch on the computer front panel is in the unlocked position.
2. At the system console, enter Control-B to enter Access Port control mode.
3. Look on the second to the last line of the display for status information. You will see a display like this:

```
TEST     90AA      REMOTE: enabled inactive multiple     ACCESS FAULT: 00
 ^         ^         ^                                      ^
 |         |         |                                      |
 |      Chassis     Status of remote console:              - # of password
 |       code        * Current security level (enabled,      faults made while
 |                       disabled, pending, locked)          trying to access
System status          * Current activity (active, inactive)  system remotely
(sysstat).             * Current access mode (single, multiple)
Possible states:
OFF, TEST, INIT, WARN,
SHUT, RUN, FAULT, ALL
(ALL = all lights ON
to test indicators).
```

4. On the bottom line of the display, you may see a message reporting that a critical entry has been made to the SP error log, or that there has been a system halt. For SP Version 1.6 and later, the SP also displays the selftest numbers beyond ST 5 on the bottom line of the system console.

Note

The sysstat field (OFF, TEST, INIT, etc.) shows system status information similar to that shown by the "Run", "Attention", and "Stopped" LEDs on the front panel. Unlike the front panel LEDs, the sysstat field can be viewed by a remote operator.

The sysstat field describes the status not only of the CPU, but of the system as a whole including the SP. For example, sysstat displays TEST when either the SP or the CPUs are undergoing selftest. Similarly, INIT is displayed when either the SP or the CPUs are being initialized. Also, WARN may indicate an unread critical log entry in the SP logs.

Access Port (AP) Messages

Table 5-11. AP Informational Messages

APMSG	Description
01	All tests passed. (APMSG 01)
02	SPU hardware was successfully reset. (APMSG 02)
04	String was truncated to 23 characters. (APMSG 04)
05	AP configuration lost. Use CA and ER commands to recover. (APMSG 05) If the error reoccurs after using the CA and ER commands, replace the AP card.
06	SE terminated: returning to console/control mode. (APMSG 06)
07	The SP failed selftest: code = XX. The SP will continue to function in a diminished capacity. (APMSG 07)
08	The SP currently has a direct session open. This command will not work until the direct connection session has completed. (APMSG 08)

Table 5-12. AP Error Messages

APERR	Description
02	Cannot verify deassertion of POW_ON signal. (APERR 02) Major failure. Circuitry pulling on the POW_ON line or circuitry reading the line back may be broken.
05	AP failed selftest number XX. (APERR 05)
08	Permitted accesses to AP NVM exceeded. (APERR 08) NVM in AP could fail at any time. CE should replace AP on next visit.
10	Illegal command, type HE for help. (APERR 10)
11	Expecting "Y" or "N." (APERR 11)
12	Expecting "H" or "L." (APERR 12)
13	Command may not be executed by a remote user. (APERR 13)
14	Your selection is outside of the legal range. (APERR 14)
15	Command may not be executed by a local user. (APERR 15)
16	Expecting "S" or "M." (APERR 16)
20	SE failed: O/S did not respond (check O/S vs AP configurations). (APERR 20) No modem connection was successfully established by the host after the user typed SE. Likely causes: ■ OS is not booted yet. ■ No getty is running on port 7. ■ The device special file attached to port 7 does not match the AP configuration (for example, the OS considers the port as a simple protocol/Bell port while the AP has it configured as a CCITT port).
21	Fatal error: POW_ON never came back. Waiting until it's reasserted. (APERR 21) Major failure. This may be an AP failure (the AP will "hang" forever) or, less likely, a system hardware failure. The AP did its best to re-assert the POW_ON signal but does not see it re-asserted when reading it back. Circuitry pulling on the POW_ON line or circuitry reading the line back may be broken.
22	Timeout error on NVM. (APERR 22) The NVM chip is probably broken: the write was probably not successful.

Interpreting SP Prompts

When you access the SP commands, you normally see the prompt:

SP>

For non-normal conditions, you may seen one of three other prompts. See Table 5-13.

Table 5-13. Service Processor (SP) Prompts

Prompt	Condition	Causes	Actions
SP>	Normal state of SP.	After main SPU power is up.	No action required.
(SPU Power Control) SP>	At least one power rail is not nominal. OS cannot run.	▪ "Standby/Ready" switch in "Standby" position. ▪ CN, DN, or RL command used to turn off at least one power rail. ▪ A power supply fault causes at least one power rail to turn off.	▪ If no fault, be sure "Standby/Ready" switch is in "Ready" position; then use GO or UP if needed to begin boot process. ▪ If fault, read error logs and use PS to display power system status. Take appropriate corrective action. * (All SP commands available, but HC and RP may give obsolete configuration status since the SP cannot read all SPU RevPorts without all power nominal. The TC command will not perform a TOC at this prompt.)
(SPU Configuration) SP>	SP has paused the OS boot process to allow user to change or confirm the SPU hardware configuration.	▪ The user pressed a key during startup after SP displayed the prompt "Press ANY key within 10 SECONDS to cancel boot with this configuration." ▪ Autostart flag is cleared and the current/pending hardware configuration is different from the configuration used for the last boot (for example, if processor or memory modules have been de-configured).	▪ Read error logs to determine if some hardware was automatically de-configured due to a hardware failure; take appropriate corrective action. ▪ Use the HC command at the SP prompt to display/modify hardware configuration.
(Fault) SP>	SP detected a severe hardware fault that will prevent the OS from booting or from continuing to run. At least one critical error should be recorded in the SP error log.	Various hardware faults in SP, PSCM, or SPU, if they can be detected by the SP.	Read the SP error logs to identify cause and take appropriate corrective action.

Reading the Service Processor (SP) Log

The Service Processor (SP) maintains logs of hardware errors and activity. Three logs are maintained:

- **Activity Log**: records major changes in the state of the computer (for example, power-up and shutdown). Critical entries are displayed in **reverse video** . The information in the Activity Log is useful for determining how far computer operation proceeded before a failure occurred. The Activity Log is circular (once the log is filled to capacity, subsequent entries cause the earliest entries to be deleted).
- **Earliest Error Log**: contains the earliest error entries.
- **Latest Error Log**: contains error entries recorded after the Earliest Error Log is full.
- **SPU Tombstones Log**: contains up to 16 tombstones. A tombstone consists of troubleshooting data generated by an HPMC, LPMC, or Transfer of Control.

The **Error Logs** contain entries for critical and non-critical errors. Critical errors are those which require immediate attention: they usually indicate a failure of hardware or software. Critical errors are shown in **reverse video** in the SP log display.

When a critical error occurs, the yellow "Attention" LED on the front panel is lit to signal the operator. If the status line on system console is enabled, critical errors also cause a message to be displayed there. If the "Attention" LED is lit because of an unread critical-error entry, reading the SP error log will turn off the LED.

The time stamp for the entries is in Universal Time (Greenwich Mean Time).

To examine the SP error or activity logs:

1. Make sure that the Console keyswitch on the computer front panel is in the unlocked position.
2. Enter Control-B at the system console.
3. Enter SP to enter the Service Processor interface.
4. Enter DL at the SP prompt.
5. To see a record of errors:
   a. If the "Latest Errors" log has entries, enter L;
   b. If the "Latest Errors" log has no entries, enter E to see the "Earliest Errors" log. (The "Latest Errors" log only has entries if the "Earliest Errors" log is full.)
6. To see a history of system activity, enter A
7. At periodic intervals use the CL (Clear Log) command at the SP prompt to keep the error and activity logs to a manageable size.

For more information, see Chapter 12d (Service Processor).

Catalog of SP Log Entries

Table 5-14 lists the entries that can appear in the Service Processor (SP) log. For a description of "Critical Errors" and the "Activity Log," see the previous page.

Table 5-14. Catalog of Service Processor (SP) Log Entries

Type	Log Entry	Description	Critical Error	Activity Log
0130	PWR_FAIL	PSCM detected an AC power failure.		
0194	PSCM_SP_IFACE_ERR	PSCM detected a PSCM <-> SP interface problem		
0220	STALE_SYS_STAT_LOG	Processor(s) did not update system status for the last 10 seconds. Processors could be busy or failed.		
0434	PSCM_PFC_ABN_STATUS	PSCM detected an abnormal status from the PFC.		
0a94	PSCM_SPS_BROKEN_SRQ	PSCM detected a broken converter SRQ line.		
1201	NEW_SYS_STAT_NC_LOG	A new value of system status was recorded for one of the following types: OFF, TEST, INIT, SHUT, RUN, ALL, FAULT.		x
1294	PSCM_OPAL_STATUS	PSCM detected an HP-PB cardcage power supply status error.		x
1344	PSCM_TEMP_WARN	PSCM detected an elevated temperature (> normal and < OS shutdown).		x
13b4	PSCM_FAN_WARN	PSCM detected a fan speed out of tolerance.		x
1514	PSCM_PFC_SV_TIMEOUT	PSCM detected a PFC Status Valid timeout.		x
1594	PSCM_PFC_SV_RECOVERY	PSCM recovered PFC Status Valid.		x
1954	PSCM_SPS_SF_GLITCH	PSCM detected a DC power converter flag glitch.		x
19d4	PSCM_SPS_ABN_STATUS	PSCM detected an abnormal status from a DC power converter.		x
1a54	PSCM_SPS_TMP_ABN_STATUS	PSCM detected a temporary abnormal status from a DC power converter.		x
1b14	PSCM_SPS_MASTER_CHG	PSCM detected a DC power converter master change.		x
2100	CLOCK_INIT_FAIL	SP host initialization failed to activate scan and clock firmware.	x	
2110	PSCM_INIT_FAIL	SP host initialization failed to activate PSCM interface firmware.	x	
2114	PSCM_ST_ERROR	PSCM selftest error.	x	
2120	PSCM_FAIL	SP detected a PSCM <-> SP interface problem.	x	
2140	CLOCK_FAIL	SP detected a clock system error.	x	

Table 5-14. Catalog of Service Processor (SP) Log Entries (continued)

Type	Log Entry	Description	Critical Error	Activity Log
2150	PDC_BANK_SW_FAIL	SP detected a PDC firmware bank switch error.	x	
2234	PSCM_FW_INCOMPAT	PSCM downloaded firmware is not compatible with PSCM ROM firmware.	x	
2240	HOST_FAILED_ST_LOG	All host processors failed early selftest.	x	
2251	WR_REV_PWR_FAIL_LOG	Aborted writing the revision port of a PMB board, due to an impending power failure.	x	
2261	WE_REV_ZEROS_LOG	Aborted writing the revision port of a PMB board, due to all data being zeros.	x	
2271	WR_REV_PARAM_LOG	Aborted writing the revision port of a PMB board, due to incorrect parameters (slot, module).	x	
2281	WR_REV_FAILED_LOG	Failed writing the revision port of a PMB board (data read back is not equal to data written).	x	
2310	LANBORGSYCN_E1	Console/LAN card did not enter SP mode when reset by SP.	x	
2330	LANBORGWATCH_E1	Console/LAN card stopped sending RequestSpStatus.	x	
2340	LANBORGWATCH_E2	Console/LAN card never sent RequestSpStatus.	x	
2344	PSCM_TEMPSCM_SHUT	PSCM detected an elevated temperature (> OS shutdown).	x	
2492	PSCM_PFC_IFACE_ERR	PSCM detected a PSCM <-> PFC interface problem.	x	
2634	PSCM_BATT_ERR	PSCM suspects a battery system problem.	x	
2684	PSCM_PFC_LO_WARN	PSCM detected a PFC latch-off warning.	x	
2754	PSCM_SPS_CNV_OFF	PSCM detected that a DC power converter shut itself down.	x	
27d4	PSCM_SPS_CNV_SHUT	PSCM shut off a DC power converter due to abnormal operation.	x	
2864	PSCM_MPM_2B_SHUT	PSCM shut off the MPM 2B Rail due to abnormal operation.	x	
28a4	PSCM_PWR_SYS_SHUT	PSCM shut off the power system due to abnormal operation.	x	
2bb4	PSCM_VM_UV_OFF	PSCM detected a voltage monitor undervoltage shutdown.	x	
2c34	PSCM_VM_UV_WARN	PSCM detected a voltage monitor undervoltage warning.	x	
2cb4	PSCM_VM_OV_OFF	PSCM detected a voltage monitor overvoltage shutdown.	x	

Table 5-14. Catalog of Service Processor (SP) Log Entries (continued)

Type	Log Entry	Description	Critical Error	Activity Log
2d14	PSCM_PS_CNFG_ERR	PSCM detected a power system configuration error.	x	
2da4	PSCM_PMB_CNFG_ERR	PSCM detected a PMB system configuration error.	x	
2e34	PSCM_SYS_CONFG_ERR	PSCM detected a system configuration error.	x	
2e84	PSCM_MAIN_STK_OVF	PSCM detected an overflow in its microprocessor main stack.	x	
2f04	PSCM_MAIN_LOOP_WD	PSCM 's main loop watchdog timer interrupt occurred.	x	
2f84	PSCM_ADC_TIMEOUT	PSCM detected an analog-to-digital converter timeout.	x	
3211	NEW_SYS_STAT_CR_LOG	A new value of system status was recorded for one of the following types: FAULT. WARN.	x	x
6340	PDC_LOG	Entry logged by PDC.	x	

Note

PSCM system-error codes (Table 5-21) are also displayed in the SP log. For a given PSCM system-error code. the corresponding entry in the SP error log is numbered *xCC4* where *CC* is the system-error code plus 80. For example. system-error code 05 (an HP-PB Cardcage Status Error) appears in the SP error log as x854 (05 + 80 = 85).

Indicators

This part of the chapter provides reference information on the indicators located on the 99x/890/T500 and its components.

- Indicators and Switches on the Front Panel.
- Service Processor (SP) Indicators.
- SP Indicator Grid.
- PSCM Hex Digit Display ("Power").
- LEDs on PMB and HP-PB Cards.
- Power Module LEDs.
- Expansion Cabinet Indicators.

Figure 5-2 shows the relationship of the system indicators to the power system and to the Service Processor.

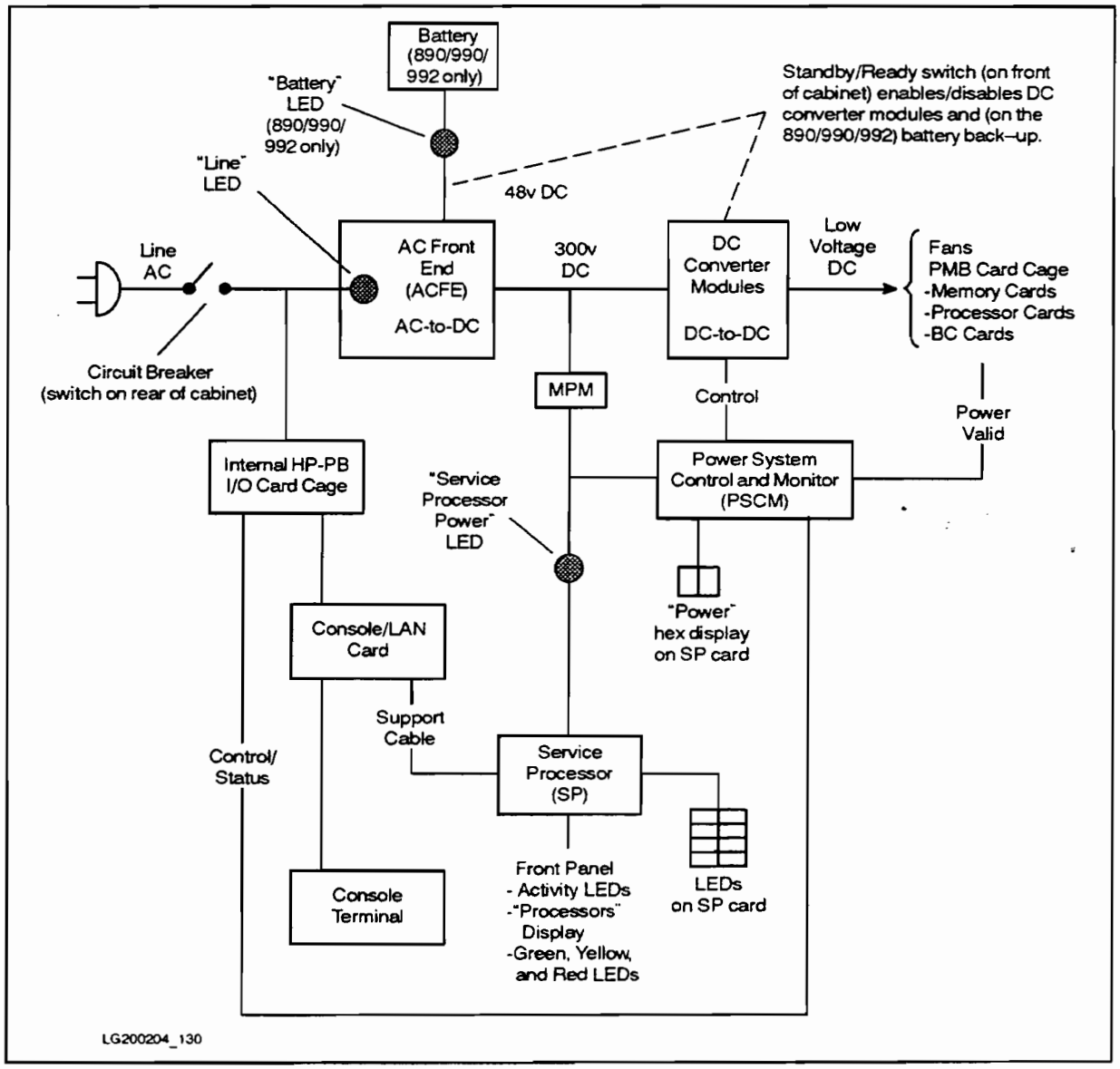


Figure 5-2. System Indicators and the Power System/SP

Indicators and Switches on the Front Panel

To operate the 99x/890/T500, you interact with the indicators and switches on the front panel (Figure 5-3). Table 5-15 summarizes information on the front panel.

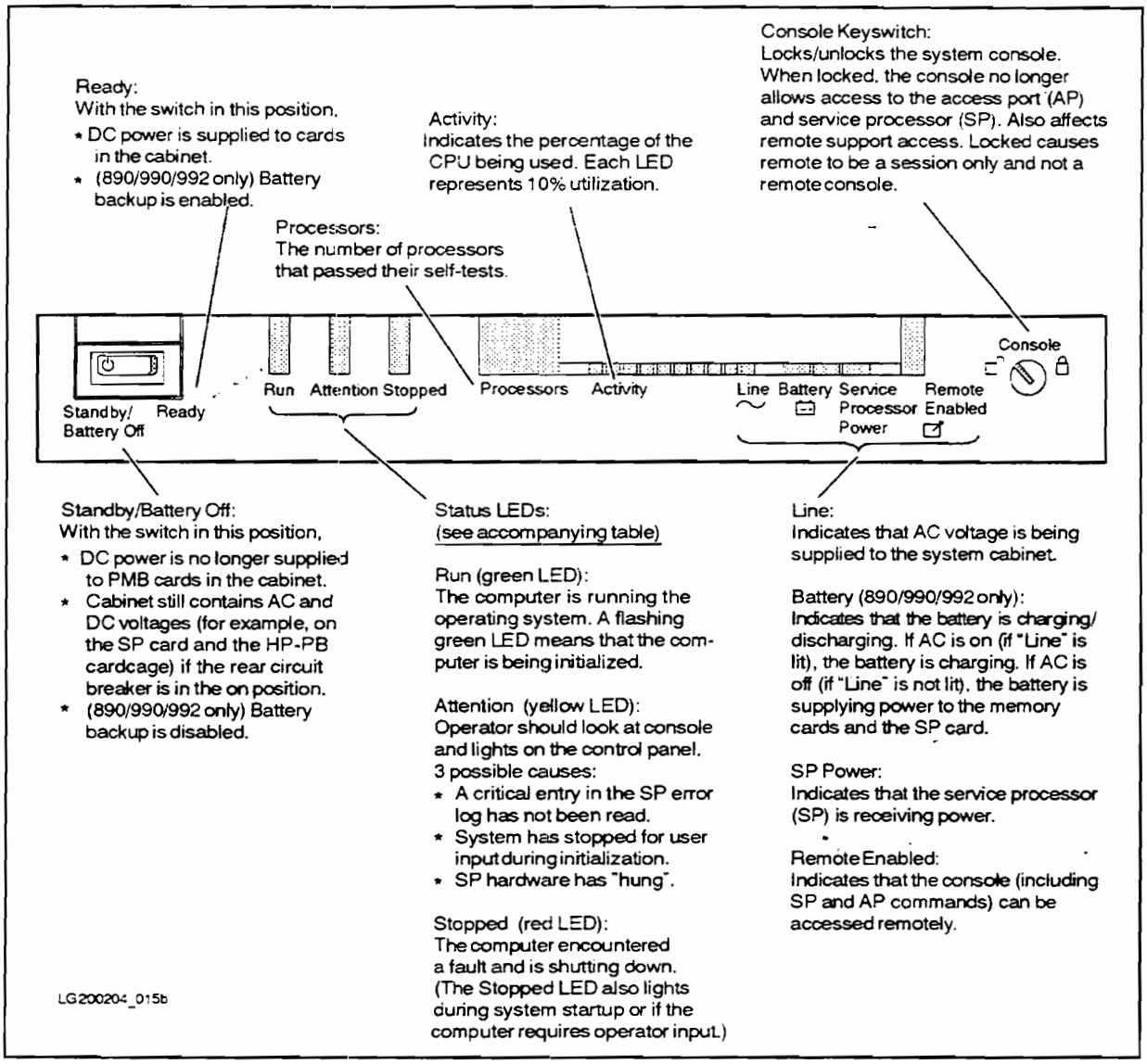


Figure 5-3. Front Panel Indicators and Switches

Table 5-15. Front Panel Indicators and Switches

Label	Description
Standby (T500/991/995) Standby/ Battery Off (890/990/992)	With the "Standby-Ready" switch in this position: ■ DC power is no longer supplied to PMB cards in the cabinet. ■ (890/990/992) Battery back-up is disabled. ■ Cabinet still contains AC, high voltage DC, and low-voltage DC bias voltages (for example on the SP card and the HP-PB cardcage) if rear circuit breaker is in ON position.
Ready	With the "Standby-Ready" switch in this position: ■ DC power is supplied to PMB cards in the cabinet. ■ (890/990/992) Battery back-up is enabled.
Run (green LED)	The computer is running the operating system. A flashing "Run" LED indicates non-OS system activity. See Table 5-16.
Attention (yellow LED)	Operator should look at console messages and LEDs on the control panel (front panel). Three possible causes: ■ Computer may have a critical unread message in the SP log. Use the DL command at the SP prompt; see Chapter 1 (Overview). ■ System has paused for user input during initialization. ■ SP hardware has "hung."
Stopped (red LED)	The computer encountered one of the following conditions (see Table 5-16): ■ Errors (computer will shut down): □ Power supply failure or over-temperature shutdown. □ High Priority Machine Check (HPMC). □ Power-on selftest failures (if PDC failed selftest on a processor or memory card and the SP Autostart flag is not set). □ Operating system kernel panic. ■ User input required (for example to confirm PMB configuration if configuration has changed.)
Processors	The number of processors that passed their selftests. During system boot, shows the section of the SP selftest being executed. (see Table 5-19).
Activity	For MPE/iX, indicates percentage of CPU in use (each LED = 10% utilization). For HP-UX, indicates the exact number of processes in the run queue. This display flashes each time the OS updates the value. The Activity LEDs represent the same data as the chassis activity codes (FxxF and Exxx). If the display stops flashing, the system may be hung. During system boot, shows the section of the SP selftest being executed (duplicating the information in the "Processors" display). Read this display as binary-weighted digits (rightmost LED = 1, next LED = 2, etc.). Add them up to find the selftest that failed.
Line	Indicates that AC voltage is being supplied to the system cabinet and the circuit breaker switch is in the ON position.
Battery (890/990/992 only)	(890/990/992) Indicates that the battery is charging/discharging. If AC is ON (if "Line" is lit), the battery is charging. If AC is OFF (if "Line" is not lit), the battery is supplying power to the memory cards.

Table 5-15. Front Panel Indicators and Switches (continued)

Label	Description
SP Power	Indicates that the Service Processor (SP) is receiving power. This LED can be lit (and the SP can respond to commands) even if the Standby-Ready switch is in the "Standby" position.
Remote Enabled	Indicates that the system can be accessed remotely. Use the AP commands ER/DR and UR/LR to control remote access. See Chapter 1 (Overview).
Console Keyswitch:	Locks/unlocks the system console. When locked, the console no longer allows access to the Access Port (AP) and Service Processor (SP). (That is, the console no longer responds to Control-B.) Affects both local and remote consoles.

Table 5-16. Conditions Indicated by System Status LEDs

Run (green LED)	Attention (yellow LED)	Stopped (red LED)	Condition
OFF	OFF	OFF	**Main Power Failure.** All power has failed and the Service Processor is unable to display a message to the operator. Possible causes: AC power failure, system power failure.
Flashing	OFF	OFF	**Non-OS system activity.** The green LED is flashing at about a one-second rate. The system is in a normal and expected state, but is not yet doing "useful" operating system work. The system is probably undergoing initialization, selftest, or bootup.
ON	OFF	OFF	**Normal OS system activity.** Normal state. The system is functioning normally and doing useful operating system work.
ON	ON	OFF	**OS system activity with an attention condition.** Attention condition encountered, but otherwise the system is functioning and doing useful operating system work. See the system console for warning messages; see the Service Processor log (DL command at the SP prompt) for critical error log entries. Critical errors are highlighted in the SP log.
x	ON	x	**Attention.** Attention condition encountered or the Service Processor (SP) log has an unread entry. See the system console for warning messages; see the Service Processor log (DL command at the SP prompt) for critical error log entries. Critical errors are highlighted in the SP log.
OFF	x	ON	**System stopped.** Several possibilities: ■ System requires user input (for example, the console is waiting for a response to a "continue booting?" prompt). ■ Operator gave the OS command to shut down the computer. ■ The system detected a critical catastrophic condition and stopped operation. Contact an HP Customer Response Center (Hardware Assistance) immediately. A reboot performed by the operator may or may not be successful. If this state occurs, it will replace any other state of the LEDs (including initialization and warning).
ON	ON	ON	**Lamp test.** During system selftest or boot, the status LEDS all flash on for a moment and then flash off. Afterwards, the LEDs return to their normal display state, reflecting the current state of the system.

Service Processor (SP) Indicators

The Service Processor (SP) card has two sets of indicators:

- SP indicator grid (at top of SP card bulkhead)
- PSCM hex digit display (at bottom of SP card bulkhead).

These indicators are described in the next two sections.

Caution Do NOT press the pushbutton switch labeled "Selftest Start" at the top of the SP card bulkhead. This switch is for factory use only.

SP Indicator Grid

At the top of the bulkhead on the SP card is a small grid composed of labeled squares (Figure 5-4). This grid reports on the state of the Service Processor (for example: SP selftests, SP communication with the console, SP clock).

	CON F	
CCP	T	64
	R	32
SPP	CT	16
	CR	8
	DT	4
	DR	2
	CK	1
		ST

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Figure 5-4. Indicator Grid on the SP Card

Table 5-17 lists the normal state of the lights in the SP indicator grid.

Table 5-17. Normal States of Lights in Service Processor (SP) Grid

Condition	State of Lights
During SP selftest	ST lit: numbered lights are lit so that the sum of the numbers equals the SP selftest in progress.
SP selftest failure	ST lit; numbered lights lit, so that the sum of the numbers equals the SP selftest that failed.
After SP selftest	ST not lit: CK flashes ON and OFF at one second intervals. Also, CT (SPP) and CR (SPP) flash at one minute intervals as the SP and the Console/LAN card handshake.
At PDC prompt or whenever PDC is active	T (CPP) and R (CPP) flash during console input/output.
At SP prompt	CT (SPP), CR (SPP), DT (SPP), and DR (SPP) flash during console input/output.

Table 5-18 describes the meaning of the lights in the SP indicator grid.

Table 5-18. Meaning of Light Indicators in Service Processor (SP) Grid

Label	Name	Meaning When Lit
picture of an unlocked padlock	Keyswitch Unlocked	The keyswitch on the control panel is unlocked, as detected on the SP. In the unlocked position, the keyswitch allows access to the AP and SP commands ([Control]-[B]). In the locked position, the keyswitch prevents local or remote access to the AP and SP commands ([Control]-[B]).
CON F	Console Failure	The SP cannot talk to the console/LAN card.
T (CCP)	CCP Transmit	A character was transmitted to the console/LAN card over the Close Console Path. This light flashes during operations at the PDC prompt.
R (CCP)	CCP Receive	A character was received by the console/LAN card over the Close Console Path. This light flashes during operations at the PDC prompt.
CT (SPP)	SPP Control Transmit	SP sent a character to the console/LAN card over the SP Port control path[1]
CR (SPP)	SPP Control Receive	SP received a character from the console/LAN card over the SP Port control path.[1]
DT (SPP)	SPP Data Transmit	SP sent a character to the console/LAN card over the SP Port data path. This light flashes during SP output during SP mode (for example when the SP displays data on the console at the SP prompt).
DR (SPP)	SPP Data Receive	SP received a character from the console/LAN card over the SP Port data path. This light flashes during console input to the SP during SP mode (for example when the operator enters data at the SP prompt).
CK	Clock	After the SP successfully completes its selftest, this light continuously flashes ON for 1 second, then OFF for 1 second. When flashing, this light indicates that the SP firmware is working.
ST	Self Test	The SP is executing its selftest. The number of the currently executing selftest is indicated by the lights above the ST light. If the SP is executing selftest 5, then the lights labeled "4" and "1" are lit (4 + 1 = 5). (The ST number is shown in more readable form in the "Processors" display on the front panel.)

1 The control path is used for control information between the SP and the Console/LAN card. It is also used for flow control for SPP data. It is also used at one minute intervals following SP selftest as the SP and the Console/LAN card handshake.

SP Selftest Codes

The SP performs a selftest after power is applied to the system (after the AC circuit breaker is turned on) and before the PDC selftest is executed. You can initiate the SP selftest by cycling power or by entering the REstart command at the SP> prompt.

As the SP performs its selftests, it displays the number of the selftest currently being executed on the front panel "Processor" display and on the SP card itself Table 5-18. For SP Version 1.6 and later, the SP also displays the selftest numbers beyond ST 5 on the bottom line of the system console.

A description of each SP selftest is given in Table 5-19.

If the SP should fail a selftest, it halts. The SP code displayed indicates the selftest section being executed when the failure occurred. The recommended action for most SP selftest failures is to replace the SP card.

(Another way of reading the SP selftest code to to decode the "Activity" LEDs on the front panel. Read this display as binary-weighted digits (rightmost LED = 1, next LED = 2, etc.). Add them up to find the selftest that failed.)

Table 5-19. SP Selftest Codes

Selftest Code	Error/Status Code Description
--	Control Panel display test.
01	Internal 68000 registers testing.
02	Stack and scratch space testing.
03	Monitor port testing.
04	Full 68000 check-out. exception interrupts.
05	Checksum testing of MAIN code space
06	Checksum testing of ALTERNATE code space
07 - 11	RAM testing (8 chips)
12	Firmware SWAP testing
13	Bus error testing
14	DUART testing
15	Counter testing
16	Watchdog timer testing
17	Voltage (+/-12 V) testing
18	GPIO port testing
19	Sending S/T message to Console/LAN card
20	MAIN interrupt testing
21 - 24	PDH testing with SP bus controller
25	PDC bank testing
26	SP Bus error testing
27	PDH strobe testing
28 - 30	SP Bus testing
31	Semaphore testing
32	Initialize the SP Bus clock
33	PDH interrupt testing
34	Real-Time Clock testing
35	Bias secondary power testing
36	PDC bank switch testing
37	PSCM I/O testing
38 - 50	(Codes not used.)
51	Secondary power testing
52	ECL clock testing for SP Bus
53	Scan Bus controller testing

PSCM Hex Digit Display ("Power")

In the lower half of the SP card are three indicators labeled "Power". These indicators show the operating status and selftest status of the Power System Control and Monitor (PSCM). The PSCM is hardware and firmware on the SP card.

PSCM Selftest Indicator

The PSCM selftest indicator is a small light labeled "Selftest". This indicator tells how the two hex indicators below it should be interpreted.

If the PSCM Selftest Indicator Is Lit

If the PSCM selftest indicator is lit: the two hex indicators show the PSCM selftest currently being executed. If system startup has stopped. then this number is the number of the PSCM selftest that failed.

Use Table 5-20 to interpret PSCM selftest error codes. In general. any selftest error will require replacing the SP card.

PSCM Selftest Codes

The PSCM performs a selftest after power is applied to the system (after the AC circuit breaker is turned on) and before the PDC selftest is executed. You can initiate the PSCM selftest by cycling power or by entering the REstart command at the SP> prompt.

As the PSCM performs its selftest, it displays a series of codes Table 5-20 on the PSCM hex digit display. If the PSCM should fail a selftest, the system halts. The PSCM code displayed indicates the selftest section being executed when the failure occurred. The recommended action for most PSCM selftest failures is to replace the SP card.

Table 5-20. PSCM Selftest Codes

Selftest code	Error/Status Code Description
00	No errors or normal operation
02	ROM test in progress
03	RAM test in progress
04	Register test in progress
05	PSCM Rev Port test in progress
06	Interrupt test in progress
07	Timer test in progress
08	SP interface test in progress
10	Watchdog Timer test failed
18	Waiting for SP to download FW
20	ROM test failed
30	Basic RAM test failed
31	Full RAM test failed
40	Misc. Output Reg 0 failed
41	Misc. Output Reg 1 failed
42	SPS interface Enb Reg failed
43	SPS Conv Enb Reg 0 failed
44	SPS Conv Enb Reg 1 failed
45	SPS Housekeeping Enb Reg failed
46	SPS Fault Led Reg 0 failed
47	SPS Fault Led Reg 1 failed
48	SPS Control Reg failed
49	PFC Control Reg 0 failed
4A	PFC Control Reg 1 failed
50	PSCM Rev Port test failed
60	Interrupt test failed
70	Timer chip failed
80	SP interface test failed
81	PSCM has timed out on SP
82	SP using the interface bus
90	Control Panel power switch error
An	Analog test failed (n = D/A #)
AC	Analog test failed on 50 mV ref test
AD	Analog test failed on 5 V ref test
AE	Analog test failed on gain test
AF	Analog test failed due to A/D timeout
nA	Analog test in process (n = D/A #)
D1	SP is downloading FW

If the PSCM Selftest Indicator Is NOT Lit

If the PSCM selftest indicator is NOT lit the two hex indicators should flash 00. If they are flashing values than 00, the two hex indicators show system-related failures (Table 5-21). There is an easy way and a hard way to decode these error codes:

- **Easy way:** Look for PSCM-type errors in the SP error log. Each error entry has a date-stamp and text describing the error. Be aware, however, that two errors may not be logged by the SP:
  - Error 03 (SP Interface Problem)
  - Error 05*st* (HP-PB Cardcage Status Error, *st* = status)
- **Hard way:** Decode the sequence of values flashing on the two hex indicators. The procedure for decoding the hex indicators is described in the next section. Caution: Some of the "errors" shown by the hex indicators may be obsolete or inconsequential. Also, there is no way of telling when the errors occurred.

Decoding a Hex Digit Sequence for PSCM System-Related Errors

Note This procedure is given only for the rare times when you cannot use the DL command at the SP prompt. *Whenever possible, use the DL command rather than this procedure!*

The faults displayed on the PSCM hex display (with Selftest LED OFF) are decoded as follows.

```
Hex
Digits                    Meaning
-------------------------------------------------------------
                  ( BLANK DISPLAY for one or two seconds. )
00  - to indicate that this is the first error (Error Number)
uu  -   "         1st two digits of error code (Operational Fault Code)
vv  -   "         2nd two digits of trailing status code (if any)
                  (Up to six trailing status codes)
                        .
                        .
                  ( BLANK DISPLAY for one or two seconds. )
01  - to indicate that this is the second error
uu  -   "         1st two digits of error code
vv  -   "         2nd two digits of trailing status code (if any)
                  (Up to six trailing status codes)
                        .
                        .
                        .
(Indicators continue to flash data in this fashion for
errors 02, 03, 04, etc.)
```

Each fault is separated by the hex display going blank. The first code after the hex display is blank is the Error Number. The Error Number is an index indicating the order of the errors. The index begins with zero. Following the Error Number, one of the Operational Fault Codes flashes (see Table 5-21).

After the Operational Fault Code, a variable number of trailing status codes are displayed depending on the type of fault. The procedure for decoding the trailing status codes is too complex to describe in this manual. Only the status codes for Error 05 (HP-PB Cardcage Status Errors) are given here (Table 5-22).

Table 5-21. PSCM System-Error Codes.

Hex Code	Number of Trailing Status Codes[1]	Description
02	5	PSCM Selftest Error
03	1	SP Interface Problem
04	3	Firmware Incompatible
05	1	HP-PB Cardcage Status Error (See Table 5-22.)
06	4	Temperature Fault
07	3	Fan Speed Warning
08	3	PFC Abnormal Status
09	1	PFC Interface Problem
0A	1	PFC Status Valid Timeout
0B	1	PFC Status Valid Recovery
0C	3	Battery Problem Suspected
0D	0	PFC Latch-off Warning
0E	5	SPS Converter Shutdown
0F	5	PSCM Shutdown SPS Converter
10	6	PSCM Shutdown MPM 2B Rail
11	2	PSCM Shutdown Power System
12	5	SPS Converter Status Flag Glitch
13	5	SPS Abnormal Status
14	5	SPS Temporary Abnormal Status
15	1	SPS Broken SRQ Line
16	1	SPS Master Change
17	3	Voltage Monitor Undervoltage Shutdown
18	3	Voltage Monitor Undervoltage Warning
19	3	Voltage Monitor Overvoltage Shutdown
1A	1	Power System Configuration Error
1B	2	PMB Configuration Error
1C	3	System Configuration Error
1D	0	PSCM Main Stack Overflow
1E	0	PSCM Main Loop Watchdog
1F	0	ADC Timeout
20	0	Supply Off due to PFC Fault

1 The trailing status codes supply additional information about the error. To decode the trailing status codes, call the HP Response Center. (Better yet, use the DL command at the SP prompt.)

Note

PSCM system-error codes (Table 5-21) are also displayed in the SP log. For a given PSCM system-error code, the corresponding entry in the SP error log is numbered *xCC4* where *CC* is the system-error code plus 80. For example, system-error code 05 (an HP-PB Cardcage Status Error) appears in the SP error log as x854 (05 + 80 = 85).

Table 5-22. Status Codes for Error 05 (HP-PB Cardcage Status Error)

Status Code	Description
70	No overtemp, power on, batt not charging (normal: not a failure).
60	overtemp, power on, batt not charging (overtemp failure).
50	No overtemp, power off, batt not charging (power failure).
40	overtemp, power off, batt not charging (overtemp failure).
30	No overtemp, power on, batt is charging (normal; not a failure).
20	overtemp, power on, batt is charging (overtemp failure).

Reading PSCM Hex Display: Example 1

The sequence:

```
00 03 pause  00 03 pause etc.
```

is decoded as follows:

Blank	Divides errors
00	Error Number 0
03	SP Interface Problem
00	
Blank (pause)	Divides errors

Reading PSCM Hex Display: Example 2

The sequence:

```
00 05 00 60  pause 00 05 00 60  pause etc.
```

is decoded as follows:

Blank	Divides errors
00	Error Number 0
05	HP-PB Cardcage Status Error
00	
60	overtemp, power on, batt not charging
Blank (pause)	Divides errors

Note This information is given only for the rare times when you cannot use the DL command at the SP prompt. *Whenever possible, use the DL command rather than this procedure!*

Reading PSCM Hex Display: Example 3

The sequence:

```
00 05 00 60  pause 01 05 00 40  pause etc.
```

is decoded as follows:

Blank	Divides errors
00	Error Number 0
05	HP-PB Cardcage Status Error
00	
60	overtemp, power on, batt not charging
Blank (pause)	Divides errors
01	Error Number 0
05	HP-PB Cardcage Status Error
00	
40	overtemp, power off, batt not charging
Blank (pause)	Divides errors

Note that the first error reports "power on" and the second error reports "power off".

Reading PSCM Hex Display: Example 4

The sequence:

```
00 14 0E 00 11 00 01 pause 01 14 04 00 03 00 01  pause  00 14 etc.
```

is decoded as follows:

Blank	Divides errors
00	Error Number 0
14	Indicates temporary abnormal SPS status received
0E	from slot 14
00	with initial status 0011 (not described in this manual)
11	
00	with secondary status 0001 (not described in this manual)

01	
Blank	Divides errors
01	Error Number 1
14	Indicates temporary abnormal SPS status received
04	from slot 4
00	with initial status 0003 (not described in this manual)
03	
00	with secondary status 0001 (not described in this manual)
01	
Blank	Divides errors
00	Back to Error Number 0
14	Indicates temporary abnormal SPS status received
	Etc., codes continue

Note that this error sequence contains several status codes which are too complex to describe in this manual. See the SP error logs for text descriptions of these errors.

LEDs on PMB and HP-PB Cards

Table 5-23 summarizes the meanings of the LEDs on the HP-PB cards. For more information on HP-PB card indicators, see the appropriate I/O card chapter: Chapter 11a (SCSI Cards) through Chapter 11g (PSI Card).

Table 5-23. Meaning of LEDs on PMB and HP-PB Cards

Card	Indicator	Meaning
Upper bus converter (BC) card	Green "CONNECTED" LEDs (2)	ON = link to one of the lower bus converter is connected and operational. for each upper bus converter module.
Lower bus converter (BC) card	Green "CONNECTED" LED	ON = link to upper bus converter is connected and operational.
Console/LAN card	Amber LED	OFF = passed selftest ON = failed selftest FLASHING = LAN fault; OR no LAN cable present and no terminator.
HP-FL card	Amber "Selftest" LED.	ON = failed selftest(turns on briefly during selftest). OFF = passed selftest.
	Amber "Config" LED.	ON = wrong configuration. OFF = card is configured and the remote device is compatible.
	Amber "Signal" LED.	OFF = HP-FL signal strength and quality is acceptable.
	Amber "Remote" LED	ON = remote device did not respond to periodic ID request. OFF = remote device correctly identified itself.
	Green "Passed" LED	ON = passed selftest. FLASHING = passed selftest and is awaiting system configuration.
	Green "Activity" LED	FLASHING = data transfers on the HP-FL; blinks at least once every 60 seconds.
SCSI card	Yellow "Selftest" LED	ON = failed selftest. OFF = passed selftest (LED goes on for 2-5 seconds during ST. then stays off.
	Green "Termpwr" LED	ON = SCSI is supplying termination power to the SCSI bus. OFF = Possible problem with TERMPWR circuitry or bad term fuse.

Power Module LEDs

AC-to-DC (PFC) Unit

Table 5-24 summarizes the meanings of the three LED status indicators on the AC-to-DC (PFC) high voltage assembly.

Note

The HVDC rail is "up" when the green LED is full ON or during battery backup operations when the green LED is flashing.

Table 5-24. LEDs on the AC-to-DC (PFC) Unit

Green	Yellow	Red	Meaning	HVDC	Possible Cause
off	off	off	Unpowered, no AC or BATT	down	No AC
off	flash	off	AC power, not enabled	down	Faulty PFC or PSCM (on SP card)
off	off	ON	PFC fault detected	down	Faulty PFC
ON	off	off	AC power, normal enabled	up	Normal
ON	flash	off	AC power, PSCM input commands not yet received	up	Power coming up
ON	ON	off	AC power, abnormal enabled	up	Fault PFC or PSCM (on SP card)
flash	off	off	DC power, normal enabled	up	Battery backup
flash	ON	off	DC power, abnormal enabled	up	Faulty PFC or PSCM (on SP card)
flash	flash	off	AC recovery, enabled	up	Normal - short duration

DC-to-DC (SPS) Power Modules

The following summarizes the meaning of the three LED status indicators on each DC/DC power module.

```
Green ON = Running
Yellow ON = Shutdown
Red ON = Failed
Red FLASHING = Abnormal condition
```

MPM Power Module

Table 5-25 summarizes the meaning of the five LED status indicators on the DC/DC MPM power module.

Table 5-25. LEDs on the MPM Module

Green	Yellow	Condition	Green	Yellow	Red
ON	off	Running	-	-	off
off	ON	Shutdown by PSCM	-	-	off
off	off	Failed	-	-	ON
-	-	Running	ON	off	off
-	-	Shutdown by PSCM	off	ON	off
-	-	Failed	off	off	ON

Expansion Cabinet Indicators

HP-PB (External) Card Cage

Three LEDs on the front of the HP-PB card cage are provided for monitoring the status of the HP-PB card cage (refer to Table 5-26 for status indicated by the LEDs). Since the expansion cabinet has no front door, you can view these LED indicators directly.

Note

The main SPU does not provide any status information on external HP-PB card cages: you must use the external HP-PB card cage LEDs to monitor status.

Table 5-26. Status Indicators on the HP-PB Card Cage

Indicator	Name	Meaning
Green LED	DC Power	ON = DC power is present in the HP-PB card cage.
Yellow LED	Battery	ON = Battery is charging or discharging. The battery is charging if the green DC Power LED is also ON. The battery is discharging (battery back-up mode) if the green DC Power LED is OFF.
Red LED	OverTemp Warning	ON = Temperature is above normal. If the temperature continues to rise. DC power to the HP-PB card cage will be disconnected.

Series 6000 Multiuser Disk Array

The following LEDs are used to visually check the status of the disk array during normal operation and selftests.

- Disk Array Status (Green/Amber LED) - ON = passed selftest: OFF = power off or controller failed: FLASHES = data being transferred.
- Disk Array Fault (4 Amber LEDs) - (See Table 5-27 below)
- Disk Module Status (Amber LED) - ON = fault: OFF = okay.
- PBus Fault (2 Amber LEDs) - Both OFF = okay: either or both ON = trouble.
- Fiber Optic Fault (Green LED) - ON = okay: OFF = trouble.

Table 5-27. Disk Array Fault Codes

Status	Description
0 0 0 0	No errors or normal operation
0 0 0 1	Fan failure
0 0 1 0	Fiber Optic Interface card fault
0 1 0 0	Power on selftest is running
0 1 0 1	Ext. selftest media error. Check disks
0 1 1 0	Power supply fault.
1 0 0 0	Disk Module in slot 1 failed.
1 0 0 1	Disk Module in slot 2 failed.
1 0 1 0	Disk Module in slot 3 failed.
1 0 1 1	Disk Module in slot 4 failed.
1 1 0 0	Disk Module in slot 5 failed.
1 1 0 1	Ext. selftest I/O error. Check disks
1 1 1 0	Configuration fault.
1 1 1 1	Disk Array controller fault.

Series 6000 SCSI Mass Storage System

- I/O errors are reported by kernel device drivers when they detect an error on a specific device.
- Errors can be soft or hard.
- The frequency and severity of the error will determine the action (if any) to be taken.

Decoding HPMCs (Tombstones)

During system startup and operation, serious errors in PA-RISC CPUs generate a **High Priority Machine Check (HPMC)**. If the system cannot recover from an error, the system halts operation. When an HPMC occurs, you should identify its cause to help isolate the faulty hardware.

Some HPMCs on the x9x Family can be decoded relatively quickly; others are very difficult to decode. This section provides the information you need to decode the easy HPMCs. For difficult HPMCs, you are referred to the Response Center.

This section covers:

- HPMC Concepts.
- HPMCs on the x9x Family.
- Sample Tombstone.
- Cookbook for Decoding HPMCs.
- HPMC Examples.
- Using MEMDIAG to Decode Memory Addresses.

HPMC Concepts

HPMC interrupts can be generated in several ways:

- Processor errors (cache and TLB errors).
- Bus errors (including memory errors and I/O errors).
- Transfer of Control (TOC).

Processor errors can be generated by the cache or TLB. Processor errors are usually easy to troubleshoot.

Bus errors are errors detected over the central bus (the Processor-Memory Bus (PMB) on the x9x Family). Bus errors are usually caused by memory or I/O modules and are more difficult to troubleshoot than processor errors.

Transfer of Control (TOC) is not an error but rather a mechanism used to gain control of the CPU. Invoking a TOC forces an HPMC interruption: the system does a soft reset (memory is not destroyed). On HP-UX systems, HP-UX is rebooted. The TOC is normally used to take a memory dump when the system is hung.

How PA-RISC SPUs Handle HPMCs

All PA-RISC SPUs including the x9x Family handle High Priority Machine Checks (HPMCs) in the same general way:

1. Circuitry in the processor module detects a fatal condition and generates an HPMC interrupt. HPMC conditions reported over the bus are detected by the processor/bus interface chip (the PMBI chip on the x9x Family).
2. The HPMC interrupt calls an HPMC-handling routine in Processor Dependent Code (PDC).
3. The HPMC-handling routine logs status and error information to a portion of memory called Processor Internal Memory (PIM).
4. PDC displays an HPMC tombstone.
5. The PDC HPMC-handling routine tries to branch to the OS HPMC handler.
   a. HP-UX systems put a tombstone display on the console and try to reboot. If the system reboots, HP-UX messages will force the HP-UX tombstone display to roll off the console.
   b. MPE-XL systems display a message on the console similar to:

```
B000 xxxx DEAD
```

HPMCs on the x9x Family

x9x Family Architecture

To understand how HPMCs are detected and reported on the x9x Family, let's review the x9x Family architecture. See Figure 5-5. Like other PA-RISC systems, x9x Family systems are based on the idea of modules (such as processors and memory) communicating over system buses. On the x9x Family, the central bus is the Processor-Memory Bus (PMB). Connected to the PMB are processor modules, memory modules and bus converter (BC) modules.

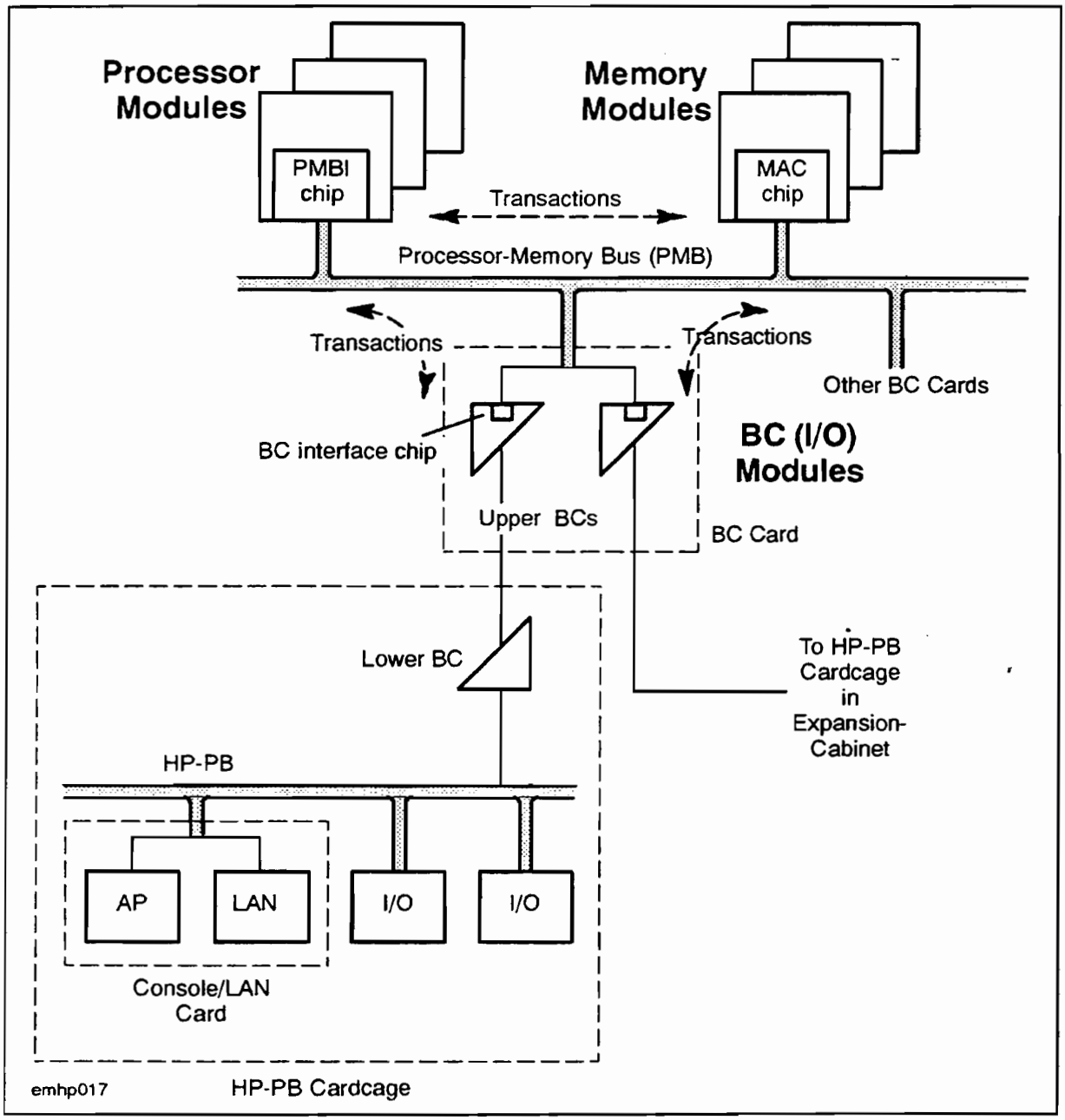

Figure 5-5. Processors, Memory, and I/O on the PMB

Bus converter modules serve as an interface between the central bus (the PMB) and the I/O buses (HP-PBs). I/O modules such as the Access Port and LAN modules are connected to the HP-PB.

Data and control signals are passed over the buses in the form of bus transaction. The module that initiates a bus transaction is the *requestor* or *master*. The module to which a bus transaction is addressed is the *responder* or *slave*.

If a transaction is sent to a *memory address* (an address of EFFF FFFF or below), then the transaction will read or write to main memory.

If a transaction is sent to an *I/O address* (an address of F000 0000 or above), then the transaction is a command to a module in the system, such as an I/O module. I/O addresses on x9x Family are difficult to decode, and are not covered in this manual.

Interface Chips

Each module on the PMB has one or more chips which serve as an interface to the PMB:

- Processor module: PMB Interface (PMBI) chip.
- Memory module: Memory Access Controller (MAC) chip.
- Upper Bus Converter (Upper BC) module: chip not named.

All these interface chips contain registers (such as status registers) that can be used to decode HPMCs.

Processor HPMCs

The simplest HPMC is an internal processor failure, caused by a failure in the cache or TLB.

If a processor detects a fatal internal failure (for example a TLB failure in the CPU), the processor jumps to the HPMC-handling routine in Processor Dependent Code (PDC). Because the processor detects the error directly and the PMB is not involved, no status information is stored in the PMBI chip.

Bus HPMCs

Most HPMCs are detected over the PMB. Each module on the PMB is constantly checking for fatal error conditions. When a module detects a fatal error condition, it stores information in registers on its bus interface chip (for example, a memory module stores information onto its MAC chip.) The module then signals an HPMC over the PMB.

The PMBI chip on a processor detects the signal over the PMB and jumps to the HPMC-handling routine in PDC. HPMCs are then handled as on other PA-RISC systems (see "How PA-RISC SPUs Handle HPMCs" in the previous section).

HPMC Difficulties

HPMCs are often difficult to troubleshoot. When a module on the PMB detects a fatal condition, the error could be caused by:

- The module itself.
- The module that just sent it data (that is, the master of the PMB transaction in which the error was detected.)
- The bus (that is, the backplane).
- Software (for example, if a process generates an address that is outide the bounds of memory).

For example if a memory module detects an error, the error could be caused by:

- A failure in one of its memory banks.
- A failure in the processor or BC module that just sent it data or a control signal (the module that was master for the PMB transaction in which the error was detected).
- The bus (perhaps a bad connector).
- Software (unusual for software used by customers: more common in the OS labs during OS development).

If an error originates in the I/O system, we have two special problems on the x9x Family:

- Translating an I/O address is difficult and is not covered in this manual.
- The x9x Family does not allow us to inspect the status registers on the individual I/O cards such as the AP or LAN cards. All we have is the information stored in the Bus Converters (BCs) to which the the I/O cards are connected.

Sample Tombstone

This section is a guided tour of the HPMC tombstone. We will point out the data you might examine when troubleshooting an HPMC. Relevant data is shaded in the example below. The cookbook procedure later in the chapter will explain how to interpret the data .

```
------- Unexpected HPMC ------------------------------------------------
                                                  05/11/93 06:56:41     ----
                                                  PDC Version 2.11      ----
     Chassis Code: 7ff4                           Processor [15/1       ----
     All codes starting with 7 apply to memory test.
     Registers:
                          o
                          o        /*  Register values */
                          o
       Machine Check Parameters:
     Check Type      = 40000000    CPU STATE     = 9e000007
     Cache Check     = 00000000    PIM state     = Fresh
     TLB Check       = a0000000    Bus Check     = 00000000
     PMBI STATUS     = 00040000    PMBI SRClog   = 00400000
     PMBI SADDlog    = fff7f008    PMBI MADDlo   = fffbc70d
     SYNlog          = 55555555    CPU DIAG0     = 019c3e03

     Slave Address   = fff7f008
     BLKID           = 0000     BANK          = 66
     SLOT            = 0

     MADDlog Breakdown:
     ARB             = f        FLEX|FIXED    = ffbc
     R               = 0        M             = 1
     S               = 1        T             = 1
     Trans. Type   = 000d

     MAC_Slot          IO_Stat  Err_Resp Info+Req
         5             00006540 000065a0 4ffbc0b3

     BC Slot IOHI/LO   IO_Stat  Err_Resp Info+Req
         0   fff8fff0 00700040 03de9a52 fffbffdb  (upper)
                      00011e48 fff7d008 0ffbcf80  (lower)
         0   fd77f554 f0d048c3 86d9ede3 fdf9ff5f  (upper)
                      00000000 00000000 00000000  (lower)
```

Top of the Tombstone

If you are using the SP DL command to look at the tombstone. the top of the tombstone should be labeled:

```
------- Unexpected HPMC ------------------------------------------------
```

The upper right of the tombstone has the date and time the HPMC occurrred:

```
                                                  05/11/93 06:56:41     ----
                                                  PDC Version 2.11      ----
                                                  Processor [15/1]      ----
```

The version of PDC is given. as well as the processor that experienced the HPMC. The processor is specified as a slot and module number (for T500/991/995) or as a slot number (for 890/990/992).

In PDC versions 2.x. the tombstone displays the chassis code (an error code composed of four hex digits):

```
Chassis Code: 7ff4
All codes starting with 7 apply to memory test.
```

The tombstone also displays a brief explanation of the error code. For more information. see Table 5-10 and "Format of Chassis Codes" in this chapter.

Registers Displayed by the Tombstone

The rest of the tombstone shows the contents of registers. We are only interested in the registers in the section labeled:

```
Machine Check Parameters:
```

The most important register for decoding HPMCs is the PMBI STATUS register:

```
PMBI STATUS    = 00040000     PMBI SRClog  = 00400000
```

The PMB Interface (PMBI) chip serves as the interface between a processor module and the PMB bus (see Figure 5-5). After an HPMC. troubleshooting information is stored in the status register on the PMBI chip for a processor detecting an error. The first step in decoding HPMCs is usually to look at the last several digits of this register.

Depending on the values of these digits. you may look at the PMBI SADDlog register:

```
PMBI SADDlog   = fff7f008     PMBI MADDlo  = fffbc70d
```

The PMBI SADDlog register contains the Slave ADDress (SADD). The SADDlog is the address of the module that was the slave (responder) for the bus transaction in which the HPMC was detected. Decoding the SADDlog can be a complex and time-consuming process on the x9x Family. Rather than explain how to decode the SADDlog. the cookbook procedure explains:

- How to identify a SADDlog value as an I/O address (it begins with "F").
- How to tell whether a SADDlog value is spurious (the SADDlog value is greater than configured memory).

In some cases. the tombstone decodes the slave address for you:

```
Slave Address  = 001510e0
BLKID          = 0047     BANK          = 3
SLOT           = 6
```

In many cases, however, the slave address is not decoded (for example in the sample tombstone just given):

```
Slave Address  = fff7f008
BLKID          = 0000     BANK          = 66
SLOT           = 0
```

Note the 0's in the fields for SLOT (the PMB slot containing the memory card) and BLKID (the block ID for the memory module). These 0's indicate that a decoding was not possible. (The value of 66 for BANK is also spurious.)

The next registers of interest are the registers under the `MAC Slot` title:

```
MAC_Slot          IO_Stat  Err_Resp Info+Req
    5             00006540 000065a0 4ffbc0b3
```

Each memory card has a MAC (Memory Access Controller) chip with several troubleshooting registers. See Figure 5-5. Memory-related errors (errors in the memory card or errors from another module directed to a memory card) are reported in the `IO_Stat` register for that memory card. A MAC chip detected an error when its IO_Stat register ends in 1440, 14C0, 1540, 6540, D040, or D0C0.

The `Err_Resp` register contains the slave (responder) address in a PMB bus transaction sent to a MAC chip when an error was detected. Similarly, the `Info+Req` register contains the address of the Requestor (master) in the PMB bus transaction when an error was detected.

Cookbook for Decoding HPMCs

The following is a cookbook for decoding HPMCs on the x9x Family. See Figure 5-6 for a flow-chart diagram of the process. This cookbook is a much shortened version of the procedure developed for Response Center Engineers.

1. **Get access to PIM data** (tombstone display). Three possibilities:
   a. **If the circuit breaker switch on the x9x Family is ON,** you can use the DL command at the SP> prompt.
      i. Access the SP prompt by typing (Control)-(B), then SP (RETURN).
      ii. Enter the HC (Hardware Configuration) command to see the processors in the system.
      iii. Enter the DL (Display Logs) command.
      iv. Enter T to see which tombstones are available.
      v. Enter the number of the tombstone with the most current data and time.
   b. **If you can get to the PDC prompt** (the system must be offline).
      i. Enter the PDC command TOMB to get to the Tombstone Menu.
      ii. Enter the PDC command DISPLAY *n* (where *n* is the slot # of the processor).
   c. **Get tombstone data from customer.**
2. **Verify HPMC time, date, and processor.** Look at the text at the top right of the tombstone for HPMC time, HPMC date, PDC revision, and slot/module number of the processor which reported the HPMC.
   a. **If the tombstone has the title Unexpected HPMC** (which it should), continue with this troubleshooting process.
   b. **If the tombstone has the title Tombstone Review**, the tombstone data may be corrupt; call the Response Center. You can continue with the troubleshooting process, but be aware that the data may not be valid.
   c. **If the tombstone has the title Unexpected LPMC or Unexpected Trap #XX,** call the Response Center. END.
3. **Look at the 4-digit chassis code (error code) near the top of the tombstone (PDC versions 2.x).** The tombstone provides an English-language translation in the line beneath the chassis code. The chassis code may provide hints as to the cause of the HPMC. See Table 5-10 and "Format of Chassis Codes" in this chapter.
4. **If the PMBI STATUS register does not end in 4 or 6**, the HPMC is an error on the CPU chip. Recommended action is to replace the processor card. END.
5. **Look at the last three digits in the PMBI STATUS register.**

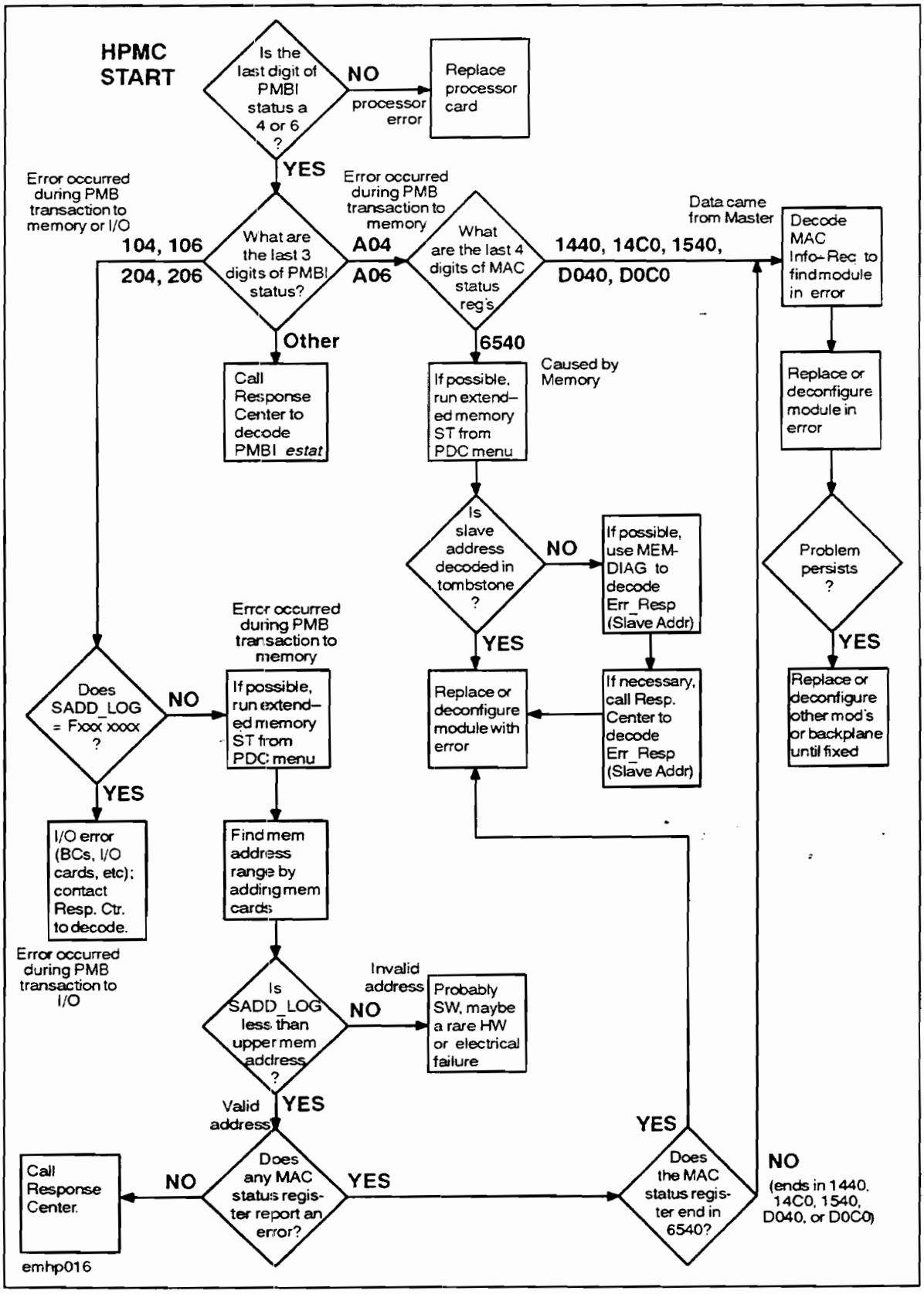

Figure 5-6. Flowchart for Decoding HPMCs

6. **If the PMBI STATUS register ends in A04 or A06**, an error occurred during a memory transaction with the PMBI chip as the master. To determine the cause of the error, look at the MACx status registers.

   a. **If a MACx status register ends with 1440, 14CO, 1540, D040 or D0C0**, suspect the master of the transaction (the requestor) as the cause of the error. For example:

```
MAC_Slot        IO_Stat   Err_Resp Info+Req
  5             00001540  000065a0 4ffbc0b3
```

      i. **Decode the MACx Info+Req register** corresponding to the MACx status register with the error. You can use the register templates below to convert from hex to binary. For an example see Figure 5-13.

         1) Bits 4 - 13 of the MACx Into+Req register specify the bus on which the requestor (master) is located:

            a) Binary 11 1111 1110 (0x3FE) = Central Bus (PMB for the 99x/890/T500).
            b) Binary 11 1111 1101 (0x3FD) = Internal HP-PB (first BC).
            c) If bits 4-13 translate to other values, call the Response Center.

         2) Bits 14 - 17 translate to a slot number.

         3) Bits 18 - 19 point to a module in the slot.

Hex to Binary

1 = 0001	5 = 0101	9 = 1001	D (13) = 1101
2 = 0010	6 = 0110	A (10) = 1010	E (14) = 1110
3 = 0011	7 = 0111	B (11) = 1011	F (15) = 1111
4 = 0100	8 = 1000	C (12) = 1100	

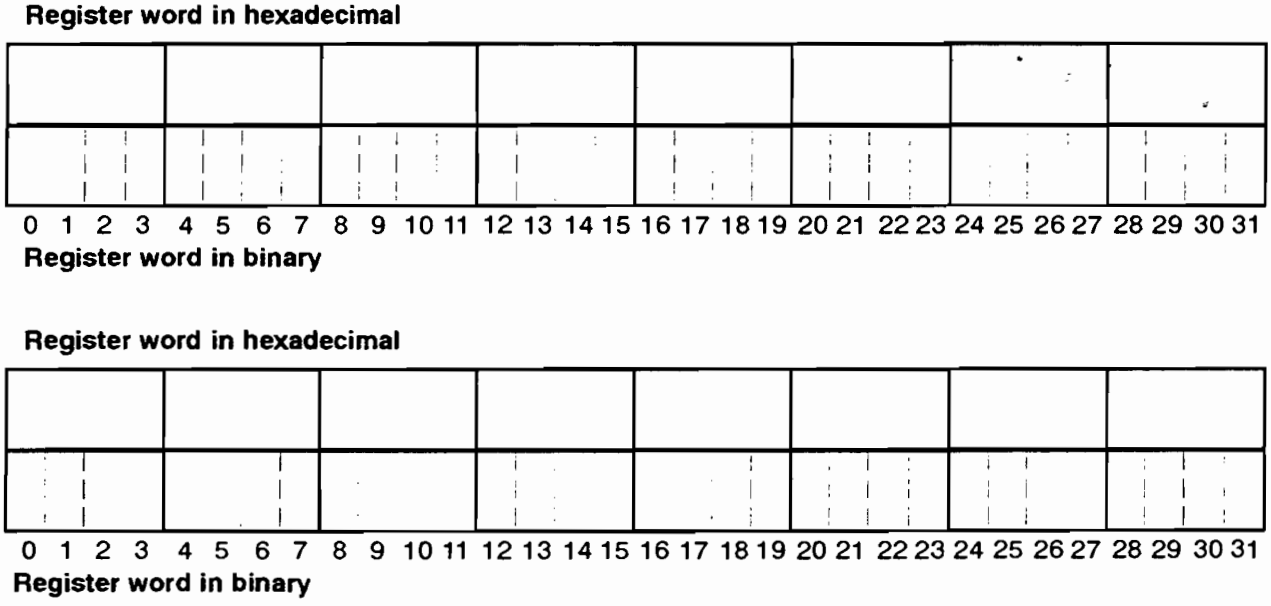

Figure 5-7. Register Diagram for Info+Req

ii. **Replace or deconfigure the requestor (master) module in error.**

iii. **If problem persists**, the next probable source of the error is some electrical/backplane problem or the memory card. Continue replacing/deconfiguring PMB modules and the backplane until the problem is fixed. END.

b. **If a MACx status register ends with 6540**, the MAC_Slot which reports this value contains the memory card that had an ECC error at the time of the HPMC. The memory card in this slot (the responder) is probably responsible for causing the HPMC. You can try replacing this memory card. END.

If you want to locate the memory bank that probably caused the HPMC (for example, so you can use the HC command at the SP prompt to deconfigure the memory bank):

i. **Optional: Verify that the value for the MACx Err_Resp register matches the value for the PMBI SADD_LOG register.** (This step is a confidence builder that the memory bank pointed to will be the correct one.

ii. **If you can get access to the PDC prompt, run the Extended Memory Selftest** to locate the memory failure:

1) At the PDC Main Menu enter `SE` to get to the Service Menu.

2) At the Service Menu enter `MT` to run the Extended Memory Selftest.

3) If the selftest locates a failing bank, deconfigure the bank or replace the card containing the bank. END.

iii. **If the Err_Resp register has been decoded by PDC**, check the "Slave Address" portion of the tombstone for the memory block ID (BLKID) of the SADD_LOG address. For example:

```
Slave Address  = 001510e0
BLKID          = 0047    BANK        = 3.
SLOT           = 6
```

The BLKID value points to the module which caused the error (0047 in this example). The SLOT value shows the slot in which this module is located (slot 6 in this example). The BANK value shows the bank on the memory card which caused the error (bank 3 in this example); this is the value to use with the HC command to deconfigure a bank.

iv. **If the Err_Resp register (Slave Address) has not been decoded by PDC**, you can use MEMDIAG to decode the memory address. See the procedure at the end of this chapter ("Using MEMDIAG to Decode Memory Addresses").

v. **If you cannot use MEMDIAG to decode the Err_Resp register (Slave Address)**, call the Response Center to decode it.

vi. **Replace or deconfigure the module or entire card in error.** END.

vii. **If problem persists**, continue replacing/deconfiguring PMB modules and the backplane until the problem is fixed. END.

7. **If the PMBI STATUS register ends in 104, 106, 204 or 206:**

   a. **If the PMBI SADD_LOG register begins with F** (Fxxxx xxxx), the HPMC originated in I/O (BCs, I/O cards, connectors, cables, etc.) For further help in decoding the tombstone, call the Response Center. Decoding I/O addresses can be complex and is not covered in this manual.

   b. **If the PMBI SADD_LOG register does not begin with F**, the transaction was directed to main memory.

      i. **If you can get access to the PDC prompt, run the Extended Memory Selftest** to locate the memory failure:

         1) At the PDC Main Menu enter `SE` to get to the Service Menu.
         2) At the Service Menu enter `MT` to run the Extended Memory Selftest.
         3) If the selftest locates a failing bank, deconfigure the bank or replace the card containing the bank. END.

      ii. **Check to see if the PMBI SADD_LOG address falls within the configured memory space.** Determine the memory address range by adding together the memory cards in the system to get a total number of MB. Use Table 5-28 to convert between MBs and addresses.

Table 5-28. Commonly Used Hex Numbers

Hex Number	Value	Hex Number	Value
0000 0100	256	0100 0000	16 MB
0000 0400	1 KB	0400 0000	64 MB
0000 1000	4 KB	0800 0000	128 MB
0000 4000	16 KB	1000 0000	256 MB
0001 0000	64 KB	1800 0000	384 MB
0002 0000	128 KB	2000 0000	512 MB
0004 0000	256 KB	4000 0000	1 GB
0010 0000	1 MB	8000 0000	2 GB
0040 0000	4 MB		

      iii. **If value for PMBI SADD_LOG is greater than the memory address range**, then the SADD_LOG value is invalid. The error was due to software or a unique hardware failure, possibly backplane/electrical-related. Verify that SW is the cause by re-running suspect programs to duplicate the error. END.

      iv. **If PMBI SADD_LOG falls into the configured memory address range**, then it is valid.

      v. **Check the last four digits of all MAC IO_Stat registers.**

1) **If any MAC IO_Stat register ends in 6540** then an error is indicated for that memory module. Replace or deconfigure the module in error. END.
2) **If any MAC IO_Stat register ends in 1440, 14C0, 1540, D040, or D0C0.** then an error could have occurred in the the master of the transaction or the memory module. Try decoding the Info+Req register for the MAC chip reporting the error. (See the procedure in step 6a.) Replace or deconfigure the module in error. Try replacing or deconfiguring the memory module. END.
3) **If NONE of the MAC IO_Stat registers ends in 1440, 14C0, 1540, 6540, D040, or D0C0.** then no error was logged. Call the Response Center to decode the SADD_LOG register. **Replace or deconfigure the module in error.** END.

vi. **If problem persists,** continue replacing/deconfiguring PMB modules and the backplane until the problem is fixed. END.

8. **If the results are still unclear**, the HPMC may have been caused by software. You can make a memory dump and submit it to personnel trained in dump analysis. END.

HPMC Examples

This section gives examples of using HPMC tombstones to troubleshoot HPMCs. If you would like to contribute HPMC case studies for HP-PB machines, please send them to "STD Hardware/HPG200/04" on HPDesk.

- Example 1: An HPMC Caused by an ITLB Failure
- Example 2: An HPMC Caused by a Memory Error (T500/991/995)
- Example 3: An HPMC Caused by a Failed HP-PB Card
- Example 4: An HPMC Probably Caused by Software
- Example 5: An HPMC Caused by a Memory Error

Note

These examples are actual, "real-world" HPMCs. Like real-world HPMCs, these HPMCs do not always have definite answers.

Example 1: An HPMC Caused by an ITLB Failure

The following example describes an HPMC caused by a failed Instruction TLB (ITLB) on a processor card in an 890/990/992 A portion of the HPMC tombstone is shown in Figure 5-8.

```
------- Unexpected HPMC ------------------------------------------------
                                                12/23/92 01:25:27     ----
                                                PDC Version 1.50      ----
     Registers:                                 Processor in slot 15  ----
                              .
                              .
                              .
                              .
     Machine Check Parameters:
     Check Type      = 40000000    CPU STATE     = 9e000007
     Cache Check     = 00000000    PIM state     = Fresh
     TLB Check       = a0000000    Bus Check     = 00000000
     PMBI STATUS     = 00040000     PMBI SRClog  = 00400000
     PMBI SADDlog    = fff7f008    PMBI MADDlo   = fffbc70d
     SYNlog          = 55555555    CPU DIAGO     = 019c3e03
                              .
                              .
                              .
```

Figure 5-8. Tombstone for an HPMC Caused by an ITLB Failure

Like most processor-generated HPMCs, this HPMC tombstone is easy to decode. Following the HPMC cookbook procedure:

1. **Get access to HPMC data** (We already have the tombstone information.)
2. **Verify HPMC time, date, and processor.** Looking at the top of the tombstone, we learn:
   a. This is an "Unexpected HPMC" and we should continue with the troubleshooting process.
   b. The HPMC occurred December 23, 1992 ("12/23/92") at 1:25 am Universal Time (= GMT).
   c. PDC Version was 1.50.
   d. Processor was located in PMB slot 15.
3. **Since the PMBI STATUS register does not end in a 4 or 6,** we know that the HPMC was caused by the processor card. Recommended action is to **replace the processor card in slot 15.**

Example 2: An HPMC Caused by a Memory Error (T500/991/995)

The following example (Figure 5-9) shows the tombstone display for a memory error on a T500/991/995. The version of PDC is a preliminary version.

```
------- Unexpected HPMC ---------------------------------------------------
                                                  06/25/93 03:00:27     ----
                                                  PDC Version 2.11      ----
     Chassis Code: 7ff4                           Processor [15/1]      ----
     All codes starting with 7 apply to memory test.

     Registers:
                          .
                          .
     Machine Check Parameters:
     Check Type      = 20000000    CPU STATE     = 9e000002
     Cache Check     = 00000000    PIM state     = Fresh
     TLB Check       = 00000000    Bus Check     = 00300035
     PMBI STATUS     = 8a0c0a04    PMBI SRClog   = 00400000
     PMBI SADDlog    = 11b56240    PMBI MADDlo   = 3ffbd7cb
     SYNlog          = 002e0098    CPU DIAGO     = 02893e11

     Slave Address   = 11b56240
     BLKID           = 0000    BANK          = 0
     SLOT            = 0

     MADDlog Breakdown:
     ARB             = 3       FLEX|FIXED    = ffbd
     R               = 0       M             = 1
     S               = 1       T             = 1
     Trans. Type   = 00cb

     MAC_Slot          IO_Stat  Err_Resp Info+Req
         4             00000040 5037cca0 4ffb90ab
         6             00006540  4caadd60 4ffb90ab
         8             00000040 20000000 0ffb80ab
         9             00000040 30000000 0ffb90ab
         a             00000040 48000000 0ffbd0ab
         b             00000040 50000000 0ffbd0ab
```

Figure 5-9. Tombstone for an HPMC on an T500/991/995 Caused by a Memory Error

Following the flowchart:

1. **Get access to HPMC data.** (We already have the HPMC tombstone information.)
2. **Verify HPMC time, date, and processor.** Looking at the top of the tombstone, we learn:

a. This is an "Unexpected HPMC" and we should continue with the troubleshooting process.

b. The HPMC occurred June 25. 1993 ("06/25/93") at 03:00 Universal Time (= GMT).

c. PDC Version was 2.11.

d. Processor was slot 15. module 1 (The T500/991/995 can have two processor modules in each slot.)

3. **The chassis code was 7ff4 (memory test).** This gives us evidence that the error was caused by memory.

4. **The PMBI STATUS register ends in a 4 or 6** (8a0c0a04 ends in 4). Therefore we continue interpreting the PBMI STATUS word.

5. **The PMBI STATUS register ends in a04.** so we know the error occurred during a PMB transaction to memory.

6. **The MAC IO_Stat (status) register for slot 6 ends in 6540** indicating that the error was generated by the memory card in slot 6. We can deconfigure or replace that memory card.

7. **If we wanted to identify the bank that caused the error:**

   a. **We could run the Extended Memory Selftest** from the PDC Service Menu. Running the extended selftest may locate the bad memory bank right away.

   b. **We could contact the Response Center** to decode the memory address (SADDlog address).

Example 3: An HPMC Caused by a Failed HP-PB Card

The following example describes an HPMC caused by a failed HP-PB card. A portion of the HPMC tombstone is shown in Figure 5-10.

```
Machine Check Parameters:
Check Type      = 20000000    CPU STATE     = 9e000002
Cache Check     = 00000000    PIM state     = Fresh
TLB Check       = 00000000    Bus Check     = 00300036
PMBI STATUS     = 8a040104     PMBI SRClog  = 00400000
PMBI SADDlog    = ffeec034     PMBI MADDlo  = effb870d
SYNlog          = 523cf341    CPU DIAG0     = 02883e03

Slave Address   = ffeec034
BLKID           = 0000     BANK          = 66
SLOT            = 0

MADDlog Breakdown:
ARB             = e        FLEX|FIXED    = ffb8
R               = 0        M             = 1
S               = 1        T             = 1
Trans. Type   = 000d

MAC_Slot          IO_Stat  Err_Resp Info+Req
    4             00000040 00000000 0ffb80ab
    6             00000040 10000000 0ffbc0ab

BC Slot IOHI/LO   IO_Stat  Err_Resp Info+Req
    0   fff8fff0 c0f00040 ffe80010 0ffb800e  upper)
                 00011e48 fff41008 0ffb8f80  lower)
    0   fff0ffe8 b0e048c2 ffefc034 0ffb800f  upper)
                 00000080 00000080 00000080  lower)
```

Figure 5-10. Tombstone for an HPMC Caused by a Failed HP-PB Card

Following the HPMC flowchart in Figure 5-6:

1. **Get access to HPMC data.** (We already have the HPMC tombstone information.)
2. **Verify HPMC time, date, and processor** by looking at the top of the tombstone. (Not shown in this example.)
3. **The PMBI STATUS register ends in a 4 or 6** (8a04 0104 ends in 4). Therefore we continue interpreting the PMBI STATUS word.
4. **The PMBI STATUS register ends in 104,** so we look at the SADD_LOG register to see if the transaction was directed to I/O address space. Since SADD_LOG (PMBI SADDlog) is ffeec034 and begins with "f", the transaction was directed to I/O address space.
5. **We have identified the error as an I/O error** (upper or lower BC cards, I/O cards, connectors, cables, etc.) This is as far as we can go with the cookbook procedure. We would have to call the Response Center for further decoding.

This example was generated by a failed HP-PB card in slot 11. Replacing the HP-PB card solved the problem.

Example 4: An HPMC Probably Caused by Software

The following example describes an HPMC that was probably caused by software. This example does not have a clear-cut solution. However it does show how a tombstone can help you narrow down the possible causes of an HPMC. A portion of the HPMC tombstone is shown in Figure 5-11.

```
------- Unexpected HPMC ------------------------------------------------
                                                02/11/93 17:27:20     ----
                                                PDC Version 1.50      ----
     Registers:                                 Processor in slot-14  ----
                          .
                          .
                          .
     Machine Check Parameters:
     Check Type      = 20000000    CPU STATE     = 1e000003
     Cache Check     = 00000000    PIM state     = Fresh
     TLB Check       = 00000000    Bus Check     = 0030003f
     PMBI STATUS     = 8a040204     PMBI SRClog  = 00400000
     PMBI SADDlog    = 2b7a8c60     PMBI MADDlo  = effb87b3
     SYNlog          = 00007e00    CPU DIAG0     = 039c3e03

     Slave Address   = 2b7a8c60
     BLKID           = 0000     BANK          = 66
     SLOT            = 0

     MADDlog Breakdown:
     ARB             = e        FLEX|FIXED    = ffb8
     R               = 0        M             = 1
     S               = 1        T             = 1
     Trans. Type   = 00b3

     MAC_Slot          IO_Stat  Err_Resp Info+Req
         4             00000040 00000080 0ffb80ab
         6             00000040 00000080 0ffbc0ab
                          .
                          .
```

Figure 5-11. Tombstone for an HPMC Probably Caused by Software

Following the flowchart:

1. **Get access to HPMC data.** (We already have the HPMC tombstone information.)
2. **Verify HPMC time, date, and processor.** Looking at the top of the tombstone, we learn:
   a. This is an "Unexpected HPMC" and we should continue with the troubleshooting process.

b. The HPMC occurred February 11, 1993 ("02/11/93") at 17:27 Universal Time (= GMT).

c. PDC Version was 1.50.

d. Processor was located in slot 14.

3. **The PMBI STATUS register ends in a 4 or 6** (8a040204 ends in 4). Therefore we continue interpreting the PBMI STATUS word.

4. **The PMBI STATUS register ends in 204**, so we look at the SADD_LOG register to see if the transaction was directed to I/O address space. Since SADD_LOG (PMBI SADDlog) is 2b7a8c60 and does not begin with "f", the transaction was directed to memory address space.

5. **If possible run the Extended Memory Selftest** from the PDC Service Menu. Running the extended selftest may locate the bad memory card right away. For the sake of this example, let's assume that you could not run the extended memory ST.

6. **Determine whether the PMBI SADD_LOG falls within the configured memory.** We have a memory address. Is it a valid address?

   a. Convert the PMBI SADD_LOG to a value in Megabytes.

   For a rough estimate, we can round the SADD_LOG value of 2b7a8c60 to 2c000000. According to Table 5-28, 20000000 is 512 MB and 01000000 is 16 MB. Calculating:

```
2c00 0000    =  2000 0000      +      0c00 0000

             =    512 MB       +    ( 0100 000  * 0xc )

             =    512 MB       +    (   16 MB   * 12  )

             =    512 MB       +            192 MB

             =              704 MB
```

   Therefore, the PMBI SADD_LOG value is within the configured range of memory if the system has at least 704 MB.

   b. In this example, we didn't have access to the machine and we couldn't directly determine the amount of memory configured. However, in this example we can get a rough estimate of memory from the number of MAC+Slot entries in the tombstone.

7. **Using MAC_Slots to estimate maximum memory.**

By looking at the number of MAC_Slot entries in the tombstone we can tell that the PMBI SADD_LOG memory address is beyond the range of configured memory. Looking at the tombstone:

```
MAC_Slot        IO_Stat   Err_Resp  Info+Req
    4           00000040  00000080  0ffb80ab
    6           00000040  00000080  0ffbc0ab
```

The tombstone contains only two MAC_Slot entries, meaning that there are only two memory modules (memory cards). Each memory module/card can contain a maximum of 4 banks of 64 MB (for a total of 256 MB/slot).

$$\text{Max. memory possible} = \frac{64\ \text{MB}}{\text{bank}} * \frac{4\ \text{banks}}{\text{MAC\_Slot}} * \frac{2\ \text{MAC\_Slots}}{1}$$

$$= 64\ \text{MB} * 4 * 2$$

$$= 512\ \text{MB}$$

The maximum possible memory in the system is 512 MB. and yet the SADD_LOG address requires at least 704 MB to be valid.

8. Therefore we know that **SADD_LOG is NOT within configured memory and the address is invalid.** The error is probably due to software or to a unique hardware failure. possibly backplane/electrical related. Possible troubleshooting strategy is to verify that SW is the cause by re-running suspect programs to duplicate the error.

   The error is probably due to software being run under the OS. If the error is not due to software, it may be due to a unique hardware problem, possibly backplane/electrical-related, possibly a CPU error. The information in the tombstone does not allow us to pinpoint the error further more than this. The HPMC was probably not caused by processor errors, memory module errors, or errors in the I/O system.

According to the person submitting the HPMC, the cause of the error was unknown.

Example 5: An HPMC Caused by a Memory Error

The following example describes an HPMC caused by a bad memory card. A portion of the HPMC tombstone is shown in Figure 5-12.

```
------- Unexpected HPMC ------------------------------------------------
                                                02/15/93 17:27:20     ----
                                                PDC Version 1.50      ----
     Registers:                                 Processor in slot 14  ----


     Machine Check Parameters:
     Check Type      = 20000000    CPU STATE     = 1e000002
     Cache Check     = 00000000    PIM state     = Fresh
     TLB Check       = 00000000    Bus Check     = 00300036
     PMBI STATUS     = 8a040106     PMBI SRClog  = 00400000
     PMBI SADDlog    = 01805220     PMBI MADDlo  = effb87b3
     SYNlog          = caf3fa5d    CPU DIAG0     = 02983e03

     Slave Address   = 01805220
     BLKID           = 0000     BANK          = 66
     SLOT            = 0

     MADDlog Breakdown:
     ARB             = e        FLEX|FIXED    = ffb8
     R               = 0        M             = 1
     S               = 1        T             = 1
     Trans. Type   = 00b3

     MAC_Slot          IO_Stat  Err_Resp Info+Req
         4             00001440 00000000 0ffb80ab
         6             00001440 10000000 0ffb80ab
         8             00001440 20000000 0ffbc0ab
         9             00001440 30000000 0ffbc0ab
```

Figure 5-12. Tombstone for an HPMC Caused by a Bad Memory Card

Following the flowchart:

1. **Get access to HPMC data** In this example, the SP DL command was used to access the data.
2. **Verify HPMC time, date, and processor.** Looking at the top of the tombstone, we learn:
   a. This is an "Unexpected HPMC" and we should continue with the troubleshooting process.

b. The HPMC occurred February 15, 1993 ("02/15/93") at 17:27 Universal Time (= GMT).

c. PDC Version was 1.50.

d. Processor was located in slot 14.

3. **The PMBI STATUS register ends in a 4 or 6** (8a040106 ends in 6). Therefore we continue interpreting the PBMI STATUS word.

4. **The PMBI STATUS register ends in 104**, so we look at the SADD_LOG register to see if the transaction was directed to I/O address space. Since SADD_LOG (PMBI SADDlog) is 01805220 and does not begin with "f", the transaction was directed to memory address space.

5. **If possible run the Extended Memory Selftest** from the PDC Service Menu. Running the extended selftest may locate the bad memory card right away. For the sake of this example, let's assume that you could not run the extended memory ST.

6. **Determine whether the PMBI SADD_LOG falls within the configured memory.** We have a memory address. Is it a valid address?

   a. Convert the PMBI SADD_LOG to a value in Megabytes.

   For a rough estimate, we can round the SADD_LOG value of 01805220 to 02000000 According to Table 5-28, 01000000 is 16 MB. Calculating:

   ```
   0200 0000    =  0100 0000  *  2

                =    16 MB    *  2

                =          32 MB
   ```

   Therefore, the PMBI SADD_LOG value is within the configured range of memory if the system has at least 32 MB. The minimum memory possible on any 89x/99x system is 64 MB. Therefore, this address falls within configured memory.

7. **Since PMBI SADD_LOG is within configured memory,** the address is probably valid.

   a. **Examine the MAC IO_Stat registers to see if an error was recorded.** In this example, all the MAC_Slots have IO_Status values of 00001440. An error could have occurred in the master of the transaction or in memory.

   b. **Decode the Info+Req registers to locate the master.** See Figure 5-13:

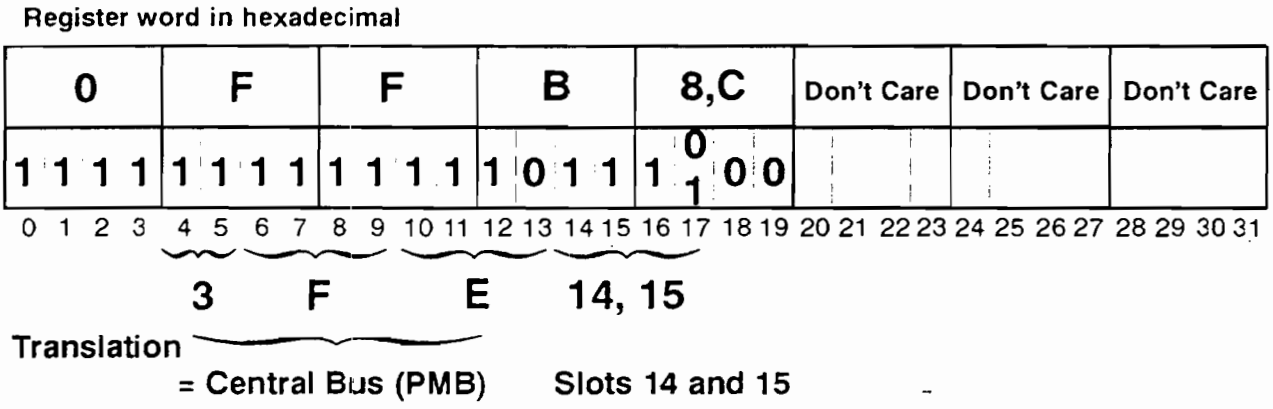

Figure 5-13. Decoding a Info+Req Register

i. Notice that there are two different addresses in the MAC Info+Req fields: 0ffb80ab and 0ffbc0ab. Because the addresses are so similar we can translate them at the same time.

ii. **Put the hex digits into the register diagram** given in Figure 5-7. The result is shown in Figure 5-13. We do not need to translate the last three digits.

iii. **Translate the hex digits to binary.** You can use the chart in Figure 5-7.

iv. **Convert bits 4 - 13 to a hex number** to find the bus on which the master is located. Bits 4 - 5 translate to the first hex digit (111 -> 3). Bits 6 - 9 translate to the second hex digit (1111 -> F). Bits 10 - 13 translate to the third hex digit (1110 -> E). The resulting hex number is 3FE which represents the PMB. (The hex number 3FD represents the HP-PB bus inside the SPU: other hex numbers are more difficult to decode and require the assistance of the Response Center.)

v. **Convert bits 14 -17 to a hex or decimal number** to obtain the slot number. In this example we have two possibilities. 1110 and 1111. These values translate to slots E (14) and F (15).

vi. **Convert bits 18 - 19 to a hex number** to find the module number. In this case, 00 translates to 0. representing module 0.

vii. **To summarize:** We have located the master(s) to be on the PMB (hex 3FE) in slots 14 and 15. The masters are module 0. Typically processor cards are located in slots 14 and 15.

c. **Replace or deconfigure the modules in error.** We can try replacing or deconfiguring the processor cards. If that fails to resolve the problem. we can replace or deconfigure the memory card represented by the PMBI SADDlog (01805220): the Response Center would have to decode the address. (Better yet. run the Extended Memory Selftest from PDC).

According to the person submitting this HPMC, the error was due to a bad memory card.

Using MEMDIAG to Decode Memory Addresses

When a memory error occurs, the memory address in error may be reported by the HPMC tombstone (PIM) or other troubleshooting messages. You can use MEMDIAG to map this memory address to the memory card which contains it.

Note

You must perform this procedure on the machine with the address you want to map. (Different machines have different memory configurations and will map addresses differently.)

To map a (physical) memory address to a memory card:

1. Check to see if any memory modules are deconfigured:
   a. Enter Control-B at the system console.
   b. At the CM> prompt, enter `SP` to enter Service Processor (SP) mode.
   c. At the SP> prompt, enter `HC` to display the hardware configuration.
   d. If the HC display shows that a memory module is deconfigured, there are two possibilities:
      i. The memory module was deconfigured before any error at the memory address you are decoding. MEMDIAG will translate your address correctly.
      ii. The memory module was recently deconfigured as a result of a memory error at the memory address you are decoding. MEMDIAG will probably not translate the memory address correctly, since deconfiguring a module changes memory mapping on a system. Note, however, that the deconfigured module contains the memory block in error.
   e. Press the Return key to exit from the HC command.
   f. At the SP> prompt, enter `CO` to return to console mode.
2. If necessary, set the diagnostic license.
3. At the system prompt, type `sysdiag`.
4. At the DUI> prompt, type `memdiag sc 8`. (This command runs section 8 of MEMDIAG—the interactive mode.)
5. At the MEMDIAG prompt, type 4 to set MEMDIAG parameters.
6. At the MEMDIAG Parameters prompt, type 10 to map physical address to a memory card (MA & MC).
7. The program displays several screens of memory configuration information.
8. At the prompt, enter the physical address (in hexadecimal) of the memory location. For example: `dfae8`.
9. The program displays the slot and block numbers for the corresponding memory card (MA and/or MC).
10. To translate another physical address, type 10 at the MEMDIAG Parameters prompt. To exit MEMDIAG, type 12.

Example

```
CM> SP
Connecting to Service Processor.  (APMSG 10)

SP> HC

Host Hardware Configuration:    (1 - deconfigure; - = non-existent port)
-------------------------------------------------------------------
|      |                  | Deconfigured      | Ports to be decnf |
| PMB  |                  | Ports             | at next boot      |
| Slot | Board Type       |  0 |  1 |  2 |  3 |  0 |  1 |  2 |  3 |
-------------------------------------------------------------------
|   0  | Bus Converter    |    |    |    |    |    |    |    |    |
|   4  | Memory           |    |    |    |    |    |    |    |    |
|   9  | Memory           |    |    |    |    |    |    |    |    |
|  12  | PCX Processor    |    |    |    |    |    |    |    |    |
-------------------------------------------------------------------

Enter the slot # of the module whose configuration is to be changed
(CR = exit): [Return]

SP> CO

HPsys14|PUB.SYS: sysdiag

*****************************************************************
******                                                   ******
******              ONLINE DIAGNOSTIC SYSTEM             ******
                              .
                              .

DUI > memdiag sc 8
*****************************************************************
******                                                   ******
******                 M E M D I A G                     ******
```

```
Welcome, Today is TUE, SEP 29, 1992 at 10:06 AM

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          ============================================

                    M E M D I A G    M E N U

          ============================================
                              .
                              .
           4.   Set  MEMDIAG parameters
                              .
                              .
          Input number >>> 4

    SELECTION # 4 :  Set MEMDIAG Parameters

       Set MEMDIAG Parameters
      ------------------------------------------------
                              .
                              .
       10.  Map physical address to MA & MC
       11.  Exit to Main Menu
       12.  Exit to DUI
      (CR)  STEP THROUGH ALL PARAMETER CHOICES
      ------------------------------------------------
      Input number desired or (CR) to STEP through parameters.  10
-------------------------------------------------------------------------------
Memory Module     #           0
-------------------------------------------------------------------------------
Slot number       =           6

Hard Physical     =      fff98000
Address (hex)

Memory Status     =       Enabled

Memory size       =           256
 (in Mbytes)

Chip size         =       4194304
 (in bits)

Associated        =           4
 Memory Blocks
```

```
Memory Interleave is ON.
Start Page      =             0
End Page        =        131070
Page Range      =        131071

>>> MEMORY BLOCKS under control of MEMORY MODULE in Slot #          6
-------------------------------------------------------------------------
Memory Block     #            0          1          2          3
-------------------------------------------------------------------------
Memory size      =           64         64         64         64
 (in Mbytes)

Memory Status    =      Enabled    Enabled    Enabled    Enabled
Interleave Group=             1          1          1          1
Block ID (hex)   =           40         41         42         43
-------------------------------------------------------------------------
>>> WARNING:  The following answer will be correct for the above
              memory configuration only.
  Input PHYSICAL ADDRESS in hexadecimal format for mapping.
     (Example: a1, 198, 5ab9001f.  Maximum length of a hexadecimal number
      is 8.  Valid number for a hexadecimal is [0-9], [A-F], and [a-f].
      Any number that is separated by a space/spaces will be ignored).
     (CR) if no mapping is needed >>>
32
***  Memory Module in Slot 6 , and Block Number 1  map to this
***  address/page.

       Set MEMDIAG Parameters
      ------------------------------------------------

       10.  Map physical address to MA & MC
       11.  Exit to Main Menu
       12.  Exit to DUI
      (CR)  STEP THROUGH ALL PARAMETER CHOICES
      ------------------------------------------------
      Input number desired or (CR) to STEP through parameters.  12

DUI>
```

6

Diagnostics and Utilities

Chapter Contents:

- Online diagnostics and utilities.
- Offline utilities.
- Booting from the Support tape.
- Running the System Exerciser (SX).

Note

Diagnostics listed in this chapter can be found online, on the Support Tape, or on the Service Tools Tape. In addition, you can access commands related to diagnostics from the PDC interface:

- The MEMTEST command, available at the Service Command menu, causes extended memory self-tests to execute.
- The SELFTEST command, available at the Service Command menu, allows you to set/clear the flags that determine which self-tests are executed by PDC.

For more information about PDC commands, refer to Chapter 12a, *Processor Dependent Code (PDC)* in this CE Handbook.

Other references:

For detailed information on diagnostic subsystems and utilities, refer to the most current editions of the following manuals:

- *PA-RISC Support Tools Manual (Licensed Users). Volume 1. SPU*
  (HP P/N 5960-3149)
- *PA-RISC Support Tools Manual (Licensed Users). Volume 2. Device Adapters/MUXes*
  (HP P/N 5960-3151)
- *PA-RISC Support Tools Manual (Licensed Users). Volume 3. LAN*
  (HP P/N 5960-3153)
- *PA-RISC Support Tools Manual (Licensed Users). Volume 4. SCSI*
  (HP P/N 5960-3155)
- *PA-RISC Support Tools Manual (Licensed Users). Volume 5. Disks*
  (HP P/N 5960-3157)
- *PA-RISC Support Tools Manual (Licensed Users). Volume 6. Tapes/Printers*
  (HP P/N 5960-3159)
- *PA-RISC Support Tools Manual (Licensed Users). Volume 7. Utilities*
  (HP P/N 5960-3161)
- *PA-RISC Support Tools Manual (Licensed Users). Volume 8. ISL Support Tools*
  (HP P/N 5960-3163)
- *PA-RISC Support Tools Manual HP Employees*
  (HP P/N 5960-3165)

Online Diagnostics and Utilities

Table 6-1 lists the online diagnostics. and Table 6-2 lists the utilities available on MPE/iX and HP-UX operating systems. Offline diagnostics are discussed later in this chapter.

The diagnostics and utilities in Table 6-1 and Table 6-2 are listed in alphabetical order by the diagnostic command name.

Note Licensed diagnostics require a password. If you need to obtain a password. refer to *PA-RISC Support Tools Manual (Licensed Users). Volume 1. SPU* (HP P/N 5960-3149) for more information.

Note In display examples. user input is shown shaded: `user input`.

Table 6-1. Available Online Diagnostics for 99x/890/T500 Systems

Command	Name	System	User
AFIDAD	AFI Device Adapter Diagnostic	HP-UX	Licensed
CENTPBA	Centronics Diagnostic	HP-UX	Licensed
CIPERLPD	Ciper Line Printer Diagnostic	MPE/iX	Licensed
CONSOLAN	Console/LAN Diagnostic	MPE/iX, HP-UX	Licensed
CS80DIAG	CS/80 Disk Diagnostic	MPE/iX. HP-UX	Licensed
DASSDIAG	Direct Access Secondary Storage Diagnostic	MPE/iX. HP-UX	Licensed
DIAG7478	HP7974A/7978 Magnetic Tape Drive Diagnostic	MPE XL, HP-UX	Licensed
FLEXDIAG	HP-FL Disk Diagnostic	MPE/iX. HP-UX	Licensed
HPFLDIAG	Fiber Link Device Adapter Diagnostic	MPE/iX, HP-UX	Licensed
HPIBDAD	HP-PB HP-IB Device Adapter Diagnostic	HP-UX	Licensed
HPIBDDS	HP-IB Digital Data Storage Drive Diagnostic	MPE/iX. HP-UX	Licensed
HPIBDIAG	HP-IB CIO Device Adapter Diagnostic	MPE/iX. HP-UX	Licensed
LAN3PBB	LAN Diagnostic	MPE/iX. HP-UX	Licensed
LANDAD	LAN Diagnostic	MPE/iX. HP-UX	Licensed
MEMDIAG	Memory Diagnostic	MPE/iX. HP-UX	Licensed
(continued on next page)			

Table 6-1.
Available Online Diagnostics for 99x/890/T500 Systems (continued)

Command	Name	System	User
OPDIAG	Optical Disk Diagnostic	MPE/iX. HP-UX	Licensed
PMUXDIAG	HP-PB 8/16-Channel MUX Diagnostic	HP-UX	Licensed
PPDIAG	Page Printer Diagnostic	MPE/iX. HP-UX	Licensed
PSIDAD	PSI Device Adapter Diagnostic	MPE/iX. HP-UX	Licensed
REELDIAG	HP7979/80 Magnetic Tape Drive Diagnostic	MPE/iX. HP-UX	Licensed
SCSICD	SCSI Compact Disk Diagnostic	HP-UX	Licensed
SCSICIO	SCSI CIO Device Adapter Diagnostic	MPE/iX. HP-UX	Licensed
SCSIDDS	SCSI Digital Data Storage Tape Drive Diagnostic	MPE/iX. HP-UX	Licensed
SCSIDISK	SCSI Disk Diagnostic	MPE/iX. HP-UX	Licensed
SCSIREEL	SCSI Magnetic Reel Tape Diagnostic	HP-UX	Licensed

Table 6-2. Available Online Utilities for 99x/890/T500 Systems

Command	Name	System	User
DTDUTIL	Disk-Tape-Disk Utility	MPE/iX	HP only
IOTT	I/O Test Tool	MPE/iX	HP only
LOGTOOL	System and Memory Log Analysis Tool	MPE/iX. HP-UX	Free
SYSMAP	System Map	MPE/iX. HP-UX	Free
TERMDSM	Terminal Diagnostic System Monitor	MPE/iX	Free

Using the Online Diagnostics

The implementation of the Online Diagnostics Subsystem is slightly different for the HP-UX and MPE/iX operating systems.

Use the *HP 9000 Series 800 HP-UX System Administration Tasks Manual* to look up information concerning HP-UX Online Diagnostics Subsystem security, the Online Diagnostics Subsystem directory tree, diagnostic special files, and DUI permissions.

Use the *MPE/iX System Configuration Manual* (HP part number 32650-90042) to look up information concerning MPE/iX system tables and configuration.

Online Diagnostic and Help Command Summary

To start the Online Diagnostics:

1. Log onto the system.
2. If necessary, set the diagnostic license.
3. Type `sysdiag`.
4. SYSDIAG loads the Diagnostic User Interface (DUI).
5. Type help to list the commands.

To display information about any command, type:

```
help <command_name>
```

To display information about any diagnostic, type:

```
help <diagnostic_name>
```

To display the test sections for a specific diagnostic, type:

```
help <diagnostic_name section>
```

To display the commands that apply to specific test sections of a specific diagnostic, type:

```
help <diagnostic_name sections=nn>
```

Diagnostic User Interface (DUI)

The Diagnostic User Interface (DUI) provides access to all programs in the Online Diagnostics Subsystem.

Note

On B1 security systems, the user must must have "debug" and "mem" authorization in order to run the DUI.

Operating Instructions:

1. At the system prompt, type:

   `sysdiag` *(for both MPE/iX and HP-UX)*

The diagnostic responds with the following header and welcome message indicating that access has been gained to the Online Diagnostics Subsystem:

```
**************************************************************************
******                                                              ******
******                  ONLINE DIAGNOSTIC SUBSYSTEM                 ******
******                                                              ******
******       (C) Copyright Hewlett Packard Co 1987,1988,1990        ******
******                     All Rights Reserved                      ******
******                                                              ******
******                                                              ******
******                     DUI Version XX.XX.XX                     ******
******                                                              ******
******               Diagnostic Monitor Version XX.XX.XX            ******
******                                                              ******
**************************************************************************
```

2. Enter **help** to the DUI prompt to see a list of available commands:

```
DUI> help
```

A list will be displayed similar to the command summary listed in Table 6-3.

Table 6-3. Diagnostic User Interface Command Summary

Command Name	Description
ABORT	Terminates active diagnostic programs or utility.
CI or !	Provides access to operating system command interpreter.
CODETEST	For HP internal use only.
DEFAULT	Resets command modifiers to their original diagnostic system default values.
DIAGSYSTEM	Used to access and manipulate internal diagnostic system processes which are usually not accessible to the user.
DO	Allows the user to re-execute any command in the command line history stack. It also permits the user to edit the command before re-executing it.
EXIT	Terminates the DUI and returns control to the operating system.
FOREGROUND	Moves a diagnostic that has been running in the background into the foreground.
HARDCOPY	Causes all terminal input/output to be echoed to the system printer.
HELP	Accesses HELP facility for information about the DUI and its commands, or for information about any of the diagnostic programs.
INSTALL	Allows the user to install diagnostic programs.
LIST	Provides information about any or all of the programs in the diagnostic system.
LISTREDO	Displays the user's command history stack.
MODE	Display and/or alters the current operating system mode.
MODIFY	Allows a user to change information about a diagnostic program without needing to reinstall the diagnostic.
OUTFILE	Causes all diagnostic system input and output to be written into the specified file.
PURGE	Removes programs from the diagnostic library.
REDO	Allows a user to display (for command editing), and re-execute any command in the command line history stack.
REDOLOAD	Replaces the user's command history stack with the history stack which was saved by the command REDOSAVE.
REDOSAVE	Causes all or part of the user's command history stack to be saved into a file.
REDOSIZE	Allows the user to set the maximum number of commands which will be saved in the users's command history stack.
REPLY	Used to send a reply to the prompt of a diagnostic program which is running in the background.
RESUME	Resumes processing of a suspended program.
RUN	Runs and executes a specified program.

(Continued on next page)

Table 6-3. Diagnostic User Interface Command Summary (continued)

Command Name	Description
SETVAR	Allows the user to explicitly set the values of environmental variables that control various features of the user interface.
SET	Allows the user to explicitly reset the system default values for modifiers which may be given on a run command line.
SHOWACTIVE	Lists programs which are currently active for the user.
SHOWDEFAULT	Causes a list of command modifiers and their default values to be displayed.
SHOWPARMS	Causes a list of user-settable modifiers and their current values to be displayed.
SHOWSTATE	Will cause the current system mode (single-user or multi-user) and their user's security capability to be displayed.
SUSPEND	Suspends processing of a specified program.
UNLOCK	Releases specified device from lock status.
USEFILE	Causes input to the diagnostic system to be input from the specified file rather than from a user's terminal.

Note Refer to Table 6-4 for RUN command parameters.

MPE/iX: Installation, modification, and removal of Online Diagnostics Programs on MPE/iX operating systems is accomplished by using the MPE/iX Online Installer (DIAGINST) facility.

HP-UX: Installation, modification, and removal of Online Diagnostics Programs on HP-UX operating systems is accomplished by using the HP-UX Online Installer facility. Refer to the *HP 9000 Series 800 HP-UX System Administration Tasks Manual* for HP-UX information.

Run Command

The following syntax is required to run diagnostics:

```
DUI> <diagnostic name> <run command modifiers>
```

For example, to run the diagnostic *MEMDIAG*, enter:

```
DUI> MEMDIAG <run command modifiers>
```

Run Command modifiers

Table 6-4 lists the modifiers (also referred to as parameters) for running diagnostics.

Table 6-4. Run Command Modifiers

Option	Abbrev.	Default Value	Description
BACKGROUND	BG	off	Causes the diagnostic program to be run in the background. Output will appear on the user's terminal unless redirected by use of the **OUTFILE** modifier.
DEBUG	DB	off	Causes the program to run within a debugger. If the user does not specify which debugger to use, the diagnostic system will invoke a default debugger, such as *nmdebug* on MPE/iX or *xdb* on HP-UX.
ERRCOUNT n	EC	Unlimited number of errors.	Sets the number (n) of errors to tolerate before aborting the diagnostic program. The number must be equal to or less than maxint.
ERRONLY	EO	off	When set to *ON*, only error messages will be printed; most informational messages will not be displayed. Place ERRONLY on by entering **ERRONLY ON** or **ERRONLY**. Three asterisks usually precede error messages. Error messages are in all capital letters; non-error messages have some lower case letters.
ERRPAUSE	EPS	off	When **ERRPAUSE** is on and an error occurs, the user will be queried as to whether to continue executing the program. If the user responds **yes**, the program continues. If the user responds **no**, the program will be aborted. If **ERRCOUNT** has been set and the maximum number of errors has been reached, the program will abort without querying the user.
ERRPRINT	EPR	on, long	Used to control the number of messages printed when an error occurs. When the **long** modifier is in effect, all error messages will be printed. When the **short** modifier is in effect, the error message only states what the diagnostic was trying to do. In the online diagnostics subsystem, **ERRPRINT** cannot be turned off.

