

HP 1000 E-Series Computer HP 2109B and HP 2113B

Installation and Service Manual





**HP 1000
E-Series Computer
HP 2109B and HP 2113B
Installation and Service Manual**



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PRINTING HISTORY

The Printing History below identifies the Edition of this Manual and any Updates that are included. Periodically, Update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this Printing History page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past Updates, however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all Updates.

To determine what manual edition and update is compatible with your current software revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

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PREFACE

This manual provides installation and field service instructions for the Hewlett-Packard HP 1000 E-Series Computer. The HP 1000 E-Series Computer is a high technology product and, because of the product design, a modular replacement philosophy has been implemented to minimize on-site repair time.

Supporting documentation for the HP 1000 E-Series Computer are as follows:

- a. *HP 1000 E-Series Computer HP 2109B and HP 2113B Operating and Reference Manual*, part no. 02109-90014.
- b. *HP 1000 E-Series Computer HP 2109B and HP 2113B Installation and Service Manual*, part no. 02109-90015.
- c. *Standard Performance Memory Systems Installation and Service Manual*, part no. 5955-4310 or *High Performance Memory Systems Installation and Service Manual*, part no. 5955-4311.
- d. *HP 1000 E/F-Series Computer Microprogramming Reference Manual*, part no. 02109-90004.
- e. *HP 12979B Input/Output Extender Installation and Service Manual*, part no. 12979-90016.
- f. *HP 12979B Input/Output Extender Operating and Reference Manual*, part no. 12979-90014.
- g. *HP 12990B Memory Extender Installation and Service Manual*, part no. 12990-90007.
- h. *HP 1000 M/E/F-Firmware Installation Manual*, part no. 5955-4310.
- i. *Diagnostic Configurator Manual*, part no. 02100-90157.

An Engineering and Reference Document, part no. 92851-90001, is also available to those who wish indepth knowledge about the architecture and logic elements of the HP 1000 M/E/F-Series Computers. Consult your local Hewlett-Packard Sales and Service Office for details regarding this package. A list of HP Sales and Service Offices is provided at the back of this manual.

Throughout this manual the designations HP 1000 E-Series and HP 21MXE are both used interchangeably. The title HP 1000 E-Series, being the latest, will be used predominately.



DOCUMENTATION MAP

HP 1000 E-Series Computer
HP 2109B/HP 2113B
Operating and Reference Manual
02109-90014

12979B

12979B I/O Extender
Installation and Service Manual
12979-90016

12979B I/O Extender
Operating and Reference Manual
12979-90014

12898A Dual-Channel Port
Controller Installation Manual
12898-90001

21MX M & E Series Computer
I/O Interfacing Guide
02109-90006

2109B/2113B

HP 1000 E-Series Computer
Installation and Service Manual
02109-90015

12897B Dual-Channel Port
Controller Installation Manual
12897-90005

12892B Memory Protect
Installation Manual
12892-90007

Standard Performance
Memory Systems
Installation Manual
5955-4310

High Performance
Memory Systems
Installation Manual
5955-4311

12944B Power Fail Recovery
System Installation Manual
(for HP 2109B)
12944-90005

12991B Power Fail Recovery
System Installation Manual
(for HP 2113B)
12991-90004

12992 Loader ROM's
Installation Manual
12992-90001

Firmware

HP 1000 E/F-Series Computer
Microprogramming
Reference Manual
02109-90004

HP 1000 E/F-Series Computer
Microprogramming
Pocket Guide
02109-90008

M/E/F-Series Firmware
Installation and
Reference Manual
12791-90001

13047A User Control Store Kit
Installation and Service Manual
13047-90001

13197A Writable Control Store
Reference Manual
13197-90005

13306A Fast FORTRAN
Processor
Installation Manual
13306-90001

Accessories

M/E/F-Series Computer
I/O Interfacing Guide
02109-90006

HP 1000 M/E/F-Series
Engineering and Reference
Documentation
92851-90001

Diagnostic Configurator
Reference Manual
02100-90157

12903B Slide Mounting Kit
Installation Instructions
(for HP 2109/12979/12990)
12903-90002

12903C Slide Mounting Kit
Installation Instructions
(for HP 2113)
12903-90003

YOU
ARE
HERE

12990B

12990B Memory Extender
Installation and Service Manual
12990-90007

Standard Performance
Memory Systems
Installation Manual
5955-4310

High Performance
Memory Systems
Installation Manual
5955-4311

12991B Power Fail Recovery
System Installation Manual
(for HP 2113B)
12991-90004

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SAFETY CONSIDERATIONS

GENERAL - This product and relation documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOLS



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



Indicates hazardous voltages.



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

WARNING

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

CAUTION

The **CAUTION** sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not 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.

CAUTION

STATIC SENSITIVE DEVICES

Some of the semiconductor devices used in this equipment are susceptible to damage by static discharge. Depending on the magnitude of the charge, device substrates can be punctured or destroyed by contact or mere proximity to a static charge. These charges are generated in numerous ways such as simple contact, separation of materials, and normal motions of persons working with static sensitive devices.

When handling or servicing equipment containing static sensitive devices, adequate precautions must be taken to prevent device damage or destruction. Only those who are thoroughly familiar with industry accepted techniques for handling static sensitive devices should attempt to service the cards with these devices. In all instances, measures must be taken to prevent static charge buildup on work surfaces and persons handling the devices. Cautions are included through this manual where handling and maintenance involve static sensitive devices.

SAFETY EARTH GROUND - This is a safety class I product and is provided with a protective earthing terminal. An interruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

WARNING

EYE HAZARD

Eye protection must be worn when removing or inserting integrated circuits held in place with retaining clips.

This section provides installation instructions for the computer mainframe. Included in these instructions are site preparation data, unpacking and inspection, configuration requirements, installation procedures, performance verification, and recommended packing and shipping methods.

1-1. SITE PREPARATION

Site preparation information for the computer mainframe includes environmental limitations, power requirements, and mounting considerations. If the computer is purchased as part of a computer system, disregard the contents of paragraphs 1-2 through 1-5 herein and refer instead to the Configuration and Site Preparation Guide for your system.

1-2. ENVIRONMENTAL LIMITATIONS

Environmental limitations for operating and non-operating conditions of the computer are specified in table 1-1. The environmental limitations imposed by peripheral devices and associated components must be taken into consideration when the computer is located in the same area.

Table 1-1. Computer Environmental Limitations

AMBIENT TEMPERATURE	
Operating:	0° to 55°C (32° to 131°F)
Nonoperating:	-40° to 75°C (-40° to 167°F)
ALTITUDE	
Operating:	4,572 metres (15,000 feet)
Nonoperating:	12,192 metres (40,000 feet)
RELATIVE HUMIDITY	
20 to 95% at 25° to 40°C (77° to 104°F) without condensation.	

1-3. POWER REQUIREMENTS

The computer is shipped with the power supply configured to operate from a single-phase power source of 110 ±20% volts (standard) or 220 ±20% volts (option 015) as specified in the purchase order. Maximum power consumption of the HP 2109B and HP 2113B is 770 watts. Reconfiguring from 110V ac operation to 220V ac operation (or vice versa) is described in paragraph 2-61.

Various safety codes require that instrument chassis, panels, and housings be grounded to protect operating and service personnel. A grounded three-conductor female power outlet must be made available to satisfy this requirement.

1-4. COOLING REQUIREMENTS

There are no external cooling requirements for the computer. The internal fans provide adequate ventilation when operated within the environmental limitations specified in table 1-1. Adequate space must be allowed on each side to ensure full intake and exhaust of ventilating air.

1-5. MOUNTING CONSIDERATIONS

The computer may be used either as a freestanding device or mounted in a standard 483-millimeter (19-inch) equipment rack. When used in a mobile environment, the computer should be installed in a shock-mounted equipment rack. Rack-mounting dimensions for the computer are specified in table 1-2.

Table 1-2. Rack-Mounting Dimensions

COMPUTER	HEIGHT	WIDTH*	DEPTH**
HP 2109B	222 mm (8-3/4 in.)	426 mm (16-3/4 in.)	622 mm (24-1/2 in.)
HP 2113B	311 mm (12-1/4 in.)	426 mm (16-3/4 in.)	622 mm (24-1/2 in.)
*Behind rack mount.			
**Required rack depth.			

1-6. UNPACKING AND INSPECTION

The computer and accessories may be shipped in more than one container. When the shipment arrives, check to ensure the receipt of all containers as specified by the carrier's papers. Inspect each shipping container immediately upon receipt for evidence of mishandling during transit. If any container is damaged, or if any container is waterstained, request the carrier's agent be present when that container is opened.

Open the shipping container marked "MANUALS AND ACCESSORIES". One of the items in this package is a list of equipment supplied. Compare this list against the purchase order to verify that the shipment is correct. Unpack the shipping container(s) and inspect each item for external damage. Look for damage such as broken controls and connectors, dented corners, bent panels, scratches, and loose components. Check also the rigid foam-plastic cushioning (if used) for signs of deformation which could be indicative of rough handling during transit.

If the visual examination reveals any damage to the computer or accessories, follow the damage claim procedure described in paragraph 1-35. Retain the shipping container(s) and packing material for examination in the settlement of claims or for future reuse.

1-7. PHYSICAL INVENTORY

1-8. MANUALS

Check to ensure that all manuals listed on the list of materials have been received.

1-9. EQUIPMENT

1-10. COMPUTER. The computer model number and serial number are written on an identification label affixed to the lower front frame and covered by the Operator panel when closed. Ensure that both the model number and serial number are identical with those specified in the Installation Record. Typical identification and information labels are illustrated in figure 1-1.

If the computer 230V ac option is specified in the purchase order, it is installed and tested at the factory, and identified by the three-digit number, 015, written on the identification label and by the current/voltage rating on the metal tag attached to the rear panel of the power supply. Ensure that this number is identical with that specified in the Installation Record.

1-11. MEMORY SYSTEMS. The memory system and memory accessories specified in the purchase order are installed at the factory. The memory configuration is identified by the memory system model number and one or more accessory product numbers as illustrated in figure 1-1. Check these numbers to ensure the inclusion of the proper memory configuration specified in the Installation Record. Turn the key on the operator panel clockwise, lower the panel assembly to the memory access position, and remove the two screws and lockwashers holding the memory PCA cage cover. Remove the memory PCA cage cover and notice that the memory slot numbers are listed on the right-hand side of the memory PCA cage as shown in figure 1-2. These slot numbers are allocated to the functions listed in table 1-3, which shows that the memory controller PCA must be installed in slot 118 for an HP 2109B or in slot 123 for an HP 2113B. If an HP 2102B

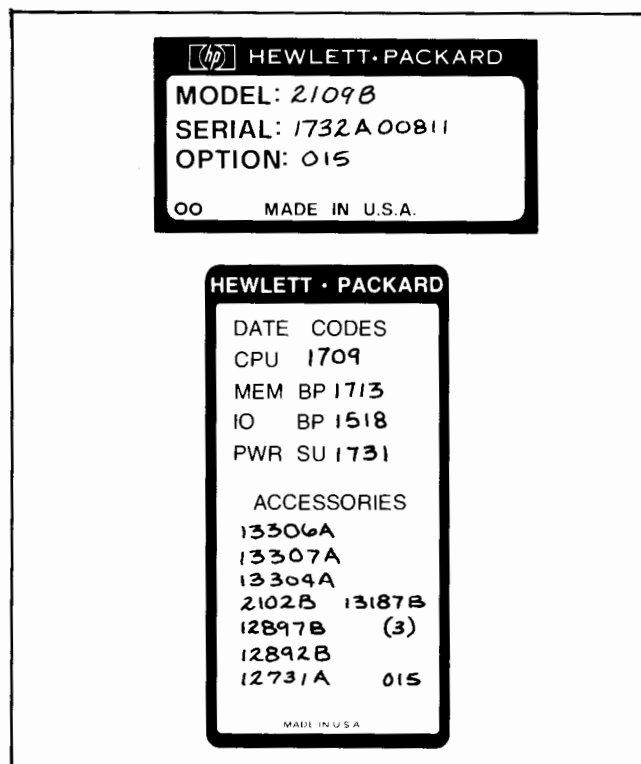


Figure 1-1. Typical Identification and Information Labels

Standard Performance Memory System is installed, the memory module PCA's may be configured for either 16k, 32k, or 128k bytes (8k, 16k, or 64k words) of memory. With 128k byte memory modules, dynamic mapping in the computer, and a HP 12990B memory extender, main memory can be expanded to 1792k bytes in the HP 2109B and 2048k bytes in the HP 2113B computer. The Standard Performance Memory modules may also be used with the Fault Control Memory Controller and Check Bit Array boards to provide a ten-fold or greater MTBF improvement of the memory system. The Fault Control Memory system which consists of a controller and one or more check bit array boards, along with the appropriate number of standard performance memory modules, is capable of correcting all single-bit memory errors and of detecting all double-bit and most multiple bit errors. The fault control system is particularly valuable in computer systems with large amounts of memory, or where fault-secure operation is essential. If an HP 2102E High Performance Memory System is installed, only the HP 12741A 32k byte (16k word) memory modules are used and the Fault Control Memory System cannot be used. Verify that all connectors are seated firmly onto the PCA's front edge connectors. Replace the memory PCA cage cover and secure the operator panel after closing by turning the key counter-clockwise until the panel is locked in place.

1-12. INPUT/OUTPUT INTERFACES. If input/output (I/O) interface PCA's have been ordered and are integrated into the computer system, remove the two screws and lockwashers holding the I/O cage cover in place

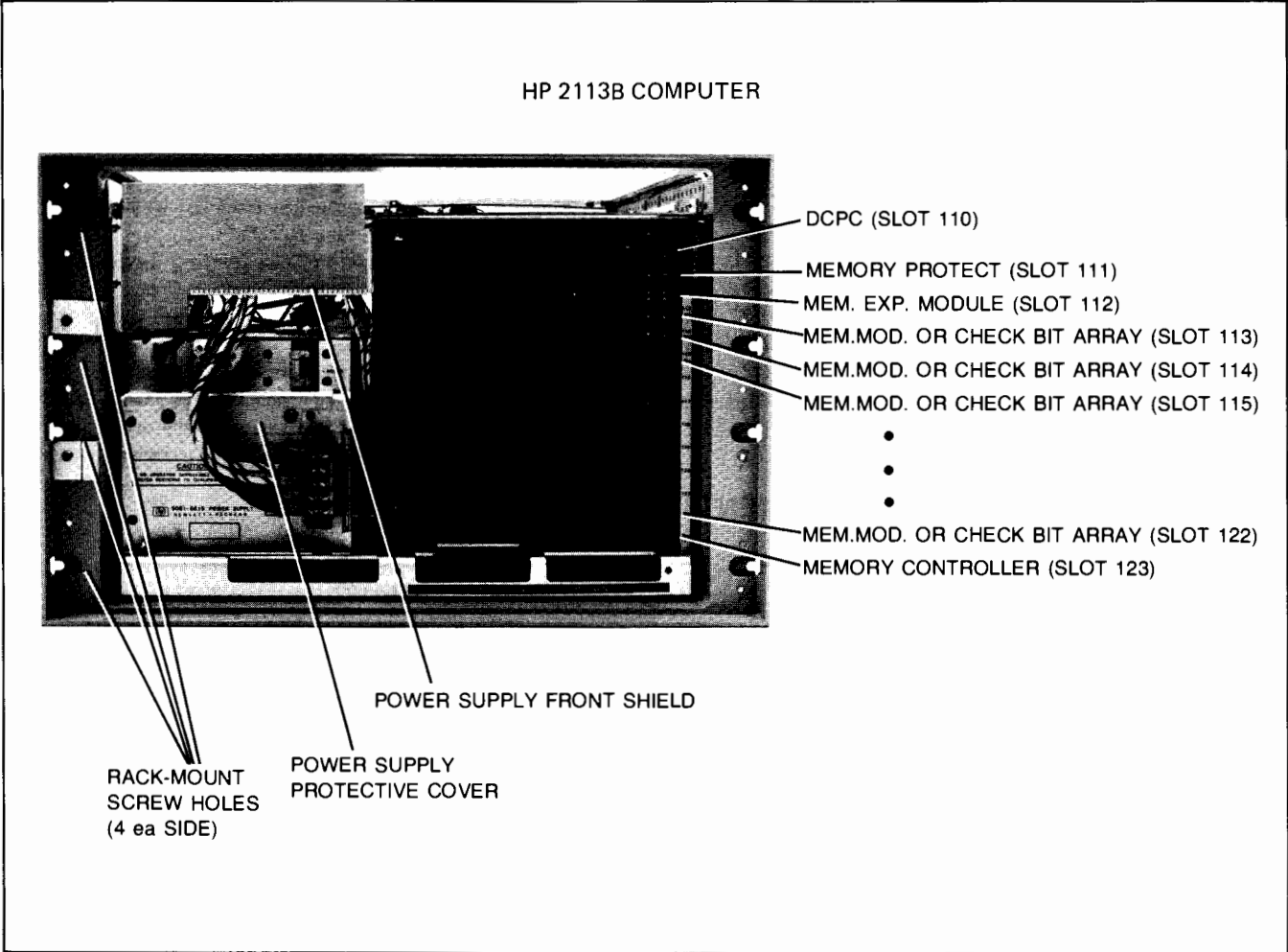
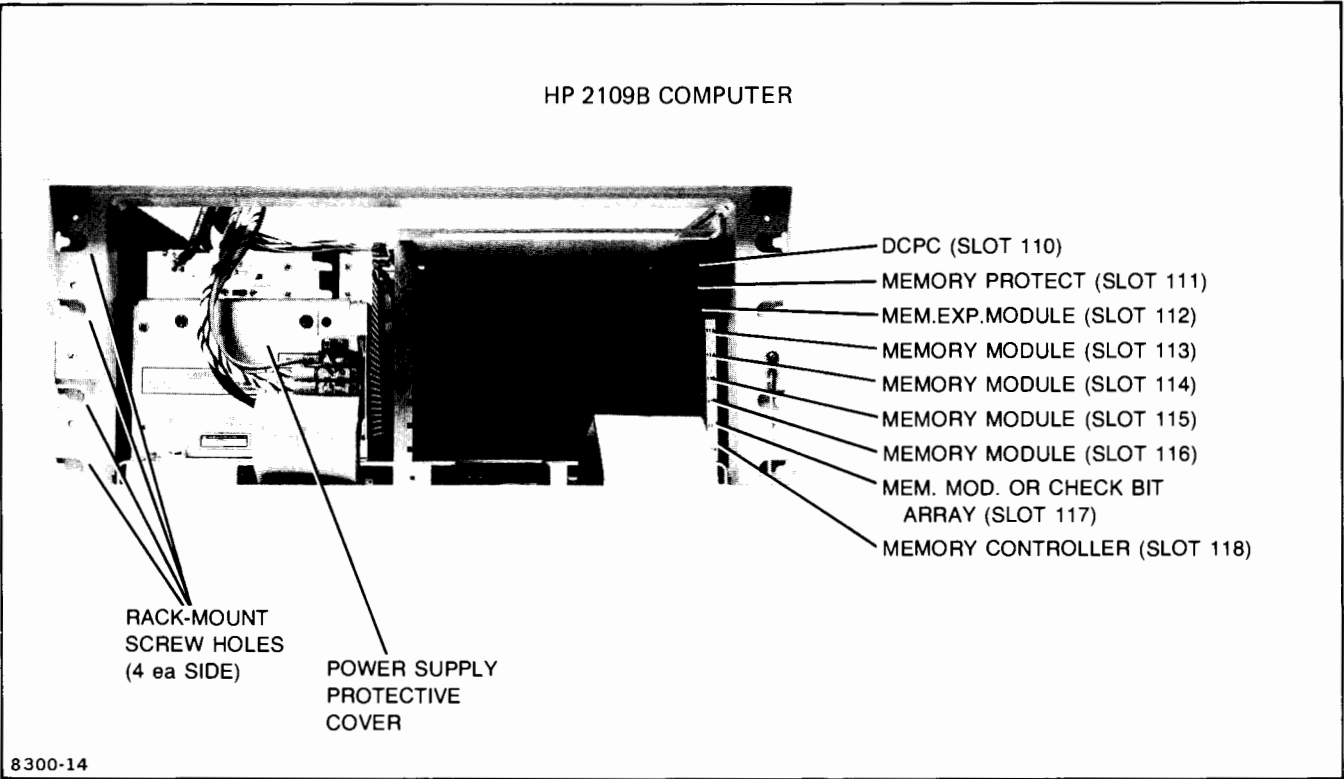


Figure 1-2. Computer Memory PCA Cage (Cage Cover Removed)

Table 1-3. Memory Slot Assignments

MEMORY SLOT	2109B ASSIGNMENTS	2113B ASSIGNMENTS
110	Dual Channel Port Controller	Dual Channel Port Controller
111	Memory Protect PCA	Memory Protect PCA
112	Memory Expansion Module	Memory Expansion Module
113	Memory Module	Memory Module
114	Memory Module	Memory Module
115	Memory Module or Check Bit Array	Memory Module
116	Memory Module or Check Bit Array	Memory Module
117	Memory Module or Check Bit Array	Memory Module
118	Memory Controller*	Memory Module
119	—	Memory Module or Check Bit Array
120	—	Memory Module or Check Bit Array
121	—	Memory Module or Check Bit Array
122	—	Memory Module or Check Bit Array
123	—	Memory Controller*
*Memory Controller must be installed in highest numbered slot (slot 118 for HP 2109B and slot 123 for HP 2113B).		

at the rear of the computer as shown in figure 1-3. Verify that the proper I/O interface PCA's have been furnished in accordance with the purchase order and as specified in the Installation Record. Replace the I/O PCA cage cover.

