



HP 1000 A990
16-Slot System/Computer
Installation and Service Manual



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HP 1000 A990 16-Slot System/Computer
Installation and Service Manual

02939-90001 February 1992

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HP 1000 A990 16-Slot System/Computer

Installation and Service Manual

**Measurement & Control Systems Division
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Cupertino, CA 95014**

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Laermangabe (Schalldruckpegel L_pA) gemessen am fiktiver Arbeitsplatz bei normalem Betrieb nach DIN 45635, Teil 19: $L_pA < 70$ dB

Acoustic Noise (A-weighted Sound Pressure Level L_pA) measured at the bystander position, normal operation to ISO 7779: $L_pA < 70$ dB

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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).

Explanation of Caution

Caution



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

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First Edition Feb 1992



Preface

The *HP 1000 A990 16-Slot System/Computer Installation and Service Manual*, part number 02939-90001, describes the procedures for configuring, installing, and servicing, the HP 2939A A990 Computer and the HP 2989A A990 System. This manual is written for systems and field service engineers.

Chapter 1 - Introduction

Includes environmental and electrical specifications plus site preparation, unpacking, and loss or damage claims procedure information.

Chapter 2 - Installation

Gives configuration information and describes the procedures for installing the A990 computer.

Chapter 3 - Service

Describes maintenance and troubleshooting requirements and procedures, power supply checks, power-on self-tests, and definitions of LED indicators. Also describes procedures for removing and replacing assemblies and reconfiguring the power supply.

Chapter 4 - Replaceable Parts

Lists and illustrates replaceable parts for the A990 computer.



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Introduction

This chapter describes environmental specifications, site preparation procedures, and procedures for unpacking and inspecting the supplied materials for the HP 1000 A990 Computer (Micro 99 CPU) (HP 2939A) and the HP 1000 A990 System (Micro 99 SPU) (HP 2989A). The HP 2939A Computer product consists of an A990 CPU Card in a 16-slot card cage with power supply, and appropriate manuals. The HP 2989A System Processor Unit (SPU) consists of an A990 CPU card in a 16-slot card cage with power supply, HP-IB or SCSI Interface, RTE-A Primary System software, diagnostic software, appropriate manuals, and on-site installation assistance and checkout by a Hewlett-Packard Service Engineer.

Site Preparation

When you prepare the site for the computer or system, be sure you include provisions for environmental considerations, power requirements, and type of mounting. The computer or system operates at a nominal 115 Vac or optionally at 230 Vac. The system may be table mounted, rack mounted, or floor mounted.

Environmental Considerations

Table 1-1 describes the environmental requirements for the A990. When you set up your computer or system, be sure you take into account environmental requirements or limitations imposed by all peripheral devices and components in the same location.

Power Requirements

The HP 2939A and HP 2989A are shipped with the power supply configured for a single-phase power source of 86 Vac to 138 Vac (standard) or 178 Vac to 276 Vac (option 015).

Maximum power consumption of the HP 2939/89A is 450 Watts (750 VA). Refer to Chapter 3 for information on changing the power supply line configuration from 115 Vac to 230 Vac operation.

For the protection of your operating and service people, various safety codes require you to ground the instrument chassis, panels, and housing. You can satisfy this requirement by providing a grounded three-wire female power outlet at the computer location. This outlet should be checked by a qualified electrician to ensure that it furnishes the required voltage and current. The computer or system also must be properly protected by fuses or circuit breakers of sufficient capacity to carry the current load specified for the computer or system. Refer to Figures 1-1 and 1-2 for descriptions of the various types of ac power cord configurations.

Cooling Requirements

No external cooling is required for the computer or system. The internal fans provide enough airflow as long as the computer or system is operated within the temperature limitations specified in Table 1-1 and the side grills are not obstructed.

Air intake is in through the left; exhaust is out through the right as you face the front of the computer. The rear doors of the computer must be closed for proper ventilation.

Mounting Considerations

You can use the computer either free-standing on a table, or mounted in a standard 483 mm (19-inch) equipment rack. If the computer is used in a mobile environment, install it in a shock-mounted equipment rack. Refer to Table 1-1 for physical dimensions of the computer. When mounting, remember to provide enough clear space at each side of the computer to permit unimpeded intake and exhaust airflow.

Table 1-1. Electrical and Environmental Specifications

ELECTRICAL SPECIFICATIONS	
AC Power Requirements	
Line voltage:	86 to 138 Vac (115 Vac $-25\%/+20\%$) standard; 172 to 276 Vac (230 Vac $-23\%/+20\%$) option 015.
Line frequency:	47.5 to 66 Hz
Inrush Current (cold power-up):	20.0 Amps maximum (at 115 Vac) 40.0 Amps maximum (at 230 Vac)
Maximum Power Required:	450 Watts (750 VA)

Table 1-1. Electrical and Environmental Specifications (continued)

Power Supply				
Output DC voltages and tolerances:	+5.1 V		±2%	
	+12.0 V		+6/-3%	
	-12.0 V		±6%	
Backplane Power:	300 Watts maximum			
Maximum output and current rating to I/O and memory cards:	+5.0 V 23.0 A	+5.0 V(M) 5.5 A	+12.0 V 6.9 A	-12.0 V 2.9 A
	Note that combined current available from the 5.1 V and +5 V(M) power supplies is 50 A maximum.			
Short circuit protection:	All dc and ac power outputs are fault protected for short circuits. The power supply will shut down if any output is short circuited when it receives power.			
25 kHz AC VOLTAGE				
HP 12159A 25 kHz power module:	The power module provides 19.5 V rms ± 8% (at 0.02 to 1.5 A), split phase (phase to common) from three pins on the backplane-mating connector. Maximum output is 30 W.			
BATTERY BACKUP				
HP 12154A Battery Backup card:	The battery backup card provides from 45 to 210 minutes of memory sustaining power, depending upon system configuration, state of charge, and temperature. Additional hold-up time can be achieved by connecting an external battery.			
Recharge time:	14 hours for a fully discharged battery pack.			
Battery type:	Nickel cadmium.			

Table 1-1. Electrical and Environmental Specifications (continued)

PHYSICAL CHARACTERISTICS	
Dimensions	
Height:	178 mm (7 in)
Width:	483 mm (19 in)
Depth:	648 mm (25.5 in)
Weight	
Without internal disks:	16.3 kg (36 lb)
Internal disks add:	3.0 kg (6.6 lb)
Vertical floor mount add:	5.7 kg (12.5 lb)
Ventilation:	Intake is in through the left; exhaust is out through the right
ENVIRONMENTAL SPECIFICATIONS	
Temperature	
Operating without internal disks:	0° to 55° C (32° to 131° F) up to 3048 meters (10,000 ft); Maximum temperature is linearly derated 2° C (3.6° F) for each 304.8 m (1000 ft) increase in altitude above 10,000 ft. The resulting temperature range is 0° to 45° C (32° to 113° F) at 4572 meters (15,000 ft).
Operating with internal disks:	10° to 40° C (50° to 104° F); maximum rate of change is less than 10° C (18° F) per hour.
Non-Operating:	-40° to 75° C (-40° to 167° F) (maximum temperature with optional internal disks is 60° C (140° F)).
Relative humidity	
Operating without internal disks:	5% to 95% with maximum wet bulb temperature not to exceed 40° C (140° F), excluding all conditions which cause condensation.
Operating with internal disks:	20% to 80% with maximum wet bulb temperature not to exceed 29° C (85° F), excluding all conditions which cause condensation.
Non-operating:	5% to 95% in non-condensing conditions.
Altitude	
Operating:	to 4.6 km (15,000 ft)
Non-operating:	to 15.2 km (50,000 ft)

Table 1-1. Electrical and Environmental Specifications (continued)

Vibration and Shock		
Shock		
Operating:	1.5 g peak, ½ sine, 6 to 9 ms duration, 45 Hz crossover	
Non-operating:	7.0 g peak, ½ sine, 6 to 9 ms duration, 45 Hz crossover	
Vibration		
Operating:	Frequency (Hz)	Power spectral density (g ² /Hz)
	5	0.002
	5-15	-1/5 dB/octave
	15	0.0015
	12-200	-6.0 dB/octave
	200-350	0.00012
	350-500	-6.0 dB/octave
Gravity, due to acceleration:	0.43 ms (approximate)	



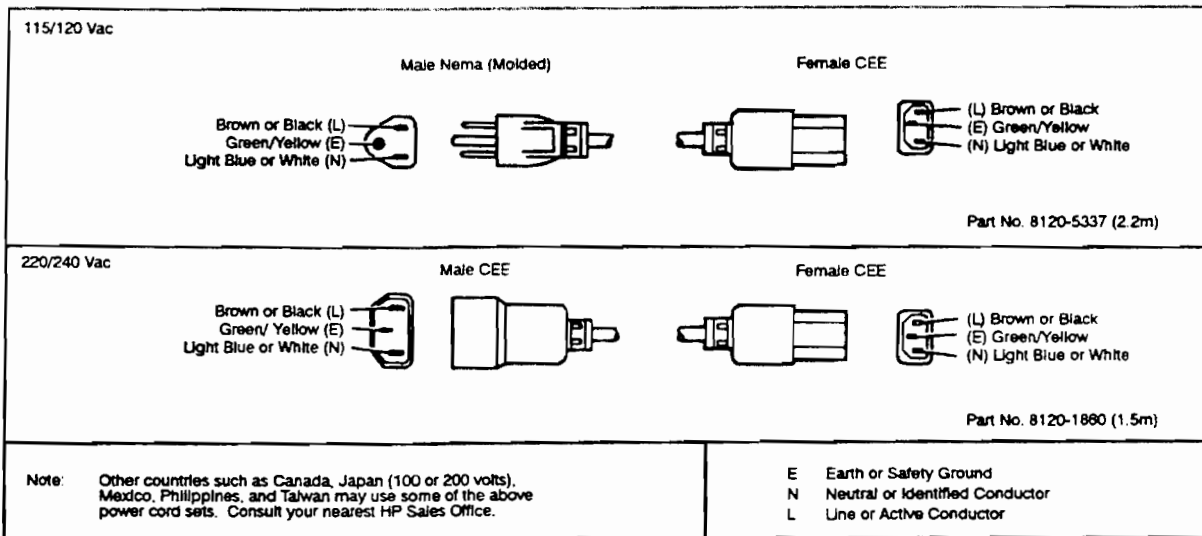


Figure 1-1. AC Power Cord Sets (USA)

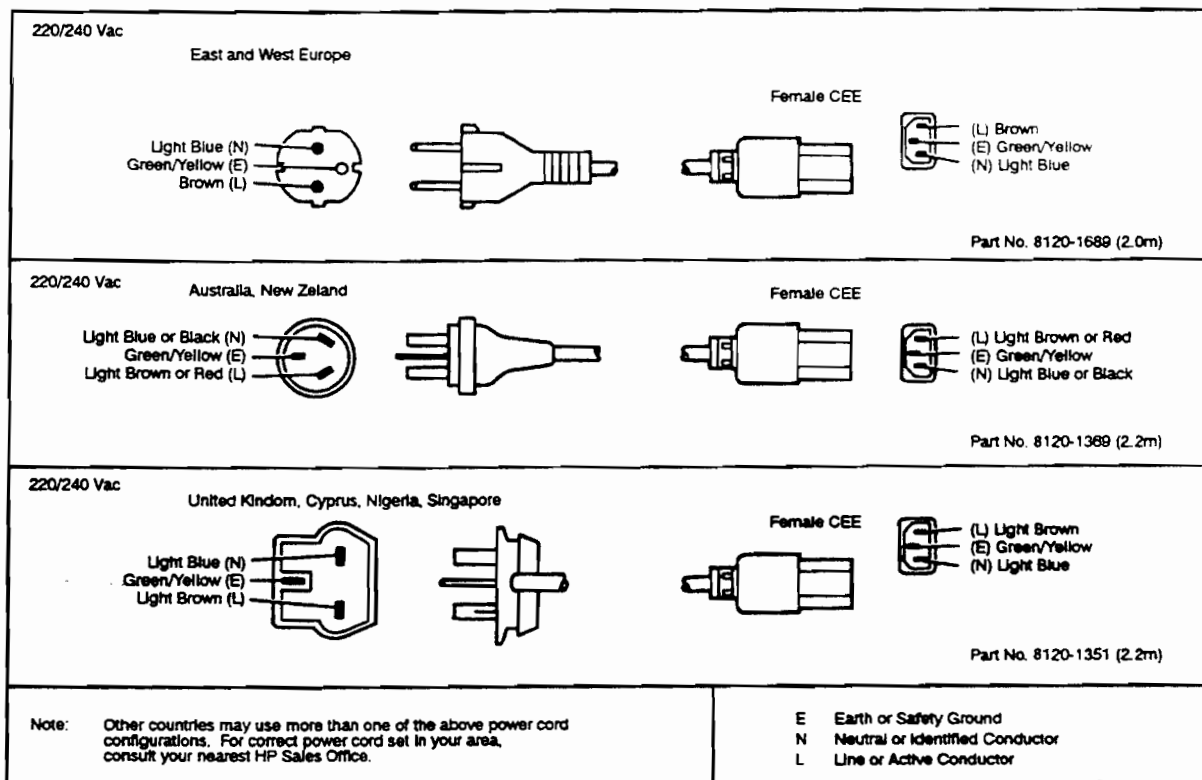


Figure 1-2. AC Power Cord Sets (Non-USA)

Unpacking and Inspecting

Your A990 computer or system may be shipped in several containers. Verify the number of containers received against the carrier's paperwork. Inspect each container for damage that may have occurred during transit. If you find damage or water stains, request that an agent of the carrier be present when you open the container.

Open the shipping container marked "MANUALS AND ACCESSORIES" and locate the materials list. Compare it with your purchase order. Make sure it includes everything you have ordered. Unpack the shipping container(s) and inspect each item for external damage, such as broken controls and connectors, dented corners, bent panels, scratches, and loose components. Also check the rigid foam-plastic packing material (if used) for signs of deformation or cracking. Such signs may indicate rough handling in transit.

If you find damage to the computer or accessories, follow the damage claim procedure described below. Be sure you keep all shipping containers and packing materials. You may need them for settling a claim, or to repackage the computer or system.

Claims Procedure

If you need to make a claim, contact your nearest Hewlett-Packard Sales and Service Office. If the loss occurred in transit, notify the carrier as well as Hewlett-Packard, and also be sure you retain all shipping and packaging materials for inspection. Hewlett-Packard will arrange to repair or replace damaged or lost items even though claims against the carrier may not yet be settled.

Physical Inventory

Make sure all manuals listed in the bill of materials are included. Your computer's model and serial number is located on the identification label on the back of the chassis. The model and serial numbers should match those on the packing list. If they do not, immediately contact your Hewlett-Packard Sales and Service Office. If you have ordered I/O or memory cards with your computer or system, verify that the cards have been supplied as specified on your purchase order.



Installation

This chapter describes procedures for configuring and installing the A990 16-slot box computer and system.

Required Tools

Slot and Phillips head screwdrivers are the only tools you will need to install the computer or system. We strongly recommend the use of a wrist strap and ground cord when handling plug-in cards.

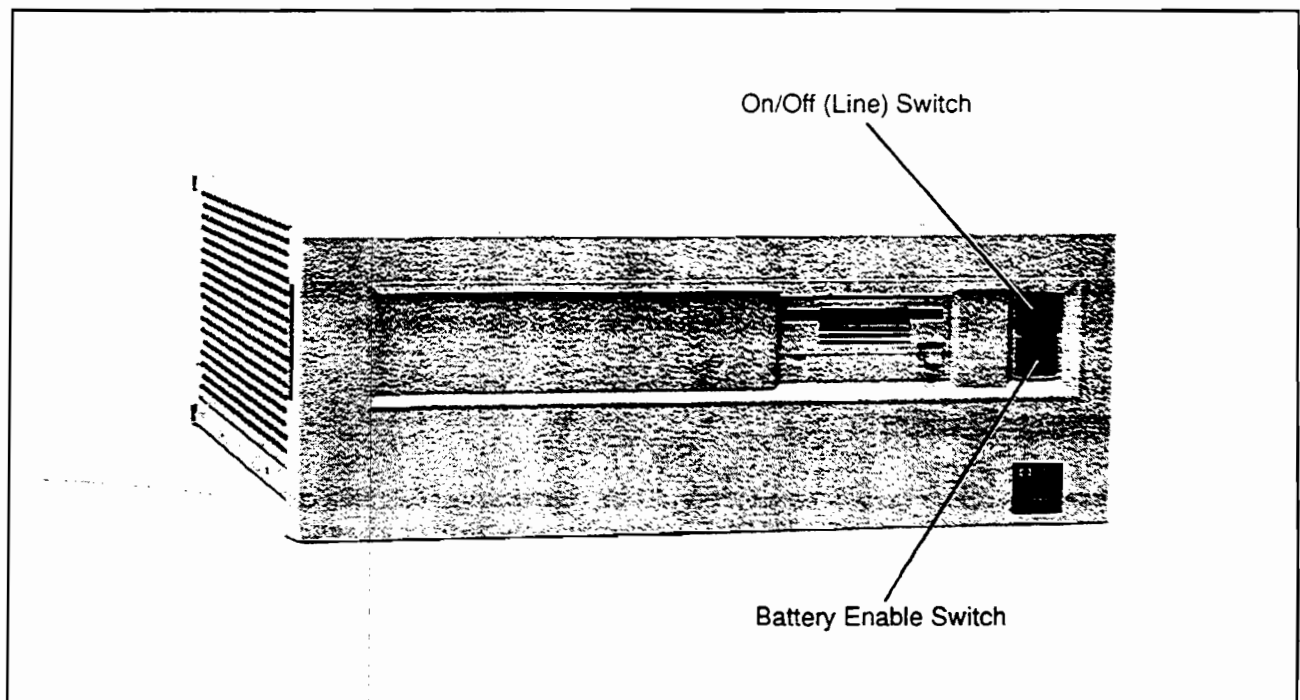


Figure 2-1. 16-Slot Box Front View

Configuration Requirements

Verifying the Power Supply Configuration

Warning



To avoid damage to equipment or injury to people, any service, adjustments, or repair to the power supply must be performed only by qualified maintenance people.