(Continued on next page)

Table 6-4. Run Command Modifiers (continued)

Option	Abbrev.	Default Value	Description
HARDCOPY	HC	off	Causes all input and output messages to be printed on a hardcopy device. All I/O will also appear on the terminal unless a modifier such as `INFILE` or `OUTFILE` has also been used. The user can specify which hardcopy device to use by `ldev` or `pdev`, but usually the diagnostic system recognizes a default hardcopy device.
INFILE	IN	Data is received via the user's terminal.	Causes all input data expected by a diagnostic program to be read from the specified `infile` rather than from the standard input device (the user's terminal).
LDEV	none	none	Represents the logical name of a device to be tested or used by a diagnostic. On MPE/iX systems, the `LDEV` is a number; on HP-UX systems, the `LDEV` is the name of a special device file under the `/dev/diag` directory.
LOOP n	none	If `LOOP` is not set, the diagnostic completes one iteration before terminating.	Specifies the number (n) of times the sections and steps are to be repeated before the diagnostic terminates. If `loop` is specified without a number, the sections and steps will be repeated until an interrupt is given. If the `ERRPAUSE` or `ERRCOUNT` modifiers are also set, they will take precedence over `LOOP`.
OUTFILE	OUT	Output is displayed on the standard output device, usually the user's terminal.	Causes all output from a diagnostic program to be placed into the named file rather than be displayed on the user's terminal.
PDEV	none	none	Represents the physical path to a device. Composed of numbers corresponding to hardware slot numbers with machine-dependent punctuation separating the numbers. If a device is needed for a diagnostic program to run, that device must be specified using either its `PDEV` or `LDEV`.
SECTIONS	SC	Sections and steps named by diagnostic developer as defaults. This differs for every diagnostic program.	Specifies sections of the diagnostic program to be run if the user does not specifically invoke one or more sections. If a section is named, but the steps are not specified, the default steps will be run automatically. Sections and steps are invoked in numerical order. Mnemonics that can be substituted for section and step numbers are listed below this table.

(Continued on next page)

Table 6-4. Run Command Modifiers (continued)

Option	Abbrev.	Default Value	Description
TRACE	TR	off	Enables/disables software tracing messages.
Diagnostic Specific Parameters	none	null	Parameters, modifiers, or other information unique to a particular diagnostic program can be specified within the run command. Such information is placed in double quotes.

The following mnemonics can be substituted for section or step numbers when using the SECTIONS parameter for the RUN command:

ALL — Run all sections, default and non-default alike.

AUTO — Run all sections designated as autodiagnosable. That is, run all sections which might be run automatically by the operating system when it detects a possible hardware defect.

CLEAR — Run whatever section or sections that "clear" or "reset" the device being diagnosed.

DEFAULT — Run the default sections. This mnemonic will be useful when non-default sections have been specified at a more global scope, and the user wishes to only run defaults locally.

ERRLOG — Run whatever sections read and decode error logs.

FAST — Run the sections that the diagnostic developer has designated as "fast." That is, run those sections that will quickly test a large part of the device.

HWSTATUS — Run the section that read and decode the hardware status of a device.

ID — Run the sections that "identify" the device.

LOOPBACK — Run whichever sections perform a loopback to the device(s). The type of loopback(s) performed will vary from diagnostic to diagnostic — the diagnostic developer determines which loopback(s) to perform when this mnemonic is given.

NON-DESTRUCTIVE — Run only non-destructive sections or steps. This will be useful to users possessing the highest security level who wish to avoid inadvertently running any potentially destructive sections.

SELFTEST — Run the sections that perform self-tests on the device(s).

INTERACTIVE — Run the diagnostic's interactive sections.

LAN Utilities

The following tools are available for use with the LAN/9000 product. For information on how to use the LAN utilities, refer to the *Installing and Administering LAN/9000* manual (HP P/N 98194-90028).

Table 6-5. Available Online LAN Utilities (for LAN/9000)

Command	Name	System
LANDIAG	A menu-driven program that resets or reports the status of the LAN card	HP-UX
LANSCAN	Reports the hardware path, station address, device lu, hardware state, interface name, and link type for eacj LAN interface	HP-UX
LINKLOOP	Used for link level loopback between HP 9000 computers and any remote nodes that support 802 test packets	HP-UX
NETFMT	Formats binary trace and log files gathered from NETTL	HP-UX
NETSTAT	Reports nodal statistics	HP-UX
NETTL	Tracing and logging facility	HP-UX
PING	Level 3 loopback verification to a remote host that is specified by a host name or IP address	HP-UX
PPLSTAT	Gives the status of each invocation of PPL	HP-UX
RLB	A stand-alone level 5 loopback verification program	HP-UX

Offline Utilities

Offline utilities are available under the ISL environment. ISL-based offline utilities are implemented on the the support tape. Some utilities are also implemented on the boot disk.

Note

Certain offline diagnostics require a password. If you need to obtain a password, refer to *PA-RISC Support Tools Manual (Licensed Users), Volume 8, ISL Support Tools* (HP P/N 5960-3163) for more information.

Minimum Performance

To run any offline diagnostics, the system must first be able to pass the PDC self-test and boot ISL.

Description

The Offline Diagnostics System provides a means of testing System Processor Unit (SPU) hardware Field Replaceable Units (FRUs) and interrogating low-level hardware register contents. It includes a standard operating environment complete with a library of common procedures, program macros, and command set/feature functionality. For more information about the Offline Diagnostics, refer to the *Support Tools Manual (Licensed Users), Volume 8, ISL Support Tools* (HP P/N 5960-3163).

Note

The ISL-based Offline Diagnostics and Utilities are implemented via the Support Tape on either an open reel, DAT, or cartridge tape format. You must boot from the support tape to implement the complete set of ISL-based Offline Diagnostics and Utilities described below. Refer to the procedure "Booting from the Support Tape" at the end of this chapter for information about using the support tape.

Offline Diagnostic Programs

The Offline Diagnostic Programs are a comprehensive set of software to test FRUs for processor, memory, and I/O functionality. These diagnostics determine which of the FRUs need replacement.

Utility Programs

Offline Utility programs cannot isolate defective FRUs, but can verify which functions of a device are operating correctly. Input/Output Map (IOMAP) helps determine the cause of device failure by providing stress simulation and diagnostic information.

Refer to Table 6-6 for a listing of available offline diagnostics.

Table 6-6. Available Offline Diagnostics and Utilities for 990/890 Systems

Command Name	Description	User
CLKUTIL	PDC Time-of-Day Utility	
DISCUTIL	Disk Drive Utility	
EDBC	990/890 Bus Converter Diagnostic	Licensed
EDPROC	990/890 Processor Diagnostic	Licensed
IOMAP	Input/Output Map Utility	Free
SADPATCH	Standalone Diagnostic Patching Utility	HP only
SAT	Standalone Analysis Tool	

To find out what offline diagnostics are available, boot the system to the ISL prompt. Ask the program for a description of the commands by typing help:

```
ISL> help

?            Help Facility
HELP         Help Facility
LISTF        List ISL utilities
LS           List ISL utilities
AUTOBOOT     Set or clear autoboot flag in stable storage
AUTOSEARCH   Set or clear autosearch flag in stable storage
PRIMPATH     Modify primary boot path in stable storage
ALTPATH      Modify alternate boot path in stable storage
CONSPATH     Modify system console path in stable storage
DISPLAY      Display boot and console paths in stable storage
LSAUTOFL     List contents of autoboot file
LISTAUTOFL   List contents of autoboot file
FASTSIZE     Sets or displays FASTSIZE
SUPPORT      Boot the Support Tape from the boot device
SUPPORTCD    Boot the Support Tape from the CDROM
READNVM      Displays contents of one word of NVM
READSS       Displays contents of one word of stable storage
LSBATCH      List contents of batch file
LISTBATCH    List contents of batch file
BATCH        Execute commands in batch file
LSEST        List contents of EST (Extended Self Test) file
LISTEST      List contents of EST (Extended Self Test) file
EST          Execute commands in EST (Extended Self Test) file
```

The ISL help display also lists the utilities available on the system. The utilities listed will depend on whether you are booting from the disk or the support tape.

Offline Diagnostics Command Summary

Diagnostic Execution Control Commands

SECTION	Used to specify a diagnostic section other than the default section. Syntax: section 4/8 9 12
LOOP	Defines the number of times a section is to be executed. For example: `loop 100` causes the section to execute 100 times: `loop (blank)` causes independent execution: and `loop 0` causes the diagnostic to stop.
RUN	Causes the diagnostic to restart at the beginning.
RESUME	Resumes the diagnostic after a pause. or starts the diagnostic after parameter selection.
RESET	Returns diagnostic parameters to the default values.
EEPS	Enables a pause after an error.
SEPS	Suppresses a pause after an error.
ENPS	Enables a non-error pause to allow diagnostic command input.
SNPS	Suppresses non-error pause.
EIPS	Enables an isolation pause after detection of an isolation error.
SIPS	Suppresses isolation pause.
ERRPAUSE	Selects the following: EEPS, SIPS, and SNPS.

Diagnostic Output Control Commands

EEPR	Enables error printout.
SEPR	Suppresses error printout.
ENPR	Enables non-error printout.
SNPR	Suppresses non-error printout.
EIPR	Enables isolation printout.
SIPR	Suppresses isolation printout.
ERRONLY	Selects EEPR, SIPR, and SNPR.
HARDCOPY	Not supported.

Diagnostic System Control Commands

STOP	Upon exiting the diagnostic, this command stops ISL from continuing the Auto-Boot sequence.
LISTIO	Lists the I/O path to the primary and secondary boot devices, the console path, and the printer path.
CHANGEIO	Changes the console, the printer, and the Units Under Test (UUTs) displayed by the LISTIO command. This command changes only the memory buffer; to permanently change the boot and console values found in stable storage, you must return to ISL. Syntax: {path name}[C.P.1.2] - where C is the console, P is the printer, and 1 and 2 are the UUTs.
STATE	Displays diagnostic state variables.
EXIT	Exits the diagnostic to ISL.
HELP	Displays detailed information about the diagnostic command. For example: `help section`.
INFORMATION	Displays detailed information about unique diagnostic commands.
Control-Y	Breaks the execution of the diagnostic between steps, similar to the MPE/XL Control-Y function, the RTE Break function, and the HP-UX Control-X (or Control-Y) function. (The Model 825 Family SPU also uses the Control-C function.) Any console command is valid after a Control-Y; the I/O associated with console commands is not suppressible.

Booting From the Support Tape

The support tape allows you to diagnose problems when the operating system cannot be booted from the system disk. For additional information on use of the support tape, refer to the most current *Support Tape Users Manual* (HP P/N 92453-90010).

To use the support tape, you need the following minimum hardware configuration:

- An HP 9000 Series 800 or HP 3000 Series 900 SPU.
- 8 Mbyte memory (16 Mbytes to run online diagnostics).
- Console.
- Magnetic tape drive.
- I/O paths to console and tape drive (or equivalent device).
- Support Tape.

Booting Up

If the system has halted and cannot be booted from the system disk, you must boot from the support tape. The procedure is described below.

Note

For HP-UX servers, if the system is not halted, you should enter the following command at the system prompt:

```
/etc/shutdown -h 0
```

For MPE/iX systems, if the system has not halted, you should enter the following command at the system console:

Ctrl-A

The system will respond with the = prompt; you need to enter the following:

```
= SHUTDOWN
```

To boot from the Support Tape:

1. Load the Support Tape (Reel #1, if you are using the open reel version of the Support Tape).
2. Reset the system:
   a. Enter Ctrl B at the system console.
   b. At the **CM>** prompt, enter the **SP** mode:

```
CM> SP
```

   c. At the **SP>** prompt, enter **rs** to start a system reset:

```
SP> rs
```

Note

The system reset will take several minutes.

---

3. If autoboot is enabled, the following appears on the console:

```
Processor is starting the autoboot process.

To discontinue, press any key within 10 seconds...
```

   Press any key. After pressing the key, the following prompt appears:

```
Continue with primary boot path?   ([y]/n/<new_path>) >
```

4. Respond to this prompt by typing N. The next prompt is:

```
Continue with alternate boot path? ([y]/n/<new_path>) >
```

5. Respond to this prompt as follows:

   If the support tape is loaded on the tape drive that corresponds to the alternate boot path, type (Y).

   If the support tape is NOT loaded on the tape drive that corresponds to the alternate boot path, type (N). The following prompt will appear:

   ```
   Enter boot Path or ?>
   ```

   Enter the physical address of the tape drive on which the support tape is loaded, and press (Return).

   The system console will now display the following:

   ```
   Interact with IPL (Y or N)>
   ```

6. Enter (Y) at the prompt. After the appropriate response is given, the tape will start spinning and the **ISL** prompt will appear:

   ```
   ISL>
   ```

   At this point, you can type **help** to see which ISL utilities are available, as previously described.

7. If you want to run the mini-kernel, type **support**:

   ```
   ISL> support
   ```

   The system will display several screens of status information, a disclaimer, and a warning, then will display the following:

   ```
                  ***** Creating device files! ******

   / on /dev/root/ read/write on !!day:month:date:hours:minutes:seconds:year!!
   Press <return> to continue.
   ```

8. Press (Return) and the following menu will be displayed:

   ```
              SUPPORT TAPE MAIN MENU

     s.  Search for a file
     b.  Reboot
     l.  Load a file
     d.  On-line Diagnostics
     m.  Display Manual page for a specific command
     r.  Recover an unbootable HP-UX system
     u.  Utilities
     x.  Exit to shell

   This menu is for listing and loading the tools contained on the support tape.
   Once a tool is loaded, it may be run from the shell.

   Select one of the above:
   ```

9. To select from the menu, type the letter preceding your selection (s, b, l, d, m, r, u, x) followed by a carriage return. For example, press **b**, then (Return) to select the Reboot menu item.

   The following is a description of the various options:

s	Search for a file on the Support Tape and return the full pathname.
b	Reboot the operating system.
l	Load a file into the memory-based file system. The system will prompt you for the name of the file you want to load.
d	Go to the ONLINE DIAGNOSTICS MENU.
m	Display the **man** pages for either **analyze** or **disked**, depending on which you specify.
r	Go to the HP-UX Recovery MAIN MENU.
u	Go to the SUPPORT TAPE UTILITIES MENU.
x	Exit the menu system to the Bourne shell.

Running the System Exerciser (SX)

The System Exerciser (SX) program exercises individual subsystems (CPU, memory, and disks), provides feedback to the user about the current state of the exercisers being run, and displays resulting errors on a log screen. In addition, an online help feature provides context-sensitive information (selectable via softkeys) about using and monitoring the exercisers, and interpreting error messages.

Although SX is not a diagnostic, it can be used to:

- Stress a system to reproduce intermittent problems.
- Serve as a test load for a system.
- Help verify the functionality (go/nogo) of newly installed systems.

The SX program runs while the system is online, and will not corrupt other processes or data.

Note

The System Exerciser (SX) has been updated for HP-UX 9.04 and MPE/iX 4.5. The updated version of SX will run on the 99x/890/T500. The updated version is available on the patch machine. Refer to "Obtaining the SX Program and Documentation" later in this section.

Running SX

To run SX, refer to the manual appropriate to your system:

Installing and Operating the HP 3000 PA-RISC System Exerciser

Installing and Operating the HP 9000 PA-RISC System Exerciser

Refer to "Obtaining SX Documentation" at the end of this chapter for information about getting the SX manuals.

Obtaining the SX Program and Documentation

You can obtain both the SX program files and SX documentation via FTP. To do so, you must have access to the HP-UX network, the required passwords (given later in this section), and sufficient disk space to hold the files. Additional requirements for obtaining the SX manuals are given under "Obtaining SX Documentation."

Obtaining the SX Program for HP 3000 Systems

The SX program for HP 3000 PA-RISC systems is available on CSY's patch machine (LPATCH.CUP.HP, IP address 15.13.168.145). To retrieve SX from the patch machine:

1. Log on to LPATCH as session SE.BBS.SX.
2. Execute *DSSX <system>*, where <system> is the full network name of your system.

The DSSX script will not only DSCOPY all SX files, but will also install the SXCONFP program (the SX configuration program under the Online Diagnostics Subsystem). You will need to know the MANAGER.SYS and MGR.TELESUP passwords for your local system before attempting to execute DSSX.

DSSX will also DSCOPY itself and *MKTAPE*, a script that creates SX tapes. This will allow you to transfer SX to other systems either by network (using DSSX), or tape (using *MKTAPE*).

If you cannot DSCOPY from the patch system to your system, but you can DSCOPY from your system to the patch system, use the following procedure to DSCOPY the SX program:

1. Log on to your system as **mgr.telesup**.
2. DSCOPY *DSSXR.SX.BBS* from the patch system.
3. Execute *DSSXR LPATCH* (from your system).
4. Log on to your system as **manager.sys**.
5. Execute *INSTSX.SX.TELESUP*.

If you need passwords or telephone numbers for the patch system, send an HPDesk message to PATCH PASSWORDS / HP6650/HL. An autoanswer message will forward complete dial-up information to you.

Obtaining the SX Program for HP 9000 Servers

The SX program for HP 9000 PA-RISC servers is available on on the Atlanta Response Center patch machine **hpatlse.atl.hp.com**. You will need to get two files from the *UNSUPP/diag/SX* directory:

SX.text contains help information (in ASCII format).

SX.updt contains the SX program (in UPDATE format).

To get the SX program from the patch machine:

1. Change to the */tmp* directory on your HP-UX machine.
2. Run the file transfer program (type: **ftp hpatlse.atl.hp.com**).
3. Log in anonymously as **ftp**. Use your username and workstation name as your password.
4. Set binary transfer mode (type: **bin**)

5. Change (**cd**) to the SX directory
6. Get the SX files:
   a. Type **get SX.text** to get the help file.
   b. Type **get SX.updt** to get the SX program file.
7. Exit ftp (type: **quit**).
8. Read the *SX.test* file for instructions on installing SX on your system.

Obtaining SX Documentation

You can get the SX documentation files via FTP, and then send the files to your LaserJet printer to get hardcopies of the manuals. Requirements are:

- Access to the HP-UX network.
- A password on system 15.0.89.102 (babar). The password is given later in this procedure.
- Sufficient disk space to hold the desired file.
- A LaserJet printer.
- A print spooler arrangement large enough to handle the .lj files (about 1.9MB each).

Note

Although the files are compressed to save disk space and make transferring easier, they will be temporarily uncompressed during the printing process on your HP-UX machine.

To get SX documentation:

1. Run the file transfer program (type: **ftp 15.0.89.102**).
2. Log in as **field** (the password is **man92**).
3. Change (**cd**) to the SX directory.
4. Set binary transfer mode (type: **bin**)
5. Type **ls** to see a list of files in the directory.
6. Get the desired SX document:
   a. Type: **get sxixcore.lj.Z** to get the HP 3000 SX manual.
   b. Type: **get sxuxcore.lj.Z** to get the HP 9000 SX manual.
7. Exit ftp (type: **quit**).

To print the SX documentation:

1. On your HP-UX system, enter the following command to automatically uncompress and print out the document:

   ```
   uncompress -c FILENAME.lj.Z | lp -oraw
   ```

   - where FILENAME is either "sxixcore" (MPE/iX version) or "sxuxcore" (HP-UX version). Note that the final .Z is a CAPITAL Z.
2. After the file is uncompressed (one to several minutes), the manual should begin printing out on your printer. To see if the file is in the print queue, enter the **lpstat** command.

7

Peripherals

This chapter lists peripherals supported on 890/990/992 and T500/991/995 systems for HP-UX release 9.04 and MPE/iX release 5.0.

Chapter Contents:

This chapter covers:

- DATACOMM Devices
- Mounted Disks
- Plotters
- Printers
- Terminals
- Tape Drives and CD-ROM Drives
- Floppy Drives
- UPS Devices
- Miscellaneous Devices

Note Unless otherwise noted. a supported peripheral is supported by all series or models of the system. Exceptions are noted.

The following terms and acronyms for interface standards are used in this chapter:

HP-IB	Hewlett-Packard Interface Bus
HP-FL	Hewlett-Packard Fiber-Optic Link (sometimes known as "PB-FL")
LAN	Local Area Network
RS-232	Standard for Serial Communication Interface
SCSI	Small Computer System Interface (single-ended 8-bit)
F/W SCSI	Differential 16-bit SCSI (fast/wide)

DATACOMM Devices

Table 7-1. DATACOMM Devices

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
37203A	High Speed Multi-pt HP-IB Extender	HP-IB		X	
37204A	High Speed Multi-pt HP-IB Extender	HP-IB	X		
37204B	High Speed Multi-pt HP-IB Extender	HP-IB		X	
92205A	Hayes 1200 Modem	RS-232	X		
92205B	Smartmodem 2400	RS-232	X		
BELL212A	Modem. Dial-In	RS-232	X		@
BELL103J	Dial-Up. Auto-Answer	RS-232	X		@
BELL202T	4-Wire Leased Line	RS-232	X		@
Telebit	PEP/V.32 Modem	RS-232	X		@
Trailblazer V.32	Telebit 19.2 Modem	RS-232	X		@
USR HST	HST/V.32 Modem	RS-232	X		@
USR24000	Courier HST Modem	RS-232	X		@
USR9600	Courier HST Modem	RS-232	X		@
TBD	DTC-72		X	X	
27212A	StarLan1			X	
D1802A	StarLan10			X	
2335A	X.25 Multiplexer			X	
2342A	HP Baseband LAN			X	
2342A	8-Port Terminal Server			X	
2340A	DTC-16		X	X	
2345A	DTC-48		X	X	
2346A	X.25			X	

Note

@ HP does not support third party software.

Datacomm devices are not supported in powerfail recovery.

Refer to chapter 4. "Configuration," for more information about Remote Support Modems.

Mounted Disks

Table 7-2. Mounted Disks

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
7907A	41 MB Fixed; Removable Disk Drive	HP-IB (fast)	X		
7914CT	132 MB Disk/Tape	HP-IB (fast)	X		
7914P/R	132 MB Disk/Tape Drive	HP-IB (fast)	X		
7914ST	132 MB/1600 CPI Disk/Tape Storage Sys	HP-IB (fast)	X		
7933HR/XR	404 MB Disk Drive	HP-IB		X	
7935/HR/XR	404 MB Removable Disk Drive	HP-IB		X	
7936FL	307 MB Fixed Disk Drive	HP-FL	X		B
7936XP	307 MB Formatted Fixed Disk Drive	HP-IB		X	
7937H	571 MB FL Disk Drive	HP-IB		X	
7937FL	571 MB FL Disk Drive	HP-FL	X		B
7937XP	571 MB Formatted Fixed	HP-FL		X	
7957B	81 MB Fixed Disk Drive	HP-IB (fast)	X		
7957S	107 MB SCSI Fixed Disk Drive	SCSI	X		
7958A	130 MB Fixed Disk in a Desktop Package	HP-IB		X	
7958B	152 MB Fixed Disk in a Desktop Package	HP-IB (fast)	X		
7958S	161 MB SCSI Fixed Disk Drive	SCSI	X		B
7959B	304 MB Fixed Disk Drive	HP-IB		X	
7959S	161 MB SCSI Fixed Disk Drive	SCSI	X		B
7962B	152 MB Fixed Disk Drive	HP-IB		X	
7963B	304 MB Fixed Disk Drive	HP-IB		X	
9122C	2 MB 3.5 Inch Micro-Floppy Disk Drive	HP-IB (slow)	X		
9122D	Dual Disk Drive	HP-IB (slow)	X		
9122S	Single 3 1/2in Flexible Disk Drive	HP-IB (slow)	X		

Table 7-2. Mounted Disks (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
9127A	Single 5 1/4in Flexible Disk Drive	HP-IB (slow)	X		
9153C	40 MB Winchester + 2 MB 3 1/2in Floppy	HP-IB (slow)	X		
9262B	152 MB Removable Disk Drive	HP-IB (fast)	X		
9263B	304 MB Removable Disk Drive	HP-IB (fast)	X		
97902B	152 MB Removable Disk Drive kit	HP-IB	X		
97903B	304 MB Removable Disk Drive Kit for HP926XB	HP-IB	X		
97962B	152 MB Upgrade Kit	HP-IB	X		
97963B	304 MB Upgrade Kit	HP-IB	X		
A1896A	1.1m Integrated Cabinet - Add 1.3 GB Disk	SCSI	X		B
A1896A	1.1m Integrated Cabinet - Add 2.7 GB Disk	SCSI	X		B
A1896A	1.1m Integrated Cabinet - Add 4.0 GB Disk	SCSI	X		B
A1897A	1.6m Integrated Cabinet - Add 1.3 GB Disk	SCSI	X		B
A1897A	1.6m Integrated Cabinet - Add 2.7 GB Disk	SCSI	X		B
A1897A	1.6m Integrated Cabinet - Add 4.0 GB Disk	SCSI	X		B
C1700A	20 GB Rewritable Optical Disk Library	SCSI	X	X	
C1700C	20 GB Optical Library	SCSI	X		
C1700T	41.6 GB Optical Disk Library	SCSI	X	X	
C1701A	Rewritable Optical Disk Library	SCSI	X		B
C1701C	650 GB Standalone Drive	SCSI	X		B
C1701T	Standalone Drive	SCSI	X		
C1703A	10 GB Optical Disk Library	SCSI		X	
C1703T	20.8 GB Optical Disk Library	SCSI	X		
C1704A	57 GB Rewritable Optical Disk Library	SCSI	X		
C1704C	60 GB Optical Library	SCSI	X		
C1704T	114 GB Disk Library	SCSI	X		

Table 7-2. Mounted Disks (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
C1705A	93 GB Rewritable Optical Disk Library	SCSI	X		
C1705C	100 GB Optical Library	SCSI	X		
C1705T	187.2 GB Disk Library	SCSI	X		
C1708T	20.8 GB Disk Library	SCSI	X	X	
C2200A	Model 335H Formatted Fixed Disk Drive	HP-IB		X	
C2201A	Model 670FL Formatted Fixed Disk Drive	HP-FL	X	X	B
C2202A	670 MB/XP Formatted Fixed Disk Drive	HP-IB		X	
C2203A	Model 670H Formatted Fixed Disk Drive	HP-IB		X	
C2204A	Model 1.34FL Formatted Fixed Disk Drive	HP-FL	X	X	B
C2212A	332 MB SCSI Disk Mass Storage Sys	SCSI	X		B
C2212A	Add-On 1.3 GB Digital Audio Tape Drive	SCSI	X		B
C2212A	Add-On 332 MB 5 1/4in Disk Drive	SCSI	X		B
C2212A	Add-On CD-ROM Drive	SCSI	X		B
C2212A	Add-On 650 MB Rewritable Optical Disk Drive	SCSI	X		
C2212A	Two Add-On CD-ROM Drives	SCSI	X		
C2213A	Add-On 664 MB SCSI Disk Mass Storage Sys	SCSI	X		B
C2213A	Add-On 332 MB SCSI 5 1/2in Disk Drive	SCSI	X		B
C2213A	Add-On 664 MB SCSI 5 1/4in Disk Drive	SCSI	X		B
C2213A	Add-On 1.3 GB Digital Audio Tape Drive	SCSI	X		B
C2213A	Add-On CD-ROM Drive	SCSI	X		
C2213A	Add-On 650 MB Rewritable Optical Disk Drive	SCSI	X		B
C2213A	Two Add-On 664 MB SCSI 5 1/4in Disk Drives	SCSI	X		B
C2213A	Two Add-On CD-ROM Drives	SCSI	X		

Table 7-2. Mounted Disks (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
C2236HA	3 disk 1 GB F/W SCSI	F/W SCSI	X		
C2247	1 GB Disk Drive	SCSI	X	X	B
C2250T	Standalone 1.3 GB MO Disk	SCSI	X		
C2252A/HA	2.72 GB Disk Array	HP-FL		X[1]	B
C2252B/BZ	2.72 GB Disk Array	HP-FL	X	X[2]	B
C2252HA/HZ	2.72 GB High Availability Disk Array	HP-FL	X		B
C2254A/HA	5.44 GB Disk Array	HP-FL		X[1]	B
C2254B/BZ	5.44 GB Disk Array	HP-FL	X	X[2]	B
C2254HA/HZ	5.44 GB High Availability Disk Array	HP-FL	X		B
C2258B/HA	4 GB Disk Array	HP-FL		X	B
C2259B/HA	8 GB Disk Array	HP-FL		X	
C2281A	Integrated 225 MB Mechanism/Controller	SCSI	X		
C2282A	Integrated 225 MB Mechanism/Controller	SCSI	X		
C2290A	332 MB SCSI Disk Upgrade Kit/C2212A/C2213A	SCSI	X		S
C2291A	664 MB SCSI Disk Upgrade Kit/C2212A/C2213A	SCSI	X		S
C2294A	650 MB Rewritable Optical Disk Upgrade Kit/C2212A/C2213A	SCSI	X		S
C2436HA	2 GB F/W SCSI Disk Array	F/W SCSI	X		
C2437HA	4 GB F/W SCSI Disk Array	F/W SCSI	X		
C2439HA	4 GB F/W SCSI Disk Array	F/W SCSI	X		
C2440HA	8 GB F/W SCSI Disk Array	F/W SCSI	X		
C2460F	Model 420F Formatted SCSI Disk Drive	SCSI	X		B
C2460R	Model 420R Formatted SCSI Disk Drive	SCSI	X		B
C2461F	Model 670F Formatted SCSI Disk Drive	SCSI	X	X	B
C2461R	Model 670R Formatted SCSI Disk Drive	SCSI	X	X	B

Table 7-2. Mounted Disks (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
C2462F	Model 1350F Formatted SCSI Disk Drive	SCSI	X	X	B
C2462R	Model 1350R Formatted SCSI Disk Drive	SCSI	X	X	B
C2470S	234 MB Single-Ended SCSI Expansion	SCSI	X		B
C2471S	328 MB Single-Ended SCSI Expansion	SCSI	X		B
C2472F	422 MB Single-Ended SCSI Expansion	SCSI	X		B
C2472R	422 MB Single-Ended SCSI Expansion	SCSI	X		B
C2472S	422 MB Single-Ended SCSI Expansion	SCSI	X		B
C2473F	677 MB Single-Ended SCSI Expansion	SCSI	X	X	B
C2473R	677 MB Single-Ended SCSI Expansion	SCSI	X	X	B
C2473S	677 MB Single-Ended SCSI Expansion	SCSI	X	X	B
C2474F	1.35 GB Single-Ended SCSI Expansion	SCSI	X	X	B
C2474R	1.35 GB Single-Ended SCSI Expansion	SCSI	X	X	B
C2474S	1.35 GB Single-Ended SCSI Expansion	SCSI	X	X	B
C2490A	2 GB 3 1/2in Disk Drive	SCSI	X	X	B
A2946A	1 GB (QIC) Disk Drive	SCSI	X		B
C3010	2 GB Disk Drive	SCSI	X	X	B
C3022T	1 GB Disk Minitower	SCSI	X	X	B
C3022R	1 GB Rackmount	SCSI	X	X	B
C3023T	2 GB Disk Minitower	SCSI	X	X	B
C3023R/RZ	2 GB Disk Rackmount	SCSI	X	X	B
C3024T	4 GB Disk Minitower	SCSI	X	X	B
C3024R/RZ	4 GB Disk Rackmount	SCSI	X	X	B
C3025RZ	3X2GB Rackmount for Factory Integration	SCSI	X		B

Table 7-2. Mounted Disks (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
C3027U	1 GB Disk Drive Exp Kit	SCSI	X	X	B
C3028U	2 GB Disk Drive Exp Kit	SCSI	X	X	B
3032T/R/RZ	1.0 GB F/W SCSI Tower or Rack	F/W SCSI	X		
3033T/R/RZ	2.0 GB F/W SCSI Tower or Rack	F/W SCSI	X		
3034T/R/RZ	Two 2.0 GB Full Height 3.5in F/W SCSI Minitower	F/W SCSI	X		
3035T/R/RZ	Four 1.0 GB Half Height 3.5in F/W SCSI Minitower	F/W SCSI	X	-	
3038U	Add-on 2.0 GB Full Height 5.5in F/W SCSI	F/W SCSI		X	B
3550T/U	3 1/2in 2 GB F/W SCSI Disk	F/W SCSI		X	B
0950-2301	1 GB Disk Drive	SCSI	X		B
0950-2302	2 GB Disk Drive	SCSI	X		B
0950-2433	535 MB F/W SCSI Disk Drive	F/W SCSI	X		B

Note

B = Supported as Boot device

[1] MPE: supported in striped mode only; not supported in independent mode.

[2] MPE: supported as boot device on HP 3000 systems for MPE/iX release 4.0 only.

Plotters

Table 7-3. Plotter List

Part Number	Description	Interface	HP-UX	MPE/iX
17440A	Graphics Enhancement Cart.	7440A	X	
7440A	Color plotter. 8 pen. A size	RS-232. HP-IB	X	
7475A	Color plotter. 6 pen. A/B size	RS-232. HP-IB	X	
7550A	Color Plotter. 8 Pen. A4/A and A3/B Size	RS-232. HP-IB	X	X
7550B	Color Plotter. 8 Pen. A4/A and A3/B Size	Cent, RS-232, HP-IB	X	X
7586B	Rollfeed Drafting Plotter	RS-232	X	
7595A	Draftmaster I Plotter. 8 Pen. A4/A - A0/E Size	RS-232. RS-422. HP-IB	X	
7595B	DraftMaster SX Plotter	RS-232. HP-IB	X	
7596A	Draftmaster II Plotter. A4 - A0 Rollfeed	RS-232. RS-422. HP-IB	X	
7596B	DraftMaster RX plotter	RS-232. HP-IB	X	
7599A	DraftMaster MX plotter	RS-232. HP-IB	X	
C1600A	HP7600 Series Model 240D A1/D size Plotter	HP-IB. Cent	X	
C1601A	HP7600 Series Model 240E A0/E size Plotter	HP-IB. Cent	X	
C1620A	HP7600 Series 355 Electrostatic Plotter	Cent. RS-232. HP-IB	X	
C1625A	HP 7600 Series Model 250 Monochrome Electrostatic D-size Plotter	Cent. RS-232. HP-IB	X	
C1627A	HP 7600 Series Model 255 Monochrome Electrostatic D-size Plotter	Cent. RS-232. HP-IB	X	

Printers

Table 7-4. Printer List

Part Number	Description	Interface	HP-UX	MPE/iX
2225C	ThinkJet Printer for USA	Cent	X	
2225D	ThinkJet Printer for USA	RS-232	X	
2225P	ThinkJet Battery Powered Printer	Cent	X	
2227A	QuietJet Plus Printer	Cent, RS-232	X	
2227B	U.S. Version of QuietJet Plus Printer	HP-IB (slow)	X	
2228A	QuietJet Printer	Cent, RS-232C	X	
2235A	RuggedWriter 480 Printer/U.S. Version	Cent, RS-232	X	
2235B	RuggedWriter 480 Printer/U.S. Version	HP-IB (slow), RS-232	X	
2235C	RuggedWriter 480 Printer/U.S. Version	HP-IB, Cent, RS-232	X	
2235D	RuggedWriter 480 Printer/U.S. Version	HP-IB (slow)	X	
2235D	RuggedWriter 480 Printer/U.S. Version	RS-232C	X	
2276A	DeskJet Printer/U.S. Version	Cent, RS-232	X	
2277A	DeskJet Printer/U.S. Version	Cent, RS-232	X	
2354XA	Guyan	Cent, RS-232		X
2356XA	Guyan Lite	Cent, RS-232		X
2562C	420 lpm Line Impact Printer	Cent, HP-IB, RS-232	X	X
2563A	Line Printer, Dot Matrix 300 lpm	Cent, HP-IB, RS-232C	X	X
2563B	Line Printer, Dot Matrix 300 lpm	Cent, RS-232C	X	X
2563C	Line Printer, Dot Matrix 420 lpm	Cent, HP-IB (slow), RS-232	X	X
2564B	Line Printer, Dot Matrix 600 lpm	Cent, CIPER, HP-IB, RS-232	X	X
2564C	Line Printer, Dot Matrix 840 lpm	Cent, HP-IB (slow), RS-232C	X	X
2565A	Line Printer, Dot Matrix Impact 600 lpm	Cent, CIPER, HP-IB, RS-232C	X	
2566A	Line Printer, Dot Matrix Impact 900 lpm	Cent, RS-232C	X	X
2566B	Line Printer, Dot Matrix Impact 900 lpm	Cent, CIPER, HP-IB, RS-232	X	X
2566C	Line Printer, Dot Matrix 1200 lpm	Cent, HP-IB (slow), RS-232	X	X

Table 7-4. Printer List (continued)

Part Number	Description	Interface	HP-UX	MPE/iX
2567B	Line Printer. Dot Matrix Impact 1200 lpm	Cent. CIPER. HP-IB. RS-232	X	X
2567C	Line Printer. Dot Matrix 1600 lpm	Cent. HP-IB (slow). RS-232	X	X
2680A	Laser Printer 45 ppm	HP-IB		X
2684A	LaserJet 2000 Printer 115 VAC 60Hz	RS-232. Cent	X	X
2684P	LaserJet 2000 Printer with Paper Deck	Cent	X	
2686A	LaserJet Printer 115 VAC 60Hz; 8ppm	RS-232. Cent	X	X
2686D	LaserJet 500+ Printer 115 VAC 50Hz	RS-232. Cent	X	
2687A	Page Printer 12 ppm	RS-232		X
2688A	Page Printer 12 ppm	HP-IB		X
C2354A	Dot Matrix Line Printer 840 lpm	HP-IB. RS-232	X	X
C2356A	Dot Matrix Line Printer 1100 lpm	HP-IB. RS-232		X
2932A	Dot Matrix Impact Printer	RS-232. Simple/HP-IB. Amigo/HP-IB. Cent. HP-IB/Simple	X	X
2933A	Factory Data Printer	RS-232		X
2934A	Dot Matrix Office Quality Impact Printer	Cent. RS-232. HP-IB (slow)	X	X
33438P	LasetJet IID Postscript Cartridge	Cent	X	
33440A	LaserJet Series II 115V 8 ppm Printer	Cent. RS-232	X	X
33447A	LaserJet Series IID Dual Tray, Duplex Printer	Cent. RS-232	X	X
33449A	LaserJet Series III 8 ppm Laser Printer	Cent. RS-232	X	X
33459A	LaserJet Series IIID Dual Tray. Duplex Printer	Cent. RS-232	X	X
33471A	LaserJet IIP 4 ppm Laser Printer	Cent. RS-232	X	
33491A	LaserJet IIISi Laser Printer	LAN	X	X
3630A	PaintJet Color Graphics Printer for A/A4	Cent. HP-IB. RS-232	X	
41063A	Asian WS Printer	RS-232	X	

Table 7-4. Printer List (continued)

Part Number	Description	Interface	HP-UX	MPE/iX
C1200A	Asian Dot Matrix Line Printer 300 lpm	Cent, HP-IB, RS-232	X	X
C1202A	Asian Dot Matrix Line Printer 300 lpm	Cent, HP-IB, RS-232		X
C1602A	PaintJet XL Color Graphics Printer	Cent, HP-IB, RS-232	X	
C2001A	LaserJet IV	SCSI	X	X
C2002A	LaserJet Series 4M	High speed parallel	-	X
C2106A	DeskJet 500 Printer	Cent, HP-IB, RS-232	X	
C2106A	DeskJet	SCSI	X	
C2010A	LaserJet Series 4Si	High speed parallel		X
C2011A	LaserJet Series 4Si MX	High speed parallel		X
C2114A	DeskJet/Color	SCSI	X	
C2753A	HP5000 Model F100 Page Printer 60Hz	SCSI	X	X
C2753B	HP5000 Model F100 Page Printer 60Hz	SCSI	X	X
C2754A	HP5000 Model F100 Page Printer 50Hz	SCSI	X	X
C2754B	HP5000 Model F100 Page Printer 50Hz	SCSI	X	X
C2755A	HP5000 Model F100 Page Printer 60Hz	SCSI	X	X
C2755B	HP5000 Model F100 Page Printer 60Hz	SCSI		X
C2756A	HP5000 Model F100 Page Printer 50Hz	SCSI	X	
C2756B	HP5000 Model F100 Page Printer 50Hz	SCSI		X
C2772A	HP5000 Model F100 Page Printer 60Hz	SCSI	X	X
C2773A	HP5000 Model F100 Page Printer 50Hz	SCSI	X	X
C2776A	HP5000 Model F100 Page Printer 60Hz	SCSI	X	X
C2777A	HP5000 Model F100 Page Printer 50Hz	SCSI	X	X
TBD	PaintJet XL300	SCSI	X	

Terminals

Table 7-5. Terminal List

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
2323A	40 Channel Seq	RS-232	X		
2382A	Office Display Terminal	RS-232	X		
2392A	Display Terminal	RS-232	X	X	C
2393A	Monochrome Graphics Terminal	RS-232	X	X	C
2394A	Data Entry Terminal	RS-232	X	X	
2397A	Color Raster Terminal	RS-232	X	X	
2622A	Display Terminal	RS-232	X	X	
2623A	Display Terminal	RS-232		X	
2624B	Display Terminal	RS-232		X	
2625A	Dual System Terminal	RS-232	X		
2627A	Color Graphics Terminal	RS-232	X	X	
2628A	HPWord Terminal	RS-232	X	X	
3081A	Workstation Terminal	RS-232	X	X	
3082A	Industrial Terminal 2397	RS-232	X	X	
3082B	Industrial Terminal	RS-232	X	X	
45610A	HP 150 PC	RS-232	X		
45610B	Touchscreen Terminal	RS-232	X		
45710A	Portable Computer	RS-232	X		
45711A	Portable Plus w/Modem	RS-232	X		
45711C	Portable Plus w/Modem	RS-232		X	
45849A	Personal Computer	RS-232		X	
45850A	HP150 II Terminal	RS-232	X		
45970C	Vectra ES/12 Model 20 SPU	RS-232	X		C
72425A	Vectra Model 25 PC	RS-232	X	X	
72445A	Vectra Model 45 PC	RS-232	X		
72475A	Vectra Office Model 1	RS-232	X		

Table 7-5. Terminal List (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
D1001A	Vectra Portable CS	RS-232		X	
D1110A	Vectra CS	RS-232		X	
D1210A	Vectra ES	RS-232		X	
D1310A	Vectra ES/12	RS-232		X	
D1500A	Vectra RS/16	RS-232		X	
D1600A	Vectra RS/20	RS-232		X	
D2300A	AXDS for Vectra PC Family	LAN	X		
D2460A	Vectra 286/12	RS-232		X	
D2220A	Vectra 486/25/33/50/66 Compaq 286/386/386S IBM PS2 30/50/60/80	RS-232		X	
9666A	OIU (Ruggedized 2397A Clr Gph Term)	RS-232	X		
97056A	ASYNC Terminal	RS-232	X		
9807A	Integrated Personal Computer U.S.	RS-232	X		
98720A	High-Resolution Display Controller	LGB	X		C
98730A	High-Resolution Display Controller	LGB	X		C
C1001A/G/W	HP700/92 Terminal	RS-232	X	X	C
C1002A/G/W	HP700/94 Terminal	RS-232	X	X	C
C1003A/G	HP700/41 Terminal	RS-232	X		
C1004A/G/W	HP700/22 Terminal	RS-232	X		
C1006A/G/W	HP700/43 Terminal	RS-232	X	X	
C1007A/G/W	HP700/44 Terminal	RS-232	X		
C1010C	Simplified Chinese HP700/92A Keyboard	RS-232	X	X	C
C1010J	Japanese HP700/92A Keyboard	RS-232	X	X	C
C1010K	Korean HP700/92A Keyboard Kit	RS-232	X	X	C
C1010T	Traditional Chinese HP700/92A Keyboard	RS-232	X	X	C
C1017A/G/W	HP700/32 Terminal	RS-232	X		
C1064A/G/W	HP700/96 Terminal	RS-232	X	X	C

Table 7-5. Terminal List (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
C1065A/G/W	HP700/98 Terminal	RS-232	X	X	C
C1080A/G/W	HP700/60 Terminal	RS-232	X	X	
C1083W	HP700/60 ES (Reduced Emission)	RS-232	X	X	C
C1084W	HP700/96 ES (Reduced Emission)	RS-232	X	X	C
C1085W	HP700/98 ES (Reduced Emission)	RS-232	X	X	C
C2300A	XWindow Graphic Terminal (700/X)	LAN	X		C
Emulators	150, 110+, 300, IPC Vectra	RS-232	X		
HP150B/C	Touchscreen I	RS-232	X		
VT100	700/60 Terminal Supports VT100 Emulation Mode	RS-232	X		
WYSE60	700/60 Supports WYSE60 in Emulation Mode	RS-232	X		

Note C = Supported as a System Console

Tape Drives and CD-ROMs

Table 7-6. Tape Drive and CD-ROM List

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
35401A	1/4in Cartridge Autochanger Tape Drive	HP-IB (fast)	X		
7974A	1600 CPI Streaming & Strt/Stp Tape Drive	HP-IB (fast)	X	X	B
7978A	6250/1600 CPI Streaming Tape Drive	HP-IB (fast)		X	B
7978B	6250/1600 CPI Streaming Tape Drive	HP-IB (fast)	X	X	B
7979A	1600 CPI Autoload 1/2in Tape Drive	HP-IB (fast)	X	X	B
7980A/XC	6250/1600 CPI Autoload 1/2in Tape Drive	HP-IB (fast)	X	X	B
7980S/SX	6250/1600 BPI Tape Drive	SCSI	X	X	B
9144A	67 MB 1/4in Cartridge Tape Drive	HP-IB (fast)	X		B
9145A	133 MB 1/4in Cartridge Tape Drive	HP-IB (fast)	X		B
A1999A	Standalone 660 MB SCSI CD-ROM	SCSI	X	X	
A2311A	QIC Upgrade Kit	SCSI	X		
A2312A	Peripheral Upgrade Kit	SCSI	X		
C1501A	Embedded Digital Data Storage	HP-IB (fast)	X	X	B
C1502A	1.3 GB DDS embedded	SCSI	X	X	B
C1503B	2 GB embedded DDS Tape Drive	SCSI		X	B
C1504B	Up to 8 GB embedded DC-DDS embedded	SCSI		X	B
C1511A	Standalone 1.3 GB DDS-Format Tape Drive	HP-IB (fast)	X	X	B
C1512A	Standalone 1.3 GB DDS-Format Tape Drive	SCSI	X	X	B
C1520B	Standalone 2 GB DDS-Format Tape Drive	SCSI	X	X	B
C1521B	Standalone Up to 8 GB DC-DDS Tape Drive	SCSI	X	X	B

Table 7-6. Tape Drive and CD-ROM List (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
C1533A	SCSI DDS up to 16 GB Tape Drive	SCSI		X	
C2292A	1.3 GB Digital Audio Tape Upgrade Kit	SCSI	X	X	B
C2293A	600 MB CD-ROM Upgrade Kit	SCSI	X		
C2293U	600 MB CD-ROM Expansion Kit	SCSI	X	X	
C2463F	1.3 GB DDS-format Tape Drive - floor-standing	SCSI	X	X	B
C2463R	1.3 GB DDS-format Tape Drive - rack-mount	SCSI	X	X	B
C2464F	2 GB DDS (tower)	SCSI	X	X	B
C2464R	2 GB DDS (rack)	SCSI	X	X	B
C2465F	Two 2 GB DDS Drive (tower)	SCSI		X	B
C2465R	Two 2 GB DDS Drive (rack)	SCSI		X	B
C2466F	Up to 8 GB Data compression Drive (tower) DDS	SCSI	X	X	B
C2466R	Up to 8 GB Data compression Drive (rack) DDS	SCSI	X	X	B
C2467F	Up to 8 GB Data compression Drive (tower) DDS	SCSI	X		
C2467R	Up to 8 GB Data compression Drive (rack) DDS	SCSI	X		
C2467RZ	Up to 16 GB Data compression Drive (rack) DDS	SCSI		X	
C2476F/R	Up to 8 GB DDS Expansion Kit (tower or rack)	SCSI	X	X	
C2476S	600 MB Half-height CD-ROM-CPU Expansion Kit (tower or rack)	SCSI	X	X	
C2477F/R	2 GB DDS Add-On Tp C256X	SCSI	X		
C2477S	2 GB DDS Expansion Kit - CPU	SCSI	X		
C2477U	2 GB DDS Expansion Kit (tower or rack)	SCSI	X	X	B
C2478F	Up to 8 GB DDS Expansion Kit (tower)	SCSI	X	X	B
C2478R	Up to 8 GB DDS Expansion Kit (rack)	SCSI	X	X	B
C2478U	Up to 8 GB DDS Expansion Kit (tower or rack)	SCSI	X	X	B

Table 7-6. Tape Drive and CD-ROM List (continued)

Part Number	Description	Interface	HP-UX	MPE/iX	Notes
C3560U	(Model 3401) SCSI 660 MB CD-ROM	SCSI	X	X	
STK 4220	C3480 Series STK Autoload Single Drive	SCSI		X	
STK 4280	C3480 Series STK Autoload Single/Double Drive	SCSI		X	
0950-2427	Exabyte 8mm	SCSI	X		
0950-2382	QIC 1 GB Tape	SCSI	X	-	

Note B = Supported as a Bootable device

Floppy Disks

Table 7-7. Floppy Disk List

Part Number	Description	Interface	HP-UX	MPE/iX
A2942A	3 1/2in Floppy Disk Drive	SCSI	X	
0950-2326	3 1/2in Half-Height Disk Drive		X	

UPS Devices

Table 7-8. UPS Device List

Part Number	Description	Interface	HP-UX	MPE/iX
A2998A	3.0 KVA UPS for T500/991/995			X

Miscellaneous Devices

Table 7-9. Miscellaneous List

Part Number	Description	Interface	HP-UX	MPE/iX
S28696A	HP-PB High Performance SCSI Adapter (F/W SCSI Card)	F/W SCSI		X
HP28642A	NIO SCSI Host Adapter Card	SCSI		X
HP1703A	NIO FL Host Adapter Card	HP-FL		X

8

Replaceable Parts

This chapter lists the replaceable parts and exchange assemblies for the 990/992/890 and 991/995/T500 systems. System diagrams are included to illustrate the locations of Field Replaceable Units (FRUs) and other replaceable parts.

Chapter Contents:

The information in this chapter includes (in order):

- Table 8-1 - Exchange Parts List
- Table 8-2 - SPU Cabinet Parts
- Table 8-3 - Internal HP-PB I/O Card Cage Parts
- Table 8-4 - Cables
- Table 8-5 - Expansion Cabinet Replaceable Parts
- Table 8-6 - External HP-PB I/O Card Cage Replaceable Parts

Ordering Information

You can order replaceable parts or service kits from the nearest Hewlett-Packard Sales and Support Office in your area. Include the following information when ordering any part or kit:

- Complete model number and serial number of the computer system.
- Hewlett-Packard part number for each part or kit.
- Complete description of each part.

Exchange Assemblies

A defective Printed Circuit Assembly (PCA) or power module assembly can be exchanged for an operating assembly. For information about cost and other details regarding the exchange program. contact the nearest Hewlett-Packard Sales and Support Office in your area.

Refer to Table 8-1 for a list of exchange assemblies for the 990/992/890 and T500/991/995 systems. The **Item** numbers in Table 8-1 are referenced to Figure 8-1 through Figure 8-10.

Table 8-1. Exchange Parts List

Item in Figures 8-1 through 8-11	New Assembly Part Number	Exchange Assembly Part Number	Description
2	A1809-60128	A1809-69128	PCA. Processor Card
3	A2234-60002	A2234-69002	PCA. 256 MB Memory Card
3	A2233-60002	A2233-69002	PCA. 128 MB Memory Card
4	A2570-60002	A2570-69002	PCA. 64 MB Memory Card
5	A1809-60005	A1809-69005	PCA. Upper Bus Converter (PMB)
6	0950-2229	0957-0061	+5V 650W Converter
7	0950-2232	0957-0059	MPM Power Supply Module
13	0950-2230	0957-0058	+5V 325W Converter
14	0950-2231	0957-0060	+24V Fan Power Supply Module
17	A1809-60003	A1809-69032	PCA. Service Processor Card
19	0950-2227	0957-0057	PFC HVDC Power Supply
20	A1809-60006	A1809-69006	PCA. Lower Bus Converter Card
20	27113-60301	27113-69301	PCA. HP-IB Card (CIO)
20	28615-60001	28615-69002	PCA. HP-FL Card (HP-PB)
20	28639-60001	28639-69001	PCA. Console/LAN Card
20	28640-60001	28640-69001	PCA. LAN Card (HP-PB)
20	28642-60001	28642-69001	PCA. SCSI Card (MPE/iX only)
20	28655-60001	28655-69001	PCA. SCSI/Parallel Card (HP-UX and MPE/iX)
20	A1820-60002	A1820-69002	PCA. TNT Processor Card
20	A1820-60003	A1820-69003	PCA. TNT Daughter Card
20	J2096-60001	J2096-69001	PCA. 32-port MUX Card
20	28696-60001	28696-69001	PCA. Fast/Wide SCSI (EDIO) HP-UX only
20	28679-60001	28679-69001	PCA. Fast/Wide SCSI (EDIO) MPE/iX only

Table 8-2. SPU Replaceable Parts

Item in Figures 8-1 through 8-11	Part Number	Description
1	A1809-60078	Assembly, Control Panel housing
1	A1820-60006	Assembly, Control Panel housing (T500/991/995)
1	A1809-60013	PCA, Control Panel
8, 18, 39	9300-1922	Ground Strap
9, 34	A1809-60001	PCA, Processor Backplane
10, 35	A1809-80021	Bus Bar, 3 layer
11, 29	A1809-60026	Fan Tray Chassis
12, 20	n/a	Internal HP-PB Card Cage (see Table 8-3)
15	1420-0652	Battery 12V - 4 each
Not shown	1420-0389	Assembly, Battery/Fuse
20	A1809-60030	PCA, Power System Control Module (HP-PB)
20	A1809-60095	PCA, HP-PB/CIO Adapter (Channelspan)
21	3105-0285	Circuit Breaker 3P 30A
22	A1809-60079	Assembly, AC Input cover
(inside 27)	2110-0902	Fuse - Battery 30A/600V
23	A1809-40004	Battery Cover
30	0515-1139	Screw - M4 X 12mm Torx T15 (no washer)
Not shown	0515-2134	Screws - M3 X 10mm (4 total) for processor daughter board
31	3160-0809	SPU Fans
Not shown	A1809-00119	Fan Plate
Not shown	A1809-60046	Fan Power Harness
32	A1809-60047	Fan Sensor Harness
33	A1809-60016	PCA, Fan Control Card
36	A1809-60014	Assembly, Front Card Cage
37	A1809-60015	Assembly, Rear Card Cage
Not shown	A1027-60017	Assembly, SSPAN (Channelspan) Bulkhead
Not shown	A1809-60025	Assembly, Backplane Bracket
Not shown	A1809-60027	Assembly, 650 DC Converter Cover
Not shown	A1809-60028	Assembly, SPS 325 DC Converter Cover

(continued)

Table 8-2. SPU Replaceable Parts (continued)

Item in Figures 8-1 through 8-11	Part Number	Description
Not shown	A1809-60031	Assembly, Key Lock Cable
Not shown	A1809-60032	Assembly, Standby Ready Switch Cable
Not shown	A1809-60037	Assembly, Front cover
Not shown	A1809-60039	Assembly, Single cover
Not shown	A1809-60040	Assembly, Trans cover
Not shown	A1809-60061	Assembly, Access cover
Not shown	A1809-60062	Assembly, Battery tray
Not shown	A1809-60070	Assembly, Cable channel
Not shown	1492-0159	Cabinet Caster
Not shown	A1809-40003	Vent Module
Not shown	A1809-40005	Configuration Block Cover
38	A1809-00090	Cap. Cabinet Top
40	A1809-40009	HP 3000 Forehead
40	A1809-40010	HP 9000 Forehead
41	A1809-80026	Air Filter, PMB
42	A1809-80027	Air Filter, Power
43	A1809-60104	Door, Front
44	A1809-60105	Door, Rear
45	A1809-60052	Panel, left side
46	A1809-60053	Panel, right side
Not shown	1390-0856	Key to remote enable switch
Not shown	A1809-80058	HEX Key (for front door)
Not shown	A1809-80066	Nameplate 890
Not shown	A1809-80068	Nameplate 992/DX
Not shown	A1809-80069	Nameplate 992
54	A1809-60084	Power Supply Fan

Note For part numbers of cables, refer to Table 8-4.

Table 8-3. Internal HP-PB I/O Card Cage Replaceable Parts

Item in Figures 8-1 through 8-11	Part Number	Description
47	0950-2246	Power Supply-260W
48	A1824-60025	Assembly. Backplane Pan
49	A1809-00009	Assembly. Front Cover
50	A1809-60030	PCA Power System Control Module
Not shown	1420-0656	Assembly. Battery/Fuse
Not shown	2110-0030	Fuse - Battery 5A/250V (slow blow)
Not shown	A1809-60017	PCA HP-PB Backplane
Not shown	A1824-60004	Assembly. Riveted
Not shown	A1809-60038	Assembly. Rear cover

Note For part numbers of internal HP-PB card cage cables. refer to Table 8-4.

Table 8-4. Cables

Item in Figures 8-1 through 8-11	Part Number	Description
SPU Battery Cables		
16, 24, 26-28	A1809-60057	Battery Cable with Fuse
25	A1809-60058	Cable, Battery Jumper
Fan Cables		
Not shown	A1809-60054	Cable, IO Fan
Internal HP-PB Card Cage Cables		
Not shown	A1809-60050	Cable, Link 6.0M
51	A1809-63002	HP-PB AC/Signal Cable
Not shown	8120-1396	Cable, Assy 18 AWG
Not shown	A1809-63001	Cable, Battery
Power Supply Cables		
52	A1809-60048	Cable, High Voltage
53	A1809-60055	Cable, PFC Interface
Not shown	A1809-60056	Cable, Input PFC
Miscellaneous Cables		
Not shown	5062-3356	1 Meter AUI Cable
Not shown	5063-1218	2.5M SCSI Cable
Not shown	A1809-60018	Cable, Control Panel
Not shown	A1809-60019	Cable, Support
Not shown	A1809-60041	Cable, Link 1.0M
Not shown	A1809-60064	Cable, Software Terminal Block
Not shown	A1809-60076	Cable, Configuration Block Ground
Not shown	A1809-60083	Cable, Software Configuration Block
Not shown	A1809-60096	AC power cable

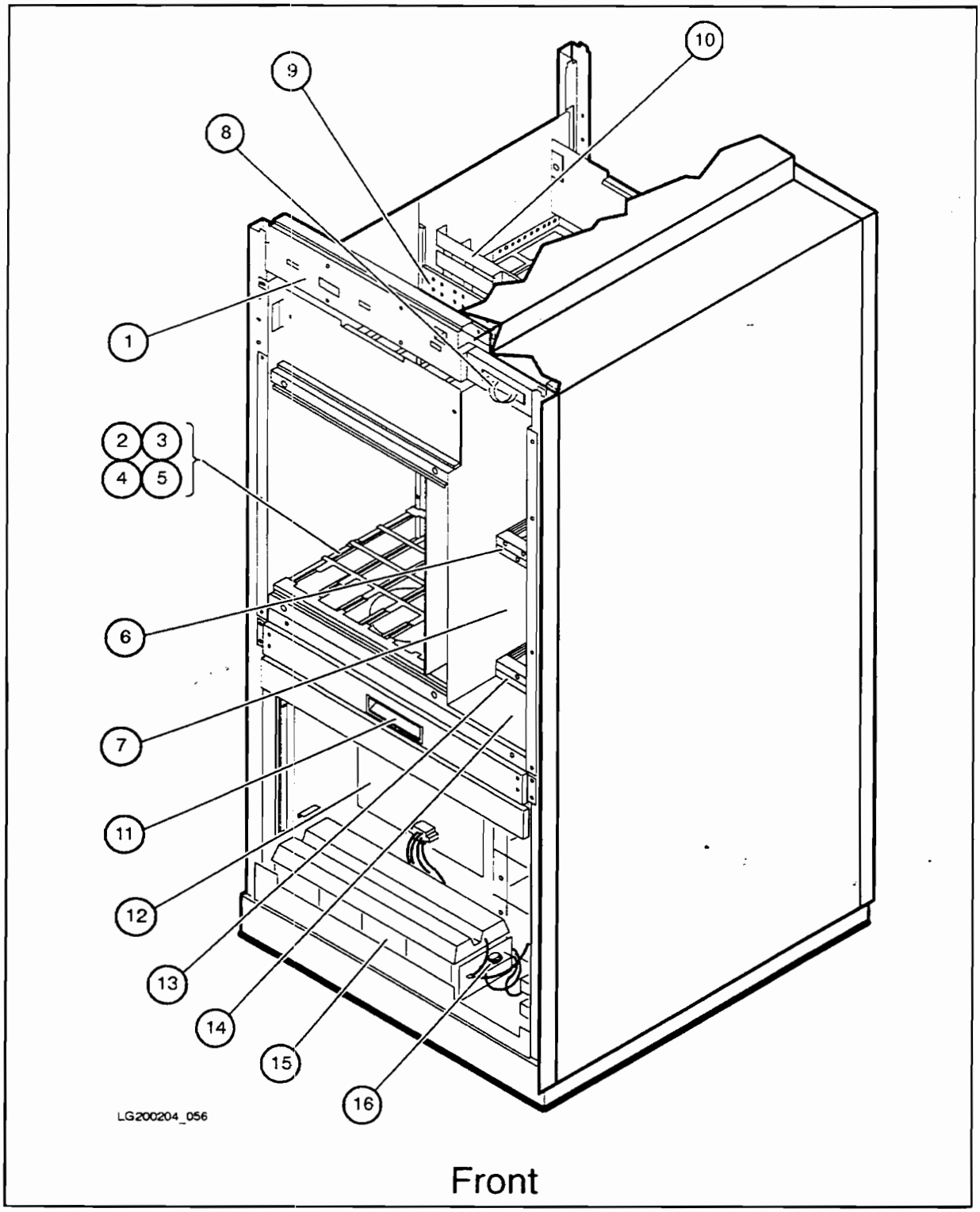


Figure 8-1. SPU Cabinet Internal Layout (Front)

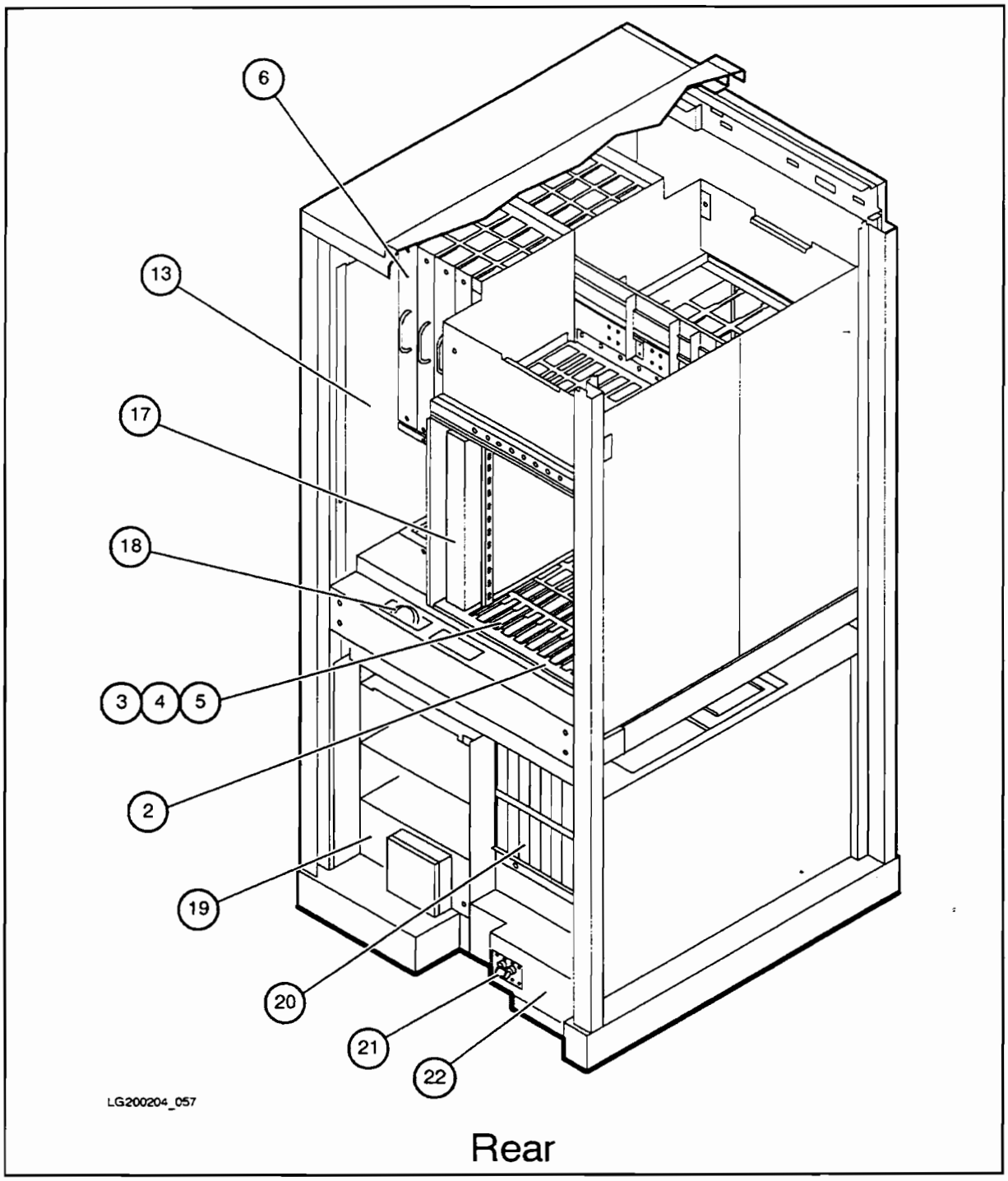


Figure 8-2. SPU Cabinet Internal Layout (Rear)

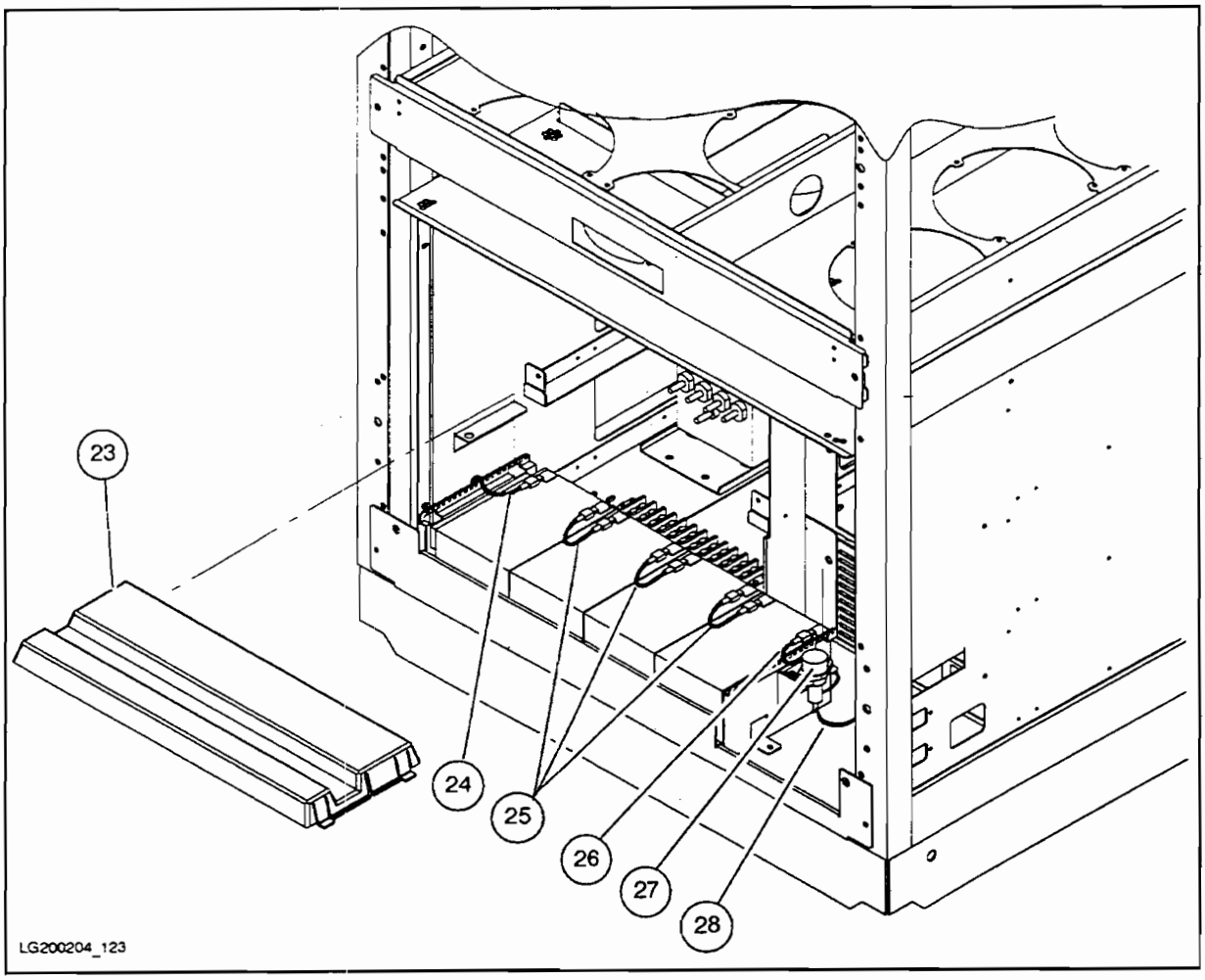


Figure 8-3. SPU Battery Parts

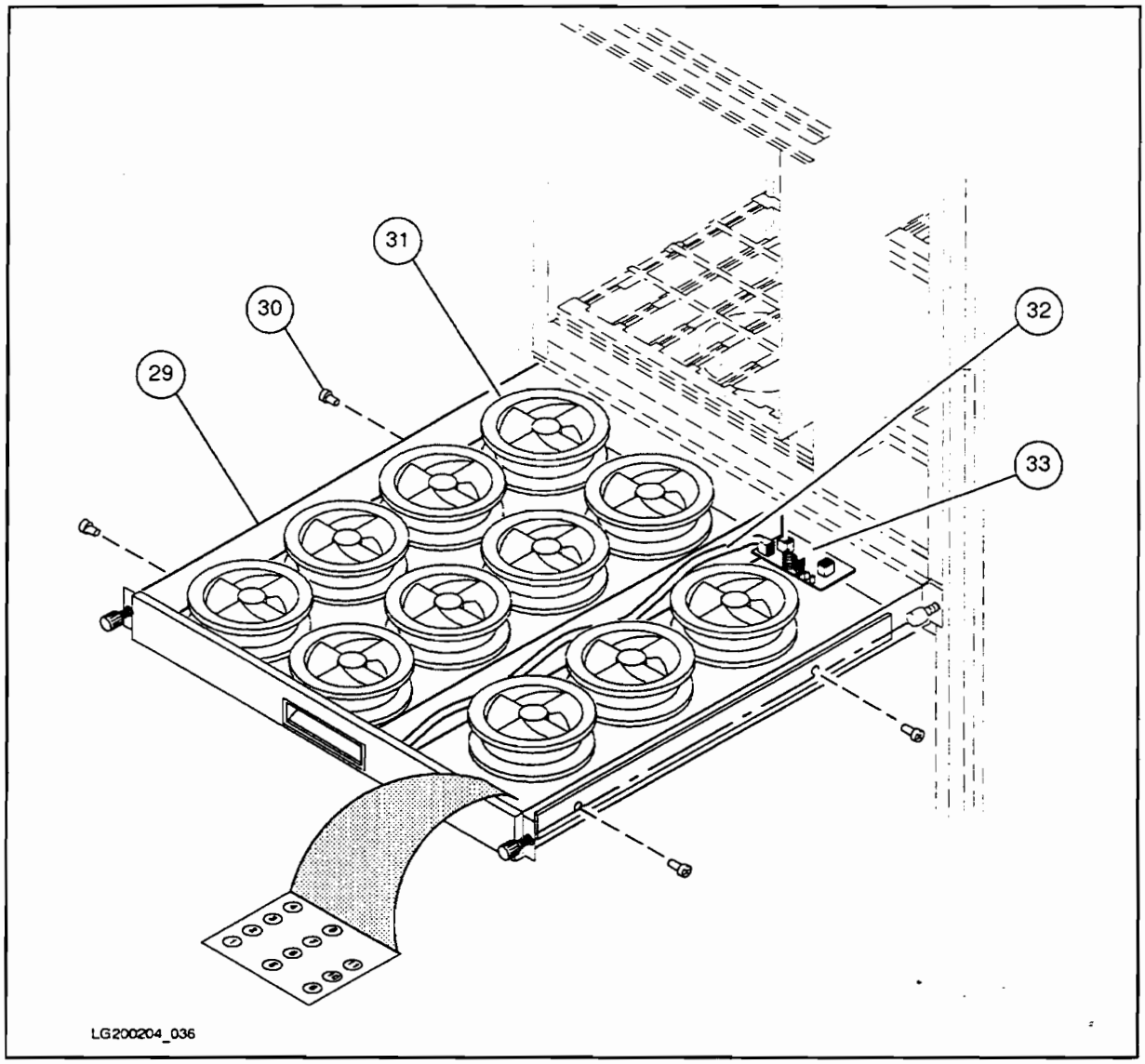


Figure 8-4. Fan Parts

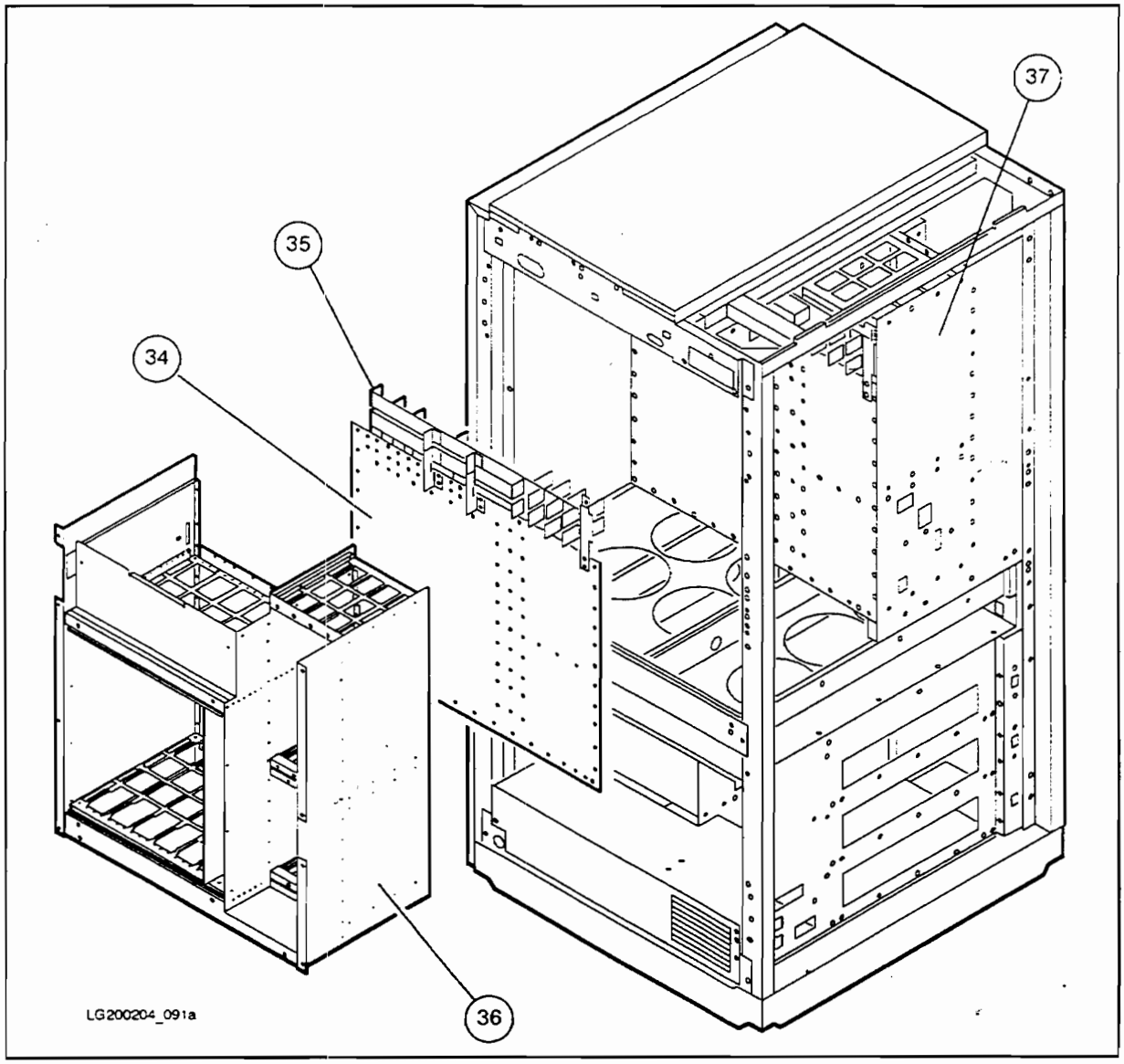


Figure 8-5. Front Card Cage and Bus Bar

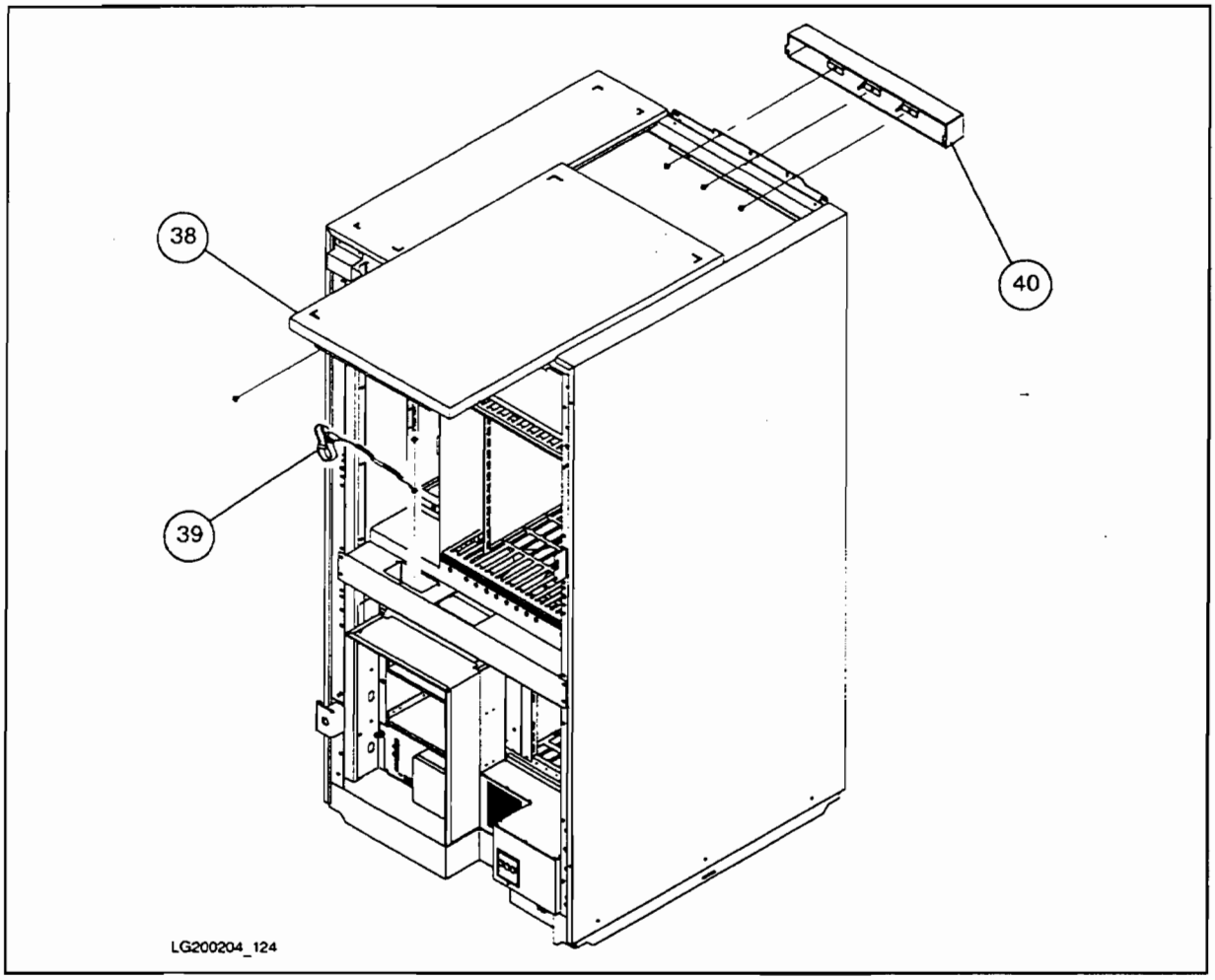


Figure 8-6. SPU Cabinet Forehead and Top Panel

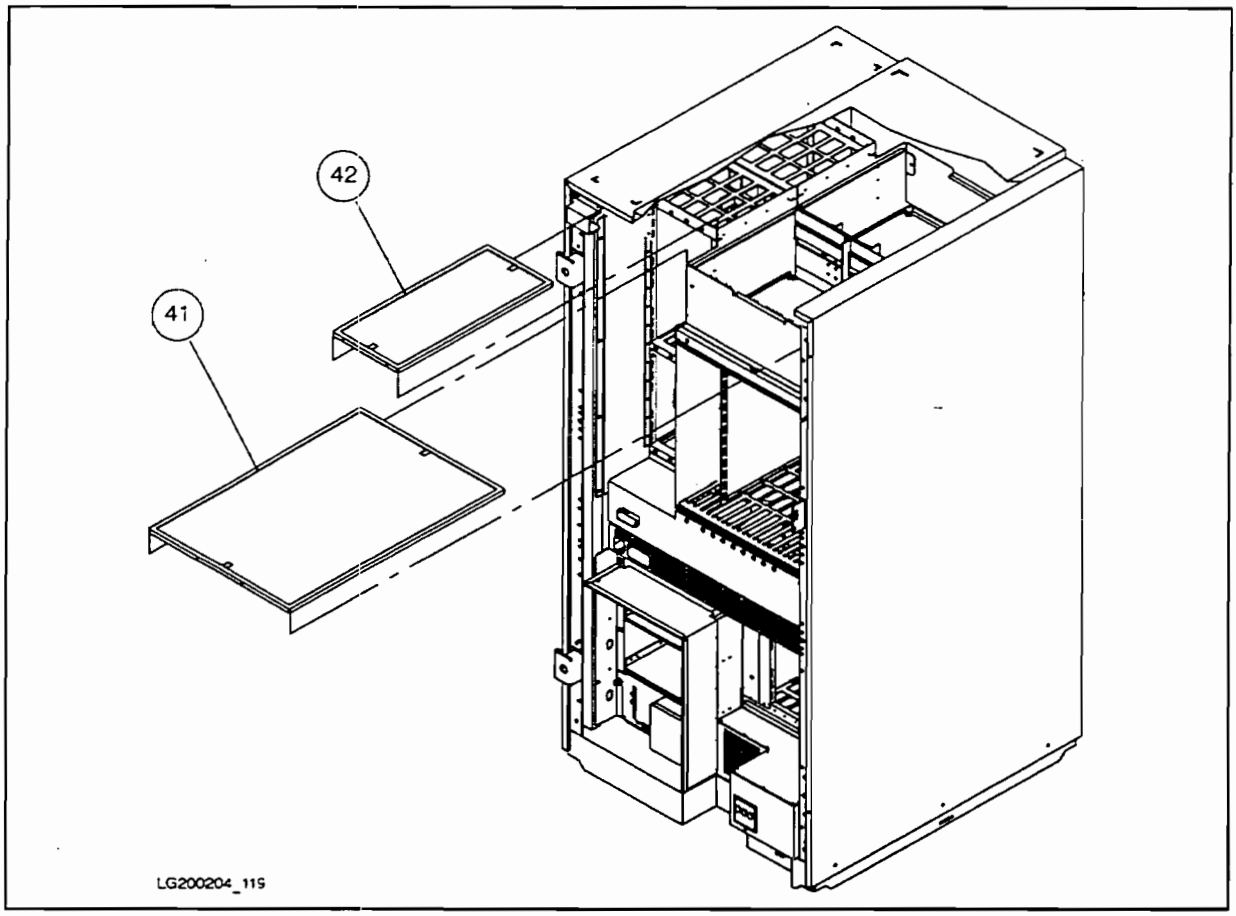


Figure 8-7. Air Filters

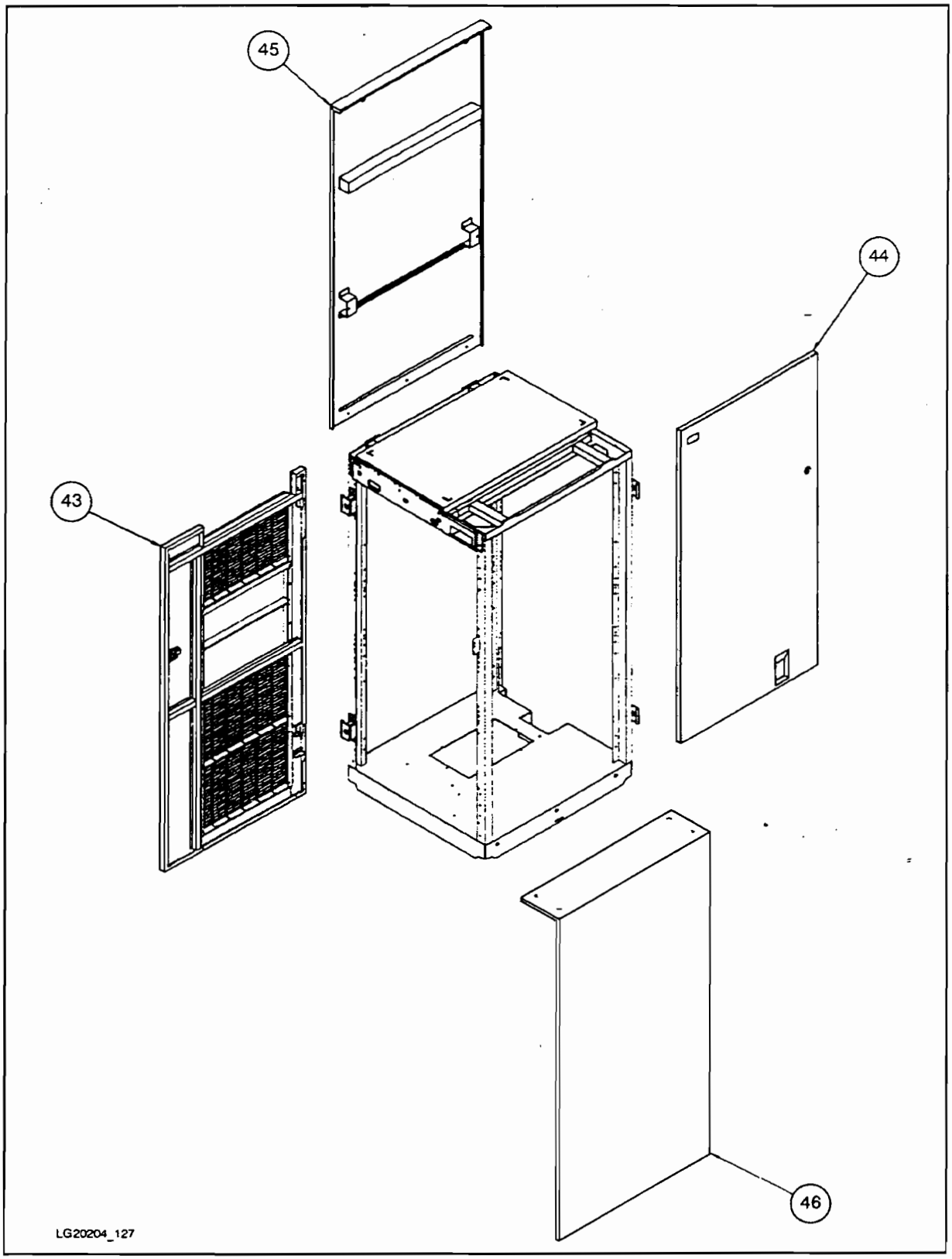


Figure 8-8. SPU Doors and Side Panels

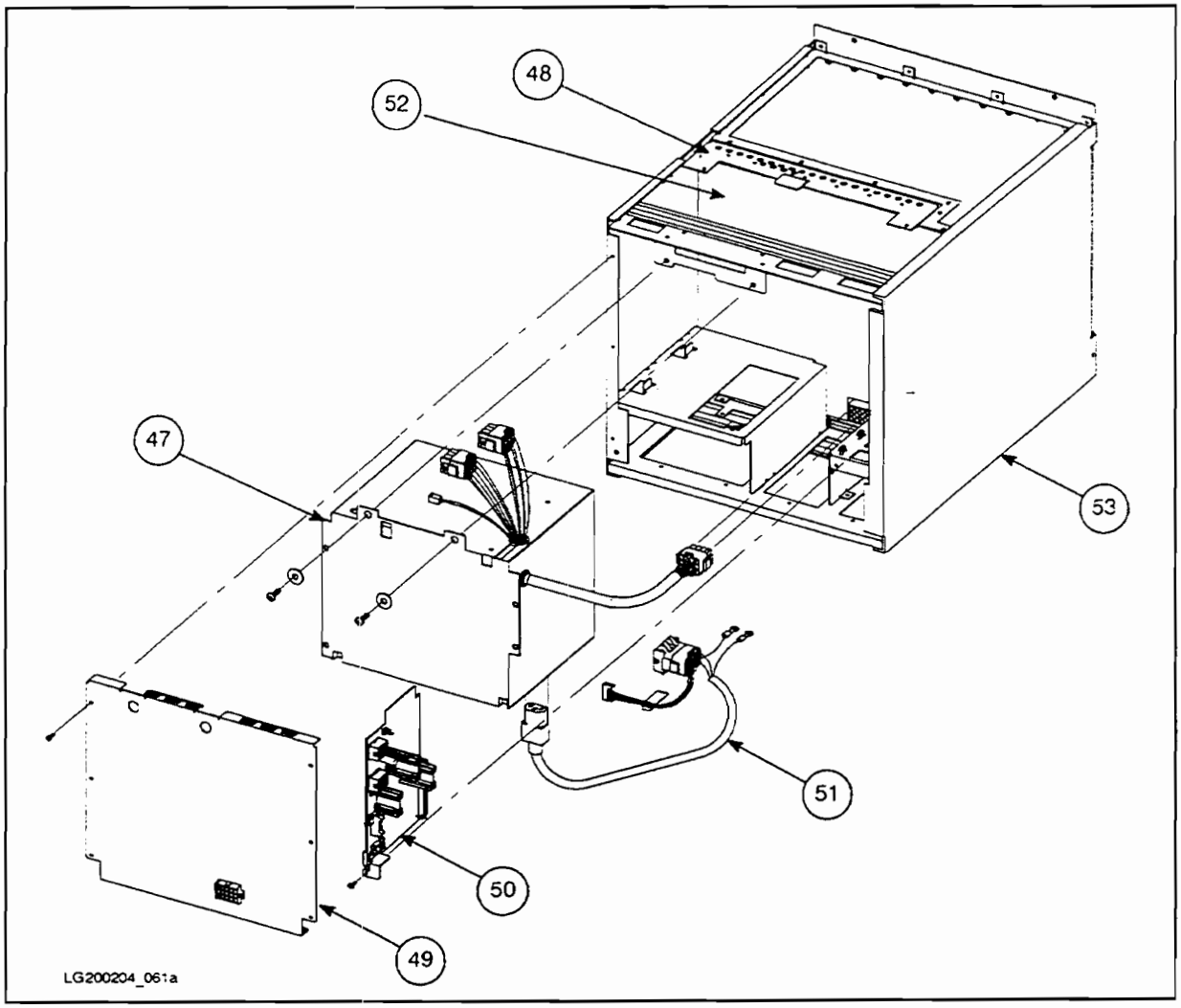


Figure 8-9. Internal HP-PB I/O Card Cage Parts

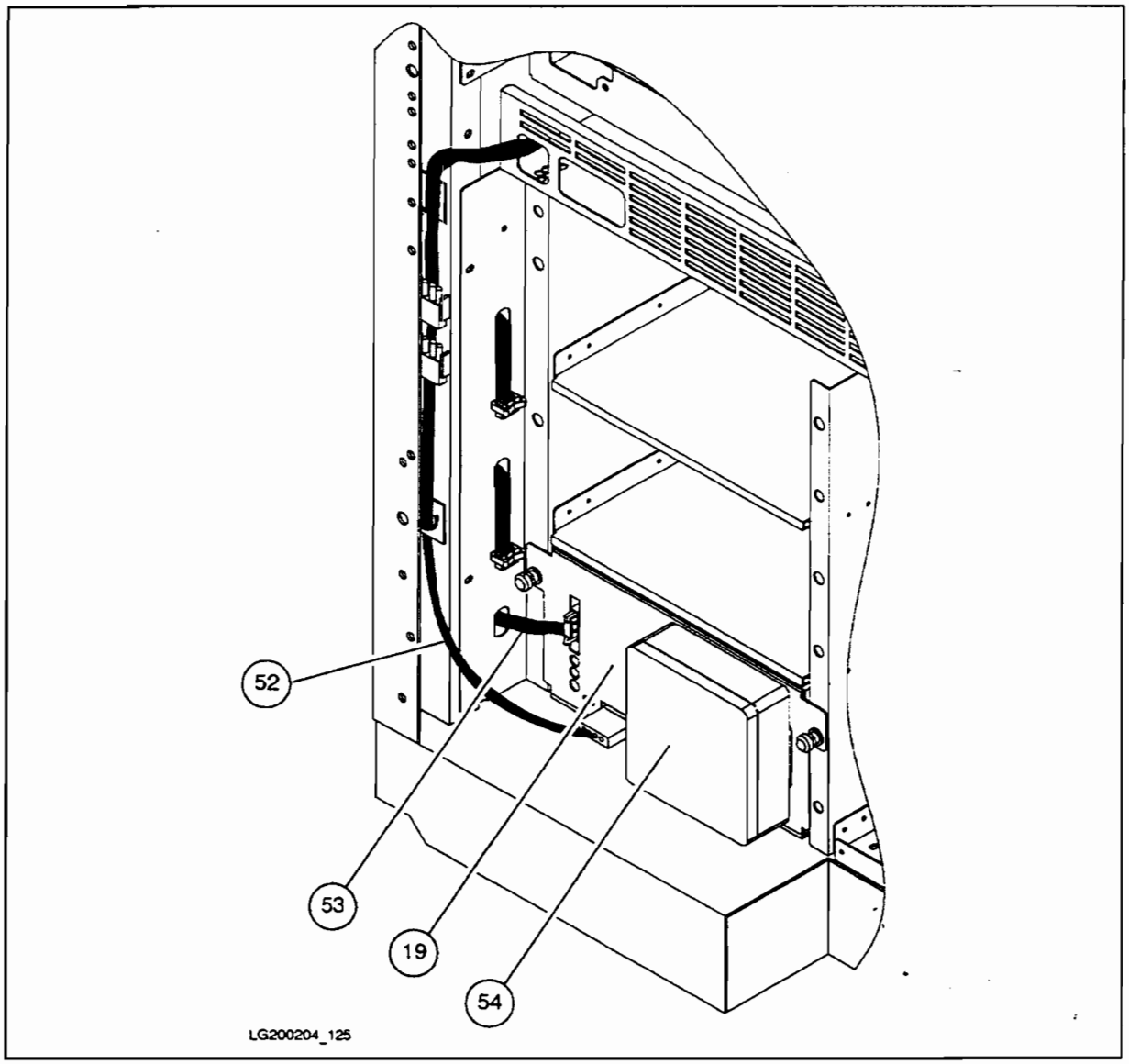


Figure 8-10. PFC Cables

1.6 Meter Expansion Cabinet Replaceable Parts

Note All Item numbers in Table 8-5 are referenced to Figure 8-11 and Figure 8-12.

Table 8-5. 1.6 Meter Expansion Cabinet Replaceable Parts

Item in Figure 8-11 or Figure 8-12	Part Number	Description
1	C2786-60016	Rear door assembly, 1.6 meter
Not shown	1390-0489	Strike Plate
Not shown	1390-0265	Magnetic Door Catch
Not shown	0403-0780	Door Bumper
2		Not used in this configuration
3	C2786-00012	Rear hinge
4	C2786-60015	Vented top cap
5	C2785-60007	Non-vented top cap
6	C2786-60014	Side cover, 1.6 meter
7		Not used in this configuration
8	C2786-60004	Forehead assembly (with On/Off Switch)
Not shown	5181-8714	On/Off Switch 220V
9	C2786-00014	Base cover, 1.6 meter
10		Not used in this configuration
11	C2786-60018	Rail assembly
Not shown	C2786-00019	Rear Stop Bracket
Not shown	3160-0378	230V Fan
13	C2786-60005	230V Fan assembly
14	C2786-63006	US 208-240V PDU, 1.6 meter
15	C2786-63007	EURO 230V PDU, 1.6 meter

(continued)

Table 8-5. 1.6 Meter Expansion Cabinet Replaceable Parts (continued)

Item in Figure 8-11 or Figure 8-12	Part Number	Description
16		Not used in this configuration
17		Not used in this configuration
18	C2786-00021	PDU Support Bracket
19	1492-0159	Caster
Not shown	0535-0096	Nut- Wiz, M8 x 1.25 (caster)
20	0403-0778	Leveler
21	C2786-60017	Ballast assembly
Not shown	0590-0804	Nut- Tinnerman 10/32
Not shown	2680-0278	Screw, T15 10/32 w/washer
Not shown	2680-0281	Screw, T25 10/32
Not shown	C2786-60001	1U (unit) Filler assembly
Not shown	8120-5470	Rack device Power cord, 20 inches
Not shown	8120-1396	Rack device power cord, 30 inches
Not shown	C2786-00036	ADP mounting bracket

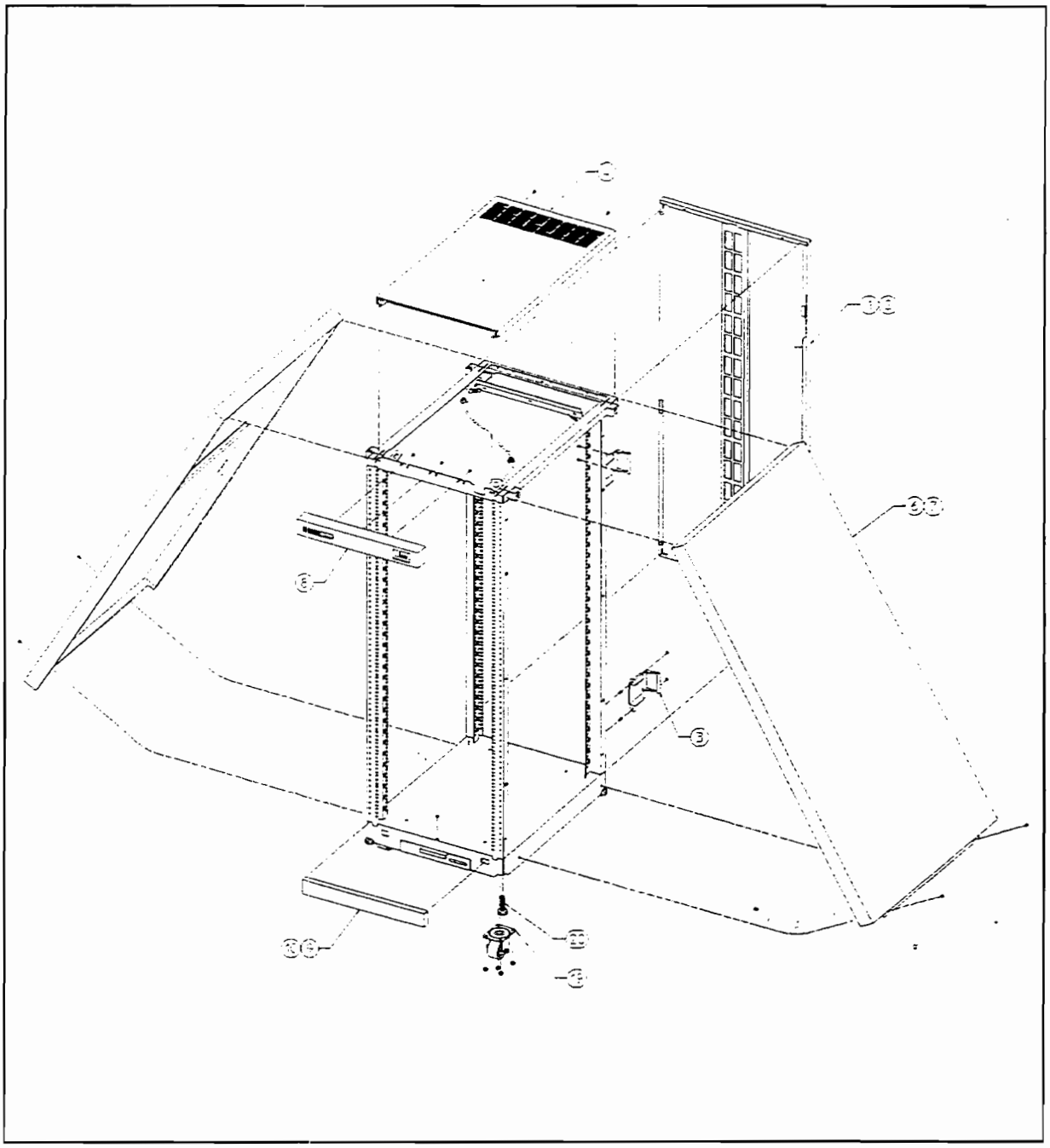


Figure 8-11. 1.6 Meter Expansion Cabinet Exploded View (Front)

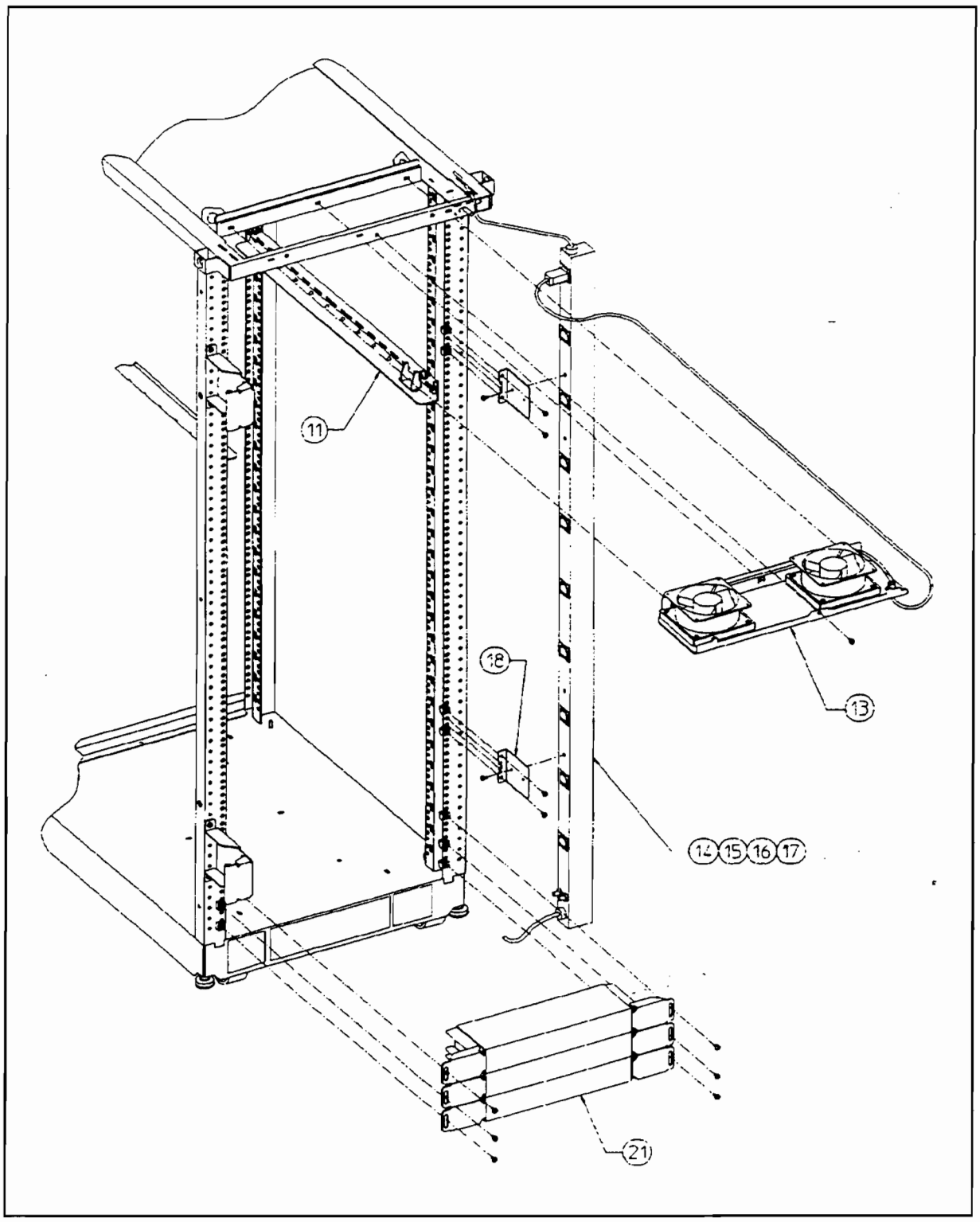


Figure 8-12. 1.6 Meter Expansion Cabinet Exploded View (Rear)

External HP-PB I/O Card Cage Replaceable Parts

Note All **Item** numbers in Table 8-6 are referenced to Figure 8-13.

Table 8-6. External HP-PB I/O Card Cage Replaceable Parts

Item in Figure 8-13	Part Number	Description
Power System		
1	0950-2246	Power Supply-260W
2	1420-0656	Assembly, Battery/Fuse
8	A1824-00015	Lock, Battery
9	A1824-00014	Holder, Battery
Not shown	2110-0030	Fuse - Battery 5A/250V (slow blow)
PCAs		
3	A1809-60030	Power System Control Module PCA
4	A1824-60002	PCA, LED
5	A1809-60017	PCA, (HP-PB) Backplane
Assemblies		
5	A1824-60009	Assembly, Backplane Pan
7	A1824-60011	Assembly, Shield
10	A1824-60004	Assembly, Riveted
Cables		
Not shown	8120-1396	Cable, Assy 18 AWG
Not shown	A1824-63001	Cable, A/C
Not shown	A1824-63003	Cable, Power/LED
Not shown	A1824-63004	Cable, Fan Assembly
Cabinet Parts		
Not shown	A1824-40001	Bezel Attachment
Not shown	A1824-80005	Label, Nameplate
6	C2786-40002	Snap for Bezel Attachment
Not shown	A1824-60015	Power Switch Assembly

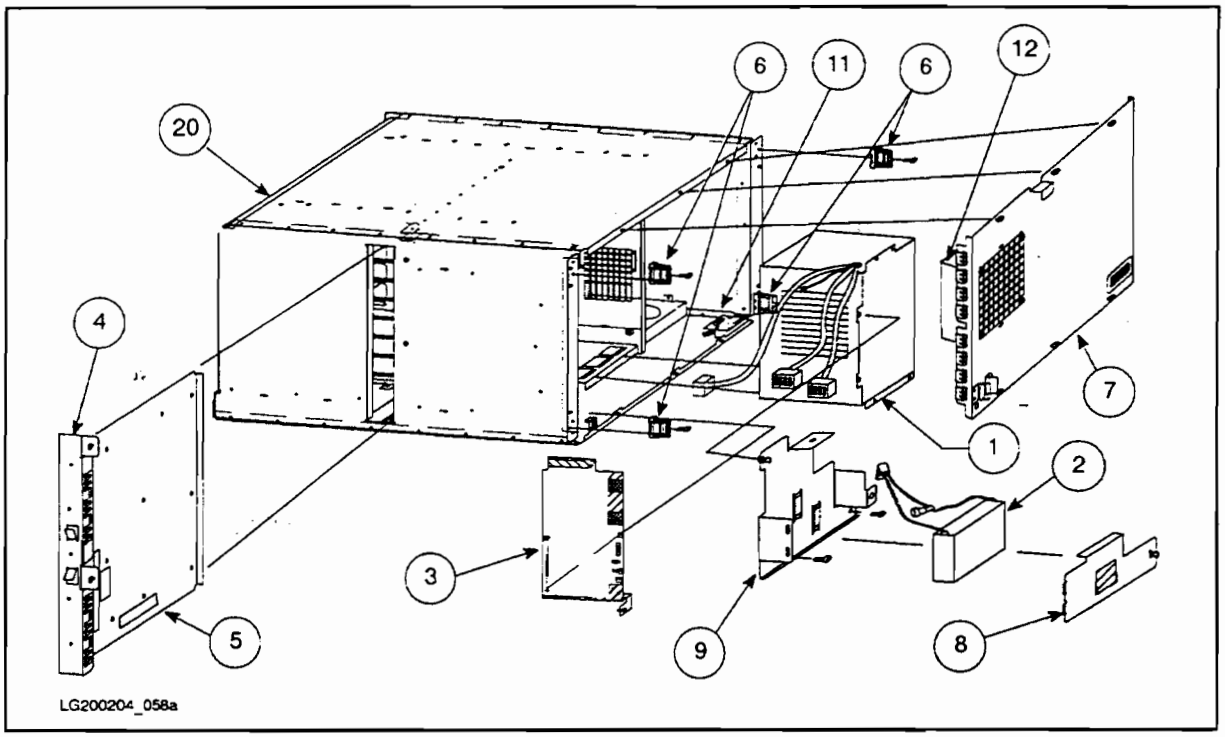


Figure 8-13. External HP-PB I/O Card Cage Parts

9

Removal and Replacement

This chapter describes how to remove and replace parts in the 99x/890/T500.

Chapter Contents:

- Before You Begin Removal Procedures
- SPU Cabinet FRU Replacement Procedures
- Expansion Cabinet FRU Replacement Procedures

Before You Begin Removal Procedures

Warning

Before removing any parts from the system, ensure that the following steps have been performed:

1. **A system backup has been performed.**
2. **The operating system has been shut down.**

Hazardous voltages are present inside the cabinet. To prevent the risk of electric shock:

1. **Place the front panel Standby/Ready switch to the "Standby/Battery Off" position.**
2. **Switch the rocker-arm switch located at the front, upper-right, corner of the expansion cabinet to the "OFF" (0) position. For cabinets supported by an HP A2998A PowerTrust UPS (Uninterruptible Power System), the power cord of the expansion cabinet PDU should be disconnected from the UPS.**
3. **Switch the circuit breaker (bottom rear of the SPU cabinet) to the "OFF" position to disconnect AC power from the system.**

Wait one minute before disassembling the system.

Caution

Handle all FRUs carefully. Dropping or otherwise jarring the FRUs will damage them.

Follow ESD procedures. Always use one of the ESD grounding wriststraps attached to the cabinet chassis during service.

Required Tools

- No. 10 TORX head driver
- No. 15 TORX head driver
- No. 25 TORX head driver
- Anti-static protective containers
- Flat-bladed screwdriver
- Grounding wriststrap
- Needle-nosed pliers

There are two grounding wriststraps attached to the SPU cabinet (one in the front and one in the rear of the cabinet). See Figure 9-1 and Figure 9-2 for their location.

Torque Specifications

Use the following torque specifications when securing the SPU fasteners:

Table 9-1. Torque Specifications

Screw Size	SPU part	Torque (in-lbs)
M3	Various	12 - 14
M4	Various	18 - 20
M5	Captive Fasteners (SPU. PFC. BH)	24 - 26
M6	Door Hinges	70
M6	Skins to Frame Columns	30 - 36

Warning

When fastening the link cable to the upper bus converter card, do not exceed 8 in-lb. The recommended torque specification is 6 +/- 2 in-lb.

SPU Cabinet

SPU Cabinet Internal Layout

The SPU cabinet contains the service processor card, processor cards, memory cards, bus converter cards, I/O cards, the power supply system, and the cooling fan assembly (see Figure 9-1 and Figure 9-2):

- At the top front of the cabinet is the front control panel, with various switches and indicators.
- The top half of the cabinet contains:
  - Processor Memory Bus (PMB) cardcages. There is a front PMB cardcage and a rear PMB cardcage. The PMB cardcages contain processor cards, memory cards, bus converter cards, and a service processor (SP) card.
  - DC-to-DC power modules such as the 5V (65A) 325W modules for memory and BC cards, 5V (130A) 650W modules for processors, and a 24V (325W) module for the fans.
  - Miscellaneous Power Module (MPM) for the Service Processor and PMB interface circuits.
- In the middle of the cabinet is the cooling fan tray. A fan identification label is located in the front right edge of the fan tray.
- The bottom half of the cabinet contains:
  - HP-PB cardcage. This cardcage accepts HP-PB I/O cards.
  - AC-to-DC power modules (PFC units).
  - AC Front End (ACFE) with the circuit breaker switch. The ACFE includes the AC-to-DC power module (PFC unit).
  - Battery Back-up Unit (BBU).