If I/O interface PCA's have been ordered separately, ensure that they have been furnished with the shipment and in accordance with the purchase order and as specified in the Installation Record.

1-13. I/O CABLES. Verify that all required cables for the interface PCAs have been furnished. When installing the I/O cables, ensure that the cables are connected with the cable-end on the right-hand side of the I/O Cage (nearest the power supply) as viewed from the rear of the computer. The I/O Cage Cover has an opening on this side to allow room for the cables.

1-14. CONFIGURATION REQUIREMENTS

1-15. INTERNAL SWITCH SETTINGS

Remove the I/O PCA cage cover and locate the two toggle switches (A1S1 and A1S2) mounted on the rear of the central processor unit PCA. (See figures 1-3 and 1-4.) The position of switch A1S1 determines the action that the computer will take in the event of a parity error (or memory protect violation assuming that a memory protect PCA is installed) and the position of switch A1S2 will enable or disable the power fail/automatic restart capability. The proper setting of each switch depends on whether or not a user-written subroutine will be included to accommodate the required computer action. Therefore, refer to paragraphs 1-16 and 1-17 and then consult with the system programmer to determine the proper switch settings. Programming considerations concerning these switches are

given in the *HP 21MX E-Series Computer HP 2109B and HP 2113B Operating and Reference Manual*, part no. 02109-90014.

Also mounted on the central processor unit (CPU) PCA are the remote program load (RPL) configuration switches. (See figure 1-5.) These switches are used as follows:

- Enable the remote program load (RPL) capability.
- Select one of our loader ROM's.
- Specify the select code of the loading device.

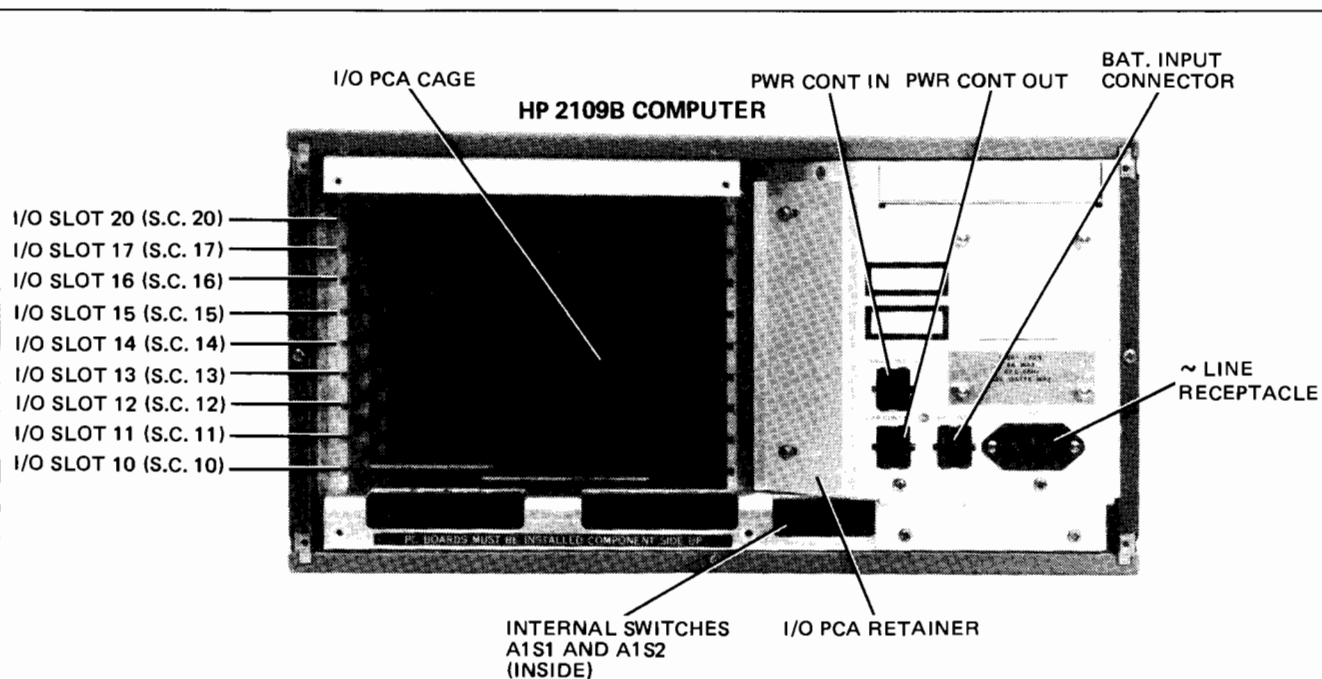
Configuration of these switches is described in paragraph 1-18.

1-16. PARITY ERROR SWITCH A1S1. The action that the computer will take when a parity error occurs is determined by the following alternative switch settings:

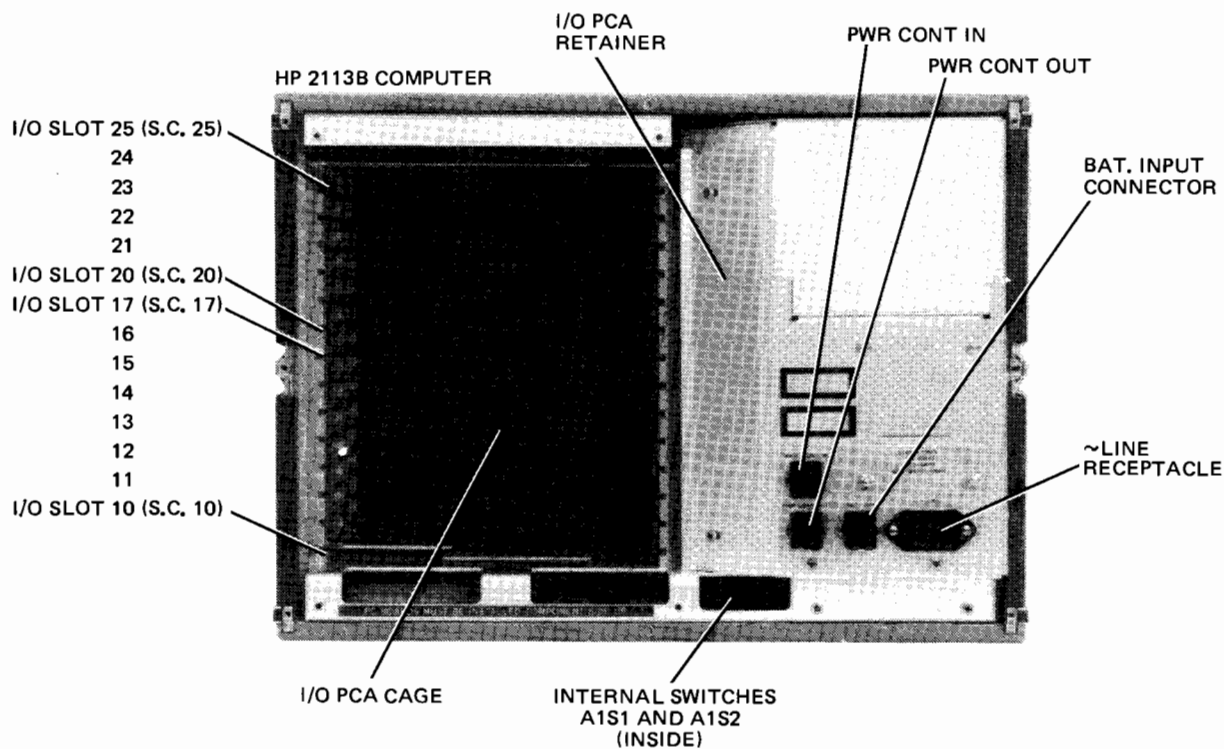
NOTE

Memory protect is an accessory available with the HP 2109B and HP 2113B Computers. As shown in table 1-3, the memory protect PCA is dedicated to memory slot 111.

- HALT.** When switch A1S1 is in the HALT position and a parity error is detected during a read cycle, the computer will halt and light the PARITY indicator on the operator panel. The PARITY indicator will remain lighted until the PRESET switch is pressed.
- INT/IGNORE.** When switch A1S1 is in the INT/IGNORE position and a parity error occurs, the computer will take one of the following two actions depending on whether or not the memory protect PCA is



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Figure 1-3. Computer I/O PCA Cage and Rear Panel

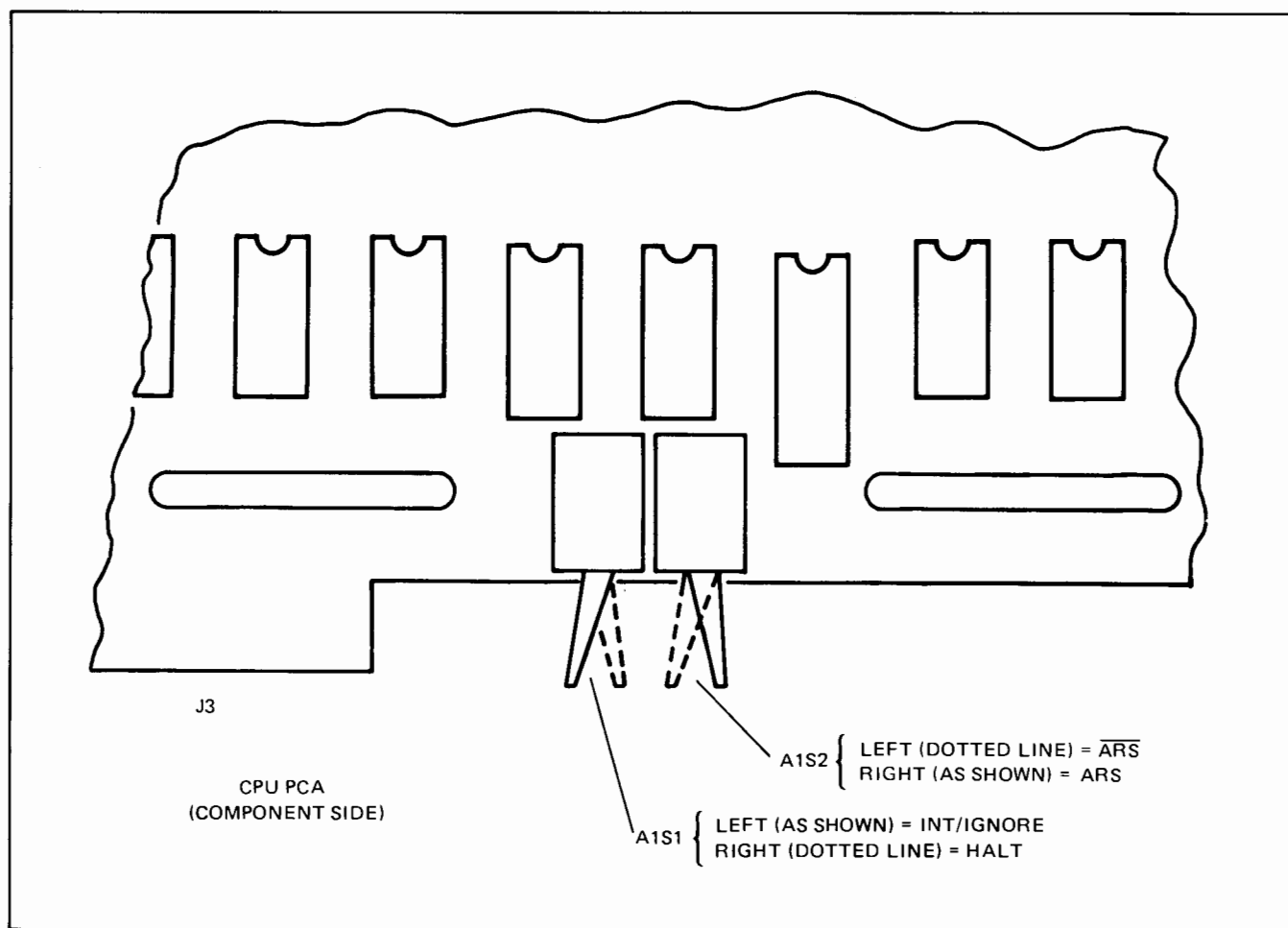


Figure 1-4. Internal Switch Configuration

installed:

- (1) If the memory protect PCA is installed and parity error interrupt has not been disabled by a CLF 05 instruction, an interrupt to memory location 00005 is generated.
- (2) If the memory protect PCA is not installed, or if the memory protect PCA is installed but the parity error logic has been disabled by a CLF 05 instruction, the parity error will be ignored and the PARITY indicator will light and remain lighted until the PRESET switch is pressed.

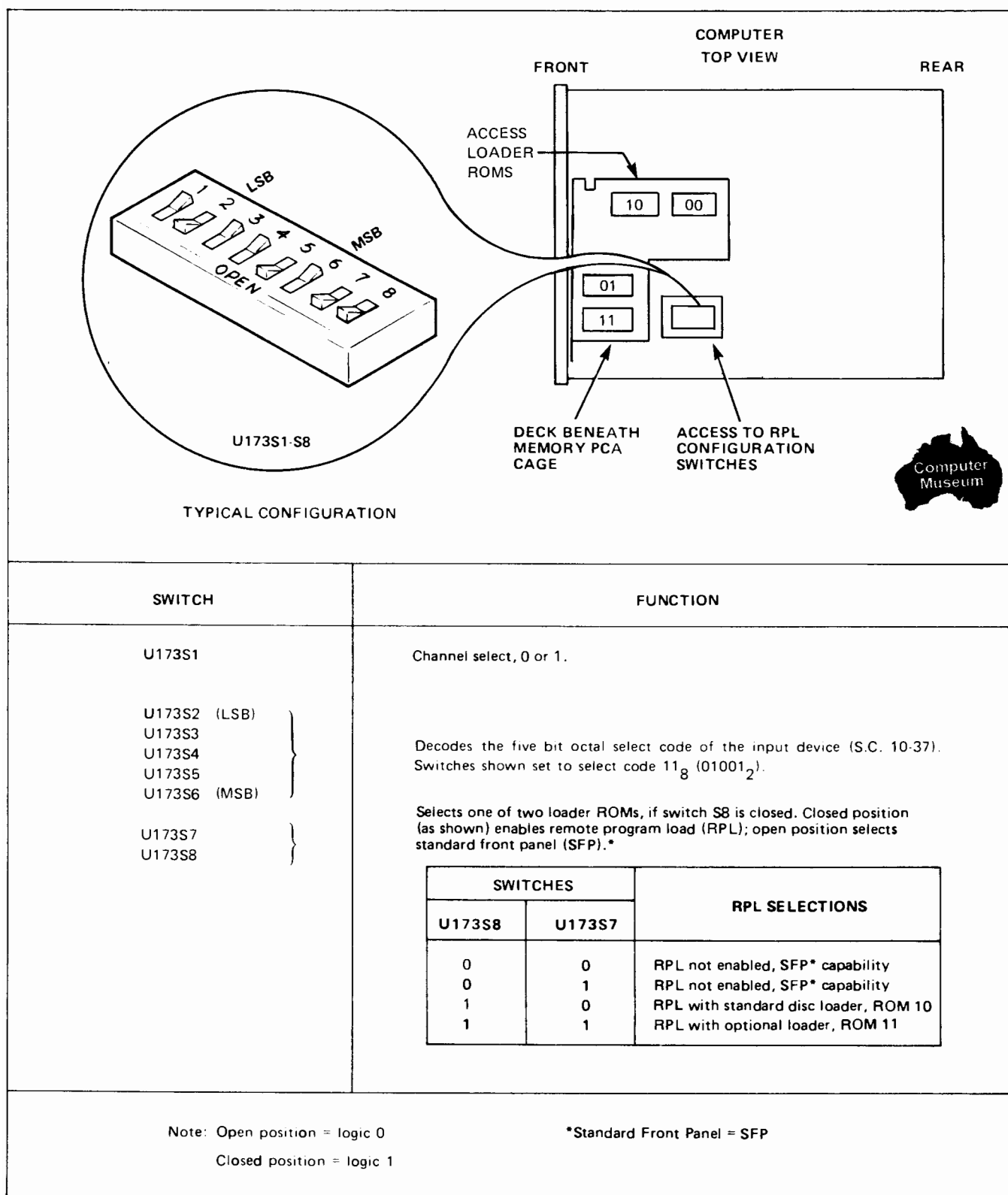
1-17. AUTOMATIC RESTART SWITCH A1S2. The action that the computer will take upon the restoration of primary power (following a momentary or prolonged power failure) is determined by the following alternative switch settings:

- a. **ARS.** The automatic restart feature is enabled when switch A1S2 is in the ARS position. After a built-in time delay of about half a second following the return to normal power levels, the computer will go into the

RUN mode and interrupt to memory location 00004_s provided that the memory was sustained. This permits entry into a restart program. If memory was not sustained, the computer will halt after the firmware diagnostic is completed. The POWER FAIL indicator will light when power is restored regardless of whether or not memory was sustained.