The computer's ac line voltage configuration is determined by the position of the line configuration power connector. The connector must be plugged into one of two sockets located under the voltage configuration cable connector cover. See Figure 2-2 for a view of the front of the computer with the front cover removed. For 115 Vac operation, the line configuration power connector must be plugged into the socket labeled *115 VAC*. For 230 Vac operation, the connector must be plugged into the socket labeled *230 VAC*.

To check the position of the line configuration power connector, remove the computer front panel and inspect the position of the power line connector.

1. Make sure the power switch is set to OFF and the ac power cord is disconnected.
2. Grasp the computer's front panel firmly by the sides and pull it away from the computer.
3. Unscrew the voltage configuration cable connector cover and pull it away from the power supply.
4. Verify the position of the line configuration power connector.

To change the position of the line configuration power connector, gently pull the line configuration power connector from its socket and then plug it into the adjacent socket.

Battery Backup Switch

Refer to the *Battery Backup Installation* section of this chapter for instructions on installing Battery Backup. If the optional HP 12154A Battery Backup card is already installed, set the Battery Enable switch on the front of the computer to the ENABLE position. To avoid draining the battery, this switch should be set to the DISABLE position if the power is turned off and if memory backup is not required.

Caution



The Battery Enable switch must be set to DISABLE whenever any card is to be connected or disconnected from the backplane, or whenever the HP 12154A card is to be removed or installed.

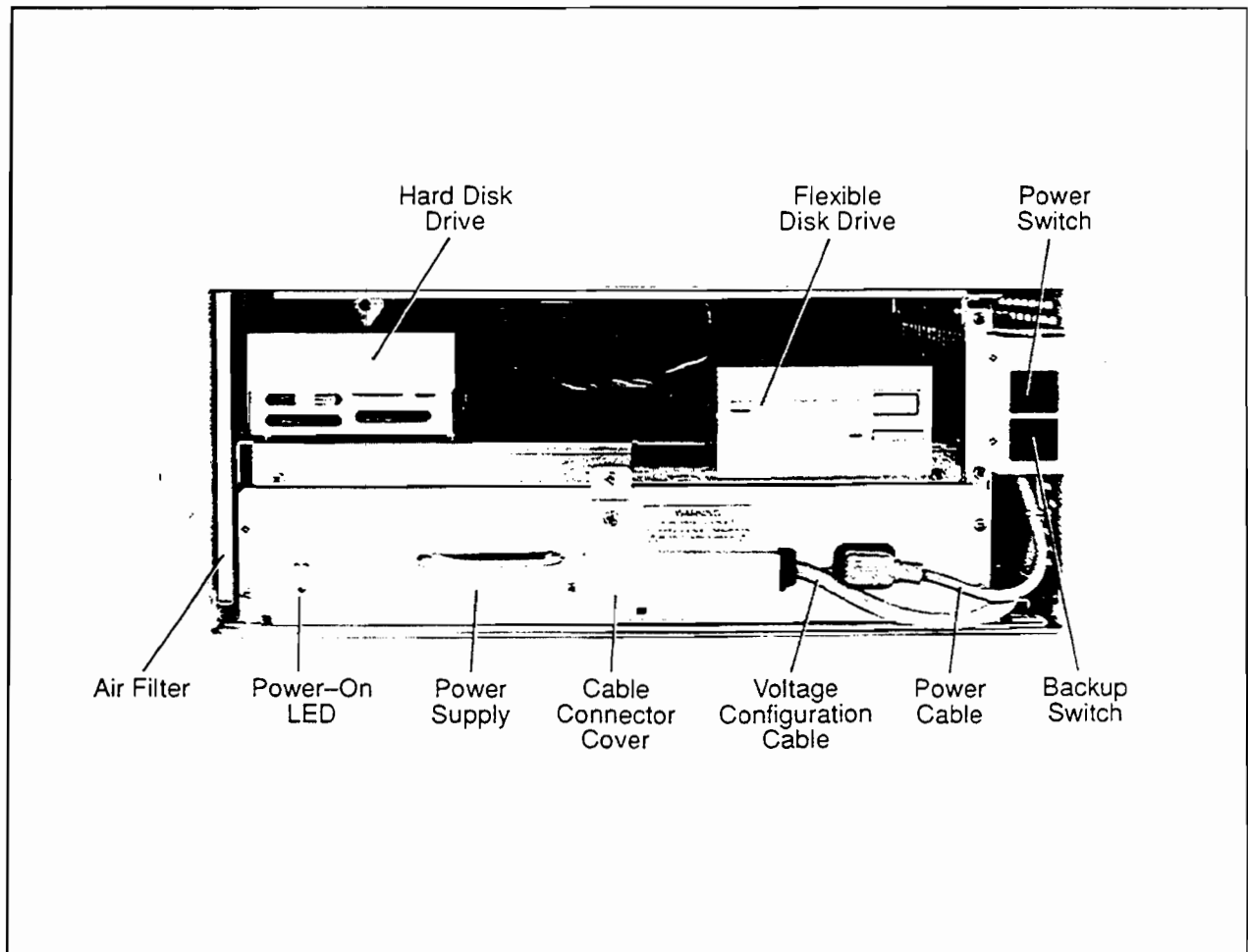


Figure 2-2. 16-Slot Box Front View, Cover Removed

A990 CPU Card Switches

The A990 CPU card contains two switches, SW1 and SW2 (see Figure 2-3). SW1 is a momentary action (push and release) reset switch that resets the A990 CPU card. SW2 is an eight-section DIP switch (see Figure 2-4) that controls the following functions:

1. BOOT SELECT, which selects computer operations at power-up.
2. Autorestart override (Memory Lost), which sets the conditions under which autorestart occurs.

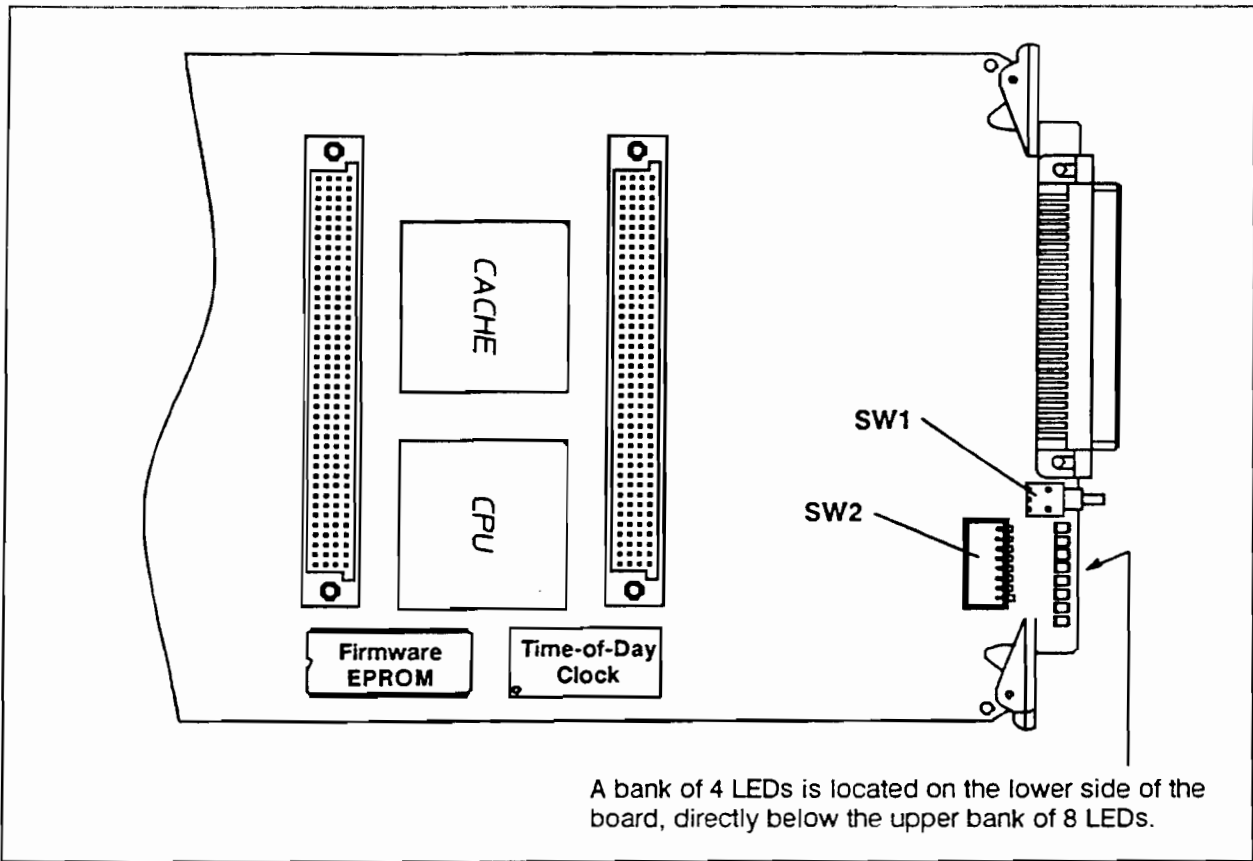


Figure 2-3. A990 CPU Card Switches SW1 and SW2

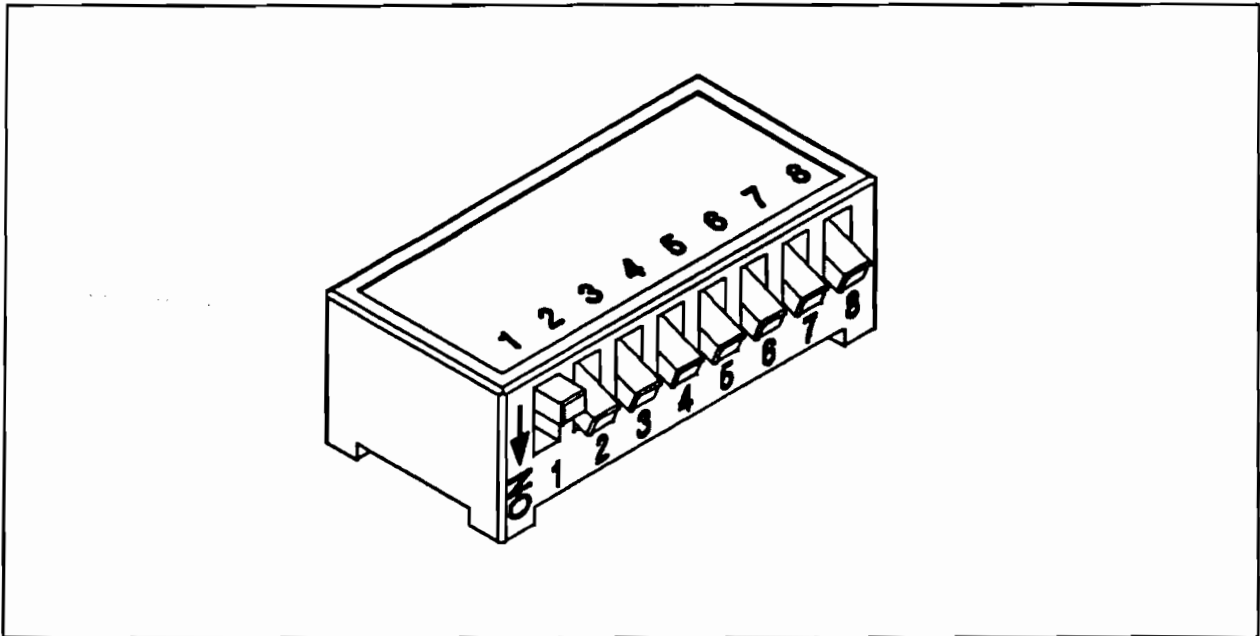


Figure 2-4. Switch SW2 In Default Configuration

Startup Option Switches

There are eight switches, SW2-1 through SW2-8, that control the startup options. Table 2-1 specifies the available startup options and corresponding switch settings.

Autorestart Switch

Autorestart is controlled by switch SW2-8 (see Figure 2-4). The settings for switch SW2-8 are:

1. **DOWN (on)** - Autorestart is not enabled. Use this setting if you do not wish to use autorestart or if battery backup is not installed. When using the ON position for SW2-8, be sure you set the Battery Enable switch to **DISABLE**.

When SW2-8 is ON, if power is lost, the autorestart feature will not restart the program that was running prior to the powerfail condition. Instead, the boot loader (or VCP routine) will execute.

2. **UP (off)** - Autorestart is enabled if battery backup is installed and the Battery Enable switch is set to **ENABLE**. If power is lost and memory was sustained, autorestart will automatically restart the program that was running prior to the powerfail condition. With no battery backup installed, you will get a self-test error when you switch the computer on.

Interface Card Switches

Assign each I/O interface card to be installed in the computer a unique select code by setting the select code switches on the interface cards. Refer to the appropriate interface card reference manuals for select code switch information and for information on any other card switches that must be set.

Virtual Control Panel (VCP) Configuration

If you are installing a Virtual Control Panel (VCP), assign *one* of your MUX (HP 12040D), ASIC (HP 12005B), LAN (HP 12076A), or HDLC (HP 12007B Modem or HP 12044A Direct Connect) cards as the VCP interface card.

Set switch U1S1 on that card to ON (closed) to designate it as the VCP interface card.

Table 2-1. SW2 Start-Up Switch Settings

Computer Action	Switches*							
	S1	S2	S3	S4	S5	S6	S7	S8
Loop on self-test Test 2 regardless of error.	D	D	D	D	z	y	D	M
Loop on self-test Test 2 and stop on error.	D	D	U	D	z	y	D	M
Run Virtual Control Panel (VCP) routine on completion of self-test.	D	U	U	D	z	y	D	M
For the following switch settings, the computer action indicated will occur if memory is lost, otherwise, the program is restarted (JMP 4B). If the autorestart feature is disabled (switch SW2-8 down), the program cannot restart and VCP will execute. When a loader finishes an autoboot, it starts execution of the loaded program at location 02.								
Run VCP.	U	D	D	D	z	y	D	M
Speed sense and run VCP. See Notes 2 and 3.	U	U	D	U	z	y	D	M
Execute program from PROM card. In order to autoboot from PROM, the card must have select code 22. This is equivalent to the loader command %BRM. **	U	D	U	D	z	y	D	M
Load and execute the program via the HDLC or LAN card. To autoboot via the HDLC or LAN card, the card must have select code 24. This is equivalent to loader command %BDS. **	U	U	D	D	z	y	D	M
Load and execute program from the first file of the disk (via HP-IB or SCSI). To autoboot via HP-IB or SCSI, the interface card must have select code 27; and, for HP-IB, the disk drive must have HP-IB address 2 or, for SCSI, address 6. This is equivalent to the loader command %BDC. **	U	U	U	D	z	y	D	M
Execute bootstring from the time-of-day clock RAM (non-volatile RAM) on the A990 CPU card.	D	D	D	U	z	y	D	M
<p>* D = Down (On); U = Up (Off)</p> <p>** Refer to the <i>HP 1000 A990 Computer Reference Manual</i>, part number 02959-90001.</p> <p>y = D, normal mode, system console uses ENQ-ACK handshaking. y = U, system console does not use ENQ-ACK handshaking. z = D, normal mode, break enabled. z = U, break disabled (but not halts). M = D, disable autorestart (battery backup not installed). M = U, enable autorestart (battery backup installed).</p> <p>Notes: 1. Do not use any switch combination that is not specified above. 2. Use this switch configuration for normal computer operation. 3. Speed sense allows VCP to execute at any baud rate supported by the 8-channel MUX.</p>								

Memory Configuration

Several memory configurations, using 768 Kbyte, 3 Mbyte and/or 8 Mbyte memory array cards, can be installed in the A990. Refer to Figure 2-5 for an illustration of minimum and maximum memory configurations. All three array sizes may be used together in the same system provided that the largest memory card is closest to the A990 CPU card. Up to four memory array cards can be installed in the A990 computer. Refer to Table 2-2 for the available memory array cards and frontplane connectors. Refer to the *Memory Installation* section in this chapter for instructions on installing memory.

Minimum A990 Memory Configuration			
slot #		slot #	
9	Available for I/O Card	1	A990 CPU Card
10	Available for I/O Card	2	12220A 768 KB Memory Array Card
11	Available for I/O Card	3	12009A HP-IB Interface Card
12	Available for I/O Card	4	Available for I/O Card
13	Available for I/O Card	5	Available for I/O Card
14	Battery Backup or I/O Card*	6	Available for I/O Card
15	Battery Backup or I/O Card*	7	Available for I/O Card
16	Battery Backup Card or Voltage Jumper Card	8	Reserved for 25 kHz Power Module
Maximum A990 Memory Configuration			
slot #		slot #	
9	Available for I/O Card	1	A990 CPU Card
10	Available for I/O Card	2	12221B 8 MB Memory Array Card
11	Available for I/O Card	3	12221B 8 MB Memory Array Card
12	Available for I/O Card	4	12221B 8 MB Memory Array Card
13	Available for I/O Card	5	12221B 8 MB Memory Array Card
14	Battery Backup or I/O Card*	6	12009A HP-IB Interface Card
15	Battery Backup or I/O Card*	7	Available for I/O Card
16	Battery Backup Card or Voltage Jumper Card	8	Reserved for 25 kHz Power Module
* Slot 16 is reserved for the HP 12154A Battery Backup which extends into the space occupied by slots 14 and 15. If the battery backup card is not installed, a voltage jumper card (02430-90009) must be installed in slot 16.			