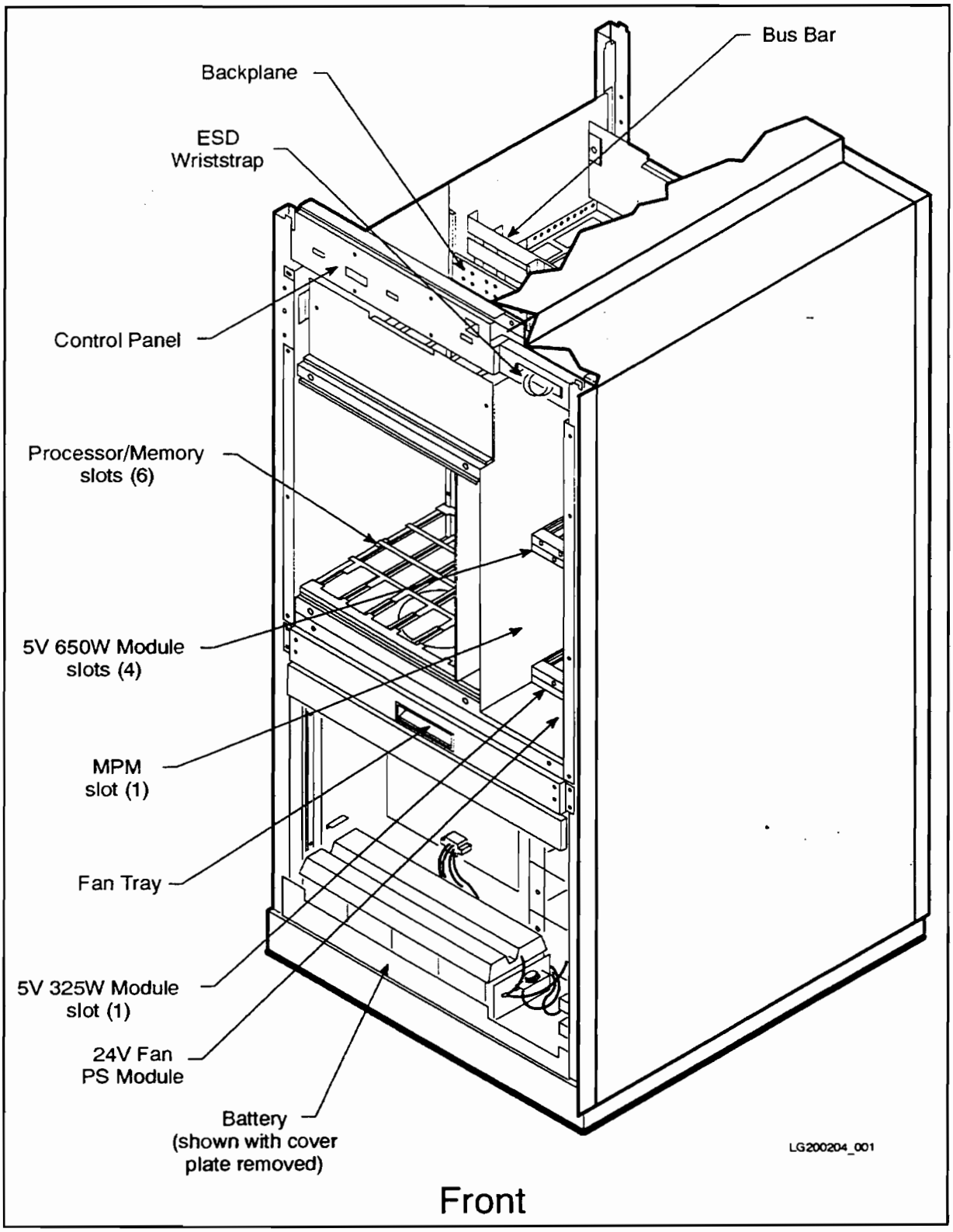


Figure 9-1. SPU Cabinet Internal Layout (Front)

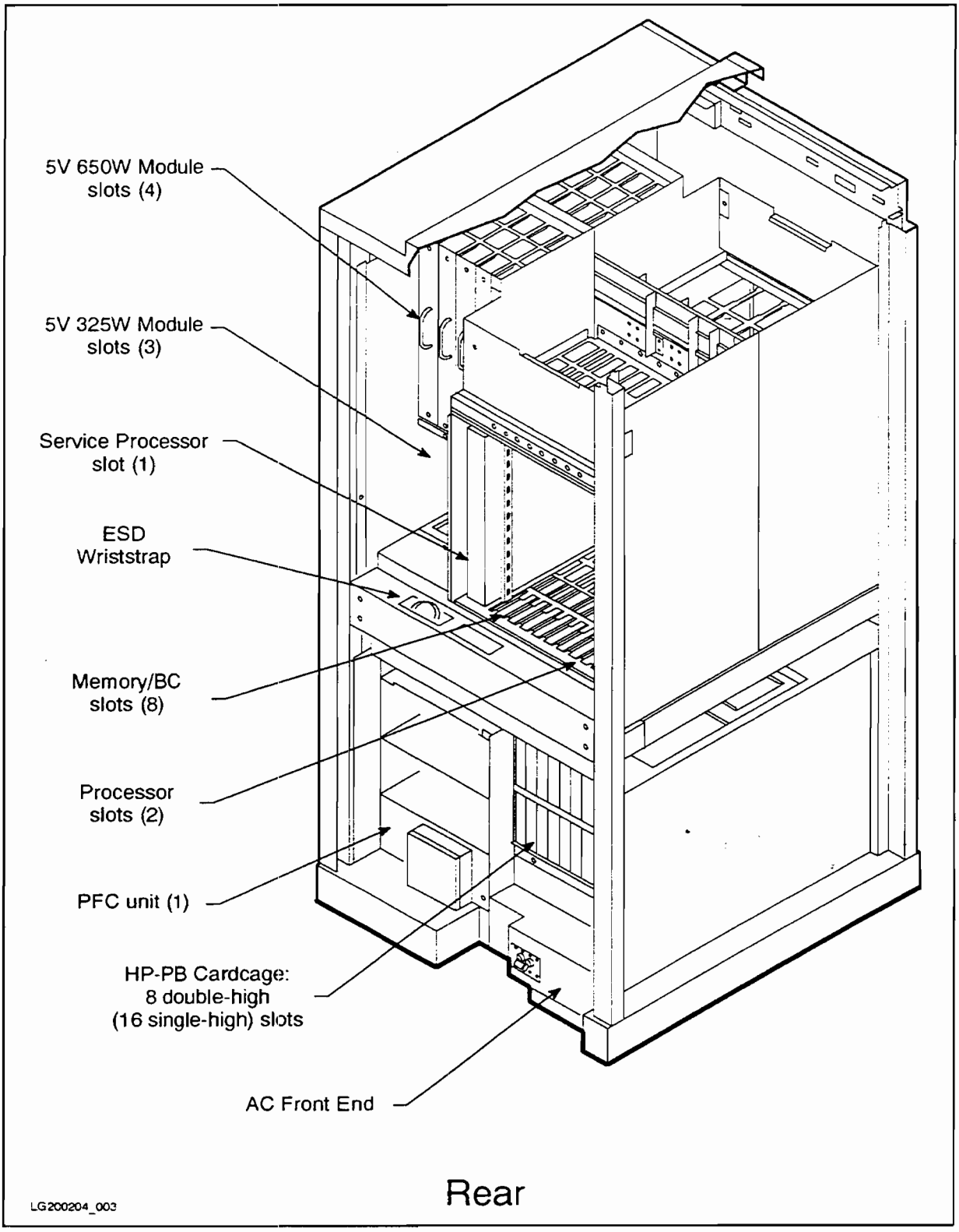


Figure 9-2. SPU Cabinet Internal Layout (Rear)

Gaining Access

To open the front and rear cabinet doors:

1. Insert the hexagonal cabinet key into the black hexagonal hole on the right of the cabinet door.
2. Rotate the cabinet key about a quarter-turn counter-clockwise.
3. Pull the door open.

The front and rear doors and the side panels can be removed, if needed. You remove the doors by lifting the doors up, and then lifting them off the hinges. See Figure 9-3 for the following items:

- item 43 - rear door
- item 45 - right panel
- item 46 - left panel
- item 44 - front door

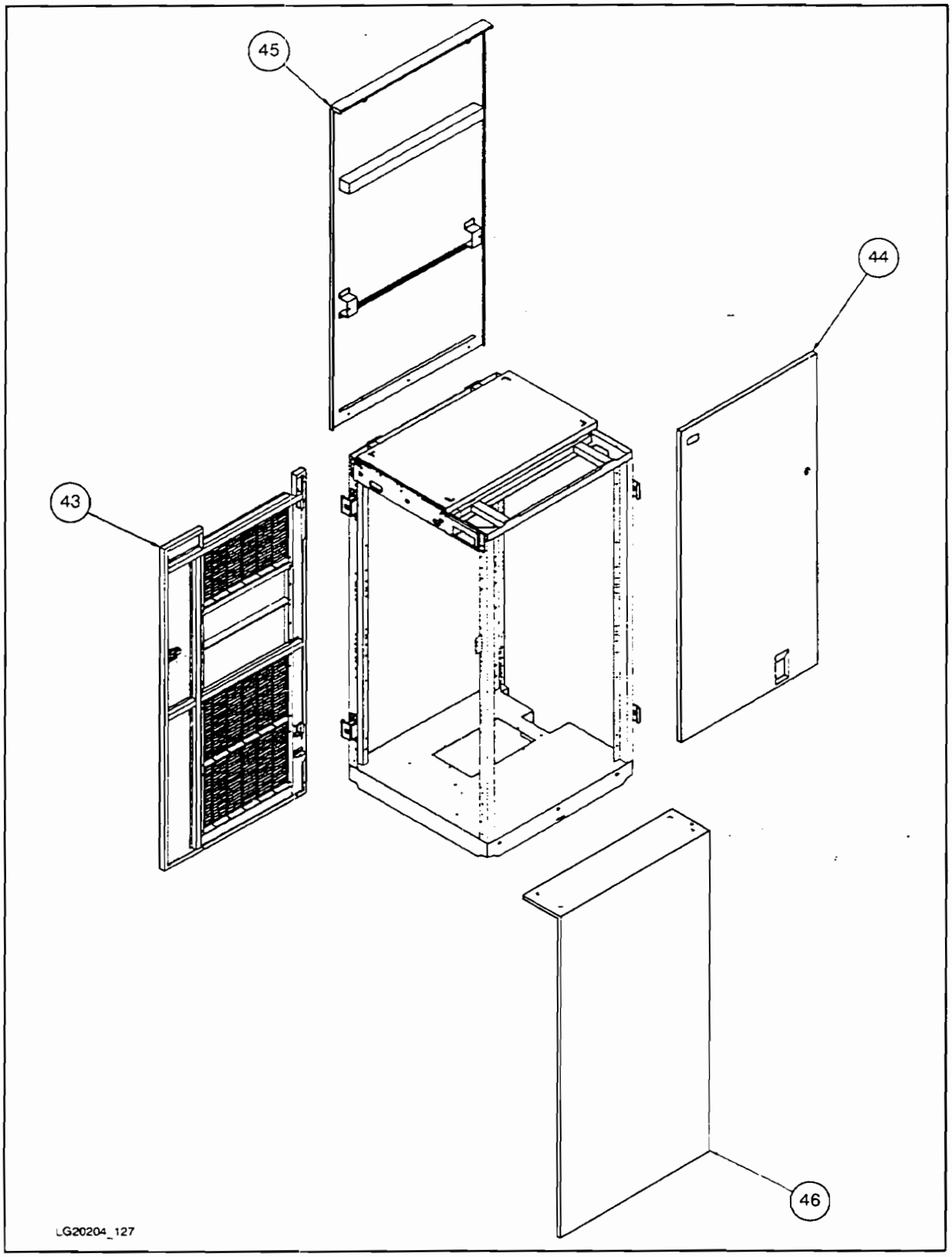


Figure 9-3. Cabinet Doors

Turning OFF Power to the SPU Cabinet and the Expansion Cabinet

Before removing any parts from the system, **remove all power to the SPU cabinet**:

1. Switch the rocker-arm switch on the front panel to the *Standby* position.
2. Switch the rocker-arm switch located at the front, upper-right, corner of the expansion cabinet to the "OFF" (0) position. For cabinets supported by an HP A2998A PowerTrust UPS (Uninterruptible Power System), the power cord of the expansion cabinet PDU should be disconnected from the UPS.
3. Switch the circuit breaker (bottom rear of the SPU cabinet) to the "OFF" position to disconnect AC power from the system.

Caution

For 990/992/890 Systems without PowerTrust UPS:

Switching the circuit breaker in the AC Front End "OFF" while the battery backup is connected and the rocker-arm switch on the front panel is in the *Ready* position will cause the power system to enter the "power-fail state."

AC Front End (ACFE)

The AC front end (ACFE) with the circuit breaker is located at the lower right of the cabinet rear and is enclosed by an irregularly shaped piece of sheetmetal.

AC Front End Access:

To access the AC Front End, see Figure 9-5 and Figure 9-6:

1. Verify that the ACFE circuit breaker is in the "OFF" position and that the SPU has been **disconnected** from its power source.
2. Remove the three (3) screws that hold the sheetmetal enclosure in place. One screw is located under the circuit breaker switch. The other screw is located under the horizontal vents to the left of the circuit breaker and the last on top of the sheetmetal enclosure.

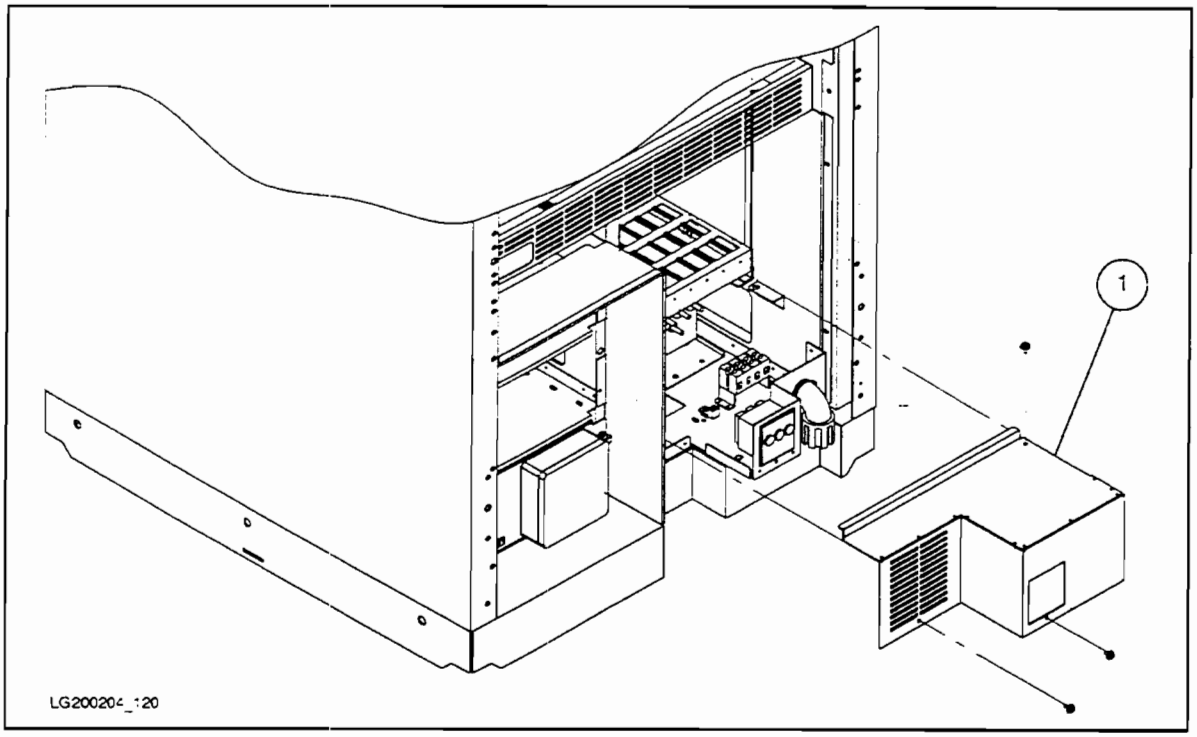


Figure 9-4. Sheetmetal Enclosure (Cabinet Rear)

3. Remove the sheetmetal enclosure (item 1 in Figure 9-4), by lifting it upward and out.

4. You should see the components shown in Figure 9-5 and Figure 9-6.
5. The voltage terminal block wires (item 1 in Figure 9-6) are fed through the round cap opening (item 2) in the PFC Module.

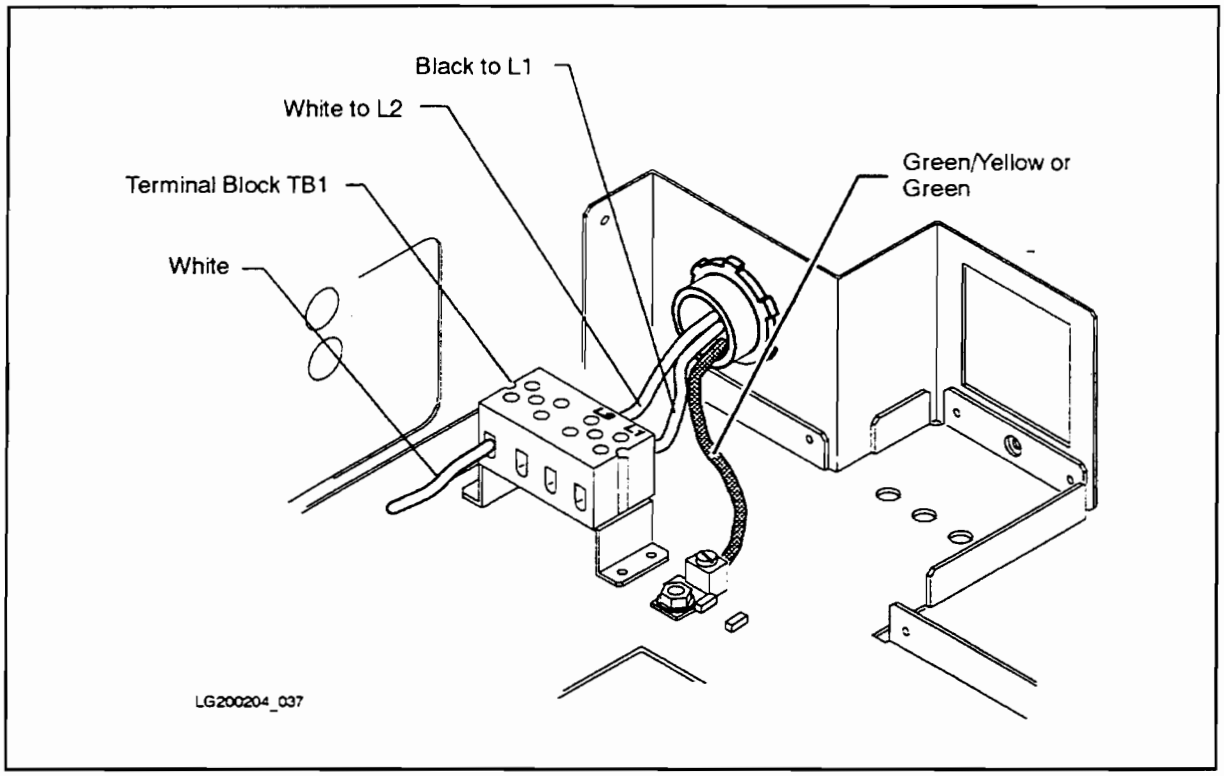


Figure 9-5. ACFE Voltage Terminal Block

Circuit Breaker Removal:

To replace the circuit breaker, see Figure 9-6:

1. Remove the plastic shield (item 4) covering the circuit breaker.
2. Disconnect the top three wires from the circuit breaker (item 3).
3. Pull out the circuit breaker and flip it over to disconnect the remaining three wires.

To replace the circuit breaker, reinstall the plastic shield, and reverse the above procedures.

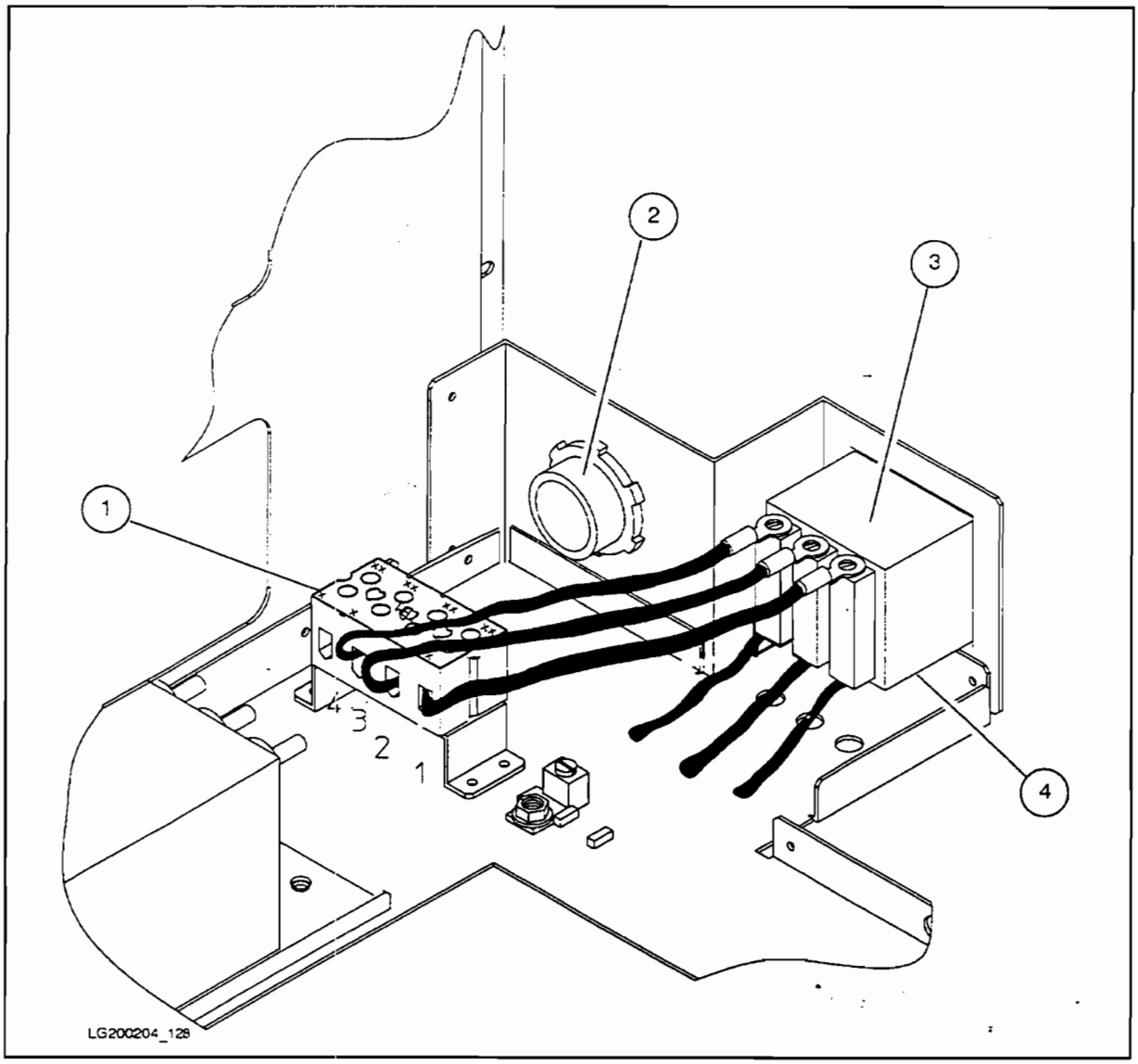


Figure 9-6. ACFE Circuit Breaker

Power-Factor Correcting (PFC) Module, Fan, Cables, Fuse, and Batteries

The PFC module is located at the rear of the cabinet, in the lower left side. To remove this module, you will need to access both the front and rear of the cabinet. There is a fan at the right side of the PFC module (see Figure 9-7).

The battery and the fuse are located at the front lower part of the cabinet. To replace the fuse or the battery, you will need to remove the metal shield protecting the battery at the front of the cabinet (see Figure 9-8).

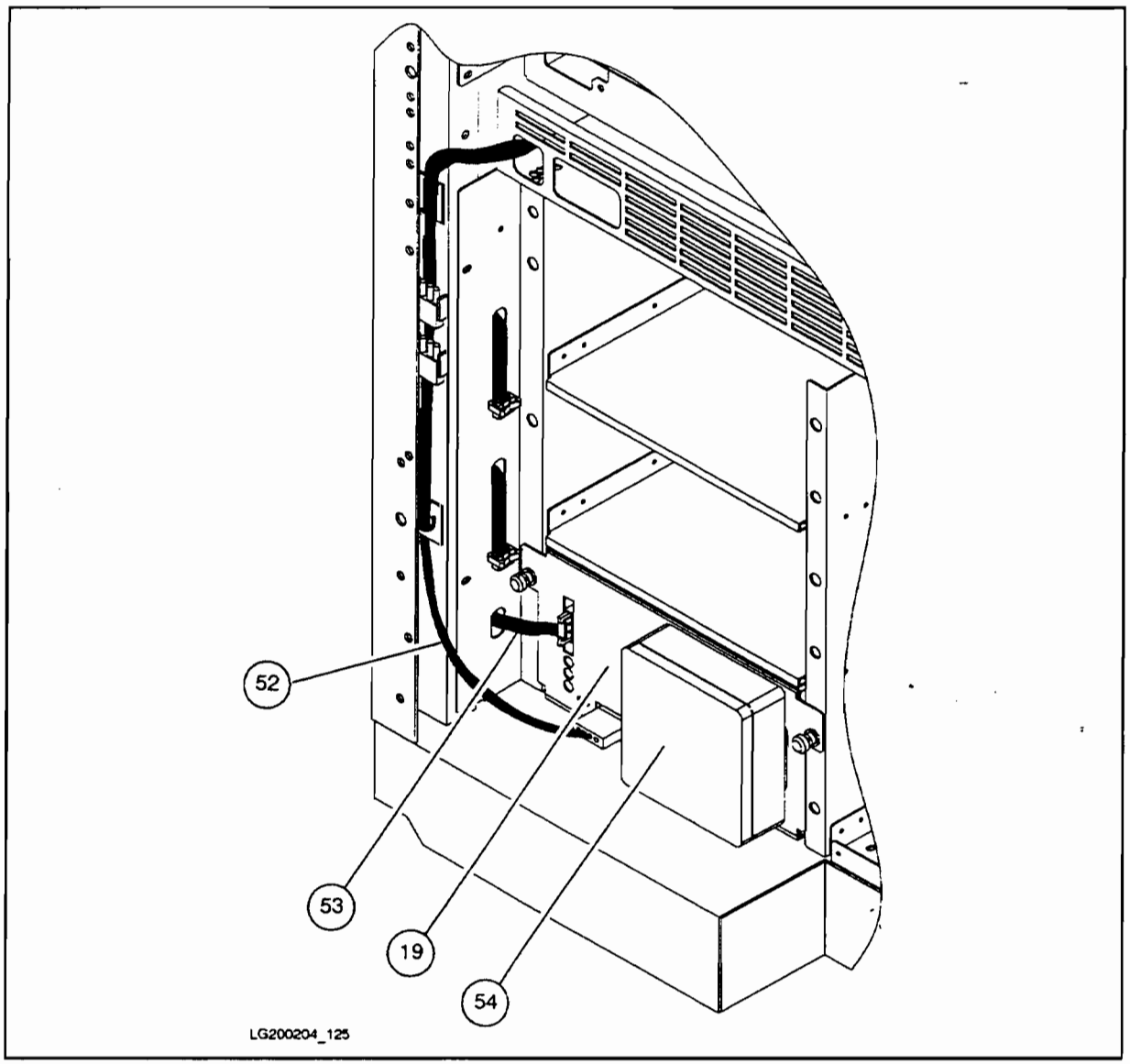


Figure 9-7. PFC Module (Cabinet Rear)

To remove the Power-Factor Correcting (PFC) Module. Fan. Cables. Fuse. and Batteries:

1. Verify that the front panel power switch is set to the *Standby* position. and that the AC circuit breaker switch has been turned "OFF."
2. From the rear of the cabinet. verify that all of the LEDs in the lower left part of the cabinet are "OFF." This means that no power is present. and it is safe to continue disassembling the PFC module.

PFC Module's Fan Removal:

To remove the fan. see Figure 9-7:

1. Remove the four screws located in the four corners of the fan (item 54).
2. Detach the power connector.
3. Remove the fan.

To replace the fan. reverse the above procedures.

PFC Module Removal:

To remove the PFC Module. see Figure 9-7:

1. Loosen the two knurled captive screws on the left and right sides of the PFC module (item 19) at the rear of the cabinet.
2. Detach the two cables (the PFC interface cable and the 300 Volt connector: items 52 and 53) that are connected to the PFC module at the rear of the cabinet.
3. Detach the AC cable and the battery cable from the PFC module at the front of the cabinet.
4. Remove the four (4) screws holding the metal cover at the bottom front of the cabinet (see Figure 9-8).
5. Remove the metal cover plate by tilting it up and lifting it slowly off the battery. exposing the plastic battery cover and fuse holder.
6. Make sure that you have a ground stap attached to your wrist. Push the PFC module toward the rear of the cabinet. Then go to the rear of the cabinet and pull the PFC module out from the rear of the cabinet along its rails.

To replace the PFC module. reverse the above procedures.

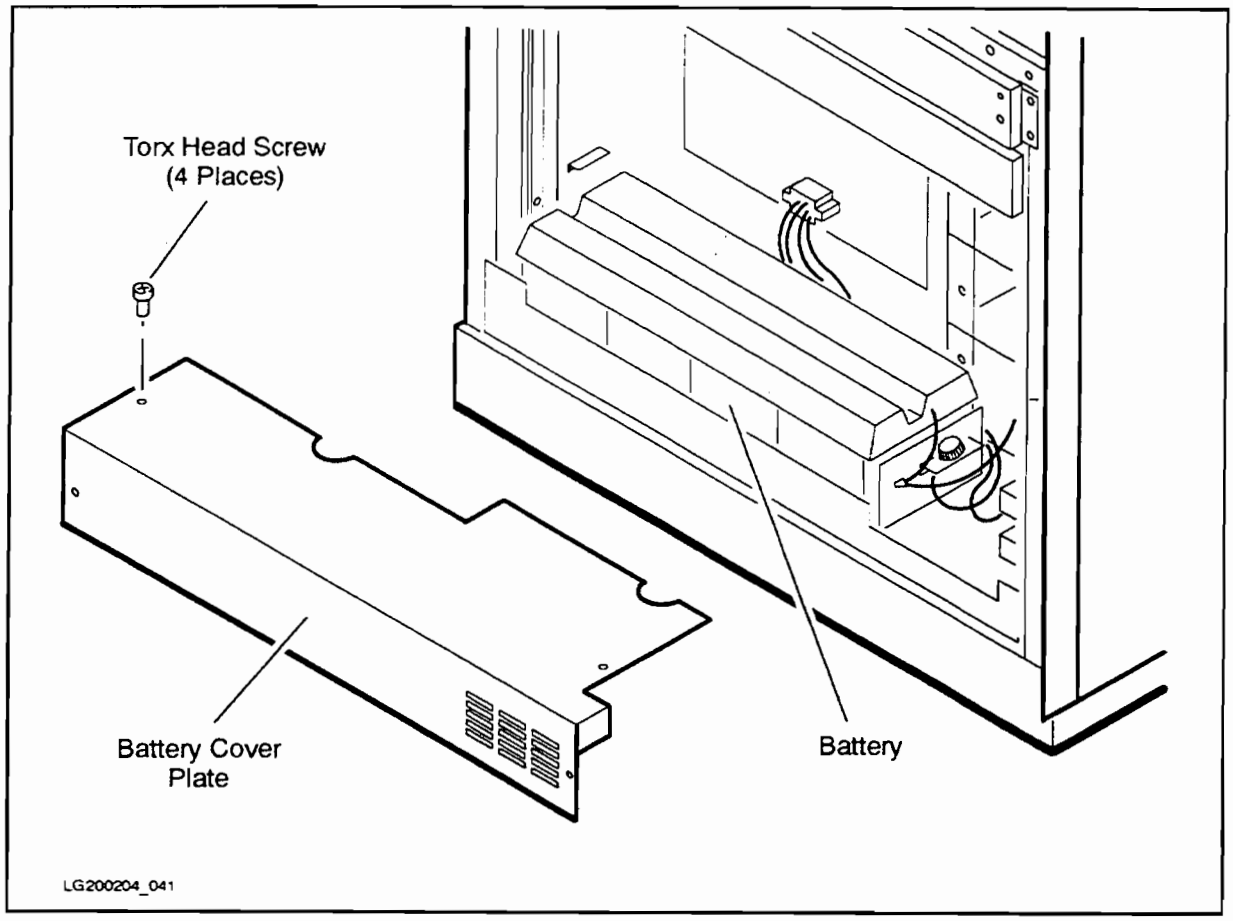


Figure 9-8. Sheetmetal Enclosure (Cabinet Front)

Fuse and Batteries Removal:

Warning **Hazardous voltages are present under the battery cover. The batteries and fuse are connected to the AC (Mains) supply. To prevent risk of electric shock, switch the AC circuit breaker to the OFF position before servicing.**

To remove the fuse, see Figure 9-8 and Figure 9-9:

Warning **Care must be taken when changing or inspecting fuses within the SPU cabinet when AC power is connected as dangerous voltages may be present even with the circ circuit breaker in the "OFF" position.**

1. Remove the four (4) screws holding the metal cover at the bottom front of the cabinet (see Figure 9-8).
2. Remove the metal cover plate by tilting it up and lifting it slowly off the battery, exposing the batteries and fuse. The voltage terminal block is located behind the batteries.

To replace the fuse (item 27 in Figure 9-9), remove the fuse cap, and reverse the above procedures.

Note Make sure the fuse is installed with the protruding bump pointed DOWN. Otherwise, no connection will be made.

To remove the batteries, see Figure 9-9:

1. Remove the plastic battery cover (item 23) by pushing in the tabs at the ends of the cover.
2. Disconnect the +(red) and -(black) wires at either end of the battery assembly (items 24 and 26).
3. Disconnect the battery jumpers between batteries (item 25).

To replace the batteries, reverse the above procedures.

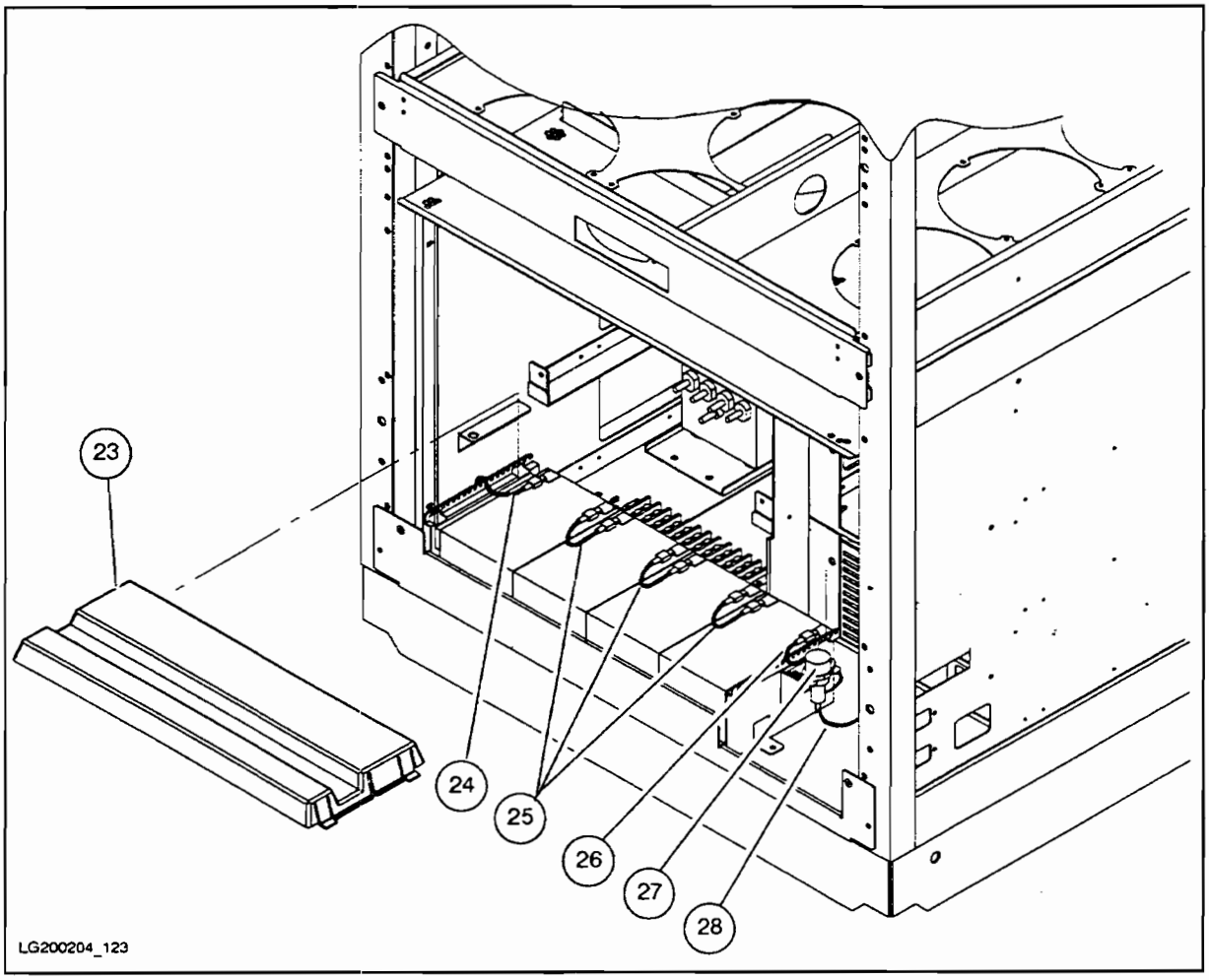


Figure 9-9. Batteries or Fuse (Cabinet Front)

Cable Removal:

Cables that plug into the PFC module from the cabinet's backplane are attached to the side of the cabinet.

To remove the cables:

1. From the rear of the cabinet, remove the one screw on the rear left side panel.
2. From the front of the cabinet, remove the grill plate (item 1 in Figure 9-10) in the middle of the cabinet by removing the two side screws. This allows you to see and access the one side panel screw that connects the right side panel to the cabinet.

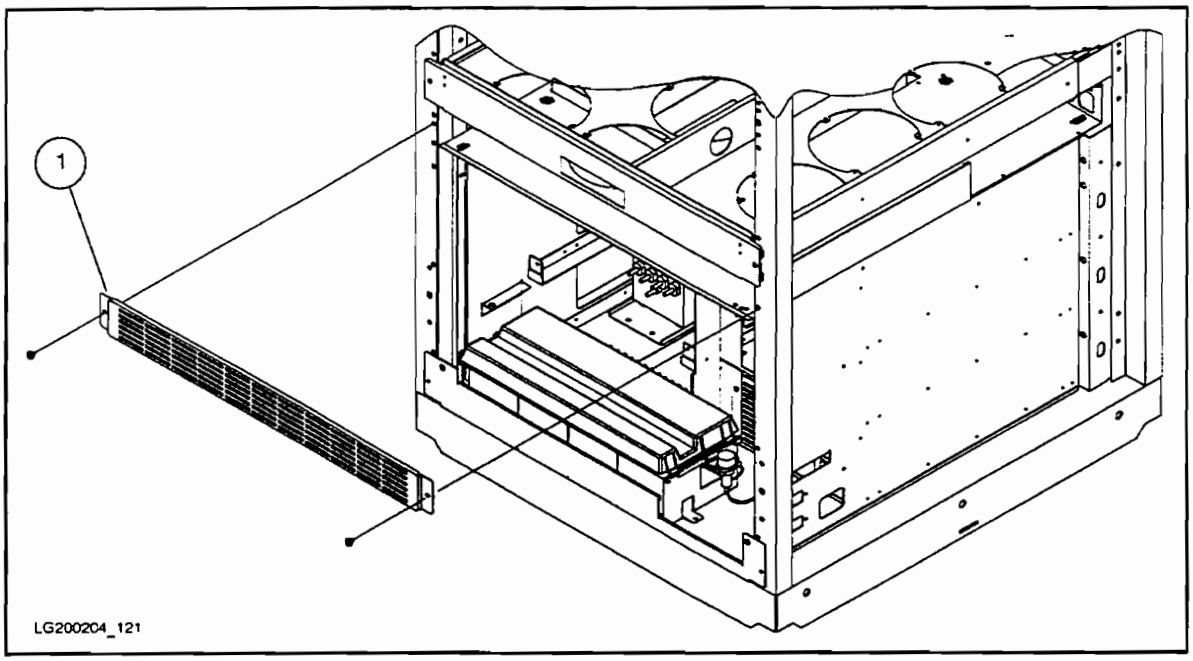


Figure 9-10. Cabinet Grill (Cabinet Front)

3. Remove the one right side panel screw.
4. Remove the ground wire (item 1 in Figure 9-11) that is connected to the side panel.
5. Lift the right side panel up and off the cabinet. Remove the two leftmost slot cover panels (P5 panel and the panel to the left of P5) on t he rear power supply cardcage.

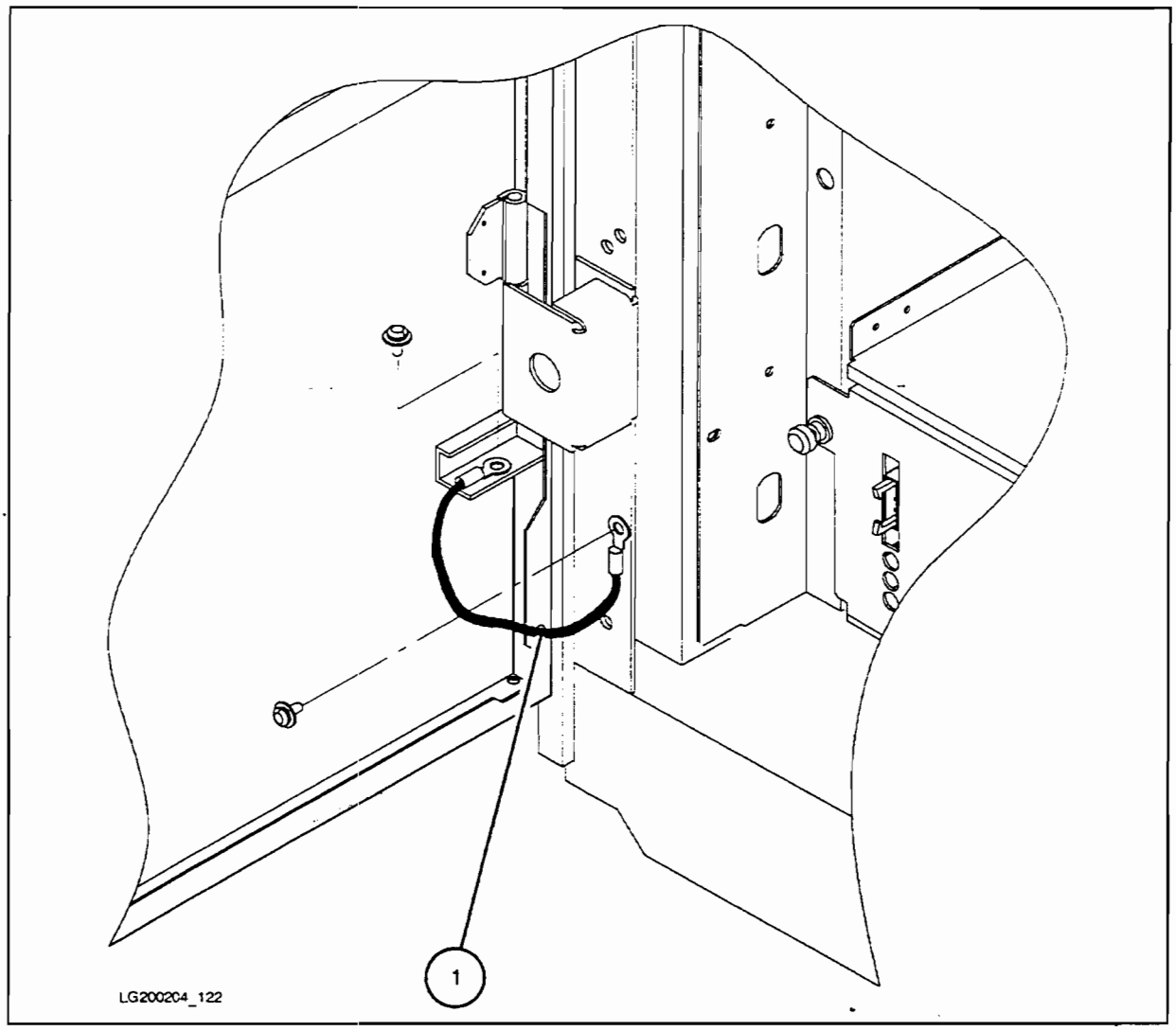


Figure 9-11. Ground Wire (Cabinet Rear)

To replace the cables. reverse the above procedures.

DC-to-DC Power Modules

The DC-to-DC power modules are located in the upper half of the front and rear of the cabinet.

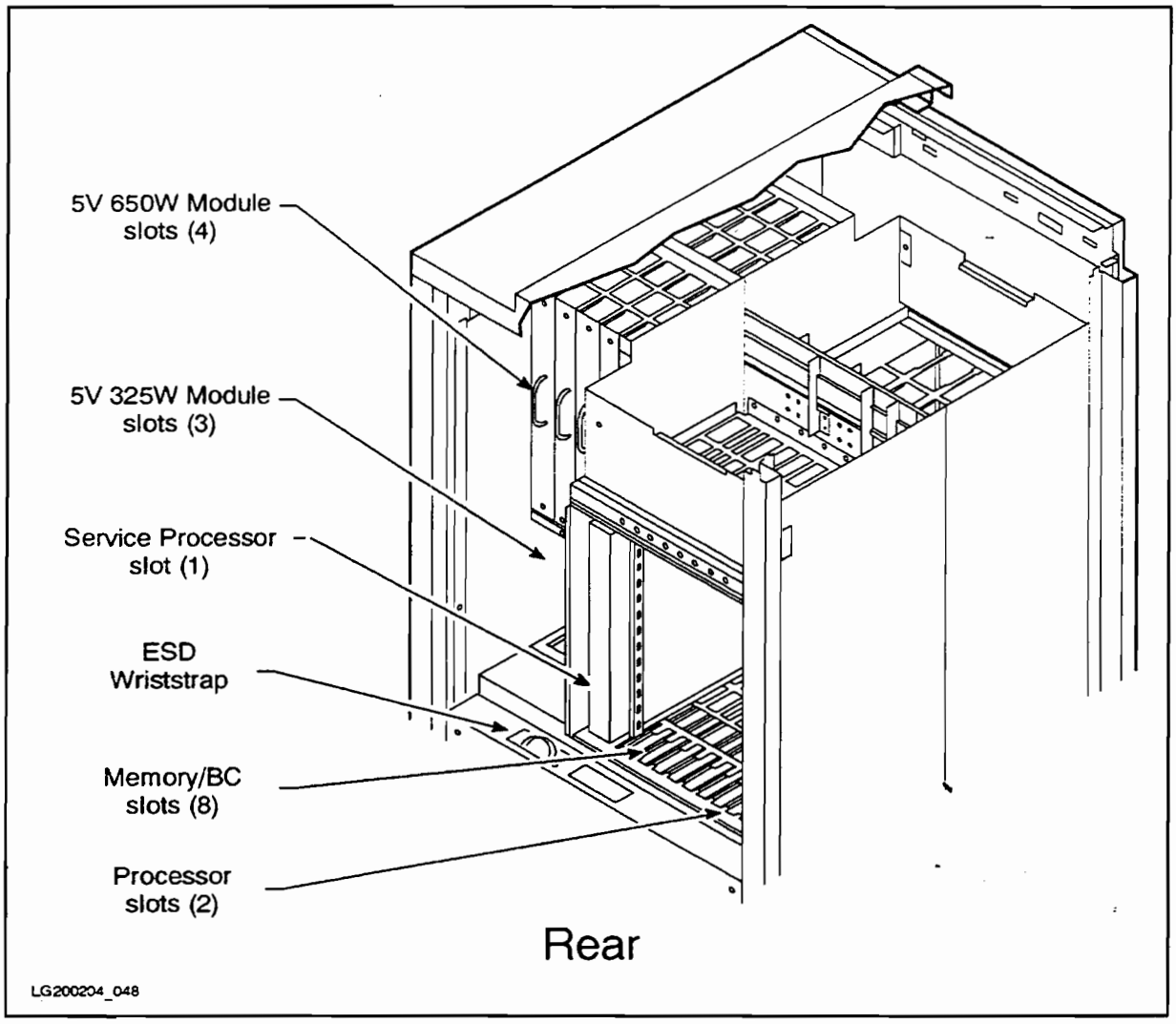


Figure 9-12. DC-to-DC Power Modules (Cabinet Rear)

Note When removing a DC-to-DC Power Module, you must switch the rocker-arm switch on the front panel to the *Standby* position and switch the circuit breaker to the "OFF" position.

DC-to-DC Module Removal:

To remove a DC-to-DC module:

1. Attach a grounding strap to your wrist.
2. Loosen the two knurled captive screws on the top and bottom ends of the DC-to-DC module.
3. Pull the DC-to-DC module out of its slot.

To replace a DC-to-DC module, reverse the above procedures.

Note All DC-to-DC converter captive fasteners must be tightened to a minimum of 24 in-lbs (27.7 Kg-cm) to ensure reliable attachment to the cardcage. Reliable attachment of the power converters is essential in maintaining the integrity of the protective earthing (grounding) system of the product.

Fans and the Fan Control Board

The fans and fan control board are located in a fan tray beneath the front PMB/power supply cardcage. The fan tray holds eleven 6-inch cooling fans and one fan control board. These fans force air down toward the bottom of the cabinet. A tachometer cable is connected to each fan to monitor the speed of the fan. You can check the fan speed with the SP "EN" command. A fan identification label is located in the front right corner of the fan tray (see Figure 9-13).

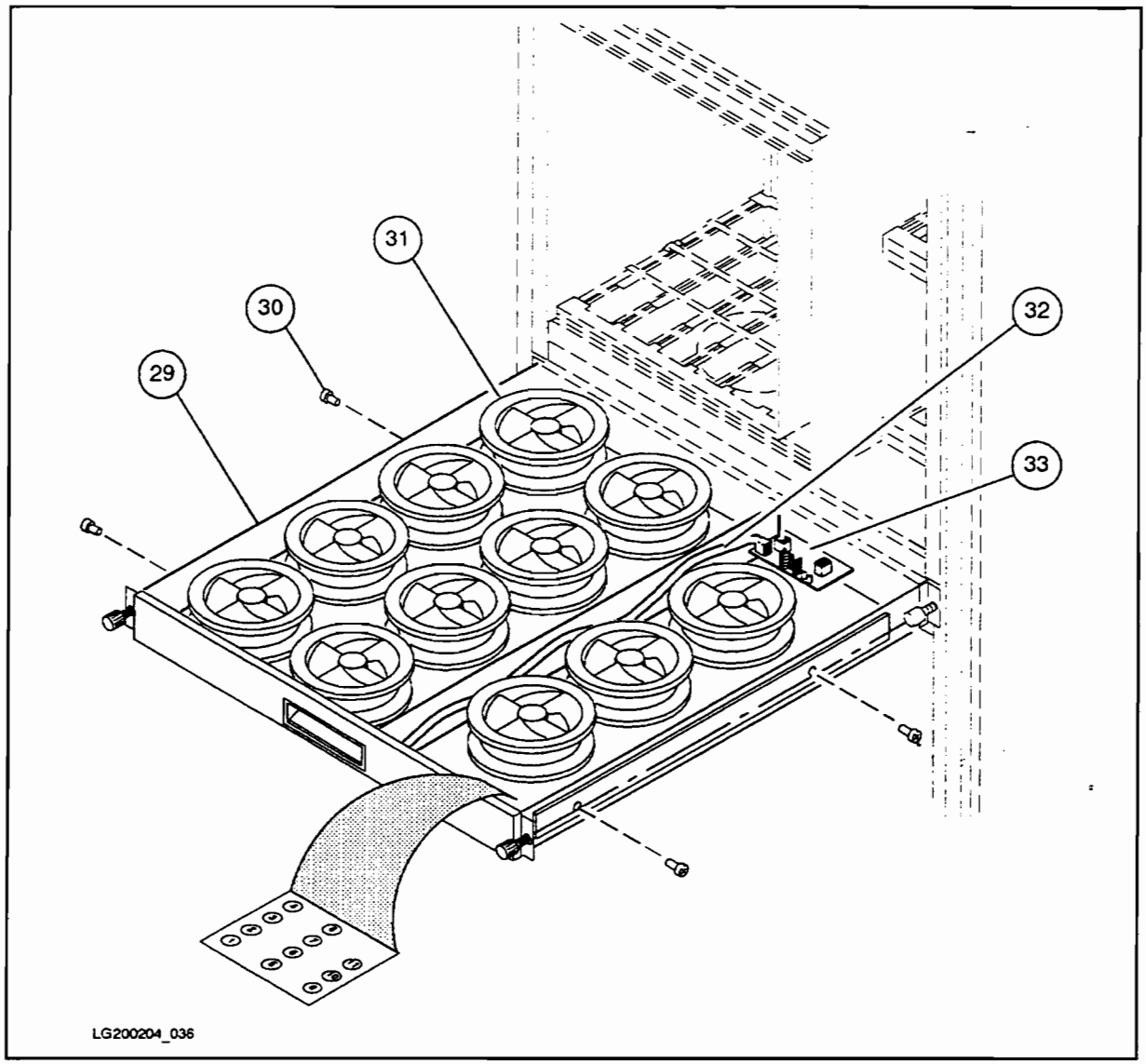


Figure 9-13. Fan Tray (Cabinet Front)

Caution If you leave the fan tray pulled out from the system for longer than 20 seconds with DC power on, the internal I/O module will shutdown. The rear circuit breaker must be reset to recover.

Fan or the Fan Control Board Removal:

To remove a fan or the fan control board, see Figure 9-13:

1. Verify that DC power has been **disconnected** before replacing a fan.
2. Loosen the knurled captive screws on the left and right sides of the fan tray.
3. Pull the fan tray (item 29) all the way out. The fan tray should lock in place when fully extended.

To remove a fan:

1. Unclip the plastic tachometer connector by pulling apart the two halves of the connector, while pressing inward on the two side tabs.
2. Remove the two screws that hold the fan in place. Remove the fan (item 31).
3. Detach the power connector that plugs into the fan housing. Use needle-nosed pliers to assist in unplugging the connector.

To remove the fan control board:

1. Detach the two connectors (item 32) plugged into the fan control board (item 33).
2. Remove the four screws that hold the fan control board in place.

To replace a fan or fan control board:

1. Reconnect the connectors, and fasten the screws that hold the unit in place.
2. Slide the fan tray back into the cabinet. If the fan tray has locked into the fully extended position, press inward on the two locking tabs on the left and right sides, then push the fan tray in.

Computer Museum

PMB Cardcage

Note

Use extreme care when inserting PMB boards into the backplane. The connectors can be damaged if boards are forcibly inserted into place.

PMB Cardcage Cover Plate (Front)

A metal shield plate covers the PMB cards in the front cardcage (see Figure 9-14.

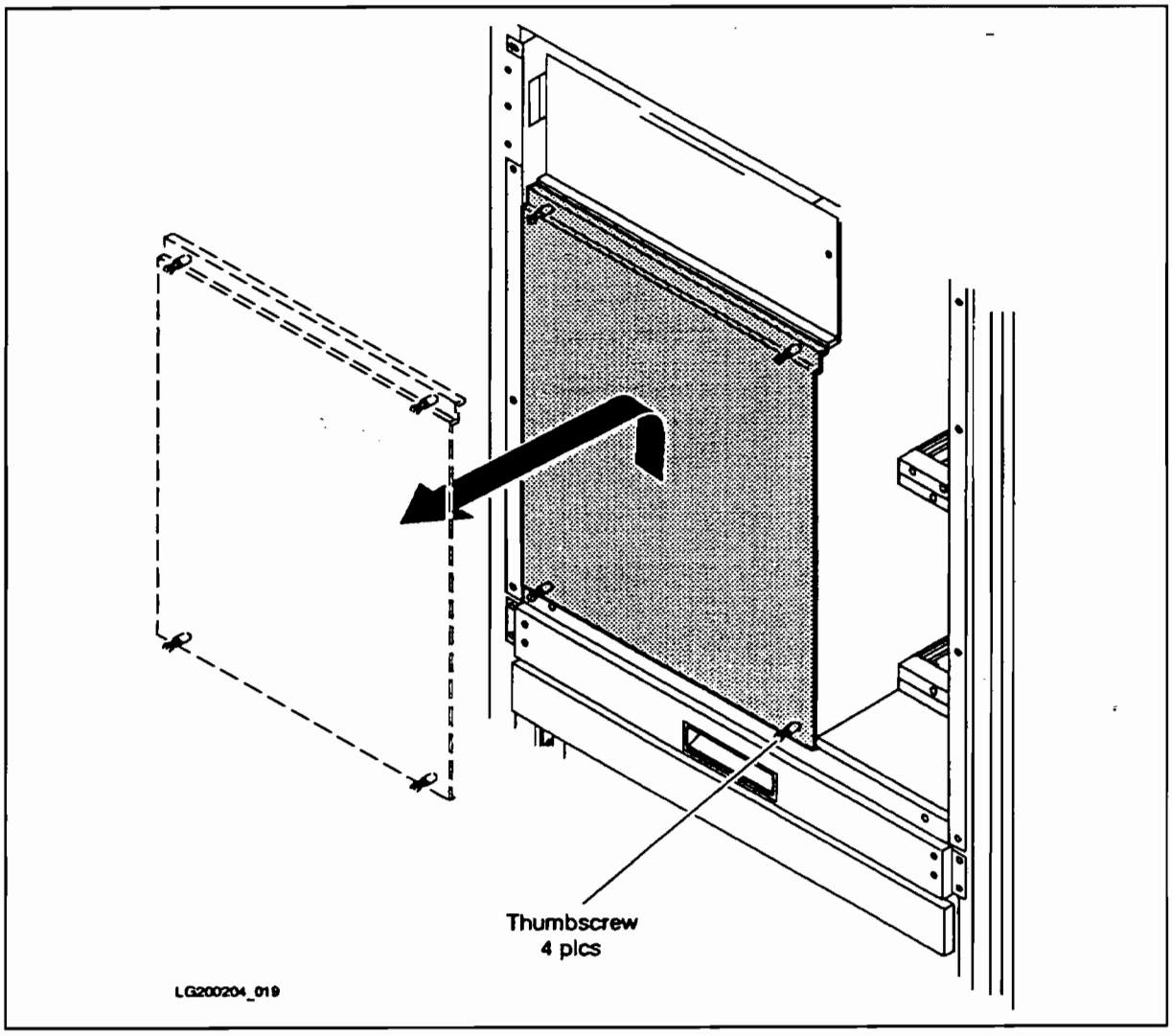


Figure 9-14. Front Cardcage Cover Plate (Cabinet Front)

PMB Card Removal:

To verify the presence of PMB cards, you do not have to remove the cover plate. You can see the PMB cards through holes in the cover plate.

To remove PMB cards:

1. Make sure that power has been **disconnected** from the system by verifying that the front panel's Standby/Ready switch has been set to the *Standby* position. You should also have a grounding wriststrap attached to your wrist.
2. Remove the cover plate by loosening the four (4) thumbscrews (two each at the upper and lower edges) and lifting the cover plate up and out (see Figure 9-14.
3. Release a PMB card from the backplane by lifting the extractor handles out from the card. Slide the card gently out of the cardcage along the slot guides.

To replace the PMB card:

1. Install the new PMB card.
2. Set the shield cover over the slots so that the screws are aligned with the holes in the cardcage frame.
3. Place the cover plate lip over the raised edge of the cabinet frame.
4. Tighten the four thumbscrews with a screwdriver so that they are more than finger-tight. (The torque specification for the thumbscrews is 24 inch-lbs.)

PMB Cardcage Slot Shields (Rear)

The rear cardcage is not protected by a cover shield. However, individual slots are protected by a slot shield secured by two thumbscrews.

Note

If you replace the SP card, you will also need to use SS_CONFIG to replace the model string, default paths, and SW_ID.

If you replace the Processor card, you will also need to use SS_CONFIG to replace SW_CAP.

Processor Card, SP Card or Bus Converter Card Removal:

To remove a processor card, the SP card, or a bus converter card, see Figure 9-15:

1. Make sure that power has been **disconnected** from the system by verifying that the front panel's Standby/Ready switch has been set to the *Standby* position. You should also have a grounding wriststrap attached to your wrist.
2. Remove the metal slot shield by loosening the two (2) thumbscrews (one at the top edge and one at the bottom edge) of the shield.
3. For a processor card or the SP card, remove the cable; then use the extractor handles to release the card and guide it out from its slot in the cardcage.
4. For a bus converter card, it is recommended that you use the extractor handles first to release the card from the backplane before detaching the two link cables.

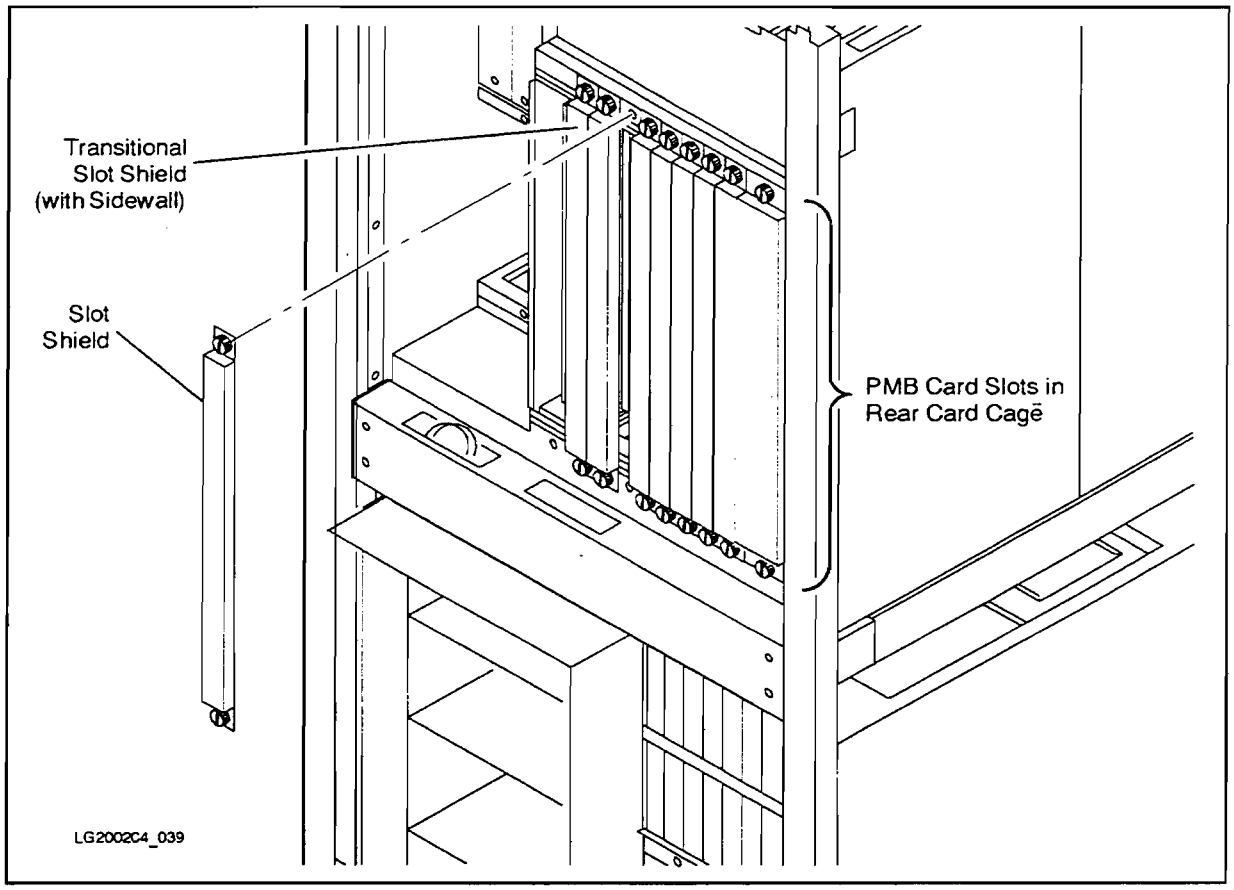


Figure 9-15. Rear Cardcage Slot Cover Plates (Cabinet Rear)

To replace a processor card, the SP card, or a bus converter card:

1. For a bus converter card, attach the two link cables with the card partially extended, then secure the card.

Warning **When fastening the link cable to the upper bus converter card, do not exceed 8 in-lb. The recommended torque specification is 6 +/−2 in-lb.**

2. For a processor card or the SP card, place the card in the slot guides, and carefully insert the card into the backplane connector.
3. Tighten the thumbscrews. (The torque specification for the thumbscrews is 24 inch-lbs.)

Note Cardcage slot cover plates are required for RFI and EMI emissions control and for proper airflow and cooling.

HP-PB I/O Cardcage

The HP-PB I/O cardcage is located at the lower. right. rear of the cabinet.

I/O Card Removal:

To remove an I/O card from the HP-PB I/O cardcage:

1. Make sure that power has been removed from the cabinet and you have a groundin g wriststrap attached to your wrist.
2. From the rear of the cabinet. detach any cables connected to the I/O card that you want to replace.
3. Loosen the two captive screws securing the card to the cardcage.
4. Use the extractor handles to release the card from the cardcage. and slide the card gently out of the cardcage along the slot guides.

To replace the card, reverse the above procedures.

HP-PB I/O Cardcage Removal:

To remove the HP-PB I/O cardcage. see Figure 9-16:

1. Make sure that power has been **disconnected** from the cabinet and the circuit breaker is in the "OFF" position.
2. From the rear of the cabinet. detach any cables connected to cards in the HP-PB I/O cardcage.
3. From the front of the cabinet, remove the connector plug.
4. Remove the AC front circuit breaker cover by removing the three screws.

Warning **Hazardous voltages are present at the circuit breaker terminals even with the circuit breaker in the OFF position. Verify that the SPU cabinet is disconnected from the AC power source.**

---

5. Remove the four screws (two front and two rear) holding the I/O cardcage in place.
6. From the front of the cabinet. push the cardcage (item 1 in Figure 9-16) toward the rear of the cabinet. Then pull the cardcage out from the back of the cabinet along its rails.

To replace the HP-PB cardcage. follow the above steps in reverse order.

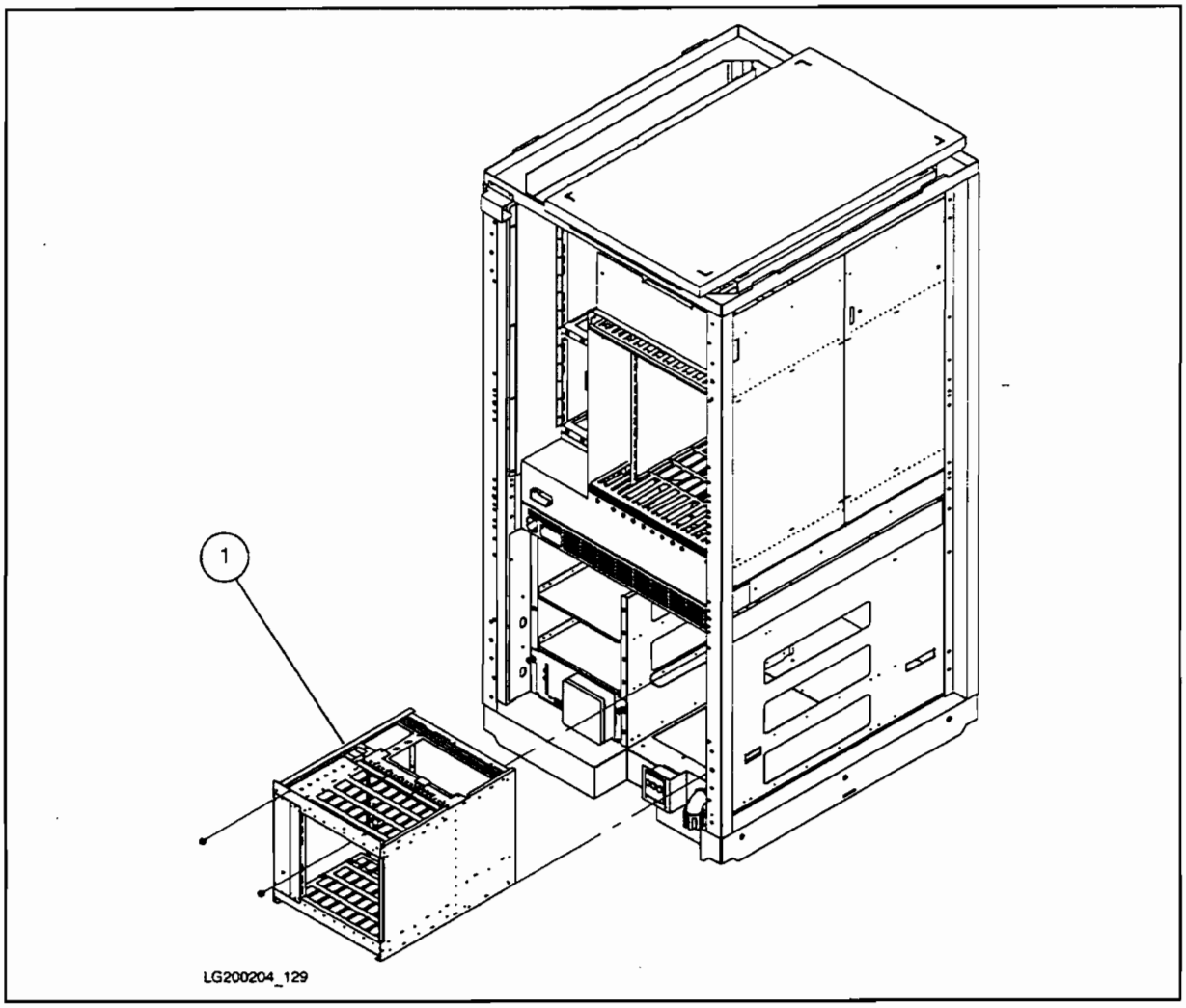


Figure 9-16. HP-PB I/O Cardcage

Power Supply Removal:

To remove the power supply, see Figure 9-17:

1. Remove the six screws from the rear cover (item 49).
2. Remove the two screws from the top of the power supply (item 47).
3. Remove the three power supply cables (item 51) from the SPCM board.
4. Disconnect the one power supply cable underneath the power supply.
5. Disconnect the AC connector from underneath the power supply.

To replace the power supply, reverse the above procedures. Refer to the cable connection diagram located on the rear cover of the cardcage to find out how to reconnect the cables.

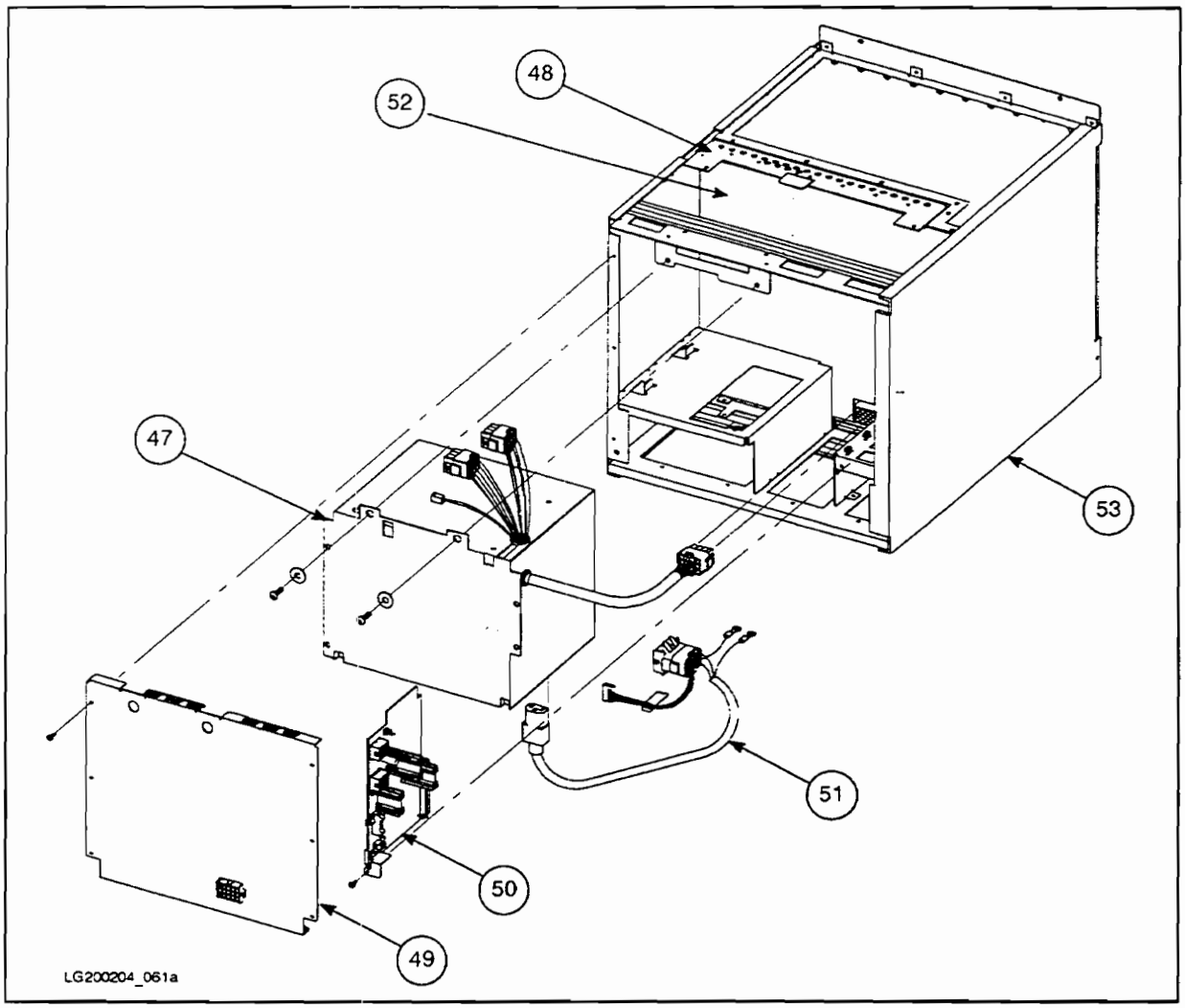


Figure 9-17. HP-PB I/O Cardcage

SPCM Card Removal:

To remove the SPCM card, see Figure 9-17:

1. Remove the five cables from the SPCM card (item 50). Make note of their location so you can reattach them correctly.
2. Loosen the one screw and the retaining clip located at the bottom of the SPCM card.
3. Use the extractor handle to release the SPCM card from the backplane, and gently slide the card out of the cardcage along the slot guides.

To replace the SPCM card, reverse the above procedures.

Note

It is recommended that you install the SPCM card into the backplane before connecting the power supply cables. This reduces the risk of damaging the connector.

Refer to the cable connection diagram located on the rear cover of the cardcage to find out how to reconnect the cables.

HP-PB I/O Cardcage Backplane Removal:

Once the HP-PB I/O cardcage has been removed, you can remove the HP-PB I/O backplane.

To remove the HP-PB I/O Cardcage Backplane, see Figure 9-17.

1. Remove the two screws from the bottom front of the HP-PB cardcage that secure the cardcage backplane to the cabinet chassis.
2. Pull the slide sheetmetal handle to remove the backplane (item 48).

To replace the HP-PB I/O cardcage, reverse the above procedures.

Warning

The cardcage assembly is heavy (approximately 35 lbs). Take the necessary precautions.

PMB Backplane

The backplane is located in the upper half of the cabinet.

PMB Backplane Removal:

To remove the backplane, see Figure 9-18:

1. Remove all SPS converters.
2. Remove all PMB cards (both front and rear PMB cardcages). Also remove the SP card.
3. Remove all cables attached to the backplane.
4. Disconnect the cables at the rear of the backplane behind the connector slot cover.
5. Remove the two air filters located above the PMB cardcage and above the SPS cage (see Figure 9-19).
6. The screws that hold the two cardcage halves together are accessible. Remove all the screws (approximately 25 to 30 screws).
7. Slide the fan tray out.
8. Remove the cable routing adhesive clips on the side of the front cardcage.
9. Slide the front cardcage assembly (item 36) out, exposing the backplane assembly (item 34).

Warning **The backplane and bus bars are heavy (approximately 50 lbs). Take the necessary precautions.**

10. Remove the backplane assembly. The backplane assembly will have all the bus bars (item 35) attached.

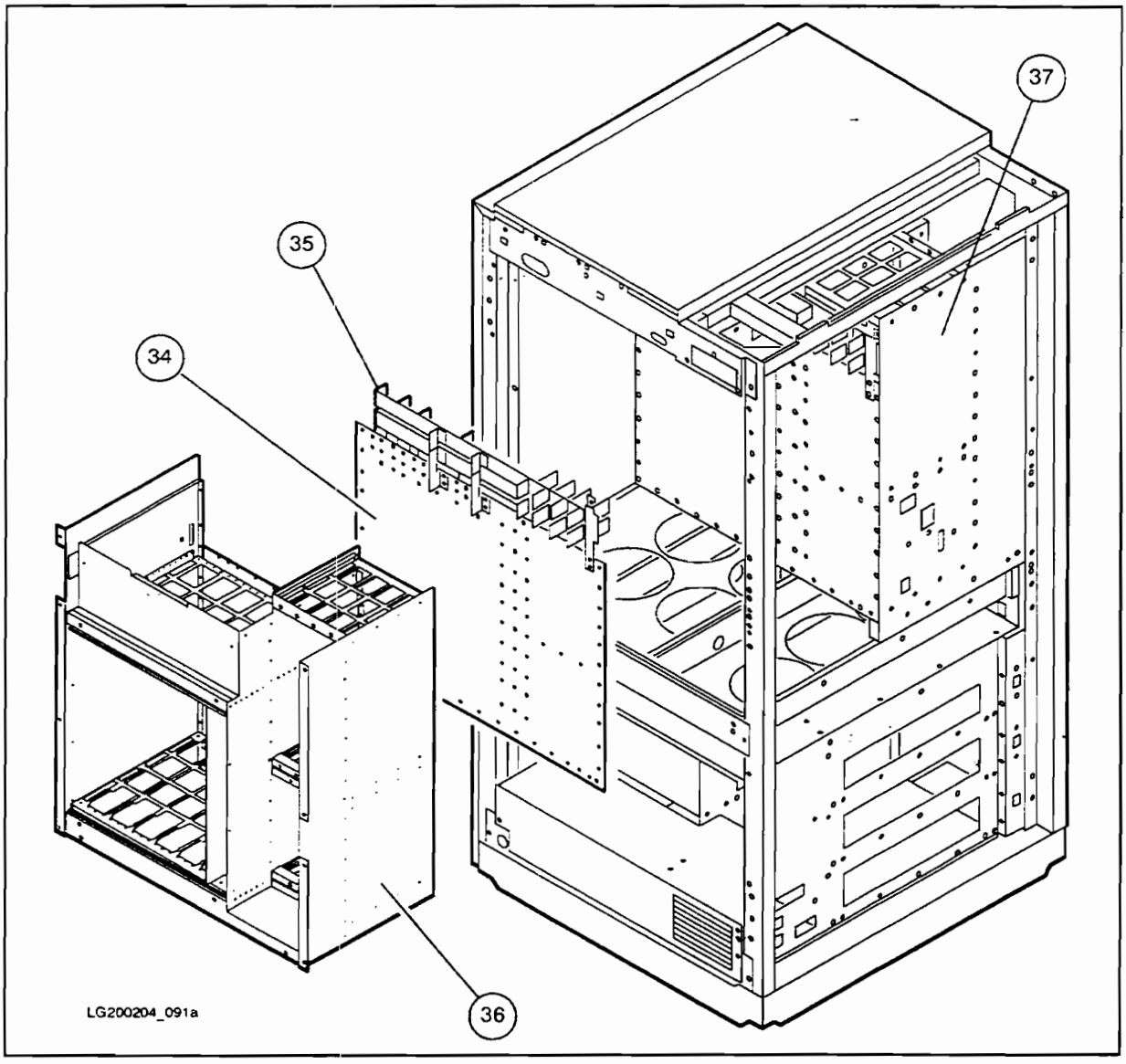


Figure 9-18. PMB Cardcage Backplane (Cabinet Front)

To replace the backplane:

1. Remove the bus bars from the old backplane, and reattach them to the new backplane.

Note

Be sure to tighten all bus bar screws securely. Failure to do so may result in a poor power connection and can damage the backplane. The torque specification for the torx screws is 24 inch-lbs.

2. Reverse the above procedures.

Air Filters

Two metal air filters are located on rails on top of the PMB/power supply cardcages (see Figure 9-19). Metal filters should not be cleaned: when they become dirty they should be replaced.

Filters should be replaced every six months in environments with a lot of dust or particulate matter (for example, in computer rooms containing printers).

On early shipments, air filters are made of plastic. When the plastic filters become dirty, they should be replaced with metal filters (metal filters provide better EMI protection).

For procedures on replacing air filters, see Chapter 3 (Installation and Maintenance).

Air Filter Removal:

To remove an air filter, see Figure 9-19:

1. Open the rear cabinet door.
2. Look for the metal air filters (items 41 and 42) on top of the PMB/power supply cardcages.
3. Lift upward on the metal air filter, using the tab in the middle front of the filter.
4. Pull the air filter upward and outward to remove it.

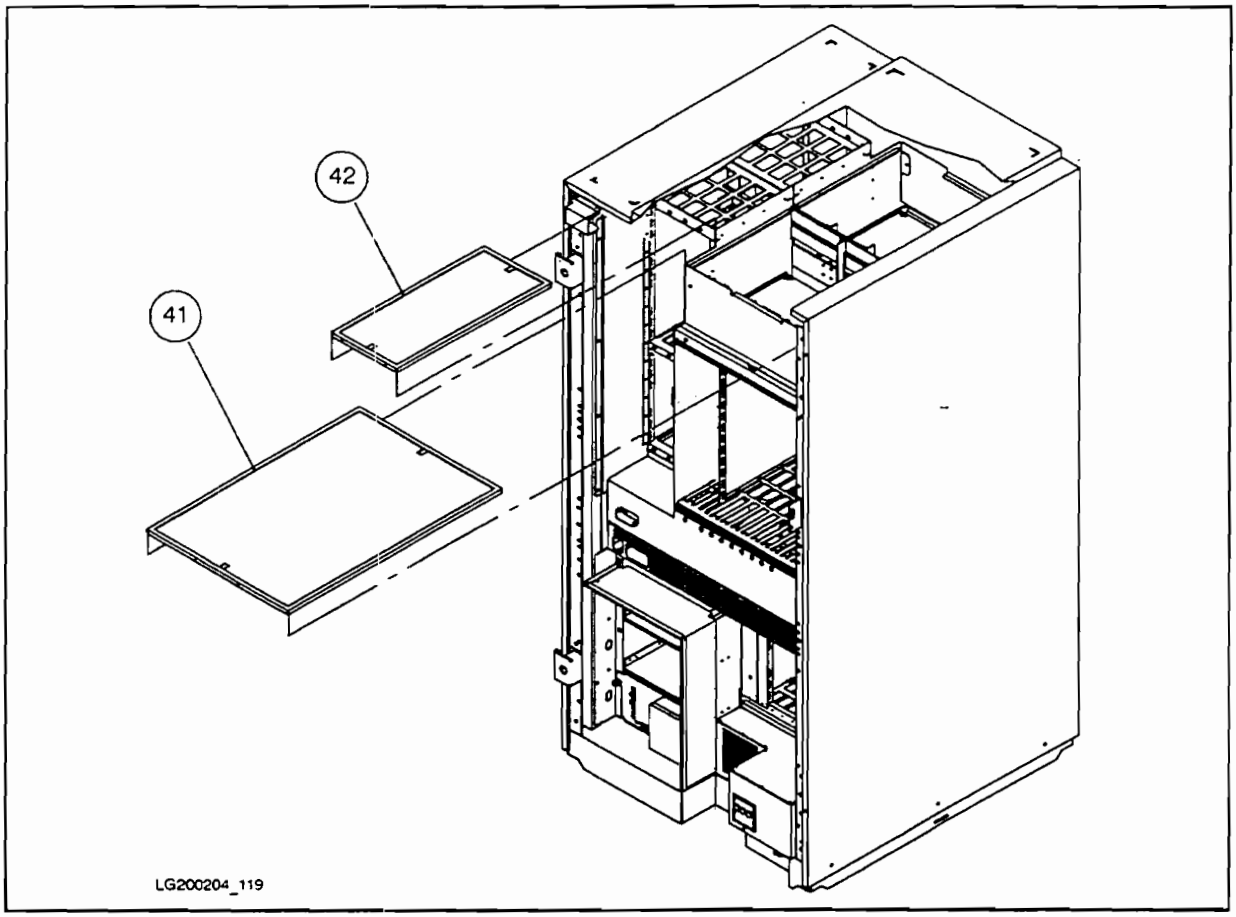


Figure 9-19. Air Filters (Cabinet Rear)

Note Do not spray oils or adhesives on these filters.

Filters must be installed according to the direction of air flow. Notice the arrow located at the front and rear of each filter. The arrow should point DOWN.

To replace an air filter, reverse the above procedures.

Front Panel (Control Panel)

The front panel is located on the upper front of the cabinet (see Figure 9-20).

Front Panel Removal:

1. Open the front cabinet door.
2. Loosen the three (3) screws that hold the front panel in place. They are accessible from underneath the front panel.
3. Pull the bottom of the front panel gently outward and upward.
4. Remove the front panel (item 1).
5. Remove the four mounting screws that secure the PCA.
6. Disconnect the standby switch cable terminal attached to the PCA.

7. Disconnect the ribbon cable that is attached to the PCA (item 2).

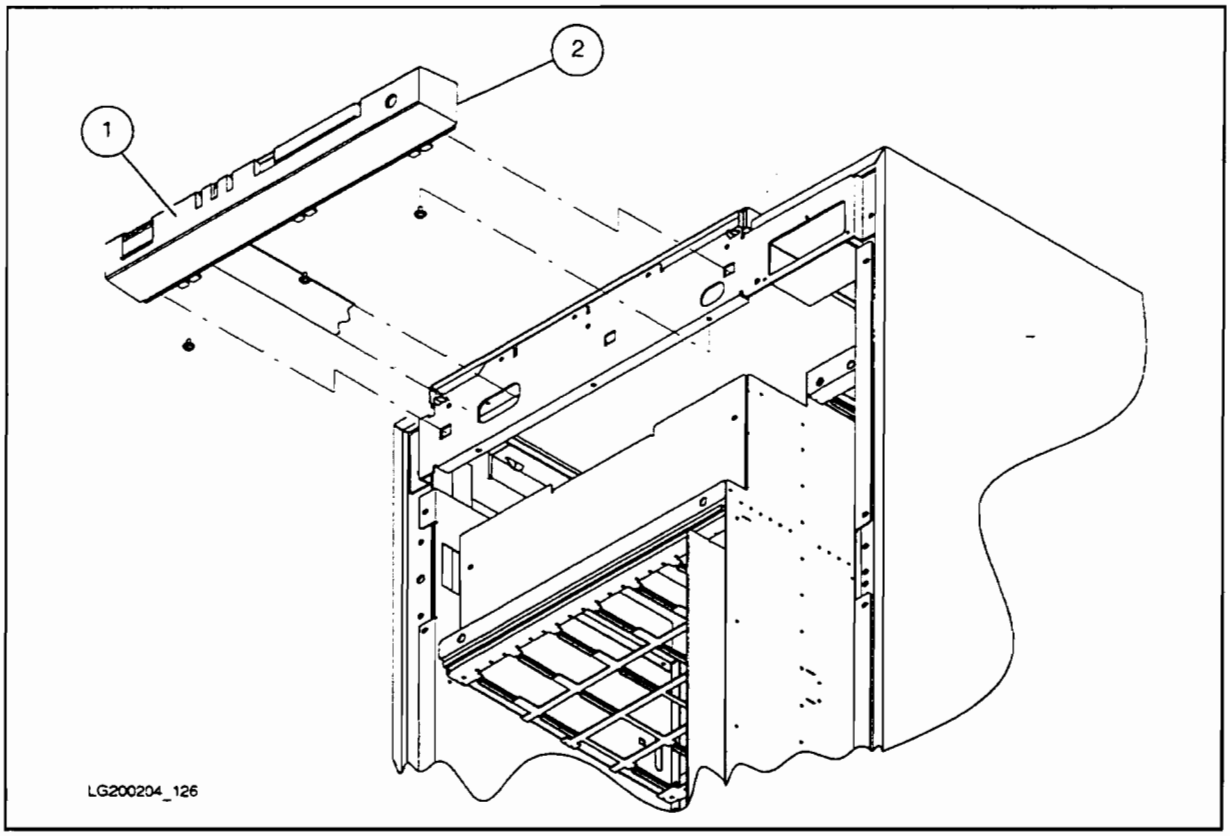


Figure 9-20. Front Control Panel (Cabinet Front)

To replace the front panel, follow the above steps in reverse order.

Lithium Battery

For the procedures to inspect, remove, and replace lithium batteries, refer to Chapter 3 (Installation and Maintenance).

Expansion Cabinet

Note

The original material for this section exists in the *99x/890/T500 Expansion Cabinet Installation Guide* (PN A1809-90006).

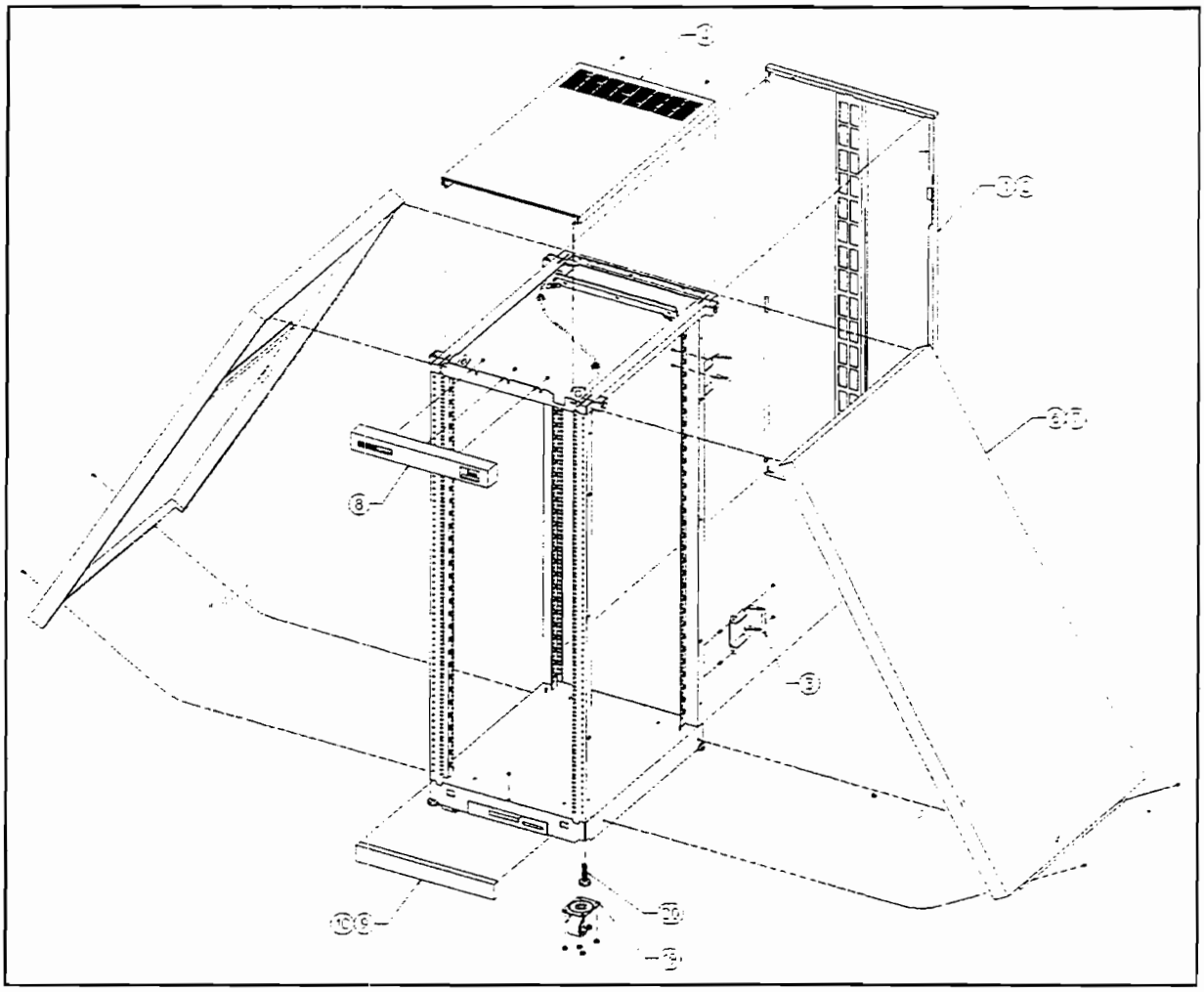


Figure 9-21. Cabinet Exploded View Front

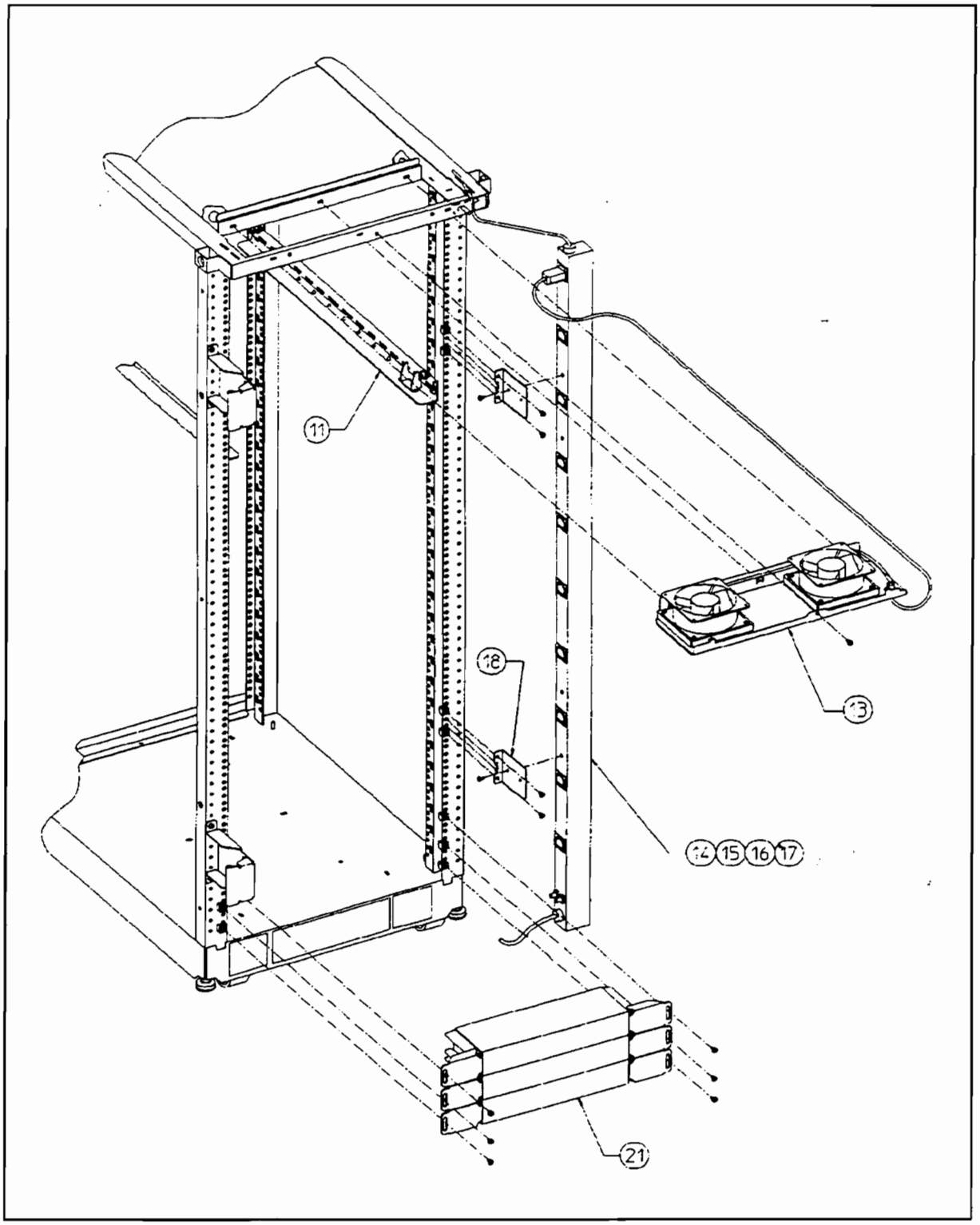


Figure 9-22. Cabinet Exploded View Rear

The following procedures are for the HP Field Replaceable Units (FRUs) contained in the HP A1884A/97A rack-mount cabinets.

Rear Door

Refer to item 1 in Figure 9-21 while performing these procedures.

Rear Door Removal:

1. Remove the rear door of the cabinet by opening the door.
2. Disconnect the bonding wire from the door.
3. Grasp the rear door support and lift the door straight up and away from the cabinet.

Rear Door Replacement:

1. Hold the rear door by the support column, in an open position.
2. Align the door hinge pins over the cabinet hinge holes.
3. Lower the door onto the cabinet hinge.
4. Reconnect the bonding wire to the door.

Top Cap

Refer to item 4 in Figure 9-21 while performing these procedures.

Top Cap Removal:

1. Turn the cabinet power switch off and unplug the cabinet power cord.
2. Open the rear door all the way.
3. Remove the two outside mounting screws at the top rear of the cabinet.
4. From the rear of the cabinet, pull the top cap toward the back, a few inches.
5. Lift the top cap off the cabinet.

Top Cap Replacement:

1. From the rear of the cabinet, place the top cap between the side covers and slide it forward until it stops.
2. Insert the two mounting screws at the top rear, and tighten the screws.
3. Close the rear door.

Side Cover

Refer to item 6 in Figure 9-21 while performing these procedures.

Side Cover Removal:

1. Remove the two mounting screws at the bottom of the cabinet.
2. On the right side cover, open the rear door and remove the two mounting screws on the upper door hinge (that secure the hinge to the side panel).
3. Grasp the sides of the side cover (pulling the bottom of the panel away from the cabinet offers a better grip), then lift up and away.

Side Cover Replacement:

1. Grasp the side cover on the sides and align it with the cabinet at a vertical angle with the bottom out, and the top toward, the top of the cabinet.
2. Lower the side onto the top edge of the cabinet side so the top of the side cover hooks onto the top of the cabinet.
3. With the side cover flush with the cabinet frame, insert the two mounting screws in the bottom. Tighten the screws.
4. On the right side cover, insert the mounting screws through the upper door hinge into the side panel, and tighten screws.

Forehead Assembly

To remove the forehead assembly, the power has to be turned off and the top cap has to be removed first. Refer to item 8 in Figure 9-21 while performing these procedures.

Forehead Assembly Removal:

1. Turn the power off (refer to Chapter 4 for power-off procedures).
2. Unplug the cabinet power cord.
3. Remove the top cap (refer to top cap removal).
4. Unplug the PDU harness from the back of the ON/OFF switch.
5. Remove the three mounting screws behind the forehead assembly.
6. Pull the forehead assembly away from the cabinet frame.

Forehead Assembly Replacement:

1. Align the forehead assembly at the top of the cabinet frame, so the three mounting holes match the frame holes, and the mounting hooks on each side engage the mounting slots.
2. Insert the three mounting screws through the frame into the forehead assembly. Tighten the screws.
3. Attach the PDU harness to the ON/OFF switch lugs as indicated:

Red:	switch terminal 1
Black:	switch terminal 2
White:	switch terminal 6

4. Replace the top cap (refer to top cap replacement).
5. Plug the cabinet power cord into the wall outlet.

Base Cover

Refer to item 9 in Figure 9-21 while performing these procedures.

Base Cover Removal:

1. Remove the mounting screw located on the top edge, center, of the base cover.
2. Pull the base cover away from the bottom of the cabinet.

Base Cover Replacement:

1. Align the base cover hooks on the bottom of the cabinet frame, then roll the base cover until the mounting holes in the cabinet and base cover are aligned.
2. Insert the mounting screw, and tighten the screw.

Rear Door Hinge

Refer to item 3 in Figure 9-21 while performing these procedures.

Rear Door Hinge Removal:

1. Remove the rear door (refer to rear door removal).
2. Remove the two mounting screws from the cabinet column (on the upper hinge, also remove the two mounting screws in the side panel), and lift the door hinge away.

Rear Door Hinge Replacement:

1. Align door hinge with the pressed nuts in the rear cabinet column.
2. Insert the two mounting screws through the hinge into the column (on the upper hinge insert the two mounting screws into the side panel). Tighten the screws.

Rail Assembly

This procedure is also used to remove or replace a rail clamp. Refer to item 11 in Figure 9-21 while performing these procedures.

Rail Removal:

1. Remove the component mounted on the rail to be replaced. Removing the component could involve a lot of cable handling. Be sure to tag the removed cables for replacement later.
2. Remove the two rail mounting screws.
3. Lift the rail out of the rail support notch in the cabinet column.
4. If the rail clamp needs to be removed, remove the clamp screw, and slide the clamp out of the rail groove.

Rail Replacement:

1. Slide the rail clamp into the rail.
2. Insert the rail tab into the appropriate inside cabinet column support notch.
3. Insert the two mounting screws through the rail into the slip nuts on the column. Tighten the screws.
4. Re-install the component that was previously removed.
5. Slide the rail clamp up to the rear of the component and insert the clamp screw. Tighten the screw.

Fan Assembly

Refer to Figure 9-23 and item 13 in Figure 9-22 while performing these procedures.

Fan Assembly Removal:

1. Turn off the cabinet power. Refer to the power-off procedures in Chapter 5.
2. Open the rear door.
3. Disconnect the fan power cord from the PDU.
4. Remove the one mounting screw at the top rear cabinet frame bar.
5. Grasp the fan assembly from the bottom. and pull toward the rear of the cabinet.
6. The fan assembly should release from the cabinet. and can be lowered out of the cabinet.

Fan Assembly Replacement:

1. Raise the fan assembly into the rear cabinet frame opening.
2. Slide the fan assembly forward engaging the tabs on the fan assembly into the slots in the cabinet frame.
3. Insert the mounting screw. Tighten the screw.
4. Connect the fan power cord from the fan assembly to the PDU.
5. The rear door can now be closed and the system powered up.

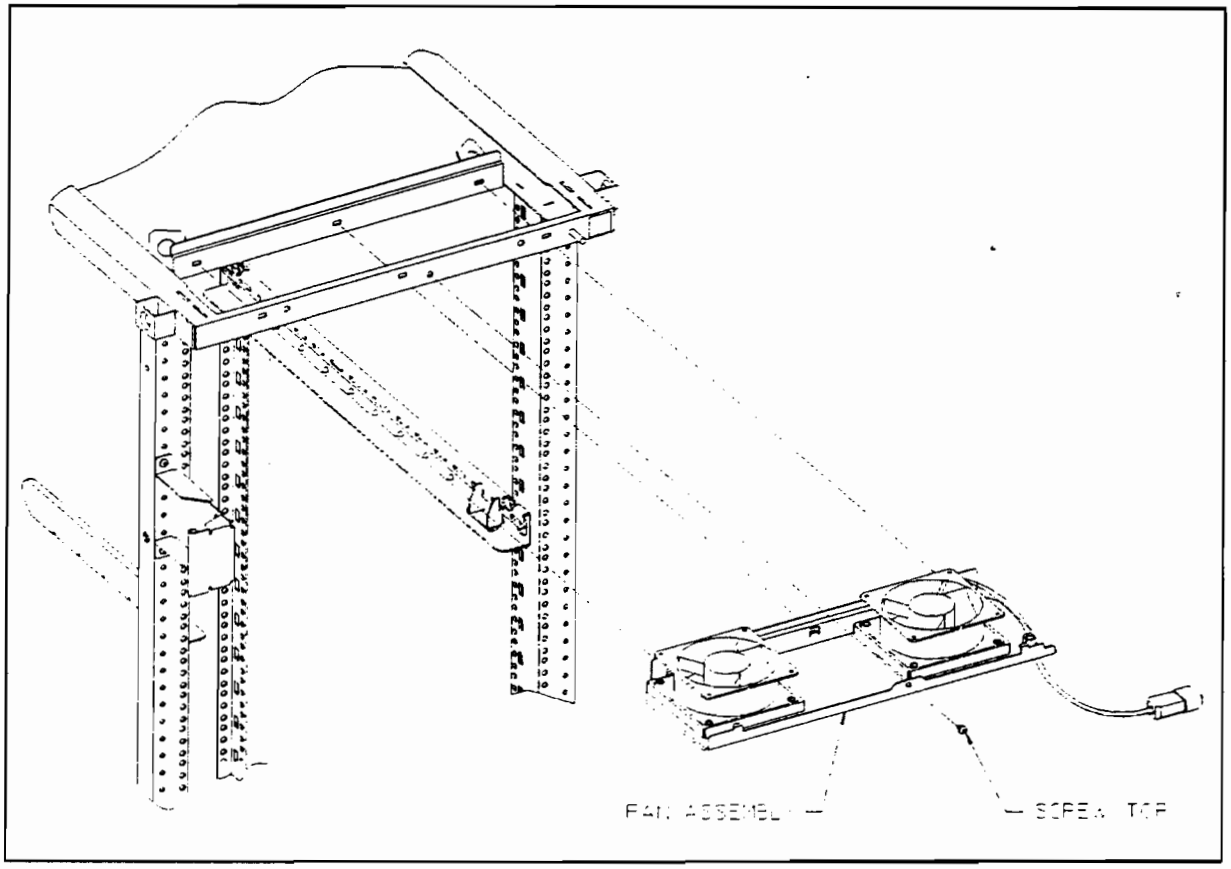


Figure 9-23. Fan Assembly

Fan

Refer to Figure 9-24 while performing these procedures.

Fan Removal:

1. Remove the fan assembly (refer to fan assembly removal).
2. Remove the power cable connectors from the fan.
3. Remove the two mounting screws and nuts holding the fan to the fan tray.
4. The fan bracket stays with the fan tray.

Fan Replacement:

1. Position the fan over the fan bracket/tray mounting holes so that the power lugs are at the rear of the fan tray, and on the right side of the fan (as viewed from the back of the assembly). Also verify that the air flow arrow points up.
2. Insert the mounting screws up through the bottom of the fan tray/bracket and fan.
3. Attach mounting nuts/washers on the mounting screw. Tighten screws and nuts.
4. Attach power cord lugs to spades on the fan (polarity does not matter).
5. Replace fan assembly (refer to fan assembly replacement).

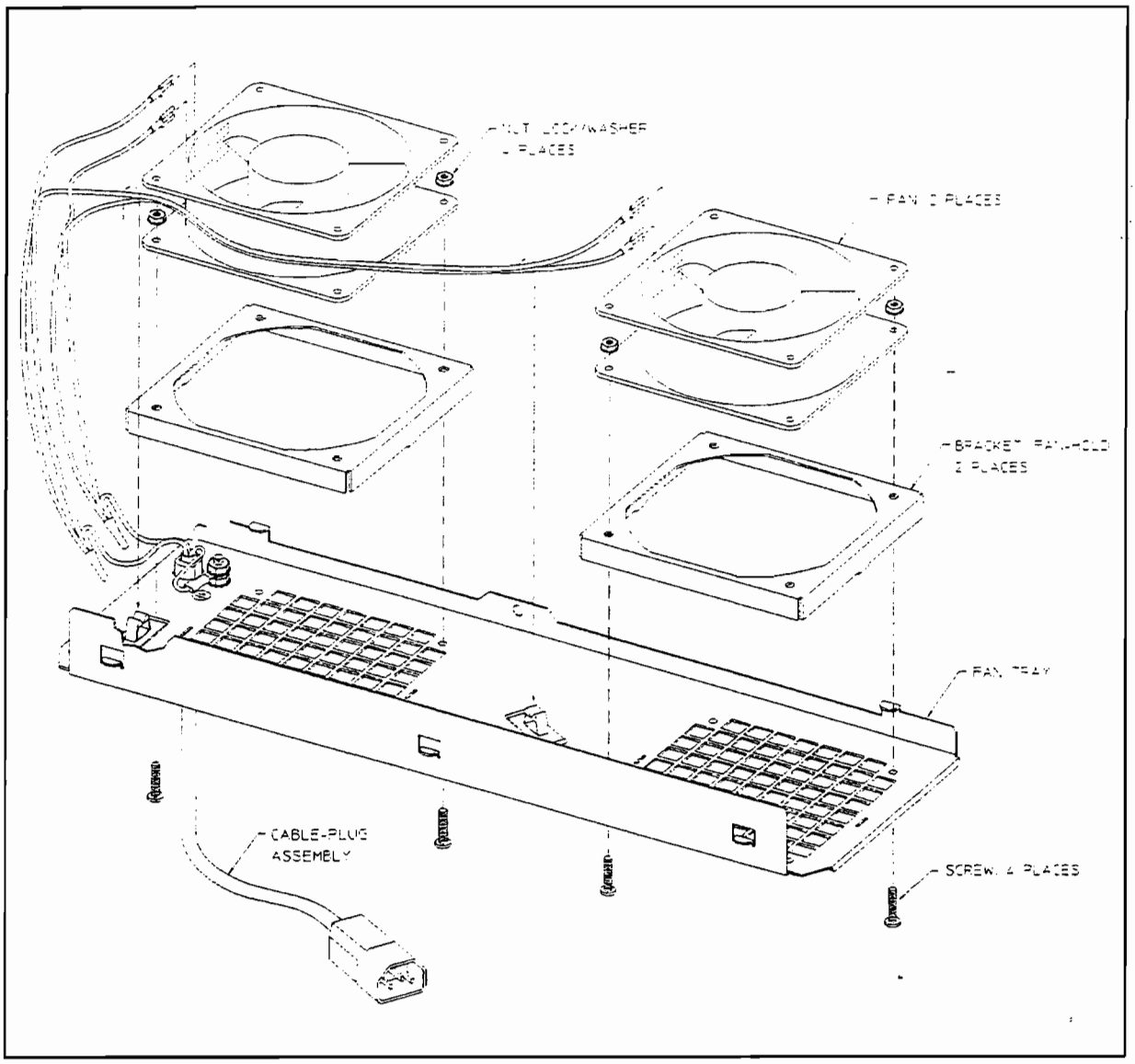


Figure 9-24. Fan Diagram

PDU

Refer to item 14 or 15 in Figure 9-22 while performing these procedures.

PDU Removal:

1. Turn OFF the power switch on the front of the cabinet.
2. Unplug the cabinet power cord from the wall outlet.
3. Remove the top cap (refer to top cap removal).
4. Unplug the PDU harness from the back of the ON/OFF switch.
5. Unclip the PDU harness from the cable clamps on the cabinet frame top and pull the PDU harness down through the top frame.
6. Remove all component power cords from the PDU.

7. Remove the four (two on each bracket) mounting screws from the PDU mounting brackets that attach to the frame columns.
8. Lift the PDU up to disengage. the PDU mounting bracket hooks from the frame column.
9. Pull the PDU out of the cabinet.

Note The PDU mounting brackets could be removed at this point. if necessary.

PDU Replacement:

1. Align the PDU (with the brackets attached) on the right rear column of the cabinet frame.
2. Insert the PDU bracket hooks into the column holes and lower the PDU until it rests on the column.
3. Insert the PDU mounting screws through the brackets into the column with slip nuts attached.
4. Route the PDU harness up through the top of the cabinet and through the cable clamps.
5. Plug the PDU harness onto the ON/OFF switch.
6. Replace the top cap (refer to top cap replacement).
7. Reconnect all the cabinet components to the PDU.
8. Plug the power cord into the wall outlet.

The cabinet and computer are ready to be powered up.

Cabinet Leveler or Caster

Refer to item 19 or 20 in Figure 9-21 while performing these procedures.

Leveler or Caster Removal:

1. Turn OFF the cabinet power switch.
2. Unplug the cabinet power cord from the wall outlet.
3. Carefully move the cabinet to an area with enough room to allow the cabinet to be laid on its side.
4. Remove all computer components mounted in the cabinet.
5. Carefully lay the cabinet over on one of its sides.
6. Remove the desired leveler or caster by removing four mounting nuts and pulling the caster off.

Leveler or Caster Replacement:

1. With the cabinet still on its side, screw in the leveler or place the caster over the four mounting studs, and attach the four mounting nuts. Tighten the nuts.
2. Carefully lift the cabinet back up to an upright position.
3. Install all computer components that were removed previously.

4. Carefully move the cabinet to its install site.
5. Plug the cabinet power cord into the wall outlet.

The cabinet is now ready for operation.

Magnetic Door Catch

The magnetic door catch is located in the rear door. with catch plate on the left side cover.

Magnetic Door Catch Removal:

1. Open the rear door.
2. Grasp the magnetic door catch on the top and bottom. It is inside the rear door fold.
3. Simultaneously press the top and bottom mounting tabs of the door catch. while pushing the door catch out of the rear door.
4. When the door catch mounting tabs are clear of the rear door opening. pull the door catch out.
5. If the door catch plate needs to be removed. pry it off with a flat blade screwdriver. It is stuck on the side cover.

Magnetic Door Catch Replacement:

1. Align the magnetic door catch back to the mounting hole in the rear door.
2. Firmly press the door catch into the rear door mounting hole.
3. Press the door catch until the mounting tabs snap into place and the door catch is firmly locked into place.
4. If the door catch plate needs to be replaced, peel the adhesive cover off the back of the new catch plate. Then align the catch plate with the magnetic door catch, and press it against the side cover until firmly stuck.

Door Bumper

The rear door bumpers (one top and one bottom) are self-adhesive rubber bumpers stuck to the rear door. To remove, pry it off with a flat blade screwdriver. To put a bumper on, peel off the adhesive cover, and press the bumper on the appropriate corner of the rear door.

10

Functional Description

This chapter describes the major hardware components of the system.