- b. **ARS.** The automatic restart feature is disabled when switch A1S2 is in the ARS position. The computer is halted immediately regardless of whether the computer was running or halted when the power failure occurred.

1-18. REMOTE PROGRAM LOAD CONFIGURATION SWITCHES. *NOTE: The RPL feature is fully described in the Operating and Reference Manual for the HP 2109B/HP 2113B Computers.* As shown in figure 1-5, the remote program load (RPL) configuration switches consist of eight miniature rocker switches mounted on the CPU PCA at location U173S1-S8. These switches are shipped from the factory unconfigured and set to the open position. The switches may be configured, if the computer is shipped as part of a system. The user does not need to



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Figure 1-5. Remote Program Load Configuration Switches

alter the RPL configuration switches if the RPL feature is not to be employed. If the RPL capability is desired, these switches are set to match the system's bootstrap loader configuration as follows:

NOTE

An optional Loader ROM is required for remote program load; See HP 12992 Loader ROM Installation Manual, part no. 12992-90001 for optional ROM product numbers.

CAUTION

All contents of the memory will be lost when a PCA is removed from or installed in the memory PCA cage. Therefore, before turning off line and battery power, ensure that any memory contents to be saved are stored in another device for later retrieval.

- a. Turn key on operator panel clockwise and lower the panel to the access position.
- b. Set the ~ POWER switch to OFF.
- c. Set the BATTERY switch to the OFF position, if a Power Fail Recovery system is being used.
- d. Remove the two screws and lockwashers securing the memory PCA cage cover to the memory cage and remove the memory PCA cage cover.
- e. Disconnect cable assembly from all memory PCA's and DCPC cable assembly (if installed) from DCPC PCA.
- f. Remove all PCA's from memory PCA cage by pulling outward on extractor levers.
- g. At bottom of memory PCA cage, locate opening in deck for the RPL configuration switches (U173S1-S8) as shown in figure 1-5.
- h. Consult with the system programmer and configure the RPL configuration switches to match the system's bootstrap loader configuration.

Figure 1-5 gives the function of each switch and an example of a typical configuration. The RPL capability is selected by setting switch U173S8 to the closed position as shown in figure 1-5. With the RPL enabled, bit 7 selects which of the two loader ROMs (ROM loader socket 10 or 11) will be used for the RPL routine. With RPL disabled control is passed to the standard front panel where program loading can be started manually. The I/O select code of the input device is configured by switches U173S2 through U173S6. Switch U173S1 selects the I/O device channel. The example in figure 1-5 shows the RPL enabled

with loader ROM socket 11 selected and select code 11 (octal) as the I/O device on channel 0.

There are four loader ROM sockets numbered 00, 01, 10, and 11. The HP 2109B and HP 2113B computers come equipped with loader ROM 00 (paper tape loader ROM) in socket 00 and loader ROM 10 (7900/7905 disc loader ROM) in socket 10, leaving two sockets (01 and 11) available for additional loader ROMs. ROM loader sockets 10 and 11 are used with RPL if it is enabled. They are selected by switch U173S1 as illustrated in figure 1-5. To remove or install ROM's in sockets 00 and 10, it is necessary to remove the CPU PCA (see paragraph 2-13).

After setting the RPL configuration switches, replace all PCA's in memory PCA cage, reconnect cable assemblies, and reinstall memory PCA cage cover and close the operator panel.

1-19. I/O PRIORITY ASSIGNMENT

Each peripheral device in the system must be connected to the computer through an interface PCA installed in the I/O PCA cage. A priority chain connects all interface PCA's in series to prevent simultaneous interrupt requests from two or more peripherals. The priority of the interface PCA is determined by the I/O slot that the PCA occupies, with slot 10 (select code 10₈) having the highest priority; the highest numbered I/O slot has the lowest priority. (See figure 1-3.) Interrupts from a higher priority device inhibit lower priority interrupts by breaking the priority chain. If the interrupt mode is used, there can be no vacant slots from select code 10₈ to the highest select code used due to the priority chaining scheme.

From a standpoint of time, it is more economical to assign the higher priorities to high-speed devices. However, if a subsystem could suffer catastrophic information loss if not serviced immediately, then that subsystem should be assigned the highest priority regardless of speed.

Refer to the individual interface or subsystem documentation for installation details concerning I/O PCA jumper assignments (if any) and priority considerations. Then confer with the system programmer to establish the desired I/O device priority and configure the I/O PCA cage accordingly.

1-20. INSTALLATION PROCEDURE

1-21. MANUAL UPDATING

Before installing the computer, perform any updating that may be required for the HP 21MX E-Series HP 2109B and HP 2113B Computer documentation. (A list of directly related hardware and software documentation is provided in the preface to this manual.) Updating instructions (if any) are provided in a supplement supplied with the appropriate document.

Table 1-4. Installation Test Equipment

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED MODEL
Digital Voltmeter	dc: At least four-digit readout. Minimum input impedance 10 megohms; full-scale ranges of 1.0000 and 100.00 volts dc. ac: Readout capable of measuring ac line voltage to $\pm 1.0\%$. Voltage range must be from 88 to 132 volts ac (standard) or 176 to 264 volts ac (option 015).	HP 34740A 4-digit display HP 34702A Multimeter Plug-In
Variable Autotransformer	Capable of reducing computer input line voltage to 80 volts ac (standard) or 160 volts ac (option 015); rated at least 1100 voltamperes.	None

1-22. TOOLS AND TEST EQUIPMENT REQUIRED

1-23. TOOLS. No installation tools other than ordinary handtools are required.

1-24. TEST EQUIPMENT. Test equipment required to verify the adequacy of the ac power outlet and the proper adjustments of the computer power supply are listed in table 1-4.

1-25. AC POWER OUTLET AND EXTERNAL GROUND

The female power outlet to be used to supply ac power to the computer must be checked by a qualified electrician to ensure that it furnishes the proper voltage for which the computer is configured. The outlet and its associated wiring and fuses (or circuit breakers) must be capable of carrying the current specified on the label on the computer rear panel. (See paragraph 1-10.)

Figures 1-6 and 1-7 illustrate and provide the necessary details of the various ac power cord configurations. If the computer is to be installed in a building, make sure that the local electrical code permits the use of the type of power cord furnished with the computer.

Have a qualified electrician check the power outlet with an ac voltmeter to ensure that the required single-phase voltage is present. If the computer is configured for 110-volt operation, the line voltage must be in the range of 88 to 132 volts ac (rms); for 220-volt operation, the line voltage must be in the range of 176 to 264 volts ac (rms). Bear in mind that the electrical load imposed by the computer and its accessories may reduce the line voltage below the no-load value.

If the line voltage is in the correct range, have the electrician also check the power outlet to ensure that it is wired correctly with respect to ac high potential, ac neutral, and earth ground. If the outlet is wired improperly, correction must be made by a qualified electrician. Local electrical codes must be observed if the installation is inside a building.

For safety reasons, it is *mandatory* that a connection be made between the computer chassis and earth ground. For installation in a mobile environment (e.g., ship, aircraft, or train), the earth ground wire in the computer ac power cord must be connected to the hull or metal frame of the vehicle.

An uninterruptible safety earth ground connection of no more than 6 ohms resistance must be provided to the computer via the power cables from the service entrance ground bus in accordance with local electrical code requirements. In addition, the voltage differential between neutral and earth ground shall not exceed 1-volt when measured at the computer power line input terminals. The fluctuation of this value must not exceed 25 millivolts peak-to-peak.

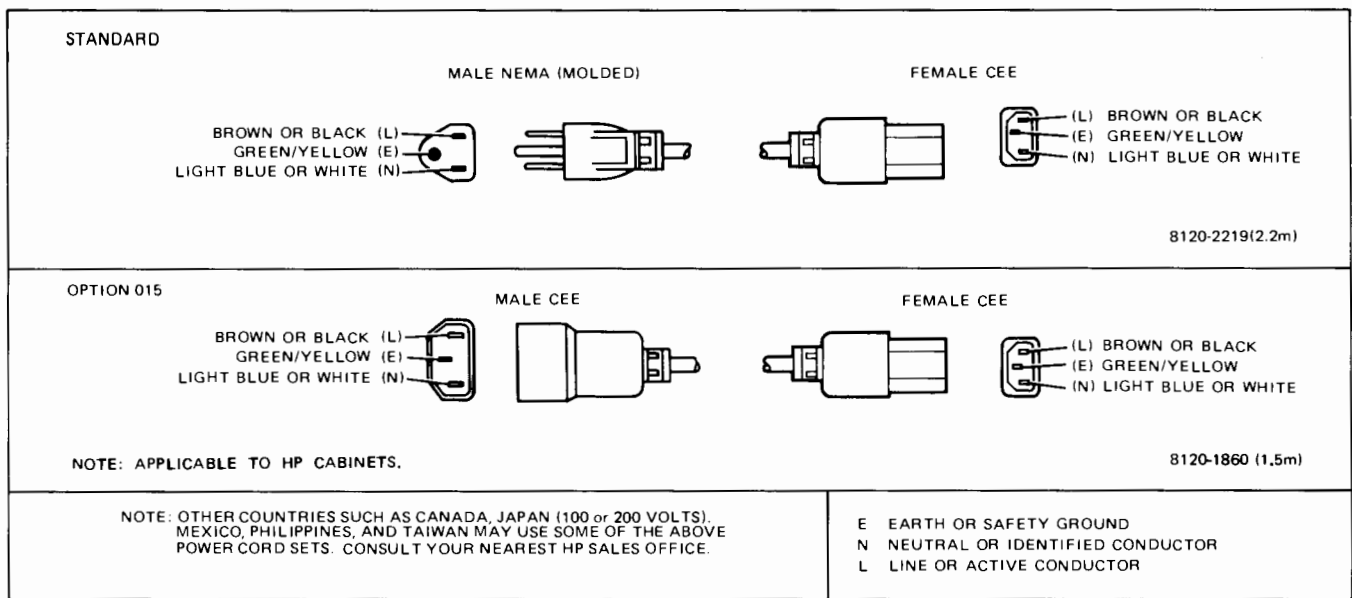
1-26. COMPUTER MOUNTING

1-27. BENCH MOUNTING. As stated in paragraph 1-5, the computer may be used as a freestanding instrument in a land-based environment. The only consideration here is that adequate space be allowed on each side to ensure full intake and exhaust of ventilating air and that all covers are installed. Bear also in mind that a minimum 30.5 centimeters (12 inches) of clearance behind the computer rear panel is required when removing and installing input/output interface PCA's.

1-28. RACK MOUNTING. The following chassis slide kits are available for rack mounting the computers:

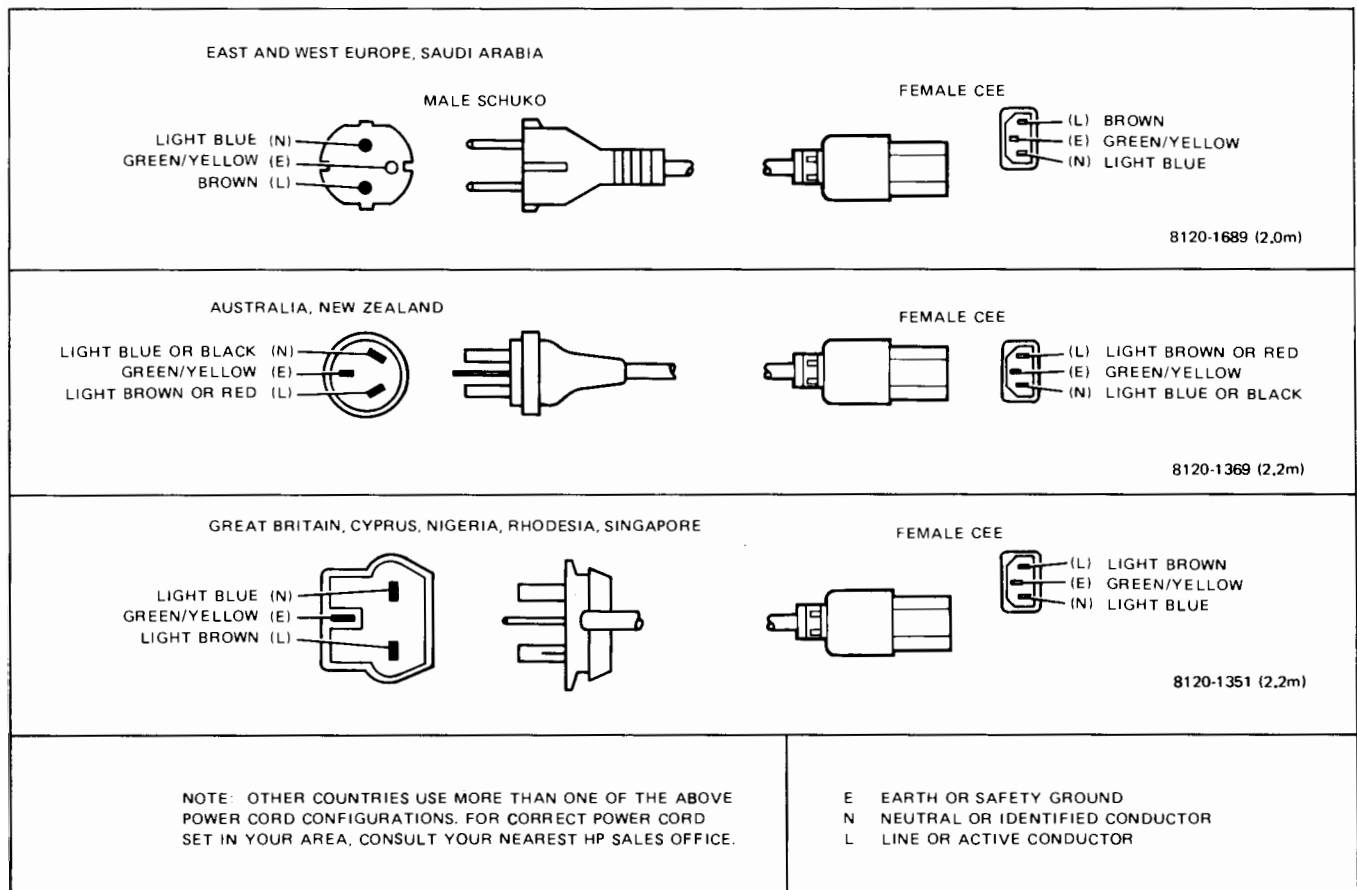
<u>COMPUTER</u>	<u>CHASSIS SLIDE KIT</u>
HP 2109B	HP 12903B
HP 2113B	HP 12903C

If a chassis slide kit has been ordered, mount the components to the sides of the computer and to the inside of the rack according to the instructions furnished with the kit. Then install the computer in the rack and secure the computer in place with screws inserted through the mounting holes identified in figure 1-2. The HP 2109B is light enough to allow installation in the rack without



7113.7

Figure 1-6. AC Power Cord Set (USA)



7113.8

Figure 1-7. AC Power Cord Sets (Non-USA)

being supported by any means other than the rack-mounting screws; however, it is strongly recommended that additional support be provided by chassis slides or slide rails. It is recommended that the HP 2113B be supported by chassis slides or slide rails.

WARNING

Ensure cabinet or system stability before extending computer on its chassis slides.

1-29. POWER SUPPLY CHECK

Verify the tolerances of the various power supply voltages as described in the following paragraphs. The power supply should be checked with all memory and I/O PCA's installed in the computer.

1-30. POWER SUPPLY ACCURACY. Energize the digital voltmeter and allow sufficient warm-up to reach its rated accuracy. Proceed as follows:

WARNING

Hazardous voltages are present inside the computer mainframe!! Only qualified service personnel should perform the power supply accuracy checks. Before performing the power supply accuracy checks, set ~POWER switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury.

- Turn the key on the operator panel fully clockwise and lower the panel to the access position.
- Plug computer power cord into the power outlet and set extender ~POWER switch to ON. Set the LOCK/OPERATE switch to OPERATE.
- Check the fault status LED on the front of the power supply. The LED is visible through the hole indicated in figure 1-8.

NOTE

If the fault status LED is ON or FLASHING, a fault condition exists. Notify the nearest Hewlett-Packard Sales and Service Office. A list of Sales and Service Offices is provided at the rear of this manual.

- If the fault status LED is OFF, proceed and check the tolerances of all output voltages at the crossover test points. Test points are shown in figure 1-9 and tolerances are listed in table 1-5.

SUPPLY VOLTAGE	MAXIMUM CURRENT	SUPPLY VOLTAGE		TEST POINT
		UPPER LIMIT	LOWER LIMIT	
+5V I/O	50A	+5.25Vdc	+5.00Vdc	A6 Crossover Assy +5V
+5V M	4.5A	+5.25Vdc	+5.00Vdc	A6 Crossover Assy +5M
+12V I/O	2.5A	+12.6Vdc	+11.4Vdc	A6 Crossover Assy +12V
+12V M	2.0A	+12.6Vdc	+11.4Vdc	A6 Crossover Assy +12 M
-2V I/O	4.0A	-2.2Vdc	-1.8Vdc	A6 Crossover Assy -2V
-12V I/O	2.0A	-12.6Vdc	-11.4V	A6 Crossover Assy -12M
-12V M	250mA	-16Vdc (Unregulated)	-9Vdc	
+30V I/O	250mA	+42Vdc (Unregulated)	+22Vdc	A6 Crossover Assy J2 Pin 4

Table 1-5. Computer Power Supply Voltages and Tolerances



NOTE

If one or more voltages are out of tolerance, notify the nearest Hewlett-Packard Sales and Service Office. A list of Sales and Service Offices is provided at the rear of this manual.