Figure 2-5. A990 Memory Configurations

Table 2-2. Memory Array Cards and Frontplanes

Description	Part Number
12220A 768 KByte Memory Array Card	12220-60001
12221A 3 MByte Memory Array Card	12221-60001
12221B 8 MByte Memory Array Card	12221-66001
Connector for 1 Memory Card	12230-60001
Connector for 2 Memory Cards	12230-60002
Connector for 3 Memory Cards	12230-60003
Connector for 4 Memory Cards	12230-60004

I/O Priority Assignment

Each peripheral device in the system must be connected to the computer system through an interface card installed in the card cage. A priority chain connects all interface cards in series to prioritize simultaneous DMA requests and interrupt requests from two or more peripherals. The priority of an interface card is determined by the slot the card occupies, with the slot directly after the last memory card having the highest priority and slot 15 having the lowest priority. Slot 8 is reserved for the HP 12159A 25 kHz Power Module and may be left vacant. See Figure 2-6 for an illustration of the I/O priority assignments. Configuring I/O priority consists of installing interface cards in the desired order of priority.

I/O requests from a higher priority device inhibit lower priority requests by breaking the priority chain. To maximize system response time and efficiency, assign the higher priorities to high-speed peripherals. Consult the system manager to establish I/O device priority and install the interface cards accordingly.

Note



Correct computer operation requires that there be NO vacant slots between plug-in cards (except for slot 8).

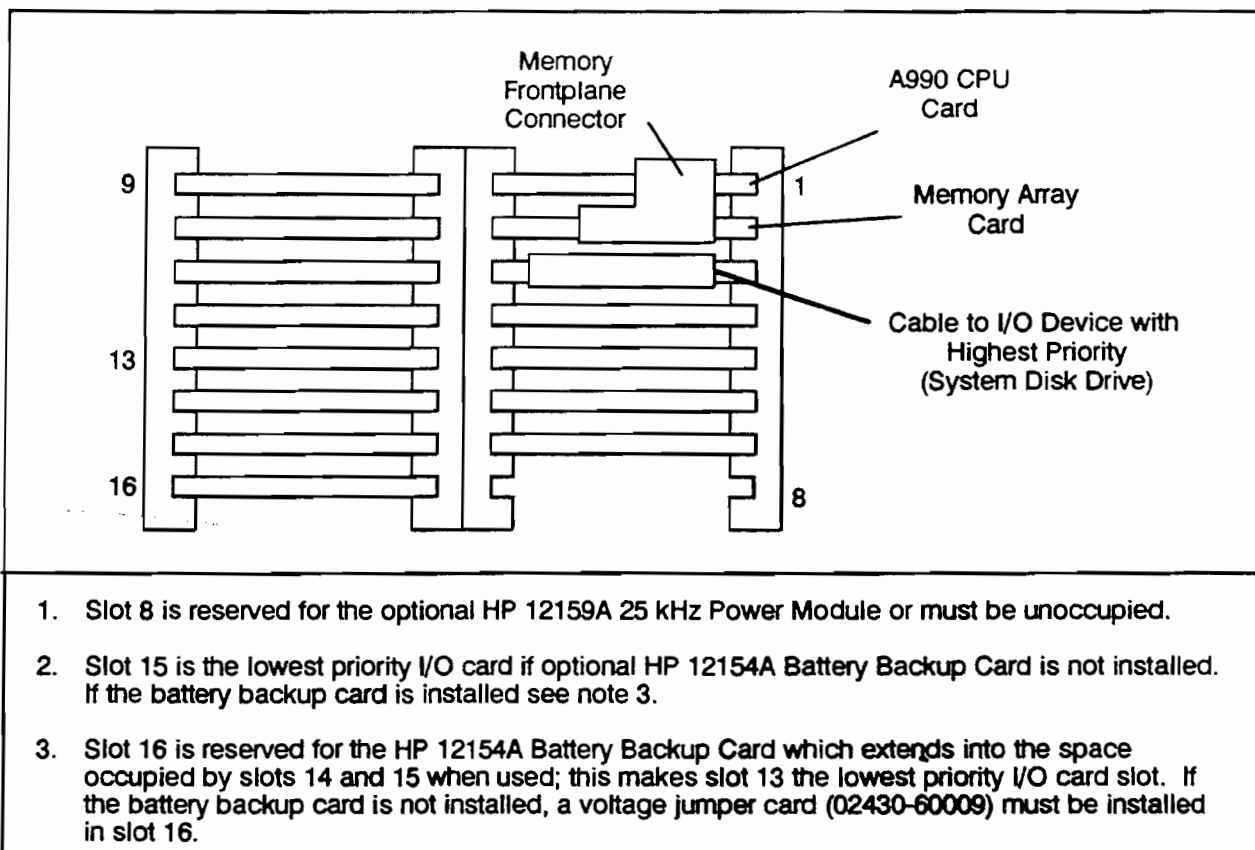


Figure 2-6. HP 2939/2989 Cards and I/O Priority Assignments

Optional Internal Disk Drive Configuration (HP 12122A)

SW3 Configuration Switches

Switch bank SW3, located on the disk controller PCA near the HP-IB connector (see Figure 2-7), is used to configure the unit and initiate the self-test routines. SW3 must be set to the setting shown in Figure 2-7 for proper operation with the A990 computer. Refer to the *Troubleshooting* section in Chapter 3 for information on using SW3 for performing self-tests.

Volume Configuration Switch

The Volume Configuration Switch is set at the factory to 0 and must not be changed. Refer to Figure 2-7 for the location of this switch on the disk controller PCA.

HP-IB Address Switch

The HP-IB address switch is a rotary switch with decimal numbers. Refer to Figure 2-7 for its location on the disk controller PCA and its setting. The switch is not accessible without removing the peripheral tray that holds the disk drives and their controller PCA. Refer to the *Internal Disk Drive Removal* section in Chapter 3 to remove the tray if it is necessary to check or change the HP-IB address setting. Table 2-3 gives definitions of the HP-IB address switch settings.

Note that the HP-IB address switch is used for more than just the HP-IB address of the drive; it is also used to designate whether the flexible disk drive is Unit 0 or Unit 1. The actual HP-IB addresses are still numbered 0 through 7. Addresses 8 and 9 are the same as address 0; however, in these positions the flexible disk drive is at Unit 0.

Table 2-3. Internal Disk HP-IB Address Switch Setting Definitions

Switch Setting	Meaning
0 thru 7	HP-IB address of the device is the same as the switch setting. Hard disk = Unit 0 Floppy = Unit 1
8 or 9 *	HP-IB address of the device is 0. Hard disk = Unit 1 Floppy = Unit 0

* Switch settings 8 and 9 are used to designate whether the flexible disk drive is Unit 0 or Unit 1.

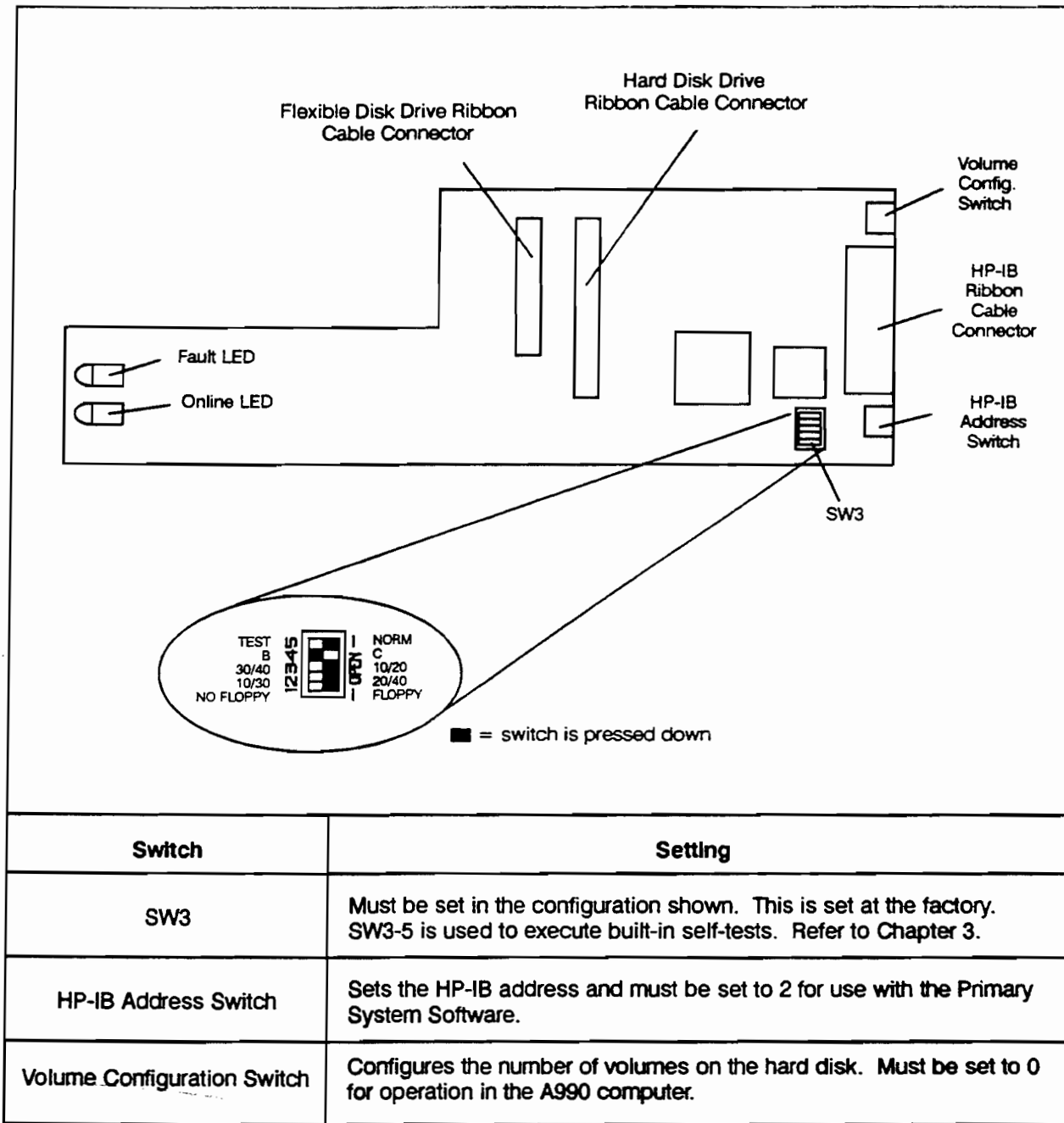


Figure 2-7. Internal Disk Drive Controller Switch Locations

Installation Procedure

Battery Backup Installation

The optional HP 12154A Battery Backup Card provides 45 to 210 minutes of sustaining power for up to 32 Mbytes of memory, depending upon the system configuration, state of charge, and temperature. (Additional hold-up time can be achieved by connecting an external battery.) When the batteries on the card are fully discharged, they require a recharge time of 14 hours to become fully charged.

The bottom left slot (slot 16) in the card cage is reserved for the battery backup card. (If the card is part of the initial order, it is installed at the factory.) To install the card, proceed as follows:

1. Set the power switch to OFF and the front panel Battery Enable switch to DISABLE.
2. Remove the left rear cover and remove the voltage jumper card from the bottom left slot (slot 16). It is recommended that you save the jumper card for future use.
3. Slide the HP 12154A card into slot 16 and press it in until it fully engages the backplane connectors. Secure it in place by screwing its flange to the center grounding strip. See Figure 2-8.
4. Connect one end of the battery backup cable to connector P3 on the battery backup card and the other end to the connector on the side of the Power Distribution Unit. See Figure 2-8. To remove the cable from the Power Distribution Unit, first push the cable connector in, squeeze its sides, and then pull out.
5. Reinstall the rear cover and set the Battery Enable switch to ENABLE.

Note



Whenever the battery backup card is NOT installed, the voltage jumper card MUST be installed in slot 16. If neither is present, the +5M voltage will be missing and the computer will not operate.

25 kHz Power Module Installation

The bottom right slot in the card cage (slot 8) is reserved for the optional HP 12159A 25 kHz Power Module. If the module is part of the initial order, it is installed at the factory. To install the module, proceed as follows:

1. Set the power switch to OFF and remove the right rear cover.
2. Insert the HP 12159A 25 kHz Power Module into slot 8 and press it in until it fully engages the backplane connector. Install the right rear cover.

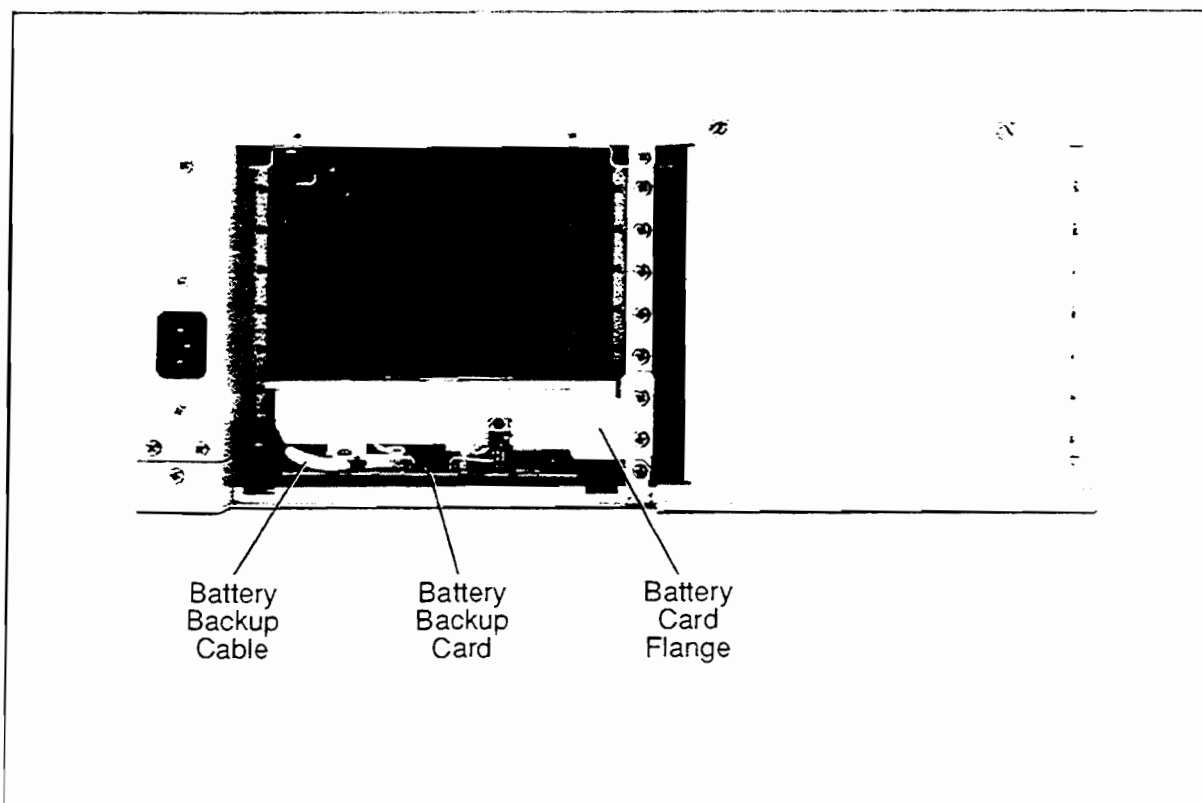


Figure 2-8. Rear View of Computer and Battery Backup Card

Memory Installation

Caution



STATIC SENSITIVE DEVICES - To avoid damage to equipment, before you install or remove memory cards, you *must* set the Battery Enable switch to **DISABLE**. Also, make sure the **LINE** switch is set to **OFF** and the ac power cord is not connected to the ac power mains. Wear an antistatic wrist strap connected to a ground wire.

You can install from one to four memory array cards in the A990 card cage. With available memory cards, you can install up to 32 Mbytes of memory. The A990 supports only the A900 ECC memory array cards. The memory frontplane connectors, however, are unique to the A990. A900 memory frontplane connectors cannot be used with the A990. Table 2-2 lists the available types of memory array cards and frontplanes.

Install the first memory array card in the slot immediately below the CPU card, the second immediately below the first, and so on. Do not leave an empty backplane slot between the CPU card and a memory card or between any memory cards. If your computer has memory array cards of different capacities, place the largest capacity card(s) nearest the A990 CPU card.

Install the appropriate frontplane connector using one of the four supplied with your computer. Attach the small connector of the frontplane to the CPU card and the other connector(s) to the memory array card(s). Be sure you use a frontplane that matches the number of memory array cards you have installed. For example, if you have installed four memory array cards, the frontplane must have five connectors.

I/O Card Installation

Install I/O cards the same way you installed the CPU and memory cards. DMA and interrupt priorities for I/O cards are related to their placement relative to the CPU card. The closer to the CPU card, the higher the priority. Install all cards contiguously (no empty slots between cards, except for slot 8 which is reserved for the 25 kHz card).