Chapter Contents:

This chapter is organized as follows:

- System Overview.
- Processor Memory Bus (PMB).
- Service Processor (SP) Bus.
- Scan Bus.
- HP Precision Bus (HP-PB).
- Processor Cards (890/990/992).
- Processor Cards (T500/991/995).
- PMB Bus Converter Cards.
- Memory Cards.
- HP-PB Bus Converter Cards.
- Service Processor (SP) Card.
- Close Console Path (CP).
- SPU Power System.
  - AC Front End (ACFE).
  - AC-to-DC Module (PFC Unit).
  - DC Converter Modules.
  - Miscellaneous Power Module (MPM).
- Uninterruptible Power System (UPS).
- Cooling the PMB Cardcage.
- Internal HP-PB Cardcage.
- External HP-PB Cardcage.
- Firmware Update Tool (FUT) Firmware.
- Differences Between T500/991/995 and 890/990/992.

System Overview

The 99x/890/T500 has an architecture similar to other PA-RISC systems (Figure 10-1). A central bus (the Processor Memory Bus) connects the processor, memory, and bus converter modules. Bus converters serve as an interface between the Processor Memory Bus (PMB) and the HP Precision Buses (HP-PB) used for I/O.

The SPU cabinet contains one HP-PB cardcage with a console/LAN card. Additional HP-PB cardcages can be installed in expansion cabinets.

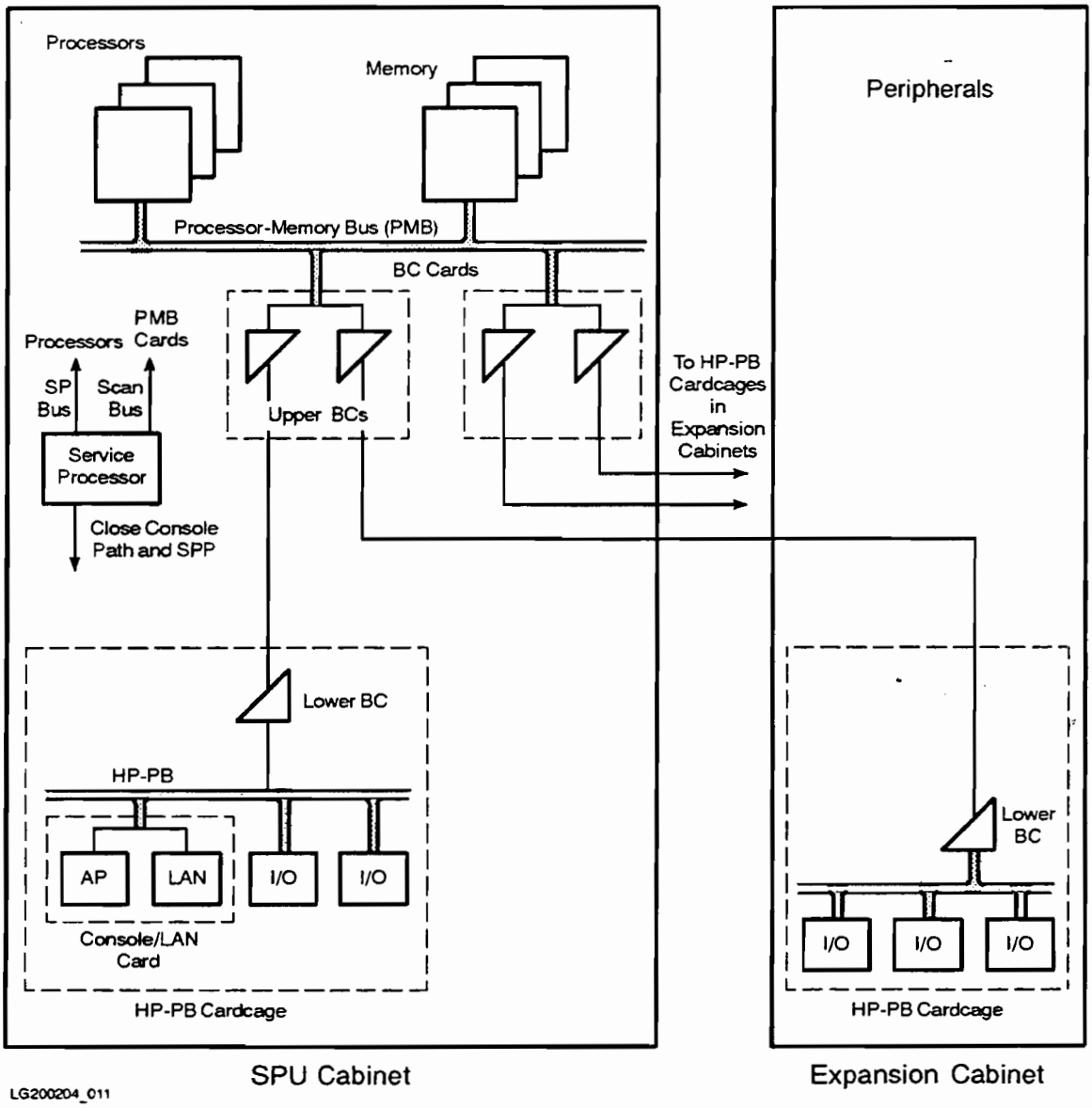


Figure 10-1. System Block Diagram

In Figure 10-1, you can see that the Bus Converters are implemented as a combination of an upper-port BC (attached to the PMB) and a lower-port BC (attached to the HP-PB). The upper-port BCs are packaged two to a card. One lower-port BC is included with each HP-PB cardcages.

Buses

- The **Hewlett-Packard Precision Bus (HP-PB)**. On the 99x/890/T500, the HP-PB is used for I/O.
- The **Processor Memory Bus (PMB)**. The PMB is a fast wide bus providing high bandwidth. The PMB connects the processor, memory, and upper-port BC modules.
- The **Service Processor (SP) Bus** connects the Service Processor card with each processor slot.
- The **Scan Bus** connects the Service Processor card with each PMB slot.

PMB Cards

Several cards attach to the PMB bus:

- **Processor cards**, containing one processor module and a floating-point math co-processor module on the 890/990/992. On the T500/991/995, processor cards can contain one or two processor modules (daughterboards).
- **Memory cards**, containing a processor-dependent memory module with up to four equal-size banks.
- The **PMB Bus Converter card** containing two (upper-port) bus converter modules.

Note

The Service Processor (SP) card does not communicate over the PMB, even though it is installed in the PMB cardcage. The SP is not a PA-RISC module.

Support Features

Support features on 99x/890/T500 include:

- The **Service Processor (SP)**. The SP provides commands and logic to help service the system.
- An **Access Port (AP)**. The AP provides the ability to service the system remotely, and to share the console terminal. The AP is similar to the Integrated Access Port (IAP) on earlier xx7 and HP-UX Silver systems.

Power System

AC Front End components:

- One AC distribution box.
- One Battery pack.
- One AC-to-DC Module. Also known as a Power-Factor correcting (PFC) high voltage unit.
- PSCM Hex Indicators

DC components:

- Up to two +5VP 130A (650W) power converter modules to power processor cards.
- Up to two +5VS 325W power converter modules to power memory and bus converter cards.
- Up to two +5VB 325W power converter modules to power portions of memory cards.
- One miscellaneous power converter module referred to as MPM, to power the Service Processor card.
- One +24V 325W fan power converter module to power the cooling fans.

Control logic:

- Power System Control and Monitor (PSCM) logic on the Service Processor card. PSCM controls the up/down of the DC voltage rails, fans, and PON when directed to do so by the SP logic. PSCM also generates a Power Fail Warning (PFW) when detected by the AC-to-DC module (PFC unit).

Processor Memory Bus (PMB)

The PMB backplane provides:

- One bidirectional (ECC-protected) 128-bit parallel data path. This data path actually consists of two separate (ECC-protected) 64-bit parallel data paths.
- One bidirectional (parity-protected) 32-bit parallel address path.

Each PMB module uses special PMB address and data chips to interface with the PMB. The special PMB chips generate/check parity on the address lines: generate/check ECC on the data lines: and convert the ECL logic levels on the PMB to TTL logic levels on the PMB cards and vice-versa.

Configuration

The PMB backplane provides 16 PMB card slots.

Theoretically, each PMB card could contain up to four modules per card. Since the PMB cardcage contains 16 card slots and each card could contain 4 modules, the PMB cardcage could theoretically support 64 PA-RISC modules (16 slots X 4 modules per slot = 64 modules). As of initial release, only the Bus Converter card contains more than one module per card. It would be possible, however, for a processor card to contain multiple processor modules or a memory card to contain multiple memory modules.

Operation

PMB cycles are synchronized and operate at a fixed frequency between 40–60 MHz/sec, providing 64-byte burst data transfer speeds close to 1 GB/sec @ 60 MHz.

This capability allows the PMB to function over a range of frequencies synchronous with current processor cards (60 MHz), as well as future PMB processor cards that may operate at frequencies two or three times faster than the PMB.

Error Handling

If the processor module detects a correctable (soft) error over the PMB, it forces a Low Priority Machine Check (LPMC). Error information is logged to Processor Internal Memory (PIM) and the computer continues operation. Single-bit data errors on the PMB data lines are corrected on-the-fly by all modules except memory modules.

If the processor module detects an uncorrectable (hard or fatal) error over the PMB, it forces a High Priority Machine Check (HPMC). Error information is logged to Processor Internal Memory (PIM), a tombstone (troubleshooting display) may appear on the system console, and the computer halts. HP-UX systems attempt to save a core file (an image of physical memory) and reboot.

You can view PIM information by several methods. The easiest method is to use the DL command at the SP prompt (choose "SPU Tombstone Logs"). Viewing and decoding PIM is described in specialist-level documentation.

Service Processor (SP) Bus

The Service Processor (SP) bus is located on the PMB backplane. It consists of four unidirectional serial data paths between the SP card and each processor slot (PMB slots 8–15). The four paths include:

- Two control lines driven by the SP. (These lines will enable the SP to address more than one processor in each slot.)
- One line for READ data (received by processors).
- One line for address, operation, and WRITE data (driven by processors).

See Figure 10-2.

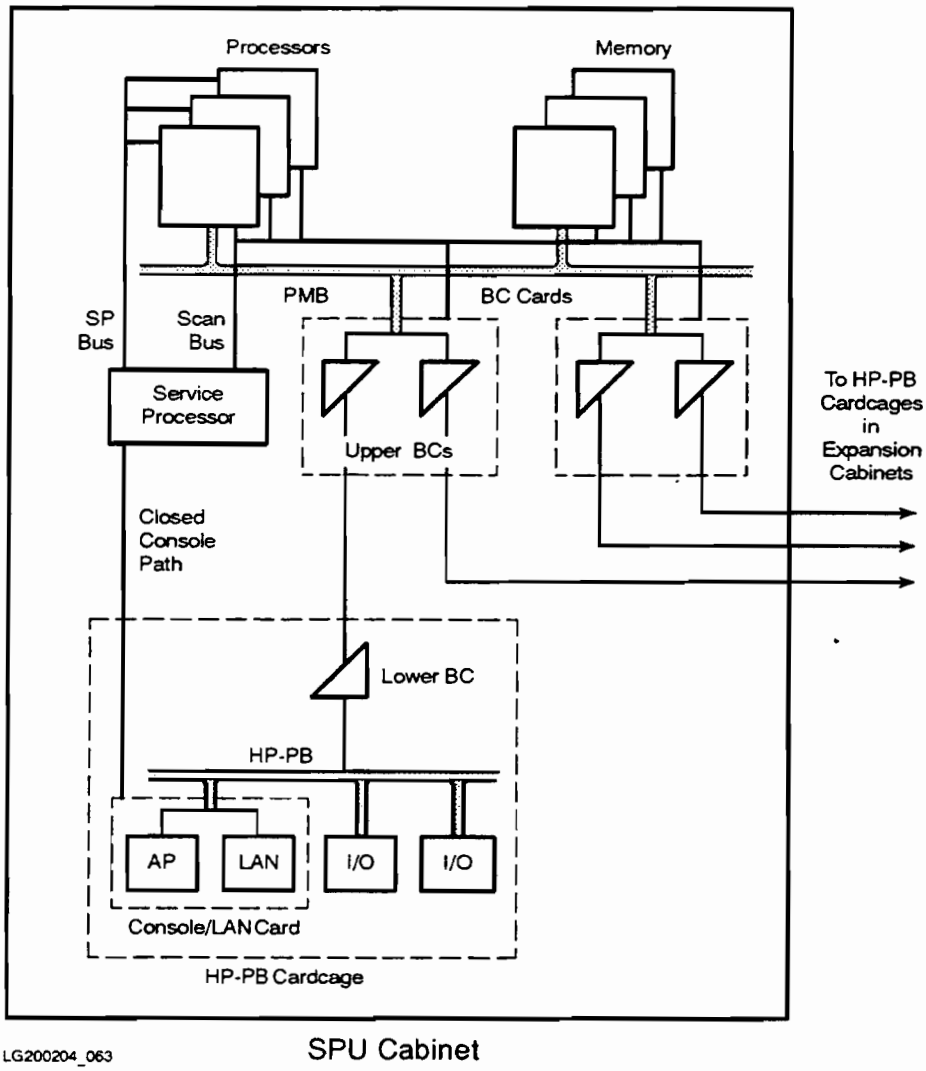


Figure 10-2. The Service Processor (SP) and Its Connections

Operation

The SP polls each processor card slot in a round-robin fashion to determine if a processor module requires access to the PDC/PDH functions on the SP card. In addition, the SP can use the SP bus to issue an architected Transfer of Control (TOC) to the monarch processor, if requested by a user.

Processor module access to the SP Bus is managed by the SP. During each access, 32 data bits plus parity are transferred.

The SP bus operates at a fixed frequency one fourth that of the PMB frequency. Since the PMB operates between 40 - 60 MHz, the SP operates between 10 and 15 MHz. Data transfer speeds for the SP bus are in excess of 330 KB/sec. This bandwidth is equally divided among all processor modules.

Error Handling

Parity errors that occur on either data path are detected:

- By the processor module involved with the SP transaction for READ data.
- By the SP for address, opcode and WRITE data.

In addition to SP bus parity errors, errors may be generated by a bad address on the PDH bus (for example, trying to perform a READ or WRITE to an unpopulated address).

If the SP detects an SP bus parity error or a PDH bus address error, it aborts the SP bus transaction.

If a processor detects a parity error in a transactions's READ data, or if a transaction is aborted by the SP, the processor involved with the transaction signals an HPMC and logs data to PIM.

Scan Bus

The Scan Bus is located on the PMB backplane. It consists of a unidirectional serial path from the SP card to each PMB card slot (0–15).

Operation

The SP micro-processor on the SP card uses the Scan Bus to:

- Configure good PMB cards and de-configure failed PMB cards.
- Read or write the revision ports on PMB cards.
- Access status from Diagnostic Interface Port (DIP) of VLSI chips on PMB cards.

Error Handling

There is no error handling for the Scan Bus.

HP Precision Bus (HP-PB)

The HP Precision Bus (HP-PB) serves as the I/O bus for HP-PB I/O modules. See Figure 10-3.

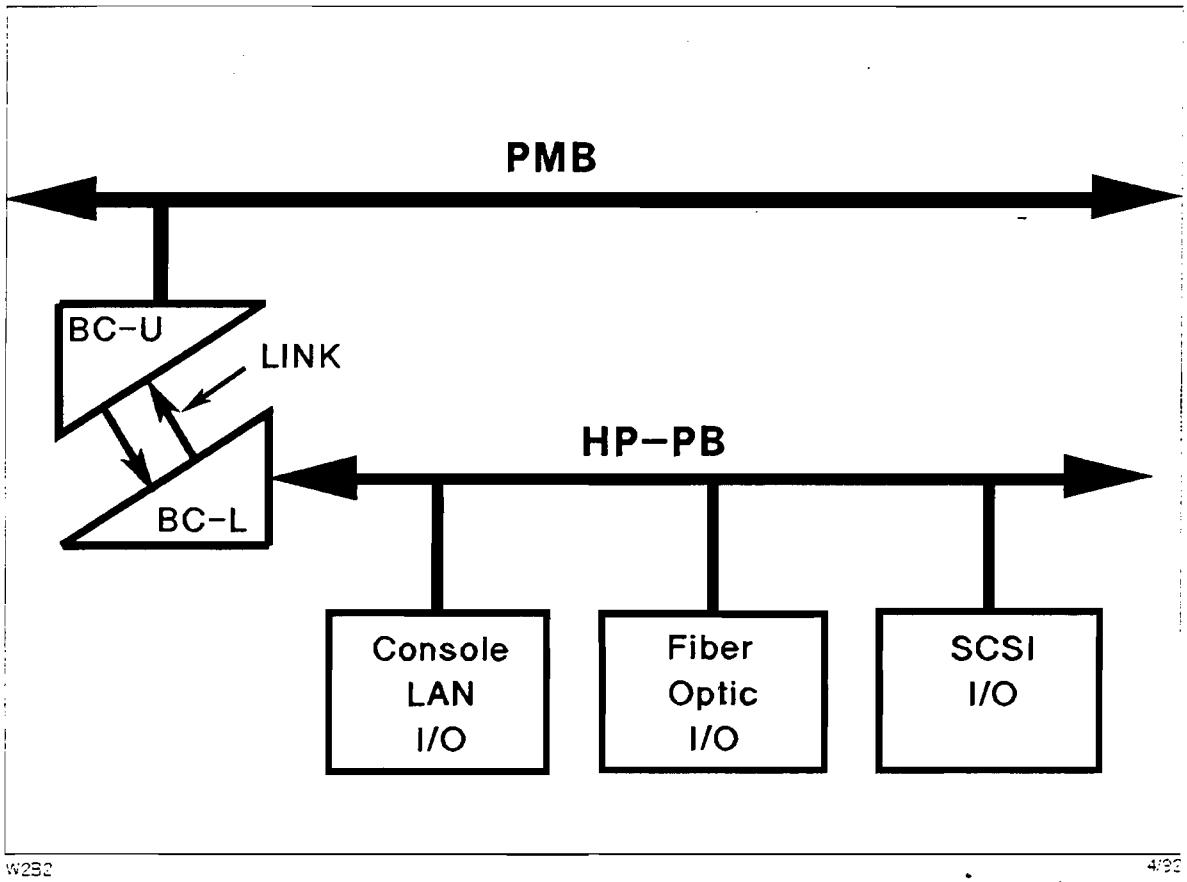


Figure 10-3. HP Precision Bus (HP-PB) I/O Modules

Configuration

Each HP-PB cardcage provides 7 double-high or 14 single-high card slots for up to 56 HP-PB I/O modules (4 modules per slot X 14 slots = 56).

See Chapter 11 (Interface Cards) for a description of the I/O cards. See "HP-PB Bus Converter Card" in this chapter for a description of the HP-PB BC card that interfaces the HP-PB to the PMB.

Operation

Each single-high card slot provides support for a bidirectional (parity-protected) multiplexed 32-bit data/address bus that runs at 8 Mhz; 32 MB/sec burst transfers.

The HP-PB cardcage has the capability for **online repair** (hot-board replacement) of any HP-PB I/O adapter card. However, neither OS currently provides procedures to make the online repair feature functional.

Error Handling

Handling of HP-PB errors is managed by each HP-PB I/O adapter module in conjunction with the HP-PB Bus Converter card.

Processor Cards (890/990/992)

Each processor card on the 890/990/992 contains a single processor module. The processor module contains a CMOS-26 VLSI CPU chip with an internal (primary) TLB. Other CMOS-26 VLSI chips control:

- External instruction/data cache (ICMUX, DCMUX0, and DCMUX1 chips).
- Secondary instruction/data TLB (ICMUX, DCMUX0, and DCMUX1 chips).
- Floating point coprocessor (FPC, ADD, and MUL chips).
- PMB interface (PMBI chip).

The processor card provides the following connections:

- On-card 60-Mhz PMB clock distribution to all logic components.
- Connection between the Diagnostic Input Port (DIP) on each VLSI chip and the Scan Bus on the PMB backplane.

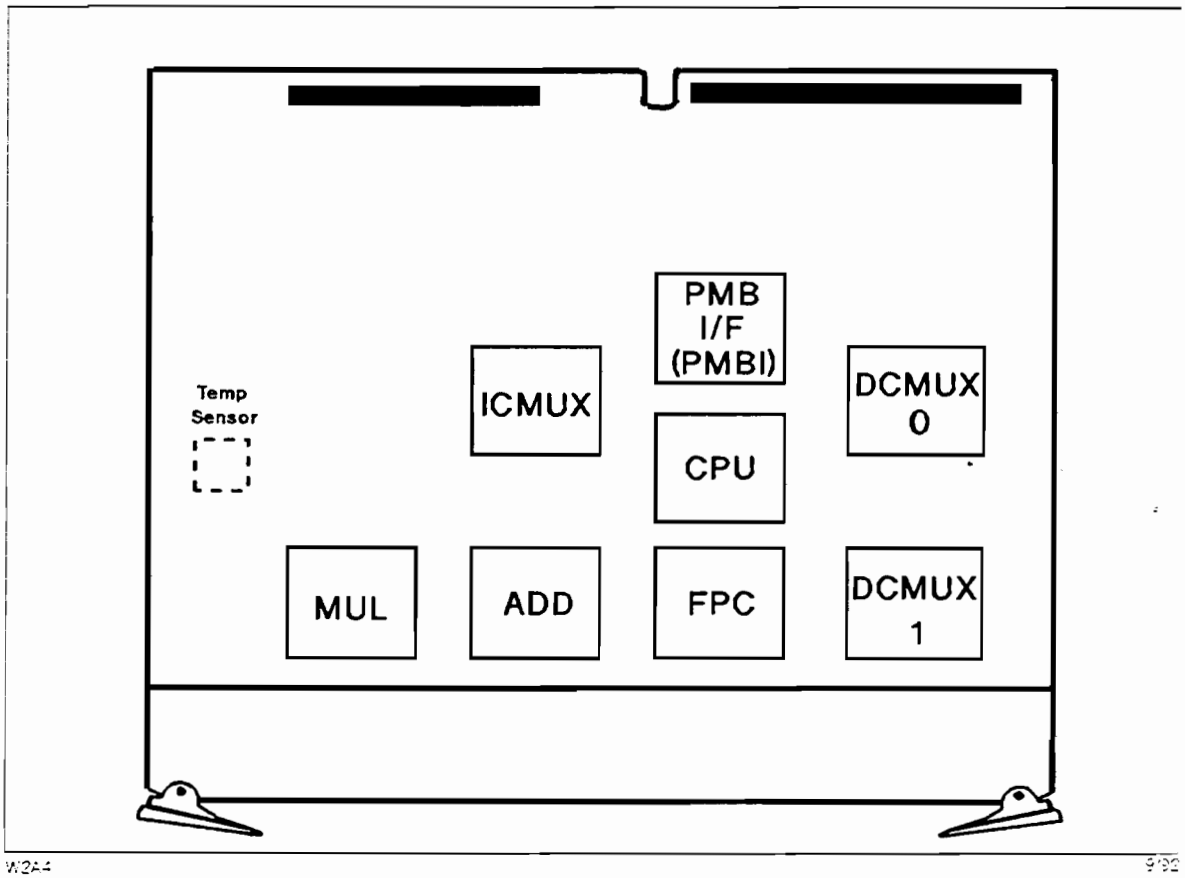


Figure 10-4. PMB Processor Card

Configuration

Up to four PMB processor cards may occupy PMB card slots 8–15 (these slots correspond to processor module numbers 0–7).

Operation

PMB processor cards operate at a fixed frequency of 60 Mhz.

VLSI Chips

CPU Chip

The CPU chip implements the Level 1 virtual address scheme. Level 1 uses 16-bit space registers for up to 48 bits of virtual addresses.

The CPU chip also provides primary or first-level of parity-protected 2-way set associative 64 entries of I-TLB and 64 entries of D-TLB.

The CPU chip interfaces with the other chips as follows:

- Separate 32-bit parallel interfaces to the data and instruction caches. Each interface includes 32-bit data and 21-bit RPN (real page number).
- 32-bit parallel interface to the Floating Point chip.
- 32-bit parallel interface to the PMB Interface (PMBI) chip.

Instruction Cache Comparator and Multiplexor Chip (ICMUX)

The Instruction Cache Comparator and Multiplexor Chip (ICMUX) provides access to 2 MB of parity-protected (2-way set associative) instruction cache. The instruction portion of the cache is organized as 64K X 32 bytes using 16 (128K X 8 bit) SRAMs; the tag portion of the cache uses 4 (64K X 4bit) SRAMs.

The instruction cache tags only use 3/4 of the total capacity of the SRAMs; the remaining 1/4 capacity is used for the 16K entries of secondary instruction TLB.

The parallel interface between the I cache and the CPU/FPU chips is 32-bits wide.

Data Cache Comparator and Multiplexor Chips (DCMUX)

Two chips are used to provide access to 2 MB of ECC-protected (2-way set associative) data cache. The data portion of the cache is organized as 64K X 32 bytes using 16 (128K X 8 bit) SRAMs; the tag portion of the cache uses 4 (64K X 4bit) SRAMs.

The data cache tags only use 3/4 of the total capacity of the SRAMs; the remaining 1/4 capacity is used for the 16K entries of secondary data TLB.

The parallel interface between the D cache and the CPU/FPU chips is 64-bits wide. Each controller chip supports a separate 32-bit parallel interface.

Floating-Point Coprocessor (FPC, ADD, MUL)

The Floating Point coprocessor supports separate 64-bit double-precision and 32-bit single-precision registers.

PMB Interface (PMBI) and Special PMB Chips

The PMB interface chips:

- Support access to the parity-protected 32-bit address path to other PMB modules.
- Support access to the most-significant (ECC-protected) 64-bit data path for 32-byte cache line fetch/flush operations to/from memory modules.
- Support a duplicate set of data tags for fast Cache Coherency Checks (CCCs).
- Provide connections to the SP Bus (2 parity-protected serial input/output paths to/from the SP card).

Processor Cards (T500/991/995)

The T500/991/995 processor board contains the following:

- Main CPU and cache system module(s).
- PMB interface, transceivers, and duplicate tags.
- Clocks.
- Scan logic.
- On-board voltage regulators.
- Miscellaneous system circuits.

Each processor board in T500/991/995 contains one or two CMOS-based processor modules (daughterboards). See Figure 10-5.

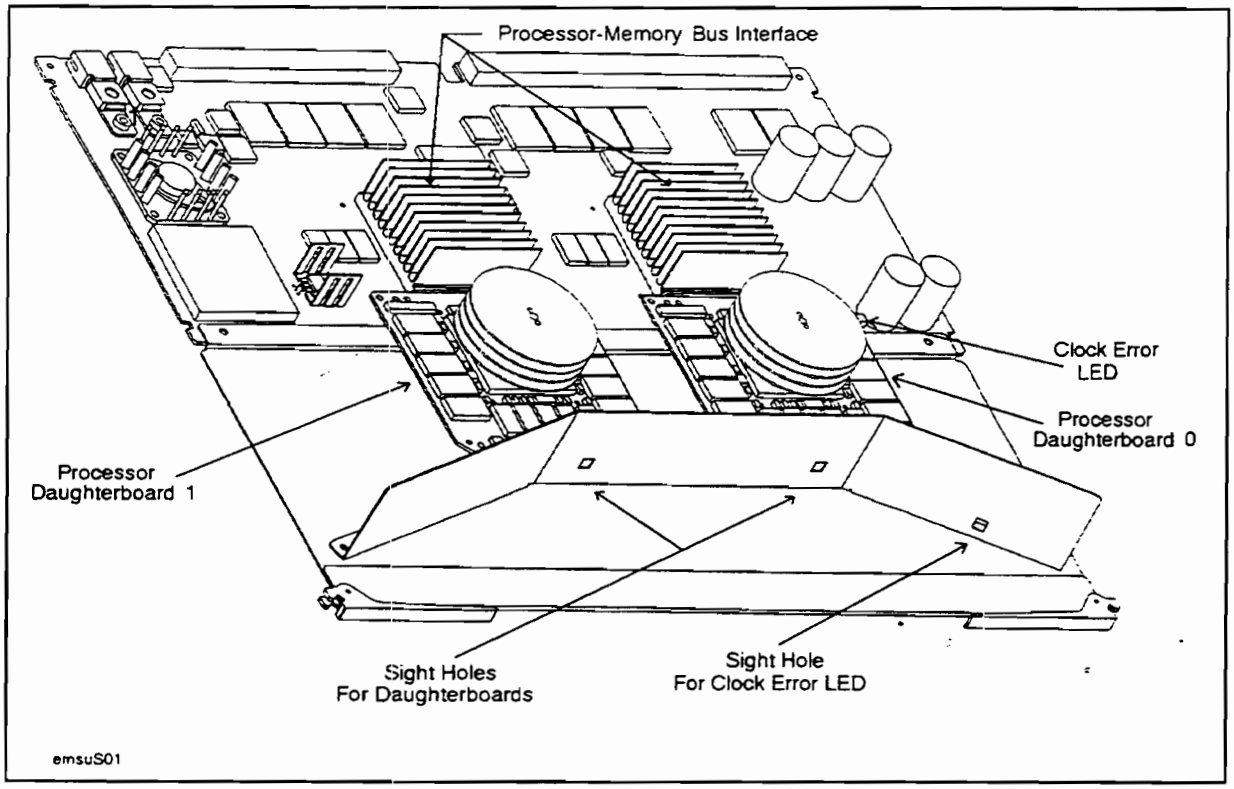


Figure 10-5.
The T500/991/995 Processor Card (Processor Motherboard with Two Daughterboards)

The modules are numbered 0 and 1. Each processor identifies itself during early selftest by its slot number and its module number. For example, the processor modules in slot 15 are identified as *proc(15/0)* and *proc(15/1)*.

The processor card has sight holes that enable you to see the number of modules installed on the card when it is in the cardcage. On processor cards with only one processor module, the daughterboard must occupy the lower position (bottom-most postion when the processor card is installed in the cardcage).

Processor Module (Daughterboard)

Each processor module contains a PA7100 (PCX-T) CPU chip along with 1-MB instruction and data caches and a P-bus connector which plugs into the processor motherboard. See Figure 10-6.

The processor modules operate at a 90 MHz clock frequency, which is 1.5 times the PMB bus frequency of 60 MHz.

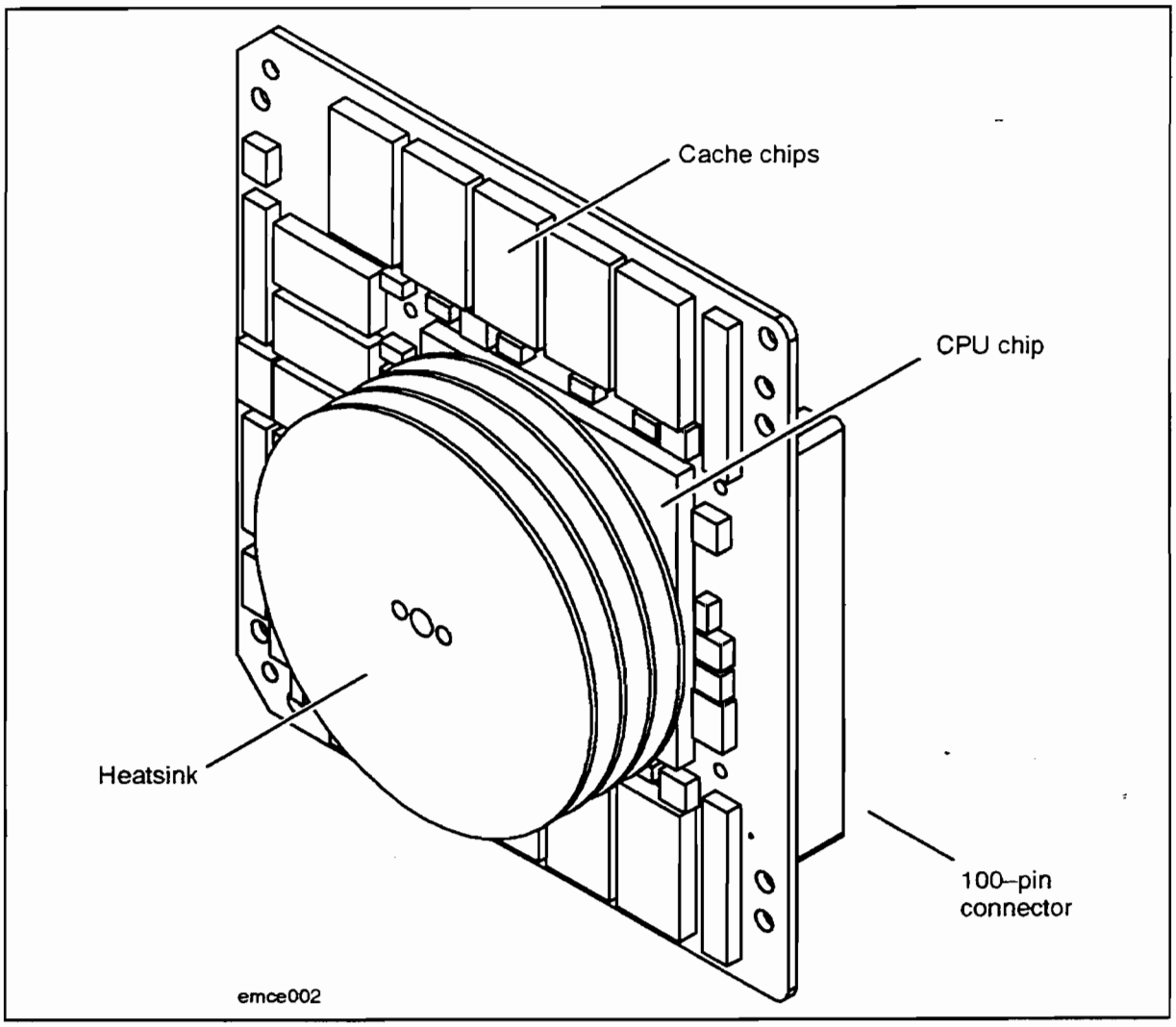


Figure 10-6. The T500/991/995 Processor Module (Daughterboard)

The processor module uses conventional unidirectional airflow supplied by the x9x Family system. A heatsink is required to adequately cool the PA7100 (PCX-T) chip. The processor motherboard sheetmetal provides an air baffle to direct more air across the modules to improve its cooling efficiency.

CPU-PMB Bus Interface

Each processor module contains a 100-pin AMP Microstrip connector which allows the CPU to communicates with the PMB bus via a PMBI chip and the data and address transceivers. Figure 10-7 is a block diagram showing the bus structure between the PA7100 CPU modules and the PMB Interface.

The CPU-PMB Bus interface is composed of the PMBI (PMB Interface) chip, 12 data transceiver chips, and 1 address transceiver chip. This portion of the T500/991/995 design is similar to the 890/990/992 with the exception of having two PMBI chips to interface with two CPU modules.

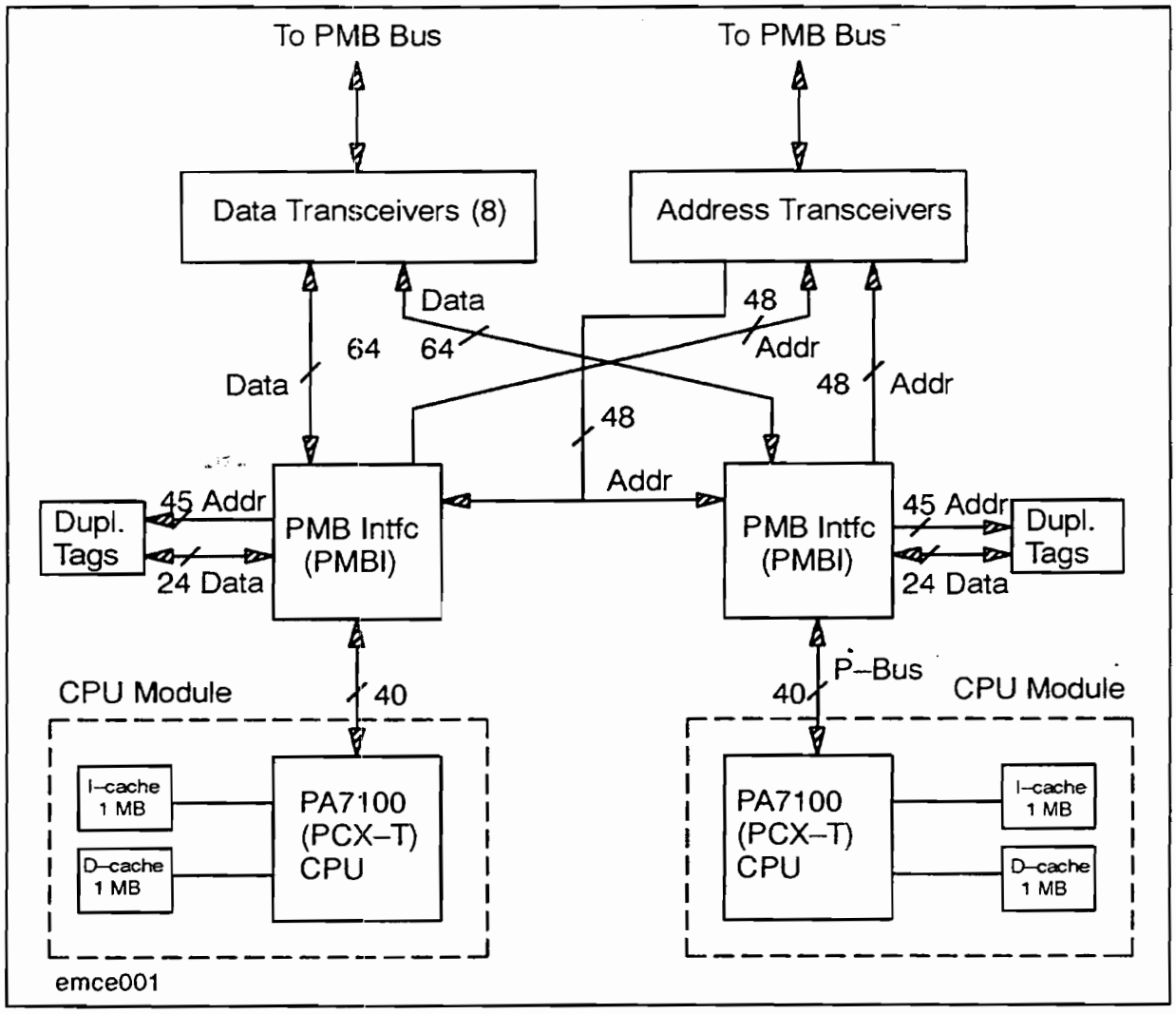


Figure 10-7. T500/991/995 Processor Bus Organization

PMBI Chip

The PMBI (PMB Interface) chip is the interface between the CPU chip and the PMB data and address transceivers on the T500/991/995 board. The PMBI also controls the duplicate tags which are used to improve multi-processor (MP) performance. Since the T500/991/995 supports two processors, there are two PMBI chips and two sets of duplicate tags on the board.

As the CPU's line size is 32 bytes, PMBI provides a 64-bit data interface to the PMB transceivers. The PMBI supports PMB's multi-processor (MP) implementation of the cache coherence and protocol. The PMBI also contains an interface that allows it to communicate to selftest, PDC, and PDH in the SP card. The PMBI is implemented in CMOS-26 and is packaged in a 408-pin PGA.

Other Components of Interest

The processor card contains two other features of interest to CEs.

Temperature Sensor

The temperature sensor is a surface-mount IC (LM35) which measures the air temperature on the down-wind side of the board. An analog output signal is provided to the backplane for the system environmental monitors to read. The temperature sensor (U19) is located on the top side of the board, near the board edge between the large bulk capacitors and the longer of the two backplane connectors.

Revision Port (Rev Port)

A marketing and support requirement is to be able to "personalize" each module as a commercial module sold by CSY or a HP-UX module sold by GSY. The modules must be identified as a CSY module or a GSY module in order to eliminate the possibility of mixing modules. The "personalization" has been done by installing a Revision Port (Rev Port) on the module. The Rev Port is the same as that put on the T500/991/995 processor card. The Rev Port can be personalized by the support engineer as he/she installs the new module.

The Rev Port is a table of critical identification information set by the factory and the field. This information is stored in a non-volatile RAM. There is one Rev Port for the processor card and one Rev Port per CPU module. These Rev Ports are read by the system processor via the T500/991/995 scan circuitry.

Initial Selftest (Processor Selftest)

The initial selftest rapidly determines if the basic hardware for code execution and error detection is functioning correctly. The goal of Selftest to detect faults down to the FRU level. Some of the selftests may reveal precise details, but other more exhaustive tests (for example ISL diagnostics) are required to isolate defects in a particular device or interconnect.

Selftest consists of the following tests:

- Processor selftests.
- Memory selftest.
- PMB Bus selftest.
- Upper BC selftests.

Processor Selftest

The processor selftest is part of the Processor Dependent Code (PDC) which resides in Flash EPROM on the SP card and is shared by all of the processors in a multi-processor x9x Family environment. Processor selftest:

- Tests processor board functionality.
- Initializes the processor board for normal operation.
- Initializes and tests the FPU. The FPU is initialized and tested at the end of Early_ST.
- Increases field supportability of the system. Selftest attempts to provide as much test coverage as possible within the execution time and code space limits placed upon it, and should insure enough functionality to allow execution of ISL Diagnostics. ISL diagnostics provide additional test coverage to insure that the processor is functional.

  If a processor board failure is detected, it displays or passes to PDC, an error code which indicates the probability of the failure being on the processor board.

Early_ST and Late_ST

Processor Selftest has two main subsections: Early Selftest (Early_ST) and Late Selftest (Late_ST). The Early_ST uses and tests only components that are physically on the processor board. Late_ST uses and tests components on and off the processor board. Early_ST and Late_ST are designed to test the processor board ONLY; off board components used by Late_ST are assumed to have been previously verified. Other sections of PDC test the rest of the system hardware.

Early_ST

After reset, each processor in the system executes Early_ST. Early_ST tests are confined to the processor board hardware for two reasons:

- System components, such as main memory or the I/O system, are not initialized at this time. For example, an attempt to access main memory will cause an HPMC.
- Tests are much easier to write if they do not access system resources. Writing tests which use system resources in a multi-processor (MP) system is tricky because the interaction of processors must be considered. By confining Early_ST tests to the processor board, there is no interaction between processors, and the probability of writing defect-free tests is much greater.

Early_ST has absolutely no access to main memory. Early_ST must initially fetch and execute instructions over the SP bus which has a very low transfer rate. After testing the Cache, in order to increase execution speed, sections are "diagnostic" loaded into cache and executed.

Late_ST

After Early_ST completes, each processor arbitrates to become the Monarch processor. The Monarch then instructs each processor to execute Late_ST. Late_ST has been loaded into main memory and executes by faulting into cache. With the exception of the sections that test the ICache which must execute from PDC_IO space, all execution is from PDC_mem space.

If Early_ST detects a processor board failure, it attempts to log the error in the ST_control table and to the console if the Close Console path is enabled. The failing processor is effectively halted, and does not arbitrate for Monarch. If the failing processor is the only processor in the system, the system is halted. If there is one or more functional processors in the system, the system runs at reduced performance, because there are fewer processors.

PMB Bus Converter Cards

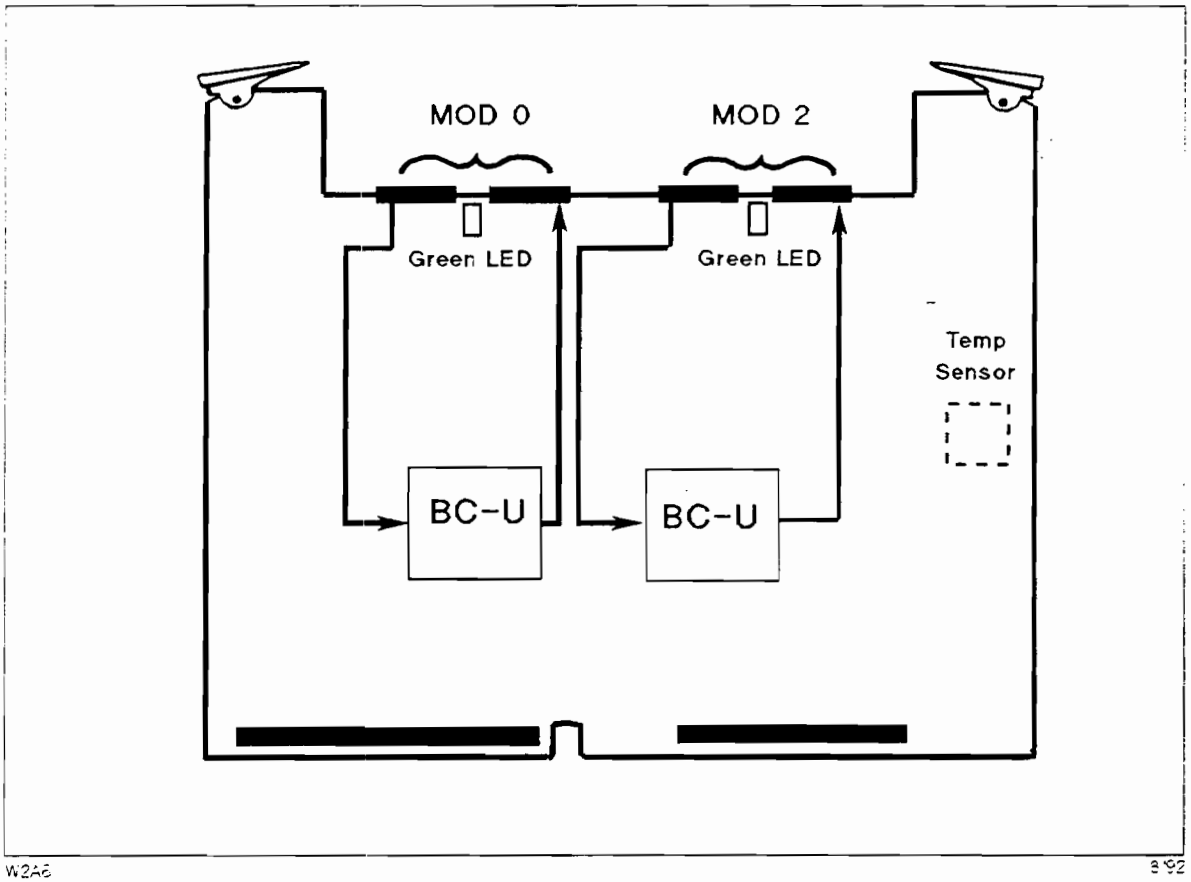


Figure 10-8. PMB Bus Converter Cards

Configuration

Up to four PMB Bus Converter cards may occupy PMB slots 0–6. Two (upper) bus converter modules are located on each card.

Each (upper) bus converter module shares the use of the Special PMB chips to access the (ECC-protected) 64-bit data path and the (parity-protected) 32-bit address path to/from the PMB.

Each (upper) bus converter module has separate differential link to a lower bus converter module in an HP-PB cardcage. This link consists of two cables for module 0 and two cables for module 2.

Each PMB Bus Converter card provides a common connection between the Scan Bus and the diagnostic input port (DIP) on each VLSI chip.

Operation

All PMB (upper) Bus Converter cards must operate at the same fixed frequency as the PMB (40–60 Mhz). Both the Receive and Transmit Links for each BC-U chip operate at 1/2 the frequency of the PMB (20–30 Mhz).

Error Handling

The bulkhead on each PMB Bus Converter card contains two LEDs (one for each upper bus converter module) to display receive link information from a lower bus converter module in an HP-PB Expansion cardcage.

The appropriate green LED on the bulkhead of the BC (upper) card is turned off if a bad connection to the lower bus converter is detected.

Note that the LED is also turned off when DC power to the BC (lower) card is turned off.

Memory Cards

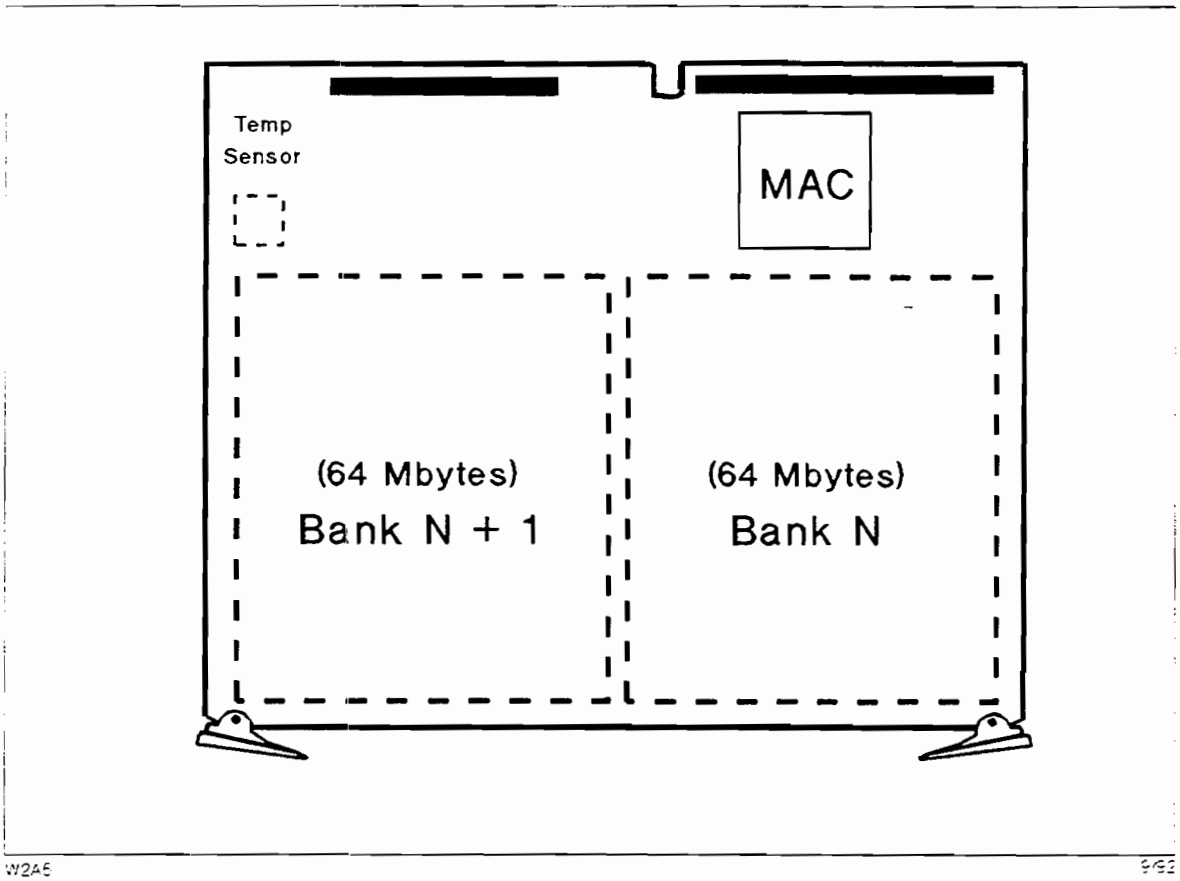


Figure 10-9. PMB Memory Card

Configuration

- Up to 8 PMB Memory cards may occupy PMB card slots 1–14.

  The number of memory cards allowed in a system is a function of how much main memory the O/S supports, the size of the banks on each card, and the number of card slots available for memory cards.

- There are three (3) versions of PMB memory cards: 64 MB, 128 MB, and 256 MB.
- The 64 MB version of the PMB Memory card contains one 64 MB bank on the top-side of the card; the 128 MB version of the PMB Memory card contains two 64 MB banks (on the top-side of the card); the 256 MB version of the PMB Memory card contains four 64 MB banks (2 on the top-side and 2 on the bottom-side of the card).
- Each PMB memory card provides a connection between the Scan Bus to the diagnostic input port (DIP) on the MAC and Special PMB chips.
- During initialization, PDC configures a unique block ID number to each memory bank that passes selftest; banks that fail selftest are not configured.

Operation

All PMB memory cards must operate at the same fixed frequency as the PMB (between 40 and 60 Mhz).

Systems with multiple memory banks employ a varying interleaving scheme to store 32 byte entries into "N" number of available memory banks. See Table 10-1 for details.

Memory interleaving has a complex implementation on 99x/890/T500, making it difficult to translate a virtual address to a physical memory address. You can use MEMDIAG to translate virtual addresses. See Chapter 5 (Troubleshooting).

VLSI Chips

MAC and PMB Address Chips

Provide support for a parity-protected 32-bit address and I/O data path to/from other PMB modules.

- Assert wait signal to modules requesting PMB transactions to a bank that is in transition.
- Participate in Cache Coherency Checks (CCCs) along with processor modules.

MAC and PMB Data Chips

- Provide support for an (ECC-protected) 64-bit data path for:
  - 32 byte cache line fetch/flush operations to/from processor modules on PMB Processor cards;
  - and for 16/32 byte DMA I/O operations to/from bus converter modules on PMB Bus Converter cards.

Table 10-1. Summary of Memory Bank Values

Total Memory	Number of Banks	Interleave Factor	Maximum Memory Slave Address
64 MB	1	none	04000000
128 MB	2	2-way	08000000
192 MB	3	2-way	0C000000
256 MB	4	4-way	10000000
320 MB	5	4-way	14000000
384 MB	6	4-way	18000000
448 MB	7	4-way	1C000000
512 MB	8	8-way	20000000
1 GB	16	16-way	40000000
2 GB	32	32-way	80000000

HP-PB Bus Converter Card

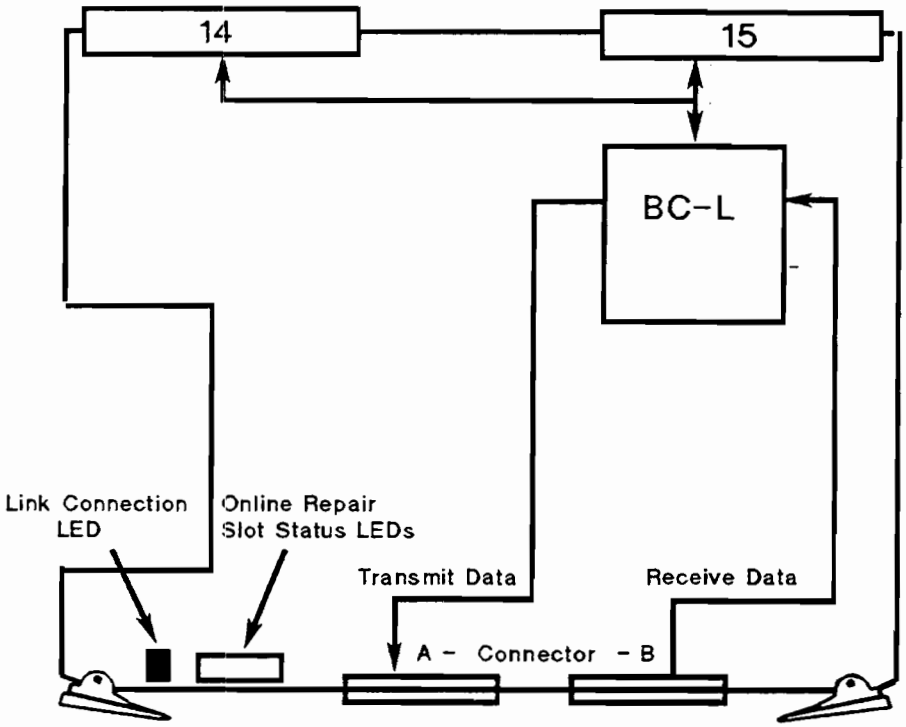


Figure 10-10. HP-PB Bus Converter Cards

Configuration

- Up to 8 HP-PB Bus Converter cards supported per system: up to 8 separate HP-PB cardcages per system.
- The lower port of each PMB (upper) bus converter module resides on a double-high card that installs into card slots 14 and 15 of the HP-PB card cage.
- Individual (transmit and receive) link connectors are provided on the bulkhead of the (lower) bus converter card for cable connections to either one of the two upper portions of the PMB bus converter module in the SPU cabinet.

Operation

All PMB (upper) Bus Converter cards must operate at the same fixed frequency as the PMB (40–60 Mhz): both the Receive and Transmit Links for each BC-U chip operate at 1/2 the frequency of the PMB (20–30 Mhz).

- Provide a means for software to support online repair (hot-board replacement) by toggling the POW_ON signal to each individual card slot 0–13.

  Note that the "on/off" status of the POW_ON signal for each card slot is displayed in the LEDs.

VLSI Chips

BC-L and Transmit Link VLSI Chips

Forward progress actions of the Transmit Link on the (lower) bus converter port is to pass the info/data from any HP-PB transaction up to the (upper) bus converter port.

BC-L and Receive Link VLSI Chips

- Turn off the appropriate green LED on the bulkhead of the BC (lower) card if a bad connection to the lower bus converter is detected.

  Note that the LED is also turned off when DC power to the BC (upper) card is turned off.

Service Processor (SP) Card

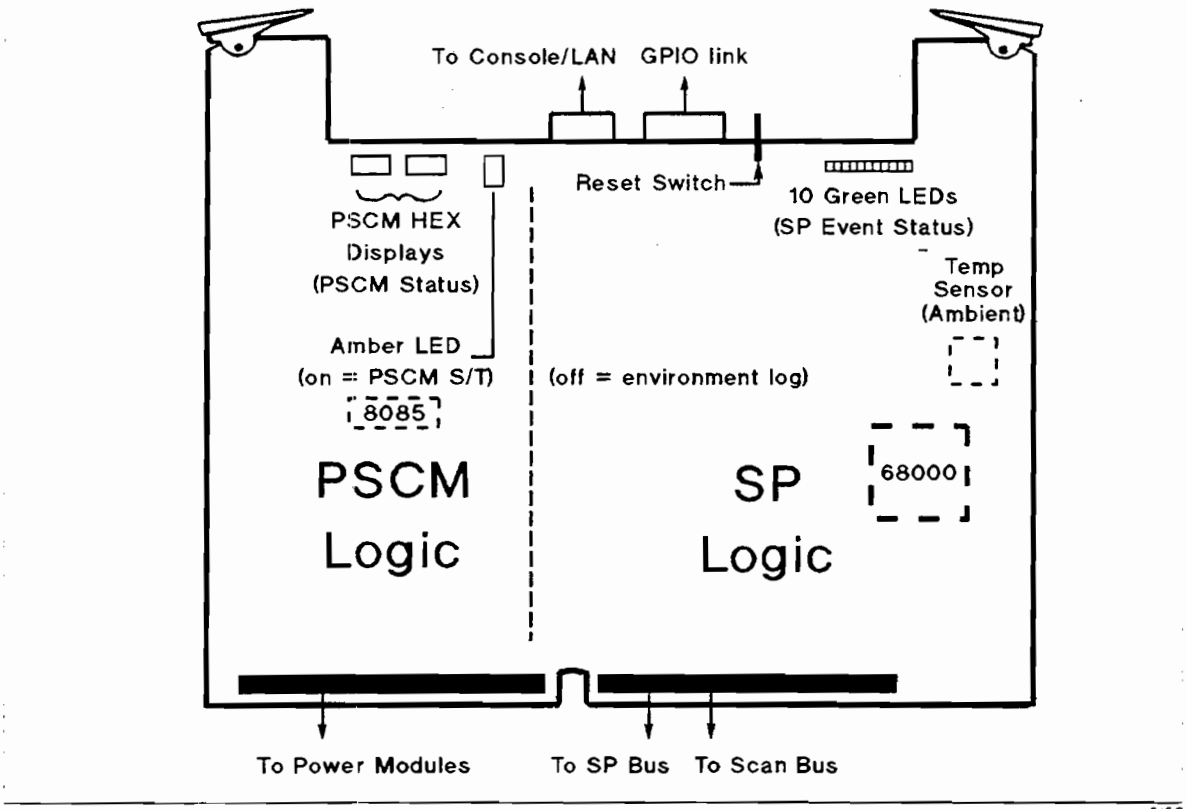


Figure 10-11. Service Processor Card Features

The 68000 micro-processor on the Service Processor (SP) card communicates to:

all the PMB cards through the Scan Bus;

all the processor cards through the SP Bus:

the Console/LAN card through one of three serial ports over a separate interface cable:

the PSCM's 8085 micro-processor through an internal bus on the SP card.

Note The SP card does not connect to either the PMB or the HP-PB.

Configuration

- One Service Processor card per system: the SP card has a special slot in the rear of the PMB cardcage.

Operation

The 68000 micro-processor plays a very active role in bringing up the power system and cooling components: checking PMB card compatibility: and launching the processor selftests.

SP Micro-processor During SPU Power On (enter the Twilight Zone)

- Initiate selftests on itself and download extended selftests to the PSCM micro-processor.
- Display SP selftest and console status on the 10 green-colored LED indicators on the bulkhead of the SP card. If possible. the SP displays the SP selftest code on the front panel "Processors" display. For selftest failures past ST 5. the bottom line of the console displays the selftest error number (SP Version 1.6 and above.)
- Issue commands to the PSCM micro-processor to control and monitor the power system functions.
- Perform PMB module scan and config/de-config functions over the Scan bus.
- Receive and execute user commands (in the SP mode) from the IAP on the Console/LAN card over serial control and data paths.

PSCM (8085) Micro-processor After SPU Power On (exit the Twilight Zone)

- Control power system turn on/off when requested by the SP micro-processor.
- Displays PSCM selftest status codes on the two 7-segment LED indicators on the bulkhead of the SP card when the amber LED is on.
- Monitor the operational state of the power system components within the SPU cabinet.
- Monitor the operational state of the cooling fans and the (internal) HP-PB cardcage within the SPU cabinet.
- Provide power system/environmental status information to the SP micro-processor upon request.
- Displays up to 10 abnormal events on the two 7-segment LED indicators on the bulkhead of the SP card when the amber LED is off.

SP Micro-processor During SPU Selftests

- Initiate early selftests on the processor cards over the SP bus: perform logging functions for processor selftest errors.
- Display important events using the array of 10 LEDs on the card's bulkhead.

  Note that the array of LEDs illuminates the appropriate mnemonic or symbol. (See Table 5-18 for details.)
- Send SPU selftest. forward progress. and warning messages over the Close Console Path (CCP) and SPU chassis codes over the Service Processor Port (SPP) path to the Console/LAN card.

During SP mode, commands and parameters are exchanged over the SPP control and data serial lines.

SP Micro-processor After SPU Selftests

- Provide processor cards access to the following functions all the time that processors are running:
  - System clocks
  - SP Bus
  - Time-of-Day clock (battery backed-up)
  - Stable Storage
  - Non-Volatile Memory (battery backed-up)
  - Processor-Dependent Code
  - Scan Bus (actually, processors are a slave to the SP over this bus).
- Perform F/W (PDC, SP, and PSCM) updates under PDC control.
- Send PDC-generated messages to the console device during console mode over the close console path to the Console/LAN card.
- Send SP-generated messages to the console device during SP mode over the SPP control and data serial lines to the Console/LAN card.

Error Handling within the SP card

SP Micro-processor During SP Selftest

- Display SP selftest error codes on the 10 green-colored LED indicators on the bulkhead of the SP card. If possible, the SP displays the SP selftest code on the front panel "Processors" display. For selftest failures past ST 5, the bottom line of the console displays the selftest error number (SP Version 1.6 and above.) (See Table 5-19 for details.)
- There is no error detection on data read or sent over the Scan Bus.

SP Micro-processor During and After Processor Selftest

- Detects SP bus parity errors on data received from individual processors and logs them into a register. The SP bus controller aborts parity-errored commands, which then causes an HPMC.

PSCM (8085) Micro-processor

- Display PSCM selftest error codes on two 7-segment displays on the bulkhead of the SP card when the amber ST LED is on. (See Table 5-20 for details.)
- Signal the SP when the environmental/operational state changes; log them and display codes. (Covered in the next topic.)

Operation (after passing selftests)

Up to 50 power system faults (entries) can be shown on the PSCM hex display on the lower part of the SP card bulkhead. If more faults occur, the earliest seven entries are always displayed, as are the 43 most recent entries. The entries displayed on the SP card are cleared after every power on.

Power system faults are also logged to the SP error logs, but with explanatory text and a timestamp. If possible, use the SP error logs to decode these faults.

See Chapter 5 (Troubleshooting) for tables and procedures for decoding power system faults.

Computer Museum

PSCM Hex Indicators

There are two means for the PSCM to display information on the SP card bulkhead, a two-digit hex display and a single red LED. The hex display is used to display both selftest and operational codes and errors. The red LED is used to indicate whether the hex display code refers to a selftest code or to an operational code. If the LED is on, the hex display will have codes relating to the PSCM selftest.

PSCM Selftest Error Code Display

When power is applied to the PSCM, the basic selftest is executed. If the PSCM passes a simple RAM test, all of the hex codes will be displayed in counting fashion, and the blanking features of the hex display will be toggled. The basic selftest will then continue, displaying various codes. This sequence will vary depending on the type of error. In general, the failure code is displayed followed by any additional information known. The failure code is then repeated before continuing.

The PSCM tries to send most error information to the SP. This will be indicated by a code of 18. If the SP does not respond after about a minute, the PSCM will timeout and display a code of 81. Note that the original error sequence will only be displayed once before the codes indicating an SP transaction. The attempt to send the error codes to the SP may not succeed, in which case a protocol error will be displayed. All of these errors have hex codes between 0x80 and 0x8F. After the error is logged to the SP, the original failure code is redisplayed and the PSCM will enter a tight loop.

If the basic selftest is successful, a code of 18 will be displayed indicating the PSCM is waiting on the SP. If the SP does not respond after about a minute, a code of 81 will be displayed, and the PSCM will continue to wait. When the SP responds, the main PSCM firmware is downloaded from the SP. During this time, a D1 (Download in progress status code) will be displayed. If the download fails, the PSCM will display an error code for about a second and then attempt to restart the download.

After the PSCM successfully downloads its code, the PSCM checks to see if the boot ROM and the downloaded code are compatible. If they are incompatible, the following error code sequence will be displayed once:

0x84	Firmware Incompatible Command
0xAB	Boot Version is A.B
0xCD	Download Version is C.D
0xEF	Minimum Boot Version must be E.F
0x84	Firmware Incompatible Command

The selftest light will remain on for this code sequence. The PSCM will then attempt to send the SP an error message indicating that the code is incompatible. If this fails, an error message will be displayed for several seconds, and then the PSCM will restore the 84 and enter a tight loop.

If the code is compatible. the power-up selftest will run. If the power-up selftest is unsuccessful. an error sequence will be displayed in the same way as was explained for the Basic Selftest that runs before the main firmware is downloaded. The PSCM will then attempt to send this error message to the SP. Again. if this fails. an error message will be displayed for several seconds. and then the PSCM will restore the error code and then enter a tight loop.

PSCM selftest error codes are given in Table 5-20.

PSCM Operational Codes and Errors

If the power-up selftest is successful. the selftest LED will be turned off. and the PSCM code will proceed with its power-on sequence. At this point. the hex display is used to display the Error Log of the PSCM. Any faults encountered will be displayed in a circular pattern. Before a fault is detected. the hex display will simply flash 00.

Up to 50 faults are saved by the Error Log Queue. The first seven faults will always be saved. If there are more than seven faults, the most recent 43 faults will also be saved.

For every fault displayed on the Error Log Queue. an identical log will be made to the SP. The data in the Error Log Queue is identical to the information sent to the SP. with the exception that the checksum byte is not displayed.

"PSCM Hex Digit Display ("Power")" in Chapter 5 describes how to decode the PSCM hex display.

Close Console Path

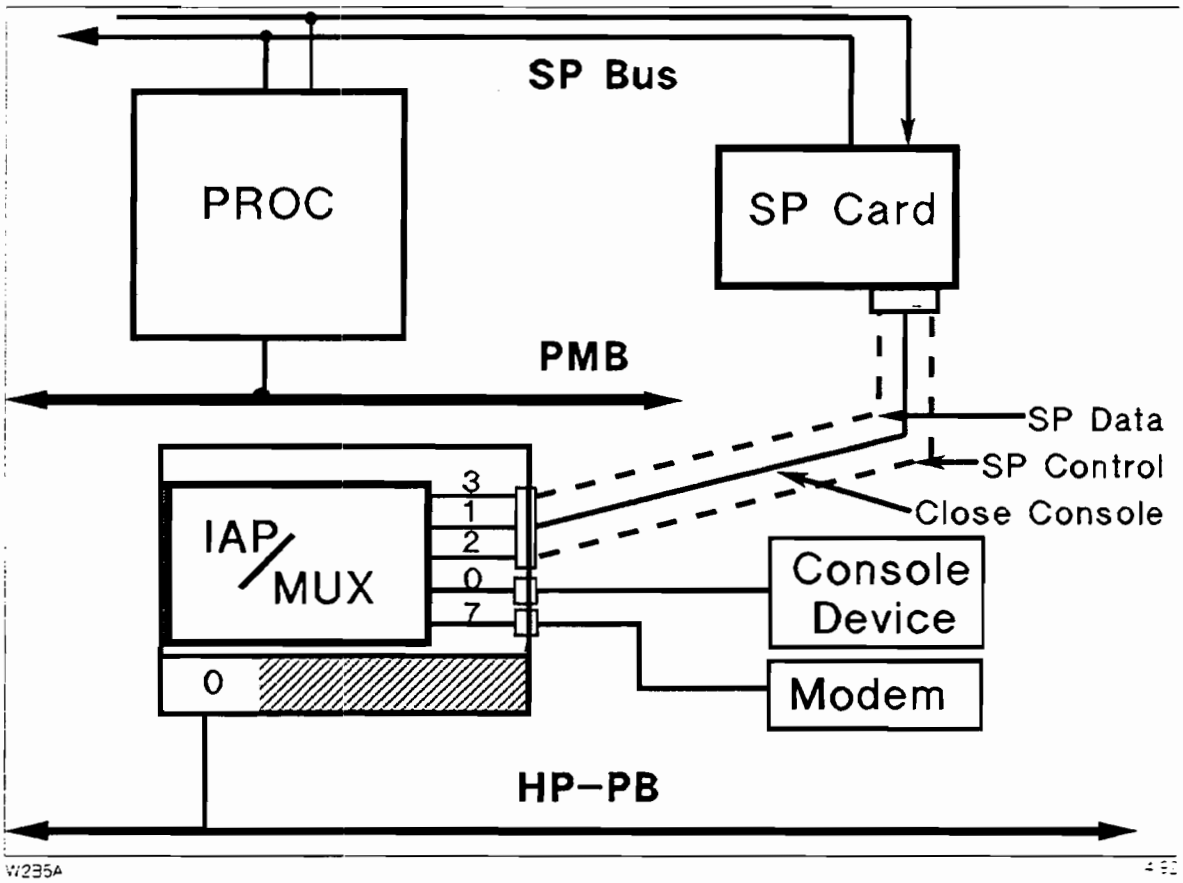


Figure 10-12. Close Console Path

The close console path is the highly reliable hardware path used by PDC during power-on, selftest, and IPL boot to input/output characters to/from the local/remote console devices. (Afterwards the normal console path over the PMB and through the bus converter is used.)

This path is also used by PDC to display LPMC/HPMC/kernel panic error information to the local/remote console devices.

The SP micro-processor uses the SPP data and control paths to present the SP user interface to the user through the the Access Port at any time after power on.

The SPP control and SPP data paths use two serial ports on the console module.

SPU Power System

AC Front End components:

- One AC distribution box.
- One Battery pack.
- One AC-to-DC Module. Also known as a Power-Factor correcting (PFC) high voltage unit.
- PSCM Hex Indicators.

DC components:

- Up to two +5VP 130A (650W) power converter modules to power processor cards.
- Up to two +5VS 325W power converter modules to power memory and bus converter cards.
- Up to two +5VB 325W power converter modules to power portions of memory cards.
- One miscellaneous power converter module (MPM) to power the Service Processor card.
- One +24V 325W fan power converter module to power the cooling fans.

Control logic:

- Power System Control and Monitor (PSCM) logic on the Service Processor card. PSCM controls the up/down of the DC voltage rails, fans, and PON when directed to do so by the SP logic. PSCM also generates a a Power Fail Warning (PFW) when detected by the AC-to-DC module (PFC unit).

Operation

- The AC front end distributes single-phase AC line voltage to the AC-to-DC (PFC) module and the power supply within the (internal) HP-PB cardcage. HVDC from the AC-to-DC (PFC) module is routed to the DC power converter modules within the power section of the PMB cardcage.
- Each DC power converter module, converts the (unregulated) high voltage DC energy to regulated low voltage DC used by the printed circuit boards and assemblies.
- The ambient temperature of each PMB card within the SPU cabinet is monitored and recorded.
- Cooling fan speed is monitored and controlled by adjusting the +24 Volts DC output voltage from the Fan Converter module to the fan tray.
- The cooling fans operate at a lower speed during nominal temperatures to reduce fan noise and at higher speed when the temperature rises within the SPU cabinet.
- During AC power failures: only seven cooling fans under the PMB section of the cardcage continue running: the other four are turned off.

Error Handling

- The PSCM status is displayed on two hex displays located on the bulkhead of the SP card. It is also shown (in a more readable form) in the SP error logs.
- Error handling for the AC and DC components is described later in this module.

AC Front End (ACFE)

Configuration

- Circuit breaker (30 Amp) to turn AC power on/off in the SPU cabinet. Only two connections in the circuit breaker are used.
- A terminal block in the front end assembly is used for connection of the AC supply wiring.
- Power-Factor Correcting (PFC) high voltage modules provide HVDC (+300 VDC +/−5%) secondary power to the PMB card section of the PMB backplane. Current systems have one PFC unit: in a later release two additional PFC units may be optionally installed.
- +48 VDC Battery pack provides up to 15 minutes carry-through time up during AC power outages.

Operation

- The front end distributes single-phase AC power to the Power-factor correcting module and to the power supply in the HP-PB (internal) cardcage.

AC-to-DC Module (PFC Unit)

Configuration

- One standard AC-to-DC module (PFC high voltage unit) per SPU cabinet.
- 30 Amperes of single (phase-to-phase) AC Input Power Options:
  - 200–240 VAC, 50/60 Hertz: ships with a 3-conductor power cord with L6-30P NEMA plug and requires L6-30R NEMA receptacle for 60 Hertz installations in North America.
- 30 Amperes of single (phase-to-neutral) AC Input Power Options:
  - 200–240 VAC, 50/60 Hertz: ships with no power cord or plug.

Operation

- The Power-factor correcting high voltage modules provide HVDC (+300 VDC −/−5%) secondary power to the DC-to-DC power modules via the PMB backplane.

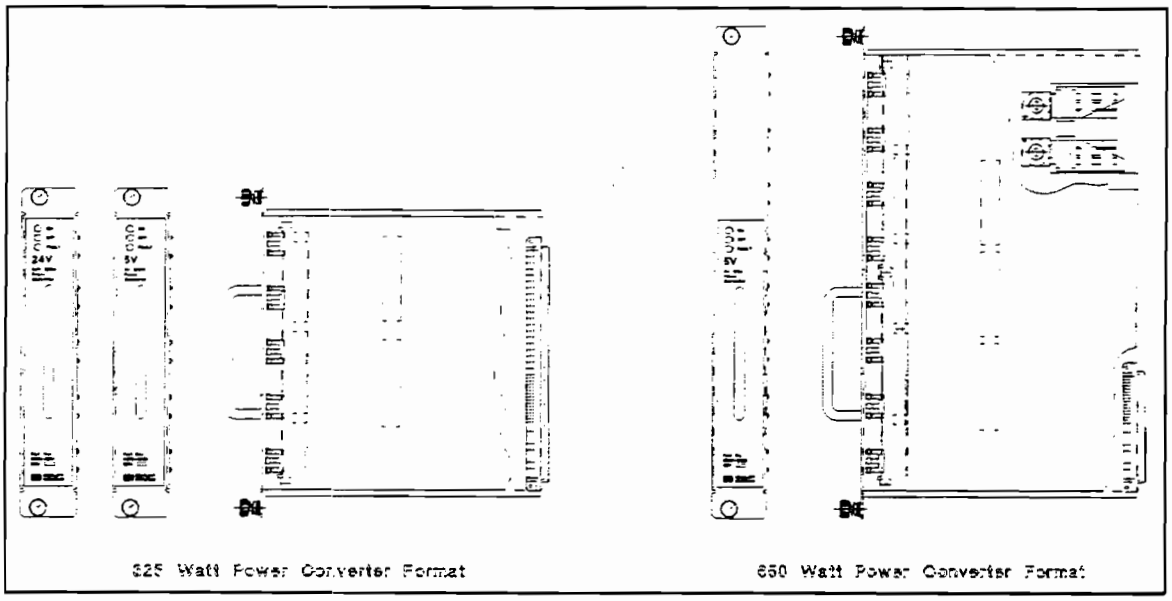
  Note that the HVDC rail is powered, either from the AC line during normal operation or from the Battery pack during power fail operation.
- Each AC-to-DC (PFC) module has its own cooling fan on the rear and the following 3 LED indicators visible from the rear of the SPU cabinet.

Error Handling

Table 5-24 shows the condition of the three LED status indicators on each AC-to-DC (PFC) module.

- Note that the HVDC rail is "up" when the green LED is *full on* or during battery backup operations when the green LED flashes.

DC Converter Modules



DC-to-DC Converter Types

Configuration

- Up to four +5V 130A (650W) DC converter modules in slots P1, P2, P8, or P10.
- Up to four 325W DC converter modules in slots P5, P6, P7, or P13.
- Only one +24V 325W DC-to-DC fan power module in slot P14.

Operation

- The 650 Watt DC-to-DC power modules in slots P8 and P10 provide +5 VDC ProcX rail to the Processor cards in slots 12–15 within the PMB cardcage.
- The 650 Watt DC-to-DC power modules in slots P1 and P2 provide +5 VDC ProcY rail to the Processor cards in slots 8–11 within the PMB cardcage.
- The 325 Watt DC-to-DC power modules in slots P7 and P13 provide +5 VDC System rail to the Memory and Bus Converter cards in slots 0–14 within the PMB cardcage.

Note One of the DC-to-DC power modules in the P7/P13 pair may be "down" and the other may be "up."

- The 325 Watt DC-to-DC power modules in slots P5 and P6 provide +5 VDC Battery rail to the Memory cards in slots 1–14 within the PMB cardcage.
- The 325 Watt DC-to-DC fan power module in slot P14 provides +24 VDC Fan rail to the 11 cooling fans located directly beneath the PMB cardcage.

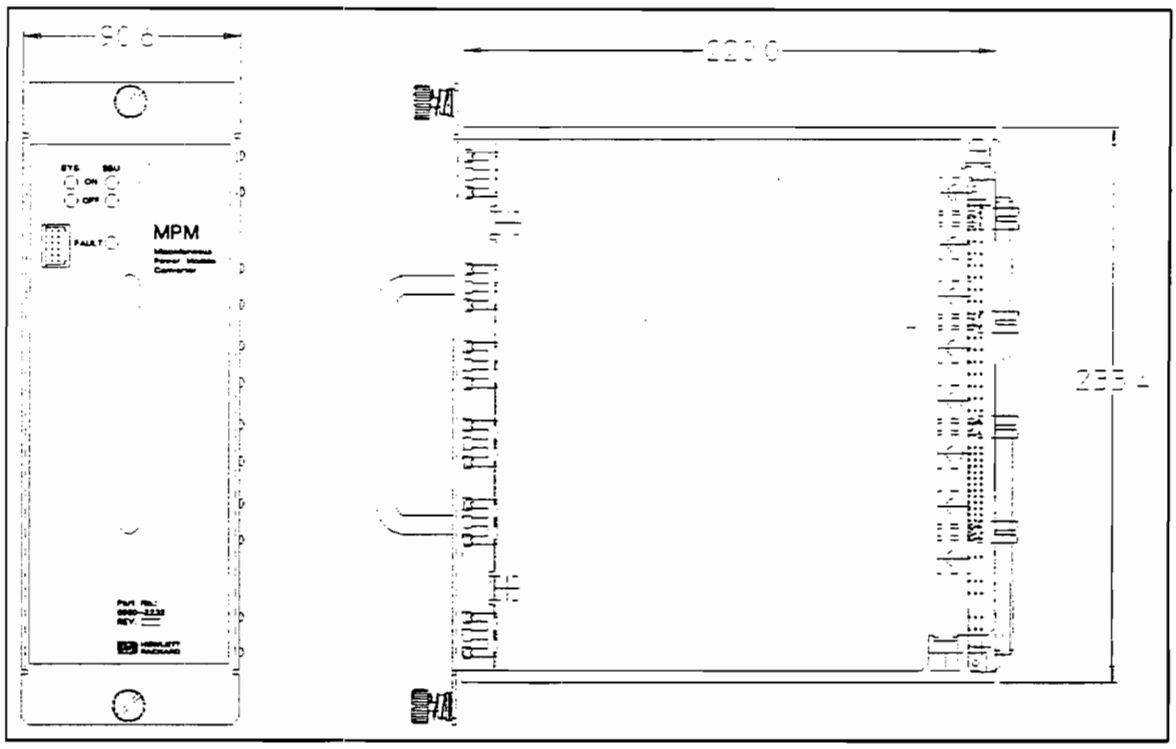
Note

One of the DC-to-DC power module pairs may be "down" and the other may be "up."

Error Handling

Three LED status indicators on each DC-to-DC power module.

Miscellaneous Power Module (MPM)



Miscellaneous Power Module (MPM)

Configuration

- There is only one Miscellaneous Power Module (MPM) DC-to-DC power module and it resides in a specific (double-wide) slot (P12) within the power section of the PMB cardcage.

Operation

- The MPM power module provides +5/+16/−16 VDC Bias. +2/−3 VDC Clock rail. +2/−3 VDC Battery rail to SP/PSCM. and +3 VDC Terminator rail to the PMB cardcage.
- The +5/+16/−16 VDC bias voltages from the MPM provide DC power to the Service Processor card when AC power is turned on within the SPU Cabinet and are the last voltages to be powered down when AC is turned off.
- The other voltage rails provided by the MPM may be turned off/on by the PSCM.

Error Handling

Five LED status indicators on the DC-to-DC MPM power module. See Table 5-25.

Uninterruptible Power System (UPS)

A new feature for T500/991/995 systems is the optional PowerTrust 3 kVA Uninterruptible Power System (UPS). One or more UPS units can be installed in a system. Each PowerTrust UPS unit is mounted at the bottom of an Expansion Cabinet, and includes an electronics unit and two battery boxes. The electronics unit has a user-accessible control panel on its front. Figure 10-13 shows front and right side views of the UPS.

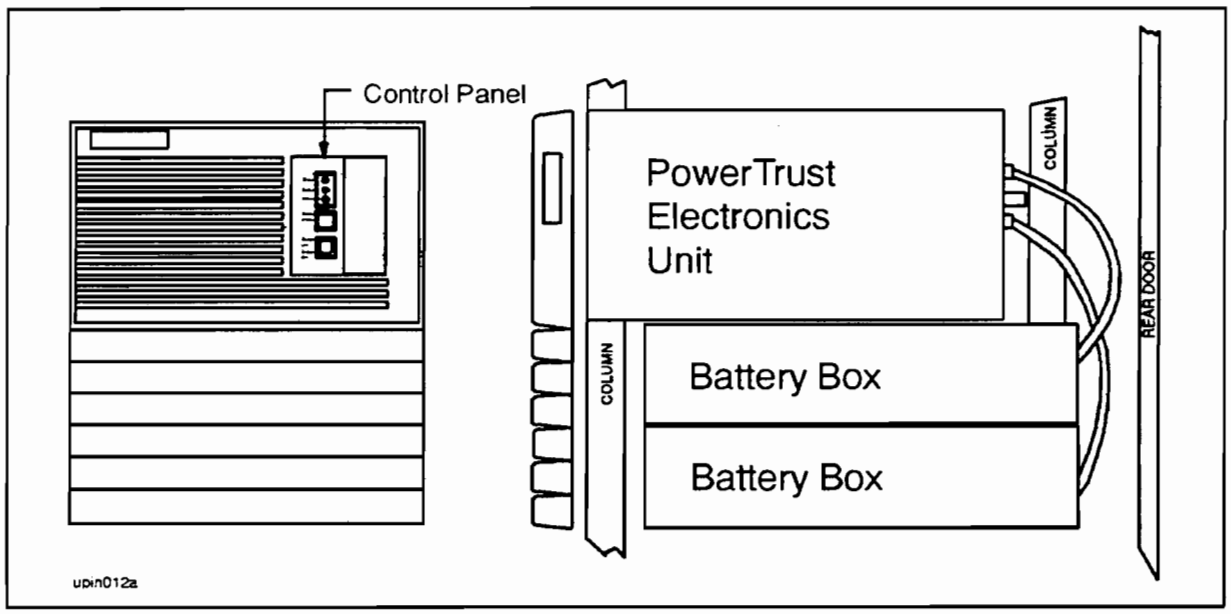


Figure 10-13. PowerTrust UPS Electronics Unit and Battery Boxes

In 890/990/992 systems, a +48 VDC battery in the SPU Cabinet provides back-up DC power for memory for approximately 15 minutes. The UPS will replace the battery back-up unit (BBU) that is used in 890/990/992 systems. In contrast to the battery back-up system in 890/990/992 systems, the UPS provides battery-backed AC power to the entire SPU, including the system disk and console, for up to 15 minutes.

When 890/990/992 systems are upgraded to T500/991/995 systems, the procedure includes removal of the BBU batteries from the SPU Cabinet and replacement of the control panel.

Operating system support for the UPS will be available in HP-UX 9.04 and MPE/iX 5.0. This will allow both operating systems to display console messages about the state of the UPS and to log error messages. HP-UX systems will have the added capability of shutting down the system in an orderly fashion at a specified time after AC power is lost.

You can find additional information about the UPS in *Level 2 Training for the PowerTrust Family of UPS Products* (PN A299xA-+49a-90001), and in the *PowerTrust System Guide* (PN 5961-8383).

Cooling the PMB Cardcage

Operation

- The PMB logic cards, large and small power modules, and HP-PB cards are cooled by 11 DC fans drawing cooler (filtered) air from the top of the cabinet past the logic components and exhausting the warm air out through vents near the bottom of the cabinet.
- The cooling fans are mounted within a removable tray located directly beneath the PMB cardcage and on top of the HP-PB cardcage.
- Eight cooling fans are positioned under the logic section of the PMB card cage: three are positioned under the power system modules.
- Seven cooling fans are initially turned on during power on: the other four are turned on prior to PDC selftests. Only the seven fans remain on during short AC power-fail conditions.

Error Handling

Each PMB card has a temperature sensor to allow the PSCM to check for and report abnormal operation.

Each fan has a rotation sensor (tachometer) to allow the PSCM to check for and report abnormal operation. Faulty fans are reported in the SP logs (DL command) and in the SP environmental display (EN command). A map to identify each fan's number is located within the fan tray.

Internal HP-PB Cardcage

Operation

- The power supply for the internal HP-PB cardcage receives single-phase AC power from the AC front end when the circuit breaker is on.

Note

DC power to the HP-PB I/O cards is NOT turned on/off by the DC power switch on the control panel at the top of the SPU cabinet. However, these DC voltages are controlled by the PSCM.

- The cardcage is situated beneath the fan tray. The 11 fans in the SPU provide cooling for all of the logic components.
- The front of the HP-PB (internal) cardcage is accessible from the rear of the SPU cabinet to allow for straight mounted HP-PB cables to exit from the rear of the SPU cabinet.
- One AMP Mate-N-Lock connector connects AC power and PSCM to the internal power supply.

Error Handling

- The following HP-PB cardcage signals are monitored by the PSCM and reported to the SP:
  - DC power OK (IOPON)
  - Battery charging status (IOBATTCH)
  - Over-temperature (IOOTEMPL)

Errors are logged in the SP error logs.

External HP-PB Cardcage

The purpose of the external HP-PB cardcage is to increase the number of I/O slots available. Each external HP-PB I/O cardcage provides 7 additional *double-high* HP-PB slots. This is equivalent to 14 *single-high* HP-PB slots.

Figure 10-14 shows an external HP-PB cardcage before it is installed.

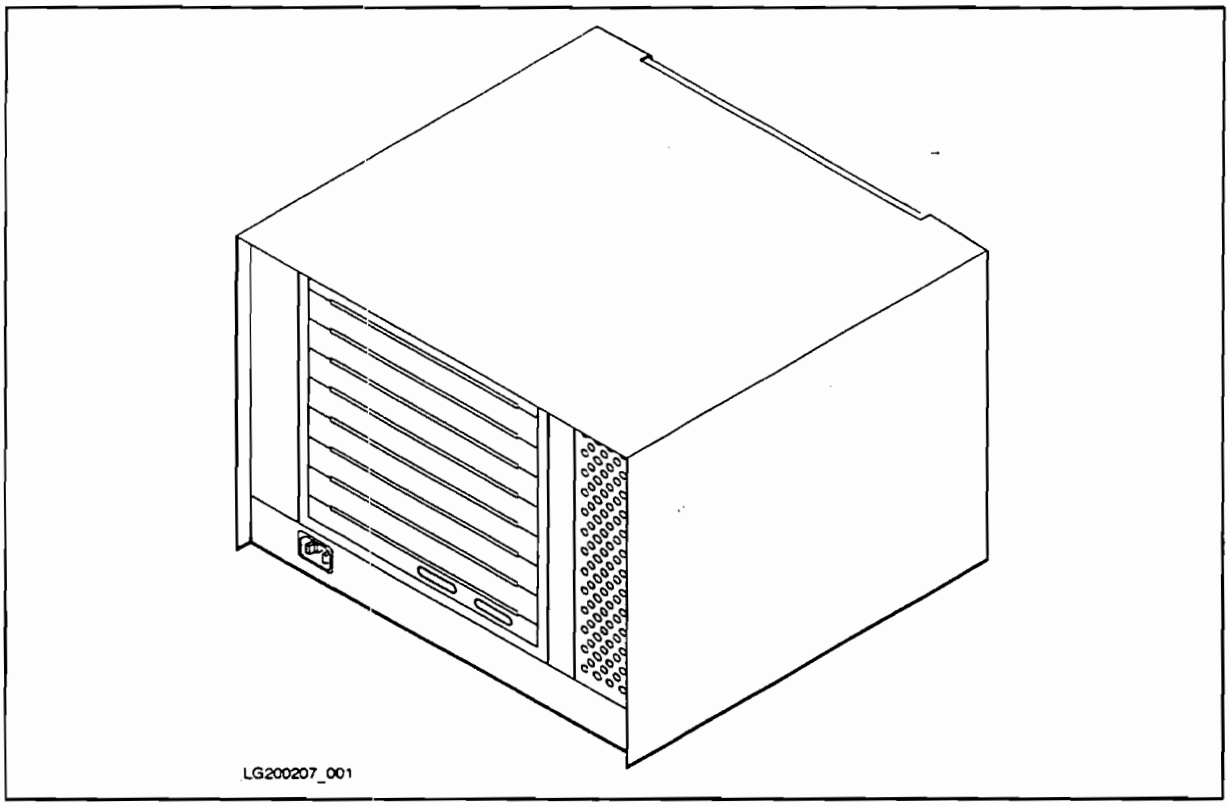


Figure 10-14. External HP-PB I/O Cardcage

The external HP-PB I/O cardcage is very similar to the internal HP-PB I/O card cage in the main SPU. The main difference is that HP-PB cards are oriented vertically in the internal HP-PB cardcage. and horizontally in the external HP-PB cardcage. Also. the external HP-PB cardcage has its own power switch and status indicators. See Table 10-2.

Table 10-2. Differences Between Internal and External HP-PB Cardcages

Difference	Internal HP-PB Cardcage	External HP-PB Cardcage
HP-PB card slots	Vertical orientation	Horizontal orientation
Power	Switched by circuit breaker at rear of SPU cabinet	Switched by push button on external HP-PB cardcage
Status	Status is not directly displayed. however. failure of cards in the cardcage can cause SPU front panel indications	LEDs on external HP-PB card cage

The internal and external HP-PB cardcages have the same backplane and power supply subassemblies.

The external HP-PB cardcage is housed in an expansion cabinet. Power is supplied from a power strip in the cabinet. The external HP-PB cardcage is connected to the main SPU cabinet by two flat 10-meter ribbon cables. Peripheral devices connect to HP-PB I/O cards installed in the HP-PB cardcage.

A push button on the front of the HP-PB cardcage controls power to the external HP-PB cardcage.

Caution

When you remove power to the expansion cabinet, always set the power switch on the external HP-PB cardcage to the OFF position. Otherwise, a battery in the HP-PB cardcage will be drained.

(This battery is designed to provide battery back-up functionality. In current systems, however, the battery back-up functionality is not used.)

Three LEDs on the front of the HP-PB cardcage are provided for monitoring the status of the HP-PB cardcage (refer to Table 5-26 for status indicated by the LEDs).

Cooling System

The cooling system in the external HP-PB cardcage is different from the internal HP-PB cardcage.

The SPU cabinet provides cooling for the internal HP-PB cardcage. Additional cooling of its power supply is provided by its internal fan. Airflow from all fans follows the same path, entering at the top and exiting at the bottom.

In contrast, the external HP-PB cardcage has a main cooling fan and a power supply fan. These two fans work in series to provide overall system cooling.

The power supply fan is internal to the power supply and provides most of the cooling to the power supply.

The main cooling fan is located on the front shield of the product. This fan provides most of the overall cooling. Since it is partially in series to the power supply fan, it also provides additional airflow through the power supply.

Air enters the HP-PB cardcage from the front, flows across the cardcage, and exits through the rear of the package.

Fan Failure

A failure of the main fan results in an immediate overtemperature shutdown. In this case, the detection circuit forces the shutdown to occur because the main fan ceases to cool the detection heating element. This protects the external HP-PB cardcage from internal overheating.

A failure of the power supply fan, however, is not detected. The reason is that the entire power supply (including the power supply fan) is a Field Replaceable Unit (FRU). A failed power supply fan can only damage the power supply.

OverTemp Sensor

In both external and internal HP-PB cardcages, the OverTemp feature relies on a temperature sensor located next to a heating element. As long as airflow is going over the heating element, the sensor stays at approximately the same temperatures as another sensor located inside the package. However, if the airflow stops, the sensor near the heating element quickly rises in temperature. The difference between the temperature of the two sensors causes the OverTemp shutdown.

Status Indicators

The LEDs reflect the state of the following signals:

Green LED (DC Power): POW_ON

Yellow LED (Battery): BATT_CH

Red LED (OverTemp Warning): TEMP_MD

Power Supply

The power supply receives single-phase AC power from the AC power strip when the rocker switch at the top front of the Expansion Cabinet is in the ON position. DC power to the HP-PB I/O cards is turned on/off by the DC power switch on the (local) control panel at the bottom front of the HP-PB cardcage.

The power supply consists of three boards, two of which supply bulk power (260W) to the HP-PB cardcage. The third board is the System Power Control Module (SPCM) which routes the raw power to the backplane and provides an HP-PB compatible interface.

Since the power supply is auto-ranging, voltage selection occurs by auto-detect.

Power Supply Fault Conditions

If the power supply detects fault conditions of overcurrent or overvoltage on any of the supply rails, or if an over-temperature condition exists, the power supply shuts down immediately. No warning is given to the SPU. To clear the fault and power up the HP-PB cardcage, toggle the power on/off switch.

Battery Failure

The external HP-PB cardcage contains a battery designed to provide battery back-up functionality. In current systems, however, the battery back-up functionality is not used.

If this battery fails, no direct indication of this condition is provided. The yellow Battery LED indicator shows whether the battery is always charging (LED always lit), or never charging (LED never lit). However the only way to determine the operating condition of the battery is to note whether the battery supplied the required 15 minutes of backup during a powerfail.

Signals From the Internal HP-PB Cardcage

AC power is supplied to the internal HP-PB cardcage by the SPU. The two AC phase lines and protective earth are provided through an AMP 15-pin mate-and-lock connector. In addition, several status and control lines are brought in through this connector as described below.

The internal HP-PB cardcage does not have its own status LEDs. Instead it provides equivalent status information to the SPU through the 15-pin connector. These signals indicate:

- DC power on: POW_ON_H.
- Battery charging: BATT_CHG_L.
- Overtemperature warning: TEMP_MID_L.

In addition, a reference ground (GND) is provided.

These signals provide exactly the same information as the LED indicators on the front panel of the external HP-PB cardcage.

On/Off Control (Power)

The on/off control of the internal HP-PB cardcage is provided by the SPU through the 15-pin connector. The SPU pulls the V_ON_L signal to ground to turn on the internal HP-PB cardcage; the SPU lets the signal float high to turn it off.

Firmware Update Tool (FUT) Firmware

This section explains the concepts behind FUT firmware:

- Firmware on the SP card.
  - Firmware has three parts: PDC, SP, PSCM
  - Two banks of firmware.
- SPU-specific firmware.
  - Different CPU chips, different firmware.
  - Naming conventions.
- FUT firmware.
  - Uses of the UPDATE command.
  - Designed as an update tool.
  - Differences from SPU-specific firmware.
  - FUT flowchart.

Firmware on the SP Card

Firmware Has Three Parts: PDC, SP, PSCM

The Service Processor (SP) card on x9x Family computers contains three types of firmware:

Table 10-3. Firmware on the SP Card

Abbrev	Full Name	Function	Commands Available
PDC	Processor Dependent Code	Initializes the hardware, conducts selftests, handles system faults. Allows operator to alter various system parameters.	Important PDC commands include: ■ Display/change the default boot and console paths. ■ Set/clear autoboot flag. ■ Update firmware. ■ View the HPMC tombstone.
SP	Service Processor	Provides functions for servicing the system, whether DC power is on or off. Monitors power system.	Important SP commands include: ■ Execute a Transfer of Control (TC). ■ Execute a reset (RS or RE). ■ Set/clear autostart flag. ■ Monitor and control power system. ■ Change/view system configuration. ■ Change/view error logs and HPMC tombstones.
PSCM	Power System Control and Monitor	Controls and monitors power system.	(Functionality is accessed through SP commands.)

Note

The different parts of firmware (PDC, SP and PCSM) are not important for the process of loading new firmware. All the components of firmware are loaded at once. For example, you cannot load one version of PDC and a different version of SP.

Two Banks of Firmware

SP cards have two banks of firmware. an active bank and an alternate bank. See Figure 10-17.

The **active bank** is the bank of firmware that the computer boots from.

The **alternate bank** of firmware allows the computer to store a second version of firmware.

By executing the SW (switch) command at the SP> prompt. you can instruct the computer to switch the active and alternate banks and to boot from the new active bank.

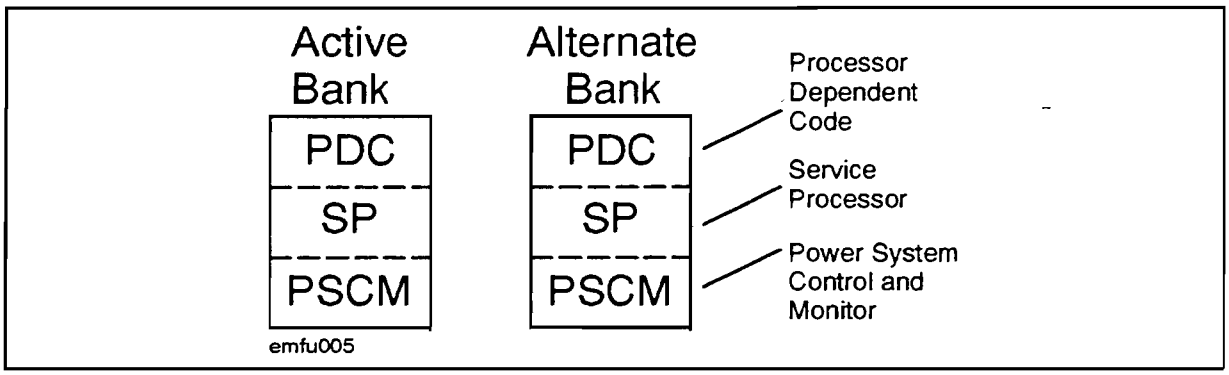


Figure 10-15. Firmware on the SP Card Contains PDC, SP, and PSCM

SPU-Specific Firmware

SPU-specific firmware allows specific SPUs to boot the operating system. If desired, a user can halt the boot process and execute PDC commands at the PDC menus.

Different versions of the firmware are available for specific SPUs. As of this writing there are two different versions: 99x/890/T500 firmware and T500/991/995 firmware. See Table 10-4.

Different CPU Chips, Different Firmware

The first release of systems was based on the PCX CPU chip. Firmware that runs on this CPU chip is named FWECXxxx. This firmware runs on the 890, 990 (DX and non-DX) and 992 (DX and non-DX). It does not run on the T500, 991 (DX and non-DX), and 995 (DX and non-DX).

The second release of systems is based on a different chip, the PA7100 chip (also known as PCX-T). The firmware that runs on this CPU chip is named FWETTxxx. This firmware runs on the T500/991/995 and on no other SPUs.

Table 10-4. Firmware on Different Models of the x9x Family

	99x/890/T500 Firmware	T500/991/995 Firmware	FUT Firmware
Firmware Name:	FWECXxxx[1]	FWETTxxx[1]	FWEUPxxx[1]
PDC Vers #:	1.xx[1]	2.xx[1]	4.xx[1]
Models:	99x/890/T500 systems: ■ 890 ■ 990 (DX and non-DX) ■ 992 (DX and non-DX)	T500/991/995 systems ■ TT500 (HP 9000) ■ 991 (DX and non-DX) ■ 995 (DX and non-DX)	All x9x systems
Chip Names:	PCX	PA7100 (PCX-T)[2]	
Code Names:	Emerald[2] with Chimaera[2] (Chimera) processor	Emerald[2] with TNT[2] processor	

1 xx, xxx = version number

2 Code names are obsolete and are provided only for your information.

Future releases of systems will mean new chips, new firmware, and new model numbers.

Naming Conventions

Figure 10-16 shows how to interpret the file names for firmware.

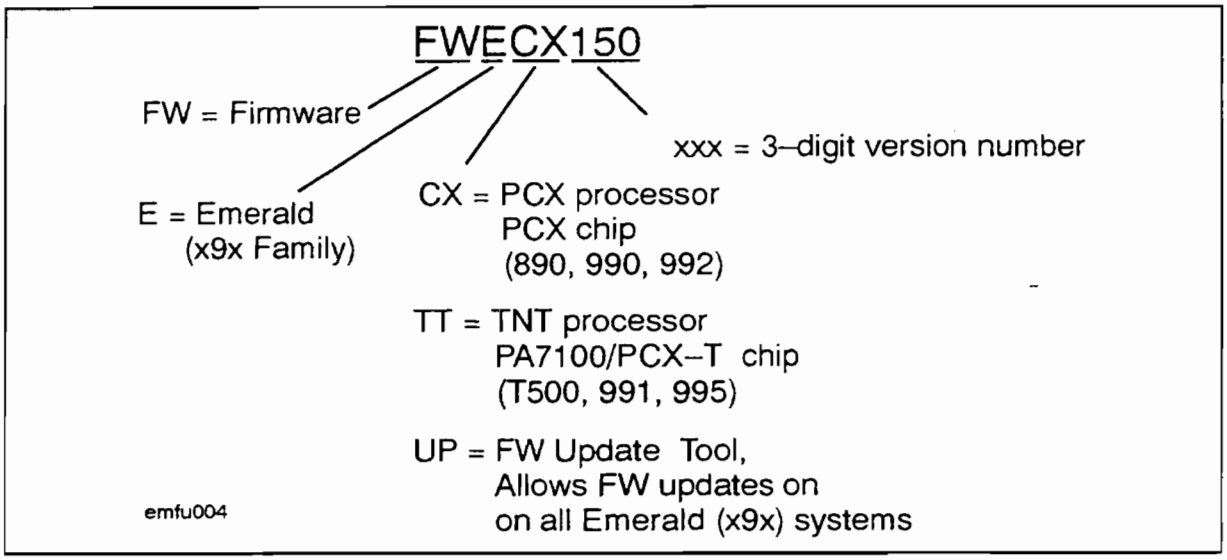


Figure 10-16. Naming Conventions for Firmware

FUT Firmware

FUT firmware will boot on all x9x Family computers. This includes x90 (890/990/992) computers and T500/991/995 computers. This means that **an SP card containing FUT firmware can be used in any x9x Family computer.**

All new SP cards are shipped with FUT firmware in their alternate banks. Early SP cards had SPU-specific firmware on both banks. See Figure 10-17.

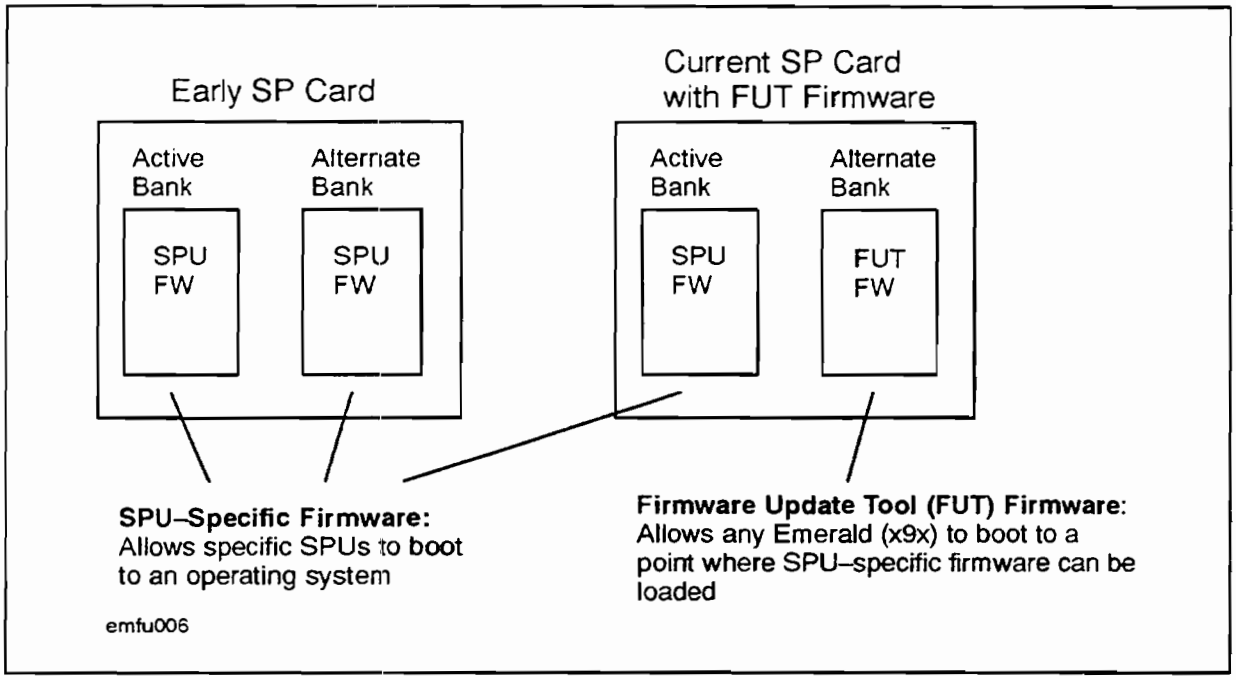


Figure 10-17. Firmware on the SP Cards

When FUT firmware is booted, it does a quick, minimalist initialization then displays the Firmware Menu of the PDC interface. At the Firmware Menu, the user can load the desired SPU-specific firmware by using the UPDATE ccommand.

Uses of the UPDATE Command

The following tasks can be performed with the UPDATE command. See Figure 10-18.

- Load FUT firmware onto a Service Processor (SP) card that does not have it.
- Load the firmware for a new processor onto an SP card in an existing system. Several situations in which you would do this:
  - As part of a processor upgrade, for example from an 890 to a T500 (HP 9000).
  - To use any SP Card in any x9x Family SPU. For example, to use an SP card that currently has T500/991/995 firmware as a replacement in an 890 with a faulty SP card.
- Load new firmware required for an OS upgrade or a processor upgrade.

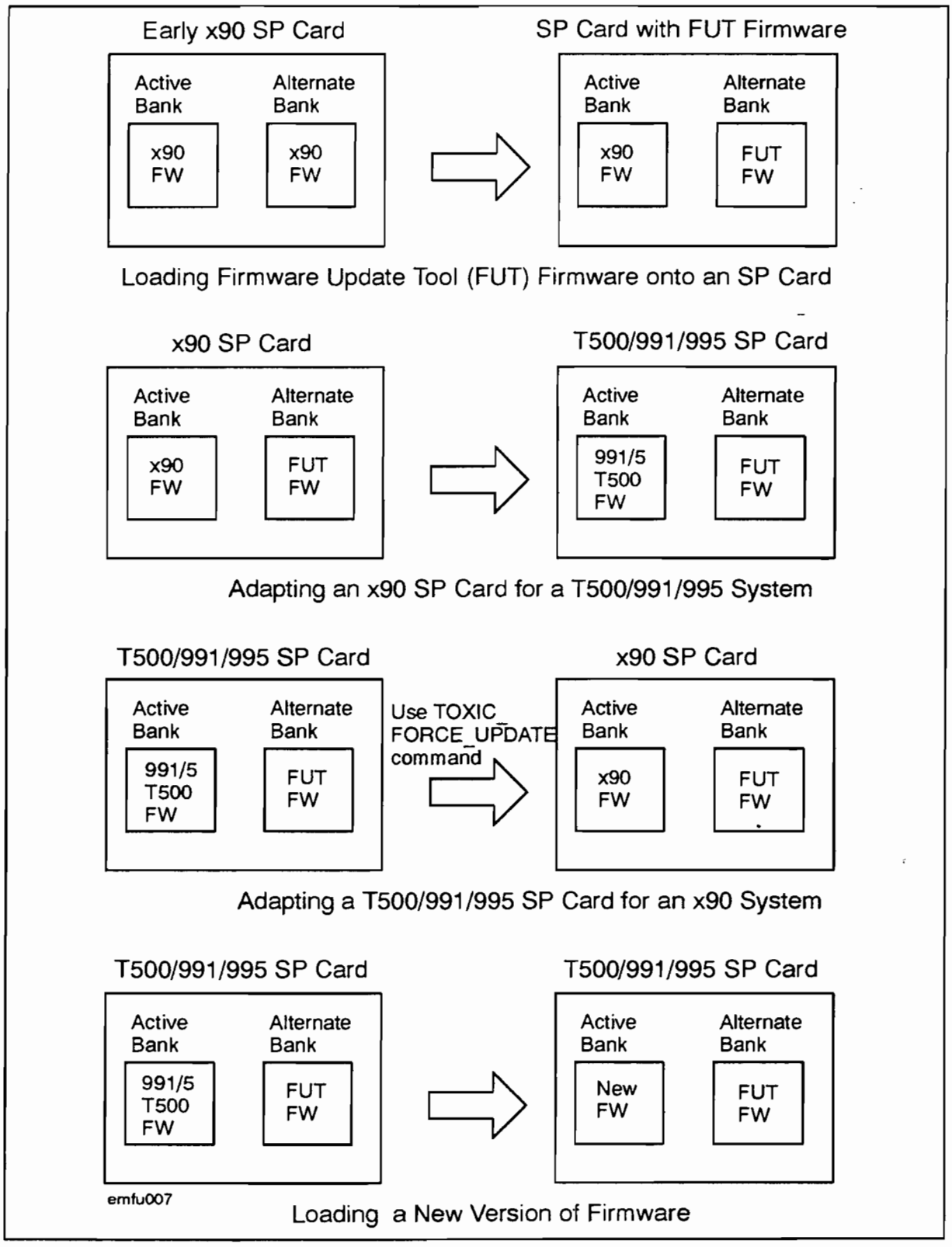


Figure 10-18. Uses for x9x Family Firmware Update Tool (FUT)

Designed as an Update Tool

The only purpose of FUT firmware is to allow other SPU-specific firmware to be loaded. By limiting its scope in this fashion, FUT PDC can be:

- Small (less than 128 KB).
- Fast (time to boot is short, less than 2 minutes).
- Robust (fewer chances for problems).

When users want full functionality, they can boot SPU-specific firmware.

Differences From SPU-Specific Firmware

Because FUT is designed for the single purpose of loading SPU-specific firmware, FUT does not implement many features of SPU-specific PDC:

- **Selftests.** To save time during bootup, FUT PDC does not execute any selftests. FUT assumes a functional machine with an unchanged configuration. For the same reason, the Service Processor does not perform most of its selftests when it detects that FUT is to be booted.
- **PDC interface.** Only a small subset of normal PDC commands are supported on FUT. FUT only supports the commands available at the Firmware Menu.
- **HPMCs.** If an HPMC occurs while FUT is executing, an HPMC tombstone is displayed to the screen. The HPMC is not logged to the SP log. The HPMC data does not overwrite existing PIM (Processor Internal Memory).
- **TOCs.** Transfer of Control (TOC) is not supported on FUT.

FUT Flowchart

The FUT firmware executes with the same general sequence as normal SPU-specific firmware. See Figure 10-19.