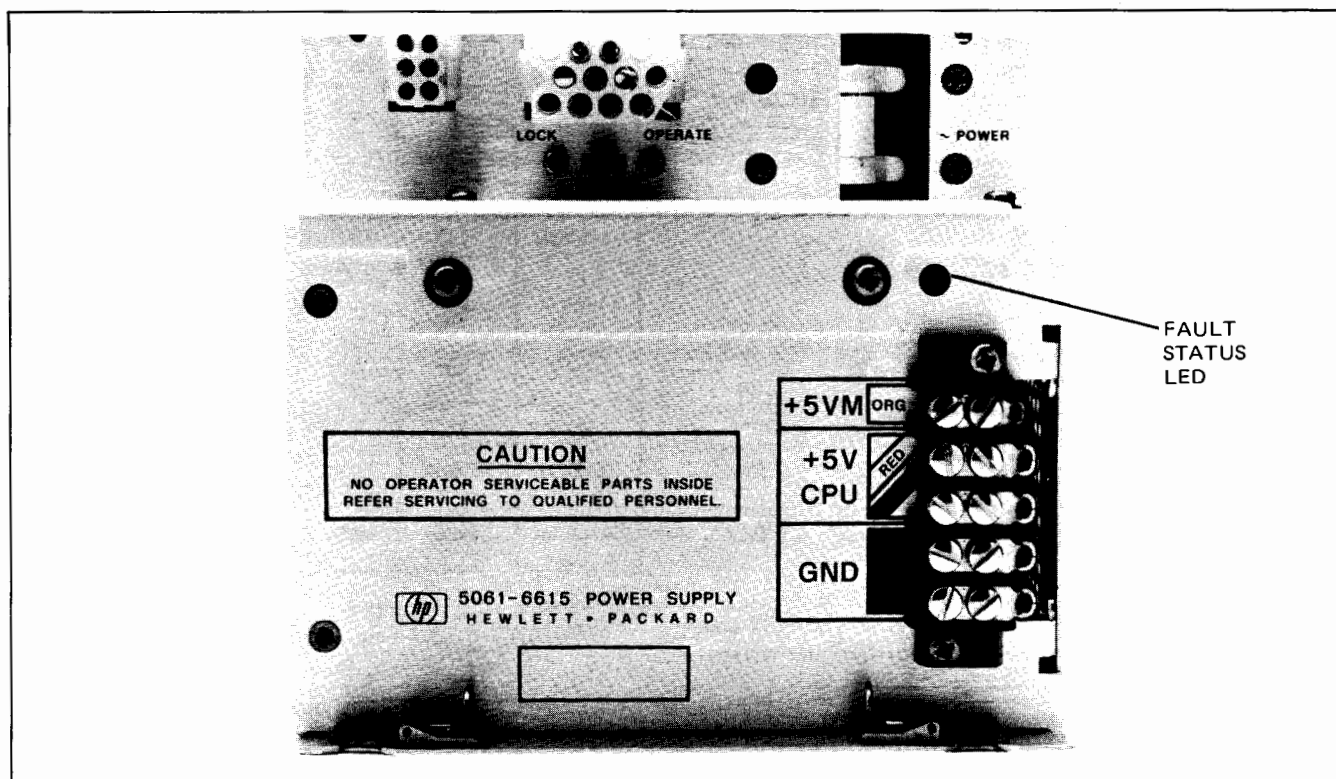
1-31. POWER-UP THRESHOLD. The power-up threshold is below the lower limit of the mains voltage configuration, 88 volts rms (standard) or 176 volts rms (option 015). This threshold is non-adjustable.

1-32. INTERFACE PCA

1-33. INTERFACING CABLING. Cable requirements to interconnect interface PCA's and associated peripherals are specified in the appropriate interface kit or subsystem documentation. After all interface cables have been assembled, lower the operator panel to the access position, set the ~POWER switch to OFF, disconnect the battery cable, if present, and remove the input/output PCA cage cover. Install the hooded connector of each cable onto the edge connector of the interface PCA's from the right-hand side, as viewed from the rear of the computer. Connect the opposite end of each cable to the appropriate peripheral device, replace the I/O PCA cage cover. Ensure that the Battery switch is OFF and connect the Battery cable, if present, to the BAT INPUT connector.

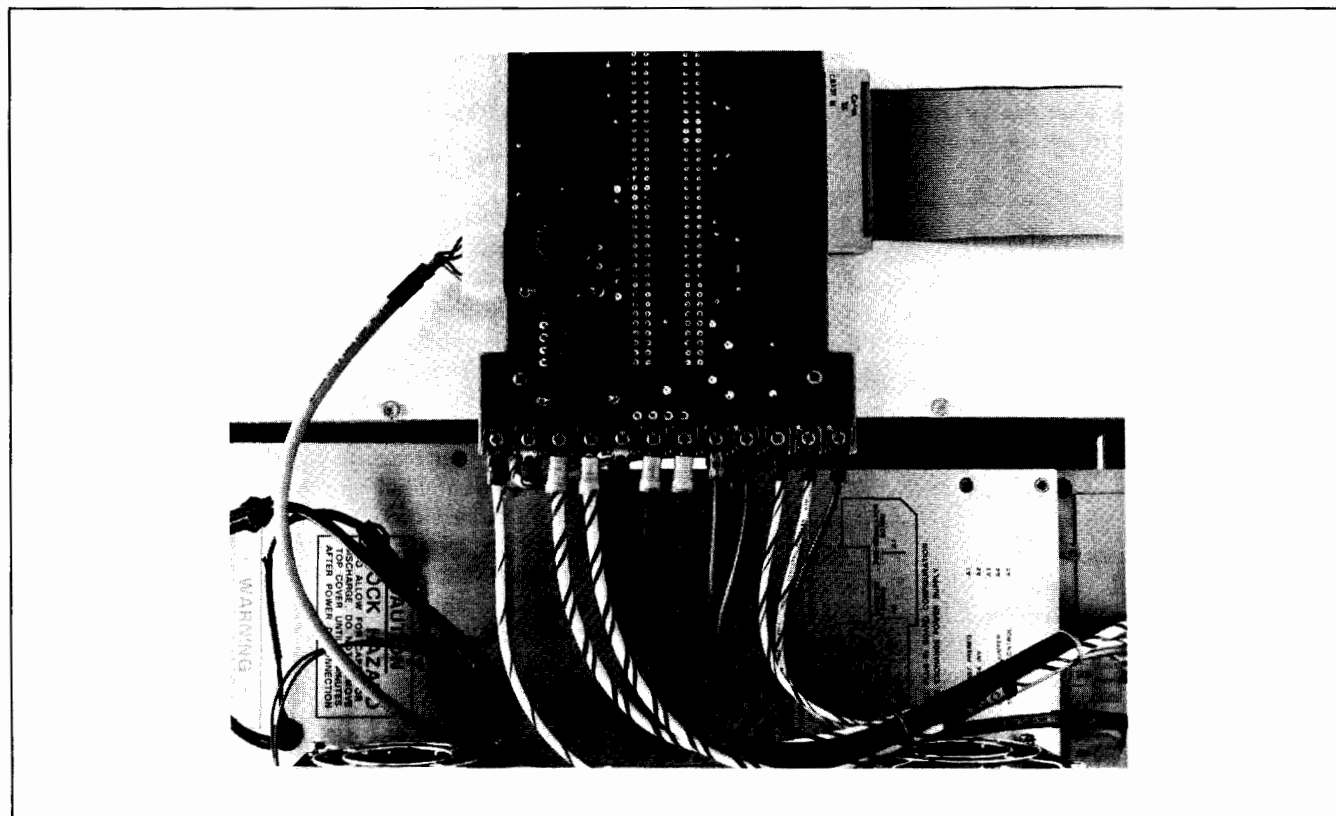
NOTE

If the Power Fail Recovery System boards (A3A3 and A3A4) are installed in the power supply, the computer *will not* start if the Battery cable is not connected.



8300-16

Figure 1-8. Power Supply Fault Status LED



8300-17

Figure 1-9. Crossover PCA Voltage Test Points

Set the LOCK/OPERATE switch to OPERATE and the ~ POWER switch to ON, and if a power fail recovery system is installed, set the Battery switch to INT.

1-34. PERFORMANCE VERIFICATION CHECK

Verify the system installation and operation by running the diagnostic programs outlined in figure 2-1 sheet 2 of this manual. The following hardware is required for the diagnostic:

- a. At least 8k bytes of memory.
- b. A diagnostic input device.

1-35. CLAIMS PROCEDURE

If the shipment is incomplete or if the equipment is damaged or fails to meet specifications, notify the nearest Hewlett-Packard Sales and Service Office. If damage occurred in transit, notify the carrier also. Hewlett-Packard will arrange for replacement or repair without waiting for settlement of claims against the carrier. In the event of damage in transit, retain the packing carton and packaging materials for inspection.

1-36. REPACKAGING FOR SHIPMENT

CAUTION

When shipping the computer with a power fail recovery system installed, the following procedure must be followed:

- a. The battery box must be securely fastened to the computer.
- b. Set the BATTERY switch to OFF, disconnect the battery cable from the BAT INPUT connector and place protective sleeving or masking tape over the battery leads.
- c. Place protective sleeving or masking tape over the BAT INPUT connector.

When shipping a power fail recovery system that is not installed in the computer, follow steps b and c above.

1-37. SHIPMENT USING ORIGINAL PACKAGING

The same containers and materials used in factory packaging can be used for reshipment of the computer. Alternatively, containers and packing materials may be obtained from Hewlett-Packard Sales and Service Offices. If the computer is being returned for servicing, attach a tag to the computer specifying the type of service required together with the computer model number and full serial number. Mark the container "FRAGILE" to ensure careful handling. In any subsequent correspondence, refer to the computer by model number and full serial number.

1-38. SHIPMENT USING NEW PACKAGING

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

- a. Wrap the computer in heavy paper or sheet plastic. If shipping the computer back to Hewlett-Packard, first attach a tag to the computer with the return address and indicating the type of service required. Include the computer model number and full serial number.
- b. Use a strong shipping container. A double-wall carton constructed of 2.41 MPa (350-psi) test material is adequate.
- c. Use sufficient shock-absorbing material on all sides of the computer to provide a firm cushion and to prevent movement inside the container. Use particular care to protect the computer corners and front and rear panels.
- d. Seal the shipping container securely and mark it "FRAGILE".
- e. In any subsequent correspondence with Hewlett-Packard refer to the computer by model number and full serial number.



This section includes preventive maintenance; a troubleshooting flowchart for isolating malfunctions to the subassembly level; procedures for removing and replacing the various computer subassemblies; and a listing of the backplane signal sources and destinations, signal mnemonics, and mnemonic definitions. Also included are a simplified block diagram and a power distribution diagram.

2-1. PREVENTIVE MAINTENANCE

The preventive maintenance outlined in table 2-1 should be performed on a semiannual basis under normally clean operating conditions. If the adverse conditions are more severe, perform the preventive maintenance as often as necessary.

Table 2-1. Preventive Maintenance

1. Clean equipment exterior and interior.
2. Using digital voltmeter (table 1-4), check power supply voltages as specified in paragraph 1-30.
3. Check fans for proper operation.
4. Check operation of all operator panel switches and indicators.
5. If installed perform the Fault Control Preventive Maintenance as specified in the appropriate Memory System Installation and Service Manual, part no. 5955-4310 or 5955-4311.
6. Perform the verification check as specified in paragraph 1-34.

2-2. TROUBLESHOOTING

2-3. SUBASSEMBLY LEVEL

Computer malfunctions can be isolated to the subassembly level by performing in sequence the procedure presented in figure 2-1. When a malfunction is encountered, replace the first suspect subassembly and repeat that portion of the procedure where the malfunction occurred. (Subassembly removal and replacement procedures are given in following paragraphs.) If the malfunction persists, reinstall the original subassembly, replace the next suspect subassembly, and again repeat the procedure. After the malfunction is cleared, contact the nearest

Hewlett-Packard Sales and Service Office for instructions regarding shipment of the defective subassembly.

2-4. FIRMWARE DIAGNOSTIC. The computer is furnished with a standard microprogrammed base set that includes three tests that quickly test the computer and memory. These firmware diagnostics are not designed as a substitute for more complex software diagnostics and it may frequently be the case that you require a more thorough and detailed testing than provided by these standard self-test routines.

Test 1 tests most of the computer registers and functions. This test will not alter or destroy the contents of any working register or memory. An error condition will set all display register indicator bits (A, B, M, T, P, S) and the overflow register. The execution time is negligible.

Test 2 is a fast microprogrammed memory test that checks the presently enabled memory space (up to 64k bytes). The microprogram reads each memory location, complements the data and writes it back, reads it, compares it to expected data, then complements it and writes it back into memory. The execution time is negligible and is non-destructive to memory data. An error condition is usually accompanied by a parity error indication and will set all display register indicator bits and clear the overflow register. The A-register will contain the expected (good) data, the B-register will contain the actual (bad) data, and the M-register will contain the logical memory location of the failure.

Test 3 is a significantly more sophisticated microprogrammed memory test. All memory installed in the computer will be tested. Execution time is dependent on the amount of memory installed; approximately one second per 64k bytes. The display register will increment as memory in each 64k byte space is tested. Error reporting is the same as in Test 2 except the S-register will contain the number of the 64k byte space where the memory failure occurred.

On a cold power-up (as described below), Tests 1 and 3 will each be executed once. Pressing the IBL/TEST switch on the operator panel will not only perform the loader function, it will also cause the execution of Tests 1 and 2.

Executing the octal instruction 100000 via the INSTR STEP switch on the operator panel with the LOCK/OPERATE switch in the OPERATE position will execute Tests 1 and 3 once. The information contained in the S-register (when selected) will be the final background pattern used to test memory. This may also be used to easily load the entire memory with the same bit pattern.

While the tests are executing, the LOCK/OPERATE switch may be set to the LOCK position and the microprogrammed diagnostics will loop continuously until the LOCK/OPERATE switch is returned to the OPERATE position. A memory failure, of course, will terminate the test and report the error.

To check most computer registers and functions and all physical memory, perform the cold power-up procedure as follows:

- a. Set ~ POWER switch to OFF. If computer is equipped with an optional power fail recovery system, set BATTERY switch to OFF.
- b. Wait approximately one second for HP 2109B six seconds for HP 2113B and then set ~ POWER switch to ON.
- c. Set BATTERY switch to INT. Set the LOCK/OPERATE switch to OPERATE.
- d. The diagnostic will begin execution and the Display Register can be observed incrementing if a dynamic mapping system (DMS) is installed.
- e. Upon successful completion, the T-register will automatically be selected for display.
- f. If a computer failure is detected, the Display Register, all six working register indicators (A, B, M, T, P, S), and the OVERFLOW indicator are lighted. Troubleshoot computer failure by performing the procedure presented in figure 2-1.
- g. If a memory failure is detected, the Display Register, and all six working register indicators (A, B, M, T, P, S) are lighted and the OVERFLOW indicator is not lighted. The PARITY indicator is lighted for odd number of bit failures and not lighted for even number of bit failures. The S-register will contain the octal number of the 64k byte space where the memory failure occurred. To isolate the memory failure, perform the following:
 - (1) Select the M-register which contains the logical memory location of the failure.
 - (2) Select the A-register which contains the expected (good) data.
 - (3) Select the B-register which contains the actual (bad) data.
 - (4) Compare bit by bit the A-register with the B-register to isolate the bad bit(s).
 - (5) Locate the bad bit(s) in figures 2-5 through 2-10, replace memory integrated circuit(s) as described in paragraph 2-23.

Figure 2-2 provides an example and reference information to aid in isolating memory failures on a memory module. If further testing is required or if the firmware diagnostic is unable to locate the memory failure, use the software diagnostic procedure described in paragraph 2-5. For additional reference information, refer to the appropriate Memory Systems Installation and Service Manual for the memory system in your computer. See Documentation Map on page iv.

2-5. SOFTWARE DIAGNOSTIC. The Semiconductor Memory Diagnostic binary tape, part no. 24395-16001, and *Semiconductor Memory Diagnostic Reference Manual*, part no. 24395-90001, are required if additional testing of computer memory is desired. Procedures for loading and running the diagnostic are given in the reference manual. Included also in the reference manual is a list of error and information halts. To isolate memory failures, perform the diagnostic procedures as outlined in the reference manual.

2-6. SUBASSEMBLY REMOVAL AND REPLACEMENT

WARNING

Hazardous voltages are present inside the computer mainframe. Use extreme care when working around the power supply area. Heed all WARNING — HAZARDOUS VOLTAGE labels.

The following paragraphs, which describe procedures for removing and replacing the various computer and memory system subassemblies shown in figures 3-1, 3-2, and 3-3 assume that the computer is installed as a freestanding device. If the computer is rack mounted, read the entire subassembly removal procedure and refer to figures 3-1, 3-2 or 3-3 as appropriate. When it is obvious that the procedure cannot be performed with the computer in the rack, proceed as follows:

- a. Set BATTERY and ~ POWER switches to OFF; disconnect power cord.
- b. Disconnect all I/O cables, including the I/O extender cable if present.
- c. Remove computer from rack.

2-7. TOP, SIDE, AND BOTTOM COVERS

WARNING

Hazardous voltages are exposed when the covers are removed and ac power applied.