Self-Test Check

The self-test for the processor automatically executes every time the computer is powered on. It is recommended that you run the self-test to ensure that the CPU is operating correctly. This check must be made with all plug-in cards installed in the computer. To verify the self-test operation, proceed as follows:

1. Set the LINE switch to the OFF position and connect the power cord to a power outlet. If the battery backup card is installed, set the Battery Enable switch to DISABLE.
2. Remove the right rear cover for observation of the processor LEDs.
3. Set the power switch to ON. A green LED on the front of the power supply indicates power is on. Observe the eight LEDs on the top of the A990 CPU card. If the computer passes the self-test, the LEDs will display one of the following values within 20 seconds. Any other LED display indicates a self-test failure. Refer to Chapter 3 for troubleshooting information.

000001★1 - VCP program is running; VCP console is connected.

000000★0 - VCP program is running; VCP console is not connected, that is, VCP is waiting for the VCP console to respond to the first Enq/Ack handshake.

00000001 - Loader is running.

00000000 - User software is running.

10000000 - Loader error. Probably a checksum error; change media on loading device.

where: 1 = LED lit; 0 = LED unlit; ★ = LED blinking

4. If your computer includes the optional internal disk drives, there is a FAULT LED on the disk controller PCA inside the computer. If the FAULT LED is lit, an error occurred during the disk drive power-on self-test. Refer to Chapter 3 for troubleshooting information.

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Computer Mounting

Table Mounting

The computer can be used as a freestanding instrument in a land-based environment. The only considerations are that adequate space should be allowed at both sides to ensure full intake and exhaust of ventilating air, and that all covers are installed. Also, a minimum of 38 centimeters (15 inches) of clearance behind the cabinet is required when removing and installing plug-in cards.

Rack Mounting

Install equipment mounting rails (HP 12679C) in a standard 19-inch EIA rack, and install the computer on the rails. The racking cabinet must allow for side-to-side cooling. Secure the computer in place with screws inserted through mounting holes in its front frame.

Floor Mounting

The HP 40025A Vertical Floor Mount can be used for vertical floor mounting of a 16-slot computer that is not to be rack mounted or placed on a table. Install the computer in an HP 40025A by following the instructions provided with the HP 40025A.

System Console (Terminal) Installation

Except for the cabling information given in this section and in Figure 2-9, refer to the documentation supplied with your terminal for all other installation information. For information on configuring the console interface as the Virtual Control Panel (VCP) interface, refer to the *Virtual Control Panel Configuration* section in this chapter.

Use one of the following interfaces for your system console:

- HP 12005B Asynchronous Serial Interface (ASIC) Card
- HP 12040C/D Multiplexer Interface (MUX) Card

Use the following procedure to connect your terminal to the interface card:

1. Set the system power switch to OFF and, if battery backup is installed, set the Battery Enable switch to DISABLE.
2. Remove the computer card cage rear covers.
3. If you connect the terminal with an electrical cable (instead of a fiber optic cable), connect the cable's hooded connector to the interface card, with the cable extending to the right. Connect the ground lug from the hooded connector to the computer chassis.
4. If you connect the terminal with a fiber optic cable (to the HP 12005B ASIC card only), connect the gray connector on the cable to the gray transmitter on the interface card and the blue connector on the cable to the blue receiver on the interface card.

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If an HP 12040 MUX is used as the VCP interface, the VCP terminal must be connected to Port 0 of the MUX.

If your terminal is connected to an ASIC card or to revision C of the HP 12040 MUX card, you must configure the terminal for 9600 baud rate.

If you are using revision D of the HP 12040 MUX card, the computer is automatically configured to operate at the baud rate of your HP terminal. You must have your terminal configured for the ENQ/ACK protocol and 8 data bits with no parity or 7 data bits with 0's parity. Baud rates 300, 1200, 2400, 4800, 9600, and 19.2k are supported for terminals connected to an HP 12040 MUX.

You may also use one of the following I/O interfaces as your VCP interface for remote VCP download and boot capabilities:

HP 12076A LAN/1000 Link Interface Card

HP 12007B or HP 12044A HDLC Interface Card



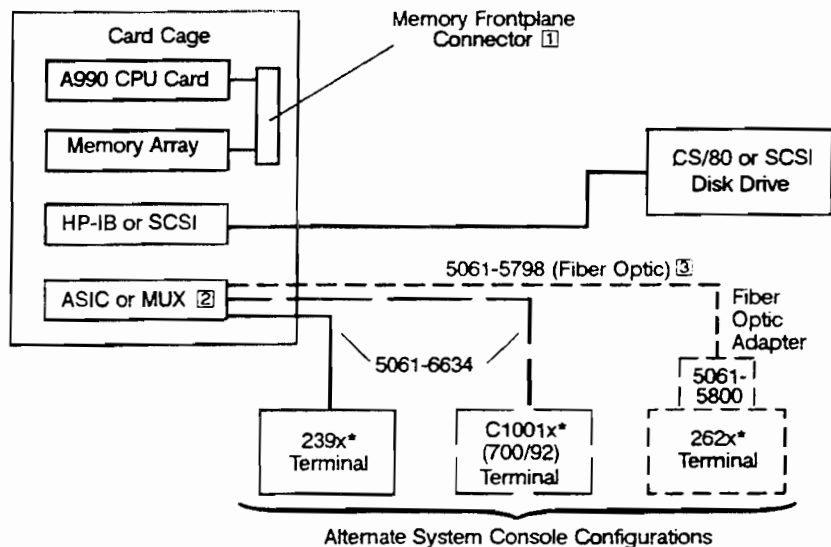
If you want to use the LAN card as your VCP interface, refer to the *RTE-A System Generation and Installation Manual*, part number 92077-90034, for information on remote VCP.

If you want to use an HDLC card as your VCP interface, your remote system must be running either NS-ARPA/1000 or DS/1000-IV software. If your remote system is running NS-ARPA/1000, refer to the *NS-ARPA/1000 Generation and Initialization Manual*, part number 91790-90030, for information on remote VCP. If your remote system is running DS/1000-IV software, refer to the *DS/1000-IV Theory of Operation and Troubleshooting Manual*, part number 91750-90014, for information on remote VCP.

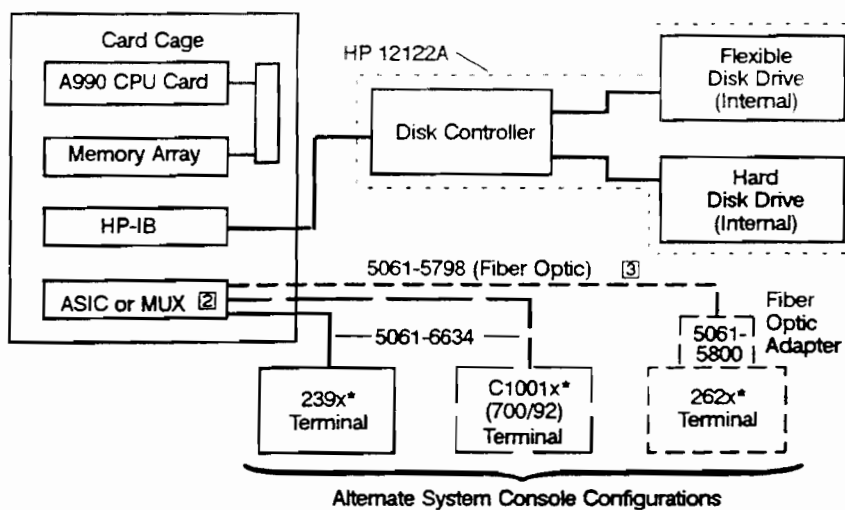
Interface Cabling

Refer to the manuals supplied with your interface cards and peripherals for information on connecting devices to I/O cards. After all interface cables have been assembled, use the following procedure to install the interface cables:

1. Set the power switch to OFF and, if battery backup is installed, set the Battery Enable switch to DISABLE. Remove the rear covers.
2. Connect the hooded connector of each cable to the edge connector of the appropriate interface card, with the cable extending to the right. Connect the cable ground wire, if present, to a vertical grounding strip.
3. Connect the other end of each cable to the appropriate peripheral device. Reinstall the rear covers.



A990 Computer Cabling Diagram without HP 12122A Internal Disks



A990 Computer Cabling Diagram with HP 12122A Internal Disks

- ① As additional memory array cards are added, the appropriate frontplane connector must be used. Memory array frontplane part numbers 12230-60001 through -60004 connect one through four memory array cards, respectively.
 - ② When installing the optional HP 12040 MUX card, refer to the card manual, part number 12040-90123, for cabling information. Note that revision D of the MUX senses and sets the baud rate to match that of the terminal.
 - ③ Connect gray connectors to gray transmitters; connect blue connectors to blue receivers.
- * Portions or all of this product line are discontinued; shown for reference only.

Figure 2-9. System Cabling Diagram

Non-Internal Disk Drive Installation

A variety of disk drives are available for use with A990 computers and systems. Except for installing the HP-IB or SCSI cable, refer to the installation manual supplied with your disk drive for installation information. Use the following instructions to install your disk drive cabling:

Note



Where both standard and high-speed disk drives are used in a multiple drive installation, assign one HP-IB Interface Card to each class of drive.

1. Set the system power switch to OFF and remove the rear covers of the computer.
2. Connect the HP-IB or SCSI connector on the disk drive cable to the HP-IB or SCSI connector on the back of the disk drive.
3. Connect the hooded connector on the disk drive cable to the HP 12009A HP-IB Interface Card or HP 12016A SCSI Interface Card, with the cable extending to the right.
4. Install the rear covers.

Powering Up the System and Booting

Use the following procedure to complete the installation and power up the system:

1. Set the terminal Power switch to ON; then set the system Power switch to ON. If battery backup is installed, set the Battery Enable switch to ENABLE. A blinking cursor will appear on the terminal screen after approximately 15 seconds. Press carriage return to get the VCP power-up message which displays the following:
 - I/O table with the select code, ID number, and revision of each installed I/O card
 - Pretest errors, if present
 - CPU identification
 - Amount of memory installed
 - Contents of selected registers

Table 2-4 gives the ID number for each A-Series interface card.

The following is an example VCP power-up message for a system with an HP 12009A HP-IB card at select code 27 and an HP 12005B ASIC card at select code 20 and designated as the VCP interface:

```
Installed I/O Cards
  ID  Rev  SC
004   0   27
000   1   20  <- VCP
```

(Pretest Error Message) (this message appears only if an error was detected; refer to Chapter 3, *A990 Self-Test Programs*)

```
HP 1000 A-Series  ? for Help
A990 CPU      8192KB MEMORY
```

```
P 00000  M 00000  T 000000  RW 000000
A 000002  B 004022  X 000003  Y 000000  E 0  0  0
VCP>
```

Note that the A-Register contains the number of I/O cards found by VCP; the B-Register contains the revision of the VCP code; and the X-Register contains the revision number of the A990 firmware EPROM.

2. Boot up the RTE-A Primary System using the instructions given in the *RTE-A Primary System Software Installation Manual*, part number 92077-90038.

Verifying Computer Operations

You can use the diagnostic programs supplied with the HP 24612A Diagnostic Package (Revision 5270 or later) to verify the installation and operation of your A990 CPU. Complete documentation is supplied with the package.

Primary System Backup

Use the appropriate backup utility to back up the Primary System. Refer to the *RTE-A Utilities Manual*, part number 92077-90004.

Table 2-4. A-Series I/O Interface Card ID Numbers

ID Number	Rev. Number	Interface Card	
000	0	HP 12005A*	Asynchronous Interface Card
000	1	HP 12005B	Asynchronous Interface Card
001	0	HP 12006A	Parallel Interface Card
002	0	HP 12043A	Multi-Use Programmable Serial Interface
002	0	HP 12092A	Data Link Master Interface Card
003	0	HP 12008A	PROM I/O Card
003	0	HP 12155A	A700 PROM Control Store Card
004	0	HP 12009A	HP-IB Interface Card
005	0	HP 12010A	Breadboard Card
006	0	HP 12041B	Multi-Use 8-Channel MUX Interface Card
022	0	HP 37222A	Integral MODEM Interface Card
023	0	HP 12022A	Integrated Disk Interface Card
025	0	HP 12065A	Color Video Interface Card
040	0	HP 12060A*/B	High Level Analog Input Card
**	**	HP 12061A	Analog Multiplexer Expansion Card
044	0	HP 12062A	Digital-to-Analog Card
060	0	HP 12153A	A700 Writable Control Store Card
061	0	HP 12205A	A900 Writable Control Store Card
102	0	HP 12007B	HDLC (Modem) Card
102	0	HP 12044A	HDLC (Direct Connect) Card
102	0	HP 12042A	Programmable Serial Interface (Modem) Card
102	0	HP 12042B	Programmable Serial Interface (Direct Connect) Card
102	0	HP 12073A	DS/1000-IV Modem Interface to HP 3000
102	0	HP 12075A	LAP-B Network Interface Card
102	0	HP 12082A	DS/1000-IV Direct Connect Interface to HP 3000
106	0	HP 12040B*/C/D	8-Channel Multiplexer Interface Card
115	0	HP 12016A	SCSI Interface Card
126	0	HP 12076A	LAN Interface Card
141	0	HP 12063A	16IN/16OUT Isolated Digital Card
143	0	HP 12072A	Data Link Slave Interface Card
177	7	HP 12100A	A400 Processor Card On-Board I/O (not an I/O card)

* Discontinued product; shown for reference only.
 ** Has no I/O master or ID number.

Repackaging for Shipment

If you need to return any part or all of your computer or system to the factory, you can use the same shipping materials originally used by the factory or you can obtain new shipping packages from Hewlett-Packard Sales and Service Offices. Alternatively, you can use commercially available materials.

Shipment Using Original Packaging

When returning an item in its original or factory supplied packaging, use the following procedure:

1. Attach a tag to the item clearly describing the type of service needed or why you are returning the item; include the item's model number and serial number on the tag.
2. Mark the container "Fragile" to assure special handling (although this is no substitute for proper packaging).
3. In correspondence dealing with an item, please refer to it by both model and serial numbers.

Shipment Using New Packaging

The following instructions should be used as a guide when packaging the computer with commercially available materials:

1. Wrap the computer in Aircap film or foam. If shipping the computer back to Hewlett-Packard, first attach a tag to the computer with your return address and indicate the type of service required. Include the computer model number and full serial number.
2. Use a strong shipping container large enough to hold the item and enough shock absorbing material to cushion the item and prevent movement inside the container. A double-wall carton made of 2.41 MPa (350-psi) test material is adequate.
3. Seal the shipping container securely and mark it "Fragile".
4. In any correspondence dealing with the computer, be sure you refer to it by its model number and serial number.

Service

This chapter describes periodic maintenance requirements and procedures, troubleshooting information for isolating malfunctions to the assembly level, and procedures for removing and replacing various assemblies.

Electrical Safety

Before proceeding with any maintenance or service on the computer which requires physical contact with electrical or electronic components, be sure that either power is removed or that safety precautions are followed to protect against shock. Heed all "WARNING" signs on equipment and in this manual. All service work must be done by qualified personnel.

Periodic Maintenance

Warning



High voltages are present in the system equipment. Always disconnect power before performing any maintenance. Failure to do this could result in serious injury.

Maintenance schedules should be set up according to the quality of the environment in which the computer is operating. A computer in a clean and air-conditioned atmosphere requires less periodic maintenance than one that is located in an atmosphere laden with dust, smoke, moisture, or other particulate matter. Consult the service manuals for any peripherals for the procedures required for a preventive maintenance schedule.

Perform the following steps as often as necessary:

1. Clean the cabinet exterior and interior with a damp cloth.
2. Check the ventilating fans for proper operation. While observing the fans spin, set the Power switch to OFF. The fans should continue to spin for at least 22 seconds. The ventilating fans in the box have sealed bearings and require no lubrication. Note that the rear doors of the computer must be closed for proper ventilation. Hewlett-Packard does not support operation of the computer with the rear doors open.

3. Remove the box air filter and clean it by vacuuming its intake surface. To remove the filter, remove the front cover by grasping it at both sides and pulling it away from the box; then slide the filter out of the box. See Figure 2-2.

Caution

To ensure that the computer remains free of dust, you must clean the air filter periodically. Inspect it as often as your computer environment dictates, and clean it as soon as the first signs of dirt appear. Failure to keep the filter clean can result in permanent damage to the computer.

Periodically check the batteries on the optional battery backup card for corrosion, which may form on the batteries when they are fully discharged. This corrosion can be removed with a cloth dampened in muriatic acid.

Troubleshooting

System malfunctions can be isolated to the assembly level by performing the following tests:

1. Power supply check.
2. Self-tests.
3. Internal disk drive self-tests.
4. Diagnostics.

When a test procedure indicates a faulty component, you can usually correct the problem by replacing the assembly in which the indicated faulty component is located. After identifying the problem, contact your nearest Hewlett-Packard Sales and Service Office for instructions regarding obtaining a new assembly and returning the faulty one. Assembly removal and replacement procedures are given in this chapter.

Power Supply Check

Warning

To avoid damage to equipment or injury to people, any service, adjustments, or repair to the power supply must be performed only by qualified maintenance people.

Before working on the power supply, you must set the computer's ac Power Switch (LINE switch) to OFF and disconnect the ac power cord. Before working on the system, turn off the power at the system Main Switch, on the rear door of the cabinet, and disconnect the ac power cord. If the computer or system is equipped with battery backup, set the Battery Enable switch to DISABLE.

To verify power supply operation, remove the left rear cover of the card cage. Using a digital voltmeter, verify that the test point signals on the voltage jumper card or battery backup card are as listed in Figure 3-1. The MLOST- signal is generated by the battery backup card and may not be within tolerance if battery backup is not installed. Also, the AC ϕ 1 and AC ϕ 2 signals are generated by the 25 kHz power module and will not be in tolerance if this module is not installed.