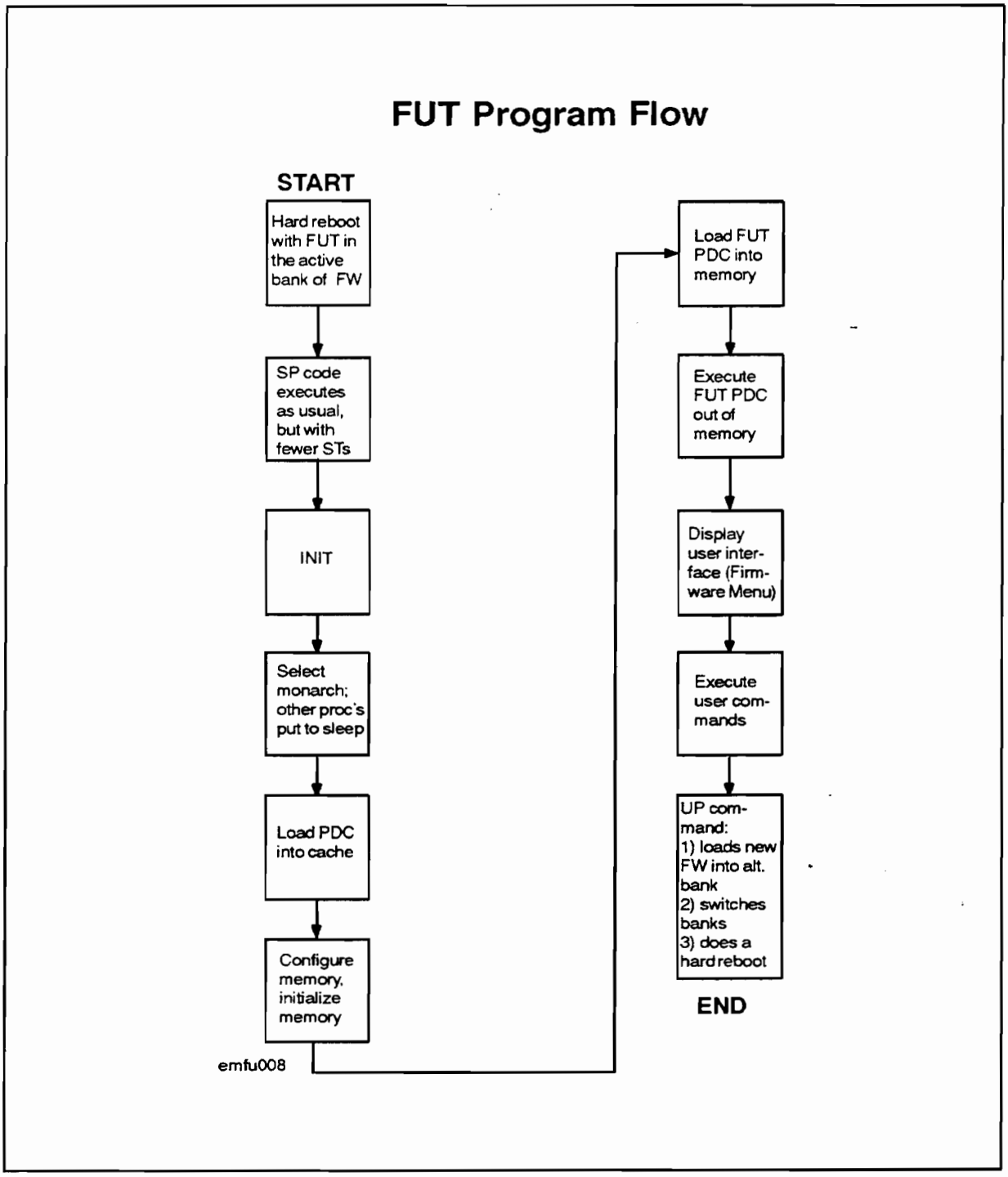


Figure 10-19. Flowchart for Firmware Update Tool (FUT)

Differences Between T500/991/995 and 890/990/992

This section highlights the differences between T500/991/995 and 890/990/992systems:

- New processor.
- Optional Uninterruptible Power System (UPS).
- Firmware Update Tool.

Processor

890/990/992	T500/991/995
Single CPU module	1-2 CPU modules per board
PCX chip	PCX-T chip
60 MHz processor clock speed	90 MHz processor clock speed

In 890/990/992 systems, each processor card has a single CPU module, which uses a PCX chip operating at 60 MHz. Each processor card in T500/991/995 systems consists of a motherboard with one or two processor modules. Each processor module contains a PCX-T chip operating at 90 MHz, along with 1 MBbyte instruction and data caches.

The modules are numbered 0 and 1. Each processor identifies itself during early selftest by its slot number and its module number. For example, the processor modules in slot 15 are identified as *proc(15/0)* and *proc(15/1)*.

Figure 10-20 shows what the new processor card looks like. The processor card consists of a motherboard with connectors for two daughterboards (modules). The processor card has sight holes that enable you to see the number of modules installed on the card when it is in the cardcage. On processor cards with only one processor module, the daughterboard must occupy the lower position (bottom-most postion when the processor card is installed in the cardcage).

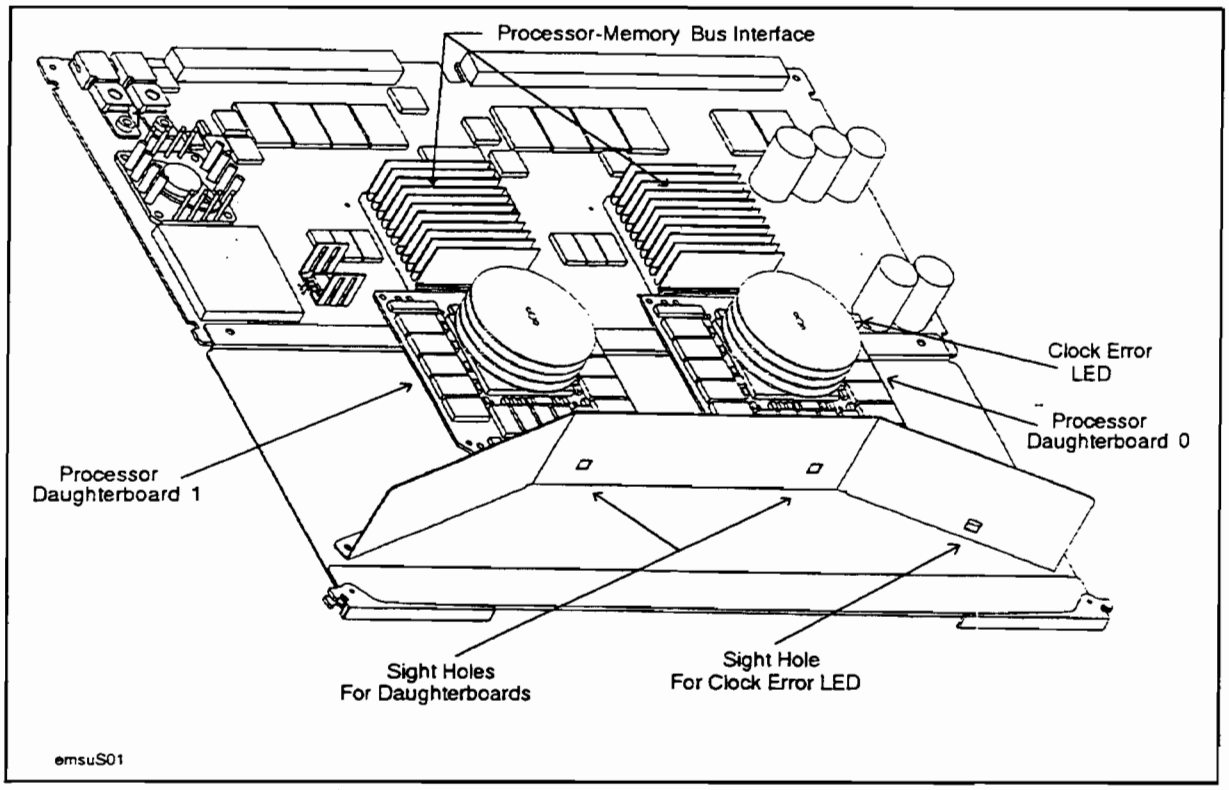


Figure 10-20. T500/991/995 Processor Card

For information about installing and configuring processor cards. see the *99x/890/T500 Installation Guide* (PN A1809-90001).

Uninterruptible Power System

890/990/992	T500/991/995
Battery back-up is part of SPU.	UPS is external to SPU.
Back-up DC power to memory cards only.	Back-up AC power to entire SPU.

A new feature for T500/991/995 systems is the optional PowerTrust 3 kVA Uninterruptible Power System (UPS). One or more UPS units can be installed in a system. Each PowerTrust UPS unit is mounted at the bottom of an Expansion Cabinet, and includes an electronics unit and two battery boxes. The electronics unit has a user-accessible control panel on its front. Figure 10-21 shows front and right side views of the UPS.

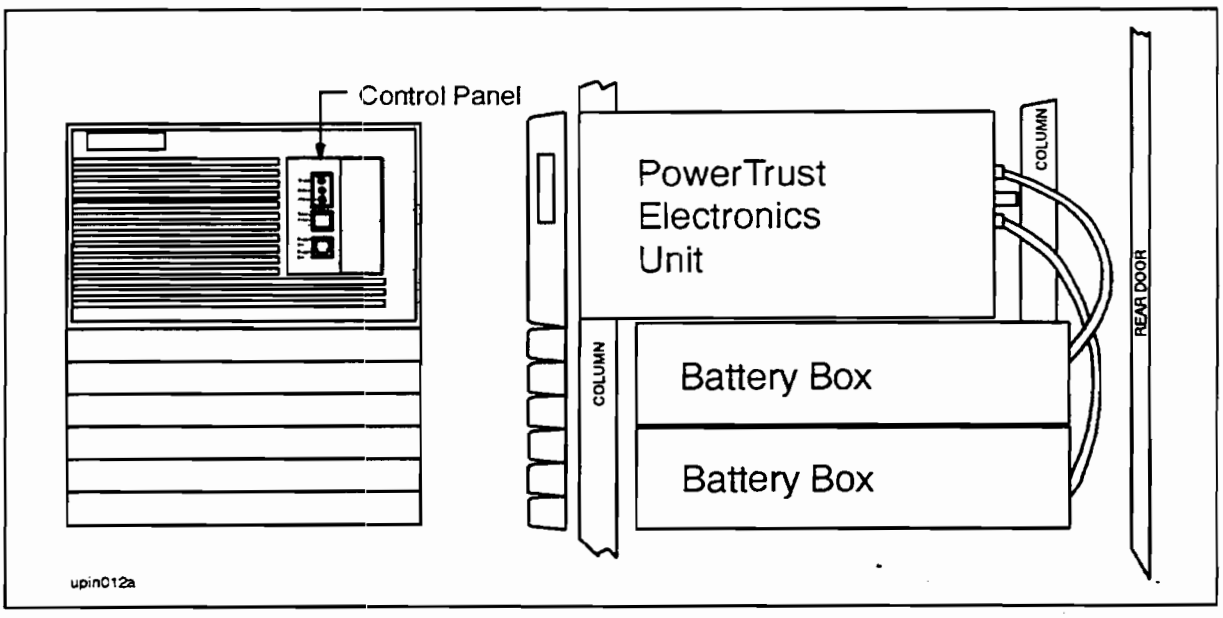


Figure 10-21. PowerTrust UPS Electronics Unit and Battery Boxes

In 890/990/992 systems, a +48 VDC battery in the SPU Cabinet provides back-up DC power for memory for approximately 15 minutes. The UPS will replace the battery back-up unit (BBU) that is used in 890/990/992 systems. In contrast to the battery back-up system in 890/990/992 systems, the UPS provides battery-backed AC power to the entire SPU, including the system disk and console, for up to 15 minutes.

When 890/990/992 systems are upgraded to T500/991/995 systems, the procedure includes removal of the BBU batteries from the SPU Cabinet and replacement of the control panel.

Operating system support for the UPS will be available in HP-UX 9.04 and MPE/iX 5.0. This will allow both operating systems to display console messages about the state of the UPS and to log error messages. HP-UX systems will have the added capability of shutting down the system in an orderly fashion at a specified time after AC power is lost.

You can find additional information about the UPS in *Level 2 Training for the PowerTrust Family of UPS Products* (PN A299xA-+49a-90001), and in the *PowerTrust System Guide* (PN 5961-8383).

Firmware Update Tool

Previous Firmware Update Method	New Firmware Update Method
Firmware updated from Firmware Menu of PDC Interface.	Firmware updated with the FUT program.
SP cards had SPU-specific firmware in both banks.	SP cards have FUT firmware in the alternate bank.
SPU-specific firmware boots only on specific SPU.	FUT boots on all x9x Family computers.
Processor upgrade requires replacing SP card.	Processor upgrade uses same SP card.
SPU-specific firmware executes selftests.	FUT does not execute selftests (saves time during bootup).

The Firmware Update Tool (FUT) is a utility designed to update processor dependent code (PDC) and Support Processor (SP) code on x90 (890/990/992) SPUs.

The FUT can be used to:

- Upgrade an 890/990/992 system to a T500/991/995 system.
- Load new firmware required for an operating system upgrade or a processor upgrade.
- Facilitate the repair process by enabling any SP card to be used in any 890/990/992 or T500/991/995 system.

SP cards have two banks of firmware, an active bank and an alternate bank. The active bank contains the boot firmware. The alternate bank allows for storage of a second version of firmware. By executing the SW (switch) command at the *SP>* prompt, you can switch the active and alternate banks and boot from the new active bank.

FUT firmware allows any x9x Family system to boot to a point where SPU-specific firmware can be loaded. The FUT is loaded into the alternate firmware bank on the SP card. This ensures that FUT firmware is not overwritten and that it's always available on the alternate bank for updates and repairs.

FUT firmware will boot on all 890/990/992 and T500/991/995 computers. When FUT firmware boots, it does a minimal initialization, and then displays the Firmware Menu of the PDC interface. You can then load the desired SPU-specific firmware by using the UPDATE command.

The FUT is available in three different media, which are included in the Firmware Update Kit (orderable from SRDO). The kit is included with all system upgrades (890/990/992 to T500/991/995 and T500/991/995 to T500/991/995). The kit includes:

- Digital Data Storage (DDS) media
- Compact Disk (CD) media
- 1/2" Open Reel Magnetic Tape
- *x9x Family Firmware Update Guide* (PN A1820-90002)
- *Firmware Update Quick Reference (x9x Family)* (PN A1820-90003)

T500/991/995 Upgrades

There are two types of upgrades involving T500/991/995:

- System upgrades from 890/990/992 systems to T500/991/995 systems
- Adding processors and memory to existing T500/991/995 systems.

Figure 10-22 shows a summary of the upgrades available.

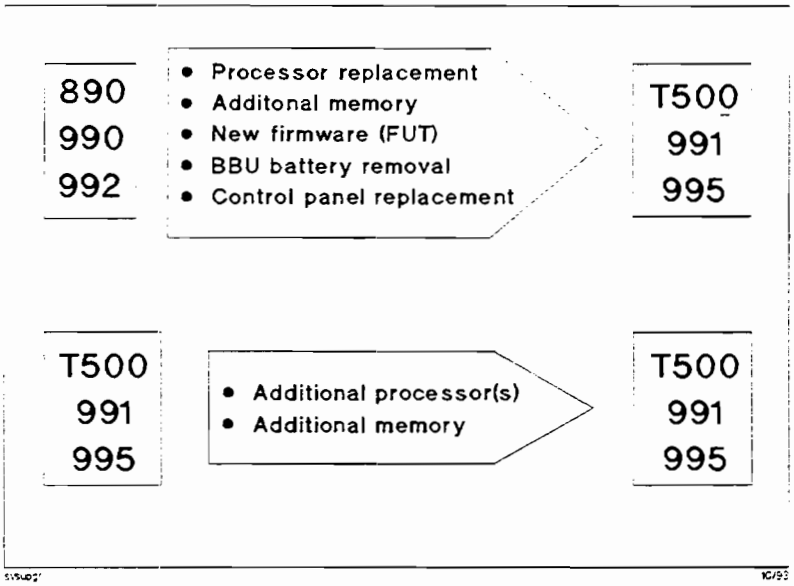


Figure 10-22. System Upgrades Available

Both types of upgrade require installing T500/991/995 processor cards or processor daughterboards (modules) to the system. You will find detailed procedures for performing these upgrades in the *x9x Family System Upgrade Installation Guide* (PN A1820-90001).

11

Interface Cards

The following chapters provide information about the interface and networking cards available for the system, including:

- Chapter 11a (SCSI Cards).
- Chapter 11b (HP-FL Cards).
- Chapter 11c (HP-IB Cards).
- Chapter 11d (Console/LAN Card).
- Chapter 11e (LAN Card).
- Chapter 11f (Token Ring Card).
- Chapter 11g (PSI Card).
- Chapter 11h (MUX Card).

Each chapter contains information such as:

- Specifications
- Configuration
- Troubleshooting
- Field Replaceable Units

11a

SCSI Interface Cards

Introduction

This chapter describes the SCSI cards supported on the HP 3000 CS 99x systems (990/992 and 991/995), and the HP 9000 CS 890 and CS T500 servers. The following SCSI cards are described:

SCSI Adapter Cards:
HP 28642A HP-PB SCSI adapter card (MPE/iX)
HP 28655A HP-PB SCSI/Parallel adapter card (HP-UX)
SCSI Fast/Wide High-Performance Adapters Cards:
HP 28696A HP-PB Fast/Wide High-Performance SCSI adapter card (HP-UX)

Chapter Contents

This chapter provides the following information:

- **General SCSI Information**
- **SCSI Card Installation and Removal**
- **HP 28642A/28655A HP-PB SCSI Cards:**
  - Specifications
  - Card Description
  - Setting the SCSI Address
  - Verifying Operation
  - (HP 28655 Only) Parallel Port Configuration, Signal Pins, and Cable Wiring
- **HP 28696A HP-PB Fast/Wide High-Performance SCSI Cards:**
  - Specifications
  - Card Description
  - Setting the SCSI Address
  - Verifying Operation
  - Configuring the Cards into the System
- **Troubleshooting**
- **Field Replaceable Units**

General SCSI Information

SCSI Configuration Guidelines

Configuration guidelines for the SCSI connector on the HP-PB adapter card are grouped under the following categories:

- Peripheral Configurations
- Cabling
- Installation and Operation
- Terminators and Termination Power
- Addressing and Parity

Specific configuration guidelines for the parallel port on the HP 28655A HP-PB SCSI/Parallel adapter card are described under "Parallel Port Configuration Guidelines (HP 28655A Only)" in this chapter.

Peripheral Configurations

- **(HP-UX Systems Only)** Up to 7 SCSI peripherals can be connected to each SCSI host adapter. Seven disks have been tested on a single host adapter without a performance penalty.
- **(HP-UX Systems Only)** The C1700A HP Series 6300 Model 20GB/A Optical Disk Library System counts as two disk drives. If two C1700As are racked on the same cabinet, they count as two systems and four disk drives and require six device addresses.
- **(HP-UX Systems Only)** Total disk drive support is limited to 32 devices.
- **(HP-UX Systems Only)** SCSI peripherals—disks and tapes—can be mixed and matched in any combination on the same SCSI bus as long as the total number of SCSI addresses does not exceed seven.
- **(MPE XL Systems Only)** Only one C1700A Series 6300 Model 20GB/A Optical Disk Library System can be supported on each SCSI host adapter. The maximum cable length is 6 meters, including internal cables. Only three C1700A systems are supported on each SPU.

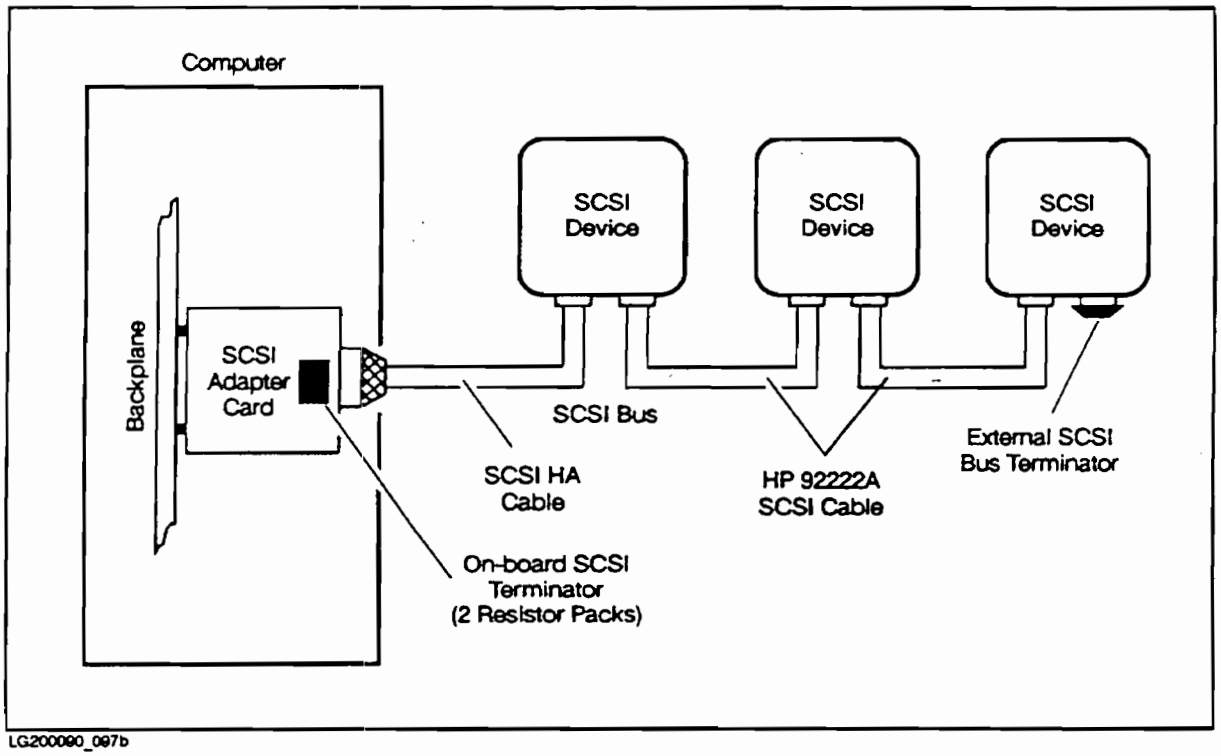


Figure 11a-1. Typical SCSI Daisy Chain Configuration

Cabling

- SCSI devices should be installed in a daisy-chain configuration, as shown in Figure 11a-1. The total cable length of the bus (including external and internal cables) cannot exceed 6 meters.
- Keep the SCSI bus length as short as possible, but do not use device-to-device cables shorter than 0.5 meters. (No shorter than 0.3 meters is recommended.)
- Make sure that all cables are attached to a device at both ends.
- Use only HP cables, because SCSI cable impedance and construction can have a significant effect on signal quality.

Installation and Operation

- Observe anti-static precautions when installing or removing the SCSI card.
- All devices must be connected to a common (single point) system reference ground. The system ground must be isolated from other electrical devices such as copy machines, arc welders, and air conditioners.
- Power on all SCSI peripherals that provide termination power first.
- Power on all SCSI peripherals and make sure they have time to complete their self-tests before powering on the SPU.

Note Some devices require termination power to pass the self-test. These devices may fail self-test if they are powered on before the host is powered on. If this occurs, the system will still boot up successfully and clear the error on the device.

- Keep all devices powered on during and after system boot-up.
- Do not add or remove SCSI devices while the system or any SCSI peripheral providing termination power is powered on.

Caution Power-cycling any SCSI device or breaking any of the SCSI connections while the system is in operation may result in data corruption.

Terminators and Termination Power

- All devices that can supply termination power should do so. Also, the first two devices that supply termination power should be located at both ends of the SCSI bus. Other devices supplying termination power can be placed anywhere along the bus.

Caution Only the two ends of a SCSI bus should be terminated. Excessive or improper termination may overload the termination power circuitry on the SCSI port. This may result in blowing the TERMPWR fuse on the adapter, or may damage transceivers on any attached device (including the adapter).

- Terminator resistors must be installed in the host adapter. These terminators provide impedance matching on the bus circuits. Without the terminators, the SCSI bus may fail intermittently.
- Use only *active terminators* like those supplied with the host adapter card. (Refer to Table 11a-14 or Table 11a-15 for the HP part number.)
- The last SCSI device in the chain (even if it is the only device) must have a terminator installed on its second connector.

Addressing and Parity

- There are 8 possible SCSI addresses on each SCSI bus. The card uses one address; the remaining 7 addresses can be used by the peripheral devices on the bus. All peripheral devices must have a unique address between 0 and 6. Most peripherals use only one address. Note that the C1700A HP Series 6300 Model 20GB/A Optical Disk Library System requires three SCSI addresses—one for the autochanger and one for each of its two disks.

SCSI Card Installation and Removal

Warning

Do not remove SCSI cards unless power is removed from your system. Removing a card when power is applied may result in electrical shock hazard, or in damage to the hardware.

Caution

SCSI cards contain electronic components that can be damaged by static electricity. To avoid damage, follow these guidelines:

- Store printed circuit cards in their conductive plastic bags.
- If possible, work in a static-free area.
- Handle printed circuit cards only by the edges. Do not touch electronic components or electrical traces.
- Use a grounding wrist strap that is connected to the metallic chassis of the system. If you do not have a wrist strap, touch the chassis before handling cards, and frequently thereafter to discharge any static buildup.

SCSI Card Installation

Caution

Be careful when installing or removing HP 28696A cards. The pins on the 68-pin backplane connector are fragile. To avoid bending any of the pins, be sure to install or remove the card by pushing straight in or straight out.

1. Power off the computer.
2. Set the SCSI address (refer to card-specific information in this chapter for SCSI addresses).
3. Select an appropriate slot and record the slot number.
4. Insert the card in the card cage.
5. Connect the card cable.

Caution

Do not connect an RS-232 cable to the parallel port of HP 28642A/28655A SCSI cards. Doing so may damage the HP-PB SCSI adapter card.

6. Make sure that all the peripheral devices are on.
7. Power up the SPU and check that the card passes its internal self-test (refer to specific card verification procedures in this chapter).

SCSI Card Removal

1. Shut down the operating system and switch off the computer power.
2. Gain access to the HP-PB I/O card cage (refer to Chapter 9 for instructions on gaining access to I/O cards).
3. Disconnect all cables from the card.
4. Unscrew two retaining screws, and pull the extractor levers out. Doing so will disconnect the card from the backplane connector.
5. While holding the extractor levers, slide the card out of its slot.
6. Place the card on a grounded surface (or put into an anti-static bag) to protect the components from ESD damage.
7. If the card is not to be replaced, install a slot cover for proper cooling and RFI suppression.

HP-PB SCSI Cards (HP 28642A/28655A)

The **HP 28655A HP-PB SCSI/Parallel adapter card** is a dual port interface card supported on HP 9000 CS 890 and CS T500 servers. One port provides a connection to a high-speed Small Computer System Interface (SCSI) bus. The other port provides a standard HP parallel connection to common, output-only devices.

The **HP 28642A HP-PB SCSI adapter card** is an interface card supported on HP 3000 CS 99x systems to provide connection to a SCSI bus. The parallel port is not supported on CS 99x (MPE/iX) systems.

Unless otherwise noted, the term "HP-PB SCSI adapter card" is used in this chapter to refer to both the HP 28655A and HP 28642A cards.

HP 28642A/28655A Specifications

Table 11a-1 lists the technical specifications for the HP-PB SCSI adapter card.

Table 11a-1.
Specifications for the HP-PB SCSI Adapter Card (HP 28642A/28655A)

Description	Specification
Bulkhead Connectors	One 25-pin female subminiature D connector for parallel connection One 50-pin shielded female, high-density SCSI connector
Typical Current:	
+5Vdc	0.75 Amps
+12Vdc	0 Amps
−12Vdc	0 Amps
Typical Power Consumption	3.75 Watts
SCSI Burst Transfer Rate, Synchronous	5.0 Mbytes per second (supported maximum)
SCSI Burst Transfer Rate, Asynchronous	3.0 Mbytes per second (supported maximum)
Parallel Burst Transfer Rate, Asynchronous	330 Kbytes per second (supported maximum)
SCSI Transfer Mode	Initiator only
Data Bus Width	8 bits
On-board SCSI Bus Length	0.1 meter

HP 28642A/28655A SCSI Card Description

The HP 28642A/28655A SCSI device adapter cards contain a dual in-line package (DIP) switch pack for setting the parity-checking capability of the card and the SCSI bus address. They also contain resistor packs for terminating one end of the SCSI bus (see Figure 11a-2).

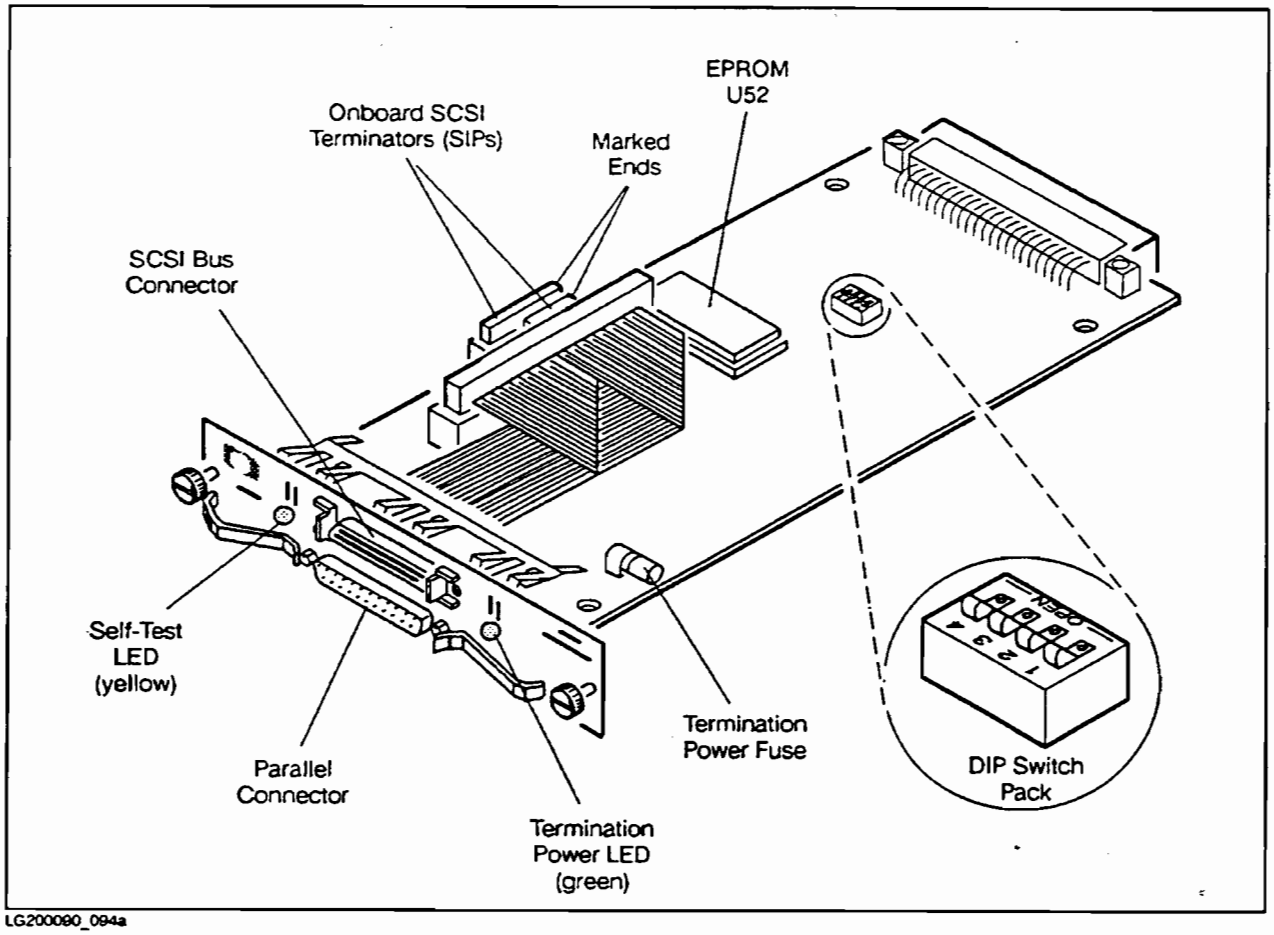


Figure 11a-2. HP-PB SCSI Adapter Card (HP 28642A/28655A)

Note

All switches in the DIP Switch Pack are factory-set to the "Open" position. This sets the SCSI address to 7 and enables parity-checking.

Setting the SCSI Address on HP 28642A/28655A Cards

The hardware address of the HP-PB SCSI adapter card is set in binary by switches 3 (most significant bit), 2, and 1 of the dual in line package (DIP) switch. This address must be set to 7, which is the factory default setting. (Refer to Table 11a-2 for additional addresses.)

Table 11a-2. HP 28642A/28655A SCSI Address Switch Settings

SCSI Address	Switch Positions		
	3	2	1
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7 (default)	1	1	1

Note 1 = ON (open position) 0 = OFF (closed position)

Parity Checking on HP 28642A/28655A SCSI Cards

Switch 4 on the HP-PB SCSI adapter card *activates* (open) or *deactivates* (closed) parity checking (refer to Table 11a-3). All devices on a SCSI bus must have the same parity-checking capability. If any device added to the SCSI bus does not generate parity, then all devices on the bus, including the adapter, must be configured to disable parity checking.

Table 11a-3. Setting HP 28642A/28655A Parity Checking

Switch 4	Parity Checking
1	Enable
0	Disable

Note 1 = open 0 = closed

SCSI contains an additional addressing layer known as *lun* (logical unit number). The term *lun* is purely a SCSI term, not related to logical units in the 99x/890/T500 I/O system. For HP-UX, all *luns* are zero.

Installing and Removing the HP 28642A/28655A Card

Refer to "SCSI Card Installation and Removal" procedures described previously in this chapter.

Verifying HP 28642A/28655A Operation

To verify the HP 28642A/28655A SCSI card installation, observe the following LED indicators:

- The yellow should be OFF (after turning on for two to five seconds).
- The green TERMPWR LED should be ON.

Refer to the "Troubleshooting" section in this chapter if the self-test LED or TERMPWR LED do not indicate as described above.

Parallel Port Configuration Guidelines (HP 28655A Only)

Configuration guidelines for the parallel port on the HP 28655A HP-PB SCSI/Parallel Adapter are as follows:

- Only uni-directional parallel devices such as printers are supported by this port.
- Only one parallel device can be attached to each SCSI/parallel adapter card.
- The maximum supported cable length is 2 meters.

Caution Do not connect RS-232 compatible cables to the parallel port. Doing so may damage the card.

Parallel Port Signal Pin Assignments

The signal pin assignments for the parallel port are listed in Table 11a-4.

Table 11a-4. Parallel Port Signal Pin Assignments

Pin Number	Signal Name	In/Out	Pin Number	Signal Name	In/Out
1	nStrobe	Out	14	nAutoFd	Out
2	Data1	Out	15	nFault	In
3	Data2	Out	16	nReset	Out
4	Data3	Out	17	nSelectIn	Out
5	Data4	Out	18	Ground	
6	Data5	Out	19	Ground	
7	Data6	Out	20	Ground	
8	Data7	Out	21	Ground	
9	Data8	Out	22	Ground	
10	nAck	In	23	no connect	
11	Busy	In	24	Ground	
12	PError	In	25	Ground	
13	Select	In			

Parallel Cable Wiring Diagram

Figure 11a-3 shows the parallel port cable and wiring diagram.

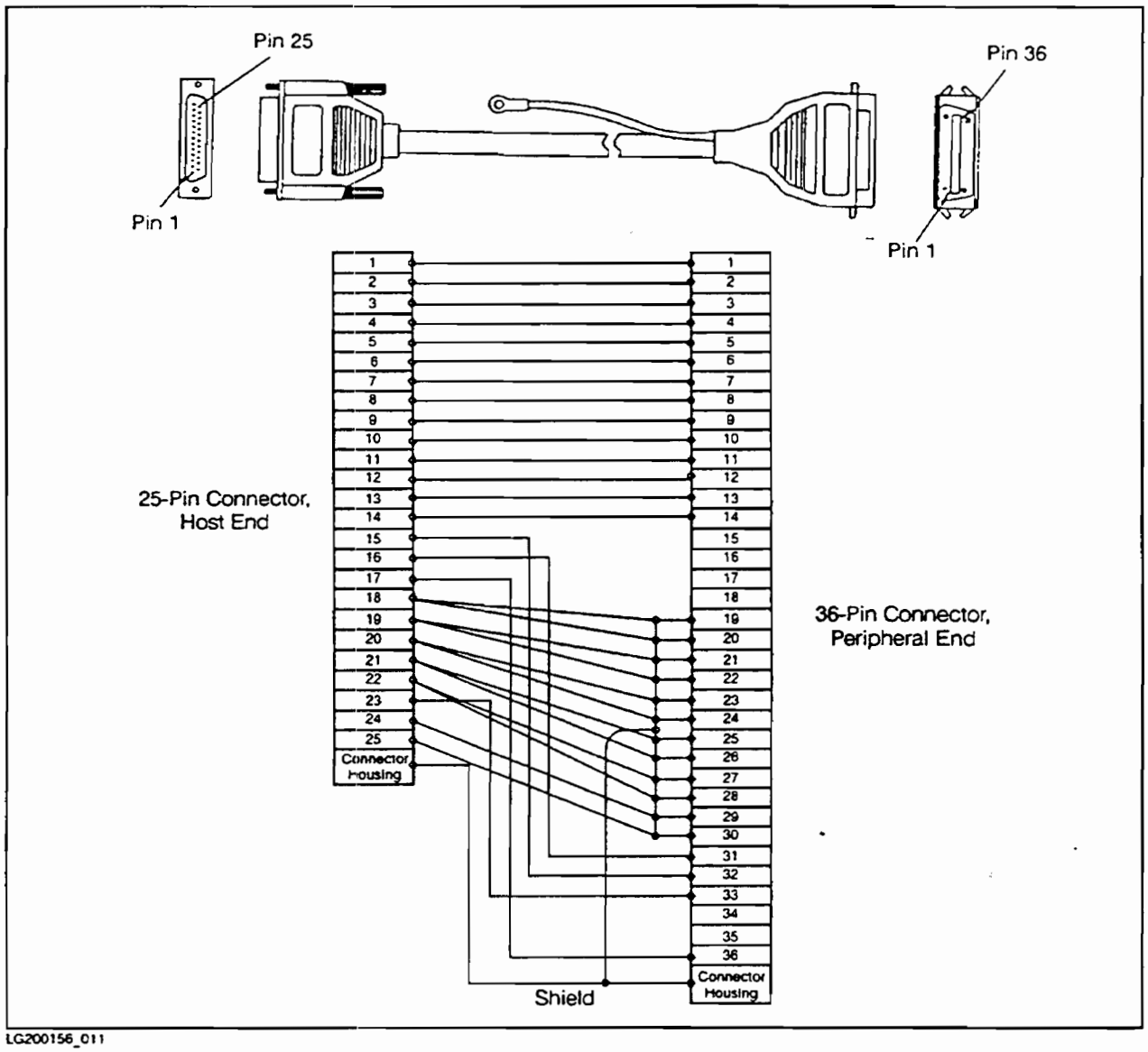


Figure 11a-3. Parallel Cable Wiring Diagram

Fast/Wide High-Performance SCSI Cards (HP 28696A)

The **HP 28696A Fast/Wide High-Performance SCSI adapter card** is an interface card supported on HP 9000 CS 890 and CS T500 servers to provide connection to a SCSI bus.

HP 28696A Specifications

Table 11a-5 lists the technical specifications for the HP-PB SCSI adapter card.

Table 11a-5.
Specifications for the Fast/Wide SCSI Adapter Cards (HP 28696A)

General Features	Supported Systems	HP 9000 CS 890 and CS T500 Family with HP-UX version 9.04 (or later) operating system.
	Standards	Complies with ANSI X3T9.2 SCSI specifications
	Performance	20 Mbytes/sec burst transfer rate
	Connector	68-pin P-type
Electrical	Power Consumption	14.2 W (typical) at +5V top/15.8 W maximum 2.79 W (typical) at +5V bottom/3.23 W maximum 4.1 A (typical) at +5V current/4.5 A maximum
Physical	Length Width Weight	220 mm (8.7 in) 233 mm (9.2 in) 294 g (10.5 oz)
Environmental	Temperature Humidity	5° to +40° C (+41° to +104° F) operating −40° to +65° C (−40° to +149° F) non-operating 15 to 80% R.H., operating

HP 28696A Fast/Wide SCSI Card Description

The HP 28696A Fast/Wide High-Performance SCSI Adapter Card provides the interface between the HP-PB backplane and Fast (differential)/Wide (16-bit) SCSI devices.

The Fast/Wide High-Performance SCSI card has the following features:

- One built-in SCSI differential connector
- 20 MBytes-per-second SCSI link speed (burst transfer rate).
- Two LED indicators:
  - Self-test (yellow)
  - Term Power (green)

The HP 28696A Fast/Wide High-Performance SCSI Adapter Card is shown in Figure 11a-4.

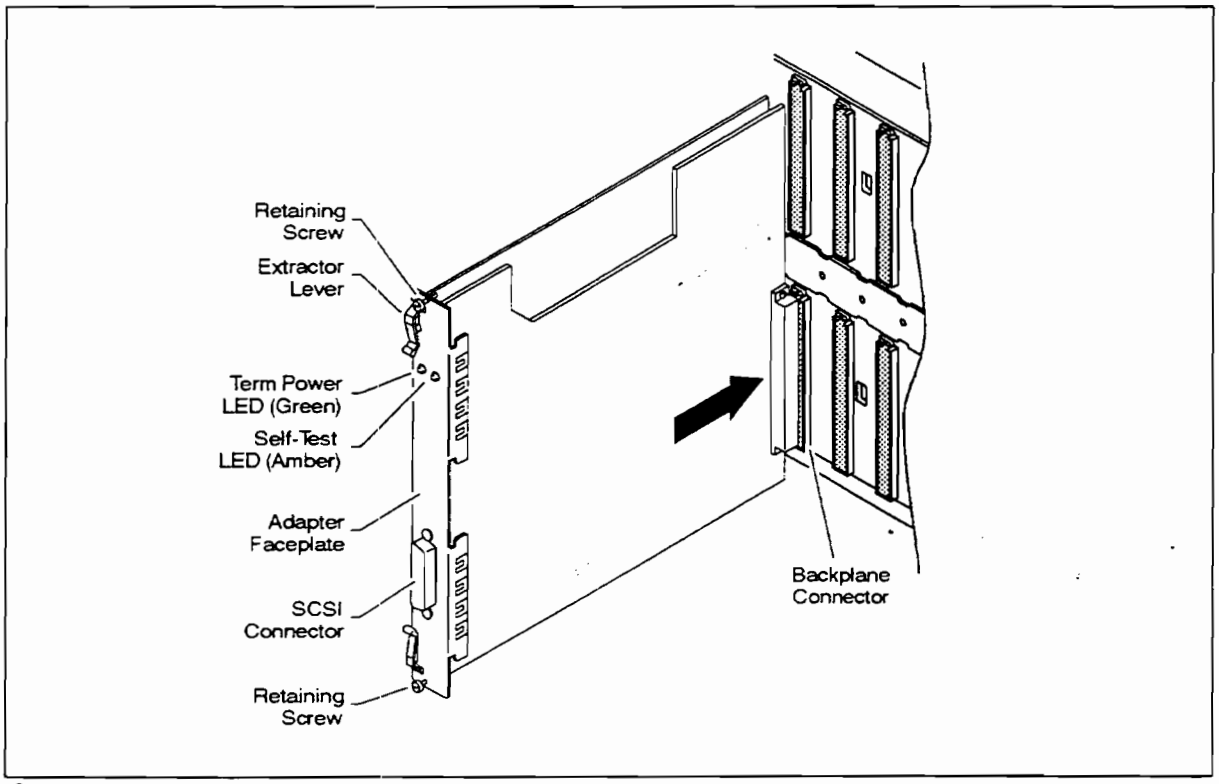
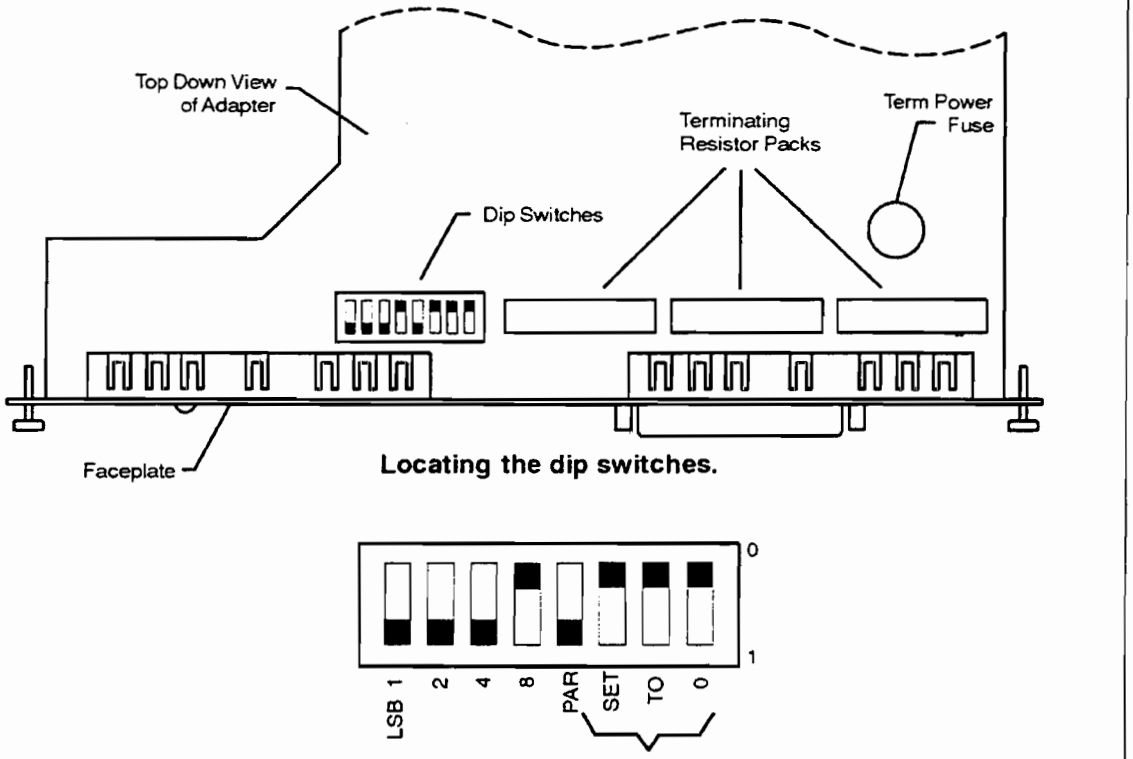


Figure 11a-4. Fast/Wide High-Performance SCSI Adapter Card (HP 28696A)

Setting the SCSI Address on HP 28696A Fast/Wide Cards

The Fast/Wide SCSI adapter cards contain a dual in-line package (DIP) switch pack. The DIP Switch Pack is factory-set to the position shown in Figure 11a-5. This setting (hexidecimal 7) should not need to be changed unless there are multiple SCSI adapters in the system.



LG200204_148

Figure 11a-5. SCSI Address Switch Settings for HP 28696A Fast/Wide SCSI Cards

Installing and Removing the HP 28696A Fast/Wide Card

Refer to "SCSI Card Installation and Removal" procedures described previously in this chapter.

Caution

Be careful when installing or removing HP 28696A cards. The pins on the 68-pin backplane connector are fragile. To avoid bending any of the pins, be sure to install or remove the card by pushing straight in or straight out.

Verifying HP 28696A Fast/Wide Card Operation

When the system is switched on, the Fast/Wide card performs a self-test. Once power is applied to the card, or the card is reset, the self-test begins.

Note

The system may perform several resets to the backplane during the normal bootup process. This causes the Fast/Wide SCSI card to execute its self-test several times, and the self-test (yellow) LED to turn on and off several times.

To verify a successful Fast/Wide SCSI card self-test, observe the following LED indicators:

- The yellow should be OFF (after turning on for two to five seconds).
- The green Termination Power LED should be ON.

Refer to the "Troubleshooting" section in this chapter if self-test fails.

Configuring HP 28696A Fast/Wide SCSI Cards into the System

On supported HP-UX systems, the SCSI card will be autoconfigured when the system is turned on. When the operating system reboots, it detects the installed SCSI card, and installs the correct software device files necessary for the operating system to communicate with peripherals connected to the SCSI card. For more information about HP-UX systems, refer to the *HP 9000 Series 800 Computer System Administration Tasks* manual (HP P/N B3108-90005), or the *Installing Peripherals* manual (HP P/N B3108-90004).

Troubleshooting

This section includes:

- **General Troubleshooting Guidelines:**
  - Connections and Configuration Troubleshooting Checklist
- **HP 28642A/28655A Troubleshooting:**
  - Card Self-Test and Self-Test LED
  - TERMPWR LED
  - Online *scsipba* and *centpba* Diagnostics
  - Troubleshooting Flowcharts
- **HP 28696A Troubleshooting:**
  - Card Self-Test and Self-Test Fail LED
  - Term Power LED
  - Online *IOMAP* and *SYSMAP* Diagnostics

Connections and Configuration Troubleshooting Checklist (All SCSI Cards)

Table 11a-6 provides a checklist that can be used for general troubleshooting of SCSI connections and configuration to help identify faults.

Table 11a-6. SCSI Connections and Configuration Troubleshooting Checklist

Check List Item	Explanation
Are all connectors (SCSI and parallel) properly and securely fastened?	Marginal connections can cause improper operation. Ensure that the adapter and retaining screws are completely engaged. Check all cable connections.
Are all the external devices operating correctly?	Run their self-tests and verify their settings.
Does each device on the SCSI bus have a unique address (0 through 7)?	Usually, there will be a set of switches on the device. Conflicting addresses may cause intermittent or complete failures in transmission.
Are SCSI bus length and cable requirements met?	Minimize the SCSI bus length. Do not exceed 6 meters, which includes cable lengths inside each peripheral (the SCSI/parallel adapter's internal SCSI bus length is 0.1 meter). However, do not use device-to-device cables that are shorter than 0.5 meters.
Are you using HP cables?	HP cables are wired to minimize noise.
Do all devices on the SCSI bus have the same parity-checking capability?	If any device on the SCSI bus does not generate parity, no device on that bus may check for it. A mismatch causes non-recoverable hardware errors because parity is both expected and missing. (Note: Only some very early SCSI devices do not generate parity.)
Are SCSI bus terminators correctly installed?	Both ends of the SCSI bus require termination. The terminator on the host adapter is installed at the factory. An external terminator is supplied for terminating the last device on the bus.
Does any device require a special SCSI terminator?	Some external devices may have peculiar termination requirements. The device manual should explain any special termination requirements and how to avoid problems.
Does any peripheral device have an internal SCSI terminator?	Excessive termination may cause damage to the transceivers of all the devices on the bus, including the adapter card, or may cause unreliable operation. Check the device manuals to determine whether they have internal terminators and how to avoid overloading the bus.
Are all devices that can supply termination power configured to do so?	For optimum noise immunity, we recommend that devices be configured to supply TERMPWR when possible. If at least two devices supply TERMPWR, locate them at each end of the SCSI bus. Additional devices that supply TERMPWR can be evenly distributed along the bus.

HP 28642A/28655A Troubleshooting

The following troubleshooting tools are available for troubleshooting the HP 28642A/28655A SCSI cards:

- Connections and Configuration Troubleshooting Checklist
- Card Self-Test and Self-Test LED
- TERMPWR LED
- Online *scsipba* and *centpba* Diagnostics
- Troubleshooting Flowchart

HP 28642A/28655A Card Self-Test

The self-test for the HP-PB SCSI adapter card runs each time the SPU is powered-on, and may run several times during the boot process. Table 11a-7 describes the power-on self-test results as displayed by the card's self-test LED.

Table 11a-7. HP 28642A/28655A SCSI Adapter Card Self-Test Results

LED Display	Condition	Action
Yellow self-test LED on the card goes on for two-to-five seconds and then goes off.	The card has passed self-test. This LED will operate even if the termination power fuse is blown.	The card is functional.
LED remains on.	Self-test has failed.	First check the termination power fuse (refer to Table 11a-8). If the fuse is not causing the problem, replace the card. For a more complete verification of the card, run the *scsipba* online diagnostic.

Note

To fully test the SCSI card, use a SCSI loopback hood installed on the end of the SCSI adapter cable. (Refer to Table 11a-14 for the HP part number.)

TERMPWR LED (HP 28642A/28655A)

Table 11a-8 describes how to interpret the termination power LED.

Table 11a-8. HP 28642A/28655A SCSI Termination Power LED Conditions

LED Display	Condition	Action
Green Termination Power LED is on.	The SCSI card is supplying termination power to the SCSI bus.	The termination power fuse is good. Termination power is available from the SCSI card. No action is required.
Termination Power LED is off.	There may be a problem with the TERMPWR circuitry.	Check and replace the TERMPWR fuse[1].

Note

[1]If another device on the SCSI bus provides termination power, the bus will continue to operate normally.

Before replacing the termination power fuse, identify the reason for the failure. Check for sources of short circuits on the SCSI bus cables and connectors. Check for proper mating of contact pins on the SCSI bus cables. Be sure that power is off on the host computer and peripheral devices when connecting SCSI bus cables to prevent inadvertent shorting.

Online Diagnostics for the HP 28642A/28655A Cards

The online diagnostics *scsipba* and *centpba* are available for use in troubleshooting the HP-PB SCSI adapter card. Separate diagnostics allow testing of each functional module on the adapter—SCSI or parallel. HP recommends use of section 1 for troubleshooting a functional module. It provides symptom and action information with messages appropriate for FRU-level troubleshooting. Section 1 also returns card configuration information (such as parity and SCSI bus address settings).

Note that scsipba provides an external loopback test. An external loopback test on the SCSI port requires the use of a loopback hood (refer to Table 11a-14 for the HP part number). If an external loopback test is desired, use section 4, step 43. In this case, you must power off the computer and peripheral devices (assuming the card is not in the boot path) and attach the loopback hood to the peripheral end of the card cable.

To run the online diagnostics, refer to chapter 6.

HP 28642A/28655A Troubleshooting Flowchart

Figure 11a-6 provides a flowchart for troubleshooting the HP-PB SCSI adapter card.

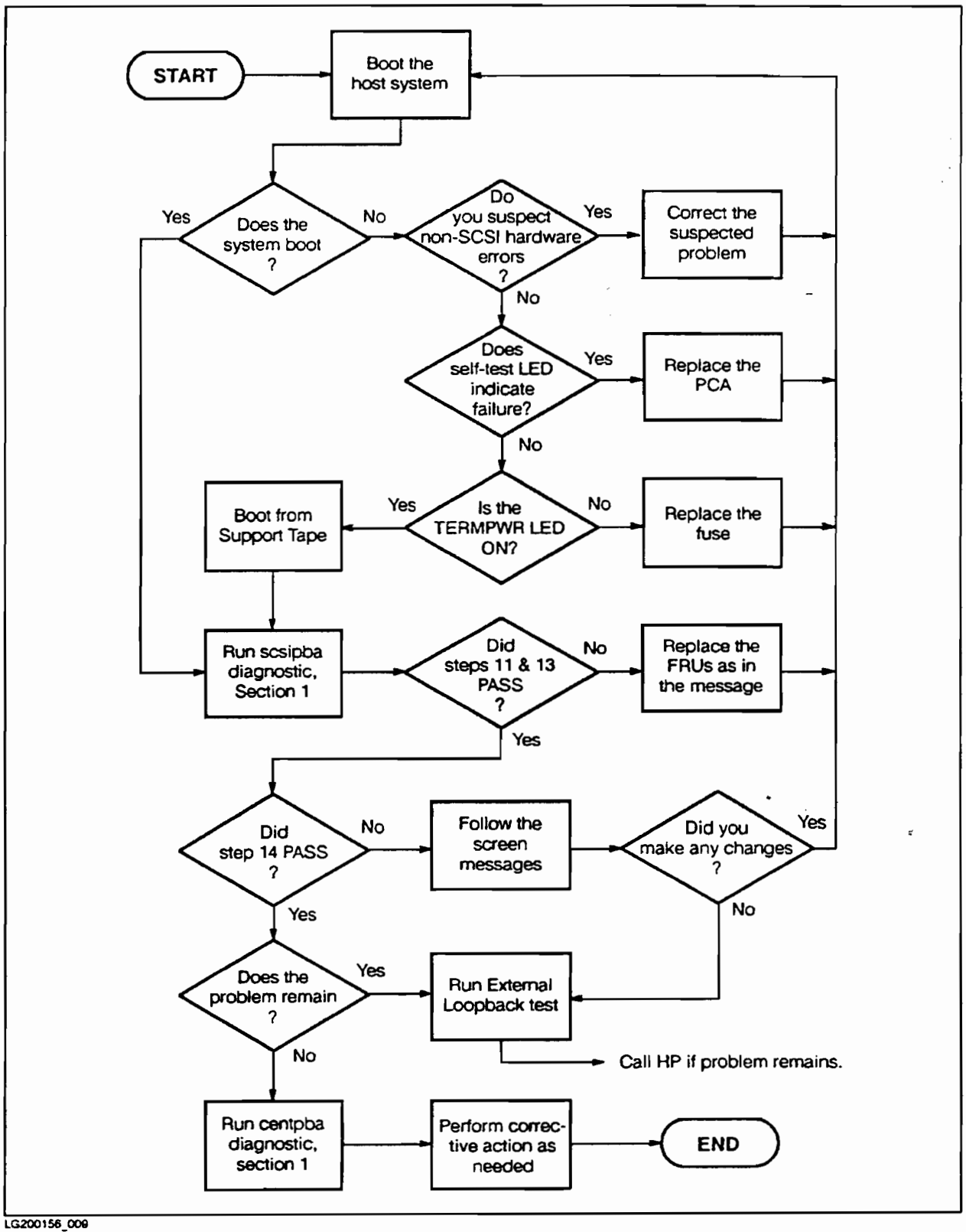


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Figure 11a-6. HP 28642A/28655A HP-PB SCSI Adapter Card Troubleshooting Flowchart

HP 28696A Troubleshooting

The following troubleshooting tools are available for troubleshooting the HP 28696A SCSI cards:

- Connections and Configuration Troubleshooting Checklist
- Card Self-Test and Self-Test LED
- Term Power LED
- Online *IOMAP*, *SYSMAP*, and *fwscsipb* Diagnostics

HP 28696A Card Self-Test

The self-test for the Fast/Wide SCSI card runs each time the SPU is powered-on, and may run several times during the boot process. A failed self-test will cause the yellow Self-Test LED to turn on. Table 11a-9 describes how to interpret self-test results indicated by the card's self-test LED.

Table 11a-9. HP 28696A Fast/Wide SCSI Card Self-Test Results

LED Display	Condition	Action
Yellow self-test LED on the card goes on for about three seconds and then goes off.	The card has passed self-test. This LED will operate even if the termination power fuse is blown.	The card is functional.
LED remains on, or never comes on.	Self-test has failed.	First check the termination power fuse (refer to Table 11a-10). If the fuse is not causing the problem, replace the card.
LED blinks continuously.	An error external to the adapter has occurred (for example, a loose connection).	The LED will continue to blink until one of the following conditions is met: - The card successfully communicates with a device. - A reset self-test is run.

Term Power LED (HP 28696A)

The green Termination Power LED turns on to indicate that the SCSI card is supplying or sensing termination power to the SCSI bus. During normal operation, this LED is on. If the Termination Power LED is off, there is no termination power from the SCSI card.

Possible faults include:

- A blown fuse
- A faulty SCSI card
- A faulty SCSI device
- A faulty cable connection (bent pins or improper seating of the cable connector)

Table 11a-10 describes how to interpret the termination power LED.

Table 11a-10. HP 28696A SCSI Termination Power LED Conditions

LED Display	Condition	Action
Green Termination Power LED is on.	The SCSI card is supplying termination power to the SCSI bus.	The termination power fuse is good. Termination power is available from the SCSI card. No action is required.
Termination Power LED is off.	There may be a problem with the termination power circuitry.	Check and replace the TERMPWR fuse[1].

Note

[1]If another device on the SCSI bus provides termination power, the bus will continue to operate normally.

Before replacing the termination power fuse, identify the reason for the failure. Check for sources of short circuits on the SCSI bus cables and connectors. Check for proper mating of contact pins on the SCSI bus cables. Be sure that power is off on the host computer and peripheral devices when connecting SCSI bus cables to prevent inadvertent shorting.

Diagnostic Utilities for the HP 28696A Cards

The online *IOMAP* and *SYSMAP* diagnostic utilities are available for use in troubleshooting the Fast/Wide HP-PB SCSI adapter card. A standard diagnostic, *fwscsipb*, is also available for use authorized personnel or licensed users.

The *IOMAP* utility will only be able to identify the SCSI adapter, not the peripheral. However, the *SYSMAP* online utility will be able to identify both the SCSI adapter card and any peripherals. Use the **ioscan(1M)** command to check the configuration of the SCSI adapter.

To run the diagnostics, refer to chapter 6.

fwscsipb Diagnostic

The *fwscsipb* diagnostic is divided into several sections, some of which of which are further divided into steps. Table 11a-11 lists the setions and steps for *fwscsipb*.

When entering the command string to run *fwscsipb*, you can specify individual sections or steps to run, or you can specify several sections to run consecutively. If no sections are specified, section 1 is run. Table 11a-11 lists the diagnostic sections and functions.

Table 11a-11. fwscsipb Diagnostic Sections

Section No.	Step No.	Diagnostic Function
1		Execute Identify/Revision and SCSI bus_rollcall function.
2	21 22	Reset card and execute selftest. Reset SCSI Bus.
3		Identify card hardware, firmware, SCSI bus address, and parity setting.
5		Reset card and execute selftest.
11		Perform SCSI bus rollcall.
13		Download firmware, selftest, and IODC code to inactive bank, and then switch banks to execute new code.
14		Switch banks to execute code in inactive bank.

Running the fwscsipb Diagnostic

To run *fwscsipb*, you must first run the Online Diagnostic Subsystem program, SYSDIAG. At the HP-UX prompt, enter:

```
sysdiag
```

SYSDIAG invokes the Diagnostic User Interface (DUI) command interpreter program.

At the **DUI>** prompt, any section of the diagnostic can be specified in the *fwscsipb* run string. For example, to run section 3, type:

```
DUI> run fwscsipb pdev = x section = 3
```

- where

x — is the physical module address calculated from the formula (4 times the slot number).

3 — indicates section 3 is to be run. Other sections can be included in the same run string. If no sections are specified, section 1 (the default section) will be run.

Note

For section 2, the step number must be specified. For example:

```
DUI> run fwscsipb pdev = x section = 2(21)
```

Updating Firmware on HP 28696A Cards

Note

Before running the *fwscsipb* (section 13) diagnostic, you must have a firmware download file installed on your system.

The firmware on HP 28696A SCSI Cards can be updated without replacing the ROMs. using section 13 of the *fwscsipb* diagnostic. To update the firmware, you will be prompted to provide a fully qualified filename for a firmware download file.

To update Fast/Wide SCSI firmware:

1. At the DUI> prompt, type:

```
DUI> fwscsipb pdev = x section = 13
```

   - where x is the physical module address calculated from the formula (4 times the slot number).

2. A display similar to the following will appear:

```
This section will require that you have obtained a
suitable download file and have it properly installed
on the system.

Do you wish to continue?  (Y/N) :
```

3. Answer Y (yes). The following prompt will appear:

```
Enter the full path name to download the file
(CR> to exit download)  >>
```

4. Enter the filename. If the filename entered is not an EEPROM download file, the following error message will appear:

```
*** FAILURE: FILE SPECIFIED AS DOWNLOAD FILE IS NOT A
             DOWNLOAD FILE.
*** ACTIONS: Obtain appropriate download file, load onto system
             and repeat download procedure.
```

   A valid EEPROM download file will cause the following message to be displayed:

```
The code executing is date code dddd.
The datecode for the code in this download is dddd.

Do you wish to continue?  (Y/N) :
```

5. Verify the date code version displayed. Upon continuing, the following messages will be displayed to show the progress of the download process:

```
Building download image.   Please wait...

Moving download image to adapter.   Please wait...

ddddd bytes of download image have been moved to adapter.
```

   The last line above is repeated to show the number of bytes downloaded (where ddddd is the number of bytes currently downloaded to the adapter).

6. When the download is completed, a "switch bank" command is automatically issued to the adapter to enable the newly downloaded code. If the download is successful, the following message is displayed:

```
Switch banks operation successful.  Executing code in
active EEPROM bank with datecode of dddd.
```

   - where dddd is the date code of the code in the active bank.

This completes the Fast/Wide SCSI card firmware update procedure.

Firmware Update Error Messages

The following is a list of possible error messages that may occur during the Fast/Wide SCSI card firmware update procedure:

```
The switch banks command failed.  Consult failure and action
information above.  An alternative is to perform a card selftest
(Section 5) and then a switch bank (Section 14).              (FWSCSIPB 1755)
```

```
The datecode in the download file header (dddd) does not match
the datecode of the code in the active EEPROM bank (dddd).  Do
a switch bank (Section 14) to get back to the previous code; get a
new download file and repeat the download operation.          (FWSCSIPB 1760)
```

```
Unable to get card identity information. Consult failure and action
information above.  An alternative is to perform a card selftest
(Sectio 5), perform an identify (Section 3) and see if the downloaded
code has the appropriate datecode.                            (FWSCSIPB 1765)
```

```
*** FAILURE : DOWNLOAD TO ADAPTER FAILED.                     (FWSCSIPB 5030)
*** ACTIONS : Retry download procedure and if failure occurs
              again, replace adapter.
```

Field Replaceable Units

Exchange Assemblies

SCSI adapter card assemblies may be replaced under the HP board exchange program. Exchange assembly and new assembly part numbers for the HP 28642A/28655A SCSI cards are listed in Table 11a-12: exchange assembly and new assembly part numbers for the HP 28696A fast/wide SCSI cards are listed in Table 11a-13.

Table 11a-12.
HP 28642A/28655A SCSI Card Exchange Assembly Part Numbers

SCSI Card	New Assembly Part Number	Exchange Assembly Part Number
SCSI/Parallel adapter card assembly (HP-UX)	28655-60001	28655-69004
SCSI adapter card assembly (MPE/iX)	Same as above	Same as above

Table 11a-13. HP 28696A SCSI Card Exchange Assembly Part Numbers

SCSI Card	New Assembly Part Number	Exchange Assembly Part Number
Fast/Wide SCSI adapter card assembly (HP-UX)	28696-60001	28696-69001

Replaceable Components

Table 11a-14 lists the FRU assemblies for the HP 28642A/28655A HP-PB SCSI adapter card.

Table 11a-15 lists the FRU assemblies for the HP 28696A HP-PB SCSI adapter card.

Table 11a-14. Replaceable Parts for the HP 28642A/28655A SCSI Cards

Description	HP Part Number
Board Components	
PROM (location U52) on HP-PB SCSI Adapter Card	5181-6144
Fuse, Termination Power	2110-0517
SCSI bus terminator (2 required)	1810-0676
Other Field Replaceable Components	
SCSI cable	5062-3383
HP 92284A parallel cable (Not supplied for the HP 28642A card (MPE/iX). MPE/iX systems do not support the parallel port.)	5180-0010
External SCSI bus terminator (active, single-ended)	1252-3920
SCSI loopback hood (single-ended)	5061-6565

Table 11a-15. Replaceable Parts for the HP 28696A SCSI Cards

Description	HP Part Number
Board Components	
Fuse, Termination Power, 125V, 2A, LF	2110-0517
Other Field Replaceable Components	
SCSI terminator (16-bit differential)	A1658-62024
2.5 meter cable (16-bit high-density)	A1658-62020
Grounding wrist strap	9300-1408
Installationa and Service Manual	9300-1408

HP 28642A/28655A PROM and Termination SIPs

HP 28642A/28655A SCSI cards contain a PROMs which is replaced when faulty or when upgrading to newer versions. The PROM firmware version is displayed during system boot and can also be determined from the *scsipba* diagnostic. (See Figure 11a-7 for the location of the PROM and termination SIPs.)

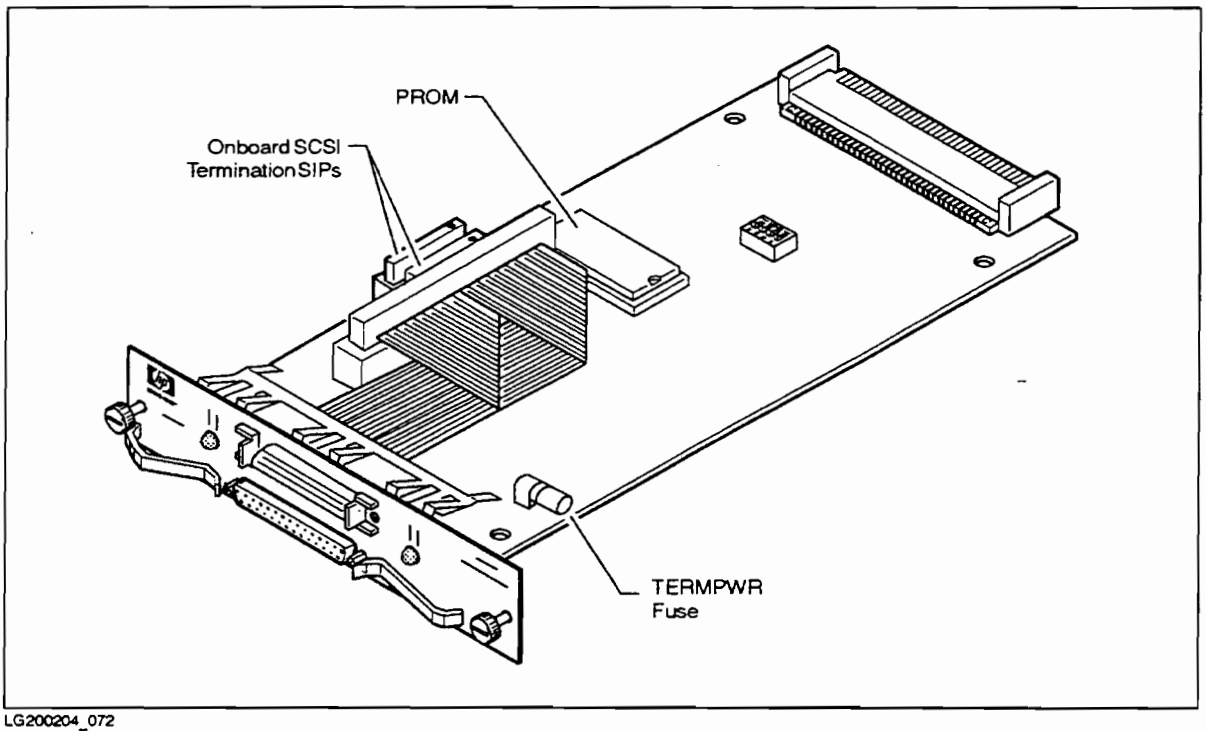

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Figure 11a-7. HP 28642A/28655A PROM, Termination SIPs, and Termination Power Fuse

Removal of PROM and termination SIPs:

1. Remove the card from the card cage as described previously.
2. Use a chip extractor or similar tool to gently pry and remove each component from its socket.

Caution Excessive prying and pressure can damage the component or its socket. Use care during removal.

Replacement of PROM and termination SIPs:

1. Identify the proper socket location for the replacement component.
2. Note the half-circle notch or identification mark located on one end of the component. When installed, the component must be oriented so that its notch or mark is in the same direction as a similar notch or mark on the socket.
3. Ensure that the component's contact pins are aligned with the socket's receptacles. You may need to adjust the pins (bow them inward or outward) for proper alignment.
4. Gently press the component into place to properly seat the pins.

Caution If pressure is not uniformly applied, the pins on one side or the other may buckle and collapse without making proper electrical contact. If this happens, remove the components, straighten the pins, and try again. If damage was extensive, you may need a new component.

Termination Power Fuse Removal and Replacement (All SCSI Cards)

For the location of the SCSI termination power fuse. see Figure 11a-2 (for HP 28642A/28655A SCSI/Parallel cards). or Figure 11a-9 (for HP 28696A Fast/Wide SCSI cards).

To remove the termination power (see Figure 11a-8 and Figure 11a-9):

1. Remove the card from the card cage as previously described.
2. Pull the fuse out of the socket. Verify that the fuse is open by using a continuity tester.

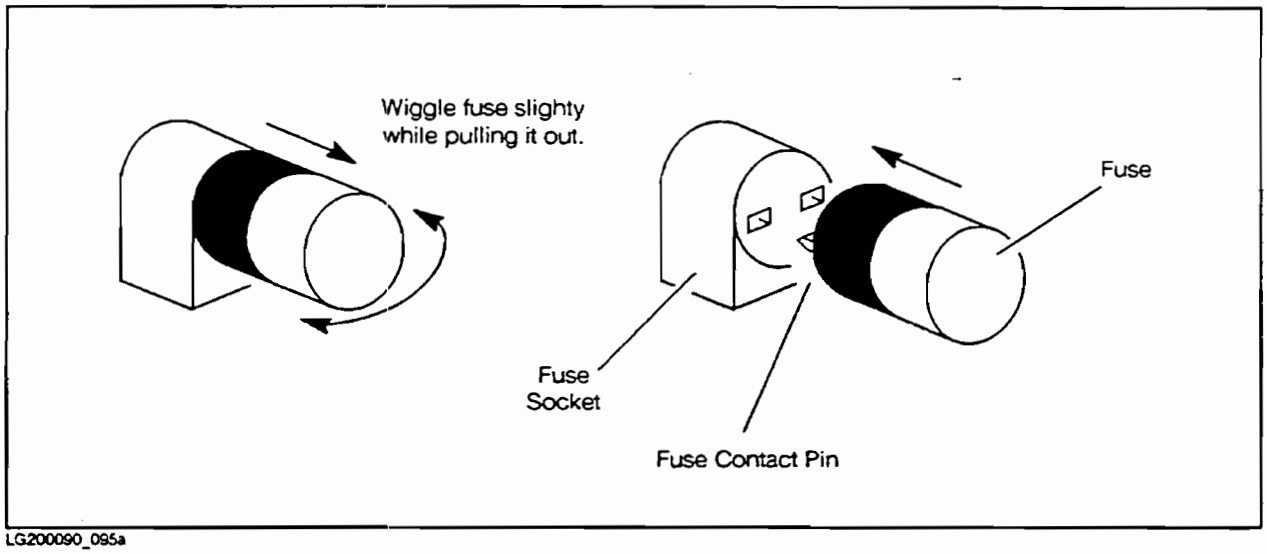

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Figure 11a-8. Removal and Replacement of HP 28642A/28655A SCSI Termination Power Fuse

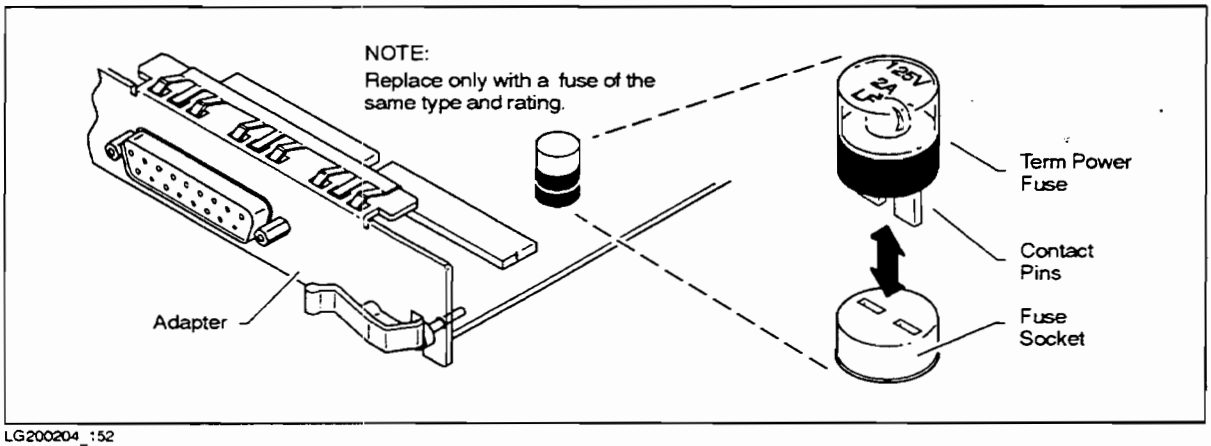

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Figure 11a-9. Removal and Replacement of HP 28696A SCSI Termination Power Fuse

To replacement the termination power fuse:

1. Replace only with a fuse of the same type and rating.
2. Carefully align the two contact pins on the fuse with the socket holes. The fuse has no polarity, so the pins can go into either socket hole (see Figure 11a-8 or Figure 11a-9).
3. Press the fuse into the socket.

11b

HP-FL I/O Interface Cards

Introduction

This section contains reference information about the HP-FL I/O Interface card for the 99x, 890, and T500 systems.

Product numbers are:

- **HP 28615A** on the HP 9000 CS 890 and CS T500 servers.
- **HP 28616A** on the HP 3000 CS 99x (990/992 and 991/995) systems.

Note

In some documentation, the HP-FL I/O Interface card may also be referred to as the "Fiber-Optic Link" (this name is printed on the card). In this section, the HP-FL I/O Interface card is referred to as the "HP-FL card."

Chapter Contents

This chapter provides the following information:

- **Description**
- **HP-FL Connections:**
  - Attaching Fiber-Optic Cable to the HP-FL Card
  - Attaching Fiber-Optic Cable HP-FL Drive Controller
  - Installing PBus Cables and Terminators
  - A Typical Installation
- **How to Verify Operation:**
  - Run Self-Test and Observe the Self-Test LED
  - Observe Status LEDs During Normal Operation
- **Field Replaceable Units (FRUs):**
  - Exchange Assemblies
  - Replaceable Components on the HP-FL Card
  - Other FRUs
- **Troubleshooting Tools:**
  - Card Self-Test
  - Self-Test Failure and Status LEDs

Description

The HP-FL card is a Type B DMA device adapter module that supports synchronous transfers up to 5 Mbytes per second for 2 Kbyte transfer sizes to and from a disk array. Up to five double-high HP-FL cards can be installed per HP-PB card cage.

Figure 11b-1 shows the HP-FL card: Table 11b-1 identifies the key components of the card shown in Figure 11b-1.

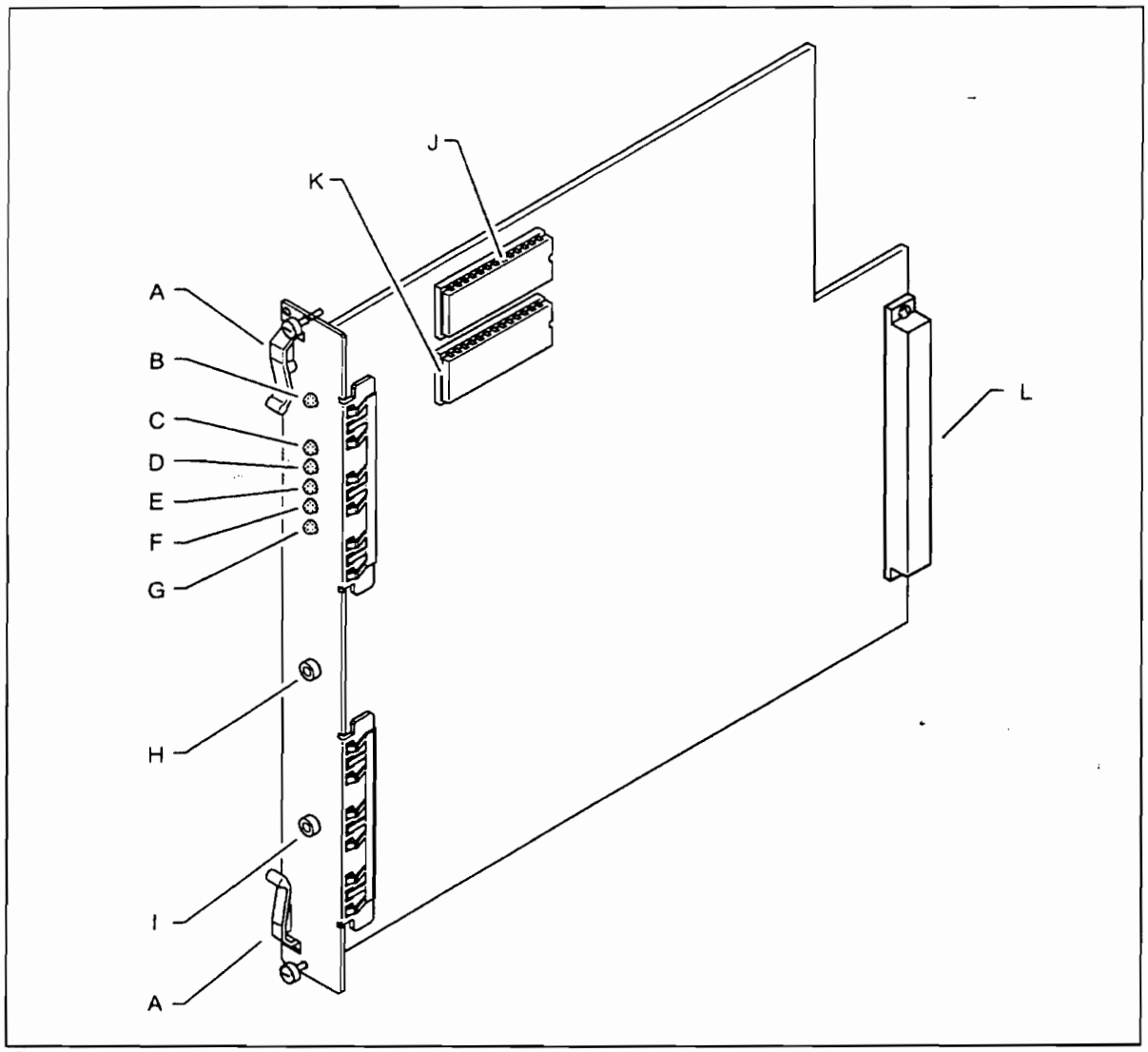


Figure 11b-1. HP-FL Card (28615A/28616A)

Table 11b-1. HP-FL Card Key Components

Item in Figure 11b-1	Description
A	Extractor lever
B	Self-Test Fail LED (yellow), normally off
C	Configuration LED (yellow), normally off
D	Signal LED (yellow), normally off
E	Remote LED (yellow), normally off
F	Passed LED (green), normally on or blinking
G	Activity LED (green), normally blinking
H	Fiber-Optic Receive port (black/dark gray)
I	Fiber-Optic Transmit port (light gray)
J	ROM at socket location U51
K	ROM at socket location U52
L	HP-PB backplane connector

HP-FL Connections

This section briefly describes the HP-FL cable connections.

Attaching Fiber-Optic Cable to the HP-FL Card

To attach the fiber-optic cables to the HP-FL card (see Figure 11b-2):

1. Remove the protective caps from each fiber of the fiber-optic cable.
2. Remove the protective caps from each port of the HP-FL card.
3. Connect the fiber-optic cable that has a white sleeve (on HP-supplied cables) to the light gray "Transmit" port of the HP-FL card.
4. Connect the remaining fiber-optic cable to the other port of the HP-FL card.

Caution Use caution to avoid cross-threading the plastic connectors. Tighten by hand - to avoid stripping the threads. do not overtighten.

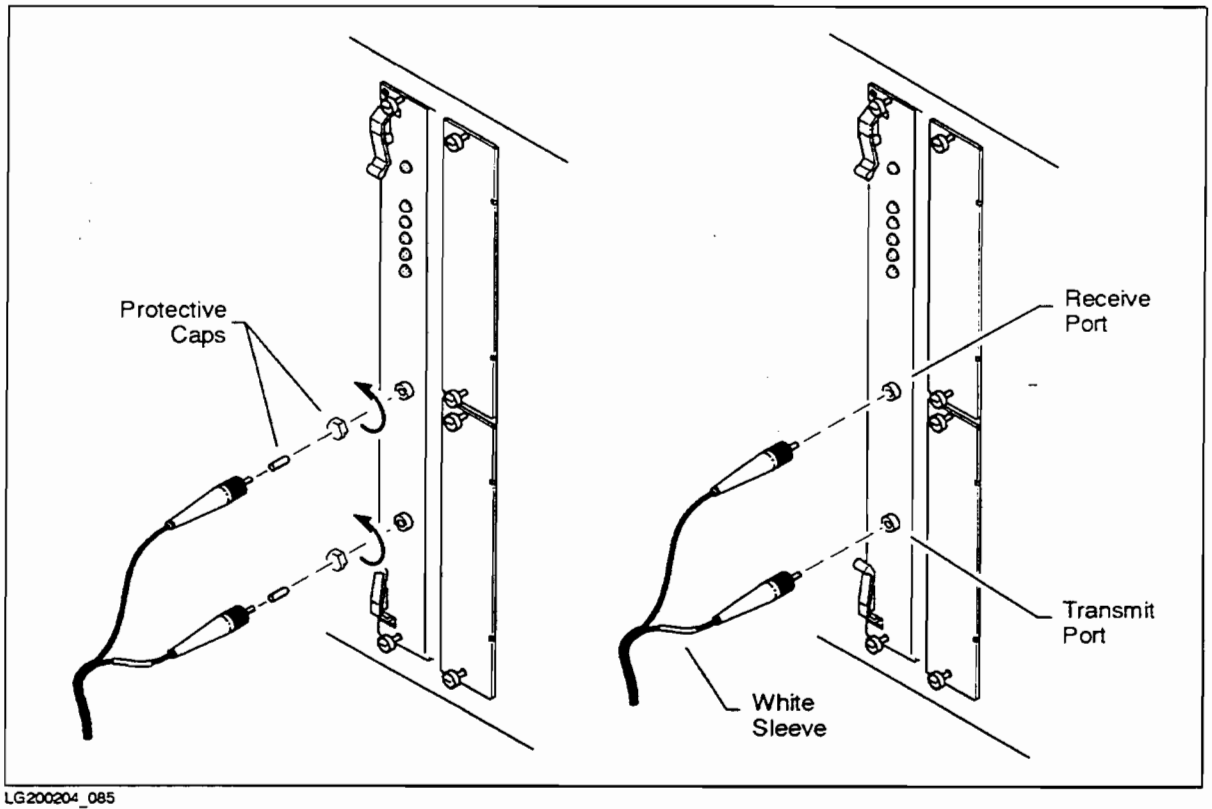


Figure 11b-2. Connecting Fiber-Optic Cables to the HP-FL Card

Attaching Fiber-Optic Cable HP-FL Drive Controller

To attach the fiber-optic cables to the HP-FL disk drive controller (see Figure 11b-3):

1. Remove the protective caps from each fiber of the fiber-optic cable. If the drive controller ports have protective caps. remove them also.
2. Connect the fiber-optic cable to the drive controller (see Figure 11b-3). On HP-supplied cables. one of the fibers is marked with a white sleeve. Connect the fiber with the white sleeve to the "Transmit" port of the drive controller (typically. this port is light gray).

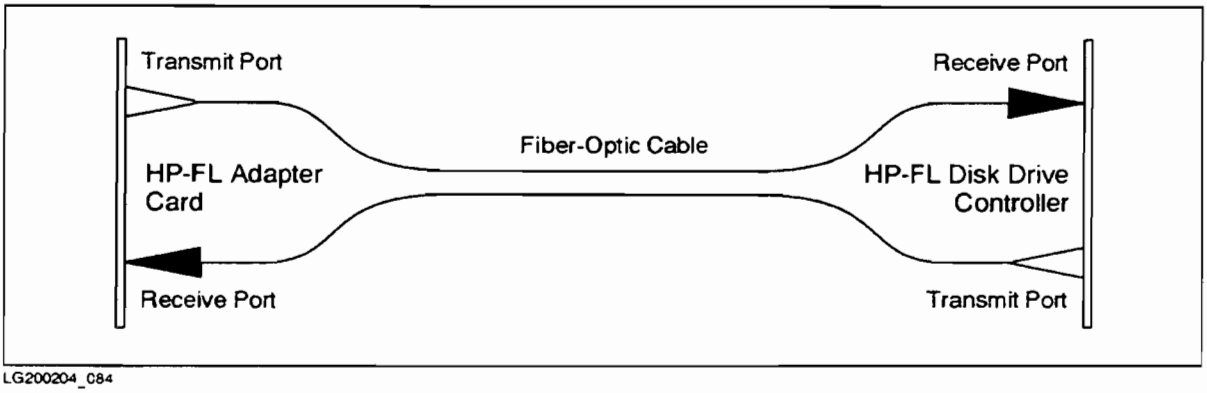


Figure 11b-3. Connecting Fiber-Optic Cables to the HP-FL Disk Drive Controller

3. Connect the remaining fiber-optic cable to the other port of the HP-FL drive controller.

Caution Do not cross-thread the plastic connectors. Do not overtighten.

Installing PBus Cables and Terminators

Because there are differences among models of HP-FL disk drives, you must refer to your particular disk drive installation manuals for information on connecting peripheral bus (PBus) cables and terminators. Note the following guidelines:

- Every PBus socket on the disk controller must have either a terminator or a PBus cable attached.
- The pair of PBus terminators must be installed in opposite directions relative to each other to invoke inverse polarity on each end of the PBus. Terminators are typically marked to identify their orientation. Also, disk controllers typically contain indicator lights that will turn on if the terminators are improperly installed.

A Typical Installation

Figure 11b-4 shows a typical connection of six HP-FL disk drives. The HP 28615A/28616A HP-FL card and fiber-optic cable connect the computer to the first disk drive. The remaining drives are daisy-chained on a peripheral bus (PBus) using PBus cables. Note that the PBus must be terminated on each end.

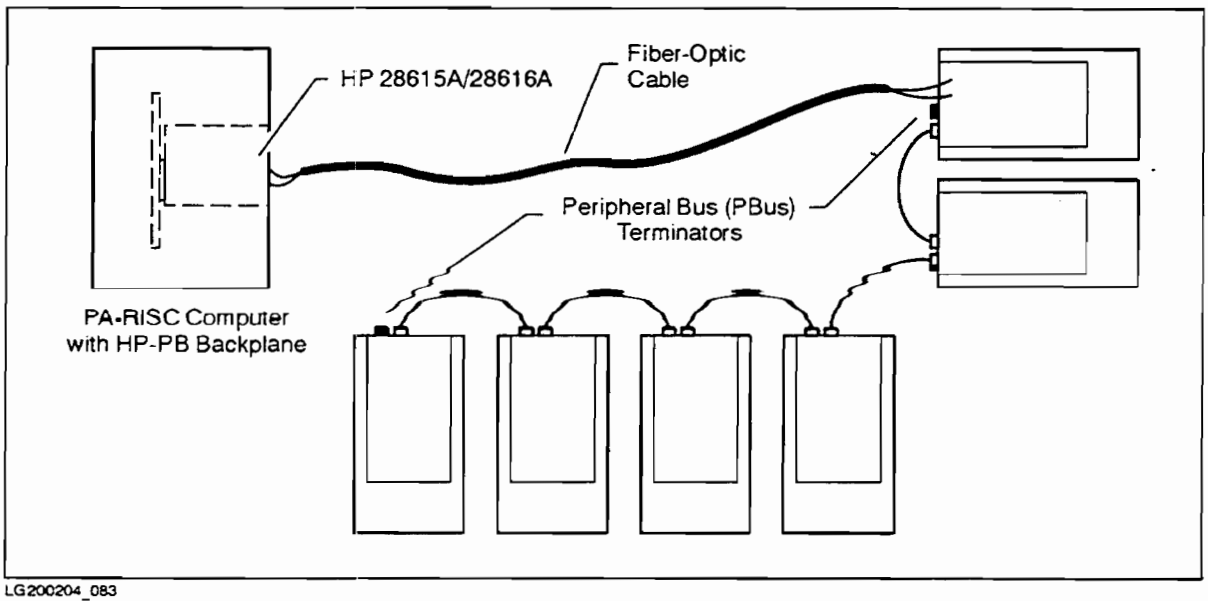


Figure 11b-4. Connecting Fiber-Optic Cables to the HP-FL Disk Drive Controller

How To Verify Operation

To verify operation of the HP-FL card, check the indicator lights (light emitting diodes, LEDs) on the card's faceplate. Figure 11b-5 shows the location of the six LEDs: one self-test and five status.

First, run the card self-test and observe the LEDs. If self-test passes, then observe the status LEDs during normal operation.

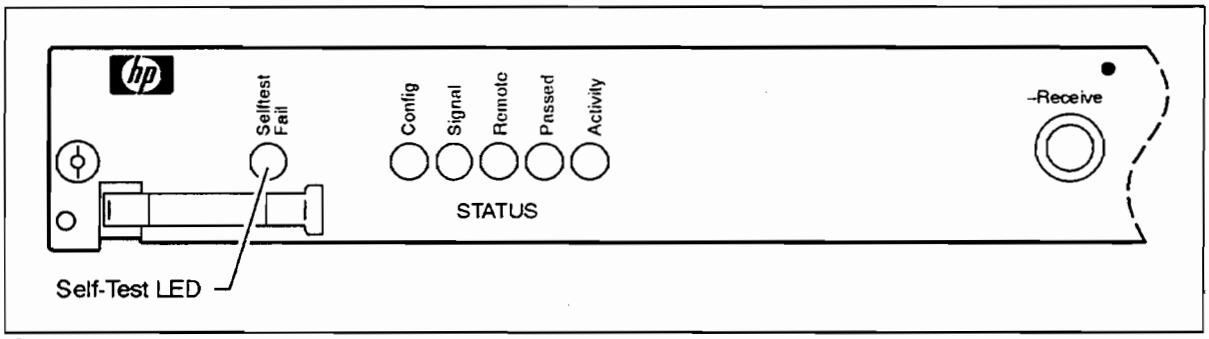


Figure 11b-5. Self-Test and Status LEDs

Run Self-Test and Observe the Self-Test LED

The card's self-test is run whenever the HP-PB backplane is reset. The backplane can be reset in the following ways:

- Switching the computer's power on
- Booting the operating system
- On command through a program (such as a diagnostic program)

Self-test results are displayed by the LEDs. Depending on your particular system, the results may also be displayed on the system console or on a system panel. Check your system reference manuals.

Run the card self-test and observe the yellow self-test LED (note: turning the computer power on and booting the system may cause the self-test to be run more than once, depending on your system).

- Self-test passes if the LED turns on for a few seconds, and then turns off.
- Self-test fails if:
  - the LED *never* turns on, or
  - turns on and remains on.

Observe Status LEDs During Normal Operation

Table 11b-2 and Figure 11b-6 show the state of the status LEDs during normal operation. Verify that the LEDs are in the normal operating state, as follows:

Table 11b-2. Status LEDs During Normal Operation

LED Label	LED Normal Operating State	Interpretation
Selftest Fail (yellow)	OFF	The card's self-test passed.
Config (yellow)	OFF	The card is configured and the remote device is compatible.
Signal (yellow)	OFF	The HP-FL signal strength and quality is acceptable.
Remote (yellow)	OFF	The remote device has correctly identified itself.
Passed (green)	Blinking	The card's self-test passed. and is awaiting system configuration.
	ON	The card's self-test passed. and is operational.
Activity (green)	Blinking	Data transfers on the HP-FL: blinks at least once every 60 seconds.

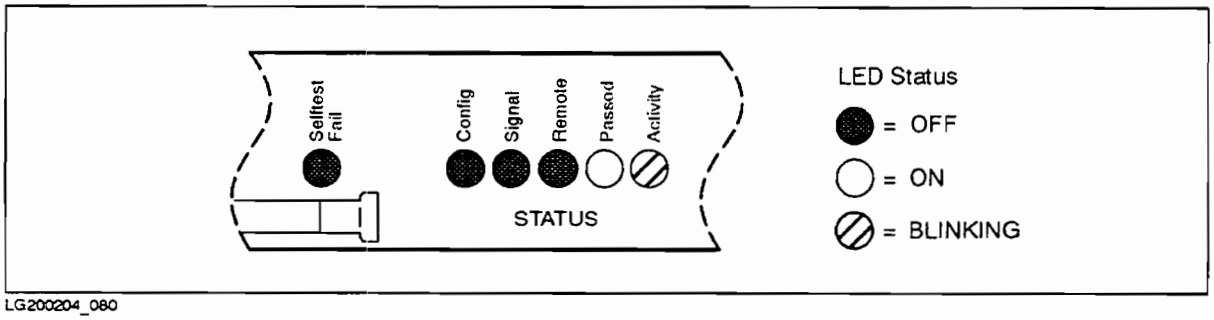


Figure 11b-6. Normal LED Operating States

Field Replaceable Units (FRUs)

Field replaceable units (FRUs) are components authorized for field replacement. Field replacement of faulty units must be performed by authorized service personnel.

Exchange Assembly

The card assembly may be replaced under the HP board exchange program. HP-FL card part numbers are listed in Table 11b-3.

Table 11b-3. Exchange Assembly Part Numbers for the HP-FL Card

New card assembly	28615-60001
Exchange card assembly	28615-69002

Replaceable Components on the HP-FL Card

Components on the HP-FL card that are available for replacement are listed in Table 11b-4 (see Figure 11b-7 for location).

Table 11b-4. Replaceable Components on the HP-FL Card

ROM (location U51):	28615-81013
ROM (location U52):	28615-81014

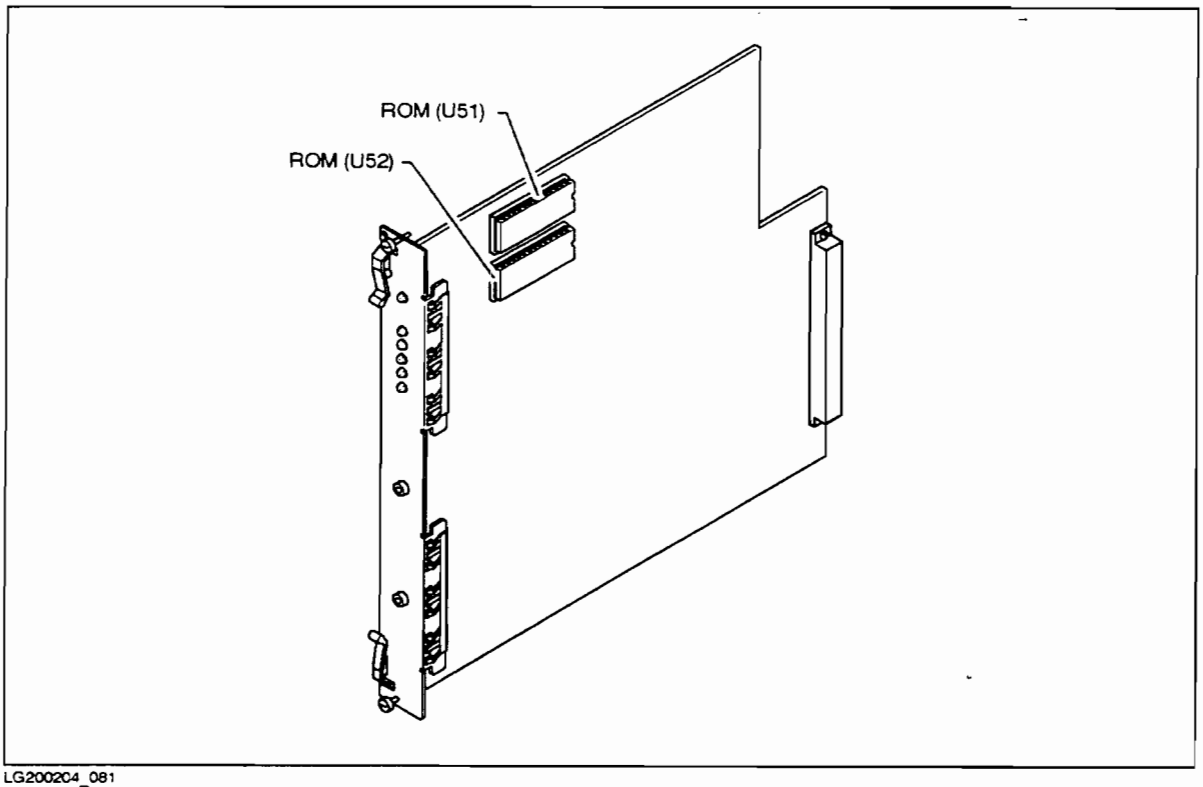


Figure 11b-7. Field Replaceable Units (FRUs) on the HP-FL Card

Other FRUs

Other FRUs associated with this product are listed in Table 11b-5.

Table 11b-5. Other Field Replaceable Units for the HP-FL Card

Fiber-Optic cable, 30 meters	1005-0078
PBus terminator:	5061-3151

Troubleshooting Tools

Troubleshooting tools are used to identify faulty FRUs. For this product, the following tools are described below:

- Card self-test
- Self-test failure and status LEDs
- Diagnostic software

Card Self-Test

The card's self-test is run whenever the HP-PB backplane is reset. The backplane can be reset in the following ways:

- Switching the computer's power on
- Booting the operating system
- On command through a program (such as a diagnostic program)

The self-test is destructive to data on the card, and requires exclusive lin link access. The self-test performs tests on the microprocessor, memory, registers, and other circuitry on the card. If the self-test completes successfully, the card will be initialized.

Self-test failures can occur from both "fatal" and "nonfatal" errors. Fatal errors (for example, the card is unable to perform direct memory access transactions with the host computer) are very serious, and communication with the card will be halted. Nonfatal errors will continue to allow communication with the card, such as from a diagnostic.

When self-test executes, the self-test LED is turned on. If self-test passes, the self-test LED is turned off and the "Passed" LED is turned on. If self-test fails, the self-test LED will remain on. For additional LED information, refer to the paragraphs below.

Self-Test Failure and Status LEDs

Self-Test Failure LED

The self-test LED will turn on during the card's self-test, and will subsequently turn off if self-test passes. A fault with the card exists if:

- During self-test, the LED *never turns on*, or
- The LED *turns on and remains on* at any time.

Note

Faulty EEPROMs may result in a soft error that will turn on the self-test LED. However, if a firmware update has never occurred, the EEPROMs are blank (without code). In this case, a faulty EEPROM will not prevent proper operations of the card. If an update has occurred, the card may be usable, however, it should be replaced as soon as possible.

Status LEDs

After successful self-test. the card is initialized and begins operations. The status LEDs provide the indicators shown in Table 11b-6.

Table 11b-6. Interpreting Status LEDs

LED	Normal Operation	Detects Failure
Config LED (yellow)	OFF	When ON. it indicates: ■ There is an incompatible HP-FL configuration with the remote device ■ The remote device is not supported ■ A single-fiber loopback cable is attached (connecting the card's "transmit" port to its "receive" port).
Signal LED (yellow)	OFF	When ON. it indicates: ■ The card is having difficulty extracting data from the received signal. ■ The intensity of the light is an indication of the quality of the incoming signal—with total absence of a signal. the LED will display at full intensity.
Remote LED (yellow)	OFF	When ON. it indicates: ■ The remote device fails to respond to periodic requests for identification (as required by the HP-FL protocol).
Passed LED (green)	Blinking (indicates it is awaiting configuration by the host computer) or ON (indicates the card is operational)	When OFF. it indicates: ■ Unable to initiate or complete transactions to/from the host. ■ Link Data Parity Errors received—data is corrupt.
Activity LED (green)	OFF	When ON. it indicates: ■ A message has been transmitted onto the fiber-optic link. or ■ The periodic identification request required by the HP-FL protocol is transmitted.

Interpreting LED Patterns

Table 11b-7 and Table 11b-8 list LED patterns and their interpretation.

Table 11b-7. Self-Test Status

LED Status						Condition	Action
Self-test Fail	Config	Signal	Remote	Passed	Activity		
off	x	x	x	on	x	Self-test passed	None
off	x	x	x	blinking	x	Self-test passed. host has not initialized the card	If this continues after system boot up. the card should be replaced.
on	x	x	x	off	x	Self-test failed - hardware failure	Replace card
on	x	x	x	on	x	Self-test failed - hardware failure	Replace card
off	x	x	x	off	x	Self-test failed - hardware failure	Replace card

Table 11b-8. Operational Status

LED Status						Condition	Action
Self-test Fail	Config	Signal	Remote	Passed	Activity		
off	off	off	off	on	blinking*	Normal operation	None
off	off	on	off	on	x	Not receiving any signal/light at the receive port	Perform loopback test & check cable
off	off	blinking	off	on	x	Excessive number of errors was detected	Perform loopback test & check connections
off	off	off	on	on	x	Remote device not responding	Perform loop back test & check peripheral
off	on	off	off	on	x	Configuration error	Check system configuration

*The Activity LED should blink at least once every 60 seconds.

If any other LED condition exists. replace the card.

11c

HP-IB Interface Cards

Introduction

This chapter provides information about the HP-IB interface cards available for the 99x/890/T500 systems. The information provided in this chapter includes:

- Description
- Configuration
- Troubleshooting
- Field Replaceable Units

Description

This chapter covers the following products:

- **HP 28650B HP-PB HP-IB Adapter Card** (for HP 9000 CS 890 and CS T500 servers).
- **PBA-IB Adapter Card** (a combination of the HP 27113A CIO HP-IB card and an HP-PB/CIO (Channelspan) adapter for HP 3000 CS 990/992 and 991/995 systems).

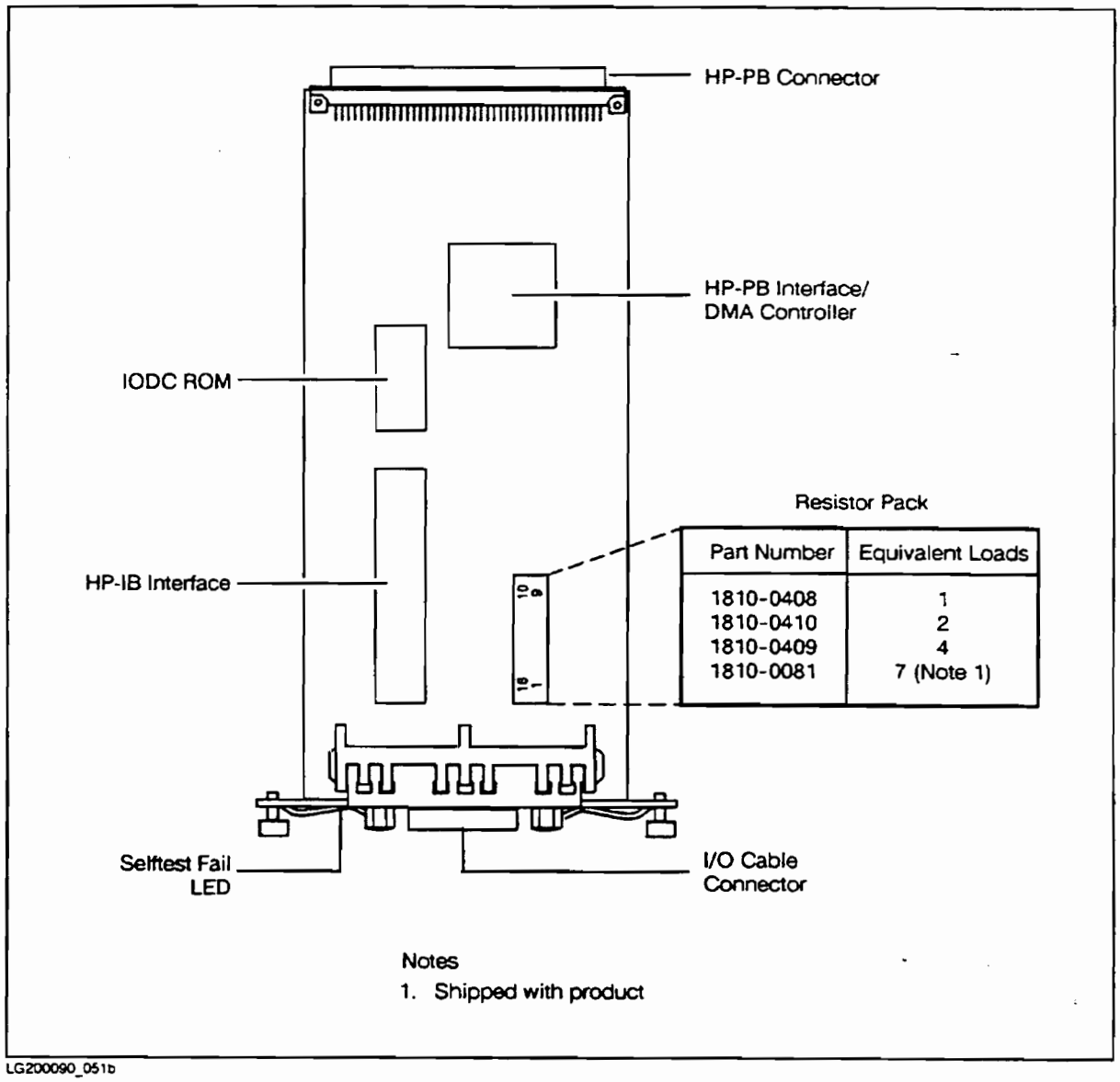
HP-PB HP-IB Card (890/T500 Only)

The HP-IB card for HP 9000 CS 890/T500 servers is the HP 28650B HP-PB HP-IB Device Adapter Card (hereafter referred to as the "HP-PB HP-IB card"). The HP 28650B is a single-high card that connects directly to the HP-PB backplane (see Figure 11c-1).

PBA-IB Card (99x Only)

The HP-IB card on the HP 3000 99x (HP 27113A) is actually a CIO card, thus it is the only card supported on the 99x systems which is not a Precision Bus (PB) card. In order to support this CIO HP-IB card on the Precision Bus, a Precision Bus Adapter (PBA; also known as the Channelspan card) is used to create the PBA-IB device adapter card. The PBA-IB device adapter card is the combination of the HP-IB interface card plugged into the PBA to comprise one double-high card that can be connected directly to the HP-PB backplane (see Figure 11c-2). Only one CIO HP-IB card can be connected to each PBA.

In this chapter, the term "PBA-IB card" is used to refer to the HP-IB card/PBA adapter combination.



LG200090_051b

Figure 11c-1. HP-PB HP-IB Device Adapter Card (HP 28650B)

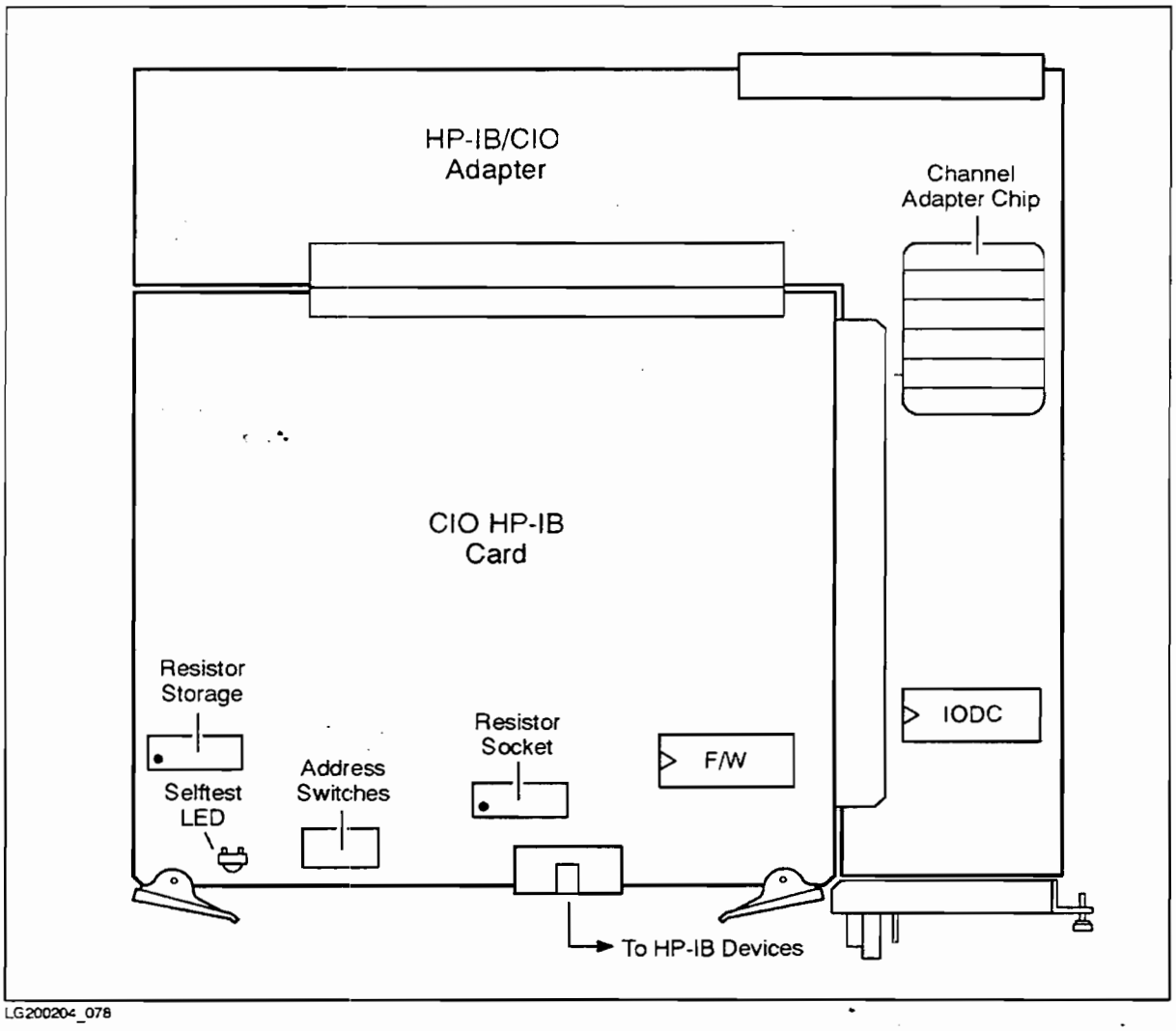


Figure 11c-2.
PBA-IB Device Adapter Card (HP 27113A CIO HP-IB Card and HP-PB/CIO Adapter)

Configuration

Card Configurations and Switch Settings

HP-PB HP-IB Card

The HP 28650B HP-PB HP-IB card (see Figure 11c-1 has no manual switches. and comes preloaded with seven resistive loads for high speed operation. The table labeled "Resistor Pack" in Figure 11c-1 identifies additional resistor packs.

PBA-IB Card

The HP 27113A card in the PBA-IB adapter has onboard configuration (address) switches. These address switches are not used by the SPU: the address and priority of the HP-IB are set by the slot position in the SPU. Each HP 27113A card contains eight switches in a DIP package (see Table 11c-1).