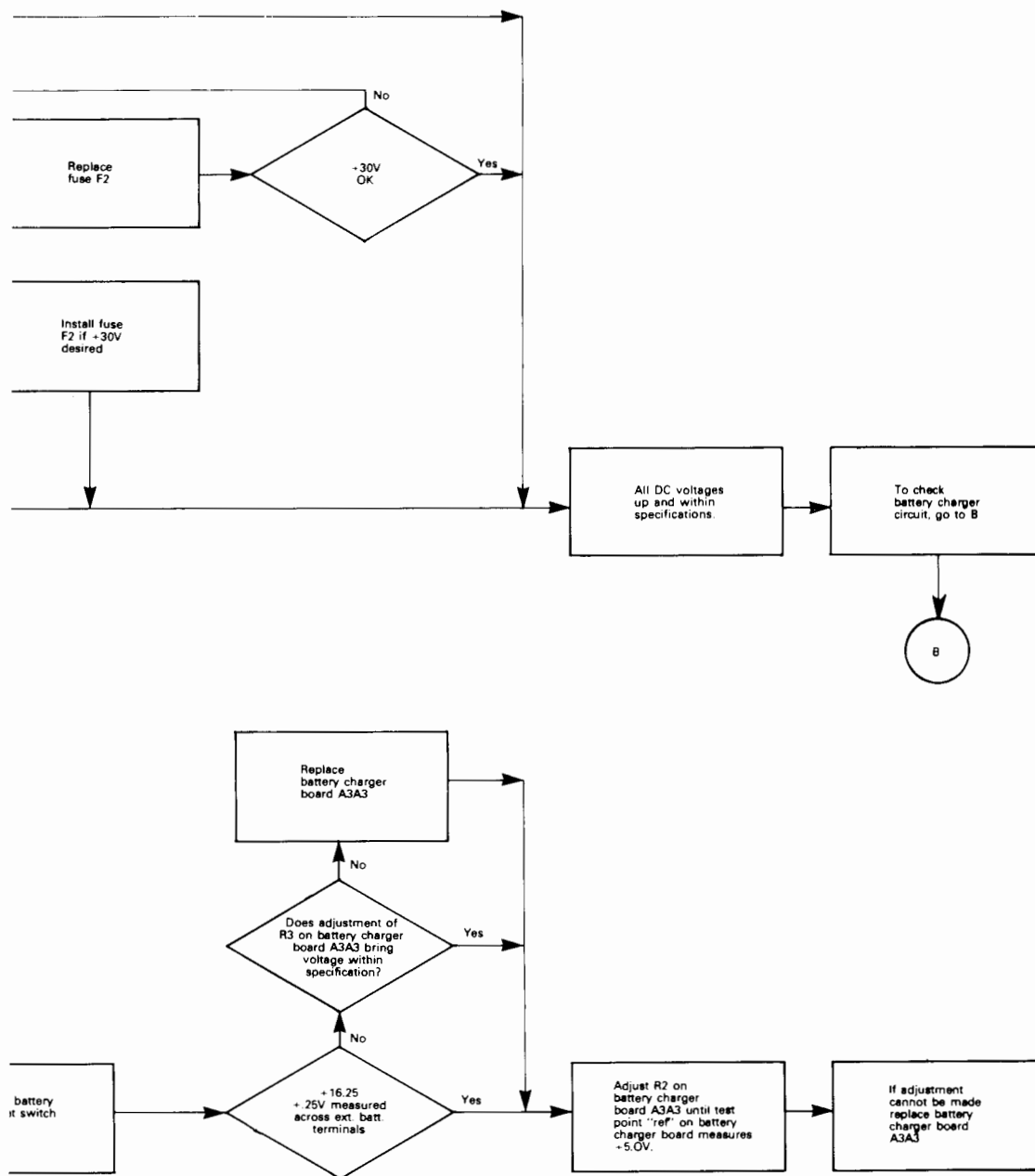
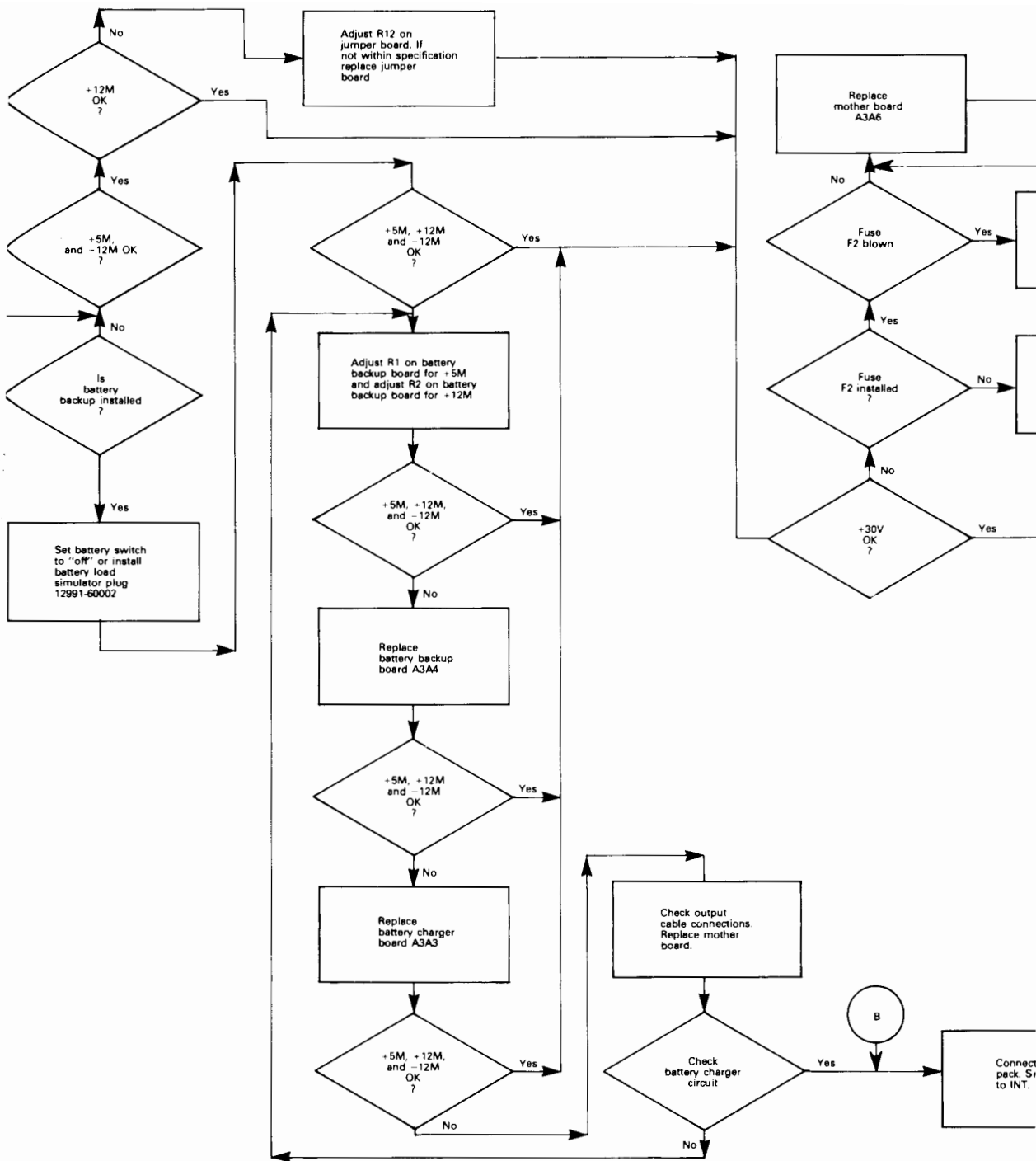
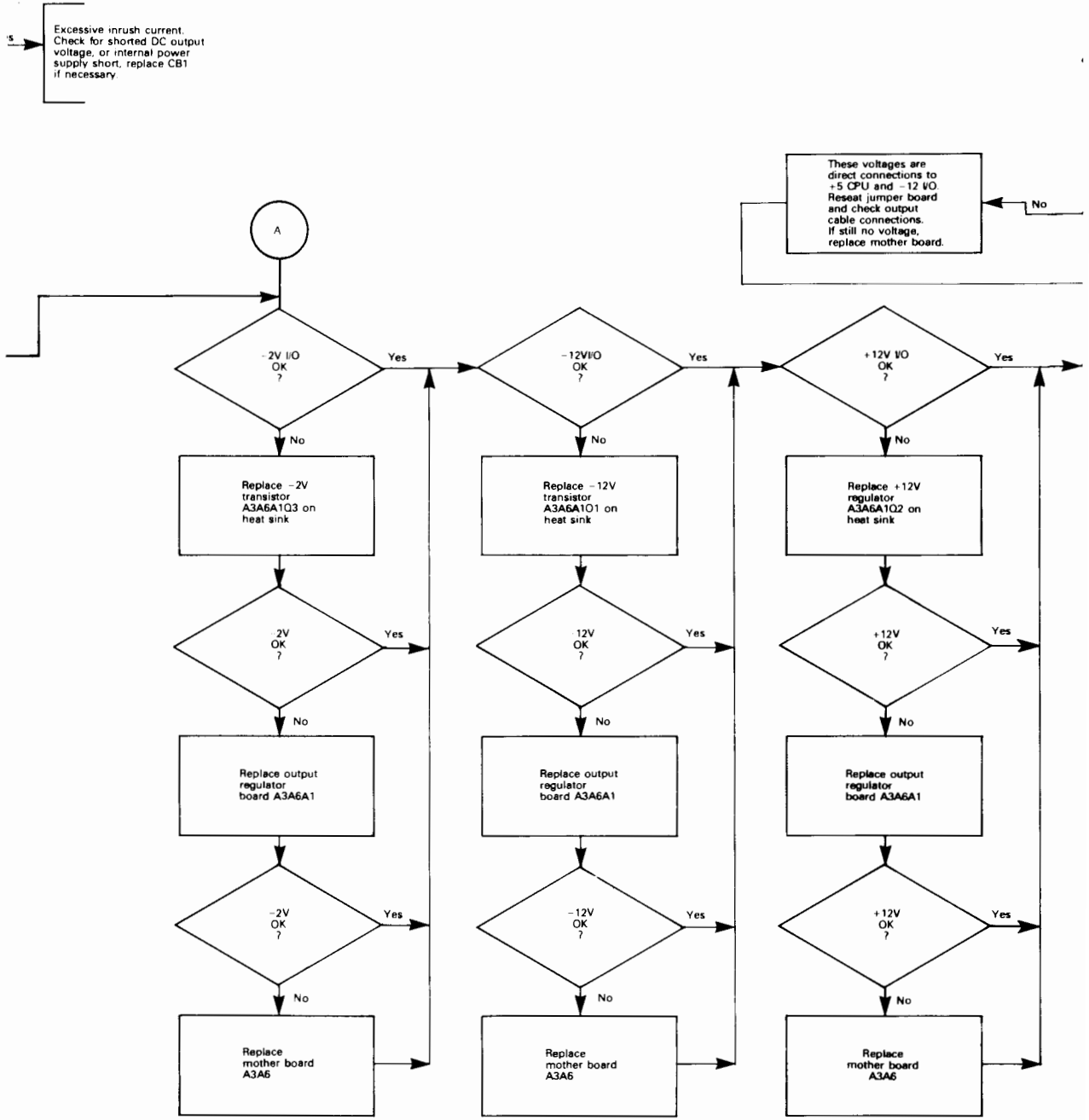


Figure 2-1. Troubleshooting Flowchart (sheet 1 of 2)
Power Supply Operation





6J5

- A3A6A1Q2

- A3A6A1Q3

A6J4

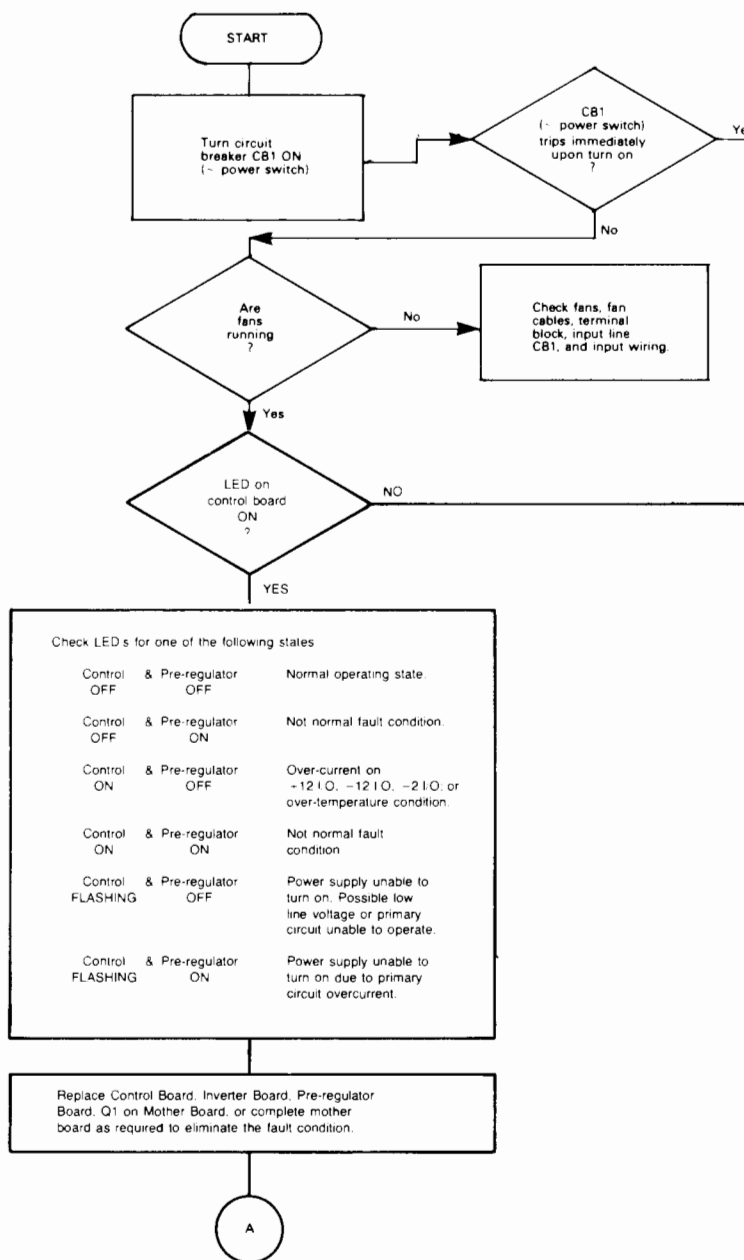
2

A6J3

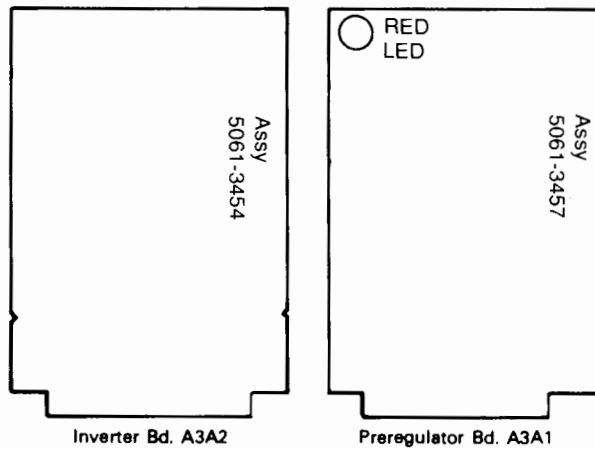
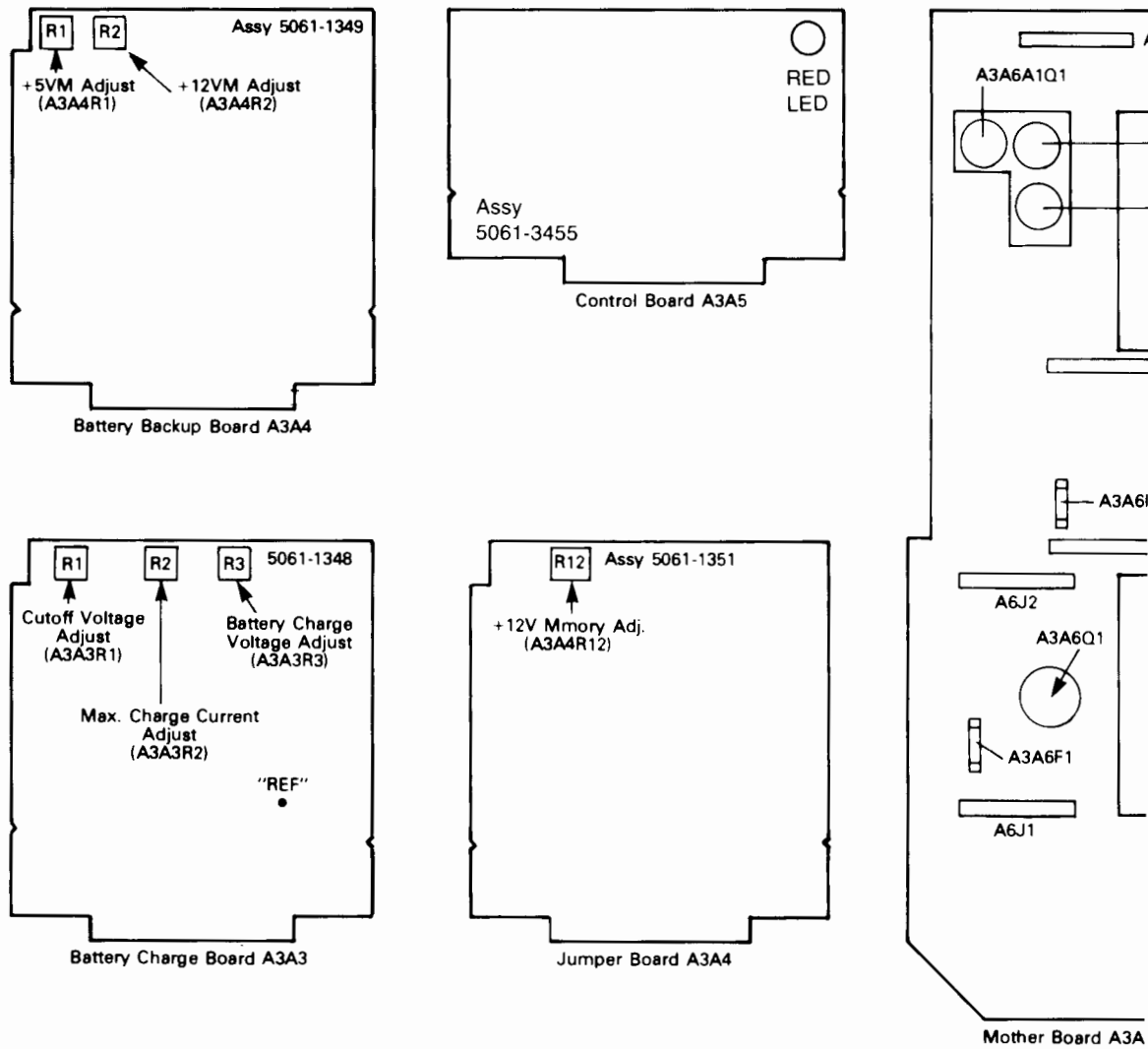
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13.
76

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PARTS LOCATION FOR THE POWER SUPPLY



Description	New Part #	
Preregulator BD, A3A1	5061-3457	Power Supply 5061-34
Inverter Bd, A3A2	5061-3454	
Jumper Bd, A3A4	5061-1351	
Control Bd, A3A5	5061-3455	
Mother Bd, A3A6	5061-1371	
Output Regulator Bd, A3A6A1 (Mother Bd subassembly)	5061-3403	
A3A6A1Q3 -2V I/O Transistor	1854-0063	Power Fail 129911
A3A6A1Q1-12V I/O Transistor	1854-0611	
A3A6A1Q2 +12V Regulator	1813-0093	
Battery Charge Bd, A3A3	5061-1348	
Battery Backup Bd, A3A4	5061-1349	