If any of the voltages are out of tolerance, perform the following steps to identify the malfunction:

1. Set the ac power switch (LINE switch) to OFF, the Battery Enable switch to DISABLE (if battery backup is installed), and disconnect the ac power cord.
2. Remove the front cover by grasping it at the sides and firmly pulling it away from the computer. Remove the cable connector cover from the front of the power supply.
3. Verify that the line configuration power connector is plugged into the correct socket. The two sockets are located under the cable connector cover that was just removed. One of the sockets is labeled *115 VAC* and the other one is labeled *230 VAC*.
4. Reconnect the ac power cord and set the power switch to ON. The green LED on the front of the power supply indicates power on. If the battery backup card is installed, set the Battery Enable switch on the front panel to ENABLE.
5. Repeat the voltage checks. If any DC voltage is not within tolerance, proceed with step 6. If the DC voltages are within tolerance and either 25 kHz voltage (voltage points AC ϕ 1 and AC ϕ 2) is not, go to the *25 kHz Power Module Check* section.

Caution



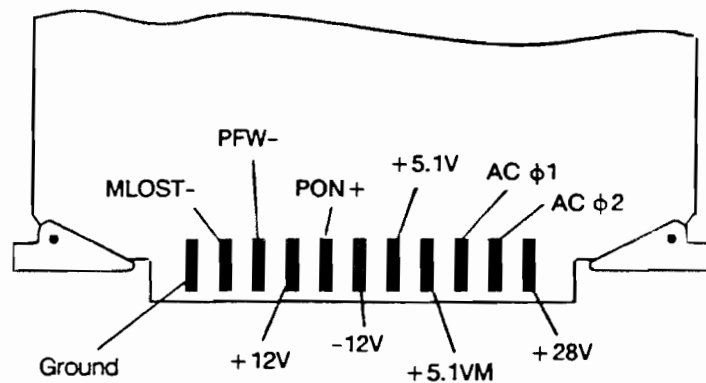
Set the Power switch to OFF and the Battery Enable switch to DISABLE before removing or inserting a plug-in card.

6. Remove all of the plug-in cards in the card cage except the voltage jumper card in slot 16. (If the battery backup card is installed, replace it with the jumper card.) Repeat the voltage checks using the following voltage ranges (these ranges are slightly wider than those listed in Figure 3-1 because there is no load on the power supply):

Voltage Point	Voltage Range
+12V	11V - 14V
-12V	-11V - -14V
+5.1V	4.75V - 5.5V
+5.1VM	4.75V - 5.5V
PON+	2.4V - 5.2V

7. If the voltages are within tolerance, one of the plug-in cards is defective. Install the cards one-by-one while making voltage checks to detect the defective card.

If any voltage is out of tolerance and internal disk drives are not installed, this could mean a faulty power supply or backplane. First, replace the power supply. If the problem persists, replace the backplane. If reinstalling the battery backup card causes an out-of-tolerance voltage, go to the *Battery Backup Card Check* section.



Voltage Point	Voltage Range*
MLOST-	2.4 - 5.2
PFW-	2.4 - 5.2
+12V	11.6 - 12.7
PON+	2.4 - 5.2
-12V	-11.2 - -12.7
+5.1V	4.99 - 5.2
+5.1VM	4.99 - 5.2
AC φ1	17.9 - 21.1 (Vrms) **
AC φ2	17.9 - 21.1 (Vrms) **
+28V	22.4 - 33.6

* Under normal load conditions

** Phase to common at 0.02 to 1.5 A

Figure 3-1. Power Supply Test Points and Voltages

8. If the voltage checks made in step 6 detect an out-of-tolerance voltage and internal disk drives *are* installed, remove the three screws securing the disk drive tray and slide the tray out far enough to disconnect the disk drive power cable from the backplane. Repeat the voltage checks using the voltage ranges given in step 6.
9. If the voltages are within tolerance, one of the disk drives is defective. Refer to the *Internal Disk Drive Troubleshooting* section to determine the defective drive assembly.
10. If the voltage checks made in step 8 detect an out-of-tolerance voltage, this could mean a faulty power supply or backplane. First, replace the power supply. If the problem persists, replace the card cage backplane.

Battery Backup Card Check

If the HP 12154A Battery Backup Card is installed and enabled, and a voltage is out of tolerance, proceed as follows:

Caution



Set the power switch of OFF and the Battery Enable switch to DISABLE before removing or inserting a plug-in card.

1. Replace the battery backup card with the voltage jumper card and check the voltages. If a voltage is out of tolerance when the jumper card is installed, use the procedure in the *Power Supply Check* section to determine which component is defective; otherwise, reinstall the battery card and go to the next step.
2. Set the front panel Battery Enable switch to DISABLE and check the voltages. If all the voltages are good except +5VM, replace the battery pack; if any other voltage is bad, replace the battery card.

To reset the battery card after isolating and correcting the problem, turn off the power; then set the Battery Enable switch to ENABLE and turn on the power.

The red LED on the front of the battery backup card indicates, when lit, that an over-current or over-voltage condition has occurred and the battery backup card is shut down. The green LED, when lit, indicates that the +5VM is within specifications.

Note that fully discharged batteries must be recharged for 14 hours to sustain memory for the specified amount of time.

25 kHz Power Module Check

If the HP 12159A 25 kHz Power Module is installed and the AC ϕ 1 and AC ϕ 2 signals are not within tolerance, turn off the power for 90 seconds. Then turn the power back on. If the fault recurs, replace the power module.

If the 25 kHz signals are at zero voltage, remove the power module and check its fuse. If the fuse is blown, replace it. The fuse is a 1A, 250V, medium-blow type. The probable cause of a blown fuse is a shorted 25 kHz signal on a measurement and control interface card in the card cage. If the problem persists and it is not due to an interface card, replace the 25 kHz power module.

A990 Self-Test Programs

The A990 self-test consists of two test programs (Test 1 and Test 2) that automatically execute each time you turn on the computer. You also can initiate these tests by pressing Reset Switch SW1 on the A990 CPU card. Test 1 (microcoded self-test) tests the processor at the circuit level. Test 2 (VCP pretest) tests the processor at the functional level. For example, Test 1 tests the hardware associated with the LIA instruction to ensure that the hardware works correctly. Test 2 executes the LIA instruction and checks the results to ensure that the instruction works correctly.

Successful completion of the tests is followed by execution of either a bootstrap loader, the Virtual Control Panel (VCP) program, or a program sustained in memory by optional battery backup. (Refer to the *A990 Computer Reference Manual*, part number 02959-90001, for information on bootstrap loaders and the VCP.) Which of these occurs depends on how the BOOT SELECT switches are configured. Refer to *A990 CPU Card Switches* in Chapter 2.

Test 1

Test 1 is stored as a microprogram in the firmware EPROM on the A990 CPU card. It executes immediately on power-up and checks all of the hardware on the card. On successful completion of Test 1, Test 2 is started. If Test 1 detects a failure, it stops executing and the LEDs on the CPU card display an error code.

The bank of four LEDs on the bottom of the CPU card displays a code that indicates which field replaceable unit failed. When Test 1 is finished, all four LEDs are extinguished. The bank of eight LEDs on the top of the CPU card is not used by Test 1 to indicate defective field replaceable units. Any pattern that is displayed on the bank of eight LEDs during Test 1 should be ignored. Table 3-1 lists the LED indications for Test 1 and their associated error codes.

Test 2

Test 2 is part of the VCP program also stored in the firmware EPROM on the A990 CPU card. It begins execution upon successful completion of Test 1. Test 2 can also be initiated by an operator command (%T) from VCP. Test 2 executes in two phases, and may take as long as 20 seconds to run, depending on the amount of memory installed.

The first phase of Test 2 checks the computer's basic instruction set, several internal flags, and the Boot RAM. When the entire Boot RAM has been successfully tested, each location of Boot RAM contains zeros.

The second phase of Test 2 tests main memory, the I/O Master of each interface card, and the computer configuration. The I/O Master of each interface card is checked to ensure that data transfer, flag, interrupt, and Direct Memory Access (DMA) functions are correctly processed.

If battery backup sustained main memory, phase two of Test 2 tests main memory in a non-destructive manner. If main memory is not sustained by battery backup, a destructive memory test is performed and main memory is effectively cleared (memory contains all zeros). On successful completion of Test 2, the LEDs will be lit with a specific pattern. This pattern depends on the startup configuration as selected by the BOOT SELECT switches (SW2). Refer to Table 3-2 for the LED displays that indicate self-test passed.

Table 3-1. LED Indicators and Error Codes for Test 1 and Phase 1 of Test 2

Error Code *		Meaning
Bank of 4 LEDs	Bank of 8 LEDs	
1111	11111111	Initial power-on condition. All LEDs are turned on when PON signal is low. Incorrect indication may be caused by microcode load or execution problem, an A990 board failure, EPROM failure, or power system failure.
0001	XXXXXXXX	Failure caused by bad EPROM or bad A990 board.
0010	XXXXXXXX	Base set fatal error (also known as machine check error) has occurred after VCP was started. See LED indications below for fatal base set error codes.
0011	XXXXXXXX	Failure caused by bad jumper board.
0100	XXXXXXXX	Failure caused by bad memory frontplane connector.
0101	XXXXXXXX	Failure caused by bad memory array card.
0110	XXXXXXXX	Failure caused by bad time-of-day clock chip or bad A990 board.
0111	XXXXXXXX	Failure caused by bad A990 board (possibly caused by a bad processor ASIC chip).
1000	XXXXXXXX	Failure caused by bad A990 board (possibly caused by a bad cache ASIC chip).
1001	XXXXXXXX	Failure caused by bad A990 board.
1010	XXXXXXXX	Failure caused by bad A990 board.
1011	XXXXXXXX	Failure caused by bad A990 board.
1100	XXXXXXXX	Failure caused by bad A990 board.
1101	XXXXXXXX	Failure caused by bad A990 board.
1110	XXXXXXXX	Failure caused by bad A990 board.
1111	0000XXXX	Failure caused by bad EPROM or A990 board (board failure possibly caused by a bad processor ASIC chip).

The following LED indications are caused by fatal base set errors after the VCP program has started:

0010	00000001	Control store parity error. May have been caused by bad hardware.
	00000010	Microcode stack overflow or underflow. May have been caused by an error in the base set microcode.
	00000100	Zap counter interrupt. May have been caused by an error in the base set microcode.
	00001000	Two consecutive micro-interrupts. May have been caused by bad hardware.
	00010000	A micro-interrupt occurred, but the micro-interrupt register did not contain a known error pattern. May have been caused by bad hardware.

The following are Test 2 Phase 1 LED indications:

0000	11111110	Microcoded self-test (Test 1) passed but first memory fetch failed. Bad A990 board.
	11111100	Basic instruction test failed. Bad A990 board.
	11111000	Boot memory access failed. Bad EPROM or A990 board.
	11110000	TBG test failed. Bad A990 board.

* 1 = lit LED; 0 = unlit LED; X = don't care

If Test 2 detects a failure, the error code is displayed on the upper 8 LEDs (the lower 4 LEDs are all off). If a failure is detected during *phase one* of Test 2, test execution stops and the LEDs indicate the type of failure by displaying a 1-byte static error code (see Table 3-1). If a failure is detected during *phase two* of Test 2, the VCP can still run if the VCP interface is functioning properly and a VCP console is installed. The failure causes the LEDs to flash the error code (in binary format) as well as display the error code in octal format in the message "Pretest Error xxx.xxx.xxx.xxx" on the VCP console.

Each error message for *phase two* of Test 2 consists of four bytes of information. The information is displayed on the LEDs using the scheme described in Figure 3-2. The first byte of the error code is the main error code (memory error, I/O interface error, or interrupt error) and the second byte is the subcode. Some of the error codes give additional information in bytes 3 and 4. For example, error code 300 203 000 022 indicates that an I/O error (300) has occurred and that the error was caused by duplicate select codes (203) and the duplicate select code was 22 (000 022). An error code of 340 201 000 000 indicates a memory error (340 201) in the first 32k block of memory (000 000). Table 3-3 shows the LED failure indications for Test 2.

Note



If a self-test error occurs, do not boot the operating system. The integrity of the system cannot be assured. Use the diagnostics to find and eliminate the cause of the error if you cannot identify a problem with the self-test.

If the computer fails the self-test only when it is cabled to an A-Series I/O extender, make sure the extender is powered on. Also, when the computer is cabled to an HP 12025A/B I/O Extender, turning off the power to the extender causes a powerfail shutdown of the computer that may appear to be a computer failure.

Revision 4022 and later of VCP uses the following scheme to display the four-byte long error code on the 8 LEDs. Preceding each byte of information a "travelling" LED pattern is displayed to indicate which byte of information is going to be displayed. For example, the following LED sequence is displayed for the error code 302 201 023 021. See Table 3-3 for a definition of all the error codes.

Octal Code	LED Display
302	 One travelling LED is displayed, then First byte of error message is displayed
201	 Two travelling LEDs are displayed, then Second byte of error message is displayed
023	 Three travelling LEDs are displayed, then Third byte of error message is displayed
021	 Four travelling LEDs are displayed, then Fourth byte of error message is displayed

Figure 3-2. Sample Display of Self-Test Test 2 Error Code

Table 3-2. Self-Test Pass Indications

Octal Code	LED Display	Definition
007 \rightarrow 005 002 \rightarrow 000	000001*1 000000*0	VCP program is running; VCP console connected and waiting for user input. VCP program is running; VCP console is not connected, that is, VCP is waiting for the VCP console to respond to the first ENQ-ACK handshake.
001	00000001	A boot loader is running.
000	00000000	User software is running.
200	10000000	Loader error. Probably a checksum error; change media on loading device.
020	00010000	Running Diagnostic Design Language (DDL) Program.

1 = lit LED; 0 = unlit LED; * = flashing LED

Table 3-3. LED Indicators and Error Codes for Test 2

Octal Code *	Definition												
<table border="1"> <thead> <tr> <th colspan="4">Byte</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>360</td> <td>360</td> <td>xxx</td> <td>xxx</td> </tr> </tbody> </table>	Byte				1	2	3	4	360	360	xxx	xxx	TBG test failed. Third and fourth bytes (xxx xxx) indicate the address in the VCP code where the error was detected.
Byte													
1	2	3	4										
360	360	xxx	xxx										
340 --- --- ---	When the LEDs are in this static pattern the memory test is running and has not yet completed; this is not an error condition.												
340 200 000 000	No memory found or missing frontplane connector.												
340 2nn xxx xxx	Main memory failed. nn = 01b to 12b depending on where in the VCP code the error was detected. Third and fourth bytes (xxx xxx) indicate the 32-KByte block of failed memory.												
341 000 377 377	ECC memory detected in A400/A600; ECC memory is not supported in an A400/A600. (This error should never occur on an A990.)												
300 200 000 000	No I/O cards in the card cage.												
300 201 0yy 0xx	More than one card has VCP enabled; yy and xx are the select codes of the enabled cards.												
300 202 0yy 0xx	Broken I/O chain; yy is the number of I/O cards found by polling; xx is the number found by priority scan; the break will usually be found at slot xx + 1.												
300 203 000 0xx	Duplicate select codes; more than one card has the select code xx.												
300 204 000 0xx	An I/O card at select code xx has a select code of less than 20b.												
300 205 000 000	No I/O card has been enabled as the VCP interface.												
300 206 000 000	Unexpected TBG interrupt.												
300 207 000 000	Unexpected Memory Protect interrupt.												
300 210 000 000	Unexpected UIT interrupt.												
300 211 000 000	Invalid ID number or select code for A400 On-board I/O. (This error should never occur on an A990.)												
300 213 000 000	VCP Speed Sense failed.												
300 220 xxx xxx	} An I/O card at select code 20 through 77 failed self-test. xxx xxx is the address in VCP where the error was detected.												
300 277 xxx xxx													

* The error codes for phase 2 of Test 2 are displayed on the upper 8 LEDs as 4 bytes of information using the scheme illustrated in Figure 3-2.

Internal Disk Drive Self-Tests

Internal disk drive self-tests can be initiated either at power-on or by setting the TEST switch of SW3 on the internal disk controller PCA. The following paragraphs describe these self-tests.

Power-On Self-Test

The following tests pertain to the LEDs mounted on the internal disk drive controller card, not the LEDs mounted on the A990 CPU card.

Three indicators show the status of the power-on self-test: the FAULT LED, the ONLINE LED, and the flexible disk access LED (see Figure 2-7). Operation of the LED indicators is described in the following paragraphs.

Self-Test Passes

When power is applied to the disk drive, the FAULT LED will illuminate during the entire self-test.

The ONLINE and flexible disk access LEDs both blink on, then extinguish when power is applied. The ONLINE LED illuminates during the hard disk portion of the self-test. The flexible disk access LED illuminates during the flexible disk portion of the self-test.

When self-test is successful, all three LEDs extinguish.

Self-Test Fails

If self-test fails, one of four possible indications is displayed:

- LEDs never illuminate
- FAULT and ONLINE LEDs never extinguish (mechanisms do not spin up)
- FAULT LED blinks
- FAULT LED never extinguishes (mechanisms spin up)

The following paragraphs describe each situation.

FAULT and ONLINE LEDs never illuminate:

If neither the FAULT or ONLINE LEDs ever illuminate, it is most likely a power problem. Check the internal disk drive power cables that are connected to the backplane. If there is no apparent problem with the cables, replace the controller PCA.