Table 11c-1. HP 27113A CIO HP-IB Card Switch Settings

Switch	Function	Settings
S8	No Listener Detection	Down - Disabled
S7	Data Settling Time Selection	UP - Medium/slow speed
		DOWN - High speed
S6	System Controller Selection	UP - System controller
		DOWN - Not system controller
S1-S5	HP-IB Address Selection (NOT USED)	Doesn't matter

Recommended Switch Settings:

```
 S1   S2   S3   S4   S5   S6   S7    S8
DOWN   X    X    X    X   UP DOWN DOWN

      X = either setting ok
     UP = relative to component side
```

Note

Ensure the resistor pack on the HP 27113A card is installed at location U123 (HP part number 1810-0081).

HP-IB Configuration Rules

General Guidelines

- HP-IB switch boxes are not supported.
- Use a daisy chain configuration for all devices.
- All devices must have a unique address between 0 and 7.
- All cable connections should occur at the device, that is, no cables should be connected together simply to extend the effective length of the cable.
- All cables should be attached to a device at both ends.
- All devices must be connected to a common (single point) system reference ground. The system ground must be isolated from other electrical devices such as copy machines, arc welders, and air conditioners.
- Power on all devices and make sure they complete their self-tests before powering on the SPU.
- Keep all devices powered on during and after system boot-up.
- Mixing disks on the same device adapter with printers and tape drives is not recommended for performance reasons.
- (*HP 3000 CS 99x only*) A mixture of disks, tapes, and printers may be attached to an HP-IB Device Adapter as long as the firmware date code is 2912 or greater.

Load Factors

Two load factors must be considered when calculating the cabling parameters of the HP-IB:

1. **Internal Load Factor.** The internal load factor of the Device adapter is seven loads.
2. **External Load Factor.** The external load factor of the peripherals is dependent upon the individual peripherals and interconnect cables. (Refer to *HP 3000 Computer Systems Configuration Guide*, HP part number 5954-9354, Appendix 1 for peripheral load values.) A basic rule for determining load values is one electrical load is equivalent to one meter length of HP-IB cable.

HP-IB Cable Length

The maximum total length of HP-IB cable that can be connected to a device adapter is 15 meters. When embedded and external peripherals are being used in the system, the HP-IB cables lengths for both must be calculated together. When testing a configuration, use the following rules:

1. No more than six HP-IB devices per HP-IB Device Adapter.
2. Maximum of 15 device loads (internal + external).
3. Maximum HP-IB cable length must not exceed one meter per device load (maximum = 15 meters).

Troubleshooting

Checking Cables and Addresses

For proper operation of the HP-PB HP-IB and PBA-IB device adapter cards, each peripheral device attached to the HP-IB must operate correctly, and the cables between them must be connected properly. If either of these is a problem, including the maximum length of cable per bus, correct the situation.

Use a backing plate (p/n 30070-00043) when extending short cables. If the cables show signs of excessive wear, replace them. Check for dirty connectors and broken wiring.

Each device on the bus (including the HP-IB device adapter) has a unique address. The device adapter address is set by software (30Db unless you have changed it). If two devices have the same address, the bus cannot function. Change any conflicting addresses, and reset the system.

Online Diagnostic System

If the HP-IB still fails, running HPIBDAD in the online diagnostic system is the next action. Instructions for running the program are beyond the scope of this manual. See the online SPU and device I/O diagnostics manuals for details. If any of the report screens shows a failure, replace the HP-IB adapter.

For quick reference and help in using the HPIBDAD diagnostic, use section 1, "More Help." However, for initial verification, run only sections 2, 3, and 5.

Briefly, to run the HPIBDAD diagnostic, follow these steps:

1. At the system prompt, type:

```
/usr/diag/bin/sysdiag
```

2. At the DUI n> prompt, type:

```
run hpibdad pdev(slot*4)sect=2,3,5
```

- Slot*4 is the physical device identifier. This integer equals four times the physical slot number.
- Section 2 resets the device adapter to clear all registers.
- Section 3 returns the identity of the device adapter and the software driver.
- Section 5 runs an extended hardware test.

When these test sections run, they return the results to the screen. If any FAIL messages display, replace the HP-IB adapter.

Check Other Hardware

Run the self-test or other diagnostic for each device on the bus. If an HP device fails, check for warranty or service agreements and repair or replace it. If another vendor supplied the peripheral, contact the supplier.

Field Replaceable Units

Table 11c-2 lists HP part numbers for exchange assemblies.

Table 11c-2. Exchange Assemblies for the HP-IB Cards

Description	New Assembly HP Part Number	Exchange Assembly HP Part Number
HP 28650B HP-PB HP-IB adapter card (HP-UX)	28650-60101	28650-69101
HP 27113A CIO HP-IB adapter card (MPE/iX)	27113-60301	27113-69301

Changing the Resistor Pack

The resistor pack (p/n 1810-0081) shipped with the HP-IB product simulates seven loads. Some applications may require changing the pack to allow attachments of more devices to the bus. Table 11c-3 lists the other resistor packs available with their equivalent loads. Contact the HP Sales and Support Office to order.

Table 11c-3. Equivalent Load Resistor Pack Part Numbers

Part Number	Equivalent Loads
1810-0408	1
1810-0410	2
1810-0409	4
1810-0081	7 (default)

To locate the resistor pack, hold the adapter with the component side up, and the extractor levers facing you. Immediately beyond the faceplate, near the center of the adapter, there is a socket holding an eighteen-pin chip with pins 1, 9, 10, and 18 numbered; this is the resistor pack. (see Figure 11c-1 and Figure 11c-2 for the location of the resistor pack).

Resistor Pack and IODC Removal Procedures

1. Remove the adapter from the host computer.
2. Use a "chip extractor" or similar tool to gently pry and remove each component from its socket.

Caution Excessive prying and pressure can damage the component or its socket. Use care during removal.

Resistor Pack and IODC Installation Procedures

1. Identify the proper socket location for the replacement component.
2. Orient the chip with the socket on the adapter.

3. Ensure that the component's contact pins are aligned with the socket's receptacles. You may need to adjust the pins (bow them inward or outward) for proper alignment.
4. Gently press the component into place to properly seat the pins.

Caution

If pressure is not uniformly applied, the pins on one side or the other may buckle and collapse without making proper electrical contact. If this happens, remove the component, straighten the pins, and try again. If damage was extensive, you may need a new component.

Field Replaceable Parts

Table 11c-4 and Table 11c-5 list field replaceable parts (other than exchange assemblies) for the HP-IB cards.

Table 11c-4. Field Replaceable Parts for the HP 28650B

Description	HP Part Number
HP-IB cable	5181-6128
HP 28650B HP-PB HP-IB Installation and Service Guide	28650-90101
Firmware ROM (IODC)	28650-81006 (see **Note**)

Note

The firmware ROM part number is subject to change as HP makes improvements. Be sure to review all Service Notes which may pertain to the system product and its associated PCAs before changing any PCA components.

Table 11c-5.
Field Replaceable Parts for the PBA-IB Card (HP 27113A/PBA Adapter)

Description	HP Part Number
HP-IB cable	5181-6128
PBA CIO/HP-PB adapter	A1809-60095

11d

Console/LAN Card

Introduction

The **HP 28639A Console/LAN card** is a double-high card that occupies slots 10 and 11 of the internal HP-PB I/O card cage in the SPU cabinet. Only one Console/LAN card is supported on each 99x system or 890/T500 server.

Description

Figure 11d-1 shows the front plate of Console/LAN card. A top view of the Console/LAN card is shown in Figure 11d-2.

The following connectors are provided on the Console/LAN card (see Figure 11d-1 and Figure 11d-2):

- A 6-pin circular connector for connections to the local console device.
- A 25-pin D-connector for connections to a modem (for remote console operation).
- A 15-pin connector for Close Console, SP-data, and SP-control connections to the Service Processor (SP) card.
- A standard AUI connector for connections to an external MAU on an 802.3 ThickLAN or Twisted-Pair network.
- A BNC connector for direct connections to an 802.3 ThinLAN network.

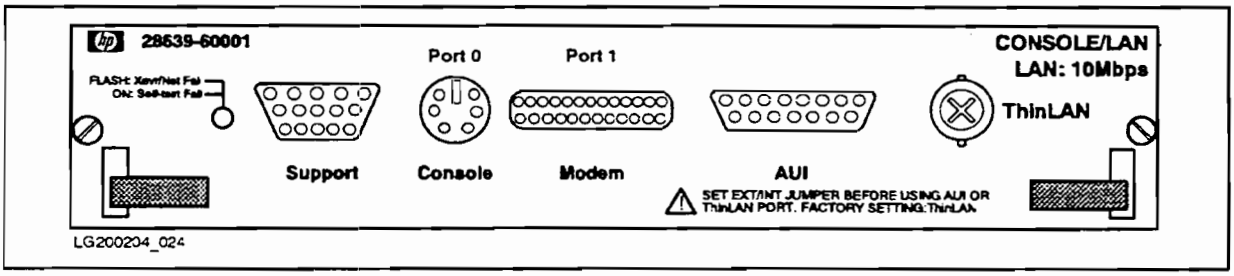


Figure 11d-1. Front Plate of the Console/LAN Card

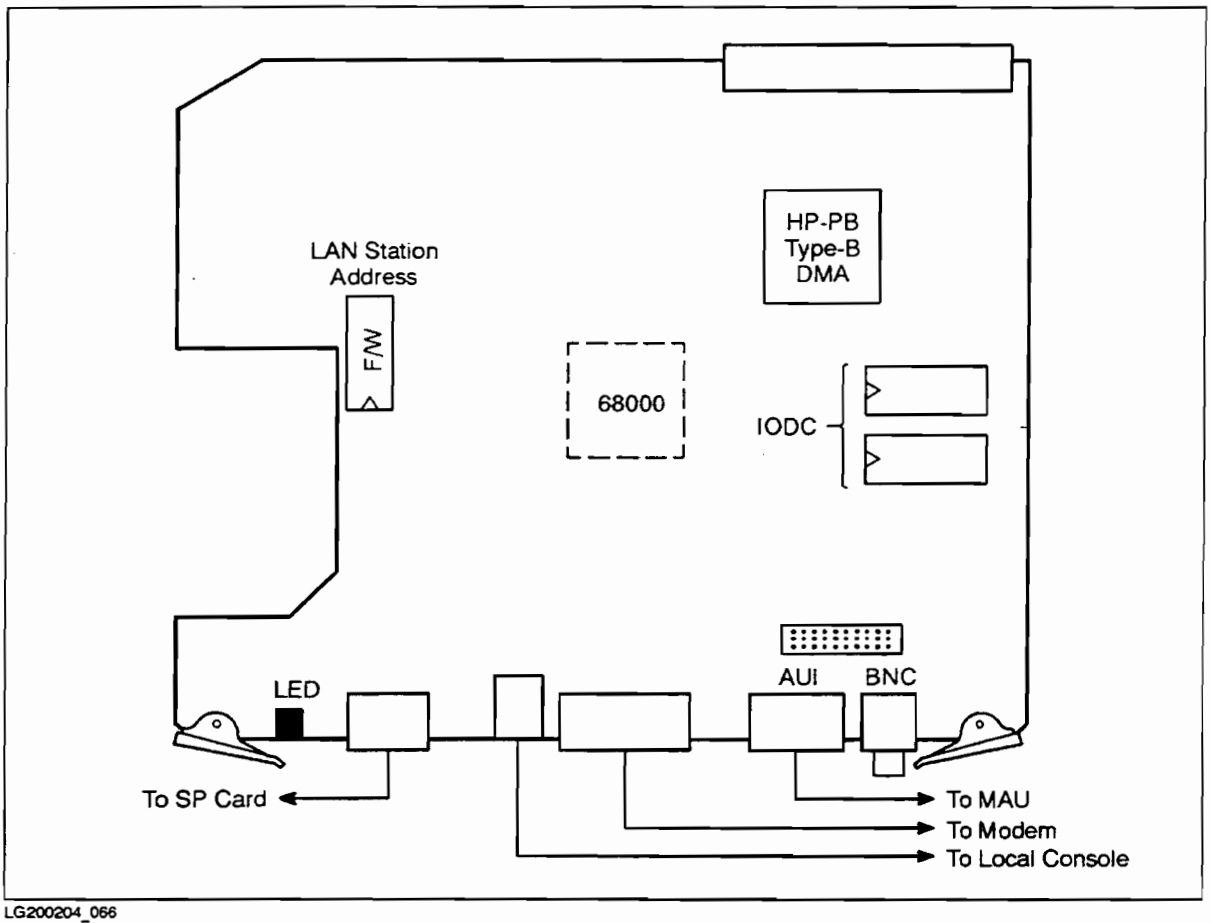


Figure 11d-2. Top View of Console/LAN Card

LED Indicator

The Console/LAN card has a single (amber-colored) LED indicator to communicate the following error conditions (see Figure 11d-2 and Figure 11d-1).

- **LED Off:** Self-test passed
- **LED On:** Self-test failed
- **LED Flashing:** Transceiver/Net fault

Installation

Refer to the *HP 3000 CS 99x and HP 9000 CS 890/T500 Installation Guide* (HP P/N A1809-90001) for detailed information about installing the Console/LAN card.

Console/LAN Connections (Internal SPU Cabinet)

The Console/LAN card is a double-high card that occupies slots 10 and 11 of the internal HP-PB I/O card cage in the SPU cabinet. The Console/LAN card is connected to other parts of the system via the following connections:

1. **Support** connector to the Service Processor (SP) card.
2. **Console** connector to the console device (700/96 terminal or OpenView PC).
3. **Modem** connector to the remote support modem.
4. **AUI** or **ThinLAN** connector to a LAN.

Refer to Figure 11d-3 to perform the detailed procedures that follow.

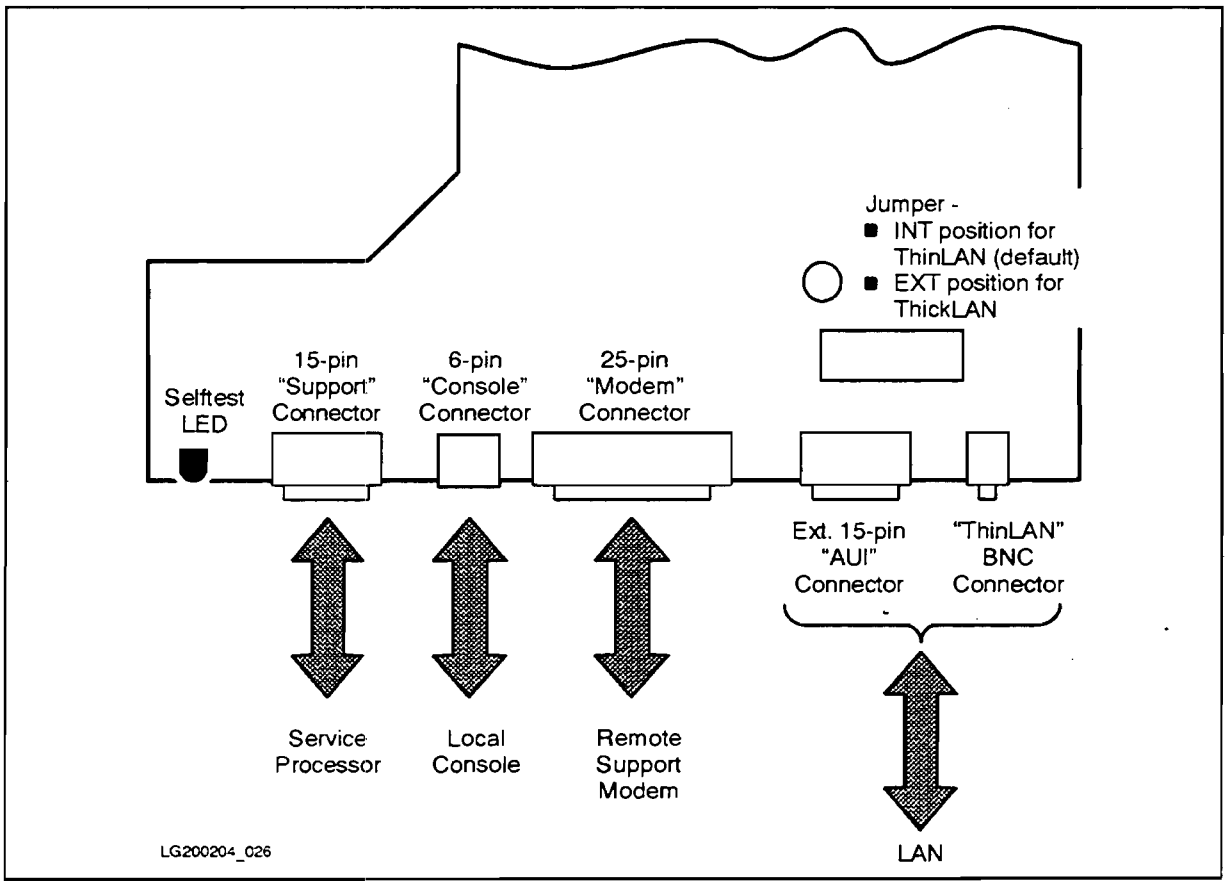


Figure 11d-3. Console/LAN Card Connections

Connecting the SP Card

The connector labeled **Support** is connected to the Service Processor (SP) card in the front PMB cardcage. This connection is normally made at the factory.

Connecting the Local Console

The connector labeled **Console** is connected to the console device. Different models have different consoles:

- A 700/96 terminal on CS 99x CX systems. and CS 890/CS T500 servers.
- An OpenView console PC on CS 99x DX systems only.

To connect the console:

1. Locate the system console cable (PN A1703-63003).
2. Connect one end to the round connector labeled "Console" on the Console/LAN card.
3. Connect the other end to the console:
   a. On the 700/96 terminal. to the connector marked **DATACOMM.**
   b. On the OpenView PC. to the RS-232 serial port on the rear. The serial port is a 25-pin connector on a card in the expansion slots (see Figure 11d-4).

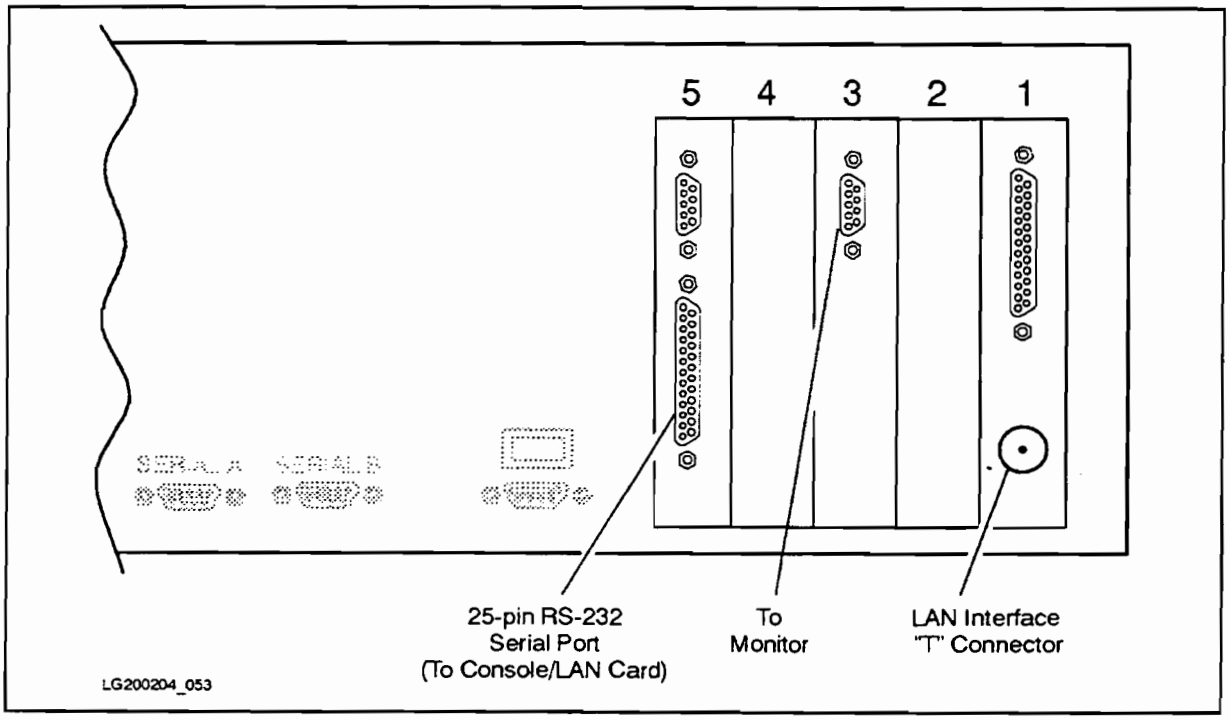


Figure 11d-4. Connectors on the Rear of the OpenView PC Console (CS 99x DX Only)

Note

When installing the OpenView console. plug the cable from the monitor into the card in slot 3 in the rear of the Vectra.

Connecting the Remote Support Modem

To connect the remote support modem (recommended model is HP50759A):

1. Perform the installation and verification procedures outlined in the documentation supplied with the modem. Refer also to Chapter 4 in this handbook for more configuration information.
2. Connect a 92219Q cable between the support modem and the connector labeled "Modem" on the console/LAN card.

Connecting to a LAN

The console/LAN card can be connected to ThinLAN or a ThickLAN (AUI). Procedures for a ThinLAN and for a ThickLAN follow:

ThinLAN

To connect a ThinLAN:

1. Verify that the jumper on the console/LAN card is set to the INT side (refer to Figure 11d-3). This is the default setting. INT stands for internal transceiver (MAU).
2. Assemble a BNC T connector (PN 92227N), with a LAN terminator (PN 92227P) on one end, and a LAN cable (PN 92227B) on the other end.
3. Connect the BNC T assembly to the **ThinLAN** connector on the console/LAN card, and cover it with a fabric anti-static cover.
4. For CS 99x CX systems, and CS 890/CS T500 servers (Figure 11d-5):
   a. Connect another BNC T connector to the connector labeled **LAN interface** on the back of the DTC.
   b. Connect the cable from the console/LAN card to the BNC T connector on the DTC.

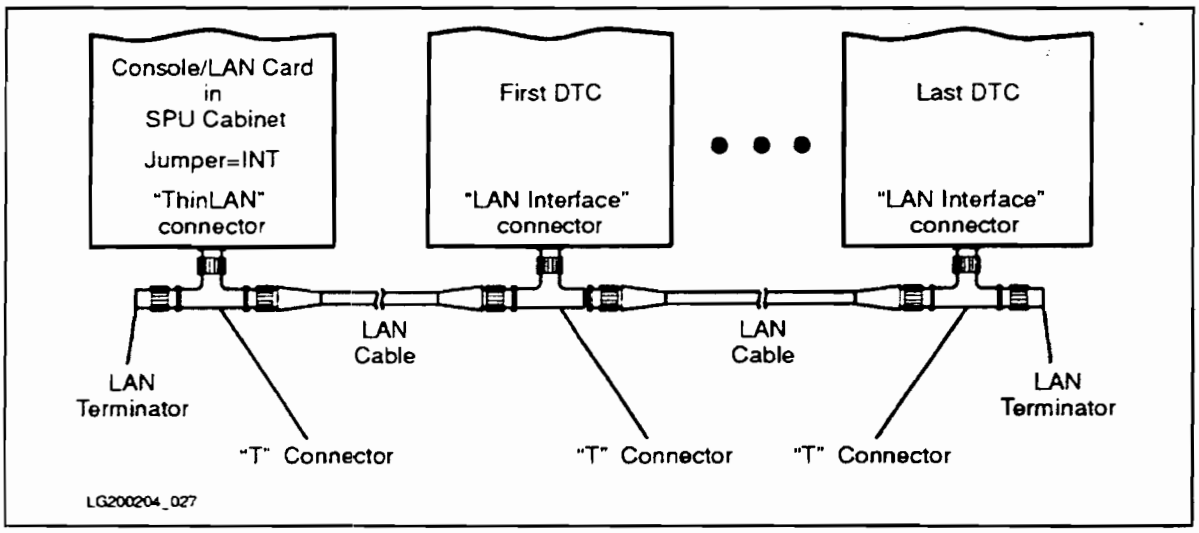


Figure 11d-5. Connecting LAN/Console Card to DTCs (CS 99x CX and CS 890/CS T500)

5. For 990/992 DX systems (Figure 11d-6):
   a. Connect another BNC T connector to the LAN connector on the back of the OpenView PC.
   b. Connect the cable from the console/LAN card to the BNC T connector on the OpenView PC.

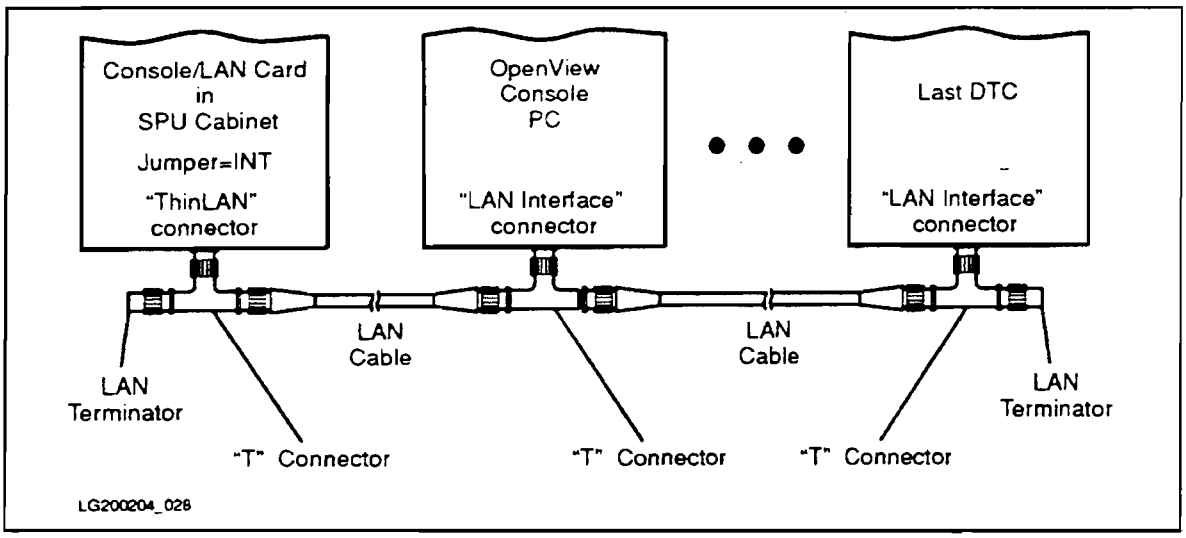


Figure 11d-6. Connecting LAN/Console Card to OpenView PC and DTCs (CS 99x DX)

6. If there is another DTC, connect a LAN cable from the other end of the BNC T-connector to the next DTC.
7. On the last DTC installed, connect a LAN terminator to the remaining side of the BNC T connector assembly.
8. Cover all the BNC T connector assemblies with the fabric anti-static cover that came with the T connectors.

ThickLAN

To connect a ThickLAN (AUI):

1. Set the jumper on the console/LAN card to the EXT side (refer to Figure 11d-3). EXT stands for external transceiver (MAU).
2. Connect ThickLAN cable to AUI port.

Caution When setting the jumper, be careful not to bend the jumper pins.

Exchange Assemblies

The Console/LAN card may be replaced under the HP board exchange program. Part numbers are listed in Table 11d-1.

Table 11d-1. Console/LAN Card Exchange Assembly Part Numbers

Description	New Assembly Part Number	Exchange Assembly Part Number
Console/LAN Card	28639-60001	28639-69001

11e

LAN Card

Introduction

This chapter contains reference information for the **HP 28640A Local Area Network (LAN) Adapter Card** used in the 990/992 and Model 890 systems. The LAN adapter card connect the CS 99x or CS 890/CS T500 host computer to a Local Area Network. and, with appropriate network software. makes the host a node on the LAN. able to access and communicate with other nodes.

Description

The HP 28640A 802.3 LAN adapter card is used in the HP 3000 CS 99x systems and HP 9000 CS 890/CS T500 servers under the following product numbers:

- The **HP 36923A, Option 002 802.3 LAN Adapter Card** is the HP 28640A LAN card supported on HP 3000 CS 99x systems.
- The **J2146A 802.3 LAN Adapter Card** is the HP 28640A LAN card supported on HP 9000 CS 890 and CS T500 servers.

Note

In this chapter, all references to the LAN card will be to the "HP 28640A LAN card." Unless otherwise noted by a specific system or product number reference. all information in this chapter applies to any HP 28640A LAN card used in either the HP 3000 CS 99x systems, or HP 9000 CS 890 and CS T500 servers.

For additional information about the HP 28640A LAN card. refer to the following manuals:

- *HP-PB LAN Adapter Installation and Service Manual* (HP P/N 28640-90001).
- *HP-PB LAN Adapter Installation Quick Start Guide* (HP P/N 28640-90006).

LAN Adapter Card Features

The HP 28640A LAN adapter card is a single-high card that connects directly to the HP-PB backplane. The LAN adapter card has the following features:

- Two built-in connectors:
  - a 15-pin AUI connector for attachment to an external transceiver.
  - a BNC connector for the internal ThinLAN transceiver.
- Self-test LED indicator.
- Operational compatibility with IEEE 802.3 specifications.

Setting the Port Selection Jumper

There is a jumper on the LAN adapter card for selecting which port (BNC or AUI) will be used to connect the adapter card to the local area network (see Figure 11e-1).

To use the BNC port: set the jumper to the **INT** side (INT meaning internal transceiver or MAU). This is the default jumper position. as shown in Figure 11e-1.

To use the AUI port: set the jumper to the **EXT** side (EXT meaning eternal transceiver or MAU).

Caution Be careful not to bend the jumper pins.

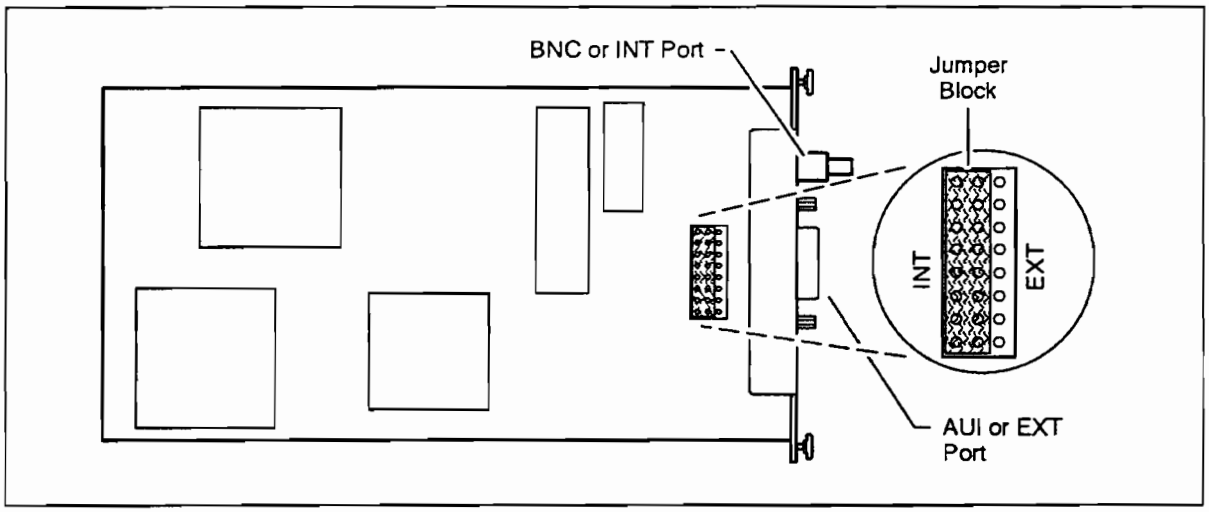


Figure 11e-1. Top View of the LAN Card

Configuring the LAN Adapter Card into the System

For HP 3000 CS 99x (MPE/iX) systems: If the LAN adapter card is not already configured into the system. you must use the SYSGEN utility to add a path for the card.

For HP 9000 CS 890/CS T500 (HP-UX) servers: The LAN adapter card should auto-configure into the system (when the operating system reboots, it will detect that the LAN adapter card has been installed). For more information about configuring HP-UX systems. refer to the *HP 9000 Series 600/800 Computer Systems Administration Tasks* manual (HP P/N B2437-90006), or the *Installing Peripherals* manual (HP P/N B2437-90005).

Note Be sure to record the station address of the LAN adapter card if it is newly installed.

Connecting the LAN Adapter Card to the Network

Two types of connection to a local area network are possible:

- Use the BNC (ThinLAN) port for connecting directly to a thin coaxial network cable.
- Use the AUI (Attachment Unit Interface) port for connecting an external transceiver to a twisted-pair, fiber-optic, or thick coaxial cable.

Caution Use only one of the ports (BNC or AUI) at a time. Damage may occur to the LAN adapter card if the jumper is not properly configured.

ThinLAN (BNC) Port Connection

To attach the LAN adapter card to a ThinLAN cable:

1. Connect a ThinLAN cable section to one side of a BNC "T" connector.
2. Connect another ThinLAN cable section or a 50-ohm terminator to the other side of the "T" connector (see Figure 11e-2).
3. Connect the "T" connector to the BNC port on the LAN adapter card.
4. Use a BNC "T" connector cover (HP P/N 1252-1650) to cover the "T" connector. This cover prevents possible inadvertent grounding (see Figure 11e-3).

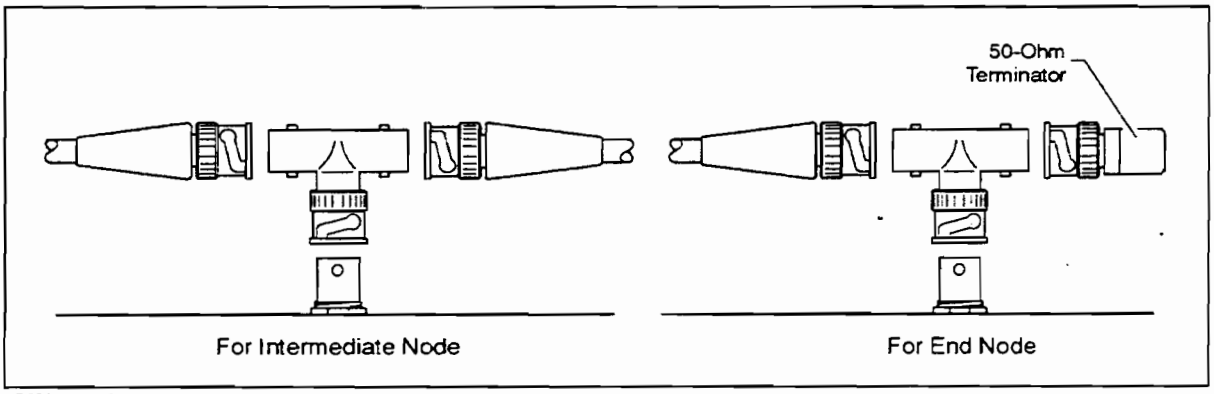


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Figure 11e-2. BNC Port Connection

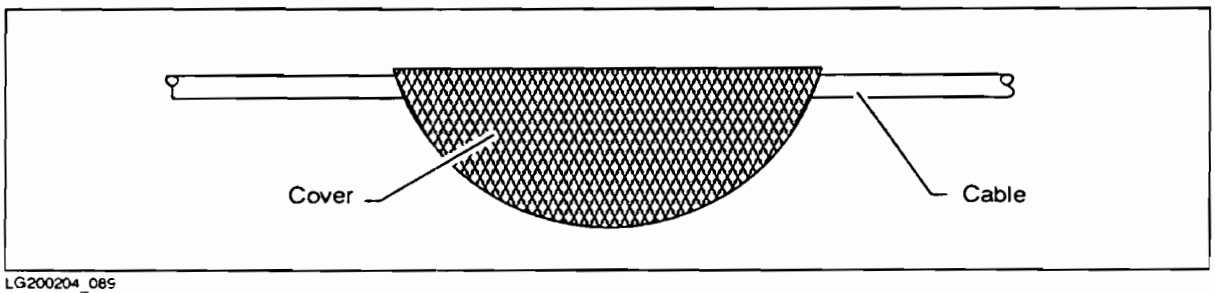

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Figure 11e-3. BCN "T" Connector Cover

AUI Port Connection

To attach the LAN adapter card to an AUI cable or transceiver:

1. Slide an AUI retainer (HP P/N 5062-3351) onto the AUI connector of an AUI cable or transceiver (see Figure 11e-4). (An AUI retainer should have been supplied with the LAN adapter card.)
2. Plug the AUI cable or transceiver into the AUI port on the LAN adapter card.
3. Secure the retainer and connector to the AUI port with the attached screws.

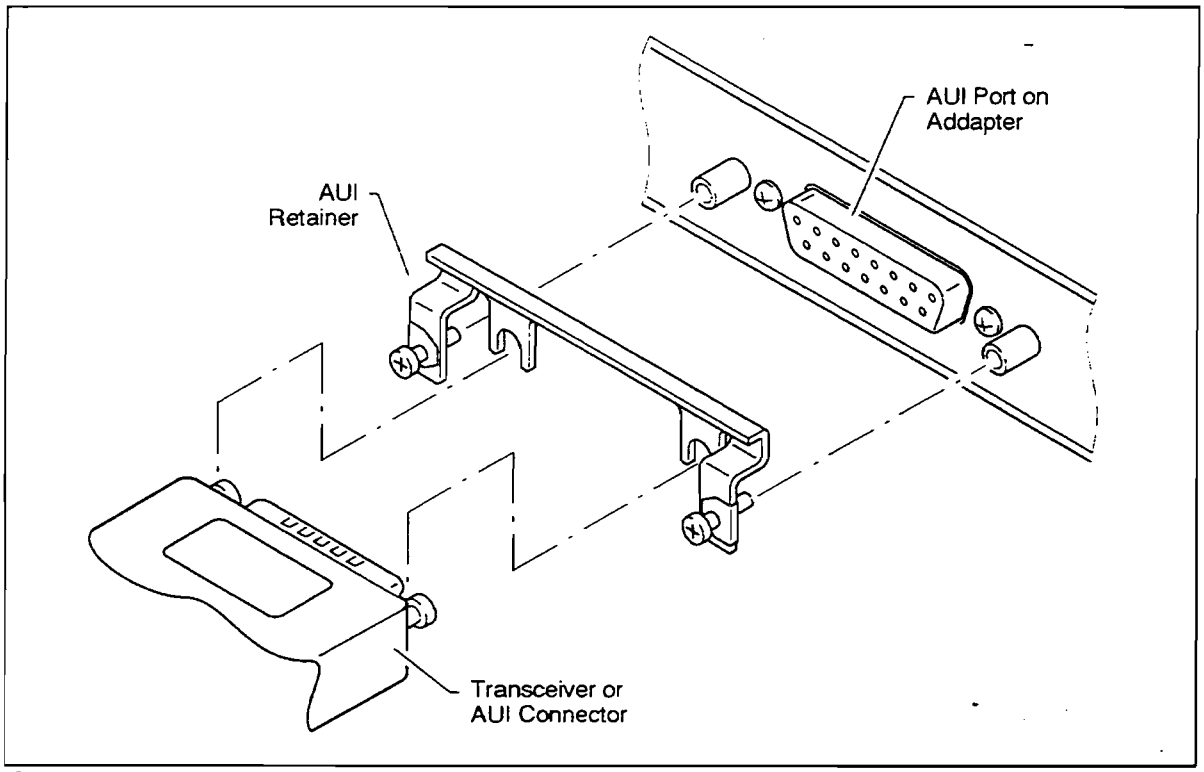

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Figure 11e-4. AUI Port Connection

Verify Operation

After installation and system power-on, verify operation of the LAN adapter card by checking the self-test LED. Switching on power to the system or rebooting the system will start the LAN adapter card self-test.

- After the boot-up process is complete, the self-test LED should remain OFF (see note below).
- If the LED stays on or never comes on, there is a problem with the LAN adapter card, and it should be replaced.
- If the LED continues blinking, there is a problem in the network (for example, a loose connection). The LED will continue to blink after the fault is corrected until one of the following conditions is met:
  - the adapter successfully transmits a packet.
  - an external loopback test is run.
  - a self-test is run.

Computer Museum

Note The system may cause several self-tests on the LAN adapter card during the boot-up process. This causes the LED to turn on and off several times.

Troubleshooting

This section provides service information for the HP 28640A LAN adapter card.

Troubleshooting Tools

The following troubleshooting tools are available for the LAN adapter card:

- Self-test LED
- Troubleshooting checklist (refer to Table 11e-1).

Self-Test LED

A self-test failure is indicated when the LAN adapter card's self-test LED is on continuously. If this occurs, the LAN adapter card should be replaced.

Note Some failures of the computer system (the SPU) can also result in the LED staying on. Before replacing the LAN adapter card, verify that the SPU is working properly.

Troubleshooting Checklist

Use the checklist in Table 11e-1 to troubleshoot problems indicated by the self-test LED.

Table 11e-1. Troubleshooting Checklist for the LAN Adapter Card

LED State	Check List Item	Explanation
On	Is the adapter card firmly seated?	Ensure that the adapter card is completely engaged.
	Is the external transceiver power fuse good?	Check the external transceiver power fuse to make sure it is seated properly and is functional.
Blinking	Are all cables and connectors properly fastened?	Marginal connections can cause improper operation. Check all cable connections.
	Is the LAN cable terminated?	Coaxial cable LANs must be terminated with 50-ohm terminators.
	If external transceiver is connected, is it operational?	Check external transceiver for proper operation. Check connections to the AUI connector and the network.
	Is external transceiver configured for heartbeat (SQE)?	If the external transceiver has a heartbeat enable switch, make sure it is set to the ON position.
	Have the cables been changed from one port to the other?	If you have changed ports (for example, AUI to BNC), you must move the port selection jumper to the proper setting (refer to *Setting the Port Selection Jumper* in this chapter).
Off	Is the software configuration correct?	The inability to communicate may be due to software configuration errors.

Field Replaceable Units (FRUs)

Exchange Assemblies

The HP 28640A LAN adapter card may be replaced under the HP board exchange program. The LAN adapter card part numbers are listed in Table 11e-2.

Table 11e-2. Exchange Assembly Part Numbers for the LAN Adapter Card

Assembly	HP Part Number
New card assembly	28640-60001
Exchange card assembly	28640-69001

Other FRUs

Parts for the LAN adapter card that are authorized for field replacement are listed in Table 11e-3.

Table 11e-3. Field Replaceable Units for the LAN Adapter Card

Component	HP Part Number
125V, 2A, LF fuse (AUI or external transceiver fuse)	2110-0517
AUI retainer	5062-3351

Removal and Replacement Procedures

This section describes removal and replacement procedures for the following items:

- the LAN adapter card
- the 2A fuse for AUI transceiver power

Caution

The LAN adapter card contains electronic components that can be damaged by static electricity. To avoid damage, follow these guidelines:

- Store the LAN adapter card in a conductive plastic bag.
- If possible, work in a static-free area.
- Handle the LAN adapter card only by the edges. Do not touch electronic components or electrical traces. We strongly recommend that you use a grounding wrist strap that is connected to the metallic chassis of the system cabinet. If you do not have a wrist strap, touch the chassis before handling the card, and frequently thereafter to equalize any static charge.

Removal and Replacement of the LAN Adapter Card

To remove the LAN adapter card from the system:

1. Before removing the card, ensure that the operating system is shut down, and power to the computer systems is turned OFF. Refer to the "Powering Down" section in Chapter 1 of this manual for proper shutdown procedures to avoid corruption or loss of data.
2. Disconnect all cabling from the LAN adapter card.
3. Remove the LAN adapter card according to the procedures described in Chapter 9, *Removal and Replacement*.
4. Unscrew the two retaining screws, and pull the extractor levers out.
5. While holding the extractor levers, slide the LAN adapter card out of its slot.
6. Place the LAN adapter card in an antistatic bag.

To install a replacement LAN adapter card into the system:

1. Ensure that the operating system is shut down, and power to the computer systems is turned OFF.
2. Set the port selection jumper, as described earlier in this manual.
3. Install the LAN adapter card into the appropriate slot.
4. Power on the system.
5. Configure the LAN adapter card into the system (MPE/iX only).
6. Connect the LAN adapter card to the network.
7. Verify operation.

Note

The preceding installation procedure is intended only as a quick reference. Refer to the *HP-PB LAN Adapter Installation and Service Manual* (HP P/N 28640-90001) or *HP-PB LAN Adapter Installation Quick Start Guide* (HP P/N 28640-90006) for more detailed installation information about the LAN adapter card.

Removal and Replacement of the External Transceiver Fuse

Caution For proper protection, replace the external transceiver fuse only with a fuse of the same type and rating (125V, 2A, LF).

If the transceiver fuse blows, the AUI port will no longer supply power to the AUI transceiver. In this case, the fuse must be replaced, or the BNC port must be used.

Before replacing the fuse, identify the reason for the failure:

- Check for sources of short circuits.
- Check for proper mating of contact pins.
- Make sure that the cable is not shorted.

To remove the fuse:

1. Ensure that the operating system is shut down, and power to the computer systems is turned OFF.
2. Disconnect all cabling from the LAN adapter card.
3. Remove the LAN adapter card from the system.
4. Pull the fuse out of its socket, as shown in Figure 11e-5.
5. Verify that the fuse is open by testing it with a continuity tester.

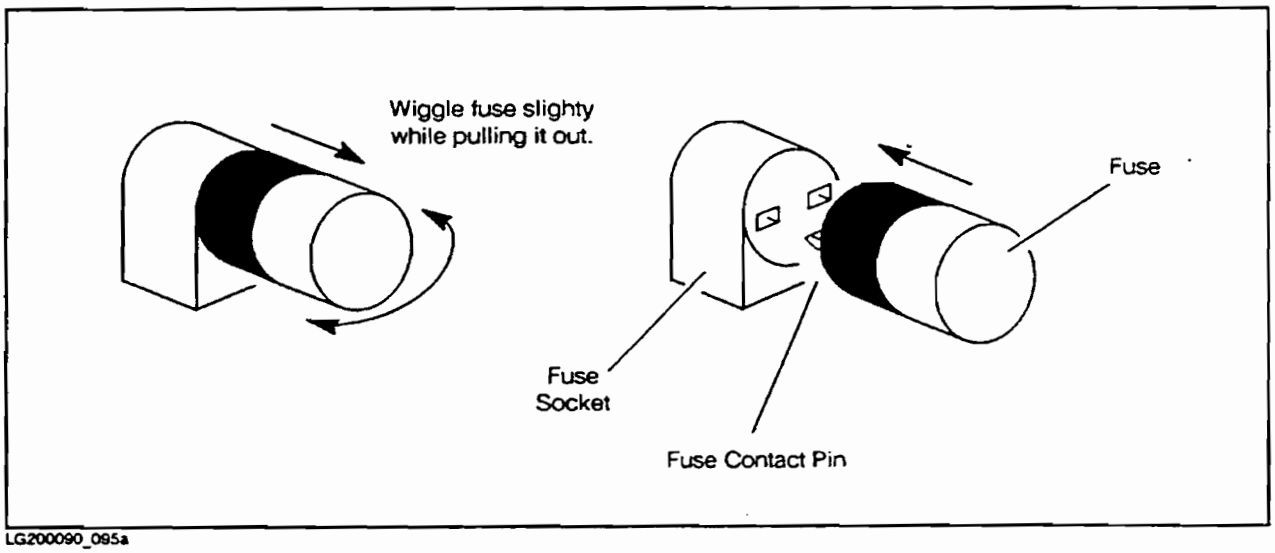

Figure 11e-5. Replacing the Transceiver Fuse

To replace the fuse:

1. Carefully align the two contact pins on the fuse with the socket holes.
2. Press the fuse in. The fuse has no polarity, so the pins can go into either socket hole.

11f

Token Ring Network Adapter Card

The **HP 28625A Token Ring Network Adapter** card provides the interface for connecting an HP-PB backplane to a Token Ring Local Area Network (LAN). The Token Ring adapter is a single-high card having one 9-pin D-type connector for attachment to the network. The Token Ring card is supported on both HP 3000 CS 99x systems. and HP 9000 CS 890/CS T500 servers.

Setting the Data Rate Selection Jumper

To select which data rate (4 or 16 megabits per second) is to be used, set the data rate selection jumper on the card (see Figure 11f-1):

- To use the 4-Mbits data rate, set the jumper to the 4 pins on the number 4 side.
- To use the 16-Mbits data rate. set the jumper to the 4 pins on the number 16 side.

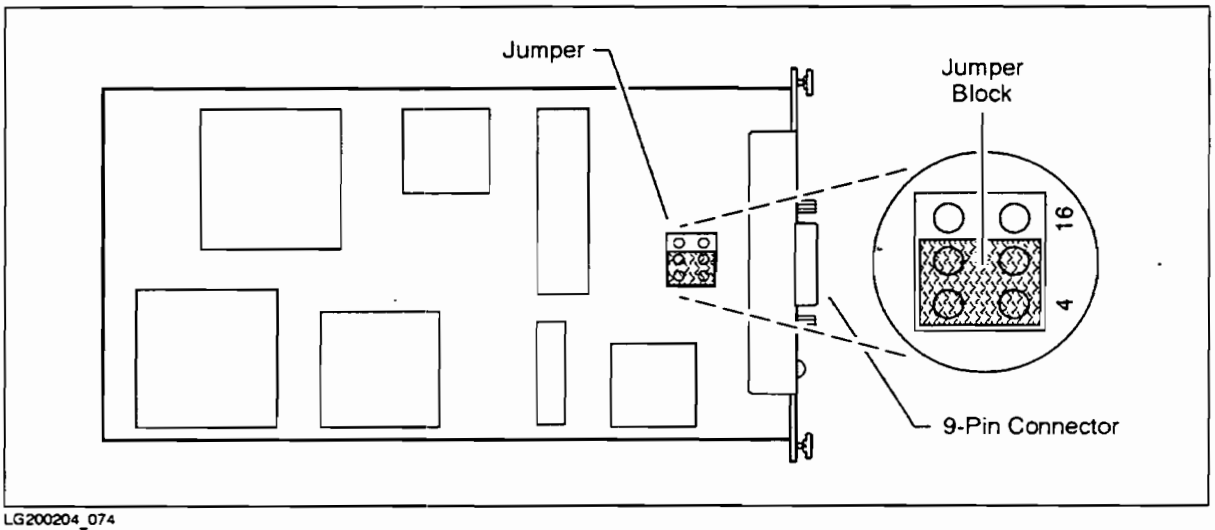

Figure 11f-1. HP-PB Token Ring Adapter Card

Caution *Be careful not to bend the jumper pins.* The default jumper position (shown in Figure 11f-1) enables the 4-Mbits data rate.

Note If the data rate of the adapter is different from the network. the adapter self-test will fail. and the adapter will not be able to insert into the ring.

Verify Operation

Verify proper operation of the Token Ring network adapter by checking the self-test LED. A self-test will be performed when the computer is switched on and the operating system is booting.

Check the self-test LED for the following conditions:

- The self-test LED turns on once power is supplied to the adapter or the adapter is reset. and it begins the self-test.
- The self-test LED should remain off after the system power-on boot-up process is complete.

Note

The system may perform several resets to the backplane during the normal boot-up process. This causes the adapter self-test to execute several times. and its LED to turn on and off several times.

- If the self-test LED never comes on or stays on after a normal boot-up process for longer than 15 seconds, then there is a problem with the adapter, and it should be replaced.
- If the self-test LED blinks continuously, there is a network error external to the adapter (for example, a loose connection). The LED will continue to blink after the fault is corrected. and until one of the following conditions is met:
  - The adapter successfully connects to the ring (which can take up to 30 seconds when two or more nodes are connected on the ring, and up to 50 seconds if this is the only node on the ring)
  - A reset self-test is run.

Once a fault condition has been corrected, the adapter will automatically connect to the ring. If you experience trouble, refer to the service information section for help.

When the adapter self-test succeeds, and the adapter has inserted in the ring, the node is ready for use on the ring network.

Exchange Assembly

The HP-PB Token Ring network adapter may be replaced under the HP board exchange program. Adapter part numbers are listed in Table 11f-1.

Table 11f-1.
Exchange Assembly Part Numbers for the HP 28625A Token Ring Card

Assembly	HP Part Number
New card assembly	28625-60001
Exchange card assembly	28625-69001

Troubleshooting

The following troubleshooting tools are available for troubleshooting the HP-PB Token Ring adapter card:

- Self-test LED
- Troubleshooting checklist (refer to Table 11f-2)

Self-Test LED

A self-test failure is indicated when the LED never comes on or is on continuously. If this happens, the adapter should be replaced (refer to Table 11f-2).

Note Some failures of the system processor unit (SPU) can also result in an LED failure indication (for example, a faulty system power supply). Before replacing the adapter, verify that the SPU is working correctly.

Table 11f-2. Troubleshooting Checklist

LED state	Possible cause	Solution
LED stays on	Adapter not firmly seated.	Ensure the adapter is completely engaged.
	Adapter failure.	Replace the adapter.
Blinking	All cables and connectors are not properly fastened.	Marginal connections can cause improper operation. Check all cable connections.
	Adapter configured for wrong speed.	Remove adapter and reset jumper for proper speed (refer to *Setting the Data Rate Selection Jumper* in this chapter).
	Duplicate station address configured.	Ensure correct software configuration. Refer to the *Installing and Administering Token Ring/9000 Software* manual (HP P/N J2165-61001) or the *NS3000/XL NMMGR Screen Reference Manual* (HP P/N 36922-61003).
Never comes on	Power is not available to the card cage.	Ensure system power has been switched on.
	Blown fuse.	Replace the adapter.

Note If the network appears to be down or is operating abnormally, be sure that the adapter data rate matches the ring data rate.

11g

Programmable Serial Interface (PSI) Card

Introduction

The HP Programmable Serial Interface (PSI) card connects an HP 3000 CS 99x system or HP 9000 CS 890/CS T500 server as a node in a Wide Area Network (WAN).

Description

The PSI card is a single-high card that plugs directly into the HP-PB backplane of the internal HP-PB I/O card cage in the 99x/890/T500 system. The PSI card has the following connectors:

- A 96-pin backplane connector mating with the HP-PB backplane.
- A 62-pin female frontplane connector on the card's face plate for connecting the telecommunications cable.

For more detailed information about the PSI card, refer to *HP Precision Bus Programmable Serial Interface Installation Manual* (HP P/N 28606-90001).

Cables Available

There are two separate telecommunications cables available for the PSI interface. Each one will accommodate a different type of transmission device (e.g., modem, etc.). Table 11g-1 lists the cables and their communications protocols, connectors (in addition to the connector for the card), and HP part numbers. Each cable is 5 meters long.

Table 11g-1. Cables Available for the HP-PB PSI Card

HP Part Number	Physical Protocol	Description	Connector(s)
28606-63003	CCITT V.35	5 meter, V.35 cable	34-pin male "M"
28606-63006	EIA RS-232C/V.28	5 meter, RS-232-C cable	25-pin male subminiature "D"

Identification

The printed circuit assembly (card) is identified by the part number "28606-60001" and the name "PSI" on the face plate (see Figure 11g-1), as well as by bar code and date code labels (e.g. a small white sticker labeled A-2949, for example) affixed to the card. If the HP-PB PSI card ever needs servicing, it will be helpful to supply the date code as well as the part number.

Start-Up Verification

Once the PSI card and telecommunications cable are installed, start up the system and verify that the card is working properly. First, do the following:

1. Connect the power and switch on the computer.
2. Boot the system.
3. Observe the LEDs on the face plate of the PSI card (see Figure 11g-1) to determine self-test status.

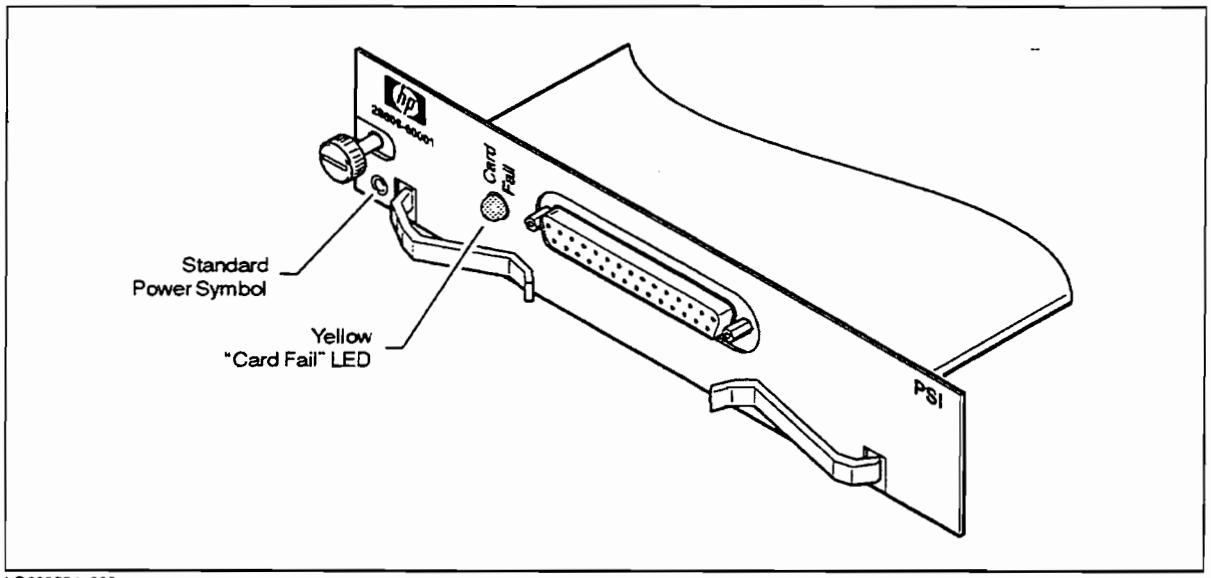

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Figure 11g-1. LED Status Indicators on the HP-PB PSI Card

Self-Test Passed

If the HP-PB PSI hardware passes the self-test, the yellow LED will light while the test is in progress (approximately 5 seconds) and then will go out. This means the hardware is functional, and you can now turn to the link product software installation manual to install the software on this node.

Self-Test Failed

If the hardware fails the self-test, the LED will remain lit after completion of the test (more than 5 seconds). This means the PSI card must be replaced.

Troubleshooting

This section describes procedures for troubleshooting the PSI hardware to isolate the failing FRU. however. software or network test procedures are not provided. If you need to troubleshoot the product in general. refer to the troubleshooting information in the link product manuals.

Diagnostic Tools

To run the diagnostic test in section 9 of the diagnostic. loopback test fixtures (hoods) are available for testing the PSI card and cables and attached modem.

Test Fixtures for the PSI Card

The 62-pin card-edge loopback hood (P/N 30263-63007) is available as a component of the PSI Support Kit (P/N 28606-67801). It fits on the 62-pin frontplane connector on the face plate of the card, and is used to test the card transmitters and receivers. The card-edge loopback hood must be in place to execute the external loop back test (in section 9 of the PSIDAD diagnostic) of all of the card circuitry.

The pin assignments for the frontplane connector to which this card-edge loopback hood mates are listed in tables C4a and C4b in appendix C. "Technical Specifications."

Test Fixtures for the Telecommunications Cable

The RS-232C 25-pin female loopback connector (P/N 28606-63067) is available as a component of the PSI Support Kit (P/N 28606-67801). It fits between the 25-pin male RS-232C/V.28 telecommunications cable (P/N 28606-63006) and your modem. The hood returns the signals to the PSI card over the same cable. If must be in place to execute the external loopback test in section 9 of PSIDAD. If the section 9 test is successful. the card circuitry is functioning properly, the cable is working, and any problem you may have with your network is on the "loop" or distant side of your telecommunications circuit.

If your modem has a loopback test setting. either a hardware switch. a jumper. or a programmatic instruction that causes the modem to loop the signals back to the sending computer. you may use its setting instead of a loopback test hood. (Please see your modem documentation for details.)

Troubleshooting Procedures

Figure 11g-2 provides a basic troubleshooting flowchart to help pinpoint a defective PSI card or other FRU.

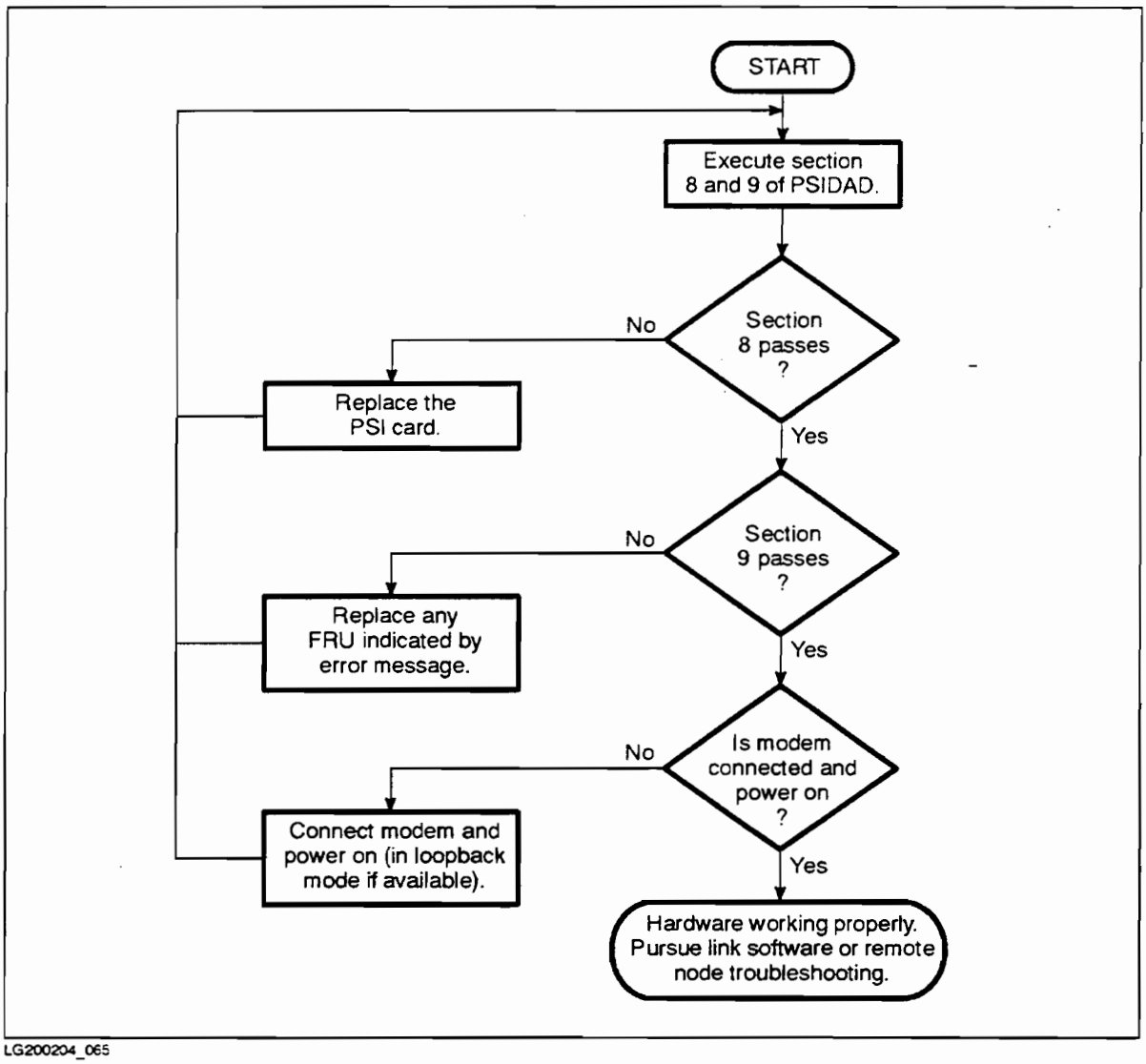

Figure 11g-2. Troubleshooting Flowchart for the PSI Card

PSIDAD Diagnostic

The PSI Device Adapter Diagnostic (PSIDAD) is a part of the online diagnostic subsystem available on the 99x/890/T500 system. PSIDAD can be used to verify installation of the PSI card beyond the power-on self-test, and to isolate defective PSI cards and other FRUs.

This section gives only a very brief description of the PSIDAD diagnostic. For more detailed information about using PSIDAD, refer to the *PA-RISC Support Tools Manual (Licensed Users), Volume 2, Device Adapters/MUXes* (HP P/N 5960-3151).

Before running PSIDAD, make sure diagnostic tools are set up for the test sections you will run (refer to the "Diagnostic Tools" section earlier in this chapter).

Note

Many PSIDAD test sections can be run without affecting the network, but some test sections of PSIDAD can destroy active network sessions, or bring down a network connection. PSIDAD has two different modes:

- **Normal Mode:** PSIDAD tests run using this mode will not bring the network down, or destroy any active sessions or data on the card.
- **Destructive Mode:** PSIDAD tests using this mode will bring down the network and its sessions if the network is up, and may destroy data on the card. If you plan to run tests in this mode, be sure that you are the only network user before you begin, and use the system console.

  For more detailed information about PSIDAD test modes, refer to the *PA-RISC Support Tools Manual (Licensed Users), Volume 2, Device Adapters/MUXes* (HP P/N 5960-3151).

Check Connectors

If no failure is found by using the PSIDAD diagnostic, check the following:

- Check cable connections, and make sure that the correct types of cables are being used.
- Ensure that connected modems are turned on and operating correctly.
- Verify that the interface link software is working properly.
- Check that the remote node is operating correctly.

Exchange Assemblies

A failing PSI printed circuit card may be exchanged for a new or refurbished exchange assembly. Table 11g-2 lists the new assembly and exchange assembly part numbers for the PSI card.

Table 11g-2. Exchange Assembly Part Numbers for the PSI Card

Description	New Assembly Part Number	Exchange Assembly Part Number
HP-PB PSI Card	28606-60001	28606-69001

Removing and Replacing the PSI Card

Caution

When removing or installing cards, be sure to observe antistatic precautions. Some card components are susceptible to damage by static discharge. Failure to observe antistatic precautions may result in degraded performance, shortened product life, or loss of operation.

To remove the PSI card:

1. Shut down the operating system
2. Turn off power to the computer system, and disconnect the power cord.
3. Disconnect the network from the PSI card:
   a. Turn off the modem or any other connected telecommunications device.
   b. On the face plate of the PSI card, unscrew the telecommunication cable connector from the card connector.
   c. Remove the cable connector from the card connector in one, smooth movement. (Jerking either piece may break the connector on the card or the cable.)
4. On the PSI card, release the two retaining screws with a Torx T-10 driver or 3/16-inch flat-blade screwdriver.
5. Release the card from the slot by gripping the two extractor levers and pulling their inside ends toward you and outward. Continue pulling the card by the levers until it is completely out of the slot.

To reinstall the PSI card:

1. Shut down the operating system.
2. Turn off power to the computer system, and disconnect the power cord.
3. Remove the metal slot shield from the selected slot.
4. Install the PSI card into the slot.
5. Connect the telecommunications cable to the PSI card's face plate connector.
6. Connect the other end of the telecommunication cable to the modem or telecommunications device.
7. Connect the power cord to the system, and turn power on.
8. Verify operation by observing the PSI card's face plate LEDs.

11h

Multiplexer (MUX) Cards (890, T500 Families Only)

This chapter contains information about the asynchronous multiplexer (MUX) cards supported on HP 9000 CS 890 and CS T500 servers. The products described in this chapter are:

- **J2092A 16-Channel RS-232-C Asynchronous Multiplexer**
- **J2093A 16-Channel RS-422 Asynchronous Multiplexer**
- **J2094A 16-Channel RS-232-C Asynchronous Multiplexer**
- **J2096A 32-Channel RS-232-C Asynchronous Multiplexer**
- **HP 40299B 8-Channel RS-422 Asynchronous Multiplexer**

Caution

Components used on printed circuit assemblies are susceptible to damage by static discharge. Observe antistatic precautions when removing or installing any PCAs.

Chapter Contents

This chapter provides the following information:

- **J2092A, J2093A, J2094A 16-Channel and J2096A 32-Channel Asynchronous Multiplexers:**
  - Description
  - Specifications
  - Installing the J2092A/93A/94A/96A Cards and DDP/MDP
  - Verifying Operation
  - Connecting the Terminals
  - Troubleshooting
  - Replaceable Parts
  - Connector Pin-outs
  - Cabling Examples
- **HP 40299B 8-Channel Asynchronous Multiplexer:**
  - Description
  - Installing the HP 40299B
  - Verifying Operation
  - Connecting Peripheral Devices
  - Connecting Terminals
  - Troubleshooting
  - Replaceable Parts
  - Cable Pin-outs

J2092A, J2093A, J2094A, and J2096A Asynchronous Multiplexers

Description

HP-PB 16- and 32-channel asynchronous multiplexers (MUXes) provide a means to connect up to 32 synchronous serial devices to a Model 890 system. The four multiplexers described in this section are:

- **J2092A** 16-Channel RS-232-C Asynchronous Multiplexer for direct connections.
- **J2093A** 16-Channel RS-422 Asynchronous Multiplexer for long-distance direct connections.
- **J2094A** 16-Channel RS-232-C Asynchronous Multiplexer for direct and remote connections with support of full-duplex modem control.
- **J2096A** 32-Channel RS-232-C Asynchronous Multiplexer for direct connections.

The complete MUX product is comprised of three principal components:

- A **multiplexer (MUX) card**. which is installed in the HP-PB system backplane (see Figure 11h-1 and Figure 11h-2).
- **Distribution panels:**
  - Two 16-port **Direct Distribution Panels (DDP)** for the J2092A. J2093A. and J2096A multiplexers (see Figure 11h-3).
  - Two 8-port **Modem Distribution Panels (MDP)** for the J2094A multiplexer (see Figure 11h-4).
- A **link cable**: a cable with a single connector at one end, and two to four connectors at the other end, to connect to the distribution panels (see Figure 11h-5 and Figure 11h-6).

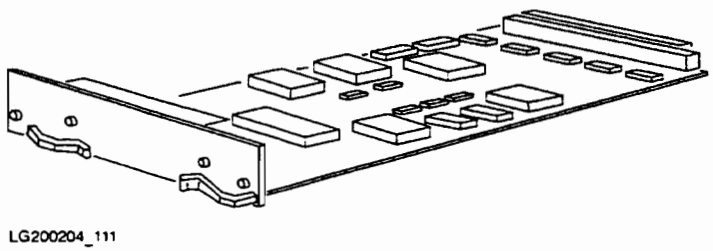

Figure 11h-1. 16-Channel Asynchronous Multiplexer Card (J2092A, J2093A, and J2094A)

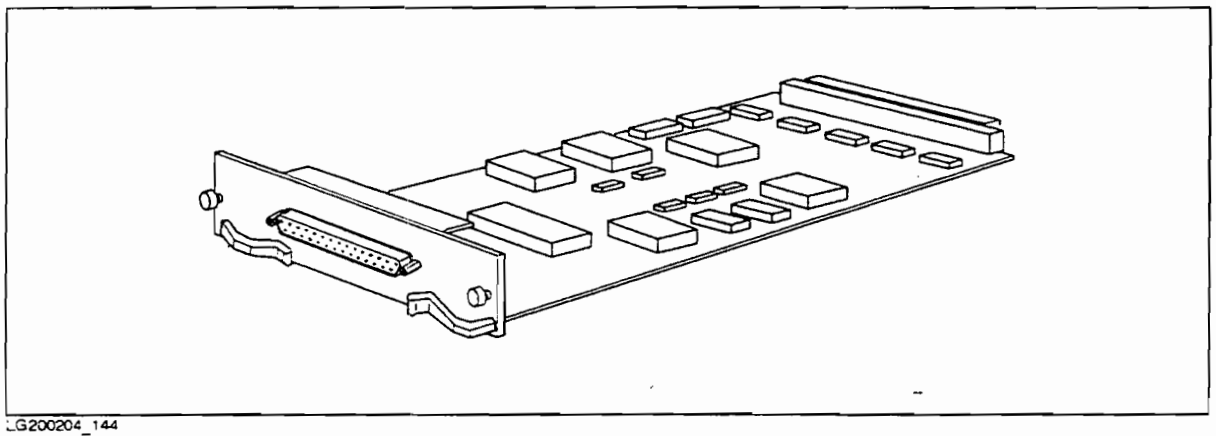

Figure 11h-2. 32-Channel Asynchronous Multiplexer Card (J2096A)

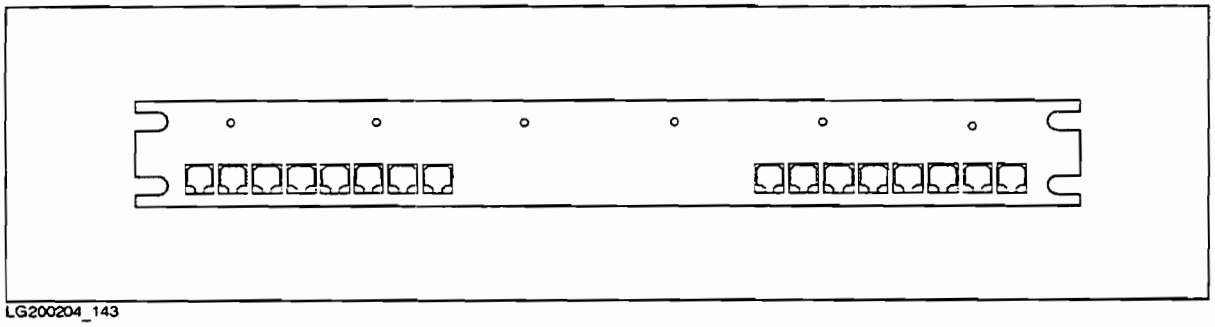

Figure 11h-3. Direct Distribution Panels (for J2092A/93A/96A MUX Cards)

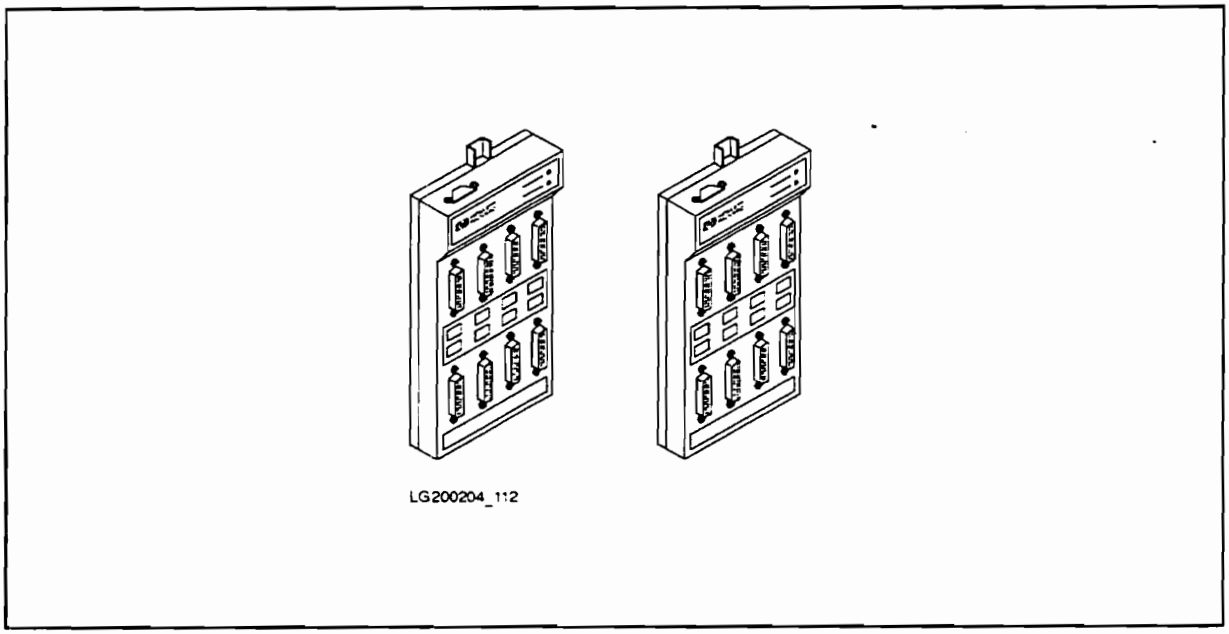

Figure 11h-4. Modem Distribution Panels (for J2094A MUX Card)

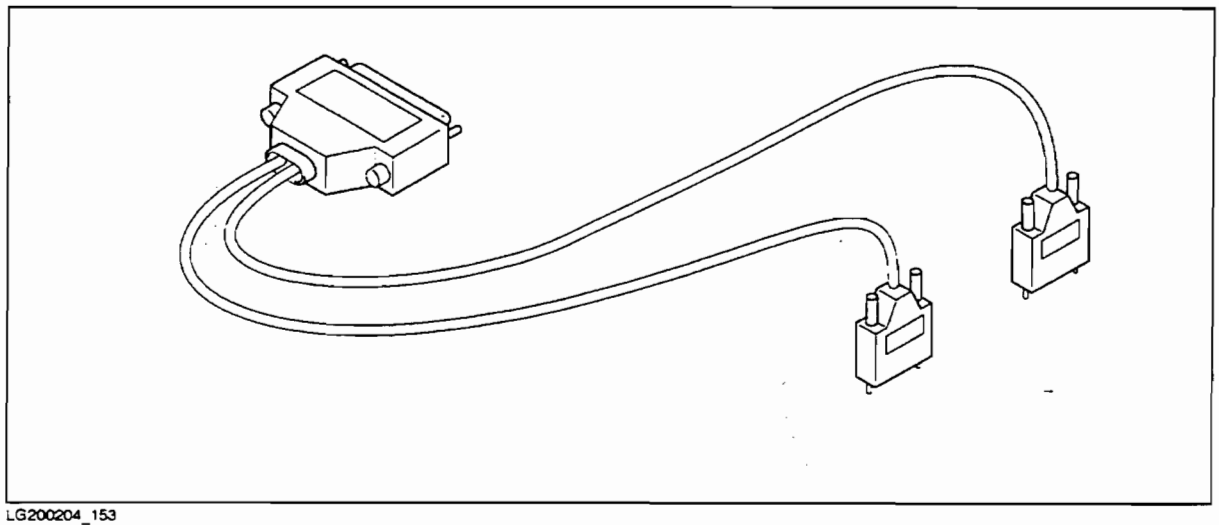

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Figure 11h-5. Link Cable for J2092A/93A/94A MUX Cards

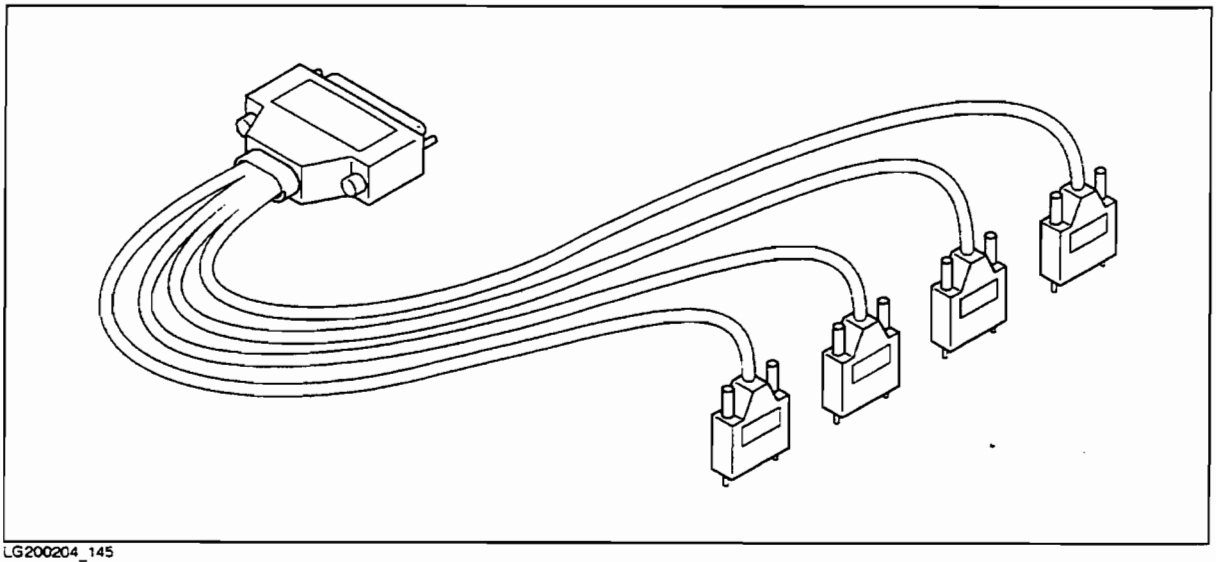

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Figure 11h-6. Link Cable for J2096A MUX Card

Installing the J2092A/93A/94A/96A Cards and DDP/MDP

This section provides a brief installation procedure for the HP-PB asynchronous multiplexers.

For more detailed installation information, refer to the *HP J2092A/93A/94A/96A HP-PB Asynchronous Multiplexer Family* (HP P/N 5961-0386).

Caution Be sure to observe antistatic precautions when removing, installing, or handling the MUX cards.

Installing the MUX card

1. Shut down the operating system.
2. Switch off power to the system, and disconnect the power cable.
3. Install the MUX card into the selected slot.
   a. Slide the cards into the slot.
   b. Be sure the card is firmly seated.
4. Tighten the screws on the card front plate to secure the card in the slot.

Connect the Link Cable and Distribution Panels

J2092A, J2093A, and J2096A Multiplexers:

1. Connect the two-connector end (J2092A and J2093A) or four-connector end (J2096A) of the link cable to the Direct Distribution Panels (DDPs).
2. Connect the single-connector end of the link cable to the multiplexer card.
3. Screw all connectors in to ensure reliable contacts (see Figure 11h-7).

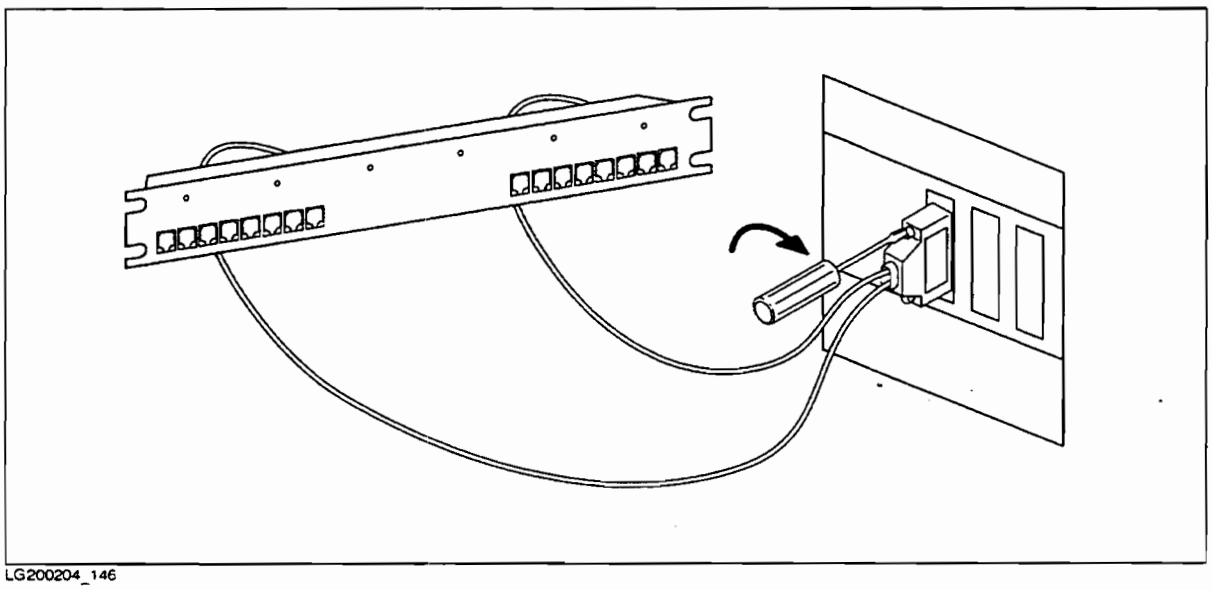

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Figure 11h-7. Connecting the J2092A/93A/96A to the DDP with the Link Cable

J2094A Multiplexers:

1. Connect the two-connector end of the link cable to the Modem Distribution Panels (MDP).
2. Connect the single-connector end of the link cable to the multiplexer card.
3. Screw all connectors in to ensure reliable contacts (see Figure 11h-8).

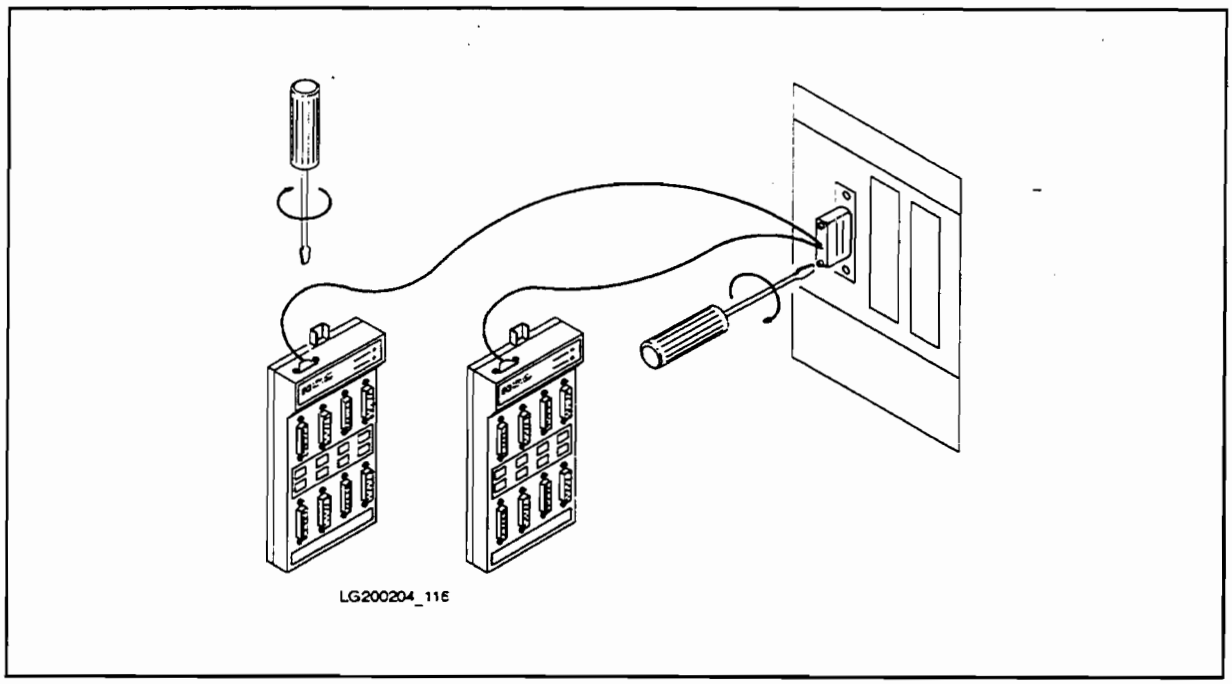


Figure 11h-8. Connecting the J2094A to the MDP with the Link Cable

Removal Procedures

To remove the MUX card and DDP or MDP, simply perform the installation described above in reverse order. Be sure to observe antistatic precautions when removing, installing, or handling the MUX cards.

Verifying Operation

MUX Status LEDs

Each multiplexer card has an LED on its front panel. Observe the LED during power-on and booting, and during normal system operation, to verify proper operation of the multiplexer.

When the system is powered on, the LED blinks for five seconds (indicating that self-tests are running), then remains OFF.

During normal operation, the LED should remain OFF.

If the LED does not light as described above, refer to the "Troubleshooting" section later in this chapter.

MDP Status LEDs (J2094A Only)

The Modem Distribution Panel (MDP) has two LEDs (labeled **Power On** and **Link Status**) to indicate the functional status of the MDP.

During normal system operation:

- The **Power On** LED should be permanently ON.
- The **Link Status** LED should be permanently OFF.

Note

The Link Status LED may blink momentarily (for less than one second) after power on.

If the LED does not light as described, refer to the "Troubleshooting" section later in this chapter.

Connecting the Terminals

To connect terminal devices to the distribution panels, the following cables are recommended:

- **To connect DDP to terminal devices (RS-232):** RS-232 standard, 3-wire.
- **To connect DDP to terminal devices (RS-423):** See "Cabling Examples" later in this section.
- **To connect MDP to terminal devices** (without hardware flow control): HP 40234A.
  - Also supported: 40242M/Y, 13242N/M/Y.
  - For hardware flow control, a custom-built cable is required (refer to "Connector Pin-outs" later in this section.
- **To connect MDP to modems:** HP 40233A.
  - Also supported: HP 92219Q.

Refer to "Connector Pin-outs" later in this section for pin-out details for the DDP and MDP connectors.

After connecting the terminals, you are ready to start your system and configure the multiplexer ports. Refer to your system documentation for details.

Troubleshooting Tools for J2092A/93A/94A/96A Cards

The primary tools for troubleshooting the J2092A/93A/94A/96A MUX cards are the *pmuxdiag* diagnostic. and the *zmuxdiag* diagnostic utility. The *pmuxdiag* diagnostic tests the functionality of the J209xA card. while the *zmuxdiag* tests the full data path.

PMUXDIAG Diagnostic

The *pmuxdiag* diagnostic tests the functionality of the following Field Replaceable Units (FRUs):

- J2092A MUX 16-channel card
- J2093A MUX 16-channel card
- J2094A MUX 16-channel card and:
  - Modem Distribution Panel (MDP)
  - MUX-to-MDP cable
- J2096A 32-channel MUX card

Card-Specific Considerations for PMUXDIAG

J2093A: You will need a 78-pin loopback hood (J2093-60002) to be able to fully test the J2093A card alone using the panel loopback. If you wish to test the cable and Direct Distribution Panels (DDPs), run the panel loopback test and ensure that the port(s) to be tested have an RJ-45 loopback hood installed on each RJ-45 DDP port under test. The loopback connector is simple to build, and is detailed under "DDP Loopback Test Hood Wiring" later in this chapter (see Table 11h-10).

J2096A: The J2096A MUX card is treated as two J2092A modules of 16 ports each (that is, Module 0, ports 0 to 15, and Module 1, ports 0 to 15).

Removing Peripheral Cables

The *pmuxdiag* diagnostic does not test the peripheral devices, so keep the following in mind:

J2092A, J2094A, and J2096A: If an error occurs while running loopbacks on ports (panel loopback), you should remove the peripheral's device cable at the DDP or MDP before re-running the panel loopback test: a faulty cable or peripheral could cause the loopback tests to fail.

J2093A: The peripheral's device cable should be removed at the DDP, and replaced by an RJ-45 loopback hood before running a panel loopback test on that port.

PMUXDIAG Mini-Operating Instructions

To use the pmuxdiag diagnostic:

1. Run the Diagnostic User Interface at the ISL prompt by entering **sysdiag**:

```
ISL> sysdiag
```

2. Run the diagnostic at the DUI prompt:

```
DUI> run pmuxdiag pdev <logical MUX specifier>
```

The command as typed above will run the default sections, described below.

The following command shows an example of how to specify a particular section:

```
DUI> run pmuxdiag pdev <logical MUX specifier> sc 4 (420/423)
```

This command will run loopback (Section 4), steps 420 to 423, corresponding to a frontplane loopback for the circuitry associated with ports 0 to 3.

3. The diagnostic will respond with a header and a welcome message. If particular sections and steps are not specified, the default sections and steps are executed based on the following diagnostic system modes:

Default Sections:

Section 1 - State
Section 3 - Identity
Section 4 - Loopback (default steps are 420 to 435)

Additional Sections:

Section 2 - Clear (default step is 199)
Section 5 - Selftest
Section 7 - Port Reset
Section 8 - Halt
Section 9 - Dump

4. To exit *pmuxdiag*, type **exit**. Control returns to the Online Diagnostic System.

ZMUXDIAG Diagnostic

The *zmuxdiag* diagnostic utility tests the full data path on J2092A, J2093A, J2094A, and J2096A MUX cards. The *zmuxdiag* utility is located in the **usr/bin** subdirectory (HP-UX 8.02 or later), and should be run in single-user mode (SUM).

To run the *zmuxdiag* utility, type:

```
usr/bin/zmuxdiag
```

- and follow the instructions displayed on the system console screen. Refer to the following card specific information when using the *zmuxdiag* utility.

Card-Specific Considerations for ZMUXDIAG

If the MUX to be tested has the capability of using internal loopbacks, the utility asks if you wish to use them. Internal loopbacks that are available for the J209xA cards are listed in Table 11h-1.

Table 11h-1. Internal Loopbacks Available for J209xA MUX cards

MUX Card	Internal Loopback Available?	Location of Loopback
J2092A	Yes	At the 78-pin connector on the MUX card.
J2093A	No	Not applicable.
J2094A with MDP	Yes	At the 25-pin connector on the MDP (5062-3054).
J2096A	Yes	At the 78-pin connector on the MUX card.

If an internal loopback is chosen, the loopback takes place just before the connector given in Table 11h-1. If there is a failure, ensure that all cables attached to this connector are removed before re-running the test. A faulty cable or peripheral could cause the loopback test to fail on an otherwise good card.

If internal loopback is not available or not chosen, the *zmuxdiag* utility will always try to reach the 25-pin port connector (for MDPs), or RJ-45 port connector (for RJ-45 DDPs). In this case, a loopback hood should be fitted (P/N 5181-2030 for the MDP, or an RJ-45 loopback hood for the RJ-45 DDP).

J2093A Only: If the Direct Distribution Panels (DDPs) are removed, a 78-pin loopback hood (J2093-60002) will be required in order to run this loopback test on the J2093A MUX card.

Troubleshooting Procedures for J2092A/93A/94A/96A Cards

Preliminary Troubleshooting (All J209xA Cards)

If the multiplexer does not appear to be working — that is, you cannot get a system prompt on a connected terminal after restarting the system — perform the following troubleshooting procedure:

1. Verify the terminal I/O configuration on the system, and ensure that it matches the terminal's configuration.
2. If your are using MPDs (J2094A only) verify the correct functioning of the multiplexer by checking the LEDs on the MDP:

   If the MDP **Power On** LED is off, or if the **Link Status** LED remains on or blinks, check the following:

   - Verify that you are using the MDP (HP P/N 5062-3054), as supplied with the J2094A, and no other model of connection panel.
   - Verify that the cables between the MDP and the multiplexer are firmly connected, and that the multiplexer is securely installed in the system.
3. If the problem has not been discovered, proceed to the card-specific troubleshooting procedures.

J2092A Troubleshooting

To locate a Field Replaceable Unit (FRU):

1. Run *pmuxdiag* loopback tests on the MUX card (backplane and frontplane loopbacks).

   a. If a backplane loopback fails, reseat the MUX card in the backplane, and try again. If it still fails, replace the MUX card.

   b. If a frontplane loopback fails, there is probably a hardware fault on the MUX card. Before replacing the card, disconnect the DDP cable at the MUX, and run the panel loopback. If it fails on one or more ports, then the MUX card is bad, and should be replaced.

   If frontplane, backplane, and panel loopback tests pass, the problem is probably in the cable or DDPs. Proceed to the next step:

2. Reconnect the cable and DDPs, and run the *xmuxdiag* utility using external loopback. You will need at least one RJ-45 loopback hood, which must be manufactured according to the wiring diagram shown in Table 11h-10.

   If the test fails on one or more ports on one DDP only, swap DDPs and repeat the test. If the same ports fail again, replace the cable.

   Also, you can try replacing a suspect DDP with a known good DDP: if doing so cures the problem, replace the suspect DDP.

J2092A without Distribution Panels:

If a J2092A MUX card is connected to a custom cabling configuration, there will be no MUX-to-DDP cable or DDP to test. In this case:

1. Test as described above for backplane, frontplane, and panel loopback tests.
2. If a panel loopback test fails, disconnect the custom 78-pin connector and cabling, and try again.

   a. If the problem persists, replace the MUX card.

   b. If the problem disappears, the custom cabling is the probable cause of the problem.

J2093A Troubleshooting

To locate a Field Replaceable Unit (FRU):

1. Run *pmuxdiag* loopback tests on the MUX card (backplane and frontplane loopbacks). You will need to disconnect the MUX-to-DDP cable and replace it with a 78-pin loopback hood (P/N J2093-60002) to run the panel loopback test.

   a. If a backplane loopback fails, reseat the MUX card in the backplane, and try again. If it still fails, replace the MUX card.

   b. If a frontplane loopback fails, there is probably a hardware fault on the MUX card. Before replacing the card, disconnect the DDP cable at the MUX, attach the 78-pin loopback hood, and run the panel loopback. If it fails, check that the loopback hood is correctly seated, then repeat the test. If the test fails again on one or more ports, replace the MUX card.

   If frontplane, backplane, and panel loopback tests pass, the problem is probably in the cable or DDPs. Proceed to the next step:

2. Reconnect the MUX-to-DDP cable, and the two DDPs, and run the *zmuxdiag* utility. You will need at least one RJ-45 loopback hood, which must be manufactured according to the wiring diagram shown in Table 11h-10.

   If the test fails on one or more ports on one DDP only, swap DDPs and repeat the test. If the same ports fail again, replace the cable.

   Also, you can try replacing a suspect DDP with a known good DDP: if doing so cures the problem, replace the suspect DDP.

J2093A without Distribution Panels:

If a J2093A MUX card is connected to a custom cabling configuration, there will be no MUX-to-DDP cable or DDP to test. In this case:

1. Before doing any testing, disconnect the custom cabling, and attach the 78-pin loopback hood (J2093-60002).
2. Test as described above for backplane, frontplane, and panel loopback tests.
3. If the loopback test pass, the custom cabling is the probable cause of the problem.

J2094A Troubleshooting

To locate a Field Replaceable Unit (FRU):

1. Run *pmuxdiag* loopback tests on the MUX card (backplane, frontplane, and panel loopbacks).

   a. If a backplane loopback fails, reseat the MUX card in the backplane, and try again. If it still fails, replace the MUX card.

   b. If a frontplane loopback fails, disconnect the MUX-to-MDP cable, repeat the test. If it still fails, replace the MUX card.

   c. If a panel loopback fails on one or more port on only one MDP, remove the peripheral cable(s) connected to the failed port(s), and try again. If the same ports still fail, replace the suspect MDP with a known good one.

   If a panel loopback fails on all ports on one (or both) MDPs, replace the MUX-to-MDP cable, and try again. If the cable is the problem, it is unlikely that some ports will fail and other ports will pass on the same MDP.

   d. The *xmuxdiag* utility can be used with the J2094A card, and (using the internal loopback mode) is equivalent to a panel loopback on *pmuxdiag*. If problems are encountered, disconnect the peripheral cable from the MDP port, and try again.

   e. The *xmuxdiag* utility can also be used in external loopback mode, in which case loopback hoods (5181-2030) will be needed on each port to be tested.

J2096A Troubleshooting

To locate a Field Replaceable Unit (FRU):

1. Run *pmuxdiag* loopback tests on the MUX card (backplane and frontplane loopbacks).
   a. If a backplane loopback fails, reseat the MUX card in the backplane, and try again. If it still fails, replace the MUX card.
   b. If a frontplane loopback fails, there is probably a hardware fault on the MUX card. Before replacing the card, disconnect the DDP cable at the MUX, and run the panel loopback. If it fails on one or more ports, then the MUX card is bad, and should be replaced.

   If frontplane, backplane, and panel loopback tests pass, the problem is probably in the cable or DDPs. Proceed to the next step:
2. Reconnect the cable and DDPs, and run the *xmuxdiag* utility using external loopback. You will need at least one RJ-45 loopback hood, which must be manufactured according to the wiring diagram shown in Table 11h-10.

   If the test fails on one or more ports on one DDP only, swap DDPs and repeat the test. If the same ports fail again, replace the cable.

   Also, you can try replacing a suspect DDP with a known good DDP; if doing so cures the problem, replace the suspect DDP.

J2096A without Distribution Panels:

If a J2096A MUX card is connected to a custom cabling configuration, there will be no MUX-to-DDP cable or DDPs to test. In this case:

1. Test as described above for backplane, frontplane, and panel loopback tests.
2. If a panel loopback test fails, disconnect the custom 78-pin connector and cabling, and try again.
   a. If the problem persists, replace the MUX card.
   b. If the problem disappears, the custom cabling is the probable cause of the problem.

Replaceable Parts for the J2092A/93A/94A/96A

Exchange Assemblies

A failing MUX card may be exchanged for a new or refurbished exchange assembly. Table 11h-2 lists the new assembly and exchange assembly part numbers for the MUX cards.

Table 11h-2.
Exchange Assembly Part Numbers for the 16-Channel MUX Cards

Description	New Assembly Part Number	Exchange Assembly Part Number
J2092A MUX card	J2092-60001	J2092-69001
J2093A MUX card	J2093-60001	J2093-69001
J2094A MUX card	J2094-60001	J2094-69001
J2096A MUX card	J2096-60001	J2096-69001

Other Field Replaceable Parts

Other replaceable parts (Field Replaceable Units or FRUs) for the J2092A, J2093A, J2094A, and J2096A products are listed in Table 11h-3.

Table 11h-3.
Field Replaceable Units for J2092A, J2093A, J2094A, and J2096A

Description	HP Part Number
J2092A	
Link cable "Y"	5062-3100
Direct Distribution Panel (DDP)	0950-2431
Loopback hood (25-pin)	5181-2030
78-pin connector (for making customer cables)	1252-4466
Installation manual (for J2092A/93A/94A/96A)	5961-0386
J2093A	
Link cable "Y"	5062-3100
Direct Distribution Panel (DDP)	0950-2431
Loopback hood (25-pin)	5181-2030
78-pin connector (for making customer cables)	1252-4466
78-pin loopback hood	J2093-60002
Installation manual (for J2092A/93A/94A/96A)	5961-0386
J2094A	
Link cable "Y" (MUX-to-MDP cable)	J2094-60004
Active Distribution Panel (MDP)	5062-3054
Installation manual (for J2092A/93A/94A/96A)	5961-0386
J2096A	
Link cable (4-branch double-Y MUX-to-DDP cable)	8120-6162
Direct Distribution Panel (DDP)	0950-2431
Loopback hood (25-pin)	5181-2030
78-pin connector (for making customer cables)	1252-4466
Installation manual (for J2092A/93A/94A/96A)	5961-0386

Connector Pin-outs

Table 11h-4 through show various connector pin-outs that you can use to assemble a custom-built cable.

Table 11h-4 and Table 11h-5 list the connector pin-outs for the 25-pin connectors on the MPDs (J2094A) and RJ45 connectors on the DDPs (J2092A, J2093A, and J2093A).

Table 11h-4.
Connector Pin-outs: MDP (J2094A) and DDP RJ45 for RS-232-C (J2092A, J2096A)

RS-232-C	V.24	Abbreviation	Description	Input/ Output	MDP Pin Numbers	DDP Pin Number
AA	101		Protective ground		1	
AB	102	SG	Signal ground		7	6
BA	103	SD	Transmit data	Output	3	3
BB	104	RD	Receive data	Input	2	1
CA	105	RS	Request to send	Output	8	
CB	106	CS	Clear to send	Input	22	
CC	107	DM	Data set ready	Input	20	
CD	108	TR	Data terminal ready	Output	6	
CF	109	RR	Data carrier ready	Input	4	
CH	111	SR	Signal rate selector	Output	23	
CE	125	IC	Ring indicator	Output	9	
		GPO	General purpose output	Output	5	

Table 11h-5. Connector Pin-outs: DDP RJ45 for RS-423A (J2093A)

Description	Input/Output	DDP Pins (RS-432A)
Protective ground		
Transmit data+	Output	3
Transmit data–	Output	6
Receive data+	Input	1
Receive data–	Input	2

Table 11h-6 lists the connector pin-out for the 78-pin connector of the J2092A and J2093A multiplexers. Table 11h-7 lists the RS-232-C and RS-423 signal names for the J2092A and J2093A multiplexers.

Table 11h-6.
Signal Connections: 78-pin Connectors on J2092A and J2093A MUX Cards

Pin Number	Signal	Pin Number	Signal	Pin Number	Signal	Pin Number	Signal
1	Ntx8	21	tx8	40	Ntx9	60	tx9
2	Nrx8	22	rx8	41	Nrx9	61	rx9
3	Ntx10	23	tx10	42	Ntx11	62	tx11
4	Nrx10	24	rx10	43	Nrx11	63	rx11
5	Ntx12	25	tx12	44	Ntx13	64	tx13
6	Nrx12	26	rx12	45	Nrx13	65	rx13
7	Ntx14	27	tx14	46	Ntx15	66	tx15
8	Nrx14	28	rx14	47	Nrx15	67	rx15
9	unused	29	unused	48	unused	68	unused
10	unused	30	unused	49	unused	69	unused
11	unused	31	unused	50	unused	70	unused
12	unused	32	tx0	51	unused	71	tx1
13	Ntx0	33	rx0	52	Ntx1	72	rx1
14	Nrx0	34	tx3	53	Nrx1	73	tx2
15	Ntx2	35	rx3	54	Ntx3	74	rx2
16	Nrx2	36	tx4	55	Nrx3	75	tx5
17	Ntx4	37	rx4	56	Ntx5	76	rx5
18	Nrx4	38	tx6	57	Nrx5	77	tx7
19	Ntx6	39	rx6	58	Ntx7	78	rx7
20	Nrx6			59	Nrx7		

Table 11h-7. Signal Names: J2092A and J2093A Multiplexers

Signal	RS-232-C	RS-423
tx(n)	Signal ground, port n	Transmit data+, port n
Ntx(n)	Transmit data, port n	Transmit data−, port n
rx(n)	unused	Receive data+, port n
Nrx(n)	Receive data, port n	Receive data−, port n

Table 11h-8 lists the connector pin-out for the 78-pin connector of the J2096A multiplexer. Table 11h-9 lists the RS-232-C signal names for the J2096A multiplexer.

Table 11h-8. Signal Connections: 78-pin Connectors on J2096A MUX Cards

Pin Number	Signal	Pin Number	Signal	Pin Number	Signal	Pin Number	Signal
1	Ntx8	21	tx8	40	Ntx9	60	tx9
2	Nrx8	22	rx8	41	Nrx9	61	rx9
3	Ntx10	23	tx10	42	Ntx11	62	tx11
4	Nrx10	24	rx10	43	Nrx11	63	rx11
5	Ntx12	25	tx12	44	Ntx13	64	tx13
6	Nrx12	26	rx12	45	Nrx13	65	rx13
7	Ntx14	27	tx14	46	Ntx15	66	tx15
8	Nrx14	28	rx14	47	Nrx15	67	rx15
9	unused	29	unused	48	unused	68	unused
10	unused	30	unused	49	unused	69	unused
11	unused	31	unused	50	unused	70	unused
12	unused	32	tx0	51	unused	71	tx1
13	Ntx0	33	rx0	52	Ntx1	72	rx1
14	Nrx0	34	tx3	53	Nrx1	73	tx2
15	Ntx2	35	rx3	54	Ntx3	74	rx2
16	Nrx2	36	tx4	55	Nrx3	75	tx5
17	Ntx4	37	rx4	56	Ntx5	76	rx5
18	Nrx4	38	tx6	57	Nrx5	77	tx7
19	Ntx6	39	rx6	58	Ntx7	78	rx7
20	Nrx6			59	Nrx7		

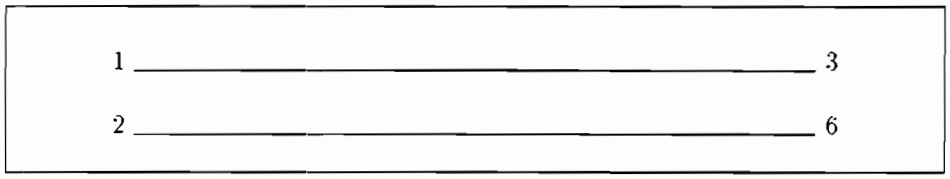
Table 11h-9. Signal Names: J2096A Multiplexer

Signal	RS-232-C
tx(n)	Transmit data+, port n
Ntx(n)	Transmit data−, port n
rx(n)	Receive data+, port n
Nrx(n)	Receive data−, port n

DDP Loopback Test Hood Wiring

A DDP loopback hood (RS-232 and RS-423) can be made using an RJ45 male connector, wired as shown in Table 11h-10.

Table 11h-10. DDP Loopback Wiring (Using An RJ45 Male Connector)



Cabling Examples

Two cabling examples are provided in Table 11h-11 and Table 11h-12: both examples are for RS-423A connections between the J2093A DDP and common HP terminals.

Note

In all cases, the transmit pair of wires and the receive pair of wires should be twisted pairs to minimize crosstalk. Cable lengths of up to 1200 meters are supported for data rates up to 19200 baud: at 38400 baud, the maximum cable length supported is 300 meters.

Table 11h-11. Connections to HP 2392A and HP 700/92 Terminals

DDP Connector Pins	Signal	Terminal Connector Pins
1	Protective ground	1
15	Transmit data+	18
17	Transmit data−	3
19	Receive data+	10
25	Receive data−	9
7	Signal ground	7

Table 11h-12. Connections to HP 700/32 Terminals

DDP Connector Pins	Signal	Terminal Connector Pins
15	Transmit data+	4
17	Transmit data−	5
19	Receive data+	3
25	Receive data−	2

HP 40299B 8-Channel Asynchronous Multiplexer

Description

The **HP 40299B 8-Channel Asynchronous Multiplexer** provides the means of connecting up to eight RS-232-C (or RS-422/RS-423) asynchronous serial devices to the HP 9000 Model 890 system. Additionally, the HP 40299B has an Access Port functionality for maintaining system hardware and software from a remote location.

There are two versions of the HP 40299B:

- The standard HP 40299B for use with peripheral devices that use the RS-232-C communications standard.
- The HP 40299B Option 1C8 for use with peripheral devices that use the RS-422 and RS-423 communications standard for use with HP 700/32 terminals.

The standard HP 40299B product contains (see Figure 11h-9):

- A printed circuit card assembly referred to as the **MUX card**.
- An RS-232-C Active Distribution Panel referred to as the **RS-232-C ADP**.
- An interconnecting cable referred to as the **Multiplexed Serial Link (MSL)**.

The HP 40299B Option 1C8 is supplied with the standard MUX card and MSL, but has an RS-422 ADP instead of the RS-232-C ADP. In addition, a loopback test hood is available.

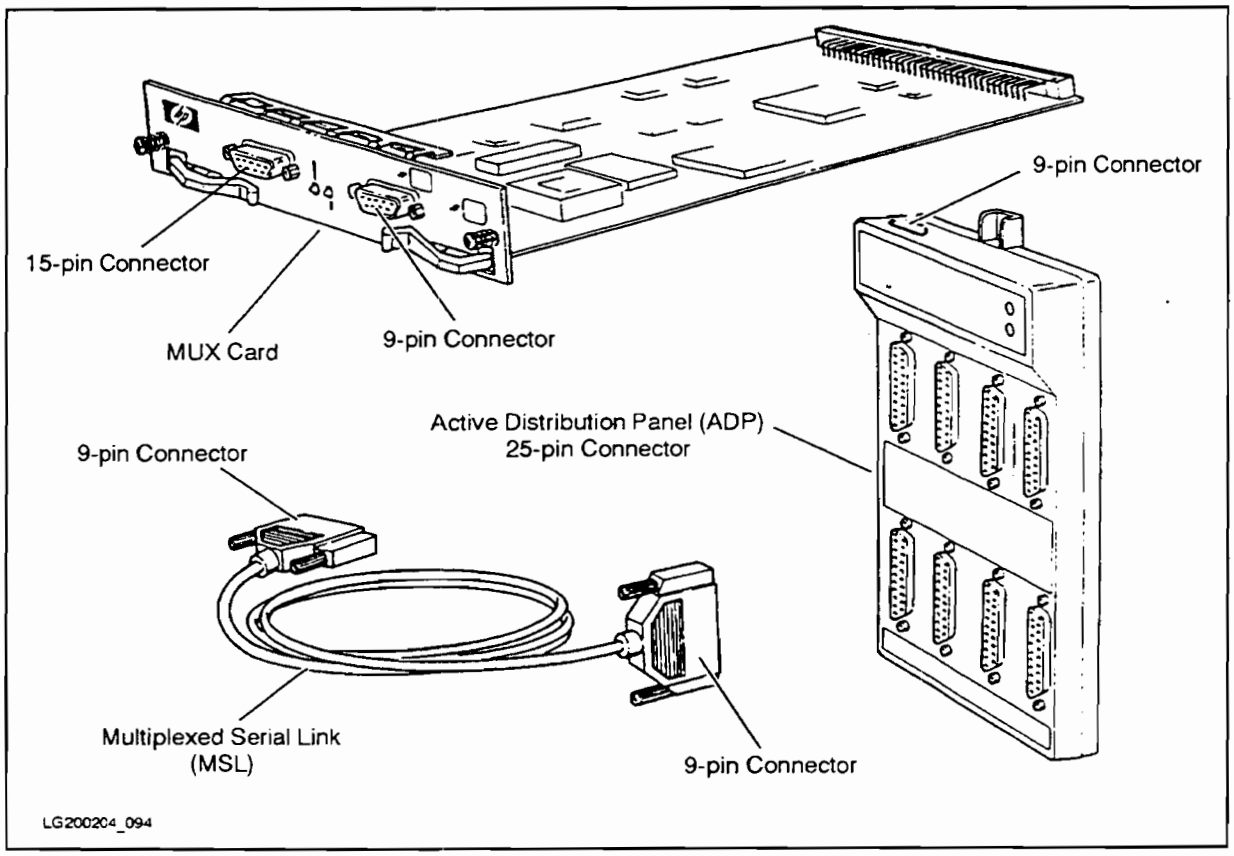


Figure 11h-9. HP 40299B Components

Installing the HP 40299B

The following list is a brief installation procedure for the HP 40299B. For a more detailed installation procedure, refer to the *HP 40299B Eight Port HP-PB Asynchronous Multiplexer Installation and Reference Manual* (HP P/N 40299-90012).

Warning

Before removing or installing the MUX card, you must perform an orderly shutdown of the operating system, and turn OFF power to the system. Failure to disconnect the power supply can result in electrical shock, and may damage both the computer and the MUX card.