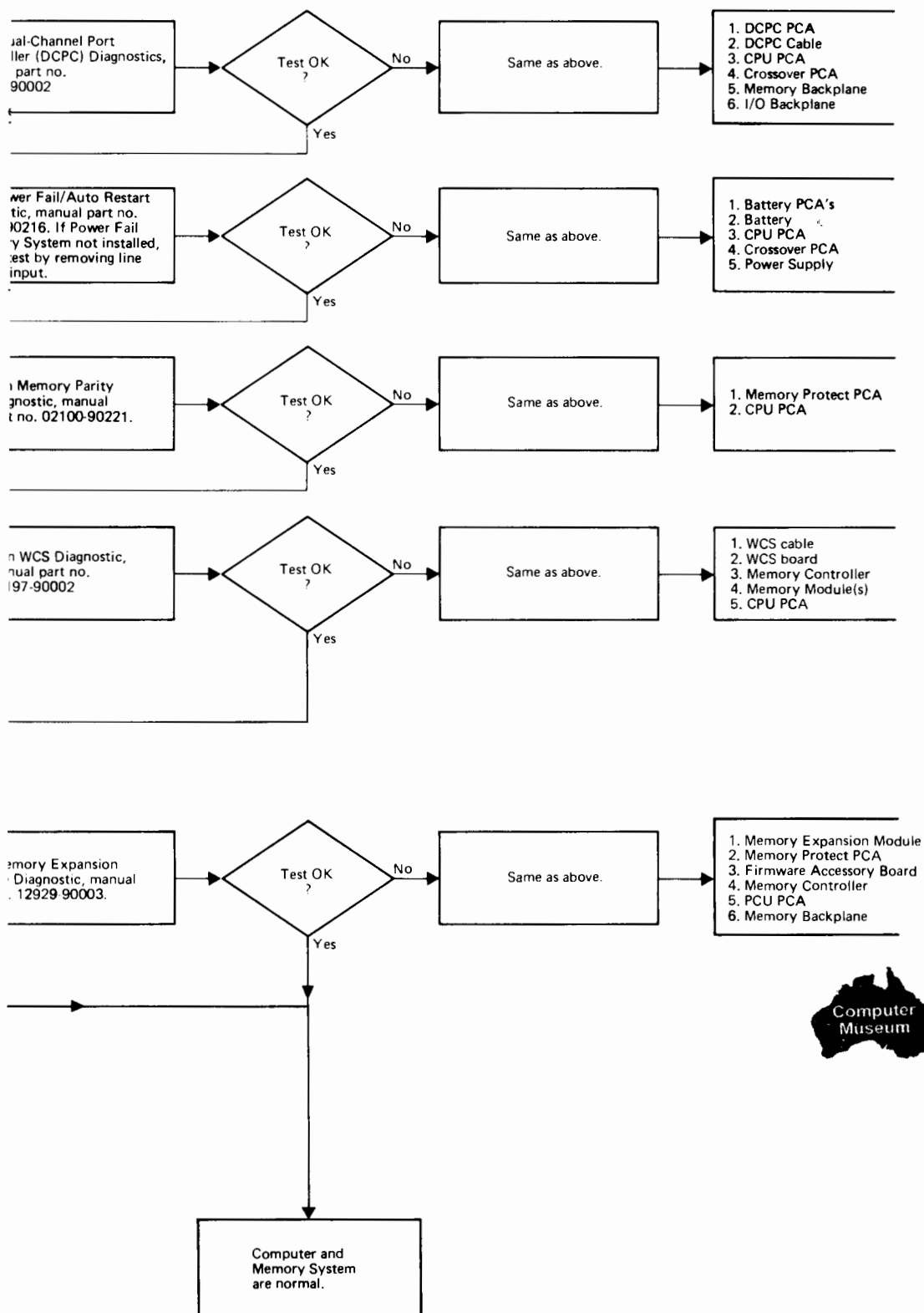
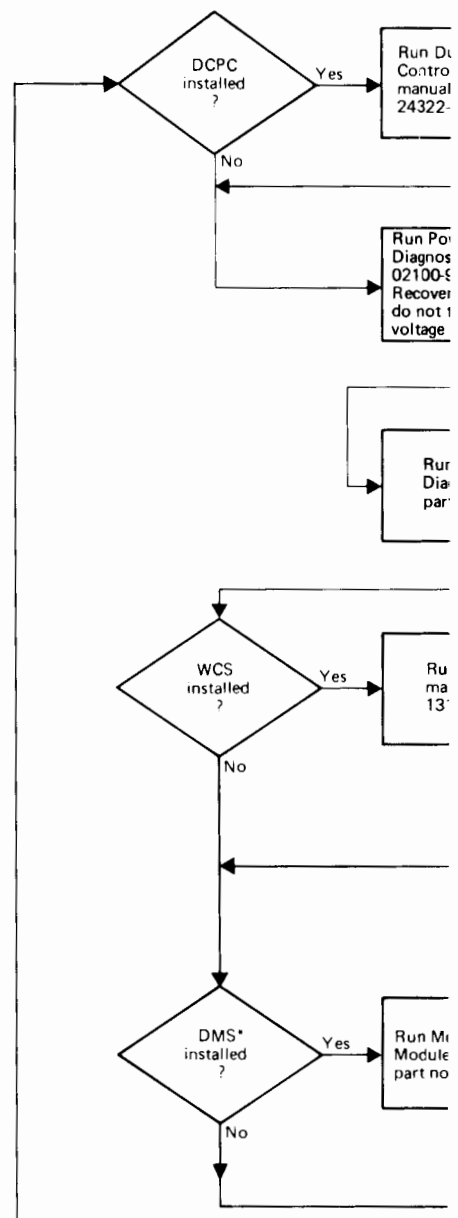
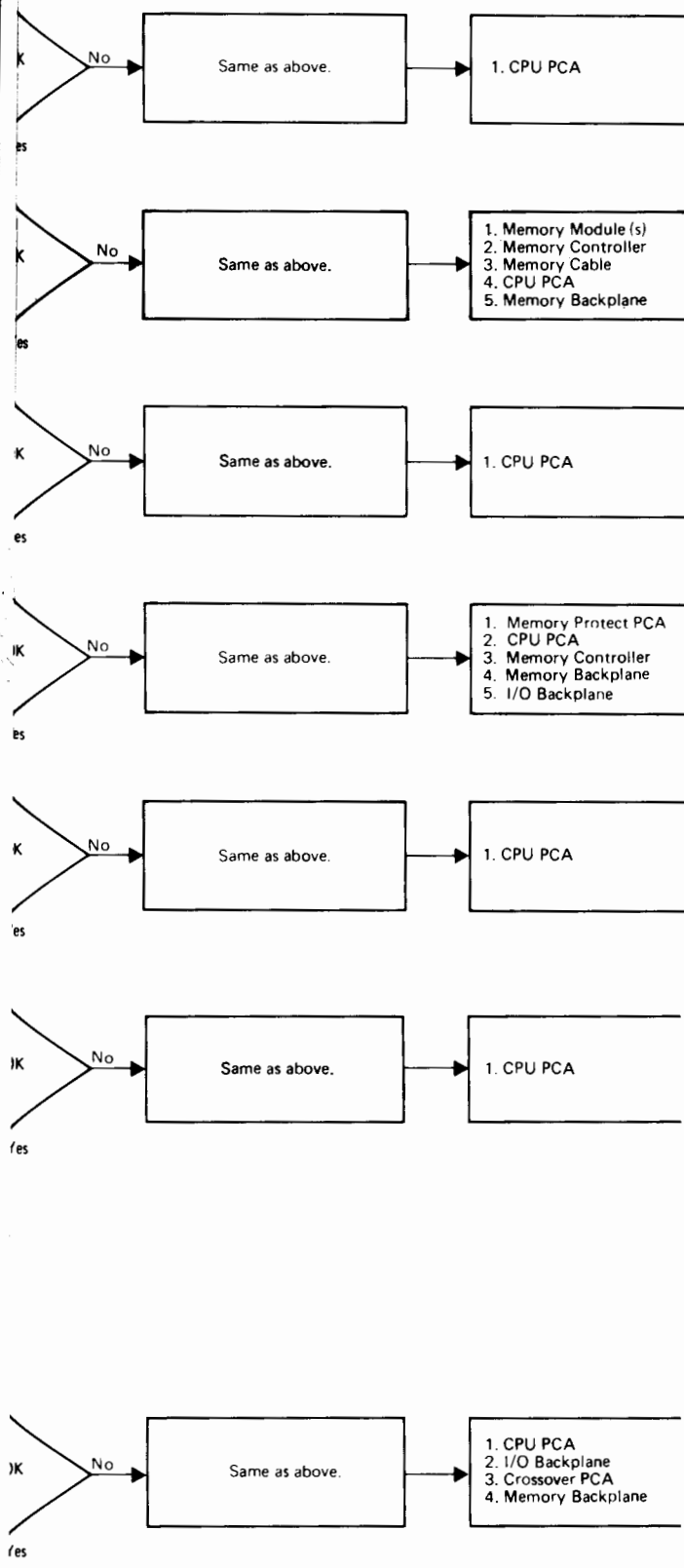
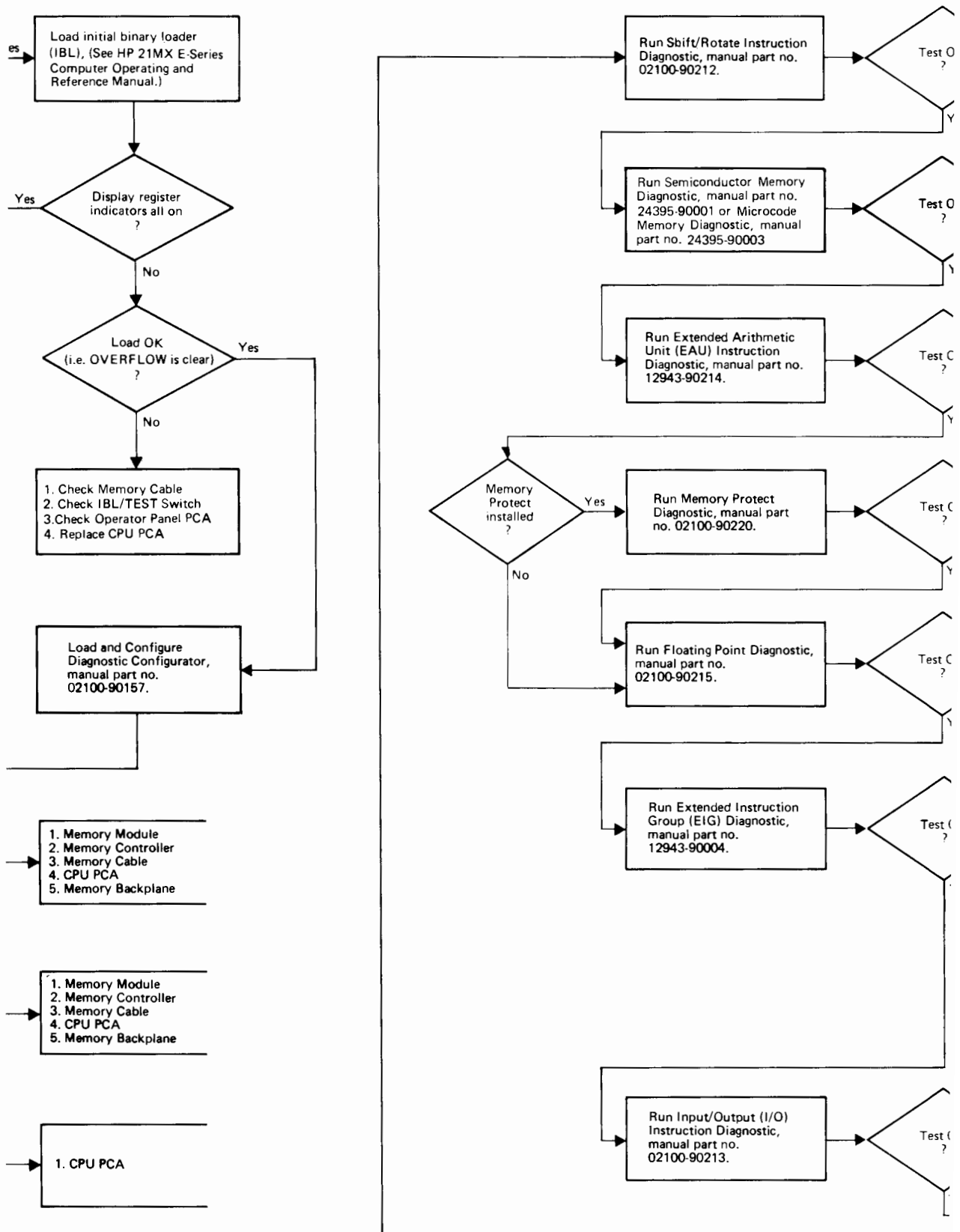
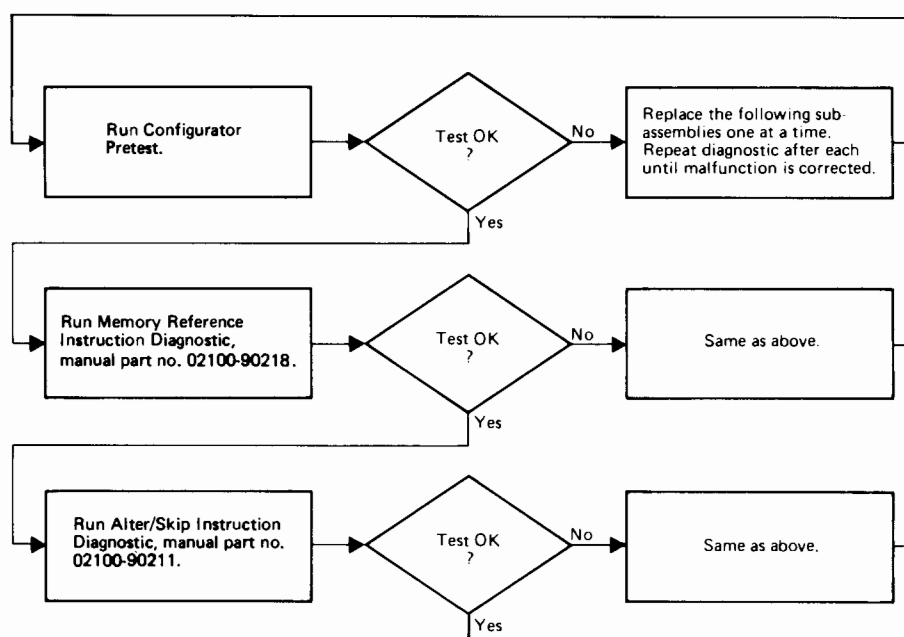
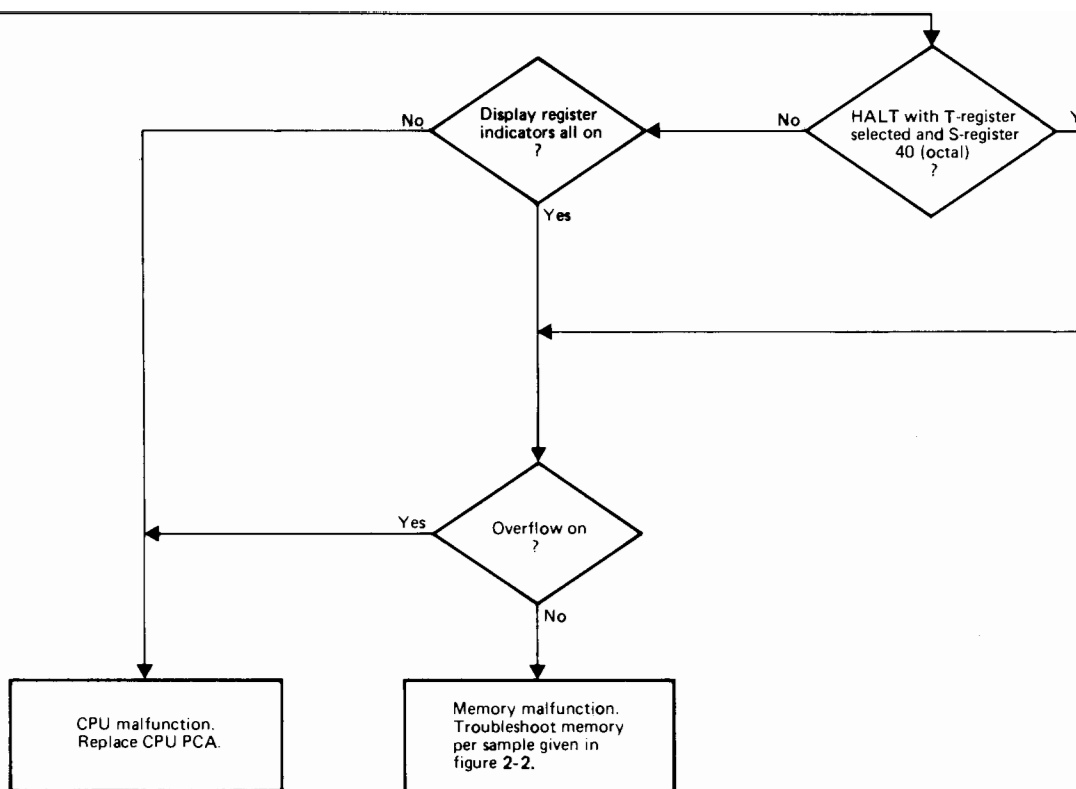


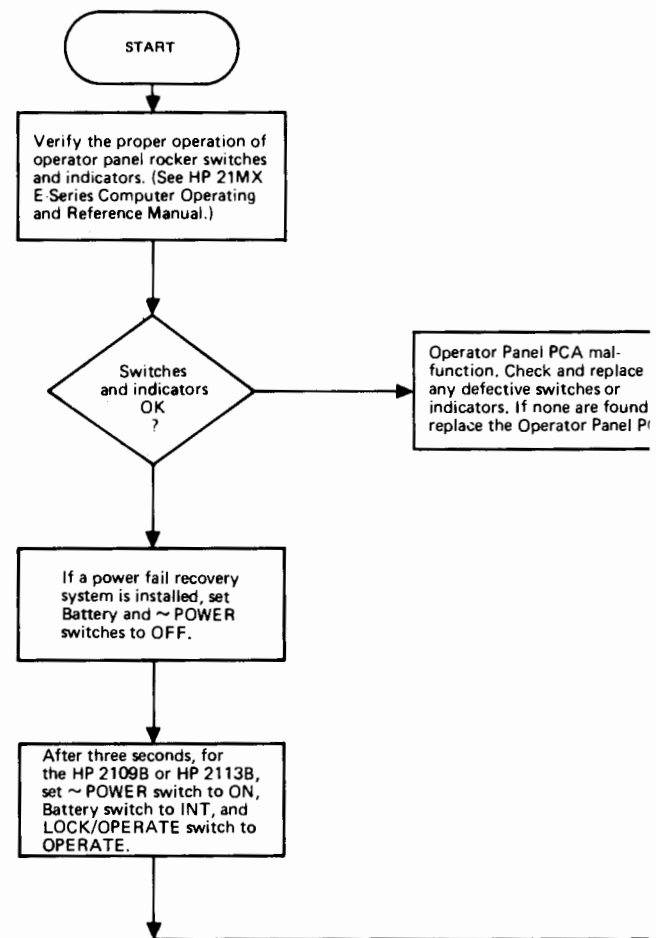
Figure 2-1. Troubleshooting Flowchart (sheet 2 of 2)
Computer Operation



* HP 13305A Dynamic Mapping System







S-REGISTER* BITS 2:0	MEMORY MODULE NUMBERS**
000	0, 1, 2, 3
001	4, 5, 6, 7
010	8, 9, 10, 11
011	12, 13 , 14, 15
100	16, 17, 18, 19
101	20, 21, 22, 23
110	24, 25, 26, 27
111	28, 29, 30, 31

*S-register will be zero if DMS is not installed in computer.
**Each module number represents 16K bytes of memory.