FAULT and ONLINE never extinguish:

If the FAULT and ONLINE LEDs (and possibly the flexible disk access LED) immediately illuminate and never extinguish, the controller PCA is most likely the problem.

FAULT blinks:

If the FAULT LED blinks, the blink sequence indicates the possible problem. The blink sequences are described in Table 3-4.

FAULT never extinguishes:

If self-test appears to complete but the FAULT LED remains illuminated, the ONLINE and flexible disk access LEDs provide information on which *unit* in the disk subsystem failed. This self-test failure occurs when one of the disk mechanisms fails. If both LEDs are extinguished, the hard disk failed. If only the flexible disk access LED is illuminated, the flexible disk failed.

After failing self-test, if the disk drive can come online it will allow the host to execute a "REQUEST STATUS" command to the disk drive. This command allows the disk drive to return failure information to the host.

Table 3-4. Internal Disk Drive Power-On Self-Test Indications

Indication	Problem
FAULT LED on 6 seconds, blinks off 1 time, repeats	ROM checksum is wrong. Replace the ROMs.
FAULT LED on 6 seconds, blinks off 2 times, repeats.	Processor RAM is bad. Replace the disk controller PCA.
FAULT LED on 6 seconds, blinks off 3 times, repeats.	The buffer RAM is bad. Replace the disk controller PCA.
FAULT LED on 6 seconds, blinks off 4 times, repeats.	The configuration switches (SW3) are set to an invalid configuration.
FAULT LED on 6 seconds, blinks off 5 times, repeats.	The HP-IB chip is bad. Replace the disk controller PCA.
FAULT LED on 6 seconds, blinks off 6 times, repeats.	The microprocessor may have failed. Probably the TEST/NORM switch of SW3 is set to TEST and performed a service test which passed.
FAULT LED on 6 seconds, blinks off 7 times, repeats.	The disk controller chip is bad. Replace the disk controller PCA.

Execution of Service Self-Tests

There are nine selectable service self-tests available. Table 3-5 gives a description of the service self-tests available. To perform the tests, set the HP-IB address switch to the desired test number, and set the TEST/NORM switch of SW3 to the TEST position (switch down). (Refer to Figure 2-7 for a diagram of the location of SW3 on the disk controller PCA.) This will run the test continuously. To run the test once, simply set the TEST/NORM switch to the NORM position. When the current test completes, the selected self-test will halt.

Note



Because the RAM test clears all parameters, some of which are needed for other tests, do not switch arbitrarily from test to test. The RAM test should be the first or last test which is run. After each RAM test, the unit goes through its power-on sequence.

The following is an example of running the processor RAM test as the first test performed.

1. Turn the power OFF and disconnect the power cord.
2. Select the RAM test (0 on the HP-IB address switch) and set the TEST/NORM switch of SW3 to the TEST position.
3. Connect the power cord and turn the power ON. The computer will go through a complete power-on sequence, then begins executing the RAM test. The FAULT LED remains on during the test. When the test completes, the FAULT LED should blink 5 times. If the FAULT LED remains on continuously, the test failed and will halt. Remove power to exit this state.
4. Turn the power OFF. Select the next test using the HP-IB address switch. Do *not* select the RAM test.
3. Turn the power ON. The disk drive will perform all or part of the power-on self-test, then begin the specified test. Again when the test completes, the FAULT LED should blink 5 times. If it does not, the test failed and power must be removed to exit this state. The disk drive automatically repeats the test until another test selection is made or until power is removed.

More tests may be selected as needed (except Test 0 – RAM test, and Test 3 – floppy test) without turning the power off. There is a delay after the selection of a test until execution of the test is begun.

FAULT LED Indications During Execution of Service Self-Tests

The FAULT LED will go on for one second (to show that it works) at the beginning of each test. The FAULT LED will then go on, and stay on, during the length of the test. A pass indication is displayed by the FAULT LED blinking 5 times. A failure is displayed by the FAULT LED remaining on.

Note

A flexible disk must be inserted in the drive to perform Tests 3, 4, and 5. Ensure that the disk is an initialized scratch disk and that it is not write protected.

Table 3-5. Internal Disk Drive Service Self-Tests Available

Test Number/Type	Test Time * Min : Sec	Test Description
0 RAM	0 : 2	All possible patterns are written in all locations of the microprocessor RAM.
1 ROM	0 : 3	A checksum calculation is performed.
2 Controller	0 : 3	The HP-IB chip, disk controller chip, and buffer RAM are tested.
3 Flexible Disk	0 : 3	A seek test, speed test, and a read/write/compare on the system cylinder are performed on the flexible disk drive.
4 Flexible Disk Drive Verify	0 : 40	All sectors in the data area of the disk are checked for CRC errors. No user data is affected.
5 Flexible Disk Drive Format	1 : 40	Formats the disk.
6 Hard Disk	7 : 30	Performs two different seek tests, hard disk mechanism read/write/compare.
7 Hard Disk Verify	2 : 30	All sectors in the data area of the disk are checked for CRC errors. No user data is affected.
8 Hard Disk Connected	0 : 3	Checks to see if the hard disk is connected.
9 ECC	0 : 3	Checks the error correction portion of the disk controller chip.

* If selected test is performed from power-on, allow additional time for self-test to complete.

Internal Disk Drive Detailed Troubleshooting Procedure

When troubleshooting the internal disk drives, the first thing to do is to determine if the fault is repeatable or intermittent. A repeatable fault usually causes the same failure each time self-test or a diagnostic test is performed. An intermittent fault, on the other hand, occurs at random intervals, and may not always cause a test failure.

In the case of a repeatable fault, the test will identify the failing assembly with a 95 percent certainty. In the event that more than one assembly is a possible cause of the failure, replace the assemblies one at a time, in the order indicated by the diagnostic error bytes. When the drives are removed or replaced, refer to Figure 3-4 for the proper setting of the drive select switch.

Note



Cable faults (for example, an open cable conductor or a loose cable connector) may present a variety of failure indications. The failure shown will be an assembly at either end of the defective cable. All cables should, therefore, be checked before replacing any assembly.

Attempt to isolate the fault to a specific assembly by running self-test following the replacement of each assembly.

Procedures P1 through P5 in the following paragraphs refer to the troubleshooting flowchart shown in Figure 3-3.

General Information

If a flexible disk is damaged by the flexible disk drive, replace the drive mechanism. It is recommended that you use HP double-sided media with a double-sided flexible disk drive. If you are using media from other sources, or HP single-sided media in double-sided mode, it is possible that media could be the cause of the problem.

Some media related problems that have occurred are visible wear of the disk and a high pitched sound from the drive while the disk is being accessed. These problems have occurred when single-sided HP media is being used frequently in a double-sided drive (instead of its intended use to exchange data with single-sided disk drives) and with media from other vendors. Note that the head resonance problem may be found occasionally as an independent failure mode.

Additional media related problems can occur, such as failure to initialize media, and intermittent failures. In some cases, media can cause an accumulation of residue on the read/write head of the disk drive. The residue must be removed, if possible, before the drive will work properly with HP media. Heads may be cleaned using the 09122-89415 cleaning disk and the HD_CLN routine in the SS/80 Exerciser SERVC module to exercise the disk drive during the cleaning.

Note



If a replacement hard disk drive is installed, the power-on self-tests will fail when the unit is powered up. The drive must be initialized (or formatted), and the power cycled before the FAULT LED will go off.

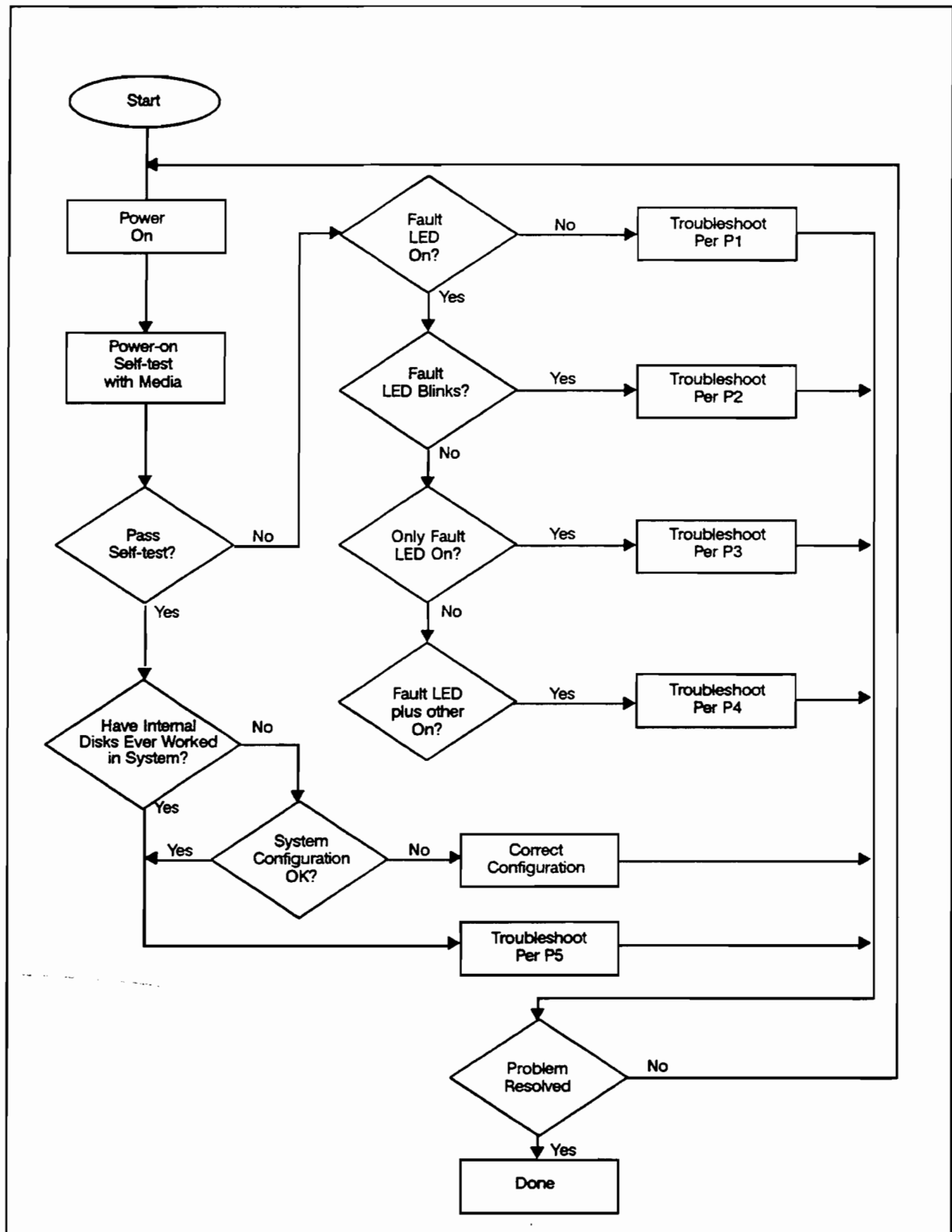


Figure 3-3. Internal Disk Drive Troubleshooting Flowchart

Troubleshooting Procedure P1 (LEDs Not On at Power-On)

Check the internal disk drive power cable. If this does not correct the problem, replace the disk controller PCA.

Troubleshooting Procedure P2 (FAULT LED Blinks)

A description of the power-on self-test indications is provided in Table 3-4. The following information indicates the probable repairs if the FAULT LED keeps blinking after power-on:

Indication	Problem
FAULT LED on 6 seconds, blinks off 1 time, repeats	ROM checksum wrong. Replace ROM or disk controller PCA.
FAULT LED on 6 seconds, blinks off 4 times, repeats	Disk controller switches (SW3) set to an illegal configuration. Set switches for correct configuration. See Figure 2-7.
All other FAULT LED blink indications	Disk controller fault. Replace the disk controller PCA.

Troubleshooting Procedure P3 (FAULT LED is On)

Drive access is indicated by the ONLINE LED for the hard disk (refer to Figure 2-7 for the ONLINE LED location) and by the ACCESS LED on the flexible disk drive. The ONLINE LED will normally light momentarily at the time power is applied, then come on again at the time the drive begins spinning up and remain on for approximately 25 seconds during the power-on self-test. The ACCESS LED on the flexible disk drive will come on only if media is inserted in the drive, and will remain on for approximately 4 seconds.

Note



If the hard disk has just been replaced, it is necessary to initialize (or format) the drive and then cycle power before the integrated disk drives will pass the power-on self-test.

Follow one of the troubleshooting procedures outlined below depending on the status of the access LEDs.

a. Neither drive accessed during self-test

1. Check power supply voltages as described in the power supply check section.
2. Ensure that all cables are connected properly.
3. Ensure that the configuration switch on the controller board is set correctly.
4. Replace controller if none of the above correct the problem.

b. Hard disk drive not accessed during self-test

Ensure that the hard disk is spinning up. A distinct sound occurs within the first 10 seconds after power is applied if the disk is spinning up.

1. Check power supply voltages as described in the power supply check section.
2. Ensure that all cables are connected properly.
3. Ensure that the configuration switch on the controller board is set correctly.
4. Ensure that the configuration switch on the drive is set correctly.
5. Replace the disk controller PCA if none of the above correct the problem.
6. Restore the original controller in the product and replace drive if the controller replacement does not correct the problem.

c. Flexible disk drive not accessed during self-test

1. Ensure that a disk is installed into the flexible disk drive.
2. Check power supply voltages as described in the power supply check section.
3. Ensure that all cables are connected properly.
4. Ensure that the configuration switch on the controller board is set correctly.
5. Ensure that the configuration switch on the drive is set correctly.
6. Replace the disk controller PCA if none of the above correct the problem.
7. Restore the original controller in the product and replace the drive if the controller replacement does not correct the problem.

d. Both drives accessed during self-test

It is possible that either a controller or disk drive can cause this fault. The two types of drives use some different circuits on the controller, and it is not always clear whether the controller or the drive is causing a problem related to the apparent failure of a drive.

1. Set SW3 on the controller PCA to the FLOPPY position and repeat the power-on self-test. If the power-on self-test passes, replace the flexible disk drive. (Make sure the SW3 is returned to the proper position.)
2. If the failure persists, return SW3 to the correct position and replace the disk controller PCA.
3. If the failure still persists, restore the original disk controller PCA and replace the hard disk drive.

Note



If the hard disk has just been replaced, it is necessary to initialize (or format) the drive and then cycle power before the integrated disk drives will pass the power-on self-test.

Troubleshooting Procedure P4 (FAULT LED and Either ONLINE or FAULT and ACCESS LED are On)

The disk controller is the most probable defective assembly. Replace the controller and re-test. If the failure persists, replace the hard disk drive if the ONLINE LED is on, or replace the flexible disk drive if the ACCESS LED is on.

Troubleshooting Procedure P5 (Failure in System but Passes Power-On Self-Test)

a. Flexible disk drive is failing

1. Determine whether HP double-sided media is being used in the system. Some media, including HP single-sided media, will not perform properly in the double-sided disk drive when the drive is used frequently. If the drive has been used frequently with some types of media it is possible that the head may require cleaning before HP double-sided media will perform properly. The only means to do this is to use the SS/80 Exerciser on the HP 85.
2. Verify failure by using Test 4 (see Table 3-5) on a customer data disk if read problems are occurring. This test verifies but does not change the data.
3. Check read/write performance using Test 5 on a scratch disk. Note that this formats the disk, destroying all data on the disk.

Note



Tests 4 and 5 continue to loop until an error is detected, at which point the test terminates and the FAULT LED remains on continuously.

4. Replace the drive if a failure is indicated.
 5. If the failure persists, restore the original drive and replace the disk controller PCA.
- ### b. Hard disk drive is failing
1. Attempt to verify that the failure is the hard disk by using Test 7.
 2. If Test 7 does not indicate a failure, replace the controller.
 3. If the failure persists, replace the original controller and replace the hard disk drive.
- ### c. Neither disk drive can be accessed - Replace the disk controller PCA.

Repair Verification

After repairing the integrated disk drives, the repair should be verified to ensure that the product is operating properly. If the repair was on the flexible disk drive, format a disk using either a host computer which supports the drive, the SS/80 Exerciser, or service self-test 5. If the SS/80 Exerciser is available, the R/W TEST module can be used to loop on a read/write test. Test 5 formats a flexible disk, and will continue to loop on that test until the test fails, thus providing a means to exercise the product without operator intervention.

If the repair is on the hard disk drive and if there is no customer data on the disk, the repair can be verified by formatting the disk. If the disk has been divided into volumes, each volume must be formatted. If the existing data must be preserved on the disk, the R/W_TEST module in the SS/80 Exerciser provides a read-only test which will not affect customer data. Test 7 also provides a verify test that will not affect data on the disk. Test 7 executes continuously until an error is detected.

If the repair is on the controller, repair can be verified by performing write and read operations on both drives.



The SS/80 Exerciser

The SS/80 Exerciser provides some capabilities that are not available otherwise, and also provides more information about the integrated disk drives than is otherwise available. Specifically, the Exerciser provides the capability to transfer data and commands between a host computer and the peripheral, as well as performing certain tests that cannot be implemented in any other way. Refer to the *SS/80 Exerciser Manual*, part number 5958-4142, for an overview of the capabilities contained in the Exerciser.