Caution

Components used on printed circuit assemblies are susceptible to damage by static discharge. Observe antistatic precautions when removing or installing any PCAs.

1. Do a system backup, and then shutdown down the operating system.
2. Switch off power to the computer system.
3. Install the HP 40299B MUX card into its slot.
4. Attach the ADP to a table leg or wall.
5. Connect the MUX card to the ADP using the MSL cable.
6. Identify suitable cables to connect the ADP to supported terminals, printers, plotters, and modems.
7. Mark and fix identifying labels to the ports of the ADP.
8. Switch on the computer system and any terminal or printer connected to the system.
9. Verify proper operation of the HP 40299B.

Verifying Operation

To verify proper operation of the HP 40299B, observe the LEDs on the MUX card and the ADP. The operating status of the HP 40299B is indicated by two LEDs on the front panel of the MUX card, and two LEDs on the ADP (refer to Table 11h-13).

Table 11h-13.
HP 40299B LED Status Indicators During Power-On and Normal Operation

Power On Sequence	MUX LEDs		ADP LEDs	
	MUX Status	Link Status	Power On	Link Status
Power Off	Off	Off	Off	Off
Power On	On (1-2ms)	On	On	On
Self-test running	Blinking (5s)	Off	On	Off
System boot start	On (1ms)	Blinking (1s)	On	Blinking (1s)
Normal operation	Off	Off	On	Off

ADP Status LEDs

The two LEDs on the ADP should indicate the following:

Power On (Green): When turned ON, indicates that power is connected to the ADP.

Link Status (Orange): When turned OFF, indicates that synchronization and data transmission is correct in both directions.

Note

If the LED indications do not conform to those listed in Table 11h-13, refer to the "Troubleshooting" section later in this chapter.

Connecting Peripheral Devices

Connections to supported peripheral devices are made via the female 25-pin sub-D connectors on the ADP. Three types of connections can be made when using the HP 40299B:

- RS-232-C direct connection using a direct connect cable or modem cable when modem control signals are required.
- RS-232-C modem cables to connect directly to a modem.
- RS-422/RS-423 direct connect cables.

Note

For cable pinout diagrams, refer to the "Cable Pin-outs" section at the end of this chapter.

RS-232-C Direct Connections

Table 11h-14. RS-232-C Direct Connect Cables for Direct Connections Only

Cable	Description
13242Y	5 meter, 25-pin male-25-pin male. Not RFI filtered.
40242Y	5 meter, 25-pin male-25-pin male. RFI filtered.

Table 11h-15. RS-232-C Modem Cables for Direct Connections

Cable	Description
13242M	5 meter, 25-pin male-25-pin male. Shielded.
13242N	5 meter. 25-pin male-25-pin male. Shielded.
40234A	5 meter. 25-pin male-25-pin male. Shielded.

Note

1. For all direct connects, the minimum wiring requires pins 1, 2, 3, and 7 wired end-to-end.
2. When using the HP 13242M and HP 13242N cables with the RS-232-C ADP, you may have self-test error messages. Note that these cables could be used when the connected device does not drive the 23-pin signal.

RS-232-C Modem Cables to Connect Directly to a Modem

To connect supported modems to the RS-232-C ADP port, the cable listed in Table 11h-16 are recommended.

Table 11h-16. RS-232-C Modem Cables to Connect Directly to a Modem

Cable	Description
40233A	5 meter, 25-pin male-25-pin male. Shielded.
40242M	5 meter, 25-pin male-25-pin male. Shielded.
92219Q	5 meter, 25-pin male-25-pin male.

Note

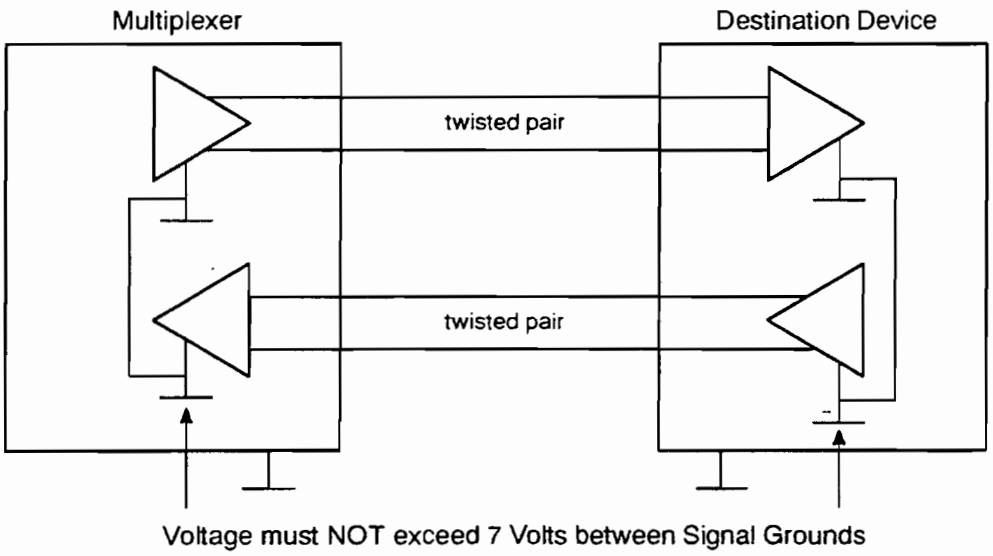
- The 40233A cable is not symmetrical: it has a computer end and a DTE end. In this case, the cable is wired as for an HP-standard DCE, which is not exactly the same as the RS-232-C DCE.
- When using the HP 40242M and HP 92219Q cables with the RS-232-C ADP, you may have self-test error messages. Note that these cables could be used when the connected device does not drive the 23-pin signal.
- The 40233A cable replaces the 30062B cable, and the 40234A cable replaces the 40242M cable. The 40233A and 40234A cables have pin 23 disconnected.

RS-422 Direct Connect

The ports of the RS-422 ADP are wired as for an HP-standard DCE. The RS-422 uses two separate wires for each signal. Although this doubles the number of wires used, it permits very high data rates, and minimizes the problem of varying ground potential. In the RS-422, pin7 may be used for the Signal Ground, however, this is not advised for cable lengths over 10 meters.

For cable lengths greater than 10 meters, do not connect the Protective Ground nor the Signal Ground. It is recommended that you use RS-422 cables that comply with the recommendations given in EIA-RS-422-A Appendix A1. Cables must be of telecommunication (telephone) standard twisted-pair of 24 AWG or less.

Caution



Ensure that the potential difference between signal ground of the multiplexer and the signal ground of the attached device **does not exceed seven (7) volts**. Failure to observe this limit may result in the destruction of the drivers on the ADP.

If the system and the peripherals are in the same building using the same earth, it is unlikely that the problem will occur. However, if the system is in a different building than that of the peripheral, and the two buildings do not have a common earth, take care that this potential does not exceed 7 volts.

Connecting Terminals

Connecting the HP 2392A and HP 700/92 Terminals to the HP 40299B

To connect the HP 2392A and 700/92 terminals, use HP cable 5181-2035, which is wired as shown in Figure 11h-10.

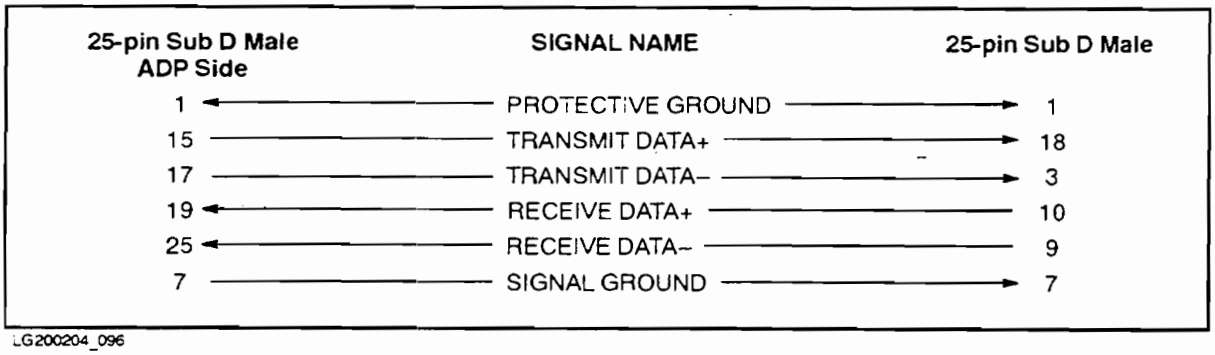


Figure 11h-10. RS-422 ADP/DTE Connections for HP 2392A and 700/92 Terminals

Note Cable pairs "Transmit+/Transmit–" and "Receive+/Receive–" are twisted pairs to reduce interference effects due to crosstalk.

Connecting HP 700/32 Terminals to the HP 40299B

The HP 700/32 terminal has a dual port (i.e., it has two Port 1s in parallel):

- Port 1, 25-pin (sub-D) is for RS-232-C ONLY.
- Port 1, 6-pin (MMJ) is for RS-423.

Computer Museum

Only one port can be used at any one time.

The pin-outs for the 6-pin, RS-423 port are listed in Table 11h-17.

Table 11h-17. RS-423 Port Pin-out for Connecting an HP 700/32 Terminal

Pin	Signal	Description	Direction
1	DTR	Data Terminal Ready	Output
2	TXD–	Transmitted Data	Output
3	TXD+	Ground Reference for DTR and TXD+	Output
4	RXD+	Received Data	Input
5	RXD–	Received Data	Input
6	DSR	Data Set Ready	Input

HP 700/32 Terminal Configuration. The "Emulation" menu of the configuration screens may be set to the values listed in Table 11h-18: the "Port 1" menu of the configuration screens may be set to the values listed in Table 11h-19.

Table 11h-18. HP 700/32 Terminal Emulation Settings (Emulation Menu)

Parameter	Value
Emulation	VT100
Control Codes	7 bit
Character Mode	8 bit
Preferred Character Set	ISO-8859-1 Latin

Table 11h-19. HP 700/32 Terminal Emulation Settings (Port 1 Menu)

Parameter	Value
Data Length	8 bits
Parity	None
Xmit Baud	9600
Recv Baud	= Xmit
Xmit Pace	Xon/Xoff
Recv Pace	Xoff at 128

To connect the HP 700/32 terminal to the HP 40299B Multiplexer (RS-422 version ADP), the cable described in Table 11h-20 should be made.

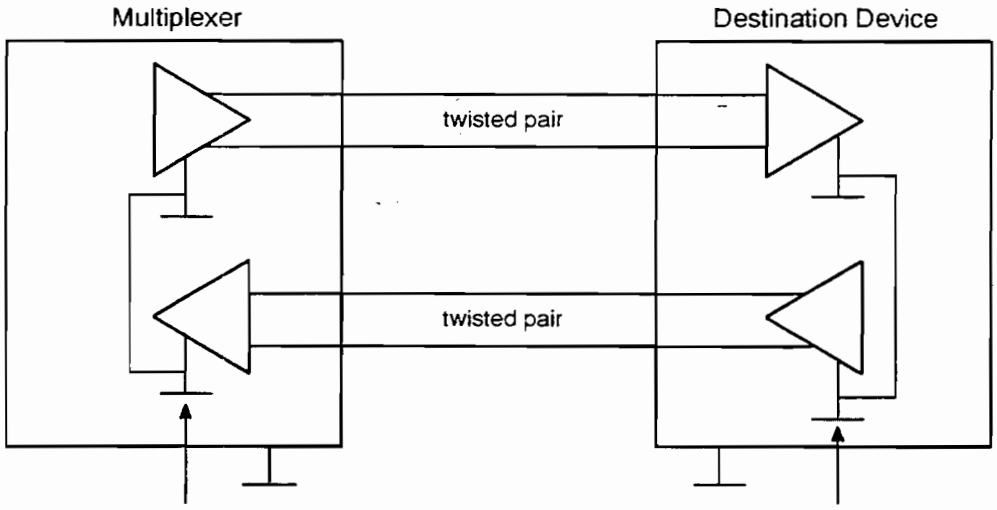
Table 11h-20.
Cable Wiring to Connect a 700/32 Terminal to the HP 40299B (RS-422 ADP)

HP 40299B 25-pin Male EIA RS-422 Sub-D Connector		HP 700/32 6-pin Male EIA RS-423 MMJ Connector
25	Twisted Pair 1	2
19		3
15	Twisted Pair 2	4
17		5

Note

- The connection should be on two twisted pairs. the RXD+ and RXD− being on one pair. and the TXD+ and TXD− on the other.
- The cables must be of telecommunications (telephone) standard twisted-pair of 24AWG or less. 52.5 pF per meter (16 pF/ft).
- If this configuration is to be used in Europe. this cable must be shielded in order to meet VDE requirements.

Caution



Ensure that the potential difference between signal ground of the multiplexer and the signal ground of the attached device **does not exceed seven (7) volts.** Failure to observe this limit may result in the destruction of the drivers on the ADP.

If the system and the peripherals are in the same building using the same earth. it is unlikely that the problem will occur. However. if the system is in a different building than that of the peripheral. and the two buildings do not have a common earth. take care that this potential does not exceed 7 volts.

Distance Limitations

The maximum distances supported between HP 700/32 terminals and the multiplexer are listed in Table 11h-21. This configuration uses an RS-423 terminal connected to an RS-422 ADP.

Table 11h-21.
Maximum Supported Distances Between HP 700/32 Terminals and the HP 40299B MUX

Protocol	Baud Rate (bits/sec)	Maximum Supported Distance
RS-423	19200	300 meters (900 feet)
	9600	600 meters (1800 feet)
	0 to 4800	1200 meters (3600 feet)
RS-422	0 to 19200	1200 meters (3600 feet)

Troubleshooting the HP 40299B

This section describes simple troubleshooting procedures for the HP 40299B.

Maintenance of the HP 40299B is restricted to the replacement of Field Replaceable Units (FRUs), as listed under "Replaceable Parts" later in this chapter.

Faulty units are identified and isolated as follows:

1. Initiating a a self-test.
2. Interpreting the self-test and status indicators.
3. Using online diagnostics.
4. Simple troubleshooting flowcharts and techniques.

Self-test and Status Indicators

The self-test code resides in the EPROM on the MUX card: it tests various activities associated with the MUX card. The self-test is activated when one of the following conditions exist:

- Power on (or recovery from powerfail).
- CMD_Reset.xT
- An "execute self-test element" command is issued by any I/O command (online diagnostics).
- An "execute self-test" command is issued by the console operator in control mode.

The self-test modes and their durations are listed in Table 11h-22.

Table 11h-22. Self-Test Modes for the HP 40299B Multiplexer

Event	Test	Duration
Power on	Short MUX test	Less than 5 seconds
CMD_Reset.xT	Short MUX test	Less than 5 seconds
Diag command	Complete MUX test	Less than 40 seconds
Console command	AP Function test	Less than 7 seconds

Note

The short MUX test and complete MUX test in Table 11h-22 do not include any ADP tests. The self-test can be successful even though no ADP or NSL cable is connected to the MUX card.

Power On Self-Tests. Whenever the Power On or CMD_Reset.xT self-tests are activated, the following MUX functions are tested:

- Operation of the 68000 microprocessor is verified, and a ROM checksum is performed.
- RAM function is verified.
- OCTART chip operation is verified (OCTART = 8 UARTs on a single chip).
- The global timer, vector, and interrupt generation are verified.
- Interrupt priority is verified.
- The function of the HP-PB interface chip, using its built-in loopback functionality, is verified.

CMD_Reset.xT. Self-tests activated by a CMD_Reset.xT check the functionality and the operation of most of the hardware on the MUX card, and at the same time maintains the connection to the local console and the remote support modem if it is the active console at the time of the reset. In the case of the local console, the port may be disabled while self-tests are in progress, however, in the case of the remote support modem (if it is in use as a remote console), the modem connection is maintained while the self-test is running.

Console-Initiated Self-Tests. The console operator can activate a MUX card self-test by using the **TA** command. For more information about using Access Port commands, refer to Chapter 12c, *Access Port (AP)*.

MUX and Status LEDs

The following LEDs are available to indicate operating status:

- Two yellow LEDs (labeled "MUX Status" and "Link Status") on the face plate of the MUX card.
- Two LEDs on the front panel of the ADP:
  - A green LED, when illuminated, indicates that power is connected to the ADP.
  - A orange LED indicates the Link Status.

Table 11h-23 lists the MUX and ADP indications for various operating states.

Table 11h-23. LED Status Indications for the HP 40299B

Power On Sequence	MUX LEDs		ADP LEDs	
	MUX Status	Link Status	Power On	Link Status
Power Off	Off	Off	Off	Off
Power On	On (1-2ms)	On	On	On
Self-test running	Blinking (5s)	Off	On	Off
System boot start	On (1ms)	Blinking (1s)	On	Blinking (1s)
Normal operation	Off	Off	On	Off

ADP Status LEDs. The signal and data activity on the MSL (Multiplexed Serial Link) cable is continually monitored. Any communication problems between the MUX and ADP can be detected by observing the ADP Link Status LED. Normal status for the Link Status LED is OFF, however, the the Link Status LED may be in one of three possible states (see Figure 11h-11):

- **ON**: indicates that the ADP does NOT receive a correct synchronization signal from the MUX card. The LED will remain on until a correct synchronization signal is received. In this state, the ADP continues sending data to the MUX card.
- **BLINKING**: The ADP receives correct data from the MUX card, but the MUX card does NOT receive correct synchronization from the ADP. In this state, the MUX card keeps sending data to the ADP.
- **OFF**: Synchronization and data transmissions are correct in both directions.

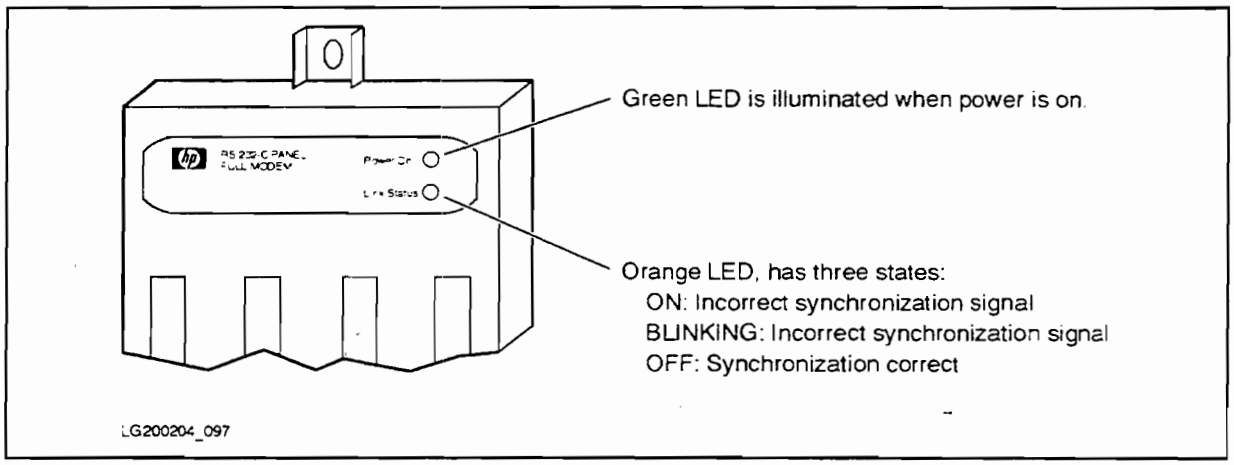


Figure 11h-11. Status LEDs on the HP 40299B ADP

Online Diagnostics for the HP 40299B

The *pmuxdiag* online diagnostic can be used to detect hardware failures, obtain system information, reset the MUX, and obtain RAM memory dumps. This diagnostic effectively tests all the assemblies of the HP 40299B such as the MUX card, MSL cable, and ADP. Note that certain limitations exist when testing the RS-422 ADP; for more information, refer to "Loopback Testing" later in this section.

The *pmuxdiag* information in this section is only a brief overview. For more detailed information about using *pmuxdiag*, refer to *PA-RISC Support Tools Manual (Licensed Users), Volume 2, Device Adapters/MUXes* (HP P/N 5960-3151).

Access to PMUXDIAG

To run *pmuxdiag*, it is recommended that two 8-channel MUX cards be installed. The system console is connected to system console port (Port 0) in order to test the other card. Alternatively, *pmuxdiag* can also be run from a terminal connected to the MUX card being tested, however, this method is not recommended because some problems may occur with data transfers during the test. If *pmuxdiag* must be run from the MUX being tested, start the diagnostic in the background, redirecting both input and output to files.

Caution *pmuxdiag* can have a potentially destructive effect on I/O data. All users attached to the MUX card being tested must complete their terminal I/O processing before the *pmuxdiag* is run to ensure that their data is not lost.

Loopback Testing

The *pmuxdiag* is used to perform various levels of loopback testing. All but one are activated automatically, and without special hardware, by the *pmuxdiag* diagnostic.

The levels of loopback testing are (see Figure 11h-12):

- **Backplane Loopback:** The data paths are looped back immediately after the HP-PB interface chip. Note that the connection between the MUX card and system bus, and the Input/Output circuitry are all tested. (*pmuxdiag* steps 29, 30-37.)
- **Frontplane Loopback:** The data paths are looped back at the OCTART chip's output (OCTART = 8 UARTs on a single chip). (*pmuxdiag* steps 39, 40-47.)
- **Cable Loopback:** The data paths are looped back at the input to the protocol-handling chip on the ADP. This verifies the function of the system bus, the MUX card, the MSL, and a portion of the protocol-handling chip. The Link Status LED will be ON during this test, and no data can be transmitted via the ADP ports. (*pmuxdiag* step 49.)
- **Panel Loopback:** Data is looped back from the ADP connector to verify the function of the system bus, the MUX card, the MSL, the protocol-handling chip, and the line driver/receivers. This test uses the built-in loopback functionality of the RS-232-C ADP. No loopback connectors are required, and the test can be performed without disconnecting peripheral connectors. However, the RS-422 ADP has no built-in loopback feature, thus it is necessary to connect the loopback hood to achieve results from this test (see Figure 11h-13). (*pmuxdiag* steps 50-57.)
- **Terminal Loopback:** Tests the data path between the HP-PB bus and an HP terminal (with loopback capability) connected to an ADP port. Note that if a failure is detected when running this loopback test, it should be treated with suspicion. Disconnect the device cable from the suspected ports, and rerun the panel loopback test. Doing so will avoid an ADP being replaced when, in fact, the test failure could be due to a faulty cable or device. (*pmuxdiag* steps 60-67.)

Note

pmuxdiag step 29 tests the backplane MUX logic common to all ports. Steps 30-37 test the backplane MUX logic unique to a specific port. Step 39 tests the main processor common to all ports. Steps 40-47 test the main processor unique to a specific port.

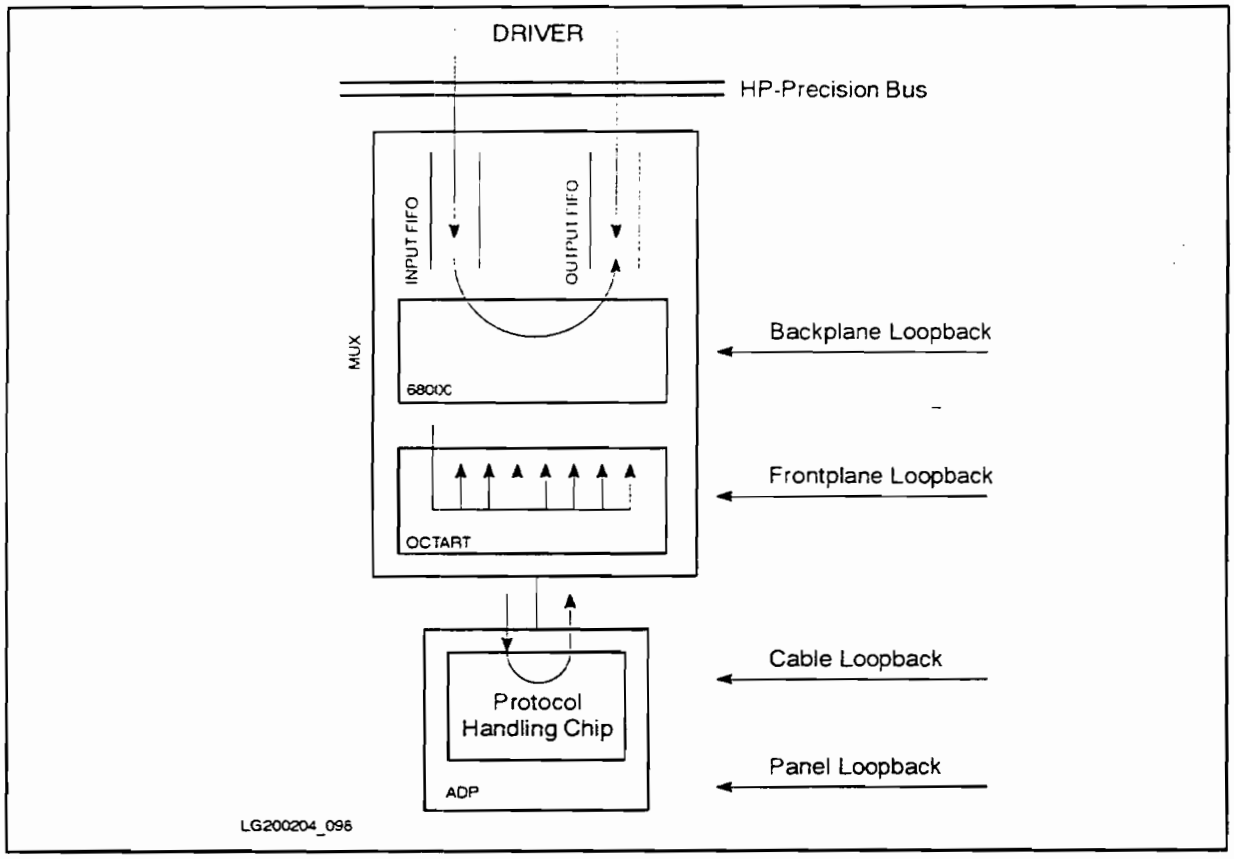


Figure 11h-12. Levels of Loopback Testing for the HP 40299B

Connecting the RS-422 Loopback Hood

If you are conducting a panel loopback test on the HP 40299B with Option 1C8 (i.e., with the RS-422 ADP), you must connect the loopback hood (HP P/N 5181-2030) to the port to be tested (see Figure 11h-13).

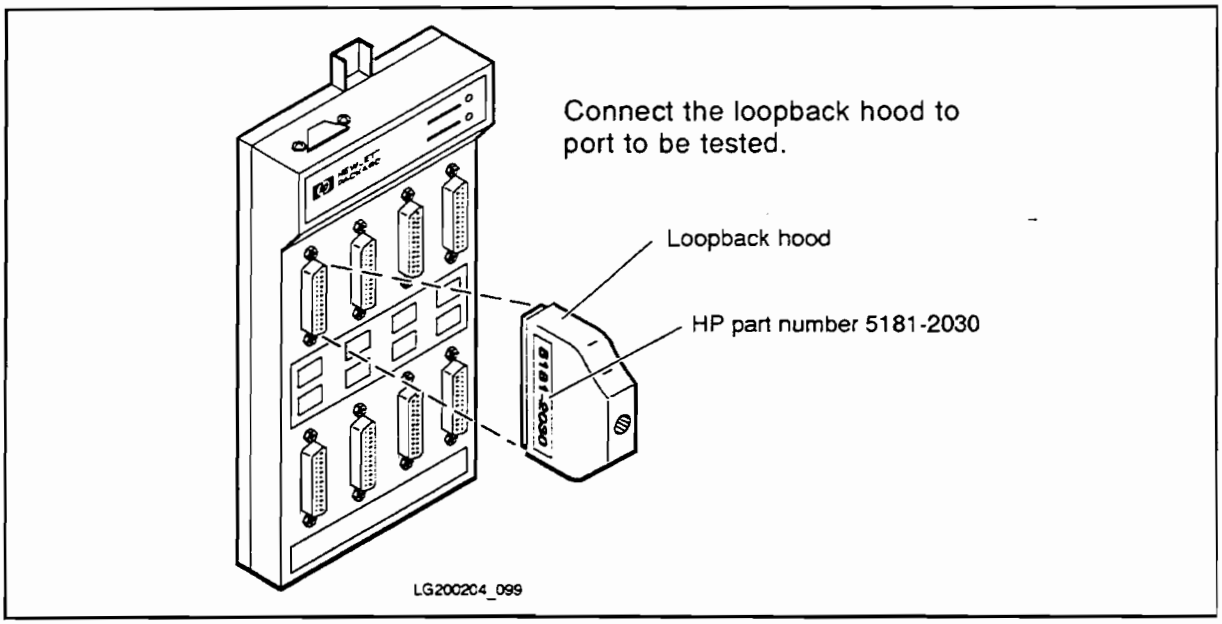


Figure 11h-13. Connecting the RS-422 Loopback Connector for the HP 40299B Option 1C8

Running PMUXDIAG

For information about running *pmuxdiag*, refer to *PA-RISC Support Tools Manual (Licensed Users). Volume 2, Device Adapters/MUXes* (HP P/N 5960-3151).

Troubleshooting Flowcharts

The troubleshooting procedure shown in Figure 11h-14 can be used if the SPU passes its self-test and can boot the ISL on the primary path.

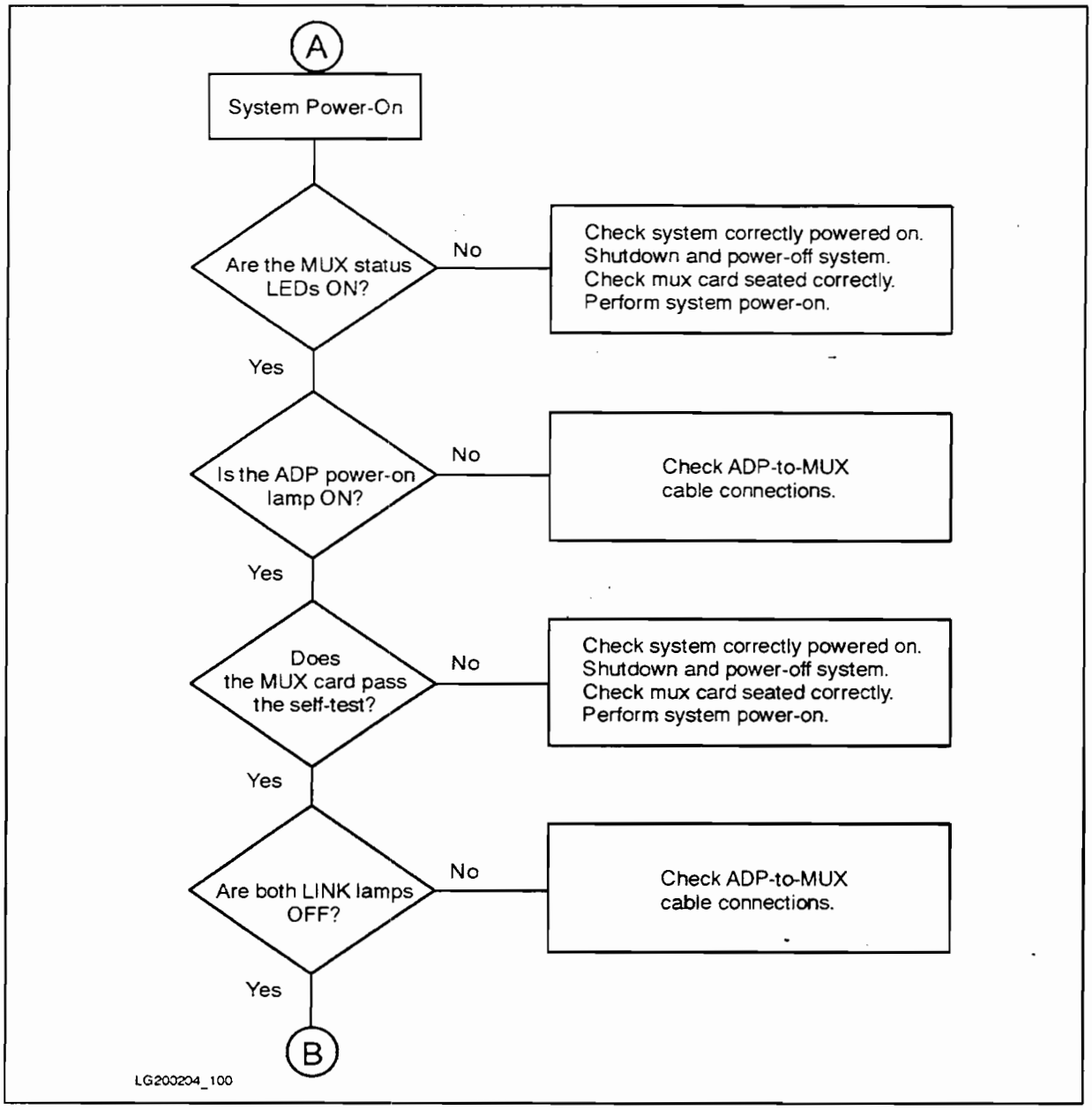


Figure 11h-14. HP 40299B MUX Troubleshooting Flowchart (Part 1 of 3)

If the operating system is loaded. it may be necessary to check the system configuration to ensure that the MUX has been correctly configured during installation (see Figure 11h-15).

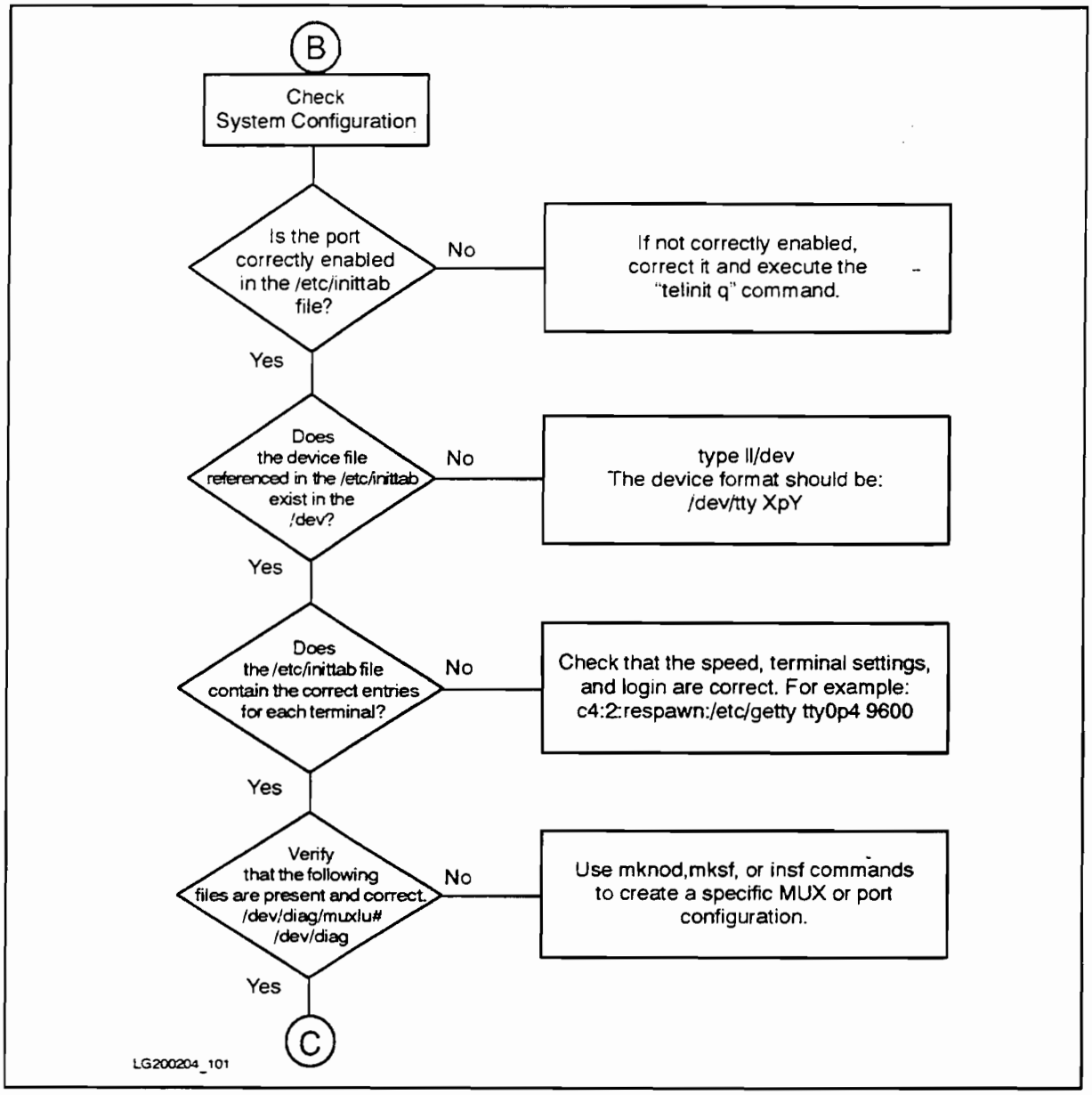


Figure 11h-15. HP 40299B MUX Troubleshooting Flowchart (Part 2 of 3)

If the operating system is loaded. the *pmuxdiag* diagnostic can be used as shown in the procedure in Figure 11h-16.

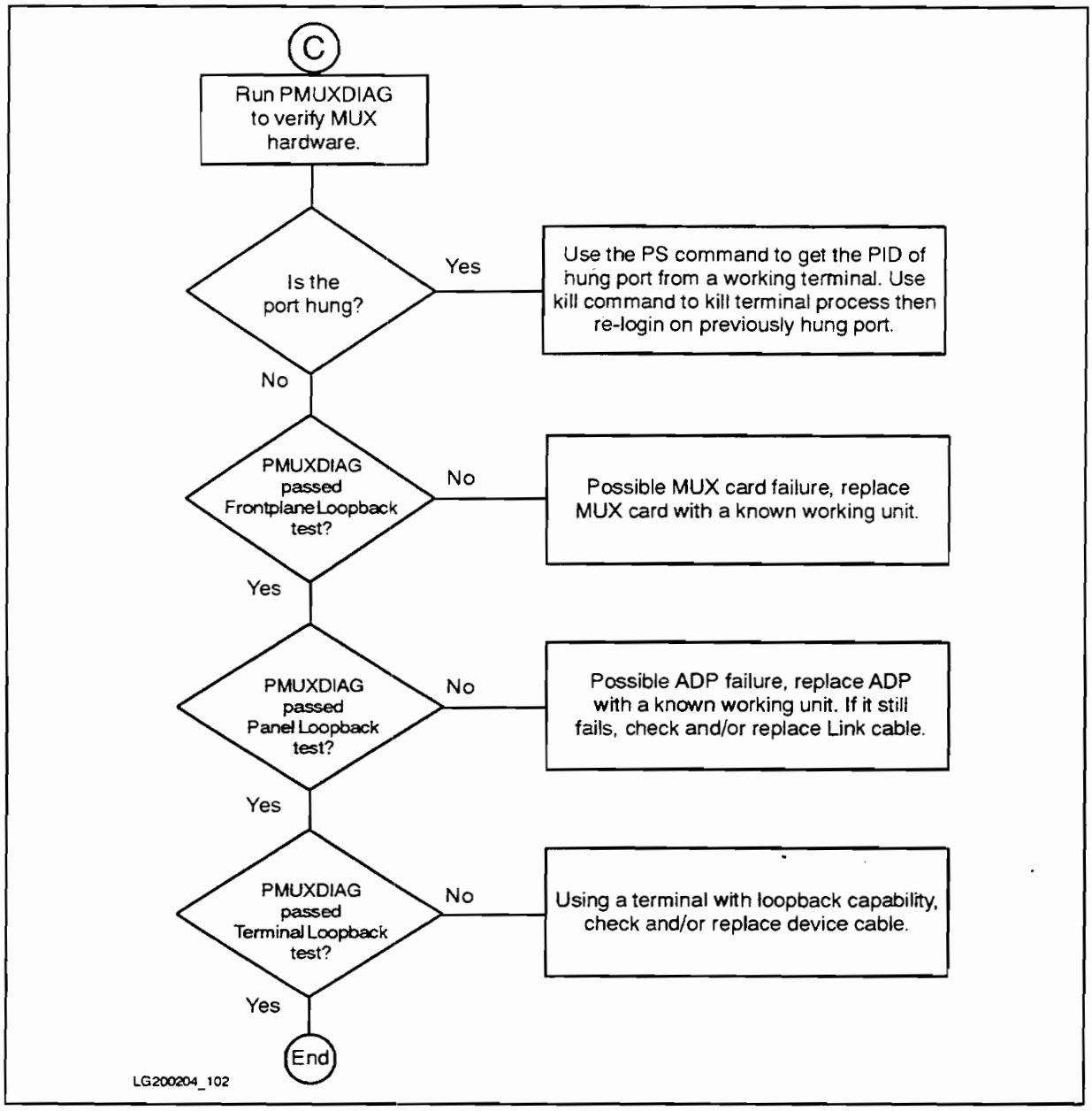


Figure 11h-16. HP 40299B MUX Troubleshooting Flowchart (Part 3 of 3)

HP 40299B Replaceable Parts

This section provides information about ordering replaceable parts for the HP 40299B multiplexer.

Exchange Assemblies

A failing HP 40299B MUX card may be exchanged for a new or refurbished exchange assembly. Table 11h-24 lists the new assembly and exchange assembly part numbers.

Table 11h-24.
Exchange Assembly Part Numbers for the HP 40299B MUX Card

Description	New Assembly Part Number	Exchange Assembly Part Number
HP-PB 8-channel MUX card	40299-60021	40299-69021

Other Field Replaceable Parts

Other replaceable parts (non-exchange Field Replaceable Units or FRUs) for the HP 40299B are listed in Table 11h-25.

Table 11h-25. Field Replaceable Units for the HP 40299B

Description	HP Part Number
Active Distribution Panel (RS-232-C)	5062-3070
Active Distribution Panel (RS-422)	5062-3085
Multiplexed Serial Link (MSL) Cable	40299-60003
RS-422 Loopback Hood	5181-2030
Installation manual	40299-90012

Cable Pin-outs

Figure 11h-17 through Figure 11h-23 show the pin-outs for the various modem cables discussed in this section for the HP 40299B.

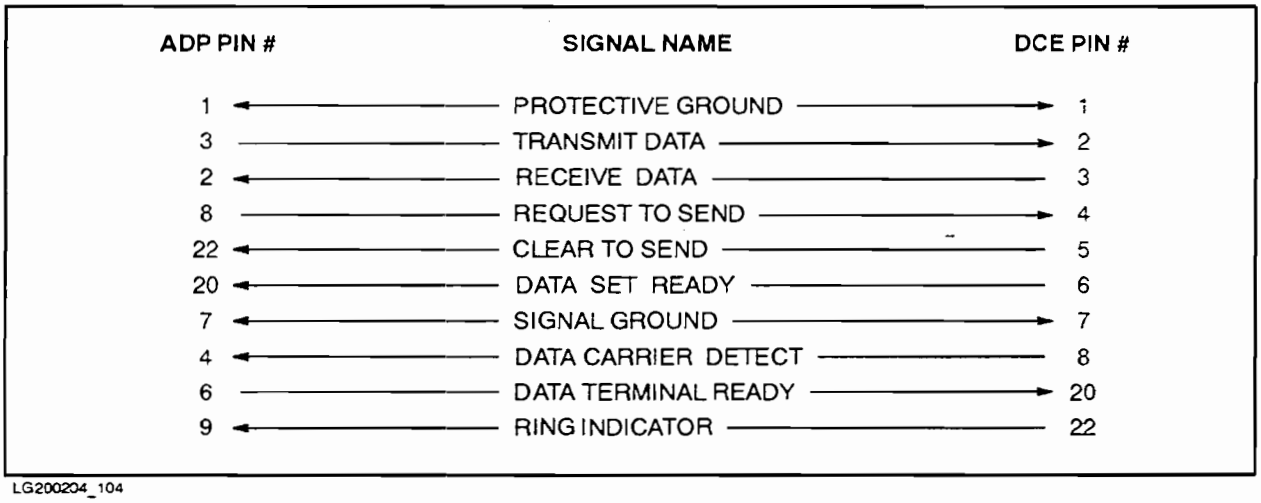


Figure 11h-17. 40233A Cable Pin-out

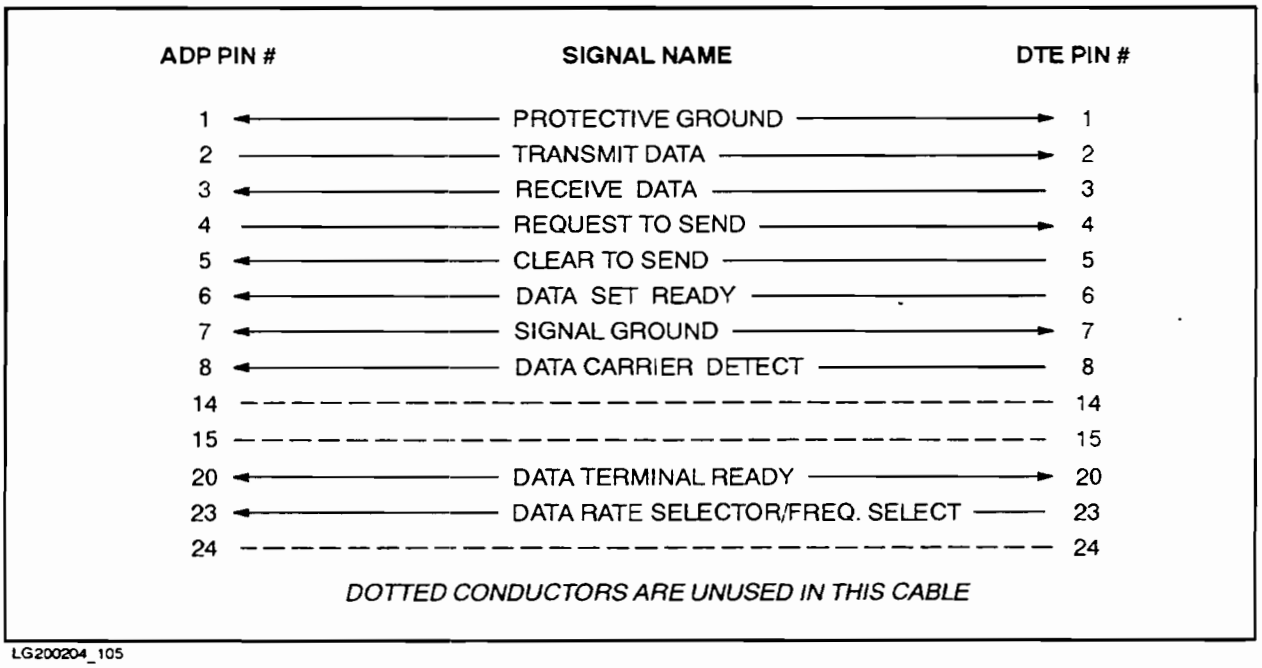
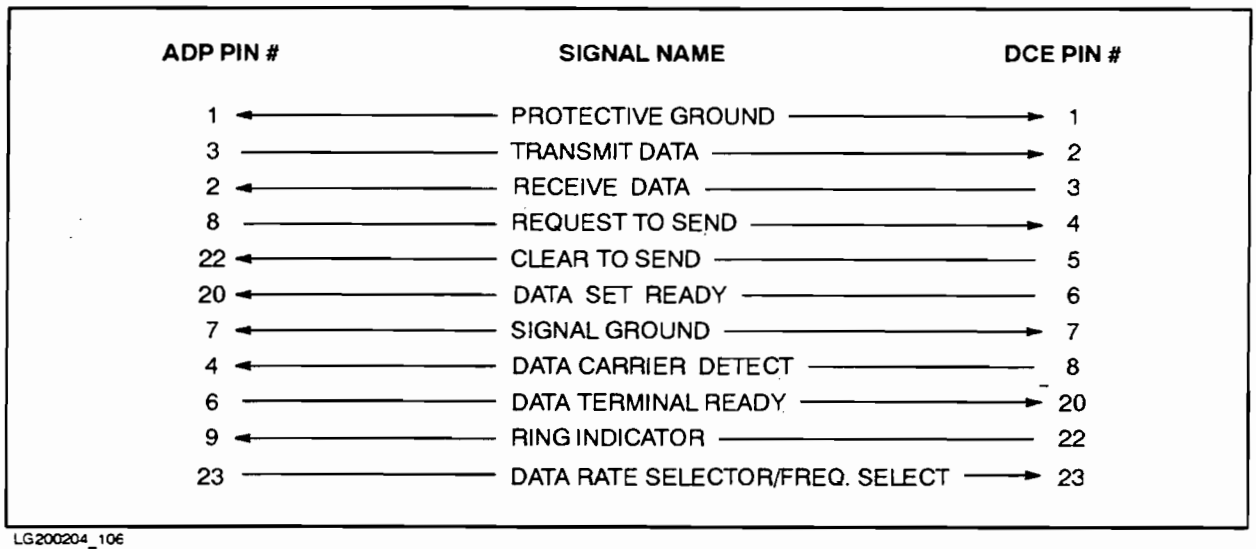
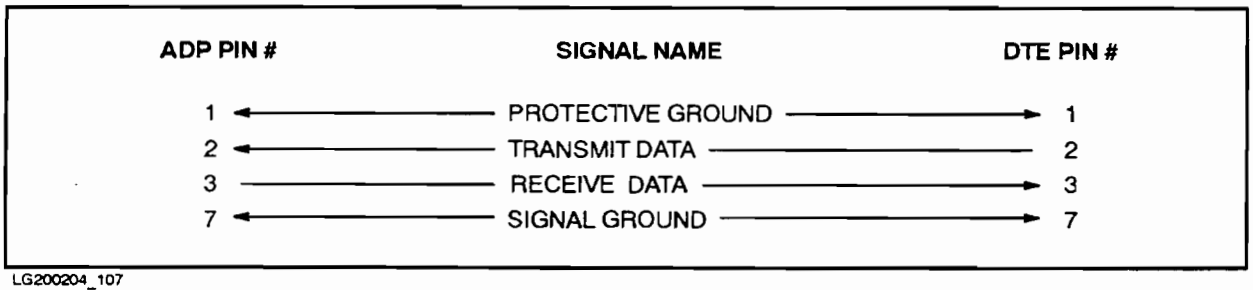


Figure 11h-18. 40242M Cable Pin-out



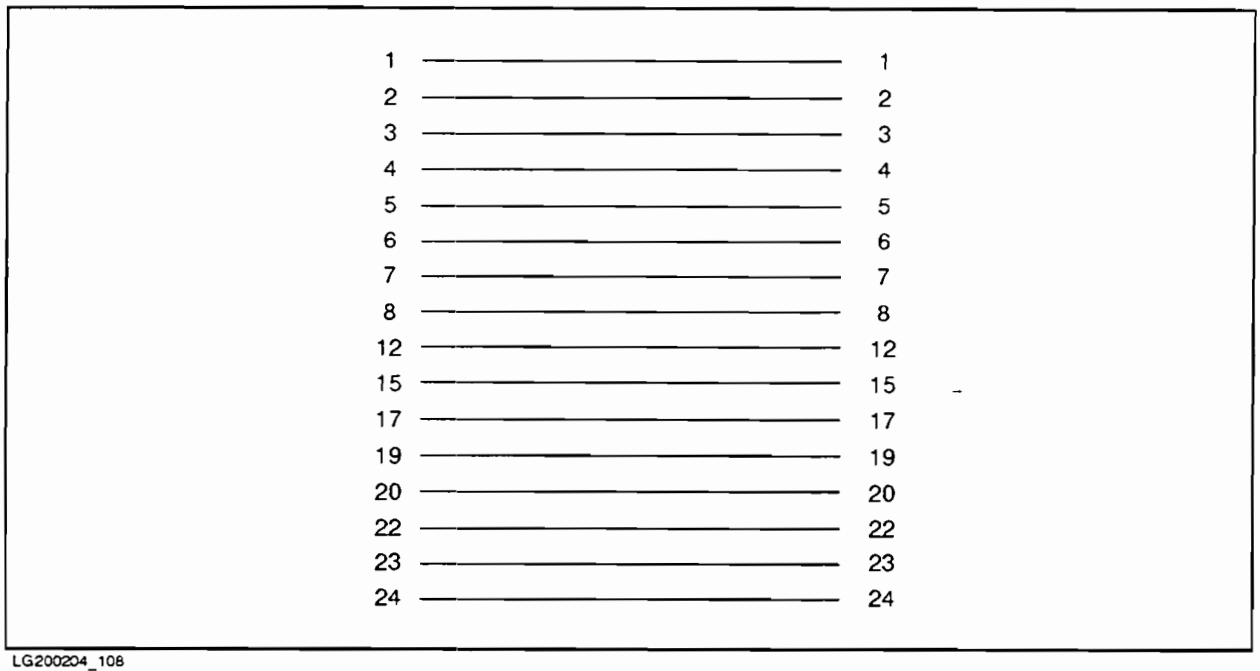
LG200204_106

Figure 11h-19. 92219Q Cable Pin-out



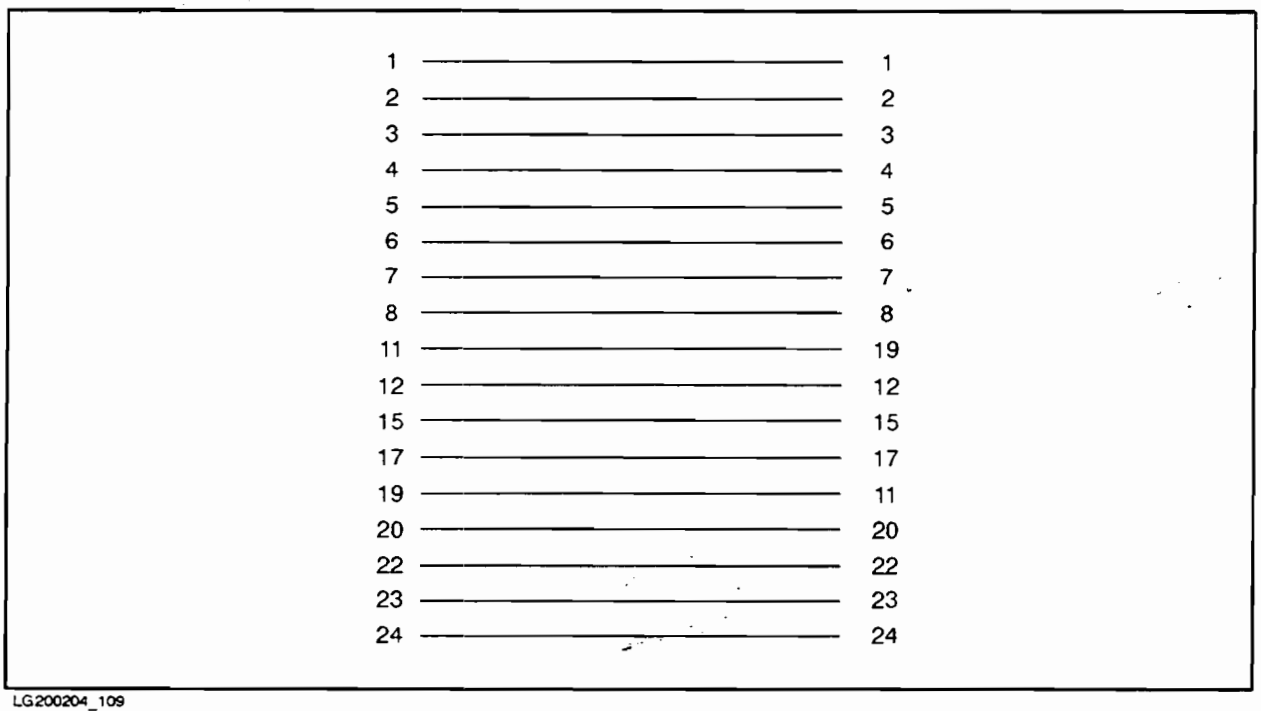
LG200204_107

Figure 11h-20. 13242Y and 40242Y Cable Pin-out



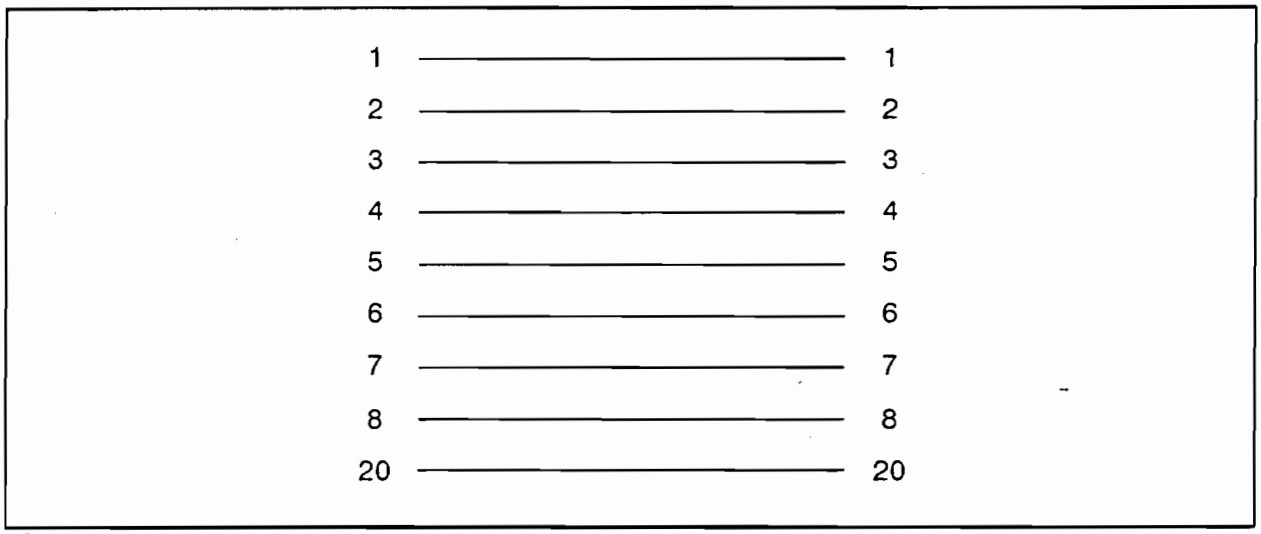
LG200204_108

Figure 11h-21. 13242M Cable Pin-out



LG200204_109

Figure 11h-22. 13242N Cable Pin-out



LG200204_110

Figure 11h-23. 40234A Cable Pin-out

12

Firmware (PDC, ISL, AP, and SP)

This chapter describes the non-OS (firmware) commands available on the 99x/890/T500. This information is taken from the *99x/890/T500 Operator's Guide* (PN A1809-90009) that is shipped with the system.

Chapter Contents:

This chapter covers:

- Interface Summary.
- Firmware and System Startup.
- Updating Firmware.

The following chapters cover the different types of firmware on the 99x/890/T500:

- Chapter 12a (PDC).
- Chapter 12b (ISL).
- Chapter 12c (Access Port).
- Chapter 12d (Service Processor).

Note

Unlike the PDC, AP, and SP commands, Initial System Load (ISL) is not in firmware. ISL is located in secondary storage (for example, on tape or disk). We group ISL with the firmware commands because it also provides non-OS commands for controlling hardware.

Interface Summary

Several dozen commands are available for operating and monitoring the hardware. These commands are available from five different interfaces (Table 12-1).

PDC, ISL, and OS commands are only available at certain stages of system startup. Many AP and SP commands are available at all stages of operation. See Figure 12-1.

Table 12-1. Interfaces Used to Operate the System

Abbrev	Full Name	Function	Commands Available
PDC	Processor Dependent Code	Initializes the hardware, conducts selftests, handles system faults. Allows operator to alter various system parameters.	Important PDC commands include: ■ Display/change the default boot and console paths. ■ Set/clear autoboot flag. ■ Update firmware. ■ View the HPMC tombstone.
ISL	Initial System Loader	Responsible for booting the operating system.	Important ISL commands include: ■ Display/change default boot and console paths. ■ Set/clear autoboot flag.
AP	Access Port	Allows remote servicing of system.	Important AP commands include: ■ Enable/disable remote console access. ■ Modify remote access security features. ■ Enable/disable the SPU status display.
SP	Service Processor	Provides functions for servicing the system, whether DC power is on or off. Monitors power system.	Important SP commands include: ■ Execute a Transfer of Control (TC). ■ Execute a reset (RS or RE). ■ Set/clear autostart flag. ■ Monitor and control power system. ■ Change/view system configuration. ■ Change/view error logs and HPMC tombstones.
OS	Operating System (HP-UX or MPE/iX).	See OS documentation.	See OS documentation.

The ISL and AP interfaces are similar to those on previous PA-RISC systems. PDC on 99x/890/T500 has a new user interface. The Service Processor (SP) is entirely new for the 99x/890/T500.

Firmware and System Startup

At system startup, the computer passes through several stages before loading the operating system (see Figure 12-1). At each stage, the operator has access to a different set of commands.

Steps involved in system startup:

1. The operator can begin the system startup in one of four ways:
   a. **Power-up:** Operator turns on rear circuit breaker and places the front panel Standby/Ready switch to the "Ready" position.
   b. **TC:** Operator enters TC at the SP prompt when the computer is powered up and the operating system is running. (The TC command is used to reset the system when you want to preserve troubleshooting data, for example to prepare for a memory dump.)
   c. **Reset:** Operator enters RS at the SP prompt when the computer is powered up. (The RS command is used to reset the system when you do not care about preserving troubleshooting information, for example when updating the operating system. An RS is also used to reset the system when a TC is not successful.)
   d. **Restart:** Operator enters RE at the SP prompt when the computer is powered up. (RE is similar to the RS command, but initializes the computer more thoroughly. It also takes more time.)
2. The computer executes Service Processor (SP) firmware. SP firmware is located on the Service Processor card inside the computer. The SP firmware:
   a. Performs a selftest (after a RE command or power-up; not after a TC or RS command).
   b. Checks the card slots inside the computer to determine whether the system configuration is appropriate for the power.
   c. Checks the outputs of the power supplies.
   d. Displays message if configuration has changed since the last power-up. If the SP Autostart flag is set, continues to boot. If the SP Autostart flag is cleared, the computer halts and waits for operator input if the configuration has changed.
   e. Allows the operator to access several SP commands. (The SP interface is available from this point on.)
3. The computer executes Processor Dependent Code (PDC). PDC is firmware located on the SP card inside the computer. PDC:
   a. Performs hardware selftests.
   b. Initializes the hardware.
   c. If it detects a memory card failure and has de-allocated the memory, it displays a message. If the SP Autostart flag is set, continues to boot. If the SP Autostart flag is cleared, the computer halts and waits for operator input.
   d. Allows the operator to access several PDC commands.
   e. Loads ISL.
4. The computer executes the Initial System Loader (ISL) program. ISL is code located in secondary storage (for example, tape or disk). ISL:

a. Allows the operator to access several ISL commands.

b. Loads the operating system (HP-UX or MPE/iX).

5. The computer boots the operating system (HP-UX or MPE/iX)

The Access Port (AP) and Service Processor (SP) interfaces are available during all stages of system startup.

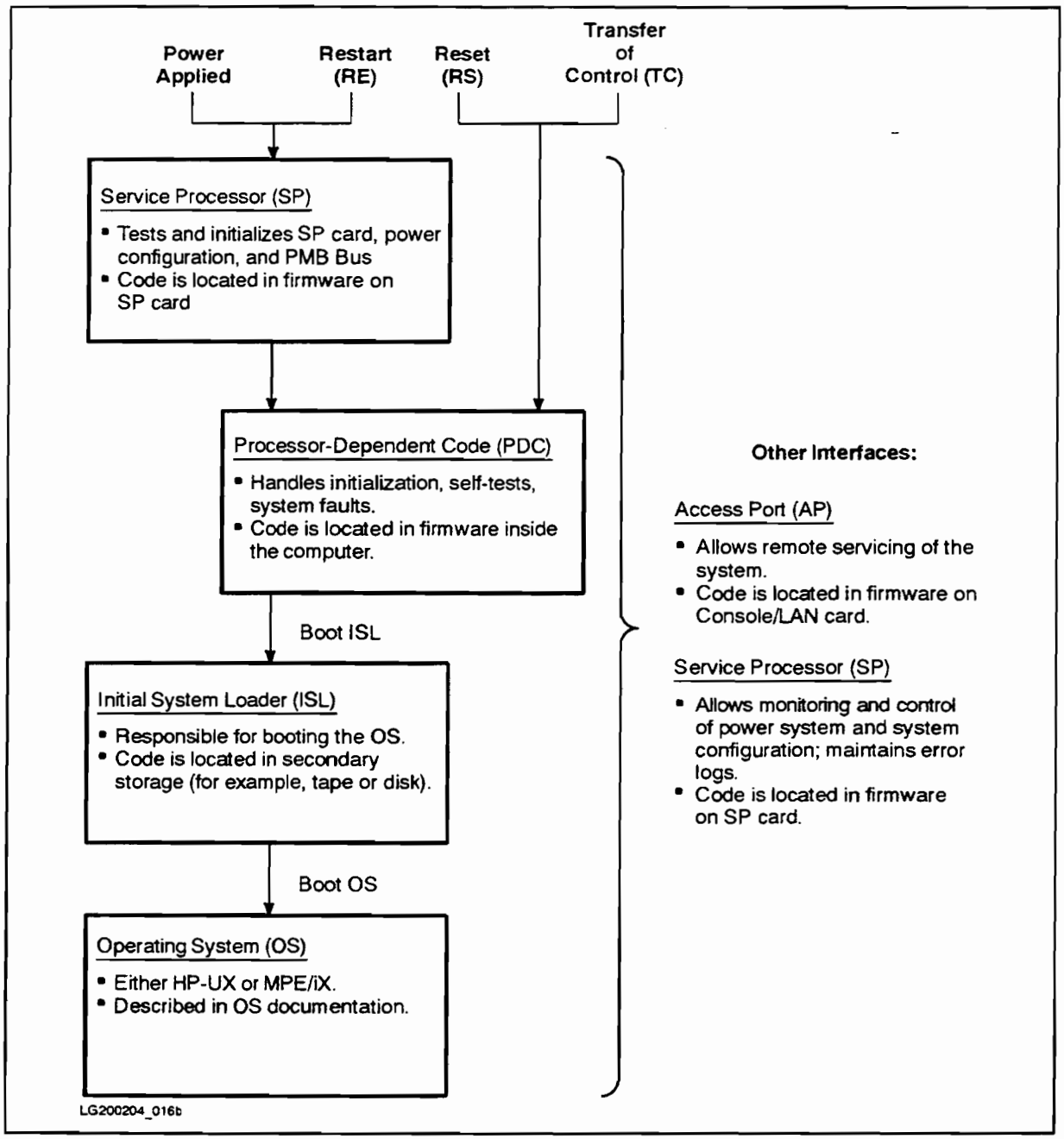


Figure 12-1. Relationship of Interfaces to System States

Updating Firmware

Processor Dependent Code (PDC) and Service Processor (SP) code can be updated using a tape device.

The procedure for updating firmware is covered in Chapter 1 (Overview).

12a

Processor Dependent Code (PDC)

PDC is firmware located internal to the computer. PDC initializes the hardware, conducts selftests, and handles system faults. Several dozen commands are available at the PDC user interface. Important PDC commands include:

- Change the autoboot flag and the default boot paths.
- View the HPMC tombstone.
- Update firmware.

Accessing PDC

1. Reset the system or cycle power (power down, then power up) as described in Chapter 1 (Overview).
2. Watch the system console carefully.
3. When the system is going through its startup routine, you will see a display similar to the following on the console:

```
-------------------------------------------------------------------------
                    PDC - Processor Dependent Code
                             Version x.xx
                      (c) Copyright 1990-1993
                     The Hewlett-Packard Company
                         All rights reserved
-------------------------------------------------------------------------
            Total Memory:          192 MB
            Total Bus Converters: 2
            Total Processors:     2

            Primary Boot Path:     0/52.0.0.0.0.0.0
                                     0 means BC 0 in PMB slot 0
                                    52 means I/O card in HP-PB slot 13
                                     0 means device ID of 0

            Alternate Boot Path:   0/36.0.0.0.0.0.0
            Console/Keyboard Path: 0/44.0.0.0.0.0.0

-------------------------------------------------------------------------
```

4. At the bottom of the display, you will also see one of two possible prompts:

   a. If the autoboot flag is **not** enabled, you will see:

```
Continue with primary boot path?   ([y]/n/<new_path>)> N
```

   If you see the above prompt, press n. You will see:

```
Continue with alternate boot path?   ([y]/n/<new_path>)> N
```

   If you see the above prompt, press n.

   b. If the autoboot flag is enabled, you will see:

```
Processor is starting the autoboot process.

To discontinue, press any key within 10 seconds...
```

   As soon as you see the above prompt, press a key. (If you do not press a key within several seconds, the system continues with its bootup and you will have to start over again by cycling power or by using the RS or RE command at the SP prompt.) After you press the key, you will see:

```
Continue with primary boot path?   ([y]/n/<new_path>)> N
```

   When you see the above prompt, press n. You will see:

```
Continue with alternate boot path?   ([y]/n/<new_path>)> N
```

   When you see the above prompt, press n.

PDC Command Reference

Initial Display

```
------------------------------------------------------------------------
                    PDC - Processor Dependent Code
                            Version x.xx
                      (c) Copyright 1990-1993
                     The Hewlett-Packard Company
                         All rights reserved
------------------------------------------------------------------------
            Total Memory:          192 MB
            Total Bus Converters: 2
            Total Processors:     2

            Primary Boot Path:     0/52.0.0.0.0.0.0
                                     0 means BC 0 in PMB slot 0
                                    52 means I/O card in HP-PB slot 13
                                     0 means device ID of 0

            Alternate Boot Path:   0/36.0.0.0.0.0.0
            Console/Keyboard Path: 0/44.0.0.0.0.0.0

------------------------------------------------------------------------
```

Messages and Prompts

Message for Insufficient Memory

```
WARNING: Insufficient memory to guarantee powerfail recovery.
         The system requires 64 MB per processor.  This system
         has 64 MB and needs at least 128 MB for 2 processors.
```

Autoboot Flag True

```
Processor is starting the autoboot process.

To discontinue, press any key within 10 seconds ... discontinued.

Continue with primary boot path?   ([y]/n/<new_path>) > N

Continue with alternate boot path?   ([y]/n/<new_path>) > N

Boot process discontinued. Going to Boot Console User Interface.
```

Autoboot Flag False

```
Continue with primary boot path?   ([y]/n/<new_path>) > N

Continue with alternate boot path?   ([y]/n/<new_path>) > N

Boot process discontinued. Going to Boot Console User Interface.
```

Main Menu

```
------- Main Commands ----------------------------------------------------

        Commands Available

        PR Primary:     Continue boot using primary boot path
        RE Restart:     Restart the system and activate new settings


        Menus Available

        BO Boot:        Perform boot tasks (menu)
        FI Firmware:    Update firmware (menu)
        SE Service:     Service the system (menu)
        TO Tomb:        Display HPMC troubleshooting information (menu)


        HE Help:        Display help text on menu selections
-------
Main>
```

Paging Prompt for Online Help

The following message appears at the bottom of each "help" page:

```
-------
Forward Back Quit? >
```

You can press Enter instead of F to page through help text. At the end of the help text, pressing Enter or F takes you back to the menu you started from.

Online Help

```
Main> HE

------- PDC Help ------------------------------------------------------

Contents:       I.   OVERVIEW OF PDC
                II.  ENTERING PDC COMMANDS
                III. SYNTAX OF ALL PDC COMMANDS

I. OVERVIEW OF PDC

     Processor Dependent Code (PDC) is firmware-based code that a system
     executes before loading ISL and the operating system.  Several dozen
     commands are available from this interface enabling the user to:
               * Change boot paths.
               * Change the autoboot flag.
               * Update firmware.
               * Service the system.

     To leave the PDC interface and continue the boot process, enter the
     command PRIMARY (to boot from disk or other media) or ALTERNATE (to
     boot from a tape drive or other media).

     For detailed information on a command, get into the menu in which
     the command occurs, then type HELP.


II. ENTERING PDC COMMANDS

     Commands and options are case insensitive.  (help = HELP).

     Commands in the current menu have two-key shortcuts.  For example
     you can type "PR" for PRIMARY at the Main Menu.

     You can execute any command from any menu by typing the FULL NAME
     of the command.
```

III. SYNTAX OF ALL PDC COMMANDS

Capitalized words "EXAMPLE" are commands and should be typed as is.
Words within brackets <example> are parameters:
Square brackets [] enclose optional parameters
The OR symbol | separates valid parameters

ALTERNATE (Boot Menu)
Boot from the alternate boot path.

AUTOBOOT [<boolean>] (Boot Menu)
<boolean> = TRUE | T | 1 | FALSE | F | 0 .

Display or optionally change the autoboot flag.

CHASSIS <chassis_code> (Service Menu)
<chassis_code> = 4-digit hexadecimal number displayed on 26th line of console after entering Control-B.

Display a string describing the meaning of a chassis code.

DISPLAY_TOMB <slot_num>/<mod_num> (Tombstone Menu)
<slot_num> = Processor slot number ranging between 8 - 15.
<mod_num> = Module number 0 or 1.

Display troubleshooting data (a tombstone) generated by an HPMC, LPMC, or Transfer of Control.

```
FASTSIZE [<fast_value>]                          (Service Menu)
    <fast_value> = Hex number (0x0 - 0xF) corresponding to amount
                   of memory to test before launching ISL.

    Display or optionally change the fastsize value.


FLAG_xx [<boolean>]                        (Selftest Flags Menu)
    <boolean> = TRUE | T | 1 | FALSE | F | 0 .

    Display or optionally change a flag value controlling selftests
    run at system startup.  Individual flags are listed below.

FLAG_NT : NT No Test
FLAG_BD : BD Bypass DCache_Tests (Early ST)
FLAG_BE : BE Bypass Early Selftest
FLAG_BF : BF Bypass FPU Tests (Early ST)
FLAG_BI : BI Bypass ICache Tests (Early ST)
FLAG_BL : BL Bypass Late Selftest
FLAG_BM : BM Bypass Memory Testing
FLAG_BO : BO Bypass I/O Testing
FLAG_BP : BP Bypass PBMI Tests (Early ST)
FLAG_BT : BT Bypass TLB_Tests

FLAG_EA : EA Enable Additional Close Console Messages (ST only)


HELP | H | ?                                      (All Menus)
    Display help for current menu.
```

```
MEMTEST                                              (Service Menu)
    Run the extended memory tests.


NOAUTOTOMB [<boolean>]                               (Service Menu)
    <boolean> = TRUE | T | 1 | FALSE | F | 0 .

    Display or optionally change the automatic tombstone display flag.


PATH [<path_type> <new_path>]]          (Boot Menu, Firmware Menu)

    <path_type> = PRIMARY | PRI | P |
                  ALTERNATE | ALT | A |
                  CONSOLE | CONS | C
                  UPDATE | U
    <new_path> = See Boot Commands Help Menu.

    Change a path stored in stable storage.


PRIMARY                                          (Main Menu, Boot Menu)
    Boot from the Primary Boot Path.


RESTART                                                  (Main Menu)
    Restart the system.  This is equivalent to a hard power on.


SHOWPDT                                                  (Service Menu)
    Show the contents of the Page Deallocation Table.


UPDATE <name>                                            (Firmware Menu)
    <name> = ASCII string corresponding to the file name of the
             new firmware located in the LIF partition of
             storage media.

    Updates firmware from the LIF file <name> by copying the firmware
    to the inactive bank of PDC, then it restarts the machine using the
    new firmware.

VERIFY                                                   (Firmware Menu)
    Display the PDC/SP firmware revisions and related information.

END
```

Boot Menu

```
Main> BO

------- Boot Commands ------------------------------------------------

        Commands Available

        PR Primary:      Boot system using primary boot path.
        AL Alternate:    Boot system using alternate boot path.
        AB Autoboot:     Change the autoboot flag.
        PA Path:         Change a path (PA <path_type> <new_path>)
                                <path_type>= Pri, Alt, Cons, or Update


        Values stored in Stable Storage:

            Autoboot Flag:              FALSE
            Primary Boot Path:          0/52.6.0.0.0.0.0
            Alternate Boot Path:        0/52.0.0.0.0.0.0
            Console/Keyboard Path:      0/44.0.0.0.0.0.0

        HE  Help:        Display help text on menu selections
        eXit:            Return to previous menu
-------
Boot>
```

Online Help

```
Boot> HE

------- Boot Commands Help -----------------------------------------------

Contents:       I.   RECOMMENDED PATHS
                II.  BOOT COMMAND DESCRIPTIONS
                III. WHAT IS A PATH?
                IV.  PATH FORMAT


I.   RECOMMENDED PATHS

                    With SCSI system disk    With HP-FL system disk
Primary:                 0/52.6.0                 0/52.0
Alternate (SCSI dev):    0/52.0.0                 0/36.1.0
Alternate (HP-IB dev):   0/12.0.3                 0/12.0.3
Console:                 0/44.0                   0/44.0


II.  BOOT COMMAND DESCRIPTIONS

        Primary      Boot from primary boot path.  The primary boot path
                     points to the device used to boot the operating
                     system (usually the system disk).

        Alternate    Boot from alternate boot path. The alternate boot
                     path points to the device (typically a tape drive)
                     used to load the operating system from the
                     distribution media.
```

Note

In the above help text, the value for Alternate (SCSI dev) on systems with an HP-FL system disk should be 0/36.0.0.

Autoboot

Set autoboot flag TRUE or FALSE. If autoboot is TRUE, the system automatically boots when powered up. (More precisely, it loads the software on the primary boot device.) During an autoboot, the process pauses for 10 seconds to allow the operator to stop the boot process.

If the autoboot flag is modified, the new setting takes effect when the system is powered up again.

```
Syntax:   AUTOBOOT <boolean>.  For <boolean>:
                TRUE  =  T = 1
                FALSE =  F = 0

Example:   AUTOBOOT TRUE  or  AB TRUE  or  AB T
```

Path

Change/display paths kept in Stable Storage.

```
Syntax: PATH [ <path_type> [ <new_path> ]]
    <path_type> is one of:
       P = primary boot path
       A = alternate boot path
       C = console path
       U = update path
    <new_path> = a path description

Examples:
 PATH            Displays all paths
 PATH A          Displays only alternate path
 PATH P 0/52.0   Changes primary path to 0/52.0
```

Note

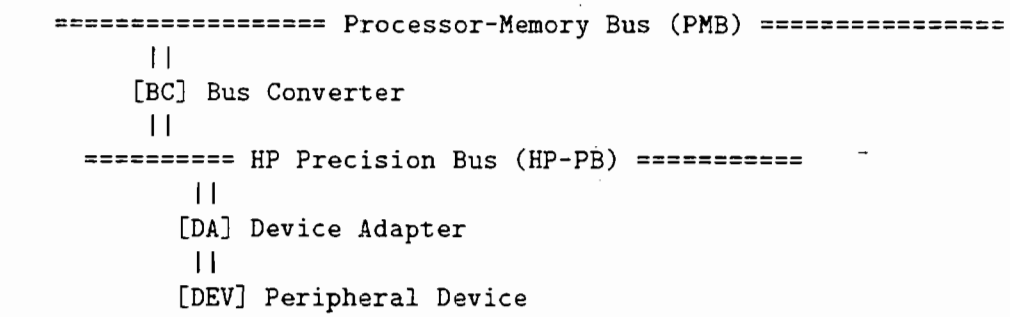
If you change the console path (PATH C), you must reboot the computer for the new console path setting to take effect:

1. Enter Control-B at the system console.
2. At the SP> prompt. enter RS.

It is not necessary to reboot the computer if you change boot paths.

III. WHAT IS A PATH?

A path is a hardware address, showing the location of a peripheral device in the bus structure. Typical bus structure:



```
IV. PATH FORMAT

On this system, a path has the format:

     BC/DA.DEV

     BC  = The PMB module of the Bus Converter (BC).  This decimal value
           is based on: 1)  the slot number of the BC card.
                        2)  whether the upper or lower connector of
                            the BC card is used.

           BC = (4 * slot number of the BC) + (BC module number)
           BC module number is 0 for the lower connector.
                               2 for the upper connector.

           Examples:
            BC =  0 for BC card in slot 0, lower connector; (4*0)+0 = 0
               =  2 for BC card in slot 0, upper connector; (4*0)+2 = 2
               = 16 for BC card in slot 4, lower connector; (4*4)+0 =16

     DA  = The HP-PB module of the device adapter (DA).
           Equals 4 * HP-PB slot number of the DA (decimal).

     DEV = The ID number of the device, often set on the
           device itself (hexadecimal).

  Example:  4/36.3   (decimal format)
     BC = 4        4/4 = 1.  The BC is in PMB slot 1; module 0.
     DA = 36      36/4 = 9.  The I/O card is in HP-PB slot 9.
     DEV = 3      The ID on the device is set to 3.

Values for BC and DA are expressed in decimal notation.
If there are additional values in the path (for example, to specify
a LAN address), these are expressed in hexadecimal notation.

END
```

Firmware Menu

```
Main> FI

------- Firmware Commands ------------------------------------------------

        +-----------------------------------------------------------+
        | NOTICE!!   A successful UPDATE will change the version    |
        |            of firmware and hardboot the system.           |
        +-----------------------------------------------------------+

        Values stored in Stable Storage:
            Update Path:              0/0/0/0/0/0/0.0.0.0.0.0.0

        Commands Available
        PA Path:            Change the update path (PA U <path>)
        VE Verify:          List firmware revisions
        UP Update:          Update inactive firmware from LIF (UP <name>)


        HE Help:         Display help text on menu selections
        eXit:            Return to previous menu
-------
Firmware>
```

Note

You should use the Firmware Update Tool (FUT) to load new firmware rather than the commands from this menu. The only reason for using the commands in this menu is to load FUT. For background on FUT, see Chapter 10 (Functional Description). For FUT procedures, see Chapter 1 (Overview). You can also refer to the *x9x Family Firmware Update Guide* (PN A1820-90002).

Online Help

```
Firmware> HE

------- Firmware Commands Help -----------------------------------------

Firmware Commands are used to update firmware on the service
processor (SP).  This firmware contains Processor Dependent Code
(PDC) and service processor code.

To perform a firmware update:

1.  Check the path displayed in the menu.  If the path is incorrect,
    change the firmware update path with the command:

    Firmware> PATH UPDATE <new_path>

2.  Determine the name of the file on the LIF partition that has the
    new revision of firmware.

3.  List firmware presently installed on the service processor.
    This function performs a checksum on firmware present and
    indicates revisions of the software, the active revision,
    and the revision that will be active after a restart.

    Firmware> VERIFY

4.  Perform the firmware update.

    Firmware> UPDATE <name>

    The firmware update writes to the inactive bank of firmware
    from the file in LIF containing the new firmware.  (The name of
    the LIF file is automatically converted to all upper-case.)
    After a successful update, the machine automatically restarts
    and uses the new firmware.

END
```

Display from VERIFY Command

```
Firmware> VE
     Performing checksums ...
     ------------------------------------------------------------------------
     Active Bank Information            | Alternate Bank Information
     -----------------------------------|------------------------------------
     Bank Status:          Firmware OK  | Bank Status:          Firmware OK
     PDC Revision:         2.20         | PDC Revision:         MR20
     SP Revision:          1.62         | SP Revision:          1.62
                                        |
     Update file name:     FWETT220     | Update file name:     FWETT104
                                        |
     Dates:                             | Dates:
       Creation:     08/12/93 16:00:54  |   Creation:     08/11/93 21:26:12
       Installation: 08/12/93 16:20:16  |   Installation: 08/12/93 14:51:28
       Activation:   08/12/93 16:21:54  |   Activation:   08/12/93 14:53:05
                                        |
     Service Processor Board ID: X3XXX
     ------------------------------------------------------------------------
Firmware>
```

Service Menu

```
Main> SE

------- Service Commands ------------------------------------------------

        Commands Available
        CH Chassis:     Decode a chassis code
        MT Memtest:     Execute extended memory self-tests
        SP ShowPDT:     Display page deallocation table

        Menus Available

        ST Selftest:    Modify selftest flags.  (menu)

        Values stored in Stable Storage:

        FA Fastsize     F (initialize and test all memory)
        AT Noautotomb   FALSE

        HE  Help:       Display help text on menu selections
        eXit:           Return to previous menu
-------
Service>
```

Online Help

```
Service> HE

------- Service Help ------------------------------------------

Commands in this menu are for service personnel.

        Chassis <chassis_code>
               Displays explanatory text for a specified chassis
               code.  Chassis codes are 4-digit hex codes displayed on
               the console.  If a system failure occurs, the chassis
               code often indicates the location of the failure.

        Selftest
               Displays a screen that allows selftest flag modification.
               These flags control the behavior of the selftests executed
               when the computer is powered up or reset.

        Memtest
               Executes a series of extended selftests on main memory.
```

```
Fastsize [0-F]                              Default = F (test all)
      This option determines the maximum amount of memory
      tested during the initial boot.  To test different sizes
      of memory, specify a hexadecimal digit from 0 to F:

        0 = 256 KB     5 =   8 MB     A = 256 MB
        1 = 512 KB     6 =  16 MB     B = 512 MB
        2 =   1 MB     7 =  32 MB     C =   1 GB
        3 =   2 MB     8 =  64 MB     D =   2 GB
        4 =   4 MB     9 = 128 MB   E-F = Initialize and
                                           test all

      For normal operation, leave FASTSIZE at its default of F
      (test all memory).  This ensures that memory problems are
      detected at bootup.

      For rapid bootups while servicing the system, the Fastsize
      can be set to a smaller value (8 for example).  Afterwards,
      reset Fastsize to F.

  Noautotomb [t|f]          Default = F (Display tombstone
                                         automatically)
      If set to TRUE, this option prevents troubleshooting
      information (the tombstone) from automatically appearing
      after an HPMC.
            true  =  t = on  = 1
            false =  f = off = 0

END
```

Note

The Fastsize option is not automatically set to "F" during bootup. If you change the Fastsize option to a "non-F" value, while servicing the system, be sure to reset it to "F" before leaving PDC.

Test Flags Commands

```
Service> ST

------- Test Flags Commands ---------------------------------------------

        NT - No test.................................false
          BE - Bypass Early Selftest.................false
            BP - Bypass PBMI Tests (Early ST).........false
            BI - Bypass ICache_Tests (Early ST).......false
            BD - Bypass DCache_Tests (Early ST).......false
            BT - Bypass TLB_Tests (Early ST)..........false
          BL - Bypass Late Selftest..................false
          BF - Bypass FPU Testing....................false
          BO - Bypass I/O Testing....................false
          BM - Bypass Memory Testing.................false
        EA - Enable Additional Close Console Messages.false

        Syntax: <flagname> ['TRUE' | 'FALSE']

        HE Help:        Display help text on menu selections
        eXit:           Return to previous menu
-------
STFlags>
```

Caution

For normal operation, all Selftest Flags should be set to their default setting ("false"). Otherwise, the system may not be completely tested during start-up.

You can use the PF command at the SP> prompt to reset the selftest flags to their default values. See the entry for "PF" in Chapter 12d (Service Processor).

Help for Test Flags Screen

```
STFlags> HE

------- Selftest Flags Help ------------------------------------------
Contents:       I.   OVERVIEW/SYNTAX
                II.  SELFTEST FLAGS DEFINED

I.   OVERVIEW/SYNTAX

     The Selftest Flags screen allows you to set flags to control the
     behavior of the selftests executed when the computer is powered
     up or reset.

Syntax: <flagname> ['TRUE' | 'FALSE']

Examples:
     EA                Displays current value of EA flag.
     EA  TRUE          Sets EA flag to TRUE.

II.  SELFTEST FLAGS DEFINED

       EA - Enable Additional Close Console Messages.  Selftest progress
            on close console path.

     Time Saved per Processor (Minutes:Seconds)

       NT  1:00              No Test.  Bypass all tests done in PDC
                                 except FP tests.
       BE        :58         Bypass Early Selftest.  Bypasses all early
                             selftests including PBMI, ICache, DCache, and
                             FPU tests.
       BP             :01    Bypass Processor Bus Tests (Early ST)
       BI             :28    Bypass ICache Tests (Early ST)
       BD             :25    Bypass DCache_Tests (Early ST)
       BT             :04    Bypass TLB_Tests (Early ST)
       BF        :01         Bypass Floating Point Unit Tests
       BL        :01         Bypass Late Selftest
       BO        :00         Bypass I/O Testing

     Time Saved per Memory Board (Minutes:Seconds)

       BM       2:00       Bypass Memory Testing.  The memory tests are
                           skipped when the NT flag is true.  The
                           time savings are for each memory board.

END
```

Failure Display

If an HPMC occurs and the operating system HPMC Handler is non-existent or corrupt, the following message appears on the system console.

```
------- Failure Commands ---------------------------------------------------

        +-------------------------------------------------------+
        |                    NOTICE !!                          |
        |   The system has experienced an unrecoverable error   |
        |   (a High Priority Machine Check - HPMC) and has      |
        |   been halted.                                        |
        |                                                       |
        |   Please call Hewlett-Packard Service.  Enter HELP    |
        |   for further instructions.                           |
        +-------------------------------------------------------+

        RE  Restart:        Restart the system
        FI  Firmware:       Update firmware (menu)
        SE  Service:        Service the system (menu)
        TO  Tomb:           Display HPMC troubleshooting information (menu)
        BO  Boot:           Perform boot tasks (menu)

        HE  Help:           Display help text
-------
HPMC>
```

Online Help

```
HPMC> HE

------- HPMC Commands Help -----------------------------------------------

        +-----------------------------------------------------------------+
        |   The system has experienced an unrecoverable error.           |
        |                                                                 |
        |   1. Record troubleshooting data such as:                       |
        |        * Error messages on console.                             |
        |        * Status of front panel indicators on computer.          |
        |                                                                 |
        |   2. Enter the TOMB command to display HPMC troubleshooting     |
        |      information.  At the tombstone menu, enter the             |
        |      DISPLAY <slot_num> command for the tombstone with the      |
        |      latest date/time.                                          |
        |                                                                 |
        |   3. Print the tombstone display on a printer. If a printer is  |
        |      not available, copy Machine Check Parameters onto paper.   |
        |      If time allows, also copy Control Registers.               |
        |                                                                 |
        |   4. On the 990/992, take a memory dump if possible.  See the   |
        |      Operator's Guide.                                          |
        |                                                                 |
        |   5. Call Hewlett-Packard Service.                              |
        |                                                                 |
        |   6. Attempt to restart the operating system by entering        |
        |      the RESTART command.                                       |
        +-----------------------------------------------------------------+

END
```

Tombstone Menu

TOMB Display for the 890/990/992

The following is an example from a 890/990/992 system (maximum 8 processors.)

```
HPMC> TO

------- Tombstones ------------------------------------------------------
                                                    Current Date: 12/25/92
        Processor                                          Time: 22:45:10
          Slot #  Date      Time      Type  State
        ---------------------------------------------
             8                                 Empty
             9                                 Empty
            10                                 Empty
            11                                 Empty
            12                                 Empty
            13                                 Empty
            14                                 Empty
            15   12/23/92  01:25:27    HPMC  Read

        DI  Display     Display tombstone for processor (DI <slot>).

        HE  Help:       Display help text on menu selections
        eXit:           Return to previous menu
-------
Tomb>
```

Note

HPMC tombstones can be viewed at any time by using the DL command at the SP> prompt.

TOMB Display for the T500/991/995

The following is an example from an T500/991/995 system.

```
HPMC> TO

------- Tombstones ------------------------------------------------------
                                                    Current Date: 07/24/93
                                                            Time: 02:28:32
        Proc.  Date-Time   Type  State      Proc.  Date-Time   Type  State
        ------------------------------------------------------------------
         8/0                      Empty    |  8/1                      Empty
         9/0                      Empty    |  9/1                      Empty
        10/0                      Empty    | 10/1                      Empty
        11/0                      Empty    | 11/1                      Empty
        12/0                      Empty    | 12/1                      Empty
        13/0                      Empty    | 13/1                      Empty
        14/0                      Empty    | 14/1                      Empty
        15/0                      Empty    | 15/1                      Empty

        DI Display:     Display tombstone for processor (DI <slot>/<mod>).

        HE Help:        Display help text on menu selections
        eXit:           Return to previous menu
-------
Tomb>
```

Online Help

The following display is from an T500/991/995. (The 890/990/992 help display is similar.)

```
Tomb> HE
------- Tombstone Commands Help ----------------------------------------

     This display shows the status of tombstone information for each
     processor in the system.  Interpret each entry as follows:

     Slot and module # of the        HPMC: High Priority Machine Check
     processor that experienced      LPMC: Low Priority Machine Check
     the TOC, LPMC, or HPMC.         TOC:  Transfer of Control
         |                  +---------+
         |                  |
       Proc.  Date-Time   Type  State      Proc.  Date-Time   Type  State
       ------------------------------------------------------------------
       15/0  06/14 21:59  HPMC  Read     |  15/1
             ^----------^          ^
                  |                |
              +---+              Empty:  No tombstone has been recorded.
              |                  Unread: Tombstone has not been read;
     Date and time that each             it cannot be overwritten.
     tombstone was recorded.     Read:   Tombstone has been read; it
                                         can be overwritten by a
                                         subsequent HPMC or TOC.
END
```

Tombstone Display

```
Tomb> DI 15/1
------- Tombstone Review ---------------------------------------------
                                                  05/11/93 06:56:41     ----
                                                  PDC Version 2.11      ----
     Chassis Code: 7ff4                           Processor [15/1       ----
     All codes starting with 7 apply to memory test.
     Registers:

     gr00/03 00000000 0000fc80 00009017 4033e158 | RP   (gr2)  00009017
     gr04/07 8200bf40 d3032000 00000000 00000000 | Arg0 (gr26) 00000001
     gr08/11 00000000 00000000 00000000 00000000 | Arg1 (gr25) 00000001
     gr12/15 00000000 00000000 00000000 00000000 | Arg2 (gr24) 4033f2bd
     gr16/19 00000000 00000000 00000000 00000000 | Arg3 (gr23) 4033f2c8
     gr20/23 00000000 00000001 00000000 4033f2c8 | Ret0 (gr28) 00000009
     gr24/27 4033f2bd 00000001 00000001 40331008 | SP   (gr30) 4033f2b0
     gr28/31 00000009 00000003 4033f2b0 00000000 | DP   (gr27) 40331008

     sr00/07 0000000a 00000000 00000000 00000000
             000002b8 000002d8 0000000b 0000000a

     Interrupt Processor Status Word  = 0006000f  (IPSW)

     PC Queue Front   000002b8.00009014 priv = 3  (IIASQ.IIAOQ)
             Back     000002b8.00009018 priv = 3  (IIASQ.IIAOQ)
     Interrupt Queue  000002b8.00009017           (ISR.IOR)
     Interrupt Instruction Register   = e85f0b8d  (IIR)

     External Interupt Enable Mask    = ffffffff  (EIEM)
     External Interupt Request Reg.   = 80000000  (EIRR)

     Protection ID's 1/4  02b2  0296  0000  0000  (PID)

     RCTR           = ffffffff       ITMR      = f24dfeb3
     SAR (dec)      = 21             CCR       = 80
     IVA            = 00106000
                                                 /* SEE NEXT PAGE */
```

```
                .           /* ITLB, ICache, DCache registers only
                .           /* displayed for the x90 (not for T500/991/995)
ITLB_DIAG      = 7db806xx       DTLB_DIAG = 1bc006xx

ICache Diagnose Registers:
r00/04  4bdf027f          6bd33f99          47d53ea5
r05/09  4bdf7dfd 4bdf4dfd 4810c8ff 4810c8e1 4fdf7fff

DCache Diagnose Registers:
r00/04  000c3fff 00008548 0006000f 84e28000 0000000b
r05/09  d9b0fff0 4390fff0 38084abf 382354bf 3df67fff

Machine Check Parameters:
Check Type      = 40000000    CPU STATE     = 9e000007
Cache Check     = 00000000    PIM state     = Fresh
TLB Check       = a0000000    Bus Check     = 00000000
PMBI STATUS     = 00040000    PMBI SRClog   = 00400000
PMBI SADDlog    = fff7f008    PMBI MADDlo   = fffbc70d
SYNlog          = 55555555    CPU DIAG0     = 019c3e03

Slave Address   = fff7f008
BLKID           = 0000    BANK          = 66
SLOT            = 0

MADDlog Breakdown:
ARB             = f       FLEX|FIXED    = ffbc
R               = 0       M             = 1
S               = 1       T             = 1
Trans. Type   = 000d

MAC_Slot          IO_Stat  Err_Resp Info+Req
    5             00006540 000065a0 4ffbc0b3

BC Slot IOHI/LO   IO_Stat  Err_Resp Info+Req
    0   fff8fff0 00700040 03de9a52 fffbffdb  (upper)
                 00011e48 fff7d008 0ffbcf80  (lower)
    0   fd77f554 f0d048c3 86d9ede3 fdf9ff5f  (upper)
                 00000000 00000000 00000000  (lower)
```

12b

Initial System Load (ISL)

This section covers the Initial System Loader (ISL) commands.

ISL includes the code responsible for booting the operating system. Important ISL commands include:

- Display default boot and console paths.
- Change the default boot and console paths.
- Set/clear autoboot flag.

Note

Unlike the PDC, AP, and SP commands, Initial System Load (ISL) is not in firmware. ISL is located in secondary storage (for example, on tape or disk). We group ISL with the firmware commands since it too provides several non-OS commands for controlling hardware.

Accessing ISL

1. Reset or power down the system as described in Chapter 1 (Overview).
2. Watch the system console carefully.
3. When the system is going through its startup routine, you will see the initial PDC display.
4. If the autoboot flag is set, you will see:

```
Processor is starting the autoboot process.

To discontinue, press any key within 10 seconds ... discontinued.
```

   As soon as you see the above prompt, press a key. (If you do not press a key within several seconds, the system continues with its bootup and you will have to start over again by resetting the system.)

5. The computer will prompt you:

```
Continue with primary boot path?   ([y]/n/<path>) >
```

a. Answer Y if the operating system and ISL are installed on the system disk. (This is the normal condition after initial installation.)

b. Answer N if the operating system and ISL are NOT installed on the system disk. You will be taken to the PDC main menu. Type the command **ALTERNATE** to boot from the alternate boot path (the tape drive).

6. You will see a display like:

```
Trying boot path 0/52.0.0.0.0.0.0 ...

Booting ...

Interact with ISL? (y/[n]) > y
```

Answer Y to the prompt. (For our purposes, IPL is the same as ISL.)

7. The ISL prompt now appears. For HP-UX systems, the display may look like this:

```
SOFT Booted.
ISL Revision xx.xx.xx xxxxxx xx, 199x
ISL>
```

On an MPE/IX system, the display may look like this:

```
MMSAVE Version n.nn
DUMPAREA protected, proceeding to ISL without memsave
ISL loaded
ISL Revision v.uu.ff Month Day, Year
ISL>
```

8. From the ISL prompt, about a dozen commands can be executed. Enter ? to see a list of the commands. For example, the following is a display from an HP-UX system:

```
ISL> ?
?               Help Facility
HELP            Help Facility
LISTF           List ISL utilities
LS              List ISL utilities
AUTOBOOT        Set or clear autoboot flag in stable storage
AUTOSEARCH      Set or clear autosearch flag in stable storage
PRIMPATH        Modify primary boot path in stable storage
ALTPATH         Modify alternate boot path in stable storage
CONSPATH        Modify system console path in stable storage
DISPLAY         Display boot and console paths in stable storage
LSAUTOFL        List contents of autoboot file
LISTSAUTOFL     List contents of autoboot file
FASTSIZE        Sets or displays FASTSIZE
SUPPORT         Boot the Support Tape from the boot device
SUPPORTCD       Boot the Support Tape from the CDROM
READNVM         Displays contents of one word of NVM
READSS          Displays contents of one word of stable storage
LSBATCH         List contents of batch file
LISTBATCH       List contents of batch file
BATCH           Execute commands in batch file
LSEST           List contents of EST (Extended Self Test) file
LISTEST         List contents of EST (Extended Self Test) file
EST             Execute commands in EST (Extended Self Test) file

Utilities on this system are:
RDB
HPUX
IOMAP
```

On MPE/iX systems, some additional utilities are available:

```
Utilities on this system are:
ISL
DUMP
START
A1002AI
A1002AM
A1002AP
A1100AI
A1100AM
A1100AP
EDBC
EDPROC
MDIAG
MPROC
TDIAG
UNIPROC
CAEXR
IOMAP
CLKUTIL
DISCUTIL
SADPATCH
SAT
```

12c

Access Port (AP)

This section summarizes the Access Port (AP) user interface.

The AP is firmware located on the Console/LAN card in the system cabinet. The AP allows the system to be remotely serviced.

Important AP commands include:

- Configure the access port functions of the I/O card.
- Enable and disable remote console access.
- Modify remote access security features.
- View the system status display.
- Enable/disable the SPU status display.

Accessing AP

From the system console, you can access the commands available from the Access Port (AP) and the Service Processor (SP). Figure 12c-1 summarizes how to change from one mode to another.

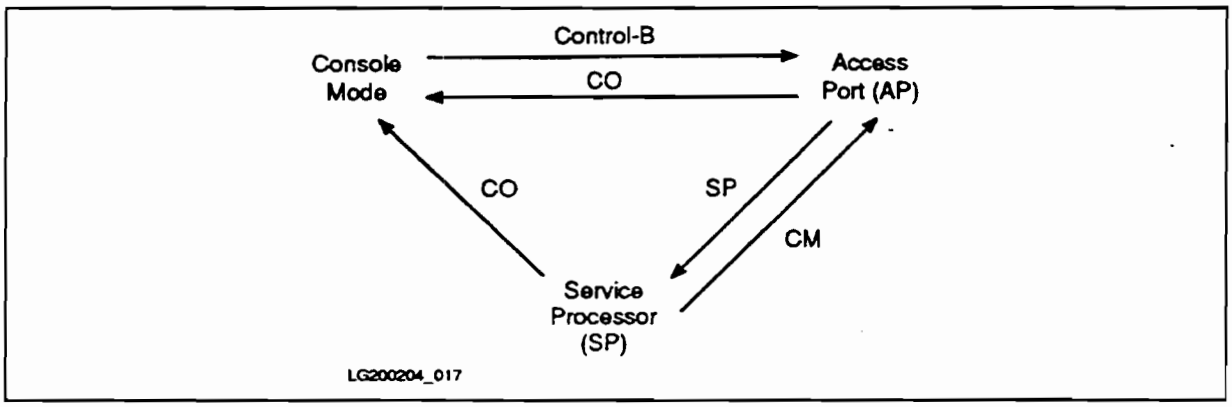


Figure 12c-1. Console Mode, Access Port, and Service Processor

You can access the Access Port through the system console by entering Control-B.

Commands may be entered in upper or lower case characters.

Caution Do not leave the console in SP mode or AP control mode for long periods of time. This blocks console messages and can eventually cause the OS to hang or crash.

Summary of AP Commands

Table 12c-1. Access Port Commands

Control Mode Commands			Valid At	
Command	Mnemonic	Function	LC	RC
CA	Configure AP	Configure remote support modem port	Y	Y
CO	COnsole	Return to console mode	Y	Y
CS	Copy Screen	Copy display memory of local console to remote console	Y	Y
DI	DIsconnect	(Service personnel only) Disconnect remote console	N	Y
DR	Disable Remote	Disable remote operator access	Y	Y
DS	Disable Status	Disable SPU status display	Y	Y
ER	Enable Remote	Enable remote operator access	Y	N
ES	Enable Status	Enable SPU status display	Y	Y
HE	HElp	Display help menu	Y	Y
LR	Lock Remote	Lock remote support modem access	Y	Y
RS	ReSet	Reset SPU. (You must issue the SP command first.)	Y	Y
SE	SEssion	(Service personnel only) Enter session mode on remote port	N	Y
SP	Service Processor	Enter Service Processor mode	Y	Y
TA	Test AP	Initiate AP selftest	Y	Y
TC	Transfer of Control	Initiate SPU Transfer of Control (TOC). (You must issue the SP command first.)	Y	Y
TE	TEll	Send a message to other console	Y	Y
UR	Unlock Remote	Unlock Remote Support Modem Access	Y	N

- LC = Local Console
- RC = Remote Console

AP Command Reference

This section gives detailed descriptions of AP commands appropriate for customer use.

CA: Configure AP

Configure Remote Support Modem Port

Allows the local console operator to set the modem protocol, bit rate, CCITT Rate Select, and the optional system identification for the remote support modem port.

Parameters set with this CA command:

- Bit Rate: 300, 1200, 2400, 4800, 9600, 19200 bits/sec
- Modem Protocol: CCITT, Bell, or CCITT_BIS
- Autodial Protocol: V25.bis or Hayes
- System Identification: 1 to 23 displayable characters

Valid From: Local Console Port, Remote Modem Port

Example

```
CM> CA

Current remote support modem port configuration:

Bit rate:                9600 bits/sec
Protocol:                Bell
Autodial Protocol:       Hayes
System identification:   System_name

Do you wish to change the configuration? (Y/[N]):
```

The "Bit rate" field must be set for the speed of the incoming modem. This function is not speed-sensed: the bit rate MUST match the speed of the incoming call.

In most cases, the "Protocol" field should be set to "Bell" or "CCITT". In the United States, the protocol is usually "Bell." In Europe, the protocol is usually "CCITT".

The "Autodial Protocol" should match that of the modem.

If you need to change parameters, enter `Y` in response to the prompt. The system displays a change menu:

```
Enter your change.  <CR> retains the current value.

Current bit rate is 9600 bits/sec.  Select the new bit rate.
(0=300, 1=1200, 2=2400, 3=4800, 4=9600, 5=19200): 2
Current Protocol is CCITT.  Select the new protocol.
(0=CCITT, 1=Bell, 2=CCITT_BIS): 1
Current Autodial Protocol is V25.BIS.  Select the new protocol.
(0=V25.bis, 1=Hayes): 1
Current System identification: System_name
New system identification (limited to 1 to 23 displayable characters
or space for none): (New_system_name)

New configuration (takes effect at next remote connection):

Bit rate:                2400 bits/sec
Protocol:                Bell
Autodial Protocol:       Hayes
System identification:   System_name
```

After the commands are processed. the new configuration is written to non-volatile memory (NVM).

The new configuration takes effect after the current operator session is disconnected and the next incoming call is answered.

If you enter an incorrect configuration. re-execute the the CA command.

CO: Console

Return to Console Mode

Switches the console terminal from control mode to console mode.

Valid From: Local Console Port. Remote Modem Port

Example

```
CM> CO
```

CS: Copy Screen

Copy Display Memory of Local Console to Remote Console

Copies the contents of display memory on the local console to the remote console display. This is useful if error messages or a tombstone display are still in display memory. Service personnel at the remote console can read this information with the CS command even if the information has scrolled off the screen at the local console (but is still in display memory).

The CS command may take a long time to complete. For example, assume that a local console has 16 pages of display memory and each page is filled with 80 characters per line. The CS command could take as long as 3 minutes to complete, assuming a remote console connection of 2400 bits per second.

The local operator can terminate the CS command before it completes by resetting the terminal. AP firmware detects an error which terminates the CS process.

The remote operator can terminate the CS command by entering ^C or ^Y.

The local console transmits all characters in display memory, including carriage return, line feed, and other control characters. If a line of characters from the local console fills a line on the remote console, the remote console terminal will wrap the text around to the next line. This may cause what appears to be an extra carriage return and line feed on the remote console.

The AP allows the remote console to stop character transmission (for example, with ^S for only 20 seconds at a time. This feature prevents the local console from becoming stuck in a state such that the only way to recover use of the local console would be to reset it (for example, if the remote console failed to send a ^Q to re-start transmission.).

Valid From: Local Console Port, Remote Modem Port

Example

```
CM> CS
```

DI: DIsconnect

DI: Disconnect Remote Console

Causes the AP to initiate a modem disconnect sequence on the remote support modem if it is being used as a remote console. After executing this command the AP de-asserts the modem control lines, thus forcing the modem to "hang up" the telephone line. The remote support modem port is then no longer connected as a mirrored console, and the local console port becomes master.

If the remote access mode (see ER command) was set to be single, remote operator access is disabled and must be re-enabled by using the ER command to once again allow remote operator access. If the remote access mode was set to be multiple, the AP will connect the next incoming call on the remote support modem port to the IAP as a remote operator connection.

Valid From: Remote Modem Port only.

DR: Disable Remote

Disable Remote Operator Access

Disables remote console access on the support modem port. Causes remote access attempts on the support modem port to be handled by the OS as a user session.

If an operator is connected as a parallel console when this command is executed. the remote console is disconnected. Future incoming calls to the remote support modem are handled by the system as a user session. If remote operator access is already disabled when this command is executed. this command has no effect.

Note

For predictive support to function correctly. the AP should be left in its default state of Remote Operator Access Disabled (DR command).

Valid From: Local Console Port, Remote Modem Port

Example

```
CM> DR
Remote console access disabled.
```

DS: Disable Status

Disable SPU Status Display

Disables display of the system's operating status and hex display to the console terminals when in console mode.

The DS command does not affect the display of this information when the console is in AP control mode or in SP mode.

See ES (Enable Status) command.

Valid From: Local Console Port. Remote Modem Port

Example

```
CM> DS
System status display during console mode is disabled.
```

ER: Enable Remote

Enable Remote Operator Access

Enables remote console access and sets security parameters for the connection. **Remote console access** means that the remote user is connected in parallel to the local console. The remote user sees the same displays and has access to the same commands as a local operator. including Control-B access to AP and SP commands.

This command is available only on the local console.

The security parameters include the remote CS parameter. the mode parameter (single/multiple) and the password fault parameter.

Remote CS Parameter

The *remote CS* parameter enables the Copy Screen (CS) to be executed from the remote console. The CS command copies a screen from the local console to the remote console.

Mode Parameter

The *mode* parameter establishes how many times the remote user may connect. disconnect. and reconnect the remote console before remote console access is automatically disabled. The two modes possible are *single* and *multiple*

In *single mode*. only one access from outside to the remote console is permitted. (The AP defines an "access" as successfully answering the password prompt.) After the one access. the remote console cannot be accessed again. Only remote sessions are permitted. To use the remote port as a remote console once again. the remote console capability must be re-enabled by the local console (ER command).

Note

For predictive support to function correctly. the AP should be left in its default state of Remote Operator Access Disabled (DR command).

In *multiple mode*. the remote console can be accessed multiple times.

In both single and multiple modes. the remote user has three attempts to enter the correct password. If the user succeeds. the remote console session is begun and remains until the user disconnects or until the user is disconnected by the local console operator. If the user fails. the line is disconnected and dropped.

Password Fault Parameter

If the user does not provide the correct password. a password fault count is increased. the caller is disconnected. and the line is dropped. When the password fault count exceeds an operator set limit, the remote operator access capability is disabled. Afterwards. the modem port may only be used as a normal session port until the local console operator re-enables the remote capability with the ER command.

The *password fault* parameter sets the number of password faults allowable (three password attempts per fault) before remote console access is automatically disabled. The password parameter is set by the local console operator and stored in non-volatile memory (NVM).

Valid From: Local Console Port

Example

```
CM> ER

Current remote console access configuration:

 Remote CS:         Enabled
 Mode:              Multiple
 Password:          the quick brown fox
 Password Faults:   10

Do you wish to change the configuration? (Y/[N]): Y

Enter your changes. (CR) retains the current value.

Remote CS command: Enabled
  Select the new setting (E=enabled, D=disabled): [Enter]

Current mode:  Multiple
  Select the new setting (S=single, M=multiple): S

Current Password:  the quick brown fox
  New password (1 to 18 displayable characters or space if
  no password is to be required): [Enter]

Current password fault limit:  10
  New number of password faults (Range: 0-99 or space.
  Space or 0 will permit unlimited password faults.): 5

New remote console access configuration:
 Remote CS:         Enabled
 Mode:              Multiple
 Password:          the quick brown fox
 Password Faults:   05

Remote console is now enabled.

CM>
```

On initial power-up the remote configuration defaults to:

- Remote Operator Access Disabled (see DR command)
- Mode = Multiple
- Password = None
- Password Faults = 3
- Remote Copy Screen = Enabled

For predictive support to function correctly, the AP should be left in its default state of Remote Operator Access Disabled (DR command).

ES: Enable Status

Enable SPU Status Display

Enables display of the system's status line (for example, the hex code) on the console terminals when they are in console mode.

After the ES command, the status line appears in place of the softkey labels when the console returns to console mode. The console status line is always enabled in AP control mode and in SP even if the DS command has been entered.

Valid From: Local Console Port, Remote Modem Port

Caveats

It is not recommended that the ES command be used. Writing the status line can interfere with some programs which use escape codes to manipulate the console screen. The *vi* program in HP-UX is one such program, the screen data become corrupted when the writing of the status line coincides with a screen update by such programs.

If you want to enable the status line in console mode with the ES command and screen data corruption is a problem, use the DS command until you have finished using the conflicting software.

Example

```
CM> ES
System status display during console mode is enabled.
```

HE: Help

Display Help Menu

Displays help information on the console terminal:

Help information is displayed if either HE or HELP is entered.

Valid From: Local Console Port. Remote Modem Port

Example

```
CM> HE or HELP

        nnnnnn Access Port Revision xxxx - dddd

CA:  Configure system remote support modem port.
CO:  Enter console mode.
CS:  Copy screen from local console to remote console.
DI:  Disconnect line to remote console terminal.
DR:  Disable access by a remote console terminal (enable session access)
DS:  Disable display of system status line during console mode.
ER:  Enable access by a remote console terminal (disable session access)
ES:  Enable display of system status line during console mode.
HE:  Display this screen.
LR:  Lock remote (disable modem access).
RS:  Use RS command in SP mode.
SE:  Transfer remote terminal from console/control to session mode.
SP:  Enter Service Processor mode.
TA:  Initiate Access Port selftest.
TC:  use TC command in SP mode.
TE:  Send message between the local and remote console terminals.
UR:  Unlock remote (enable modem access).
```

The nnnnnn in the first line is the product number of the I/O card on which the AP is implemented.

xxxx is the AP firmware revision number.

dddd is a date code indicating the year and week that the code revision was last updated.