In the example shown in the shaded areas, the computer halts on a cold power-up with the register "dots" lighted and 000003 (octal) in the S-register. This signifies that a memory failure has occurred somewhere in the fourth contiguous 64k byte block of memory in memory module number 12, 13, 14, or 15.

The M-register is now selected and displays some value between 34000 and 35777 (octal). Examining the memory module column shows that the module number 13 matches one of the module numbers identified by the S-register. If module number 13 is a 16k byte memory board, the failing address is in the second 8k byte segment of that board; if module number 13 is a 32k byte memory board, the failing address is in the fourth 8k byte segment of the board; and if module number 13 is a 128k byte memory board, then the failing address is in the third 32k byte segment of that board.

Now the A-register is selected and its octal contents noted as shown below. (The A-register will always contain the expected or good data.)

Next, the B-register is selected and its contents noted as shown below. (The B-register will always contain the actual data which in this case is faulty data.)

Finally, a bit-by-bit comparison is made and indicates that bit 9 in the B-register is a logical "1" instead of a logical "0". After module number 13 is identified by the jumper configurations shown in figures 2-5 through 2-10, the failing chip associated with bit 9 on that memory module or the memory module may be replaced.

If more than 128k bytes of memory are used, this cycle must be repeated for each 128k byte section.

M-REGISTER ADDRESS (OCTAL)	MEMORY MODULE NUMBERS	16k BYTES MM (8k BYTES)	32k BYTES MM (8k BYTES)	128k BYTES MM (32k BYTES)
00000 to 07777	0, 8, 16, 24	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 1 (1st 32k bytes)
10000 to 17777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
20000 to 27777	1, 9, 17, 25	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
30000 to 37777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	
40000 to 47777	2, 10, 18, 26	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 2 (2nd 32k bytes)
50000 to 57777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
60000 to 67777	3, 11, 19, 27	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
70000 to 77777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	
00000 to 10000	4, 12, 20, 28	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 3 (3rd 32k bytes)
10000 to 17777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
20000 to 27777	5, 13, 21, 29	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
30000 to 37777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	
40000 to 47777	6, 14, 22, 30	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 4 (4th 32k bytes)
50000 to 57777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
60000 to 67777	7, 15, 23, 31	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
70000 to 77777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	

A-REGISTER (EXPECTED DATA)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	1	1	0	0	0	1	1	0	1	1	1	0	0	1

B-REGISTER (ACTUAL DATA)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1

Figure 2-2. Typical Memory Chip Malfunction Isolation for Less Than 128k Bytes of Memory

2-8. REMOVAL. Remove the top, side, and bottom cover as follows:

- Loosen screw located in rear fold of top cover. Slide top cover toward rear and remove.
- Remove chassis slide(s), if present. On an HP 2109B, loosen screw in rear fold of side cover; slide cover toward rear and remove. On an HP 2113B, remove the two screws and washers from center of side cover; slide cover toward rear and remove.
- Remove all I/O cables, including the I/O Extender cable.

2-9. REPLACEMENT. Replace covers in the reverse order of the removal procedure.

2-10. FIRMWARE ACCESSORY BOARD

2-11. REMOVAL. Set the ~ POWER and BATTERY switches to OFF, remove the bottom cover, and proceed as follows:

- Disconnect the connector assembly from firmware accessory board and CPU PCA.
- Remove the four screws and lockwashers securing firmware accessory board to CPU PCA and remove.

2-12. REPLACEMENT. Replace firmware accessory board in reverse order of the removal procedure.

2-13. CENTRAL PROCESSOR UNIT PCA

2-14. REMOVAL. Set the ~ POWER and BATTERY switches to OFF, remove the bottom cover, and proceed as follows:

- Disconnect operator panel cable assembly from CPU PCA front edge connector; remove firmware accessory board (if installed) and connector assembly.
- Remove the 12 screws and lockwashers securing CPU PCA to bottom of computer mainframe.
- Remove the three nuts and six washers from power terminals located in center of CPU PCA. (See figure 2-3.)
- Carefully disengage CPU PCA from memory and I/O backplanes.

2-15. REPLACEMENT. Install CPU PCA in the computer mainframe as follows:

- Carefully insert power terminals in center of CPU PCA as shown in figure 2-3. Secure power terminals to CPU PCA with the three nuts and six washers.

- Position CPU PCA with receptacles A1XA4 and A1XA5 in contact with I/O backplane and memory backplane connectors.
- Press inward on back of A1XA4 and A1XA5 to seat backplanes fully into CPU PCA receptacles.
- Replace the 12 screws and lockwashers securing CPU PCA to bottom of computer mainframe.
- Replace the firmware accessory board (if installed) and connector assembly, and connect operator panel cable assembly to CPU PCA front edge connector. Replace bottom cover.
- Set ~ POWER switch to ON and BATTERY switch to INT.

2-16. OPTIONAL LOADER ROM'S

Optional loader ROM's, if installed, are mounted in 16-pin IC sockets on the component side of the CPU PCA. (See figure 2-4.) Optional loader ROM's (1 and 3) may be removed or replaced by performing the following:

CAUTION

Optional loader ROM's may be damaged if ac power is present when removing or replacing ROM's.

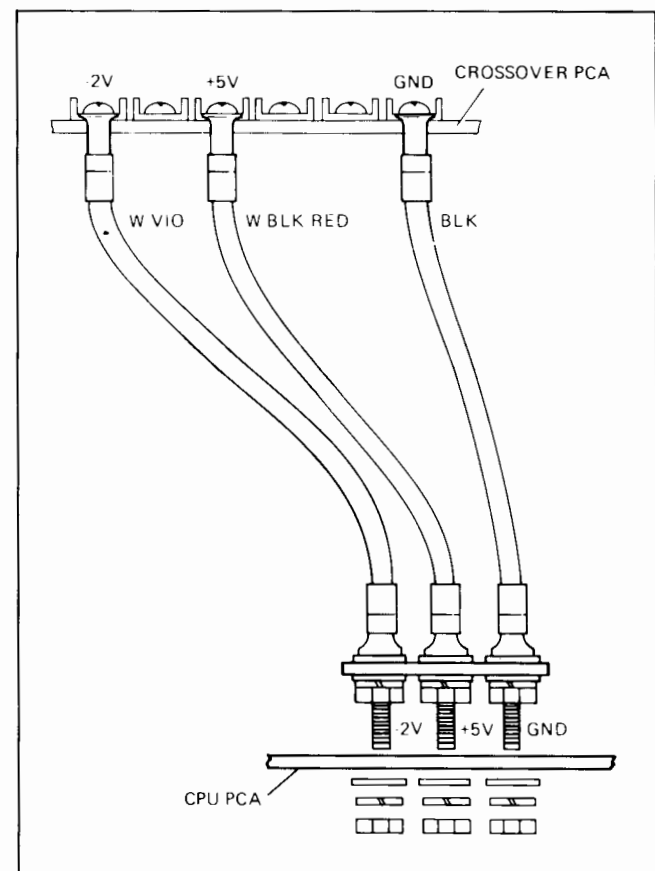


Figure 2-3. CPU Power Connections

NOTE

All contents of the memory will be lost when a PCA is removed from or installed in the memory PCA cage. Therefore, before turning off line and battery power, ensure that any memory contents to be saved are stored in another device for later retrieval.

- a. Set ~ POWER and BATTERY switches to OFF.
- b. Turn key clockwise on operator panel and lower it to the access position.
- c. Remove the two screws and lockwashers securing memory PCA cage cover to the memory PCA cage; remove memory PCA cage cover.
- d. Disconnect cable assembly from all memory PCA's and DCPC cable assembly (if installed) from DCPC PCA.
- e. Remove enough memory PCA's from the PCA cage by pulling outward on extractor levers to allow access to the loader ROM's.
- f. At bottom of memory PCA cage, locate opening in deck for the optional loader ROM sockets (01₂ and 11₂). (See figure 2-4.)

- g. Remove or replace optional loader ROM integrated circuit(s). Ensure that the ROM integrated circuit is oriented with the notched end facing in the same direction as the other integrated circuits on the CPU PCA.

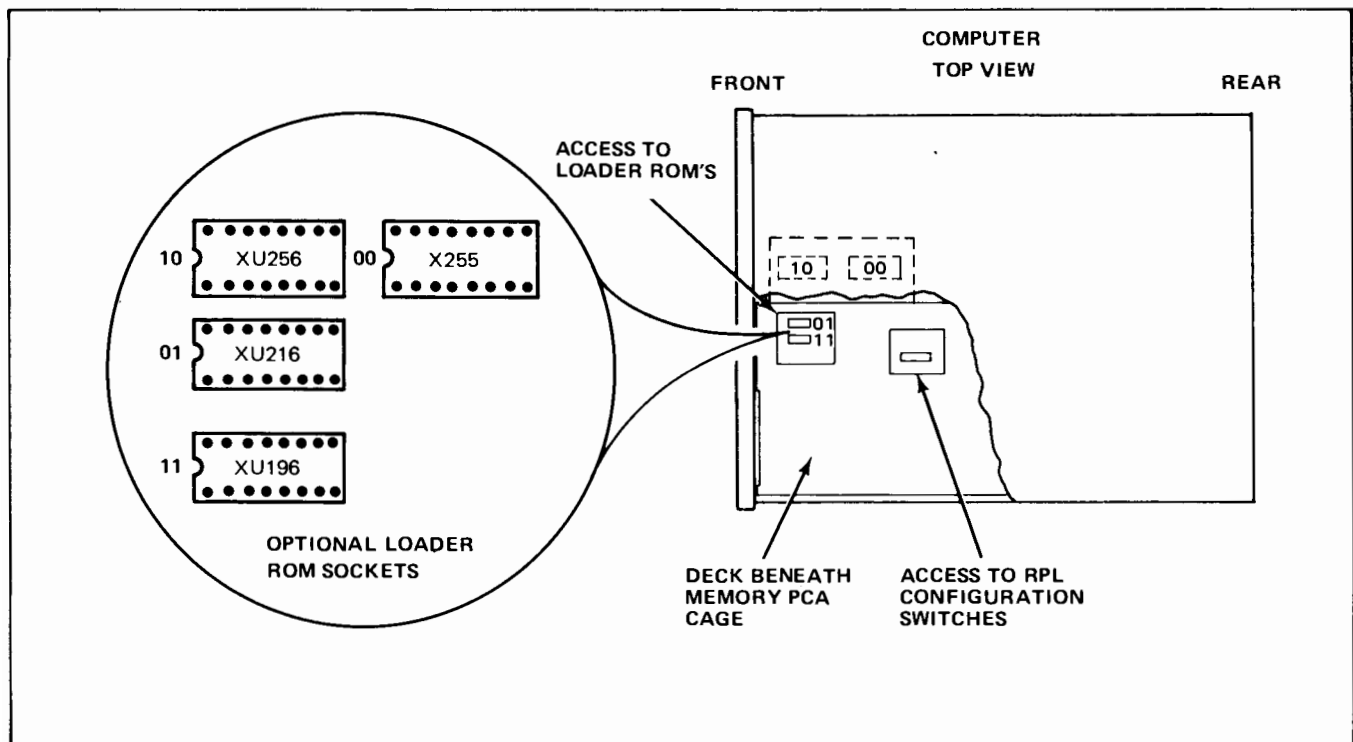
After removing or replacing optional loader ROM, replace all PCA's in memory PCA cage, reconnect cable assemblies, and reinstall memory PCA cage cover and operator panel.

To remove or install ROM's in sockets 0 or 2, it is necessary to remove the CPU PCA. (See paragraph 2-14.)

2-17. OPERATOR PANEL PCA

2-18. REMOVAL. Turn the key clockwise on the operator panel and lower it to the access position.

- a. Disconnect operator panel cable assembly from CPU PCA front edge connector.
- b. Remove the four screws, flatwashers, and lockwashers from operator panel PCA cover; remove operator panel PCA cover.
- c. Remove the seven screws and lockwashers securing operator panel PCA to operator panel; remove operator panel PCA.



7700-80

Figure 2-4. Optional Loader ROM Sockets

2-19. ROCKER SWITCH CONTACTS. Defective rocker switch contacts on the operator panel PCA are replaced as follows:

- a. Remove the plastic material on the circuit side of operator panel PCA securing the rocker switch assembly to the operator panel PCA.
- b. Grasp rocker switch assembly and pull straight out from operator panel PCA.
- c. Separate defective spring contacts from rocker switch assembly.
- d. Clean replacement spring contacts with the Freon TF Degreaser (or equivalent) and position replacement spring contacts onto operator panel PCA.
- e. Using a new rocker switch frame, place the rocker switch assembly over the spring contacts; press inward on the rocker switch assembly until it snaps into place.
- f. Apply a hot soldering iron with a broad tip or a similar device and melt the plastic tip protruding through the circuit side of the PCA to secure the switch assembly in place.

2-20. REPLACEMENT. Install the operator panel PCA as follows:

- a. Carefully place operator panel PCA into position and replace the seven screws and lockwashers.
- b. Place operator panel PCA cover over operator panel PCA and secure in place with the four screws, flatwashers, and lockwashers.
- c. Connect operator panel cable assembly to CPU PCA front edge connector.
- d. Set LOCK/OPERATE switch to OPERATE.
- e. Close operator panel and turn key fully counter clockwise to secure the panel in place.

2-21. MEMORY CAGE PCA'S

2-22. REMOVAL. Remove the printed-circuit assemblies (PCA's) from the memory cage as follows:

- a. Set ~ POWER and BATTERY switches to OFF. Turn key clockwise on operator panel and lower it to the access position.
- b. Remove the two memory PCA cage cover retaining screws and lockwashers; remove memory PCA cage cover.

- c. Disconnect cable assembly(ies) from front edge connector(s). (The memory protect PCA does not have a front edge connector.) If removing the DCPC, do not disconnect the cable assembly from the crossover PCA; if removing the memory controller or memory module, disconnect the cable assembly from all PCA's.
- d. Remove PCA by pulling outward on extractor levers.

2-23. REPLACEMENT. Replace memory cage PCA's in the reverse order of the removal procedure. When installing a replacement memory module, be sure to configure the memory module address jumpers correctly. Figures 2-5 through 2-10 illustrate the jumper requirements for the various memory modules and check bit arrays.

2-24. I/O INTERFACE PCA'S

2-25. REMOVAL. Remove an I/O interface PCA from the I/O PCA cage as follows:

- a. Turn key clockwise and lower operator panel to access position. Set ~ POWER switch to OFF.
- b. If power fail recovery system is installed, set BATTERY switch to OFF and disconnect battery cable from BAT. INPUT connector.
- c. Remove I/O PCA cage cover and loosen the screw(s) securing I/O PCA retainer. Slide retainer to the right.
- d. Remove I/O cable connector hood from I/O interface PCA. Remove I/O interface PCA by pulling outward on the PCA extractor levers.

2-26. REPLACEMENT. Replace I/O interface PCA in reverse order of the removal procedure. Be sure to configure the I/O interface PCA jumpers (if used) if a replacement PCA is being installed.

2-27. CROSSOVER PCA

2-28. REMOVAL. Remove the crossover PCA from the computer mainframe as follows:

- a. Set ~ POWER and BATTERY switches to OFF.
- b. Remove computer top cover and disconnect DCPC cable assembly (if used) from edge connector J1. (See figure 2-11). Disconnect power supply cable assembly from edge connector J2.
- c. Disconnect connector going to power supply plus (P9). (See figure 2-11.)

- d. Remove the four screws and lockwashers securing crossover PCA to PCA cage covers.
- e. Carefully lift crossover PCA to free it from backplane edge connectors.

2-29. REPLACEMENT. Install the crossover PCA as follows:

- a. Position crossover PCA with receptacles A6XA4 and A6XA5 in contact with I/O and memory backplane connectors.
- b. Press downward on back of A6XA4 and A6XA5 to seat backplanes fully into crossover PCA receptacles. Secure crossover PCA to PCA cage covers using the four screws and lockwashers.
- c. Connect connector to power supply plug (P7). (See figure 2-11.)
- d. Connect DCPC cable assembly (if used) to edge connector J1. Connect power supply cable assembly to J2.
- e. Replace computer top cover and set ~ POWER switch to ON and BATTERY switch to INT.

2-30. MEMORY AND I/O BACKPLANES

2-31. REMOVAL. Remove the memory and I/O backplanes from the computer mainframe as follows:

- a. Set ~ POWER and BATTERY switches to OFF.
- b. Remove top cover and disconnect DCPC cable assembly (if used) from crossover PCA edge connector J1.
- c. Withdraw all memory PCA's approximately 5 cm (2 inches) to clear rear connectors from memory backplane receptacles.
- d. Withdraw all I/O interface PCA's approximately 5 cm (2 inches) to clear rear connectors from I/O backplane receptacles.
- e. Remove the four screws and lockwashers securing crossover PCA to PCA cage covers. Carefully lift crossover PCA to free it from backplane edge connectors.
- f. Grasp memory backplane and lift up and out of memory PCA cage assembly.
- g. Grasp I/O backplane and lift up and out of I/O PCA cage assembly.

2-32. REPLACEMENT. Replace the memory and I/O backplanes in reverse order of the removal procedure.

Be sure to reconnect DCPC cable assembly (if used) after all PCA's have been seated firmly into their mating receptacles.

CAUTION

Note markings on backplanes to ensure proper orientation. Improper orientation can damage the computer.



2-33. POWER FAIL RECOVERY SYSTEM FOR HP 2109B AND HP 2113B

2-34. BATTERY REMOVAL. Set the Battery switch to OFF and disconnect the battery cable from the BAT. INPUT connector. Remove the four captive screws securing the I/O cage cover to the computer frame. Remove the four flat head screws securing the I/O cage cover to the battery assembly. Lay the battery assembly with the side mounted to the I/O cage cover on the bottom and remove the four screws holding the battery cover in place. Remove the four screws holding the battery pack(s). Remove the battery pack(s) by disconnecting the connector(s).