Some general testing solutions which can be implemented using the Exerciser are as follows:

HP-IB channel test	The LOOPBAK test in the MANUAL module tests the capability to communicate with the product across the HP-IB.
Testing for R/W errors	The R/W_TEST module allows either a Read Only, or a Write then Read test to be performed on a single unit. This test can be set to loop up to 32,000 times and allows extensive testing to identify a problem or verify a repair.
General product eval.	The R/W_TEST module performs general product testing and is recommended for this use.
Flexible disk tests	The SERVC module contains special flexible disk drive tests (for example, motor speed, Track 0, Head cleaning routine).
Complete product eval.	The OPER program tests all units and volumes of a disk drive without manually selecting each one. An OPER program can be defined which will select each unit and volume and then perform a locate and verify, locate and read, locate and write, etc. The program will allow looping to perform extensive testing.

If the drives are removed or replaced, refer to Figure 3-4 for the proper setting of the drive select switch.

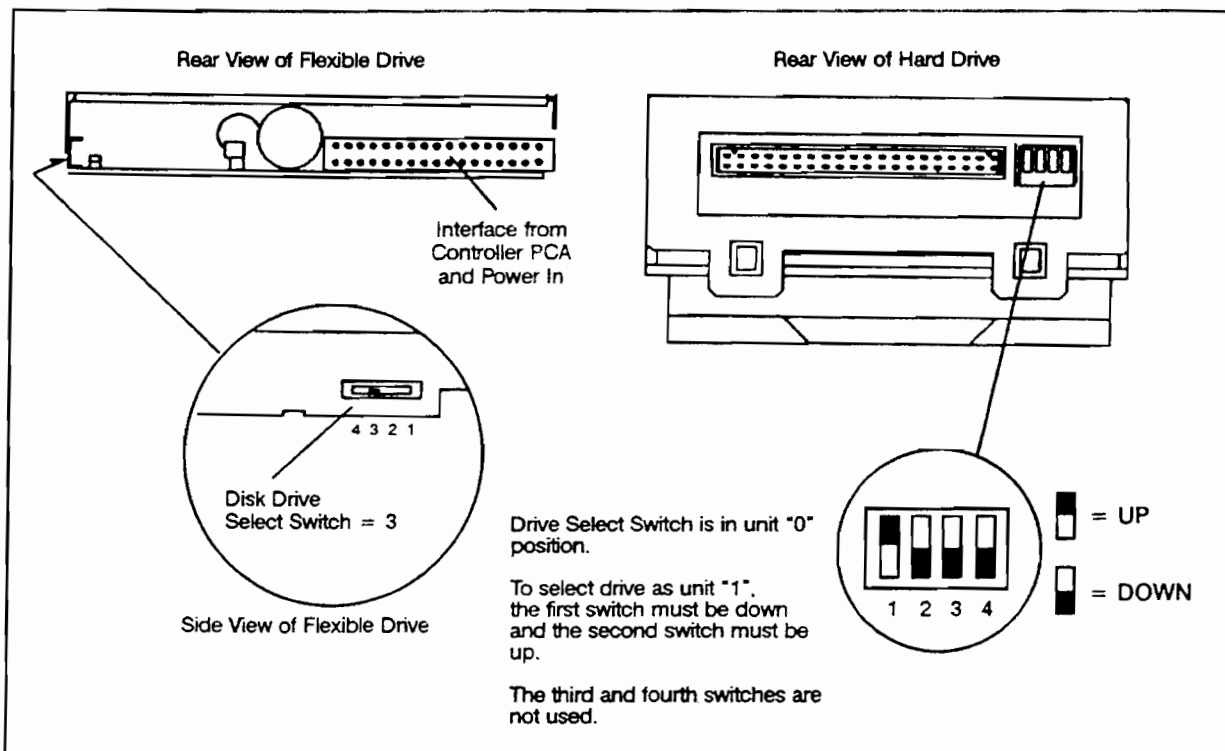


Figure 3-4. Internal Hard Disk and Flexible Disk Drive Switch Configurations

Diagnostics

You can use the diagnostics in the HP 24612A Diagnostics Package (Revision 5270 or later) for testing the computer when you cannot identify a problem with the self-test. You will find instructions for running the diagnostics in the manuals included with the diagnostics package.

Memory Card LEDs

Memory array cards are equipped with a green LED indicator. If the LED is off, it indicates that a multiple-bit error has occurred on that card since the time you switched the computer on. Single-bit errors are automatically corrected. Multiple-bit errors cause the computer to execute a jump to memory location 05.

Assembly Removal and Replacement

Warning



Hazardous voltages are present inside the system mainframe. Heed all **WARNING - HAZARDOUS VOLTAGE** labels.

To avoid damage to equipment or injury to people, any service, adjustments, or repair to the power supply must be performed only by qualified maintenance people.

Caution



The contents of memory will be lost when ac line voltage is OFF and battery backup (if installed) is disabled. Before shutting down the computer, be sure to save and store the contents of memory.

The following paragraphs describe procedures for removing and replacing the various computer assemblies. Refer to Chapter 4 for exploded views of the computer. If your computer is rack mounted, read the entire assembly removal procedure. When it is obvious that the procedure cannot be performed with the computer in the rack, do the following:

1. Set the power switch (LINE) to OFF and disconnect the power cord. If battery backup is installed, set the Battery Enable switch to DISABLE.
2. Disconnect all I/O cables from the computer interface cards.
3. Remove the computer from the rack. Refer to the manuals supplied with the rack for mounting and dismounting information.

Power Supply

Removal

Remove the computer power supply as follows:

1. Set the power switch to OFF, set the Battery Enable switch to DISABLE, and disconnect the power cord from the rear of the computer.
2. Remove the front cover by grasping it at the sides and firmly pulling it away from the computer. Remove the cable connector cover from the front of the power supply.
3. Disconnect the power cable and voltage configuration cable from the power supply. (See Figure 2-2.)

4. Remove the four screws securing the front of the power supply to the mainframe. Grasp the power supply by its handle and pull it out of the mainframe.

Replacement

Replace the power supply by reversing the removal procedure. Note that when reconnecting the voltage configuration cable connector to the power supply, use the connector labeled *115 VAC* if the ac line voltage is 115 Vac, and the connector labeled *230 VAC* if the ac line voltage is 230 Vac.

Fans

Removal

Remove a fan as follows:

1. Set the power switch to OFF and disconnect the power cord. If battery backup is installed, set the Battery Enable switch to DISABLE.
2. Remove the three screws securing the Power Distribution Unit (PDU) at the rear of the computer. If the optional battery backup card is installed, disconnect the battery cable from the PDU. When disconnecting the battery cable from the PDU, first push the cable connector in, squeeze its sides, and then pull out.
3. Remove the computer front panel by grasping at the sides and firmly pulling it away from the computer. Remove the cable connector cover from the front of the power supply.
4. Disconnect the power cable and voltage configuration cable from the front of the power supply.
5. Remove the two screws securing the front of the PDU. Grasp the PDU and carefully pull it out of the front of the computer.
6. Place the PDU on a workbench and disconnect the power cord from the defective fan. Remove the four screws securing the fan and remove the fan. See Figure 4-2.

Replacement

Replace the fan by reversing the removal procedure. Be sure to orient the fan so that the direction of air flow is out of the box. Air flow direction is indicated on the fan.

Internal Disk Drive

Removal

Remove an internal disk drive as follows:

1. Set the power switch to OFF and disconnect the power cord from the computer.
2. Remove the computer front cover by grasping it at the sides and firmly pulling it away from the computer.
3. Loosen the three screws securing the internal disk drive tray.

Caution



The disk drives are sensitive to shock and vibration. Do not drop the disk drive tray. Set it on a piece of plastic foam when it is removed from the computer.

-
4. Carefully slide the tray out of the mainframe and disconnect the HP-IB ribbon cable from the disk controller PCA by first removing the two screws securing it to the connector. Disconnect the disk power cable from the backplane.
 5. Disconnect the disk drive ribbon cable from the drive.
 6. Remove the screws securing the drive to the tray. Remove the drive. Note that the microfloppy drive is secured by metric screws.

Replacement

Replace the internal disk drive by reversing the removal procedure. When connecting the HP-IB ribbon cable to the connector on the disk controller card, make sure that you line up the triangles on the sides of the connectors.

If the drives are removed or replaced, refer to Figure 3-4 for the proper setting of the drive select switch.

Internal Disk Drive Controller PCA

Caution



STATIC SENSITIVE DEVICE. Use anti-static handling procedures when removing or installing the internal disk drive PCA. Do not set it on a conductive surface or on top of another printed circuit card.

Removal

Remove the internal disk drive controller PCA as follows:

1. Perform steps 1 through 4 in the previous section (*Internal Disk Drive Removal*).
2. Disconnect the disk drive ribbon cables from the controller PCA.
3. Remove the disk controller PCA by lifting up on one edge of the board to release it from the spring clips on the disk drive tray.

Replacement

Replace the disk controller PCA by reversing the removal procedure. When connecting the ribbon cables to the connectors on the disk controller PCA, make sure that you line up the triangles on the side of the connectors.

Plug-In Cards

Caution



STATIC SENSITIVE DEVICE. Use anti-static handling procedures when removing or installing a system plug-in card. Do not set the optional battery backup card on a conductive surface or on top of another printed circuit card.

Removal

Remove a plug-in card from the computer card cage as follows:

1. Set the power switch to OFF and disconnect the power cord. If the battery backup card is installed, set the BATTERY switch to DISABLE.
2. Remove the rear covers.
3. If applicable, remove the cable connector from the plug-in card, and disconnect the wire from the grounding strip. Remove the plug-in card by firmly pulling outward on the card extractor levers.

When removing the optional battery backup card, disconnect the battery cable from the PDU by pushing the connector into the PDU, squeezing its sides, and then pulling out.

Replacement

Replace a plug-in card by reversing the removal procedure. Be sure the card's switches are set properly. All plug-in cards must be installed with the component side facing up. For the A990 CPU card, the side with the bank of eight LEDs must face up.

EPROM and Time-of-Day Clock Chips

Caution



STATIC SENSITIVE DEVICE. Use anti-static handling procedures when removing or installing a chip on the A990 CPU card.

Removal

To remove the EPROM or time-of-day clock chip, set the power switch to OFF and remove the CPU card from the computer, placing it on a flat surface. While observing the anti-static handling precautions, carefully pull the chip from its mounting socket. Refer to Figure 3-5 for the chip locations.

Replacement

Replace the EPROM or time-of-day clock chip by reversing the removal procedure. When reinstalling the chip, be sure to note the orientation of pin 1 as illustrated in Figure 3-5.

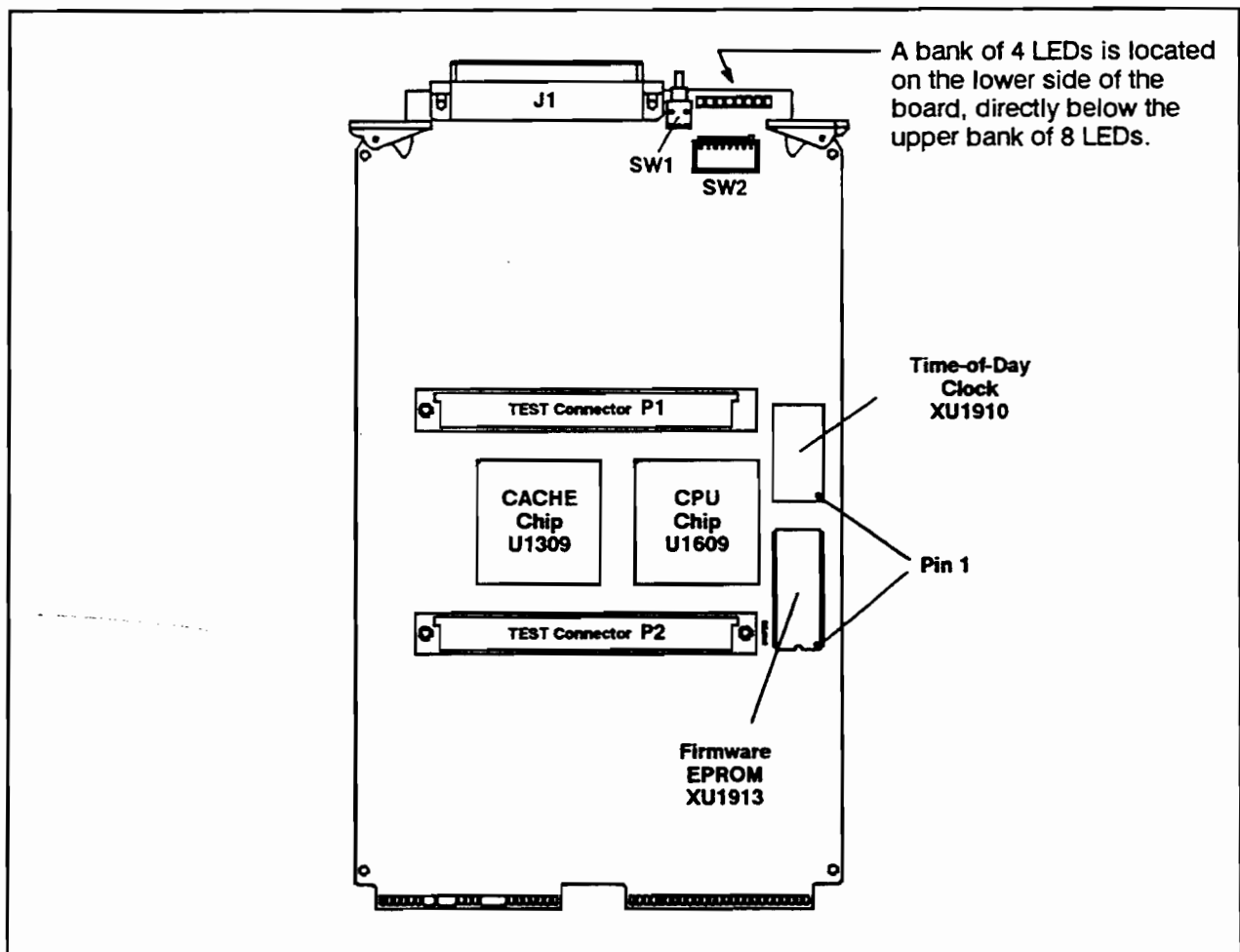


Figure 3-5. A990 CPU Card Chip Location Diagram

Backplane

Removal

If the computer is rack mounted, remove it from the rack. To remove the card cage backplane, proceed as follows:

1. Set the Power switch to OFF and disconnect the power cord. If the battery backup card is installed, set the Battery Enable switch to DISABLE.
2. Remove all of the plug-in cards from the card cage by using the procedure given in the *Plug-In Cards Removal* section.
3. Remove the computer power supply by using the procedure given in the *Power Supply Removal* section.
4. Loosen the three screws securing the internal disk drive tray.

Caution



The disk drives are sensitive to shock and vibration. Do not drop the disk drive tray. Set it on a piece of plastic foam when it is removed from the computer.

5. Carefully slide the tray out of the mainframe and disconnect the HP-IB ribbon cable from the disk controller PCA by first removing the two screws securing it to the connector. Disconnect the disk power cable from the backplane.
6. Remove the two screws securing the front of the Power Distribution Unit (PDU), and the three screws securing its rear.
7. Remove the screws securing the top and sides of the shroud, including the two screws inside the disk drive chamber. Remove the shroud.
8. Remove the screws securing the RFI shield to the backplane and remove the shield.
9. Remove the screws securing the backplane and remove the backplane.

Replacement

Replace the backplane by reversing the removal procedure.

115/230 Vac Reconfiguration

Warning



Reconfiguring the computer to operate from 115 or 230 Vac line voltage must be done only by qualified personnel. Before changing from 115 Vac to 230 Vac configuration, or vice versa, set the power switch on the front of the box to OFF, the Battery Enable switch to DISABLE, and disconnect the power cord. Failure to observe this precaution can result in serious injury or in damage to the power supply.

To reconfigure the computer ac line power voltage, proceed as follows:

1. Set the Power switch to OFF and disconnect the power cord.
2. Remove the computer front cover by grasping it at the sides and firmly pulling it away from the computer.
3. Remove the cable connector cover from the front of the power supply. There may be a cover plate over the unused socket on the power supply. Remove the cover plate.
4. Disconnect the voltage configuration cable connector from the front of the power supply by squeezing both ends of the connector. Insert the connector into the appropriate socket (one is labeled *115 VAC* and the other is labeled *230 VAC*).
5. If you removed a cover plate in step 3, install it over the unused socket.
6. Reinstall the cable connector cover over the connectors.
7. Using the alternate power label supplied with the computer, placard the new power requirements next to the ~LINE receptacle on the rear of the computer.

Power Distribution Diagram

Figure 3-6 is the power distribution schematic diagram for the 16-slot box.