LR: Lock Remote

Lock Remote Support Modem Access

Disables access to the remote support modem.

After the local operator issues this command, neither a remote operator nor the system can use the remote support modem. Active session on the remote support modem are disconnected (this includes user session or a remote operator). Incoming calls are ignored. Requests by the system for establishing a modem connection are also ignored.

This command may be issued by the local or remote console operators. A remote operator issuing this command will lose connection to the system. If the modem is already in the locked state, this command has no additional effect.

This command does not affect the state of remote operator access (enabled or disabled). However, no remote operator connection can be established after executing this command.

The local console operator must use the UR (Unlock Remote support modem access) command to re-enable access to the remote support modem.

The state of the lock (either locked or unlocked) is saved in non-volatile memory (NVM). If power fails, the same state as existed before the power failure will exist after power is restored. Initially, the lock is set to the unlocked state.

Valid From: Local Console Port, Remote Modem Port

Example

```
CM> LR
Remote is now locked.
```

RS: Reset

Reset SPU

Not available at the AP interface.

Note

To reset the system, enter the SP command first:

```
CM> SP
SP> RS
```

SE: SEssion

Enter Session Mode On Remote Port

May only be entered from the remote port. Allows the user to leave control mode and enter session mode. To re-enter control mode, the user need only exit the user session. The AP will reconnect the operator as a parallel console after the driver releases the connection.

Valid From: Remote Modem Port only.

SP: Service Processor

Enter Service Processor Mode

Enters Service Processor (SP) mode. In SP mode. more than 20 commands are available for servicing the system. Important SP commands include:

- Execute a Transfer of Control (TOC).
- Execute a reset.
- Monitor and control power system.
- Change/view system configuration.
- Change/view error logs.

The Transfer of Control (TC) and reset (RS) commands can only be executed in SP mode.

Valid From: Local Console Port. Remote Modem Port

Example

```
CM> SP
Connecting to Service Processor.  (APMSG 10)

SP>
```

TA: Test AP

Initiate AP Selftest

Causes the AP card to execute its selftest.

Execution of the selftest does not alter the configuration or disconnect the modem port if on line. However, any data sent to the I/O card during selftest is lost.

Valid From: Local Console Port. Remote Modem Port

Example

```
CM> TA

Console data arriving during selftest execution will be lost.

Type Y to confirm your intention to execute AP selftest (Y/N): Y
0001 0002 0003 0004 0005 0006 0007 0008 0009

All tests passed (APMSG 01)
```

TC: Transfer Of Control

Initiate Transfer Of Control (TOC)

Not available at the AP interface.

Note

To perform a Transfer of Control on the 99x/890/T500, enter the SP command first:

```
CM> SP
SP> TC
```

TE: Tell

Send a Message to Other Console

Sends a message to the other console.

All displayable characters following the TE command are treated as a comment. Since characters are echoed to the local console terminal and to the remote console terminal if it is connected, this has the effect of sending a message to the other terminal. The comment string, including the command mnemonic, is limited to a maximum of 80 characters.

Valid From: Local Console Port, Remote Modem Port

Example

```
CM> TE Any comments you care to write to the other console operator
```

UR: Unlock Remote

Unlock Remote Support Modem Access

Enables access to the remote support modem.

After the local operator issues this command, either a remote operator or the system can use the remote support modem.

If remote operator access had been enabled previously, the card returns to the remote operator enabled state, allowing incoming calls to be connected as a mirrored console.

If remote operator access had been disabled previously, the card returns to the remote operator disabled state, allowing system usage of this port for user sessions.

If the modem was already in the unlocked state, this command has no additional effect.

This command does not affect the state of remote operator access (either enabled or disabled). After unlocking the remote support modem access, if remote operator access was enabled before locking, it continues to be enabled. If it was disabled, it continues to be disabled.

The state of the lock (either locked or unlocked) is saved in non-volatile memory (NVM) so that if power fails, the same state as existed before the power failure will exist after power is restored. Initially, the lock is set to the unlocked state.

Valid From: Local Console Port, Remote Modem Port

Example

```
CM> UR
Remote is now unlocked.
```

12d

Service Processor (SP)

This section covers the Service Processor (SP) user interface.

SP firmware is located on the Service Processor card in the system cabinet. SP provides functions for servicing the computer. One set of commands is available when DC power is on. A subset of SP commands is available when DC power is off.

More than 30 commands are available from the service processor prompt. Many of these commands are designed for service personnel rather than for customers. However, the SP commands allow the operator to:

- Initiate a Transfer of Control (TOC) to recover a computer that has hung.
- Initiate a hard reset to recover a hung computer if the TOC is not successful.
- See more information about errors indicated by the yellow ATTENTION LED on the control panel.

Accessing SP

From the system console, you can access the commands available from the Access Port (AP) and the Service Processor (SP). Figure 12d-1 summarizes how to change from one mode to another.

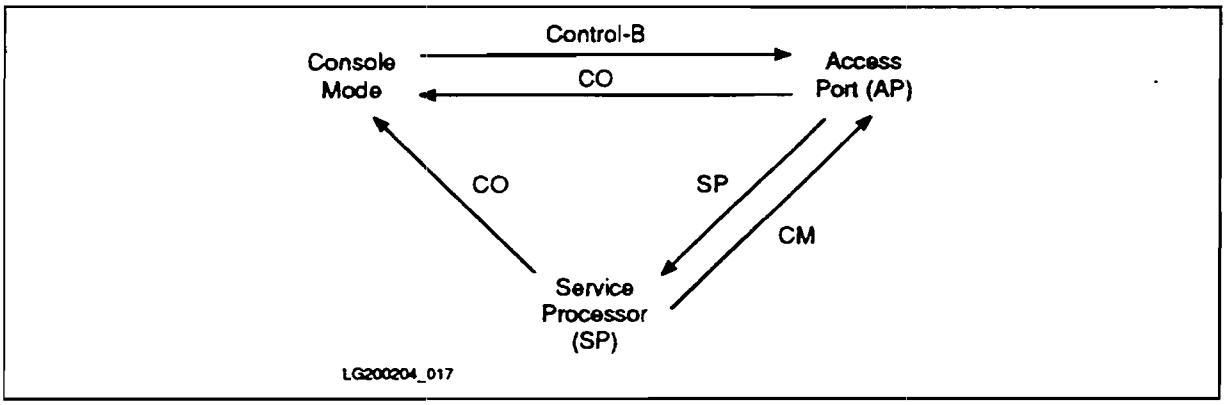


Figure 12d-1. Console Mode, Access Port, and Service Processor

To access the service processor:

1. Enter Control-B at the console to enter access port mode.
2. At the access port prompt (CM>), enter SP.

Commands may be entered in upper or lower case characters.

Caution

Do not leave the console in SP mode or AP control mode for long periods of time or during boot. This blocks console messages and can eventually cause the OS to hang or crash. During boot. this can cause a processor selftest failure.

SP Prompts

When you access the SP commands. you normally see the prompt:

```
SP>
```

For non-normal conditions. you may seen one of three other prompts. See Table 12d-1.

Table 12d-1. Service Processor (SP) Prompts

Prompt	Condition	Causes	Actions
SP>	Normal state of SP.	After main SPU power is up.	No action required.
(SPU Power Control) SP>	At least one power rail is not nominal. OS cannot run.	■ "Standby/Ready" switch in "Standby" position. ■ CN, DN, or RL command used to turn off at least one power rail. ■ A power supply fault causes at least one power rail to turn off.	■ If no fault, be sure "Standby/Ready" switch is in "Ready" position; then use GO or UP if needed to begin boot process. ■ If fault, read error logs and use PS to display power system status. Take appropriate corrective action. "(All SP commands available, but HC and RP may give obsolete configuration status since the SP cannot read all SPU RevPorts without all power nominal. The TC command will not perform a TOC at this prompt.)
(SPU Configuration) SP>	SP has paused the OS boot process to allow user to change or confirm the SPU hardware configuration.	■ The user pressed a key during startup after SP displayed the prompt "Press ANY key within 10 SECONDS to cancel boot with this configuration." ■ Autostart flag is cleared and the current/pending hardware configuration is different from the configuration used for the last boot (for example, if processor or memory modules have been de-configured).	■ Read error logs to determine if some hardware was automatically de-configured due to a hardware failure; take appropriate corrective action. ■ Use the HC command at the SP prompt to display/modify hardware configuration.
(Fault) SP>	SP detected a severe hardware fault that will prevent the OS from booting or from continuing to run. At least one critical error should be recorded in the SP error log.	Various hardware faults in SP, PSCM, or SPU, if they can be detected by the SP.	Read the SP error logs to identify cause and take appropriate corrective action.

Summary of SP Commands

SP commands are divided into two groups:

- SP commands usable by customers.
- SP commands for service personnel only.

SP Commands for Customers

Table 12d-2 summarizes the SP commands that are appropriate for customer use. These commands are explained in detail in the last part of this chapter.

Caution

Inappropriate use of some commands in Table 12d-2 can crash the computer or interfere with computer operation.

Table 12d-2. Service Processor (SP) Commands: Usable by Customers

Command	Mnemonic	Function
AF	Autostart Flag	Display/modify SP autostart flag. If the autostart flag is set, the computer continues its startup even if memory modules or processors are to be deconfigured. If the autostart flag is cleared, the computer halts for user input during startup if memory modules or processors are to be deconfigured.
CL	Clear Logs	Clear one or more troubleshooting logs maintained by SP.
CM	Control Mode	Enter AP control mode.
CO	COnsole	Enter AP Console mode.
DA	Disable Activity Codes	Disable updates of SPU activity chassis codes (codes in the form FxxF or Exxx).
DC	Display Converter	View status of power system modules.
DL	Display Logs	Displays troubleshooting logs maintained by the Service Processor.
DN	DowN	Shut down main DC power (shuts down all DC-DC converters except MPM bias).
EA	Enable Activity Codes	Enable SPU Activity Chassis Codes
EN	ENvironmental	Display power system environmental status.
FE	Front End	Display AC front-end status.
FV	Firmware Version	Display version information for PDC, SP and PSCM firmware.
GO	GO	Continue the boot process.
HC	Host Configuration	Display/modify host configuration. Allows you to see what modules are configured in the PMB cardcage. Also allows you to de-configure hardware modules such as BCs, processors, and memory.
HE	HElp	Display help information
PC	Power Configuration	Display power system configuration.
PS	Power Status	Display power system status.
RE	REstart	Restart the computer (hard boot). Performs SP and PDC initialization. Destroys some troubleshooting information. Same as the PDC RESTART command.
RS	ReSet	Reset the computer (hard boot). Performs only PDC initialization. Used to reset the machine after a system hang, if TC fails. Destroys some troubleshooting information.
SM	Software Monitor	Display/modify software monitor flag. If the software monitor flag is set, the SP reports an error if no OS activity is detected within any 10-second interval.
TC	Transfer of Control	Initiate SPU Transfer of Control (TOC). Used to soft reset the machine if the system hangs. Troubleshooting information is preserved.
UP	UP	Bring up main DC power.

Computer Museum

SP Commands for Service Personnel

Some of the SP commands are designed for service personnel rather than for customers:

- They display information that requires a detailed knowledge of the computer to interpret.
- They can interfere with computer operation if they are invoked at the wrong time.

Caution

Inappropriate use of some commands in Table 12d-3 can crash the computer or interfere with computer operation. Some commands can cause the computer to fail, requiring a service call.

Table 12d-3. Service Processor (SP) Commands: For Service Use Only

Command	Mnemonic	Function
BA	BAttery	Enable/disable battery back-up.
CN	CoNverter	Enable/disable the individual SPS power converter modules (HVDC to LVDC).
DM	Display Memory	Display a range of bytes in SP non-volatile memory.
ID	ID Code	Display/modify Service Processor (SP) hardware date code.
MR	Margin a Rail	Set permissible margins for voltage on the power system rails.
PF	Set PDC Selftest Flags	Set flag values that control the execution of PDC selftests.
RL	RaiL	Enable/disable individual power system rails.
RP	Revision Ports	Display/modify revision port information.
SW	SWitch	Switch SP and PDC firmware banks. (Dangerous command.)
TH	Voltage THresholds	Display/Modify Voltage Shutdown Thresholds

SP Command Reference

This section gives detailed reference information on SP commands that might be used by customers.

AF: Autostart Flag

Display/Modify Autostart Flag

Used to display or modify the autostart flag.

If the autostart flag is set, the computer startup process continues even if processor, memory, or bus converter (BC) modules will be de-configured during the boot process (for example if they fail selftest).

If the autostart flag is cleared, the computer startup process halts at the SP or PDC prompts if processor, memory, or BC modules are de-configured during a boot.

The autostart flag described here is different from the autoboot flag which can be modified from the PDC interface. The PDC autoboot flag allows the OS to boot automatically upon power-up.

Purpose

Set the autostart flag if you want the computer to boot up regardless of whether some modules are de-configured.

Clear the autostart flag to ensure that the operator is warned about modules being de-configured. By default, the autostart flag is cleared.

Caveats

If you want to be certain that the computer reboots during powerfail recovery, SET the autostart flag. Otherwise the computer will not automatically reboot during powerfail recovery if processor or memory modules are scheduled for de-configuration.

If you want to be certain that the computer never runs with fewer memory modules or processors than expected, CLEAR the autostart flag. Otherwise the computer could be running with fewer memory modules or processors than are physically present. System performance would be degraded. The computer signals the operator of the de-configuration by:

- Displaying a de-configuration message during startup.
- Lighting the yellow "Attention" LED on the control panel because a critical entry has been logged to the SP error log.
- Creating an entry in the SP log when de-configuration occurs.

The OS can choose not to use processors that have been configured by the SP. This is only known by seeing the OS start-up messages.

Note

During boot, the computer will halt with no console display if the following conditions are all true:

- The autostart flag (AF at the SP prompt) is not set.
- A module is de-configured.
- The front panel keyswitch is in the locked position.

If this should happen, recover the console display by putting the front panel keyswitch into the unlocked position.

Example (Setting/Clearing the Autostart Flag)

```
SP> AF

The Service Processor autostart flag is currently SET (autostart enabled)

Do you wish to CLEAR the flag (y/[n])? N

The Service Processor autostart flag will remain SET.  (autostart enabled)
```

Example (Boot-up sequence if autostart flag is set):

```
                    .
                    .

Service Processor: Commanding PSCM to turn on Main DC.

The contents of the following PMB slots have changed since the last boot:
    (NONE)

The configuration of the following PMB modules changed since the last boot:
Memory module 0 in slot 6, from OUT to IN

The following PMB modules are present, but will be deconfigured for the
upcoming boot:
    (NONE)

==> Press ANY key within 10 SEC to cancel boot with this configuration. <==

No key was pressed.  Continuing with system initialization...

Service Processor: Finished initialization.  Starting PDC boot process...

Proc[13/0]: PDC Version 1.11 (HARDBOOT)
Proc[15/0]: PDC Version 1.11 (HARDBOOT)
                    .
                    .
```

Example (If operator presses key to cancel boot):

```
                    .
                    .

==> Press ANY key within 10 SEC to cancel boot with this configuration. <==

BOOT PAUSED: Change configuration if desired using the HC command:
             then enter UP or GO to continue with system initialization.

(SPU Configuration) SP> HC
                    .
                    .
```

BA: BAttery (Service Only)

Enable/Disable Battery Back-Up

(890/990/992 only) Switches the battery back-up (BBU) on and off. If the BBU is off, the system does not retain main memory during powerfail recovery.

Purpose

The BA command allows you to run the 890/990/992 without battery back-up. This may be useful in troubleshooting.

Caveats

For normal operation, the BBU should be enabled. This command is irrelevant for the T500/991/995 since the T500/991/995 uses the optional PowerTrust UPS rather than a BBU.

Example

```
SP> BA

WARNING:  If you disable the battery subsystem, the computer will NOT recover
from a power failure.

The battery is currently ENABLED.

Do you wish to DISABLE the battery (y/[n])? Y

The battery is now DISABLED.

SP> BA

The battery is currently DISABLED.

Do you wish to ENABLE the battery (y/[n])? Y

The battery is now ENABLED.
```

CL: Clear Logs

Clear the SP Logs

Clears entries in one or more logs maintained by the SP. You can clear the activity log, the error logs, activity and error logs, or the SPU tombstone logs.

Purpose

Use the CL command to keep the SP logs to a manageable size.

Caveats

Clearing SP logs can delete information useful for troubleshooting the system.

Example

```
SP> CL

Select the Log to be cleared :

   Activity Log              =  a
   Error Logs                =  e
   Activity and Error Logs   =  ae
   SPU Tombstone Log         =  t

   Enter (a/e/ae/t/CR = exit) :  A

   Clear the Activity Log? (y/[n]) :  Y

The Activity Log has been cleared
```

CM: Control Mode

Enter AP Control Mode

Used to leave the SP interface and enter the Access Port (AP) Control Mode. The user can then enter commands at the AP prompt (CM>).

Purpose

The CM command is one of several commands used to change modes:

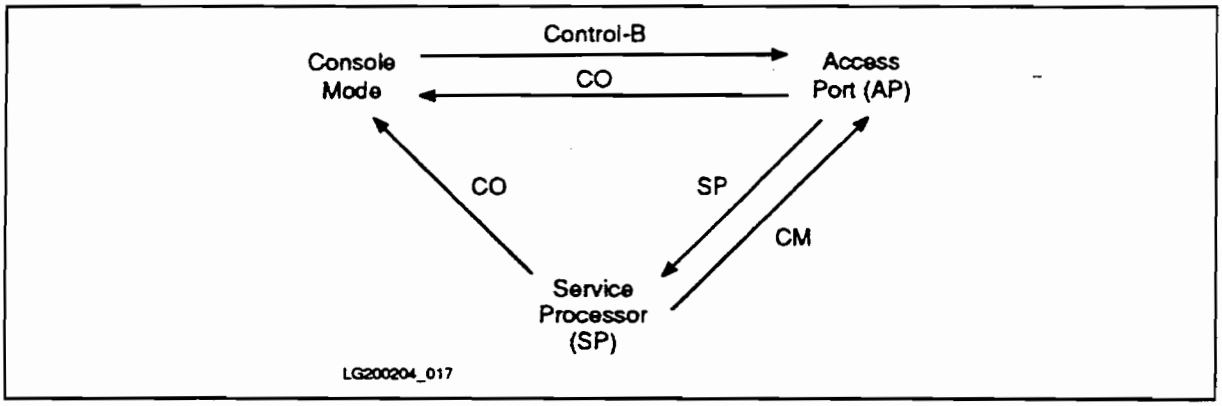


Figure 12d-2. Console Mode, Access Port, and Service Processor

Example

```
SP> CM

CM>
```

CN: CoNverter (Service Only)

Power Converter On/Off

Switches a power converter on or off. The power converters (SPS converter modules) are DC-to-DC modules in the power supply.

Purpose

HP service personnel can use this command to troubleshoot the power system or deconfigure a bad power converter.

Caveats

This command can damage electronic components in the system. The command should be used only by HP field or factory engineers.

This command can only be executed before the processors have been started. This means that the CN command is valid at the (SPU Power Control), (SPU Configuration), and (Fault) SP prompts; it is not valid at the SP> prompt.

Example

```
SP> CN

The system is currently running; use the DN command to shut off main DC
power before using the CN command.

Command aborted.

SP> DN


(SPU Power Control) SP> CN
**** WARNING ****
This command can damage computer electronic components; it should ONLY be
used by an HP Customer Engineer.

Are you SURE you want to change the state of the pwr converters (y/[n])? Y

Power System Configuration
Slot    Rail_Name       Voltage Status
----    ---------       ------- ------
 6      5.00v   Batt    5.00v   (0x1)  Master; Normal Status
 9      5.00v   ProcX   4.98v   (0x1)  Master; Normal Status
 12     MPM
        2.00v   Clock   2.00v
        2.00v   CBatt   2.00v
        3.00v   PMBt    2.99v
        -2.50v  PMBc    -2.49v
        -2.50v  PMBb    -2.49v
13      5.00v   Sys     5.00v   (0x1)  Master; Normal Status
14      24.00v  Fan     23.09v  (0x1)  Master; Normal Status

**** NOTE ****
The CN command can't be used to power up a converter which is
attached to a rail that is already being powered by another
converter.

Which Power System Converter Slot? 14
Slot    Rail_Name       Voltage Status
----    ---------       ------- ------
14      24.00v  Fan     23.09v  (0x1)  Master; Normal Status

This converter is currently ON.
Do you wish to turn it OFF? (y/[n])? N
```

CO: COnsole

Enter AP Console Mode

Used to leave the SP interface and enter console mode. In console mode. the user can interact with software running on the computer.

Purpose

The CO command is one of several commands used to change modes:

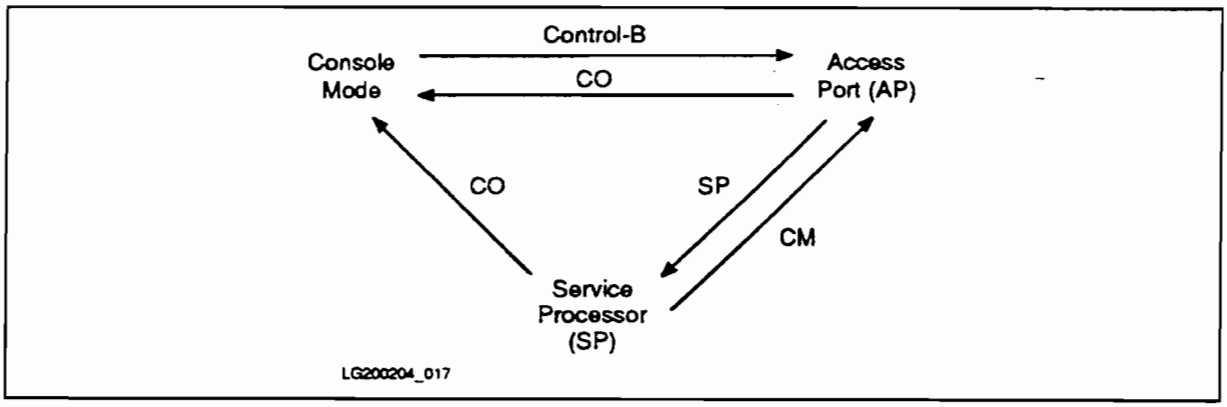


Figure 12d-3. Console Mode, Access Port, and Service Processor

Example

```
SP> CO
```

DA: Disable Activity Codes

Disable SPU Activity Chassis Codes

Disables updates of the four-digit hexadecimal activity codes displayed at the bottom of the system console display. Only codes in the form FxxF or Exxx are disabled.

When the status line is displayed during console mode, the hex code is updated every few seconds to show operating system activity levels. These activity codes typically have the form FxxF or Exxx.

Other hex codes indicate conditions other than system activity. These hex codes are displayed when they occur even if activity codes have been disabled with the DA command.

Even when the DA command has disabled the display of activity codes, the activity LEDs on the control panel continue to display the same information.

To re-enable update of hexadecimal activity codes, enter the SP command EA.

(The hexadecimal codes are displayed on the system console when in Access Port control mode or in SP mode. The console enters these modes after the operator presses Control-B. Hexadecimal codes can also be displayed in console mode by using the Access Port's ES command.)

Purpose

Used when remotely monitoring the system over a network. Minimizes the number of characters sent over the network. (With the activity codes enabled, the status/error code at the bottom of the system console is updated every few seconds.)

Example

```
SP> DA
SPU Activity Chassis Codes Disabled

SP> EA
SPU Activity Chassis Codes Enabled
```

DC: Display Converter

Display Converter Status

Displays the status of a power converter in a particular slot. Status information includes:

- Type of converter in selected slot.
- Rail to which this converter is connected.
- Current voltage output from the converter.
- Operational status of the converter (not displayed for the MPM converter).

Purpose

Monitor the status of the power system.

Example

```
SP> DC

Main DC power is ON.

Show status for which power system converter slot?
Enter (1-14), (a = all present), (CR = exit): A

Power System Configuration

Slot    Rail_Name       Voltage Status
----    ---------       ------- ------
 6      5.00v   Batt    5.00v   (0x1)  Master; Normal Status
 9      5.00v   ProcX   4.98v   (0x1)  Master; Normal Status
 12     MPM
        2.00v   Clock   2.00v
        2.00v   CBatt   2.00v
        3.00v   PMBt    2.99v
        -2.50v  PMBc    -2.49v
        -2.50v  PMBb    -2.49v
13      5.00v   Sys     5.00v   (0x1)  Master; Normal Status
14      24.00v  Fan     23.09v  (0x1)  Master; Normal Status
```

DL: Display Logs

Display SP Logs

Displays messages stored in the logs maintained by the SP. The logs are stored in SP non-volatile memory (NVM). Four logs are maintained:

- **Activity Log**: records major changes in the state of the computer (for example, power-up and shutdown). The information in the Activity Log is useful for determining how far computer operation proceded before a failure occurred. The Activity Log is circular (once the log is filled to capacity, subsequent entries cause the earliest entries to be deleted).
- **Earliest Error Log**: contains the earliest error entries.
- **Latest Error Log**: contains error entries recorded after the Earliest Error Log is full.
- **SPU Tombstones Log**: contains up to 16 tombstones. A tombstone consists of troubleshooting data generated by an HPMC, LPMC, or Transfer of Control.

The **Error Logs** contain entries for critical and non-critical errors. Critical errors are those which require immediate attention: they usually indicate a failure of hardware or software. Critical errors are highlighted in the SP log display.

When a critical error occurs, the yellow "Attention" LED on the front panel is lit to signal the operator. If the status line on system console is enabled, critical errors also cause a message to be displayed there. If the "Attention" LED is lit because of an unread critical-error entry, reading the SP error log will turn off the LED.

The time stamp for the entries is in Universal Time (Greenwich Mean Time).

Purpose

Log entries are used for troubleshooting the computer and for keeping a record of hardware activity.

Caveats

Interpreting entries in the SP logs may require a detailed knowledge of the computer.

Periodically clear the logs with the CL command to keep them to a manageable size.

Example of Initial DL Screen

```
SP> DL

Log Name         Entries   Earliest Entry           Latest Entry
-------------    -------   --------------------     --------------------
Activity             7     11/14/1992  00:54:17     11/14/1992  01:00:45
Earliest Errors     18     11/12/1992  18:01:27     11/14/1992  00:55:17
Latest Errors        0
SPU Tombstones       3     11/12/1992  18:58:52     11/12/1992  23:01:29

Activity Log:  Provides a history of SP activity.

Earliest Error and Latest Error Logs:  Contain error entries.
   Entries are stored in the Earliest Error Log until it is full.
   When the Earliest Error log is full, entries are stored in the
   Latest Error Log.

Enter CNTL-C to abort a Log Display                 /* SEE NEXT PAGE */
```

Example of Activity Log

```
Select the Log to be displayed :

   Activity              =  a
   Earliest Errors       =  e
   Latest Errors         =  l
   SPU Tombstones        =  t

   Enter (a/e/l/t/CR = exit)  : A

Select the Log entries to be displayed :

   All entries           =  a
   Last 10 entries       =  l
   Block of entries      =  b

   Enter (a/l/b/CR = exit)  :  A

Activity Log
----------------

 Log   Type   Mos/Day/Yr   Hour:Min:Sec
----   ----   ----------   ------------

   1   1180    11/14/1992      00:54:17 UT
       Power has been disabled by using a SP command.
   2   1201    11/14/1992      00:55:25 UT
       New system status: TEST
   3   1201    11/14/1992      00:57:52 UT
       New system status: INIT
   4   1201    11/14/1992      00:58:15 UT
       New system status: TEST
   5   1201    11/14/1992      01:00:13 UT
       New system status: INIT
                    .
                    .
                    .
```

Example of Earliest Errors Log

```
Select the Log to be displayed :
   Activity              =  a
   Earliest Errors       =  e
   Latest Errors         =  l
   SPU Tombstones        =  t

   Enter (a/e/l/t/CR = exit)  :  E

Select the Log entries to be displayed :
   All entries           =  a
   Last 10 entries       =  l
   Block of entries      =  b

   Enter (a/l/b/CR = exit)  :  A

Earliest Error Log
------------------
 Log   Type   Mos/Day/Yr   Hour:Min:Sec
----   ----   ----------   ------------
   1   2240    11/12/1992      18:01:27 UT
       CRITICAL LOG
       All host processors failed self-test
   2   0084    11/12/1992      18:43:26 UT
       PSCM received abnormal status from PFC number 1
          AC undervoltage; AC operation; Not charging battery;
   3   0130    11/12/1992      18:43:26 UT
       AC Power has failed
   4   0084    11/12/1992      18:43:26 UT
       PSCM received abnormal status from PFC number 1
          AC undervoltage; Boost OFF; Bulk HVDC powerfail; AC operation;
          Charger undervoltage; Not charging battery;
   5   0084    11/12/1992      18:43:27 UT
       PSCM received abnormal status from PFC number 1
          AC undervoltage; Boost OFF; Bulk HVDC powerfail;
          Bulk HVDC undervoltage; AC operation; Charger undervoltage;
          Not charging battery;
   6   0204    11/12/1992      18:43:27 UT
       PSCM reduced PMB load due to a PFC Fault.
       This may be caused by turning off the SPU.
   7   2350    11/12/1992      18:58:52 UT
       CRITICAL LOG
       PDC stored a tombstone. See the SPU Tombstones log
                  .
                  .
```

Example of Latest Errors Log

```
Select the Log to be displayed :

   Activity              =  a
   Earliest Errors       =  e
   Latest Errors         =  l
   SPU Tombstones        =  t

   Enter (a/e/l/t/CR = exit)  :  L

This log is empty.  See the Earliest Error log,
```

Example of SPU Tombstones Log

```
Select the Log to be displayed :

   Activity              =  a
   Earliest Errors       =  e
   Latest Errors         =  l
   SPU Tombstones        =  t

   Enter (a/e/l/t/CR = exit)  :  T


Tombstone #  Slot #   Mos/Day/Yr   Hour:Min:Sec
-----------  ------   ----------   ------------
      1       13      11/12/1992   18:58:52 UT
      2       13      11/12/1992   22:58:57 UT
      3       15      11/12/1992   23:01:29 UT

Enter tombstone # (tombstone #/CR = exit) : 1
------- Unexpected HPMC ------------------------------------------------
                                              11/12/92 18:58:43    ----
                                              PDC Version 1.11     ----
     Registers:                               Processor in slot 13 ----

     gr00/03 00000000 f0060000 ef019b7c f004aa00 | RP   (gr2)  ef019b7c
     gr04/07 13f4aa00 13f62de8 08000240 00062de8 | Arg0 (gr26) f0000000
     gr08/11 f0062de8 7ffff800 00000000 f004246c | Arg1 (gr25) f0062de8
     gr12/15 f0042468 00000000 00000000 00000104 | Arg2 (gr24) 13f00000
     gr16/19 00444000 00000000 f0042364 00000010 | Arg3 (gr23) 00000020
     gr20/23 f030fc10 aaaaaaaa 00000001 00000020 | Ret0 (gr28) 00000000
     gr24/27 13f00000 f0062de8 f0000000 f0201cb0 | SP   (gr30) f020f1b0
     gr28/31 00000000 00000007 f020f1b0 f030fc00 | DP   (gr27) f0201cb0

     sr00/07 ffff0000 00000018 aaaaaaaa cccccccc
             33333333 99999999 66666666 ffff0000

     Interrupt Processor Status Word  = 00000009  (IPSW)

     PC Queue Front   ffff0000.f0060370 priv = 0  (IIASQ.IIAOQ)
              Back    ffff0000.f0060374 priv = 0  (IIASQ.IIAOQ)
     Interrupt Queue  33333333.13f4aa00           (ISR.IOR)
     Interrupt Instruction Register   = 0c8612a8  (IIR)

                                                   /* SEE NEXT PAGE */
```

```
External Interupt Enable Mask    = 00000000  (EIEM)
External Interupt Request Reg.   = 80000000  (EIRR)

Protection ID's 1/4  3333  5555  aaaa  cccc  (PID)

RCTR           = 00000004        ITMR       = bf25c09e
SAR (dec)      = 21              CCR        = 80
IVA            = f001e800
ITLB_DIAG      = 1f0006xx        DTLB_DIAG  = 1f4006xx

ICache Diagnose Registers:
r00/04  0000027f          00000000          00000000
r05/09  00000cfc 00000cfc 0778317f 02aadbcb 07feffff

DCache Diagnose Registers:
r00/04  000c3fff 00000000 00000000 00000000 00000000
r05/09  0000fff0 0000fff0 08000007 08000001 3f9e7fff

Machine Check Parameters:
Check Type     = 20000000    CPU STATE    = 9e000002
Cache Check    = 00000000    PIM state    = Fresh
TLB Check      = 00000000    Bus Check    = 00300035
PMBI STATUS    = 8a040b04    PMBI SRClog  = 00400000
PMBI SADDlog   = fff97008    PMBI MADDlo  = dffb470d
SYNlog         = 55d55537    CPU DIAG0    = 03983e03

Slave Address  = fff97008
BLKID          = 0000    BANK         = 0
SLOT           = 0

MADDlog Breakdown:
ARB            = d       FLEX|FIXED   = 1bff6
R              = 0       M            = 1
S              = 1       T            = 1
Trans. Type  = 000d

MAC_Slot         IO_Stat  Err_Resp Info+Req
    6            00000040 00000000 0ffb40ab
    8            00000040 10000000 0ffbc0ab

BC Slot IOHI/LO  IO_Stat  Err_Resp Info+Req
    0   fba7fba7 f0f00042 ff67bfcf 5cd7fdbf  (upper)
             00000000 00000000 00000000  (lower)
    0   fffbffbe 50e048c3 f7d7febb fff9ff77  (upper)
             00000000 00000000 00000000  (lower)
```

DM: Display Memory (Service Only)

Display SP Memory

Display a range of bytes in Service Processor non-volatile memory (NVM).

A much better way to access PIM information is the "SPU Tombstone Log" under the Display Logs (DL) command.

Caveats

This command is not listed in the display from the Help command.

Example

```
SP> DM

Display Service Processor memory

Enter starting address (hex) (CR = exit): f00000

Enter number of bytes to display (dec) (CR = exit): 50

Address          : Contents

00f00000         : fffa 0000 0000 0000 0000 0000 0000 0002
00f00010         : 0000 0001 0000 0000 0000 0000 0000 0000
00f00020         : 0000 000d f020 4010 f033 0e00 f020 0768
00f00030         : 0000 0004 0000 0000 0000 0000 0000 0000
```

DN: DowN

Shut Down Main Power

Shuts down main DC power on the computer. (Shuts down all DC-to-DC coverters except the MPM bias. The High Voltage DC (HVDC) rail remains powered up.)

If the user enters the DN command while the SP is in the MAIN_POWER_UP access state. the SP turns off main DC power. The SP is then in the MAIN_POWER_DOWN state.

From the MAIN_POWER_DOWN state. the user can turn main DC power back on by entering the GO or UP command at the SP prompt.

Purpose

Duplicates the function of the "Standby/Ready" switch on the front panel. With the DN command. you can shut down DC power from the local or remote console rather than having to go to the computer cabinet.

Caveats

If the DN command is executed while the computer is running. processing is aborted and data will be lost.

Voltages are present inside the computer cabinet even after the DN command is executed. This command does not shut down the High Voltage DC (HVDC) or MPM bias voltages.

Warning **Do not use this command to replace any cards or power modules.**

To completely turn off power to the computer cabinet, turn the "Standby-Ready" switch to the "Standby" position and turn off the circuit breaker switch on the bottom rear of the cabinet.

Example

```
SP> DN

This command will SHUT OFF the MAIN DC POWER of this computer system.

Continue (y/[n])? Y

Service Processor: Commanding PSCM to turn off Main DC.

The system is in the SPU Power Control state.
The system power is down.

==> Type GO or UP to continue system initialization. <==

(SPU Power Control) SP> UP

System initialization resumed...

Service Processor: Commanding PSCM to turn on Main DC.

The contents of the following PMB slots have changed since the last boot:
    (NONE)

The configuration of the following PMB modules changed since the last boot:
    (NONE)

The following PMB modules are present, but will be deconfigured for the
upcoming boot:
    (NONE)

==> Press ANY key within 10 SEC to cancel boot with this configuration. <==

No key was pressed.  Continuing with system initialization...

Service Processor: Finished initialization.  Starting PDC boot process...

Proc[13/0]: PDC Version 1.11 (HARDBOOT)
Proc[15/0]: PDC Version 1.11 (HARDBOOT)
                    .
                    .
                    .
```

EA: Enable Activity Codes

Enable SPU Activity Chassis Codes

Enables updates of the four-digit hexadecimal status codes displayed at the bottom of the system console display. These codes have the form FxxF or Exxx.

When the status line is displayed during console mode, the hex code is updated every few seconds to show operating system activity levels. These activity codes typically have the form FxxF or Exxx.

Other hex codes indicate conditions other than system activity. These hex codes are displayed when they occur even if activity codes have been disabled with the DA command.

To disable the update of hexadecimal activity codes, enter the SP command DA.

(The hexadecimal codes are displayed on the system console when in Access Port control mode or in SP mode. The console enters these modes after the operator presses Control-B. Hexadecimal codes can also be displayed in console mode by using the Access Port's ES command.)

Purpose

See the entry for DA (Disable Activity Codes).

Example

```
SP> EA
SPU Activity Chassis Codes Enabled

SP> DA
SPU Activity Chassis Codes Disabled
```

EN: ENvironmental

Read Environmental Status

Displays environmental status information, including environmental information sensed by the Service Processor.

Purpose

Indicates if a particular PMB card is overheating, if any fans are malfunctioning, or if the external HP-PB cardcage is operating normally.

Examples

```
SP> EN

Power System environmental data:

Enter (t = temps.), (f = fan speeds), or (i = internal HP-PB cardcage): T

   PMB Slot      Temperature
   --------      -----------
      4          27.34 Deg. C
      9          26.86 Deg. C
     12          27.83 Deg. C
      .              .
      .              .

 Ambient         26.86 Deg. C
 Service Proc.   28.32 Deg. C

Ambient temperature ranges:
Normal < 33C < Warning < 43C < OS Shutdown < 48C < System Shutdown

Slot temperature ranges: (A = Ambient temperature)
Normal <(A+15C) <Warning < (A+25C) <OS Shutdown < (A+30C) <System Shutdown
```

Interpreting the display:

"Ambient" temperature is the air temperature measured at the top of the Service Processor card.

"Service Proc." and "PMB Slot" temperatures are the air temperatures measured at the bottom of the designated SP or PMB card.

"Ambient temperature ranges" shows how the system responds to over-temperature conditions. If the ambient temperature is:

- Above 33°C, a Warning occurs.
- Above 43°C, an operating system (OS) shutdown occurs.
- Above 48°C, a system (PSCM) shutdown occurs.

"Slot temperature ranges" shows how the system responds to differences in temperature between the slot temperature and the ambient temperature: If the slot temperature exceeds the ambient temperature:

- By more than 15°C, a Warning occurs.
- By more than 25°C, an operating system (OS) shutdown occurs.
- By more than 30°C, a system (PSCM) shutdown occurs.

```
SP> EN

Power System environmental data:

Enter (t = temps.), (f = fan speeds), or (i = internal HP-PB cardcage): F

Fan #   Speed  (should be > 1900 RPM)
-----   -----
 0      3087 RPM
 1      3166 RPM
 2      3218 RPM
 3      3136 RPM
 4      3098 RPM
 5      3097 RPM
 6      3134 RPM
 7      3102 RPM
 8      3219 RPM
 9      3164 RPM
10      3117 RPM
11      3071 RPM
```

```
SP> EN

Power System environmental data:

Enter (t = temps.), (f = fan speeds), or (i = internal HP-PB cardcage): I

Internal HP-PB cardcage power supply status:
      No overtemperature; Power is ON; Battery is not charging
```

FE: Front End

Display ACFE Status

Displays the status of the AC Front End (ACFE). (The ACFE transforms the AC line voltage to 300 VDC when operating from the AC line. When operating on battery, the ACFE transforms the 48V battery voltage to 300 VDC.)

Purpose

Monitoring the AC power system.

Example

```
SP> FE

AC Front End units present:

   1    AC Front End unit 1

Display information for which AC Front End unit? (CR = exit) 1

        AC Front End #1
        ---------------
        Status = (0x1) :
          AC operation; Not charging battery;

        Secondary Positive Bias = 0.00 Volts
        Ambient Temperture = 29.36 Degrees Celsius
        Main Inverter Temperture = 28.22 Degress Celsius
        Fan Current = 0.98 Amps
        Fan Voltage = 13.04 Volts
        Secondary Negative Bias = -10.24 Volts
        HVDC Output Voltage = 287.19 Volts
        HVDC Output Current = 2.63 Amps
        Regulated Primary Bias = 17.88 Volts
        PFC Boost Temperture = 33.85 Degrees Celsius
        Bulk High Voltage = 337.02 Volts
        AC Input Voltage = 197.18 Volts
        PFC Boost Current = 2.91 Amps
        Battery Charger Current = 0.02 Amps
        Battery Charger Voltage = 55.07 Volts
        Battery Voltage = 0.00 Volts
```

FV: Firmware Version

Display Version Information for PDC, SP and PSCM Firmware.

Displays the version information for firmware stored on the Service Processor (SP). Information on three kinds of firmware are displayed:

- Service Processor (SP) firmware.
- Power System Control and Montior (PSCM) firmware.
- Processor Dependent Code (PDC).

The "Active Firmware Versions" are the versions of firmware currently being used by the computer. The "Alternate Firmware Versions" are versions of firmware stored on an alternate bank located on the SP card. The "Alternate Firmware Versions" will become the current firmware versions after executing a firmware update from PDC.

FV reports if a firmware update has been corrupted.

Purpose

Identifies the versions of firmware currently being used by the computer. Useful when updating the firmware by using the PDC Firmware menu.

Example

```
SP> FV
Active Firmware Versions:
   SP Bank 1: SP 1.62, PSCM 1.5. Compiled 07/10/93 00:50 UT
   PDC Bank 0: 2.20
   PSCM Boot ROM: 2.2

Alternate Firmware Versions:
   SP Bank 0: SP 1.62, PSCM 1.5. Compiled 07/10/93 00:50 UT
   PDC Bank 1: MR202

Checking SP active bank checksum...
...SP active bank passes its checksum test!

Checking PDC active bank checksum...
...PDC active bank passes its checksum test!


Checking SP alternate bank checksum...
...SP alternate bank passes its checksum test!

Checking PDC alternate bank checksum...
...PDC alternate bank passes its checksum test!
```

GO: GO

Continue the Boot Process

Resumes the system initialization process. The system initialization can pause at the SP prompt on error or by user choice.

Purpose

If system initialization has stopped, this command resumes it. For example, if system initialization has stopped because a processor or memory module is to be deconfigured, you can use GO to resume the initialization process. You can also use GO to bring up the power system after a DN command.

Examples

```
SP> GO

The system is already initialized.
Command ignored.
```

```
(SPU Power Control) SP> GO

System initialization resumed...


Service Processor: Commanding PSCM to turn on Main DC.

The contents of the following PMB slots have changed since the last boot:
    (NONE)

The configuration of the following PMB modules changed since the last boot:
    (NONE)

The following PMB modules are present, but will be deconfigured for the
upcoming boot:
    (NONE)

==> Press ANY key within 10 SEC to cancel boot with this configuration. <==
```

HC: Host Configuration

Display/Modify Hardware Configuration

Used to display and modify the computer hardware configuration. For each Processor Memory Bus (PMB) slot, the display tells:

- Whether the slot is occupied.
- Which module type resides in the slot.
- Whether the module is currently configured IN or OUT of the computer.
- Whether the module is scheduled to be configured at the next boot.

This command can be used to configure PMB modules IN or OUT of the computer. The new configuration status becomes effective during the next boot of the computer.

Purpose

To view the configuration of the PMB cardcage. Also, to de-configure and reconfigure PMB cards (useful in servicing the computer).

De-configuring a PMB module with an HC command electrically removes the module so it is no longer seen on the bus. Breaking the connection is done very close to the backplane, so a defective card that is jamming the bus can often be removed remotely in this way.

Caveats

The HC command does not show the configuration of I/O interface cards in the HP-PB cardcages.

De-configuring PMB cards by accident will interfere with computer operation (degraded performance or inability to boot-up).

Example

Interpreting the display:

"Ports" correspond to modules. For example, a bus converter port 0 corresponds to BC module 0.

Memory ports are actually 64-Mbyte banks.

The bus converter does not use ports 1 and 3.

```
SP> HC


Host Hardware Configuration:   (D = deconfigure; - = non-existent port)
-------------------------------------------------------------------
|      |                 | Deconfigured      | Ports to be decnf |
| PMB  |                 | Ports             | at next boot      |
| Slot | Board Type      |  0 |  1 |  2 |  3 |  0 |  1 |  2 |  3 |
|------------------------------------------------------------------|
|   0  | Bus Converter   |    |  - |    |  - |    |  - |    |  - |
|   6  | Memory          |    |    |    |    |    |    |    |    |
|   8  | Memory          |    |  - |  - |  - |    |  - |  - |  - |
|  13  | TNT Processor   |    |    |  - |  - |    |  - |  - |  - |
|  15  | TNT Processor   |    |    |  - |  - |    |  - |  - |  - |
-------------------------------------------------------------------

Enter the slot # of the module whose configuration is to be changed
(CR = exit): 6
Enter the port # of the module whose configuration is to be changed
(CR = exit): 0

Port 0 in slot 6 will now be configured OUT.


Host Hardware Configuration:   (D = deconfigure; - = non-existent port)
-------------------------------------------------------------------
|      |                 | Deconfigured      | Ports to be decnf |
| PMB  |                 | Ports             | at next boot      |
| Slot | Board Type      |  0 |  1 |  2 |  3 |  0 |  1 |  2 |  3 |
|------------------------------------------------------------------|
|   0  | Bus Converter   |    |  - |    |  - |    |  - |    |  - |
|   6  | Memory          |    |    |    |    |  D |    |    |    |
|   8  | Memory          |    |  - |  - |  - |    |  - |  - |  - |
|  13  | TNT Processor   |    |    |  - |  - |    |  - |  - |  - |
|  15  | TNT Processor   |    |    |  - |  - |    |  - |  - |  - |
-------------------------------------------------------------------

Enter the slot # of the module whose configuration is to be changed
(CR = exit): 6
Enter the port # of the module whose configuration is to be changed
(CR = exit): 0

Port 0 in slot 6 will now be configured IN.
```

HE: HElp

Display Help Information

Gives a brief description of all SP commands. (Note: HE does not display the DM or PF commands.)

Example

(On next page.)

```
SP> HE

SP 1.16, PSCM 1.5. Regres Compiled 11/5/92 7:35pm

AF - Display/Modify Autostart Flag.
BA - Battery Enable/Disable.
CL - Clear the SP Logs.
CM - Enter AP Control Mode.
CN - Power Converter On/Off.
CO - Enter AP Console Mode.
DA - Disable SPU Activity Chassis Codes.
DC - Display Converter Status.
DL - Display the SP Logs.
DN - Shut Down Main DC Power.
EA - Enable SPU Activity Chassis Codes.
EN - Display Power System Environmental Status.
FE - Display AC Front End (ACFE) Status.
FV - Display PDC, SP and PSCM Firmware Versions.
GO - Continue the Host Initialization Process.
HC - Display/Modify Host Configuration.
HE - Help.  Display This Screen..
ID - Display/Modify Service Processor ID Code.
MR - Margin a Power Rail.

More? ([y]/n): Y

PC - Display Power System Configuration.
PS - Display Power System Status.
RE - Restart the SP/PSCM and System.
RL - Power Rail On/Off.
RP - Display/Modify Revision Ports.
RS - Reset SPU (Hard Boot).
SM - Display/Modify Software Monitor Flag.
SW - Switch SP and PDC Firmware Banks.
TC - Initiate SPU Transfer of Control.
TH - Display/Modify Voltage Shutdown Thresholds
UP - Bring Up Main DC Power.

The SP commands can be grouped by category:

The PDC / SP firmware related commands are AF, DA, EA, FV, SM, and SW.
The power system commands are BA, CN, DC, DN, EN, FE, MR, PC, PS, RL,
RP, TH, and UP.   DC, EN, FE, PC, PS are the basic commands.  CO and
CM are the AP Console Commands.  The system hardware commands are GO,
HC, ID, RE, RP, RS, and TC.  CL and DL are the SP Log commands.
```

ID: ID Code (Service Only)

Display/Modify Service Processor ID Code

Allows user to display and modify the Service Processor hardware datecode.

Purpose

The ID command allows the datecode to be read remotely. The datecode must be read when altering the SP hardware, for example when replacing the PSCM Boot ROM.

Example

(On next page.)

```
SP> ID

        The date code of the Service Processor is 13220

        Do you wish to change the date code (y/[n])? Y

        Date code format = aYYWWb, where
                 a = Art work revision level: (e.g.: A=Rev A),
                YY = No. of years since 1960
                WW = No. of weeks since Jan 1
                 b = Sub rev levl for multiple revisions in 1 week

        Enter new date code (aYYWWb) (CR = no change): [Enter]

        The date code is unchanged.
```

MR: Margin a Rail (Service Only)

Margin a Power Rail

Margins a rail up or down by 0 to 5%.

When a rail is margined UP, the voltage differential between that rail and ground is increased. When a rail is margined DOWN, the voltage differential between that rail and ground is decreased. For example, margining +10V up by 10% produces 11V. Margining -10V up by 10% produces -11v.

Purpose

Identifying the causes of intermittent errors.

Caveats

The only method of determining if any rails are margined is to use the MR commands.

The MR command sends margining information from the SP to the PSCM. The PSCM retains this information only as long as it is powered. If the system is cold reset (for example by cycling power or with the SP or PDC REset commands), then the PSCM loses the margining information. This could happen, for example, if a long powerfail occurs after a CE sets up margining.

All margined rails return to nominal voltage levels when the SP is re-initialized (following an SP REstart command or after power is cycled). The margining is NOT reset by an RS command or by simply turning the Standby/Ready switch to "Standby".

Margining has a maximum time limit of 24 hours. After the time limit expires, the power system returns to nominal voltage levels.

Example

(On next page.)

```
SP> MR

Main DC Power is ON.

**** WARNING ****
This command can damage system electronic components; it should ONLY be used
by an HP Customer Engineer.

Are you SURE you want to change the MARGIN of the power rails (y/[n])? Y

Available DC Rails:
 0 = ProcX - Processor X Rail
 1 = Proc  - Processor Rail
 2 = Batt  - Battery Rail
 3 = Sys   - System Rail
 4 = ProcY - Processor Y Rail
 5 = Fan   - Fan Rail

Available MPM DC Rails:
 6 = Clock - Clock Rail
 7 = CBatt - Clock Battery Rail
 8 = PMBt  - PMB Termination Rail
 9 = PMBc  - PMB Clock Rail
10 = PMBb  - PMB Battery Rail

Margin which rail? (CR = exit) : 5

Slot    Rail_Name       Voltage Status
----    ---------       ------- ------
 14     24.00v  Fan     23.03v  (0x1)  Master; Normal Status

Do you wish to change the margin of this rail (y/[n])? N

Command aborted.
```

PC: Power Configuration

Display Power System Configuration

Displays the configuration of the power system. showing the power modules in the power system slots. Also shows the status of each power module.

Purpose

Monitoring and troubleshooting the power system.

Caveats

Understanding all the information displayed by the PC command requires a knowledge of the power system.

Example

```
SP> PC

Power System Configuration

Slot    Rail_Name       Voltage Status
----    ---------       ------- ------
 6      5.00v   Batt    5.00v   (0x1)  Master; Normal Status
 9      5.00v   ProcX   4.98v   (0x1)  Master; Normal Status
 12     MPM
        2.00v   Clock   2.00v
        2.00v   CBatt   2.00v
        3.00v   PMBt    2.99v
        -2.50v  PMBc    -2.49v
        -2.50v  PMBb    -2.49v
13      5.00v   Sys     5.00v   (0x1)  Master; Normal Status
14      24.00v  Fan     23.09v  (0x1)  Master; Normal Status
```

PF: PDC Flags (Service Only)

Set PDC Selftest Flags

While servicing the system, you can save time during reboots by disabling PDC selftests (enter a value of 80000000). You can save 5 minutes or more, depending on the number of memory cards in the system.

Afterwards, reset PDC selftest flags to their default values by entering 00000000

Purpose

To reduce the time required for reboots, while servicing the system. Also, an easy way to return PDC selftest flags to their defaults.

If someone has set the Loop-on-Selftest flag, using the PF command is the only way to get out of the loop.

Caveats

Caution

After servicing the system, the PDC selftest flags should be set to their defaults. Otherwise, the system may not be completely tested during start-up.

This command is not listed in the display from the Help command.

Example

(On next page.)

```
SP> PF
Display and modify PDC self-test flags

Proc #   Slot #   Present   Flags (hex)
------   ------   -------   -----------
   0        8                 00000000     /* Default values */
   1        9                 00000000
   2       10                 00000000
   3       11                 00000000
   4       12                 00000000
   5       13                 00000000
   6       14                 00000000
   7       15        *        00000000

Enter new value of PDC self-test flags register (hex) (CR = exit): 80000000
Enter processor number (dec) (a = all; CR = exit): A

Display and modify PDC self-test flags

Proc #   Slot #   Present   Flags (hex)
------   ------   -------   -----------
   0        8                 80000000  /* To set the No Test (NT) flag */
   1        9                 80000000
   2       10                 80000000
   3       11                 80000000
   4       12                 80000000
   5       13                 80000000
   6       14                 80000000
   7       15        *        80000000

Enter new value of PDC self-test flags register (hex) (CR = exit): 00000000
Enter processor number (dec) (a = all; CR = exit): A

Display and modify PDC self-test flags

Proc #   Slot #   Present   Flags (hex)
------   ------   -------   -----------
   0        8                 00000000
   1        9                 00000000
   2       10                 00000000
   3       11                 00000000
   4       12                 00000000
   5       13                 00000000
   6       14                 00000000
   7       15        *        00000000
```

PS: Power Status

Display Power System Status

Displays status information for the power system. For example. it tells the state of the:

- Standby/Ready switch.
- Internal power-on signals (PON).
- AC and DC power.
- Battery back-up.

Purpose

Monitoring and troubleshooting the power system.

Caveats

Understanding all the information displayed by the PS command requires a knowledge of the computer power system.

Example

```
SP> PS

        Power System Status
        -------------------
   - AC power on
   - DC power nominal
   - PON on
   - Secondary PON on
   - Status of power system conditions that affect the Battery Backup system:
      - Standby/Ready switch in READY position
      - Battery presence DETECTED
      - SP Battery enable flag (BA) is SET

      The combined state of these three conditions has ENABLED the
      Battery Backup system.

SP> DN
          .
          .
          .
(SPU Power Control) SP> PS

   - AC power on
   - DC power not nominal
   - PON off
   - Secondary PON off
   - Status of power system conditions that affect the Battery Backup system:
      - Standby/Ready switch in READY position
      - Battery presence DETECTED
      - SP Battery enable flag (BA) is SET

      The combined state of these three conditions has ENABLED the
      Battery Backup system.
```

RE: REstart

Restart the SPU (Computer)

Causes the Service Processor to perform a reset and hard boot on the computer. A hard boot tests memory destructively: some troubleshooting data may be lost.

Same as the RESTART command available at the PDC interface.

Purpose

To reset the system when you do not care about saving troubleshooting data and when you want a more thorough re-initialization than is provided by the RS or TC commands. The RE command performs both an SP and a PDC initialization: the RS and TC commands only perform an SP initialization.

Caveats

The RE command takes longer to execute than the RS or TC commands.

Do not perform an RS or RE command in preparation for a memory dump. Use the TC command instead.

Example

```
SP> RE

WARNING: This command will completely RESTART the System.
Execution of this command irrecoverably halts all system processing
and I/O activity and restarts the Service Processor.
The Service Processor will turn off Main DC power, run its selftest,
and then re-boot the System.

Type Y to confirm your intention to RESTART the system (y/[n]): N

Command aborted.
```

RL: RaiL (Service Only)

Power Rail On/Off

Switches a power rail ON or OFF.

Purpose

Troubleshooting the power system (deconfiguring a bad power supply).

Caveats

Caution Inappropriate use of the RL command can damage SPU components.

Not valid when the "Standby-Ready" switch on the front panel is in the "Standby" position.

Cannot be used to start the system by manually turning on all rails. Some rails in the MPM cannot be individually controlled.

Example

```
SP> RL

The system is currently RUNNING;  use the DN command to shut off main DC
power before using the RL command.

SP> DN

          .
          .
          .

(SPU Power Control) SP> RL

**** WARNING ****
This command can damage system electronic components; it should ONLY be
used by an HP Customer Engineer.

Are you SURE you want to change the state of the power rails (y/[n])? Y

Available DC Rails:
 0 = ProcX - Processor X Rail
 1 = Proc  - Processor Rail
 2 = Batt  - Battery Rail
 3 = Sys   - System Rail
 4 = ProcY - Processor Y Rail
 5 = Fan   - Fan Rail

Available MPM DC Rails:
 6 = Clock - Clock Rail
 7 = CBatt - Clock Battery Rail
 8 = PMBt  - PMB Termination Rail
 9 = PMBc  - PMB Clock Rail
10 = PMBb  - PMB Battery Rail

Modify which rail? (CR = exit) : 5

Slot    Rail_Name       Voltage Status
----    ---------       ------- ------
 14     24.00v  Fan     23.03v  (0x1)  Master; Normal Status

This rail is currently ON.  Do you wish to turn it OFF? (y/[n]) N

Command aborted.
```

RP: Revision Ports (Service Only)

Display/Modify Revision Ports

Displays Revision Port (RevPort) information on the PMB modules, power modules (DC-to-DC), and the AC Front End (ACFE).

A small number of RevPort fields can be modified with this commands.

Purpose

The RP command is also used for displaying and updating date codes.

The RP command can also change which processor is selected as monarch processor:

- Use the RP command to set the boot IDs for all non-monarch processors to 0.
- Set the boot ID of the desired monarch processor to a value greater than 0.

Caveats

During system initialization, RevPort information is stored in SP non-volatile memory (NVM). If the PMB hardware configuration is changed when the system is powered down, the SP does not detect the change until the system is powered up.

If system power is down, the RP command displays the RevPort information that the SP scanned out last; the SP cannot scan out the new RevPort information from the PMB modules.

Example

```
SP> RP
Change/display revision port information for which subsystem?
(m = PMB), (p = power), (CR = exit) : m

PMB Slot        Module Type ("-" = empty slot)
--------        -----------
    0          Bus Converter
    1           -
    2           -
    3           -
    4           Memory
    5           -
    6           -
    7           -
    8           -
    9           -
   10           Memory
   11           -
   12           -
   13           -
   14           -
   15           PCX processor

To display a board's revision port, enter the slot number (CR = exit): 0

Revision Port number 0 of PMB slot 0:

Bytes   Definition          Value
-----   ----------          -----
 0- 5   Serial Number       11N1D5
 6- 7   Division            52
 8-12   Assembly Number     A180960005
13      Reserved for SP     00
14-15   Date Code           3229
16      Module type         07
17      IODC Revision       00
18-19   IODC h-version      1840
20-23   IODC s-version      00000C000
24-27   Boot ID             000000000
28-31   S/W Capabilities    000000000

Fields in INVERSE VIDEO may be modified
Change revision port (y/[n])? N
```

Example

```
SP> RP
Change/display revision port information for which subsystem?
(m = PMB), (p = power), (CR = exit) : P

Power System Configuration

Slot    Rail_Name       Voltage Status
----    ---------       ------- ------
 1      5.00v   ProcY   5.21v   (0x3)  Master; UNDERCURRENT
 6      5.00v   Batt    5.00v   (0x1)  Master; Normal Status
 9      5.00v   ProcX   4.98v   (0x1)  Master; Normal Status
 12     MPM
        2.00v   Clock   2.00v
        2.00v   CBatt   2.00v
        3.00v   PMBt    2.99v
        -2.50v  PMBc    -2.49v
        -2.50v  PMBb    -2.49v
13      5.00v   Sys     5.00v   (0x1)  Master; Normal Status
14      24.00v  Fan     23.09v  (0x1)  Master; Normal Status
17      AC Front End unit 1

To display a converter's revision port, enter the slot number (CR = exit): 1

Revision Port number SPS converter slot 1:

Bytes   Definition                    Value
-----   ----------                    -----
 0- 3   Assembly Number               B3050000
 4      Converter Type                02
 5      Converter Type Extension      00
 6- 7   Date Code                     0000
 8- 9   Country of Origin             ??
10-12   Serial Number                 00000
13-18   Host Serial Number Prfx.      000000000000
19-20   Host Serial Number            0000
21-23   Last Repair Date              000000
24      Last Fault Slot Number        00
25-26   Last Fault Repaired           0000
27      Present Fault Slot Number     00
28-29   Present Fault Detected        0000
30-31   Reserved for PSCM             0000

Fields in INVERSE VIDEO may be modified
Change Revision Port (y/[n])? N
```

RS: ReSet

Reset SPU (Computer).

Causes the Service Processor to perform a reset and hard boot on the computer. A hard boot tests memory destructively; some troubleshooting data may be lost. The computer performs PDC initialization. It does not perform SP initialization.

Purpose

To reset the system when you do not care about saving troubleshooting data. For example:

- When updating the operating system.
- After changing the console path.

Caveats

Do not perform an RS or RE command in preparation for a memory dump. Use the TC command instead.

On the 99x/890/T500, the RS command is only available from the SP prompt. It is not available from the Access Port (CM>) prompt as on most other PA-RISC systems.

Example

```
SP> RS

WARNING: Execution of this command irrecoverably halts all system processing
and I/O activity and restarts the computer system.  (Hard boot.)

Type Y to confirm your intention to restart the system (y/[n]):  N

Command aborted.
```

SM: Software Monitor

Display/Modify Software Monitor Flag.

If the software monitor (SM) flag is set, the SP reports an error if no OS activity is detected within any 10-second interval:

- The red "Stopped" LED on the front panel turns ON until the OS updates the chassis display.
- The yellow "Attention" LED on the front panel turns ON until the operator reads the SP error log with the DL command.
- The SP error log contains a stale system status entry (STALE_SYS_STAT_LOG).

The SP monitors OS activity by checking whether the OS has updated the chassis display within any 10-second interval.

HP recommends that you NOT set the Software Monitor (SM) flag on HP-UX systems. With the SM flag set, HP-UX systems may display false warnings of no OS activity

Purpose

To receive notification if the operating system is not functioning.

Caveats

At times HP-UX may not update the chassis display every 10 seconds even though HP-UX is functioning properly.

Example

```
SP> SM

The Service Processor software monitor flag is currently CLEARED
(monitor disabled).

Do you wish to SET the flag (y/[n])? Y

The Service Processor software monitor flag is now SET
(monitor enabled).

SP> SM

The Service Processor software monitor flag is currently SET
(monitor enabled).

Do you wish to CLEAR the flag (y/[n])? Y

The Service Processor software monitor flag is now CLEARED
(monitor disabled).
```

SW: SWitch (Service Only)

Switch SP and PDC Firmware Banks

The 99x/890/T500 contains an active bank of firmware (SP and PDC) and an alternate bank of firmware. The SW command switches these two banks of firmware. The alternate bank becomes the active bank, and the active bank becomes the alternate bank. The SW command then performs the equivalent of a PDC RESTART command so that the SPU goes through both SP and PDC initializations. As a result the SPU begins running with the new active bank of PDC and SP firmware.

Purpose

May be helpful if the system will not boot due to firmware corruption. (May be helpful if the system appears dead.)

Do not use the SW command to update firmware; instead, use the commands at the PDC Firmware Menu.

Caveats

Warning

This is a very dangerous command since it could put the system in an irrecoverable state. It may then be necessary to replace the SP card.

For example, do not execute SW if the alternate bank of firmware is corrupted or is for a different processor type.

Example

```
SP> SW
WARNING: This command will switch to the alternate SP and PDC firmware banks.
         The system could be put in an IRRECOVERABLE state.
         This command should ONLY be executed by a Hewlett-Packard
         Customer Engineer.

Are you sure you want to switch banks (y/[n])? N

Command aborted.
```

TC: Transfer of Control

Initiate SPU Transfer of Control (TOC)

Causes the computer to perform OS-specific tasks, then to perform a soft boot. A soft boot tests memory non-destructively, preserving troubleshooting data. The computer performs PDC initialization. It does not perform SP initialization.

The TC command causes the Service Processor to place the console terminals in console mode and request the processor designated by PDC as the TOC target to perform a transfer of control (TOC). The SP user interface is deactivated when the console terminals are placed in console mode.

The consoles enter console mode when PDC outputs its first message.

In a multiprocessor system, the TOC is directed to the "TOC target" processor, which is the same processor as the Monarch and the PMB configuration master.

Purpose

To reset the system when you want to save troubleshooting data. For example:

- When the system is "hung" (does not respond to input) and you want to preserve troubleshooting data (for example in preparation for a memory dump on MPE/iX machines).
- After changing the console path.

Example

```
SP> TC

WARNING: Execution of this command causes a Transfer of Control instruction
(TOC) to be executed (Soft Boot).  Depending upon the TOC handler that is
configured by your system software, this may halt all system processing and
reboot your system.

Type Y to confirm your intention to execute this command (y/[n]):  N

TOC will not be executed.
```

TH: Voltage THresholds (Service Only)

Display/Modify Voltage Shutdown Thresholds

Changes the voltage threshold at which the power modules (DC-to-DC converters) shut themselves off. Each voltage has an upper threshold and a lower threshold. The upper threshold is the voltage farthest from ground. For example, a 10% upper threshold for +10V would be +11V. A 10% upper threshold for -10V would be -11V.

For positive voltages:

```
                          EXAMPLE

Upper Threshold           26.4V (24V + 2.4V)
                           ^
                           | 10%
                           v
POSITIVE Nominal Voltage  24V
                           ^
                           | 10%
                           v
Lower Threshold           21.6V (24V - 2.4V)

Ground                     0V
```

For negative voltages:

```
Ground                     0V

Lower Threshold           -2.25V (-2.5V - -0.25V)
                           ^
                           | 10%
                           v
NEGATIVE Nominal Voltage  -2.5V
                           ^
                           | 10%
                           v
Upper Threshold           -2.75V (-2.5V + -2.5V)
```

To "change the threshhold up" (to raise) means to increase the absolute number. To "change the threshhold down" (to lower) means to decrease the absolute number.

Purpose

Troubleshooting the power system.

Caveats

This command does not apply to the AC-to-DC converters on the AC Front End (ACFE).

Caution Inappropriate use of the TH command can damage SPU components.

Example

```
SP> TH

Main DC Power is ON.

**** WARNING ****
This command can damage system electronic components; it should ONLY be
used by an HP Customer Engineer.

Are you SURE you want to change the state of the power rails (y/[n])? Y

Available DC Rails:
 0 = ProcX - Processor X Rail
 1 = Proc  - Processor Rail
 2 = Batt  - Battery Rail
 3 = Sys   - System Rail
 4 = ProcY - Processor Y Rail
 5 = Fan   - Fan Rail

Available MPM DC Rails:
 6 = Clock - Clock Rail
 7 = CBatt - Clock Battery Rail
 8 = PMBt  - PMB Termination Rail
 9 = PMBc  - PMB Clock Rail
10 = PMBb  - PMB Battery Rail

Which rail? 5

Slot    Rail_Name       Voltage Threshold
----    ---------       ------- ------
 14     24.00v  Fan     23.03v  over=0%, under=0%

Do you wish to change its threshold (y/[n])? Y
Upper threshold or Lower threshold (u/l)? U
Threshold: Up 10 percent, Down 10 percent or Nominal (u/d/n)? [Enter]

Slot    Rail_Name       Voltage Threshold
----    ---------       ------- ------
 14     24.00v  Fan     23.03v  over=0%, under=0%

SP>
```

UP: UP

Bring Up Main DC Power

Brings up the main DC power for the computer system and causes SP initialization to continue.

Purpose

The UP command powers up and boots a computer system that had been powered down with the DN command.

Caveats

The UP command will not bring up power if the "Standby-Ready" switch on the front panel is in the "Standby/Battery Off" position.

This command is valid only if the computer system had been powered down with the DN command.

Examples

```
SP> UP

Main DC power is already ON.
        Command ignored.                    /* SEE NEXT PAGE */
```

```
SP> DN

This command will SHUT OFF the MAIN DC POWER of this computer system.

Continue (y/[n])? Y

Service Processor: Commanding PSCM to turn off Main DC.

The system is in the SPU Power Control state.
The system power is down.

==> Type GO or UP to continue system initialization. <==

(SPU Power Control) SP> UP

System initialization resumed...

Service Processor: Commanding PSCM to turn on Main DC.

The contents of the following PMB slots have changed since the last boot:
    (NONE)

The configuration of the following PMB modules changed since the last boot:
    (NONE)

The following PMB modules are present, but will be deconfigured for the
upcoming boot:
    (NONE)

==> Press ANY key within 10 SEC to cancel boot with this configuration. <==

No key was pressed.  Continuing with system initialization...

Service Processor: Finished initialization.  Starting PDC boot process...

Proc[13/0]: PDC Version 1.11 (HARDBOOT)
Proc[15/0]: PDC Version 1.11 (HARDBOOT)
                    .
                    .
                    .
```

Computer Museum

13

Glossary

Chapter Contents:

This chapter contains information on PA-RISC and 99x/890/T500 terms:

- A list of acronyms (Table 13-1).
- A glossary organized by subject.
  - Physical (Table 13-2).
  - Operating System and Software (Table 13-3).
  - Buses (Table 13-4).
  - Processor (Table 13-5).
  - Memory (Table 13-6).
  - Bus Converters (BCs) (Table 13-7).
  - Support System (Table 13-8).
  - I/O System (Selected I/O Cards) (Table 13-9).
  - Power System (Table 13-10).
  - Selected Peripherals (Table 13-11).
- A glossary in alphabetical order.

Acronyms

Table 13-1. HP System Acronyms (Including 99x/890/T500 Acronyms)

Acronym	Description
ACD	Architecture Control Document
ACFE	AC Front End
AP	Access Port
BBU	Battery Back-up Unit
BC	Bus Converter
BC-L	Bus Converter (Lower port)
BC-U	Bus Converter (Upper port)
CA	Channel Adapter
CCC	Cache Coherency Check
CCP	Close Console Path
CCU	Cache Control Unit
CIO	Channel I/O
CP	Control Panel
CPU	Central Processor Unit
DA	Device Adapter
DIO	Direct I/O
DMA	Direct Memory Access
DUI	Diagnostic User Interface
ECC	Error Correction Circuitry
FPC	Floating Point Coprocessor
FRU	Field Replaceable Unit
F/W SCSI	Fast/Wide SCSI
HPA	Hard Physical Address
HP-FL	Hewlett-Packard Fiber Link
HP-IB	Hewlett-Packard Interface Bus
HPMC	High Priority Machine Check
HP-PA	Hewlett-Packard Precision Architecture
HP-PB	Hewlett-Packard Precision Bus
HP-UX	Hewlett-Packard UNIX
HVDC	High Voltage DC
I/O	Input/Output
IODC	I/O Dependent Code
IPL	Initial Program Loader
ISL	Initial System Loader
LANIC	Local Area Network Interface Controller
LED	Light Emitting Diode
LPMC	Low Priority Machine Check

Table 13-1.
HP System Acronyms (Including 99x/890/T500 Acronyms) (continued)

Acronym	Description
MAAD	Memory Array Address Driver (chip)
MAC	Memory Access Controller (chip)
MADM	Memory Array Data Mux (chip)
MAU	Media Attachment Unit
MPM	Miscellaneous Power Module
MUX	Multiplexer
NVM	Non-Volatile Memory
OS	Operating System
PB	Precision Bus (HP-PB)
PB-FL	Precision Bus Fiber Link
PBA-IB	Precision Bus Adapter for HP-IB
PSCM	Power System Control and Monitor
PDC	Processor Dependent Code
PDH	Processor Dependent Hardware
PFR	Powerfail Recovery
PIM	Processor Internal Memory
PMB	Processor-Memory Bus
PMBI	Processor-Memory Bus Interface (chip)
PON	Power On

Acronym	Description
RAM	Random Access Memory
RISC	Reduced Instruction Set Computer
ROM	Read Only Memory
RS-232C	Standard for Serial Communication Interface
RTC	Real Time Clock
SCSI	Small Computer System Interface
SP	Service Processor
SPA	Soft Physical Address
SPS	Spectrum Power System
SPU	System Processor Unit
SS	Stable Storage
TC,TOC	Transfer of Control
TCU	Translation lookaside Control Unit
TLB	Translation Lookaside Buffer
TOC	Transfer of Control
UPS	Uninterruptible Power System
VLSI	Very Large Scale Integration

99x/890/T500 Terms (By Subject)

Table 13-2. Physical

Term	Abbrev	Obsolete	Description
HP9000 890 and HP3000 990/992	890/990/992	Emerald with Chimera CPUs	High-end PA-RISC system.
HP9000 T500 and HP3000 991/995	T500/ 991/995	Emerald with TNT CPUs	High-end PA-RISC system.
Control Panel, Front Panel	CP		Location for user-accessible displays and controls mounted on the SPU.
HP-PB cardcage	A1828A (external)	Opal	Contains backplane, card cage and power supply for HP-PB cards. One HP-PB cardcage is internal to the SPU; others are external.
expansion cabinet	A1897A (890/T500), A1884A (99x)	Rosebowl, peripheral rack system	Large (1.6m) cabinet for racking peripherals in an 99x/890/T500.

Table 13-3. Operating System and Software

Term	Abbrev	Obsolete	Description
MPE/iX		MPE-XL, MPE/XL	HP3000 operating system.
HP-UX			HP9000 operating system.

Table 13-4. Buses

Term	Abbrev	Obsolete	Description
Processor-Memory Bus	PMB	SuMMit, Primary Memory Bus	Central bus in 99x/890/T500. Cards that attach to the PMB include: processor cards, memory cards, and upper-port bus converter (BC) cards.
PMB address/arbitration buffer	SAAB		PMB transceiver chipset which handles PMB addressing and arbitration. SAAB chips are located on PMB cards. (SAAB = Summit Address Arbitration Buffer).
PMB data buffer	Slice	Diet Slice	PMB transceiver chipset which handles data transfer onto the PMB. Also does ECC. Slice chips are located on each PMB card.
HP Precision Bus	HP-PB	NIO Bus	The I/O bus used on 99x/890/T500. Cards that attach to the HP-PB include the lower-port bus converter (BC) card, the console/LAN card, SCSI cards, HP-FL cards, PBA-IB card (99x only) and HP-IB cards (890/T500 only). The HP-PB is also used by many previous PA-RISC systems: the xx7, the 808/815, and the Silver Family of SPUs.
Small Computer System Interface Bus	SCSI Bus		Industry standard bus used for I/O. On the 99x/890/T500, a SCSI card can attach to the HP-PB. SCSI is also known as "standard SCSI", "SCSI-2", "Single-Ended SCSI (S.E. SCSI, SE-SCSI)".
Fast/Wide Small Computer System Interface Bus	F/W SCSI Bus		Industry standard bus used for I/O. On the 99x/890/T500, a F/W SCSI card can attach to the HP-PB. Fast/Wide SCSI is also known as "Differential-Wide SCSI", "Fast and Wide SCSI".
Channel Input/Output Bus	CIO Bus, CIB		A foreign (non-native) bus used for general-purpose I/O on some PA-RISC systems. It is not used on the 99x/890/T500, except for the PBA-IB card on the 99x
Scan Bus		Support Bus, Scan Path, Scan Port, Scan Interface	Connects SP card to all PMB modules. Provides card and chip level scan paths. Used to configure and deconfigure PMB modules, initialize chips.
Service Processor Bus	SP Bus	Jazz Bus	Connects SP card to all PROCESSOR modules. Allows PDC to communicate with PDH functions.

Table 13-5. Processor

Term	Abbrev	Obsolete	Description
processor card (890/990/992)		(Chimera CPU)	Contains: ■ PCX processor chipset (Chimera) ■ Floating point coprocessor (FPC). ■ I-cache and D-cache. ■ TLB logic. ■ PMBI and other chipsets to interface the processor with the PMB.
processor card (T500/991/995)		(TNT CPU)	The processor motherboard onto which two processor daughterboards may be installed.
processor daughterboard (T500/991/995)		(TNT CPU)	Board containing one PCX-T (PA7100) CPU chip. One or two daughterboards can be installed on a processor card.
processor chip (890/990/992)	PCX		890/990/992 processor chipset.
processor chip (T500/991/995)	PCX-T, PA7100		T500/991/995 processor chipset.
processor-to-PMB interface chip	PMBI	PEPSI	Interfaces the CPU with the PMB transceiver chips. PMBI plays an important role in detecting and reporting High Priority Machine Checks (HPMCs).
floating point coprocessor	FPC		VLSI chip on the processor card that controls the operations of the floating point (MUL and ADD) VLSI chips.
monarch processor			The processor in an multiprocessing system which has been selected to perform boot and to execute IPL. In 99x/890/T500, the monarch processor is the same as the PMB configuration master and the TOC target.
PMB bus configuration master			The processor in an multiprocessing system which has been selected to initialize the PMB. In 99x/890/T500, the PMB bus configuration master is the same as the monarch processor.

Table 13-6. Memory

Term	Model/Abbrev	Obsolete	Description
memory module			PA-RISC modules which can be addressed individually through HPAs over the PMB. A memory card contains one memory module. Memory on 99x/890/T500 is processor dependent.
memory card	A2570A (64 MB). A2233A (128 MB). A2234A (256 MB)		The physical card (=board =PCA) on which main memory resides. A memory card contains one memory module.
memory bank			A physical unit used in interleaving and deconfiguring memory. A memory module can contain multiple banks. each of which can be deconfigured. For example, the 128-MB card contains two 64-MB banks; the 256-MB card contains four 64-MB banks.
memory blocks			A logical unit used in memory interleaving. Each memory bank on the system is seen as a memory block. Memory blocks are configured by PDC during system startup according to PMB guidelines.
memory interleaving group	interleaving group		A memory interleaving group is a set of memory banks (blocks) used in interleaving. Each memory bank/block on 99x/890/T500 is assigned to an interleaving group according to its size. For example, all 64-MB banks/blocks belong to the same interleaving group. Another interleaving group might consist of all 16-MB bank/blocks. An interleaving group might consist of banks/blocks on several different cards. 99x/890/T500 supports up to three different interleaving groups at the same time.
Memory Access Controller chip	MAC		Main control unit for a memory module on one memory card. Provides control, timing and handles error operation. Participates in cache coherency checking. Contains HPA and BPA registers. (One MAC chip per memory card.)
Memory Array Address Driver chip	MAAD		Drives the RAS and CAS signals to the RAM chips. Located on memory cards. (Four MAAD chips on a 256MB card.)
Memory Array Data Mux chip	MADM		Multiplexes data and ECC bits from the RAM chips. Located on memory cards. (18 MADM chips on a 256MB card.)
page deallocation			Causes a page of memory to be deallocated if a single-bit error occurs in that page. Not implemented in HP-UX 9.04 or MPE/iX 4.x.

Table 13-7. Bus Converters (BCs)

Term	Model/Abbrev	Obsolete	Description
Upper-port BC card	BC-U. A1829A	SuMMit BC	PMB card containing the upper ports of two bus converters (BCs). Both BCs share the same interface to the PMB. Each BC is connected by a link to a lower BC card located in an HP-PB cardcage.
Lower-port BC card	BC-L	ACME BC	Card containing the lower port of one bus converter (BC). Connected to the upper port of the BC via a link. Plugs into a slot in an HP-PB cardcage.

Table 13-8. Support System

Term	Abbrev	Obsolete	Description
Service Processor card	SP card	Jazz card	Card located in the PMB cardcage (but not attached to the PMB) containing: ■ Service Processor (SP). ■ Processor Dependent Hardware (PDH), including PDC. ■ Power System Control and Monitor (PSCM). ■ System clocks. Connects to SP Bus, Scan Bus, Console/LAN card, control panel, and power system.
Service Processor	SP	Support Processor	A microprocessor-driven controller which provides access to hardware functions required to control and monitor the logic of the 99x/890/T500 SPU. Owns and controls PDH. Located on SP card.
Scan Bus		Support Bus, Scan Path, Scan Port, Scan Interface	Connects SP card to all PMB modules. Provides card and chip level scan paths. Used to configure and deconfigure PMB modules.
Service Processor Bus	SP Bus	Jazz Bus	Connects SP card to all PROCESSOR modules. Allows PDC to communicate with PDH functions.
Service Processor firmware	SP		Provides operator with functions for servicing the system, whether DC power is on or off. Monitors power system.
Processor Dependent Code	PDC		Firmware that initializes the hardware, conducts selftests, handles system faults. Allows operator to alter various system parameters.
Initial System Loader firmware	ISL		Responsible for booting the operating system. Allows operator to alter various system parameters.
Access Port firmware	AP		Allows remote servicing of system.
Close console path	CCP		System/console interface connection used by PDC. The CCP bypasses the PMB and I/O systems, allowing processors to communicate via the SP directly with the Console/LAN card and the system consoles.
Chassis codes, hex codes			The four-digit hexadecimal status/error codes for PA-RISC systems. On the 99x/890/T500, the hex codes can be displayed on bottom line of the system console by entering Control-B.

Table 13-9. I/O System (Selected I/O Cards)

Term	Model	Obsolete	Description
Console/LAN card		Countach. (LANborghini). multi-module HP-PB card	HP-PB card for LAN and AP. Supports local and remote system consoles. Connected to both the HP-PB and the SP card. LANborghini is the generic console/LAN module used on several systems. Countach is a console/LAN module with an interface to the SP. (A related card is the Diablo console/LAN card which has a SCSI interface).
9x7 multi-function card (LAN/AP)		Diablo	The design of the 99x/890/T500 console/LAN card was leveraged from this card.
HP-IB card	28650B (890/T500)		Card for interfacing HP-IB peripherals to the HP-PB.
HP-FL card (890/T500). PB-FL card (99x)	28615A (890/T500). 28616A (99x)		Card for interfacing HP-FL peripherals to the HP-PB.
PBA-IB card (99x only)	A1747A		Chan-Span (HP-PB to CIO adapter) with CIO HP-IB device adapter. Allows HP-IB peripherals to be connected to the HP-PB on a 99x system.
SCSI card	28655A (890/T500). 28642A (99x)		Card for interfacing SCSI peripherals to the HP-PB. Also known as "Single-Ended SCSI," "Standard SCSI." "SCSI," "SCSI-2," and "SE-SCSI."
F/W SCSI card	28696A (890/T500)		Card for interfacing Fast/Wide SCSI (F/W SCSI) peripherals to the HP-PB. Also known as "Differential-Wide," and "Fast and Wide."
802.3 LAN card	J2146A (890/T500). 36923A opt. 002 (99x)		Second LAN card. (First 802.3 LAN is supplied on Console/LAN card.)
MUX card (890/T500 only)	40299B (8-port). J2092A. J2093A. J2094A (all 16 port). J2096A (32-port)		Allow terminals and modems to be connected to the HP-PB on the 890/T500.

Table 13-10. Power System

Term	Abbrev	Obsolete	Description
AC Front End	ACFE		Supplies the SPU with a variety of AC and DC voltages derived from the outside power lines. Includes the circuit breaker and the AC-to-DC Module (PFC Unit).
Power System Control and Monitor	PSCM		Circuitry which monitors and controls power system modules and fans. Located on SP card.
AC-to-DC Module. PFC Unit			Converts AC to high-voltage DC. In battery back-up mode, converts battery DC to high-voltage DC. The AC-to_DC Module is also known as a Power Factor Correcting (PFC) unit.
High Voltage DC	HVDC		The high-voltage DC used to power the DC converter modules.
DC Converter Modules		Spectrum Power System (SPS) modules	One of the several DC-to-DC modules in the 99x/890/T500 power supply. Three kinds: ■ +5V 130A (for processors). ■ +5V 325W (for memory and BCs). ■ +24V 325W (for fans).
Main DC Power			Power from the DC-to-DC converter modules.
Miscellaneous Power Module	MPM		Power module containing the DC-to-DC power converters for eight small-usage voltages required by the SPU. Supplies power for the Service Processor.

Table 13-11. Selected Peripherals

Term	Model	Obsolete	Description
HP-PB cardcage	A1828A (external cardcage)	Opal	Contains backplane, card cage and power supply for HP-PB cards. One HP-PB cardcage is internal to the SPU; others are external.
expansion cabinet	A1897A (890/T500). A1884A (99x)	Rosebowl, peripheral rack system	Large (1.6m) cabinet for racking peripherals in an 99x/890/T500.
HP-FL disk array	C2252HA/B. C2254HA/B	Cascade	Allows racking of up to five 5.44-GB HP-FL disk array modules.
Series 6000 SCSI device rack		Volkswagen	Allows racking of 1.3-GB SCSI disk storage with/without DDS.
C1701A disk	C1701A	Shark	Rewritable optical disk drive (SCSI)
C1701C disk	C1701C	Corsair	650-MB standalone disk drive (SCSI)
C1703C disk	C1703C	Corvette	10-GB optical disk drive (SCSI)
C1704A/C disk	C1704A/C	Half Orca	60-GB Sony disk drive (SCSI)
C1705A disk	C1705A	Orca	100-GB Sony disk drive (SCSI)
C2245 disk	C2245	Wolverine II	500-MB disk drive (SCSI)
C2247/A disk	C2247/A	Wolverine II	1.0-GB disk drive (SCSI)
7937H/XP		Eagle	571-MB disk drive (HP-IB)
C3010 disk	C3010	Coyote IV	2.0-GB disk drive (SCSI)
Digital Data Storage	DDS		A format used in Digital Audio Tape (DAT) drives.
C1504A DDS tape drive	C1504A	Tardis	DDS with data compression; 2-GB to 5-GB (SCSI)
C1511A DDS tape drive	C1511A	Foxbox	DDS-format tape drive (HP-IB)
7980A/XC tape drive	7980A/XC	Gnu	6250-bpi tape drive with HP-IB interface
7980S tape drive	7980S	Gnu	6250-bpi tape drive with SCSI interface
C2753/54A printer	C2753/54A	Mercedes	HP5000 F-1000 PG printer

Selected 99x/890/T500 Terms (Alphabetical Order)

allocate	A term related to memory banks on PMB memory cards. Memory banks that pass selftests are allocated or configured for use by the O/S. *See also deallocate.*
autoboot	A PDC user command used to toggle the on/off state of the autoboot flag in stable storage. *See also autoboot flag.*
autoboot flag	A flag in stable storage that, when set, will initialize and test the *primary* boot path logic at power up. When the autostart flag is also set, will search for a bootable device and launch the O/S without user intervention.
autostart	A PDC user command used to toggle the on/off state of the autostart flag in stable storage. *See also autostart flag.*
autostart flag	A flag in stable storage that, when set, will allow the SPU to continue the a initialization process, assuming that no fatal errors were detected during the SPU selftests.
BC-L	A term related to (lower) bus converter ports on a double-high HP-PB cards. *See also BC-U.*
BC-U	A term related to (upper) bus converter ports on PMB Bus Converter cards. *See also BC-L.*
Battery Back-up Unit (BBU)	(890/990/992 only) A unit that provides power to main memory in the computer for a limited period of time if an ac power failure occurs. On the T500/991/995, powerfail backup is provided by the optional PowerTrust Uninterruptible Power System (UPS).
boot device	Any of the following peripherals that contains a copy of the ISL program that can be loaded into main memory: disk, tape, or CD-ROM device.
boot path errors	Those errors detected by the hardware or firmware while attempting to locate and test the boot device. *See also boot device.*
bus converter module	Each Bus Converter card contains two (BC-U) ports. Each BC-U port connects to a single (lower) bus converter (BC-L) port. *See also BC-L and BC-U.*
cache coherency check (ccc)	An operation performed by a processor module when multiple processor modules share the same data from main memory. A ccc must guarantee only one copy of data available to all processor modules.
configure	A term related to modules on PMB cards. Modules that pass selftests are configured for use by the O/S. *See also deconfigure.*
console device	An HP RS-232C terminal (with keyboard) that supports block mode serial transfers.

console path errors	Those errors detected by the hardware or firmware while attempting to locate and test the console device. *See also console device.*
data cache (D-CACHE)	The 2 MBytes of D-CACHE on the Processor card is organized as a "2-set" virtually-indexed, physically-tagged, ECC-protected cache. The control logic resides within two DCMUX chips; each chip manages a separate (64 K by 32 byte) array.
DCMUX	A VLSI chip in the processor module that controls the operations of the secondary data tag and RAM chips.
deallocate	A term related to memory banks on PMB memory cards. Memory banks that fail selftests are deallocated or deconfigured from use by the O/S. *See also allocate.*
deconfigure	A term related to modules on PMB cards. Modules that fail selftests are deconfigured from use by the O/S. *See also configure.*
D-TLB	The D-TLB on the Processor card is used to translate 48-bit *virtual* addresses into 32-bit *physical* addresses. The D-TLB logic consists of 96 (data word) entries that reside within the CPU chip and 16 K entries within the D-CACHE tags. *See also I-TLB.*
fastsize	A byte value, expressed with two hexadecimal digits, used to control the size of memory tested during selftest. A small numeric value reduces the amount of memory to test which, in turn, reduces the time to boot the ISL program into memory. The fastsize value is maintained in stable storage and may be changed during the Boot or ISL program environments.
floating point controller (FPC)	A VLSI chip in the processor module that controls the operations of the floating point (MUL and ADD) VLSI chips.
hard boot	Initialize and test the processor, memory (with writes and reads), and I/O device paths prior to the loading and execution of the ISL program on the boot device. *See also soft boot.*
HPA	Hard physical address (HPA) is a unique range of consecutive (word) addresses assigned to each PA-RISC module for the purpose of addressing registers associated with each PA-RISC module. HPA addresses are in the I/O address range from 0xF0000000 to 0xFFFFFFFF. *See also I/O-SPA.*
HPMC	A high-priority machine check is the highest priority interruption (group 1 of 5) triggered when an unrecoverable fault such as a data cache error is detected. When a HPMC occurs, PDC routines write the current state of the CPU (general registers, space registers, etc.) into a portion of main memory for examination by the O/S. The O/S determines whether the error condition is recoverable or not.

HP-PB (I/O) Bus	This bus provides connections for up to 56 I/O modules. All HP-PB transactions to processor or memory modules are forwarded up to the PMB by the bus converter modules. All PMB transactions to I/O modules are passed down to the HP-PB by the bus converter modules. *See also PMB.*
ICMUX	A VLSI chip in the processor module that controls the operations of the secondary instruction tag and RAM chips.
instruction cache (I-CACHE)	The 2 MBytes of I-CACHE on the Processor card is organized as a "2-set" virtually-indexed, physically-tagged, parity-protected cache. The control logic resides within one ICMUX chip that manages a (64 K by 32 byte) array.
IODC	IODC (input/output-dependent code) provides identification information and software (ENTRY_INIT and ENTRY_IO routines) for PA-RISC modules. IODC routines are located on a single EEPROM on the Service Processor card. *See also PDC.*
I/O-SPA	A range of addresses within the I/O address space reserved for I/O modules when more register space is needed by the S/W drivers. *See also HPA.*
IPL	The initial program loader (IPL) is a boot routine stored in PDC. This routine loads the ISL program into main memory from the *selected* boot device. *See also PDC.*
ISL environment	ISL is an (optionally) interactive environment which PDC loads from a boot device. This environment provides user commands to list and execute diagnostic and utility programs on the boot device in an offline environment.
I-TLB	The I-TLB on the Processor card is used to translate 48-bit *virtual* addresses into 32-bit *physical* addresses. The D-TLB logic consists of 96 (data word) entries that reside within the CPU chip and 16 K entries within the I-CACHE tags. *See also D-TLB.*
LPMC	A (low-priority machine check) is a lower priority interruption (group 2) triggered when a recoverable error such as an instruction cache parity error is detected. When a LPMC occurs, PDC routines correct and log the condition and continue program execution without delay.
main memory	Name given to the portion of virtual memory made up of dynamic RAMs. *See also virtual memory.*
operating system (OS or O/S)	Refers to the HP-UX or MPE/iX operating system software on Hewlett-Packard PA-RISC computer systems.
page deallocation	With page deallocation, a page of memory is deallocated if a single-bit error occurs in that page. Not implemented in HP-UX 9.04 or MPE/iX 4.x.

PA-RISC modules	Basic hardware elements connected by system buses that make up PA-RISC systems: processors, memory, I/O adapters, bus converters and adapters.
P-Bus	This is a multiplexed (32-bit) address/data bus between the CPU chip and the other VLSI chips on the Processor card.
PDC	PDC (processor-dependent code) is a series of entry-points and subroutines located within the EEPROM on the Service Processor card that are used by the CPU to provide a uniform, architected context in which to perform processor-dependent operations. *See also IODC.*
PIM	Processor internal memory (PIM) is a reserved area in main memory that is used to store error information from HPMC, LPMC, and TOC interruptions.
PMB (central) Bus	This bus is the main bus used by all processor, memory, and (upper) bus converter modules to interface with each other. *See also P-Bus.*
PMBI	A VLSI chip in the processor module that controls the operations of to/from the PMB and SP bus.
PowerTrust UPS	The PowerTrust Uninterruptible Power System (UPS) is an optional part of 99x/890/T500 computer systems, providing power to the devices connected to it for approximately 15 minutes after an AC power failure.
Scan Bus	This bus provides a connection between the SP card and each PMB card.
soft boot	Initialize and test the processor, memory (without writes), and I/O device paths prior to the loading and execution of the ISL program on the boot device. *See also TOC.*
SPA	Soft physical address (SPA) is a range of consecutive (word) addresses assigned to each memory bank for the purpose of building up main memory. *See also HPA.*
SP Bus	This bus provides a connection between the SP card and each processor module.
stable storage	Non-volatile (EEPROM) memory associated with each PA-RISC processor module whose contents must not be lost under any conditions. Stable storage contains critical file system and system initialization information.
TOC	A transfer of control operation is performed as a result of a user manually entering the TC command or programmatically by the O/S to save processor state and other information: and transfer control to the O/S, if possible, for later analysis. *See also HPMC.*
Uninterruptible Power System (UPS)	*See PowerTrust UPS.*

virtual memory

The total amount of memory addressable by a system. PA-RISC systems support either 48 or 64 bits of virtual memory composed of both (expensive) RAM memory and (inexpensive) disk memory.

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Service Notes

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Diagrams

Introduction

This chapter provides supporting diagrams for the CS 99x/890/T500 Family SPUs.

Functional Block Diagrams

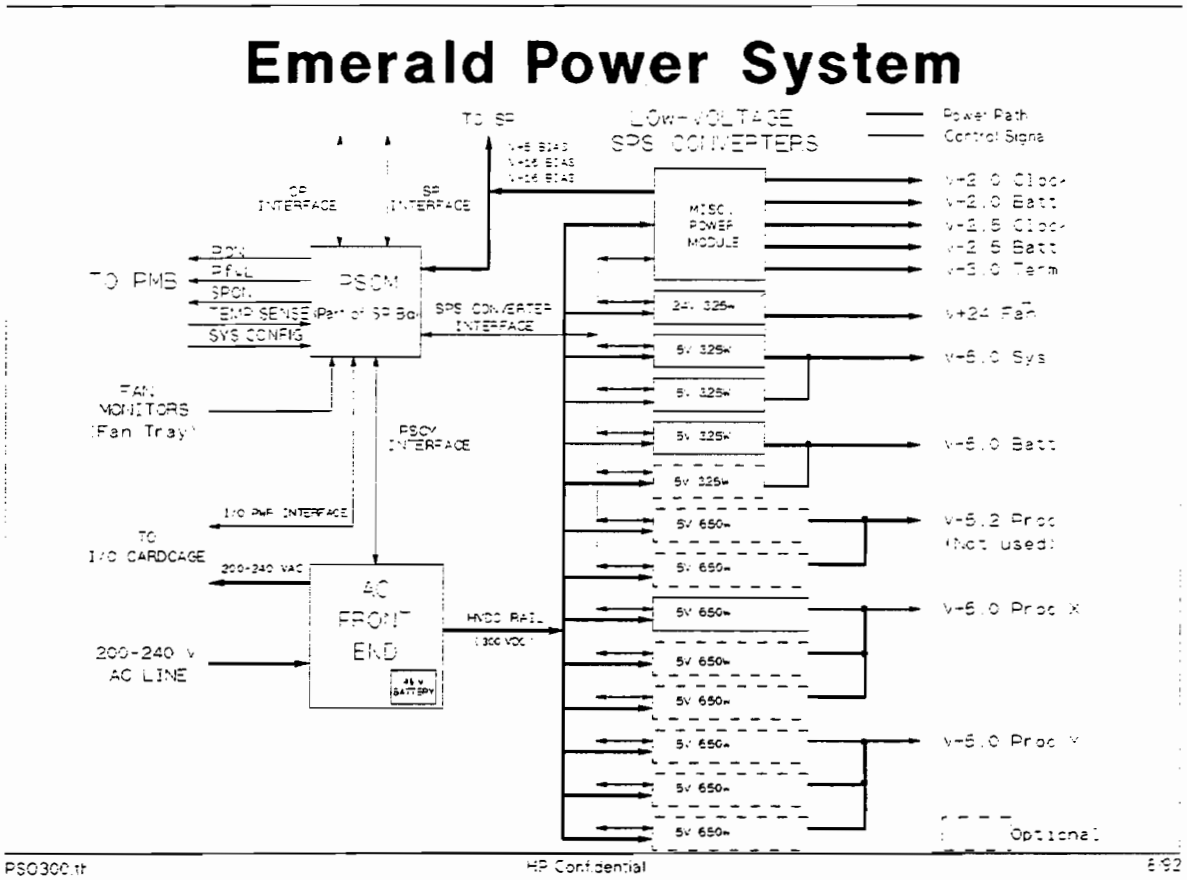


Figure 15-1. Power System Block Diagram

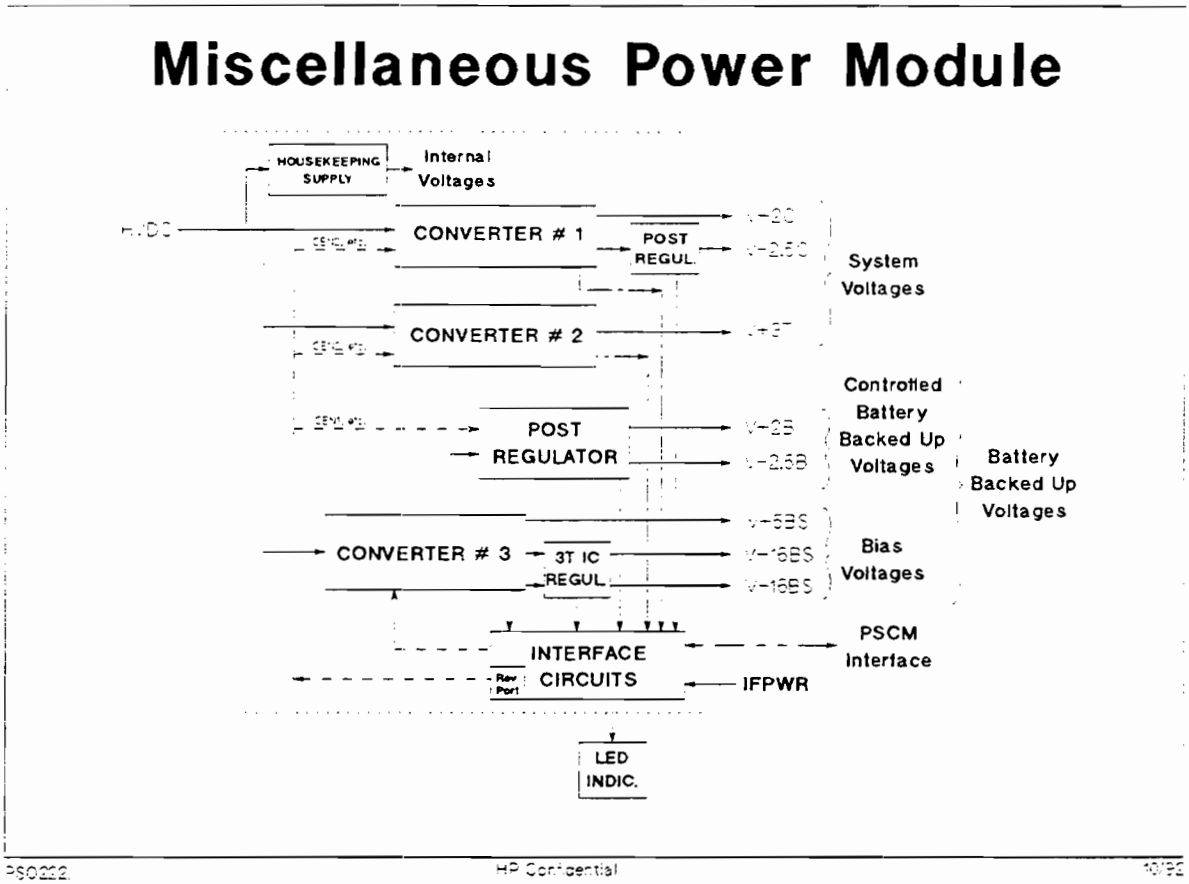
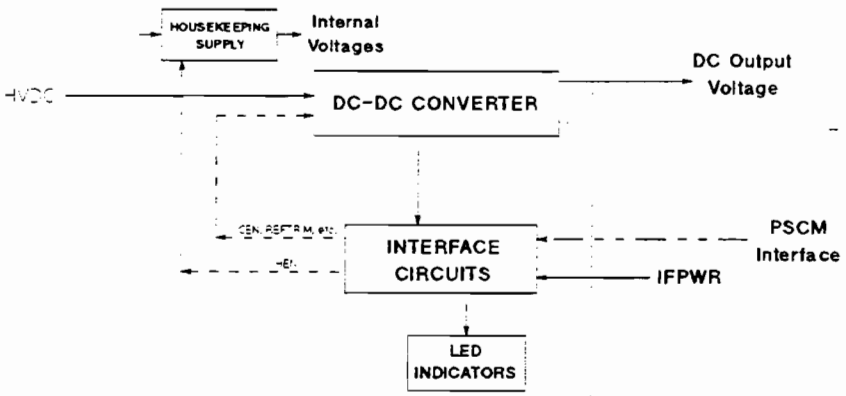


Figure 15-2. Miscellaneous Power Module Block Diagram

SPS Power Module



PSO510.cn HP Confidential 10/92

Figure 15-3. SPS Power Module Block Diagram

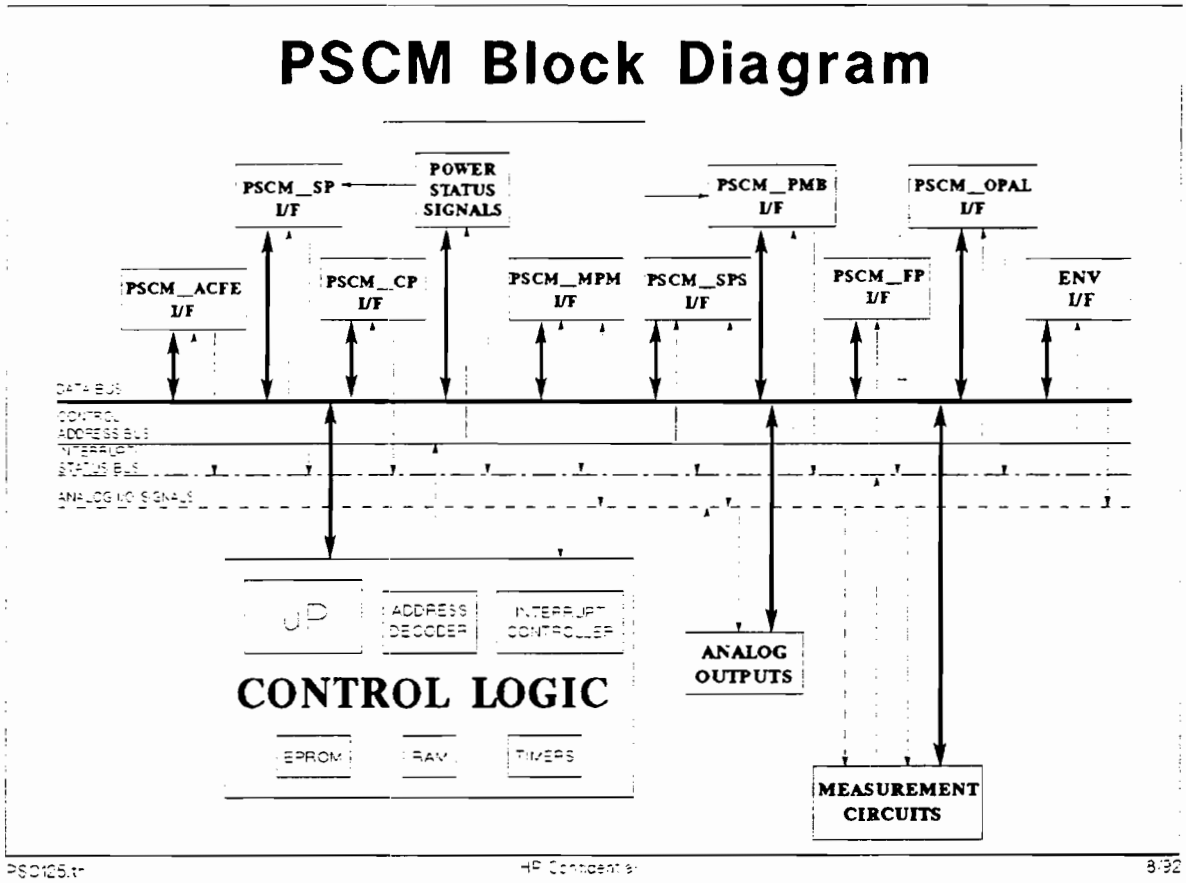


Figure 15-4. PSCM Block Diagram

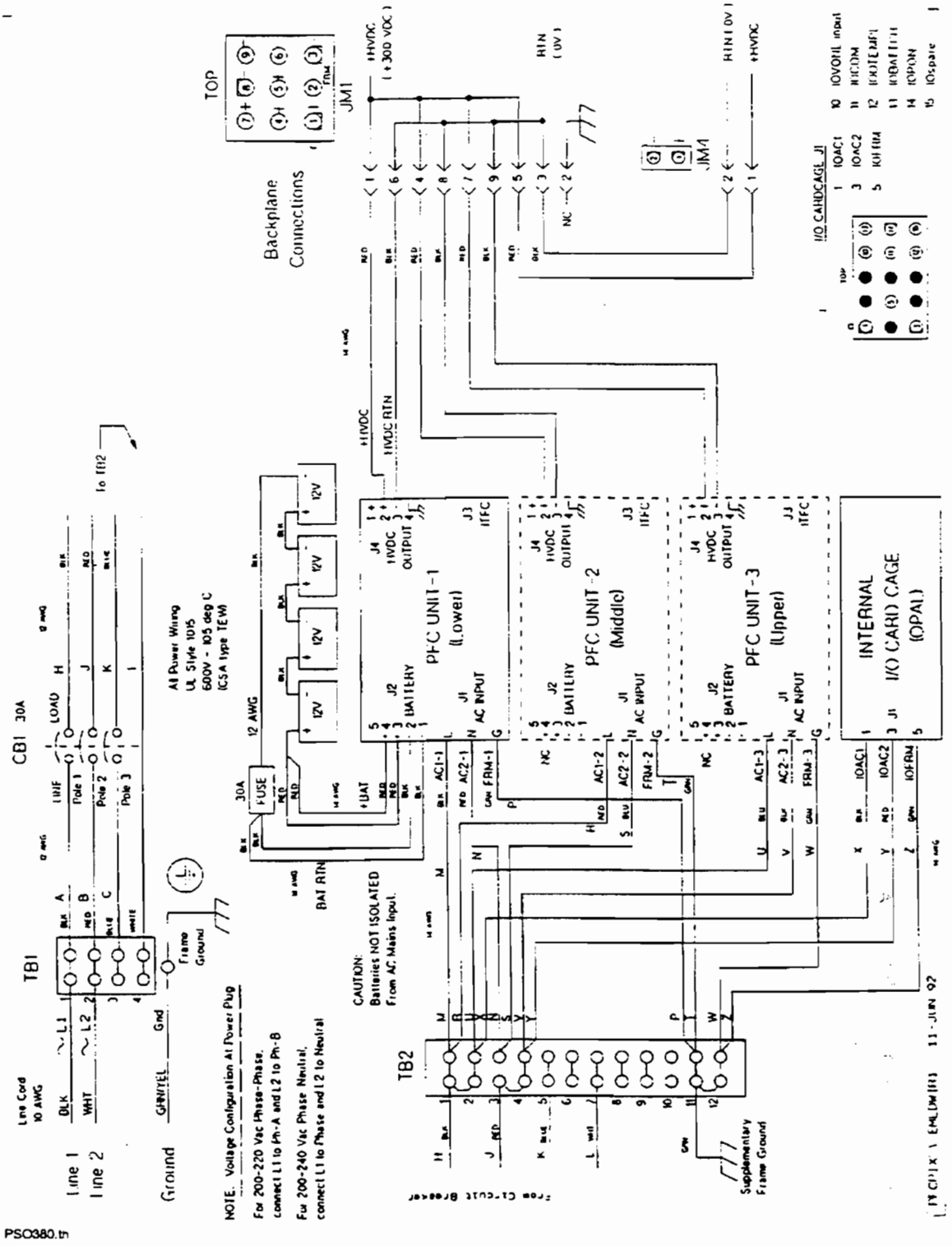


Figure 15-5. Power System Wiring Diagram

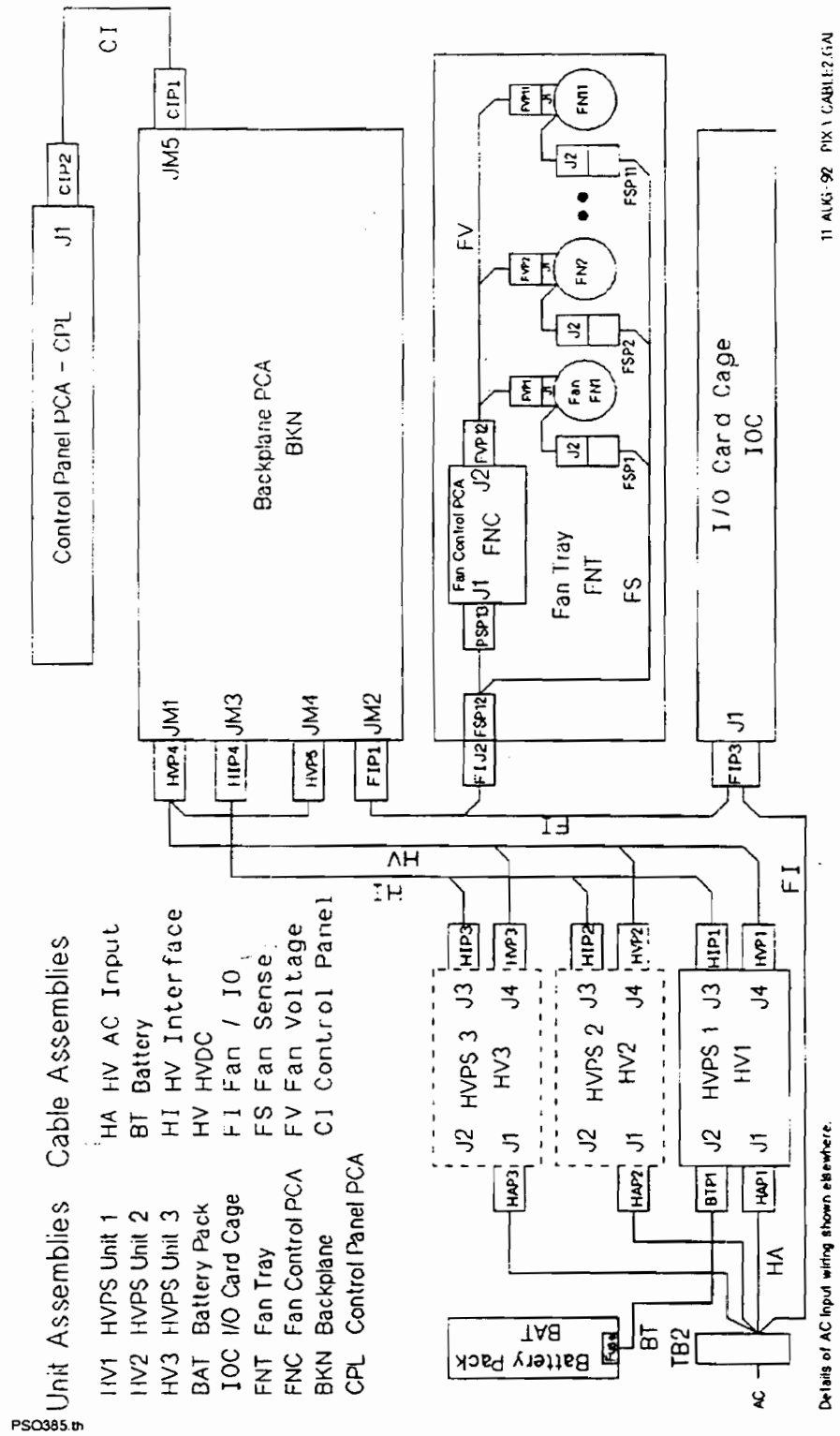


Figure 15-6. Cabling Diagram