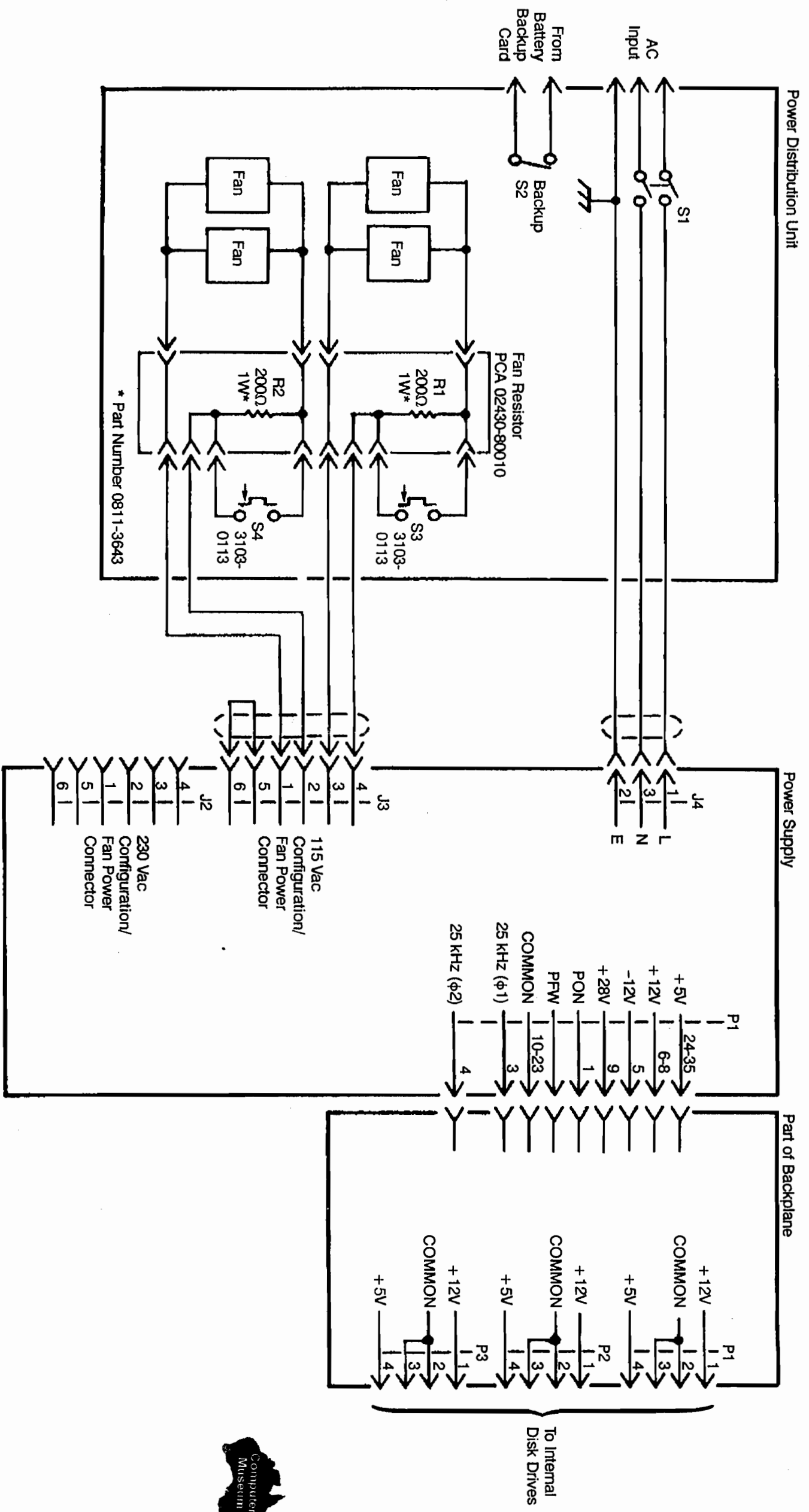


Figure 3-7. Power Distribution Schematic Diagram

Replaceable Parts

This chapter provides a list of replaceable parts and illustrated parts breakdowns of the computer.

Replaceable Parts Table

Table 4-1 lists the replaceable parts shown in Figures 4-1, 4-2, and 4-3. Parts are referenced in the table and in the illustrations by index numbers. The columns in the table provide the following information for each part.

1. Index No. - The figure index number of the part as shown in the Figure 4-1, 4-2, or 4-3.
2. Description - The description of each part.
3. HP Part No. - The Hewlett-Packard part number for each part.

Ordering Information

When ordering replaceable parts, address the order to the nearest Hewlett-Packard Sales and Service Office. Include the following information for each part ordered:

1. Complete model number and serial number of the computer.
2. HP part number for each part.
3. Complete description for each part as provided in the replaceable parts list.

Parts Exchange Program

If you have a defective processor card, memory card, or power supply, you can exchange it for an operating assembly. For costs and other details of the exchange program, contact your nearest HP Sales and Service Office.

Table 4-1. List of Replaceable Parts

GENERAL PARTS		
Index No.	Description	HP Part No.
1	Front Cover (blank)	02430-40001
-	Front Cover (single flexible disk drive)	02430-40002
2	Internal Flexible Disk Drive	09123-67101
3	Internal Hard Disk Drive	45816-67111
4	Disk Controller Card	09153-67511
5	Mounting Tray	97596-04701
6	Power Supply	0950-1788
7	HP-IB Interface Card	12009-60020
8	Cable, HP-IB	97596-61602
9	Cable, Hard Disk Drive	09153-61604
10	Cable, Flexible Disk Drive	97596-61603
11	Cable, Internal Disk Power	97596-66501
12	Air Filter	3150-0459
13	PDU and Fan Assembly	02430-60026
14	Fan	3160-0420
15	Shroud	02430-00015
16	Screw, 6-32 x 0.25	2360-0192
17	Snap-in Grommet	0400-0056
18	Snap-in Fastener	1890-0144
19	Screw, FH, 6-32 0.312	2360-0116
20	Screw, 6-32 x 0.312	2360-0113
21	Screw, captive panel	1390-0688
22	Rear Left Panel	02430-00030
23	Rear Right Panel	02430-00029
-	Backplane	02430-60015
-	Voltage Jumper Card	02430-60009
-	Battery Backup Card	12154-60001
-	Battery Backup Cable	12154-60002
-	Battery Pack	1420-0321
-	25 kHz Power Module	12159-60001
-	Fuse	2110-0001

Table 4-1. List of Replaceable Parts (continued)

A990 CPU CARD AND MEMORY		
Index No.	Description	HP Part No.
-	A990 CPU Card	12990-60202
-	Time-of-Day Clock Chip	1826-2068
-	Firmware EPROM Chip	12990-80106
-	768 KByte ECC Memory Card	12220-60001
-	3 MByte ECC Memory Card	12221-60001
-	8 MByte ECC Memory Card	12221-66001
-	Connector to 1 Memory Card	12230-60001
-	Connector to 2 Memory Cards	12230-60002
-	Connector to 3 Memory Cards	12230-60003
-	Connector to 4 Memory Cards	12230-60004



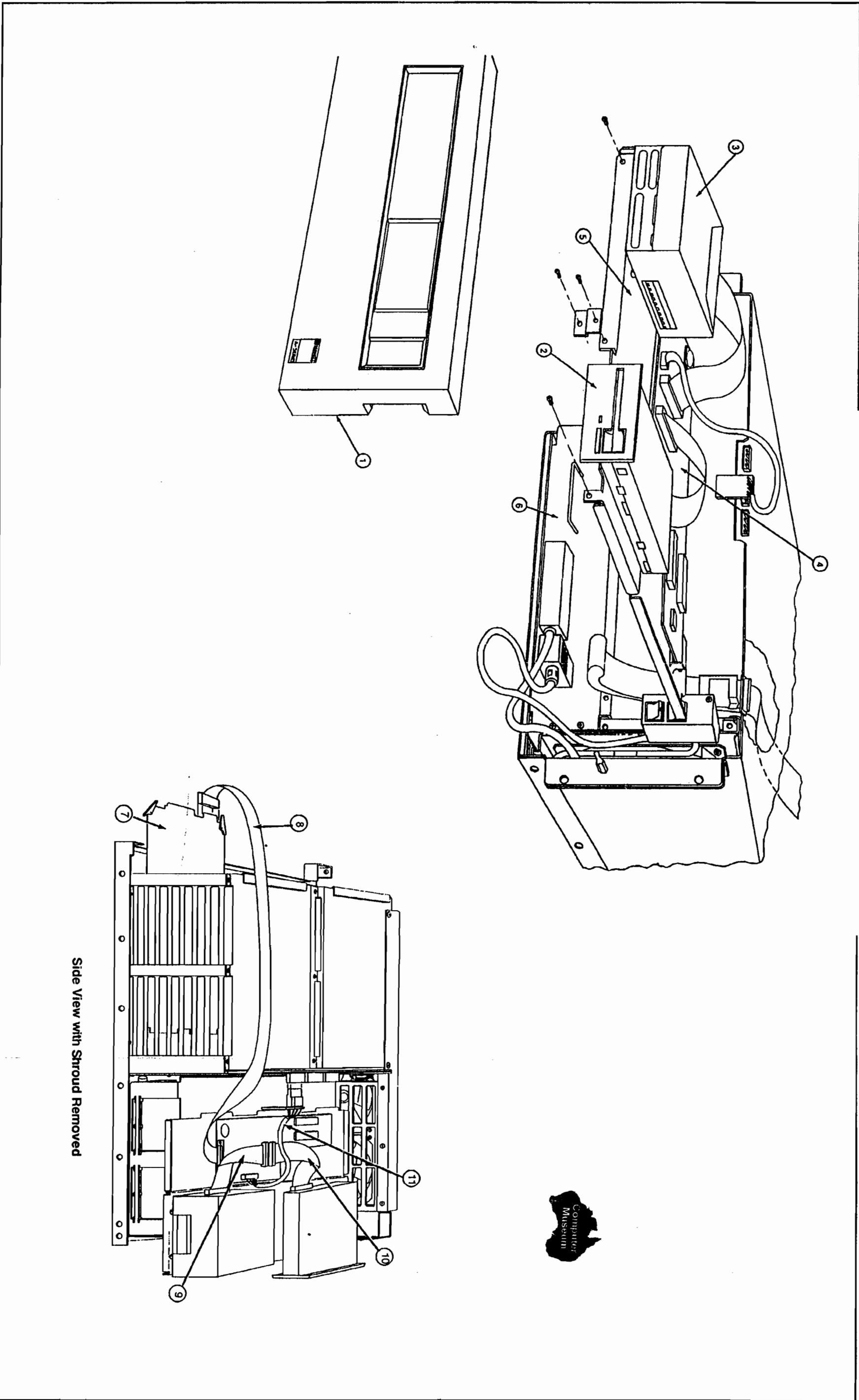


Figure 4-1. 16-Slot Box Exploded View
(Front) with Internal Disks

Replaceable Parts 4-5/4-6

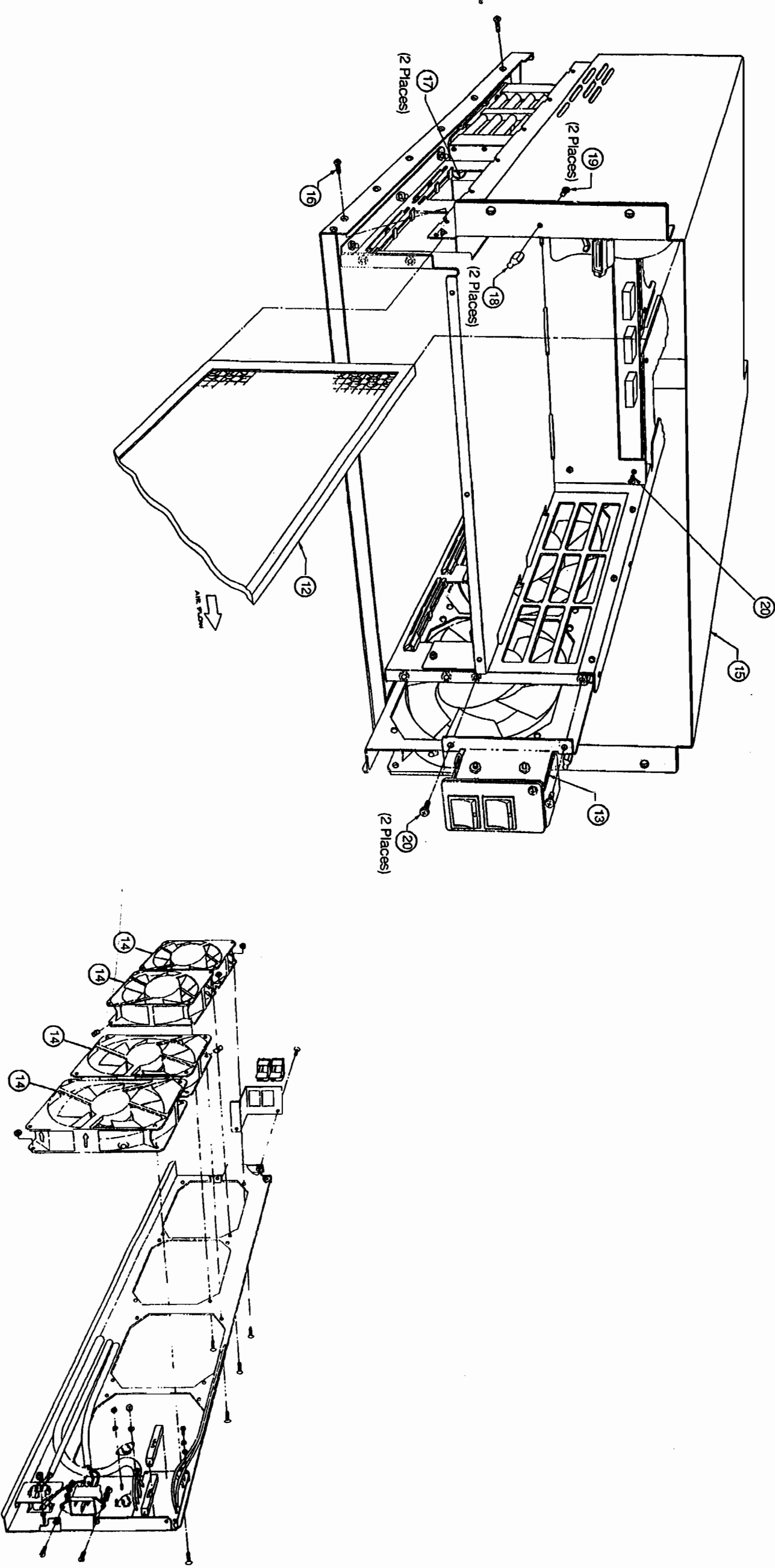


Figure 4-2. 16-Slot Box Exploded View (Front)

Replaceable Parts 4-7/4-8

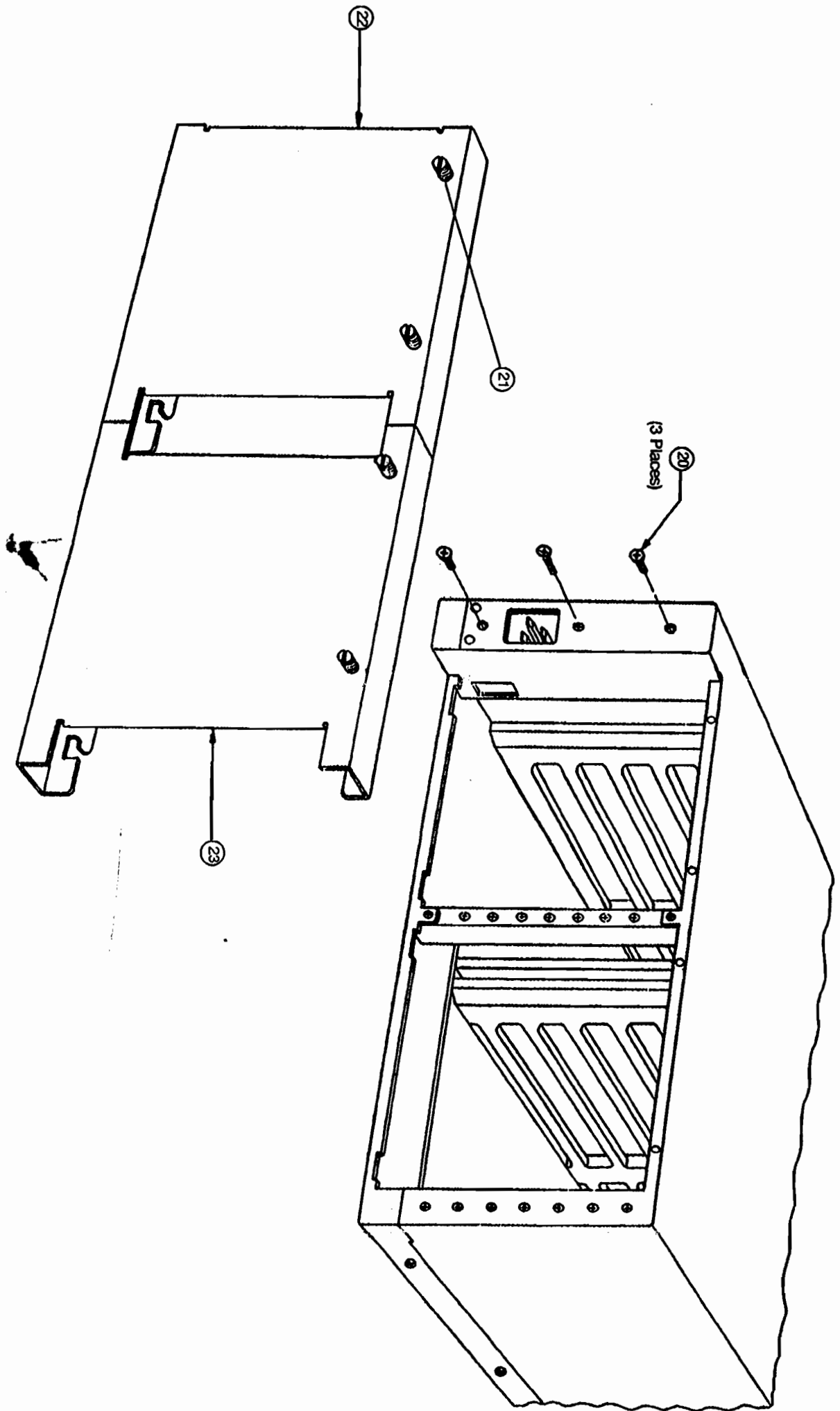


Figure 4-3. 16-Slot Box Exploded View
(Rear)

Replaceable Parts 4-9/4-10