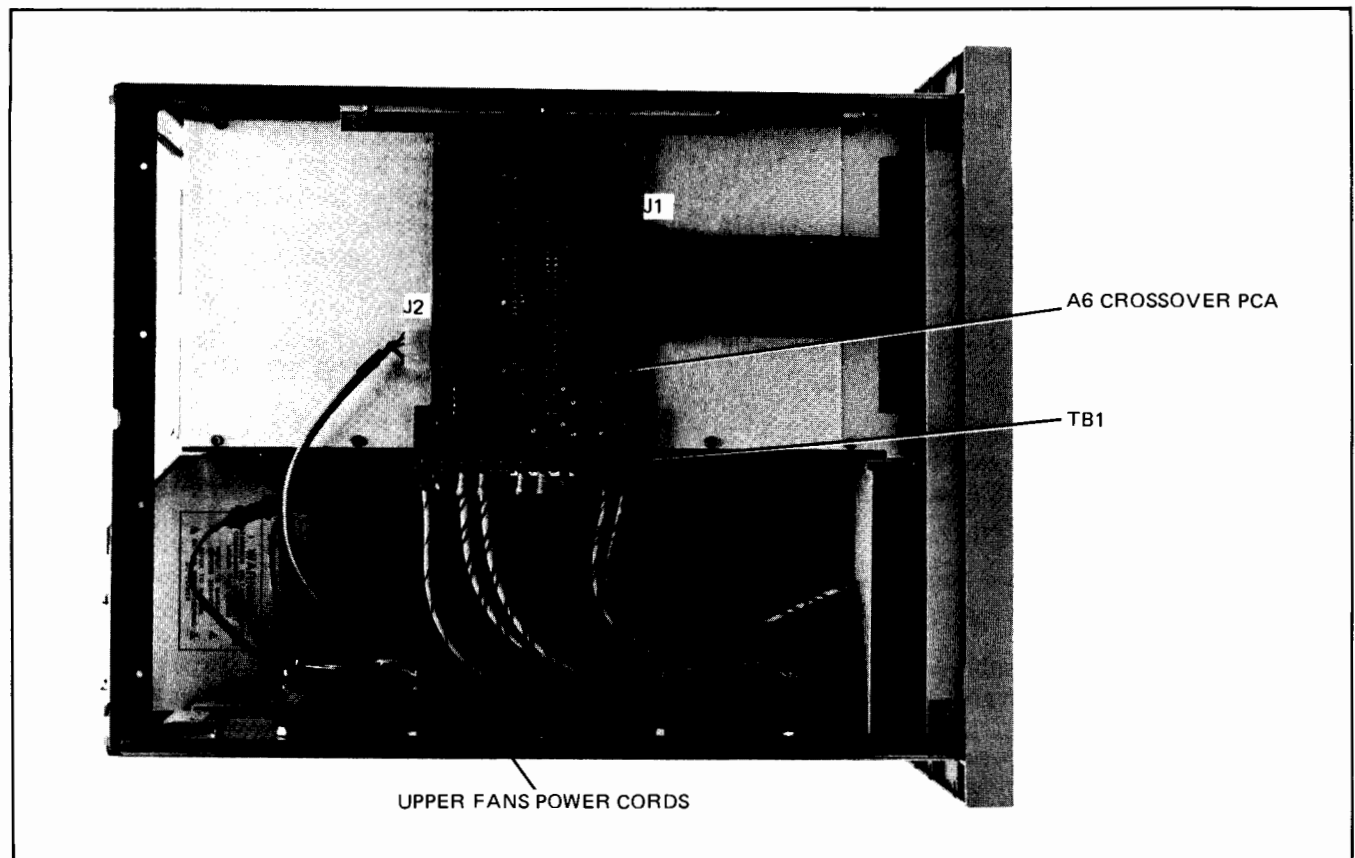
2-35. BATTERY PCA REMOVAL. Lower the operator panel to the access position. Unfasten the two clips holding the power supply by pushing them towards each other. Disconnect the two connectors at the front of the power supply. Remove the two screws from the rear of the power supply securing it to the rear frame. Slide the power supply part way out of the computer, if it is an HP 2113B, and disconnect the upper fan power cords. Remove the power supply from the computer. Remove the 10 screws from the top of the supply. Lift the top cover off the supply. Figure 2-12 shows the location of the two battery PCA's. A3 is the Battery Charger Board and A4 is the Battery Backup Board. Grasp the Battery Backup Board and pull upward out of the board guides. Remove the Battery Charger Board in the same manner as the Battery Backup Board.

2-36. REPLACEMENT. Replace the battery(s) and the battery PCA's in the reverse order of the removal procedures.

2-37. POWER SUPPLY FOR HP 2109B AND HP 2113B

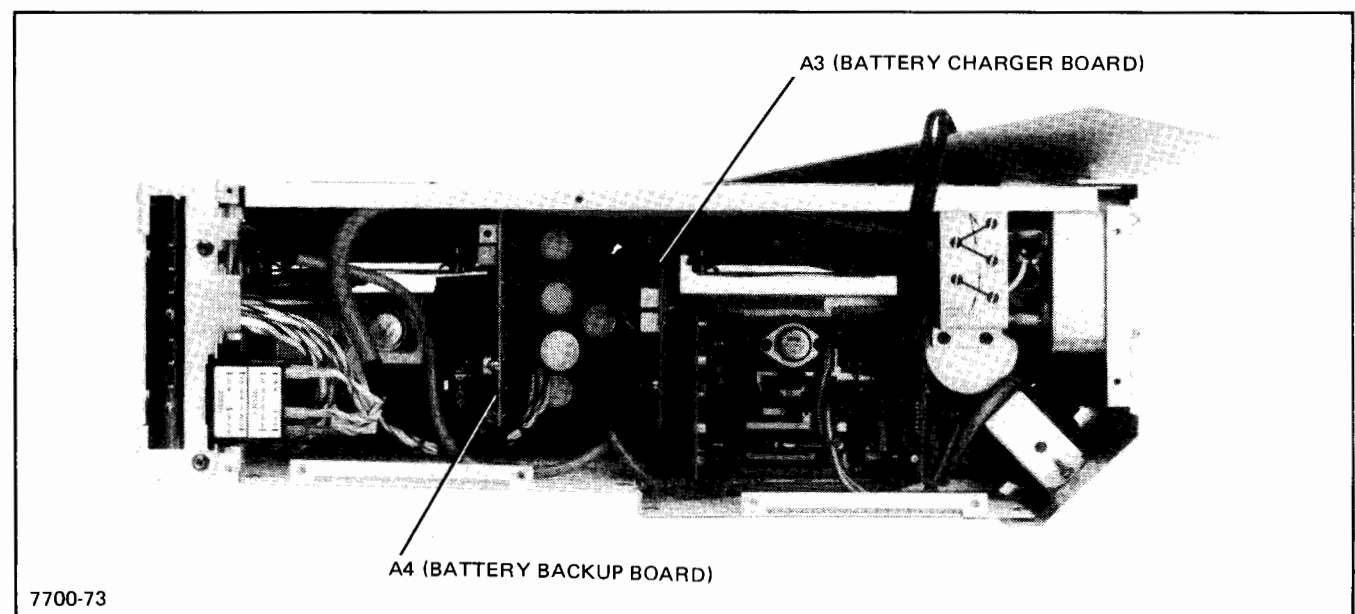
WARNING

Hazardous voltages are present with the ac power cord connected. Ensure that ac power cord is disconnected before proceeding.



8300-18

Figure 2-11. Crossover PCA Power Connections and Upper Fans Power Cords



7700-73

Figure 2-12. Power Fail Recovery PCAs Locations in the Power Supply

2-38. REMOVAL. Proceed as follows:

- a. Turn the key in the operator panel clockwise and lower the operator panel to the access position.
- b. Disconnect the two plastic cable connectors from front of the power supply.
- c. Remove the plastic protective cover from the barrier block of the power supply front panel.
- d. Loosen the five slotted screws on the left side of the barrier block and remove the +5VM, +5V CPU and GND wires.
- e. Unfasten the two clips holding the power supply at the front by pushing them towards the center line of the power supply.
- f. If a power recovery system is installed, set the BATTERY switch to OFF and disconnect the battery cable from the BAT INPUT connector. Loosen the two screws holding the I/O PCA retainer and slide the retainer to the right.
- g. Remove the two screws and lockwashers located at the bottom of the rear panel of the power supply securing the power supply to the rear frame of the computer.

Step h is necessary only for the HP 2112B.

- h. Slide the power supply out from the computer about 50 mm (2 in.) and stop. The two fan cables for the top fans must be disconnected before proceeding.

Grasp the connector and squeeze the latching sides to free the connector. Do this for both connectors.

- i. Slide the power supply out and remove it from the computer.

2-39. REPLACEMENT. Replace the power supply in the reverse order of the removal procedure.**2-40. POWER SUPPLY VENTILATING FANS FOR THE HP 2109B AND HP 2113B****2-41. REMOVAL.** Remove the computer top cover and proceed as follows:**WARNING**

Hazardous voltages are present with the ac power cord connected. Ensure that ac power cord is disconnected before proceeding.

- a. Remove the power supply from the computer.
- b. Remove the ten screws securing the top cover of the power supply and lift off the top cover.

- c. Disconnect the fan power cords from the terminal board (TB1) in the power supply. (See figure 2-13.)
- d. Remove the four screws securing each fan to the right side of the power supply. Move the cables as necessary to remove the fans.

2-42. REPLACEMENT. Replace the ventilating fan(s) in reverse order of the removal procedure.**2-43. UPPER VENTILATING FANS FOR THE HP 2113B****WARNING**

Hazardous voltages are present with the ac power cord connected. Ensure that ac power cord is disconnected before proceeding.

2-44. REMOVAL. Remove the computer top cover and proceed as follows:

- a. Disconnect the fan(s) power cord(s). (See figures 2-11 and 2-13.)
- b. Remove the two screws securing the computer's right side panel.
- c. Remove the three screws securing the power supply's front shield.
- d. Remove the six screws securing the upper fan panel to the computer.
- e. Pull the fan panel toward the front frame until the lip at the rear of the fan panel clears the rear frame. Then lift the fan panel up and out of the computer.
- f. Remove the four screws securing each fan.

2-45. REPLACEMENT. Replace the ventilating fan(s) in the reverse order of the removal procedure.**2-46. POWER SUPPLY VOLTAGE ADJUSTMENTS****WARNING**

Hazardous voltages are present with the ac power cord connected. Ensure that the ac power cord is disconnected before proceeding.

2-47. ADJUSTMENTS. The adjustments should be made with the same number of I/O and Memory modules in the computer as will be used for normal operation. The adjustments will be given for operation with and without the power fail option.

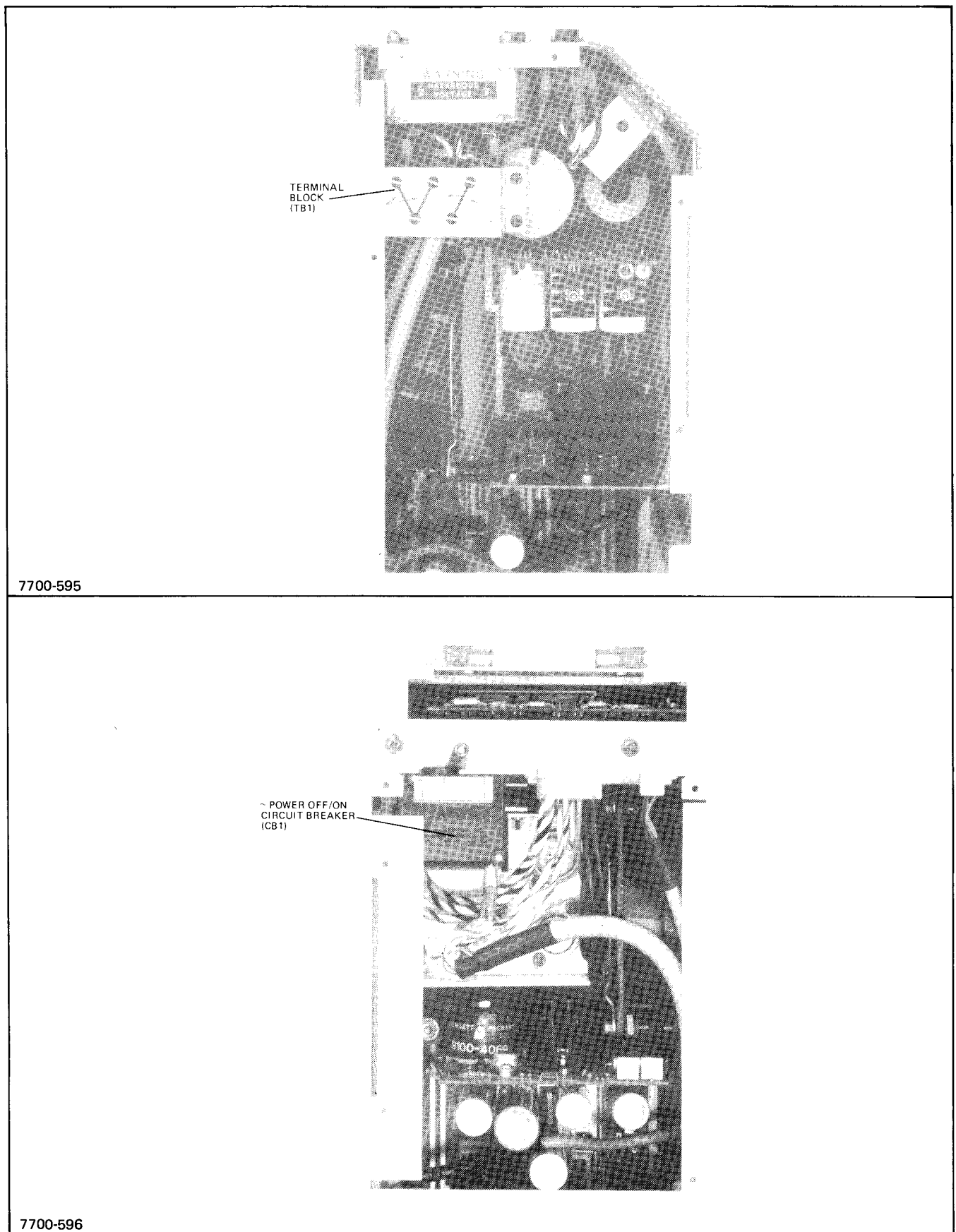


Figure 2-13. Internal Views of the Power Supply Circuit Breaker and Terminal Block

2-48. VOLTAGE ADJUSTMENTS WITHOUT THE POWER FAIL OPTION. Proceed as follows:

- a. Set the ~ POWER switch to the ON position and the LOCK/OPERATE switch to OPERATE.
- b. Connect the DVM to the +12 Vdc M (+12M) on the Crossover Assy (A6).
- c. Adjust A4R12 on the Jumper Board (A4) (see figure 3-3) for an indication of $+12.0 \pm 0.6$ Vdc.

There is no adjustment for any other voltage supply.

NOTE

All other voltages should be within specifications as stated in table 1-5. If any of the voltages cannot be adjusted to within the stated specifications, refer to the troubleshooting flowchart in figure 2-1, sheet 1.

2-49. REPLACEMENT. Replace the covers of the computer and the power supply in the reverse order of the removal.

2-50. VOLTAGE ADJUSTMENTS WITH THE POWER FAIL OPTION. Proceed as follows:

- a. Disconnect the power cord from the line (mains) power and remove the power supply from the computer.
- b. Remove the top cover from the power supply and the top cover from the computer.
- c. Install the power supply in the computer and reconnect all cables.
- d. Set the Battery switch to the OFF position.
- e. Set the ~ POWER switch to the OFF position and connect the power cord to the line (mains) power.
- f. Set the ~ POWER switch to the ON position and the LOCK/OPERATE switch to OPERATE.
- g. Connect the DVM to the +5 Vdc M (+5 M) test point on the Crossover Assy (A6).
- h. Adjust A4R1 on the Battery Charger Board (A4) (see figure 3-3) until the DVM indicates $+5.15 \pm .10$, $-.15$ Vdc.
- i. Connect the DVM to the +12 Vdc (+12 M) test point on the Crossover Assy (A6).
- j. Adjust A4R2 on the Battery Charger Board (A4) (see figure 3-3) until the DVM indicates $+12.0 \pm 0.6$ Vdc.

- k. Connect the DVM to terminal A3E1 on the Battery Backup Board (A3).
- l. Adjust A3R2 on the Battery Backup Board (A3) (see figure 3-3) until the DVM indicates $+5.0 \pm 0.25$ Vdc.
- m. Connect the DVM to the anode of CR4 (yellow wire) on the Battery Charger Board.
- n. Adjust A3R3 on the Battery Backup Board (A3) (see figure 3-3) until the DVM indicates approximately $+16.25 \pm 0.25$ Vdc.

NOTE

All other voltages should be within specifications as stated in table 1-5. If any of the voltages cannot be adjusted to within the stated specifications, refer to the troubleshooting flow chart in figure 2-1, sheet 1.



2-51. REPLACEMENT. Replace the covers of the computer and power supply in the reverse order of the removal.

2-52. MEMORY RECONFIGURATION

If desired, the Memory Systems may be reconfigured. Reconfiguration requires assigning memory block numbers, reconfiguring module address jumpers or switches, reinstallation, and verification. Complete information on installing and servicing the memory systems is given in the Standard Performance Memory Systems Installation and Service Manual, part no. 5955-4310 or the High Performance Memory Systems Installation and Service Manual, part no. 5955-4311.

2-53. FIRMWARE DIAGNOSTICS. To execute the firmware diagnostics perform the following:

- a. Set the P-register = 0.
- b. Set the A-register = 100000 (octal).
- c. At the end of the diagnostic (when executed once), the memory will be filled with the value in the S-register. Set the S-register, if so desired.
- d. Press PRESET.
- e. To loop the diagnostic, set the computer to the LOCK mode by setting the OPERATE/LOCK switch to the LOCK position.
- f. Press INSTR STEP (Instruction Step).
- g. The diagnostic will now be executed.

- h. If a failure occurs in a data bit, all display indicators and the display register indicators will be lighted. Failures are indicated as follows:
1. OVERFLOW — indicates a memory failure when extinguished; indicates a CPU failure when lighted.
 2. S-register = 64k byte (32k word) block of memory where failure occurred.
M-register = memory address within 64k byte block where failure occurred.
A-register = data written (good data).
B-register = data read (possible faulty data).
When A- and B-registers are equal, a check bit failure has occurred.

2-54. 110/220 VAC RECONFIGURATION FOR HP 2109B AND HP 2113B

To reconfigure the HP 2109B or the HP 2113B to operate from a 220-volt power source instead of a 110-volt power source (or vice versa), refer to figures 2-13 and 2-18 and proceed as follows:

WARNING

Hazardous voltages are present inside the power supply!! Before changing from 110V ac to 220V ac configuration, or vice versa, set ~ POWER and BATTERY switches to OFF and disconnect the power cord!! Failure to observe this precaution can result in serious injury.

- a. Set the ~ POWER and BATTERY switches to OFF and remove the power cord. This step is required only for the HP 2113B.
- b. Remove the top cover from the computer and disconnect the top ventilating fans power cords from the power supply.
- c. Remove the power supply from the computer.
- d. Remove the top cover from the power supply and the protective cover from TB1 (see figure 2-13).
- e. For 110 Vac operation, connect jumpers and wires as shown in figures 2-13 and 2-18.
- f. For 220 Vac operation, connect the jumpers and wires as shown in figures 2-13 and 2-18.
- g. Replace the protective cover over TB1, replace the power supply top cover, and replace the power supply into the computer.
- h. Ensure that the correct power cord set is used in the new configuration (see figure 1-6 or 1-7).

2-55. DIAGRAMS

Figure 2-19 is a simplified block diagram of the HP 21MX E-Series Computer. The power distribution diagram provided in figure 2-18.

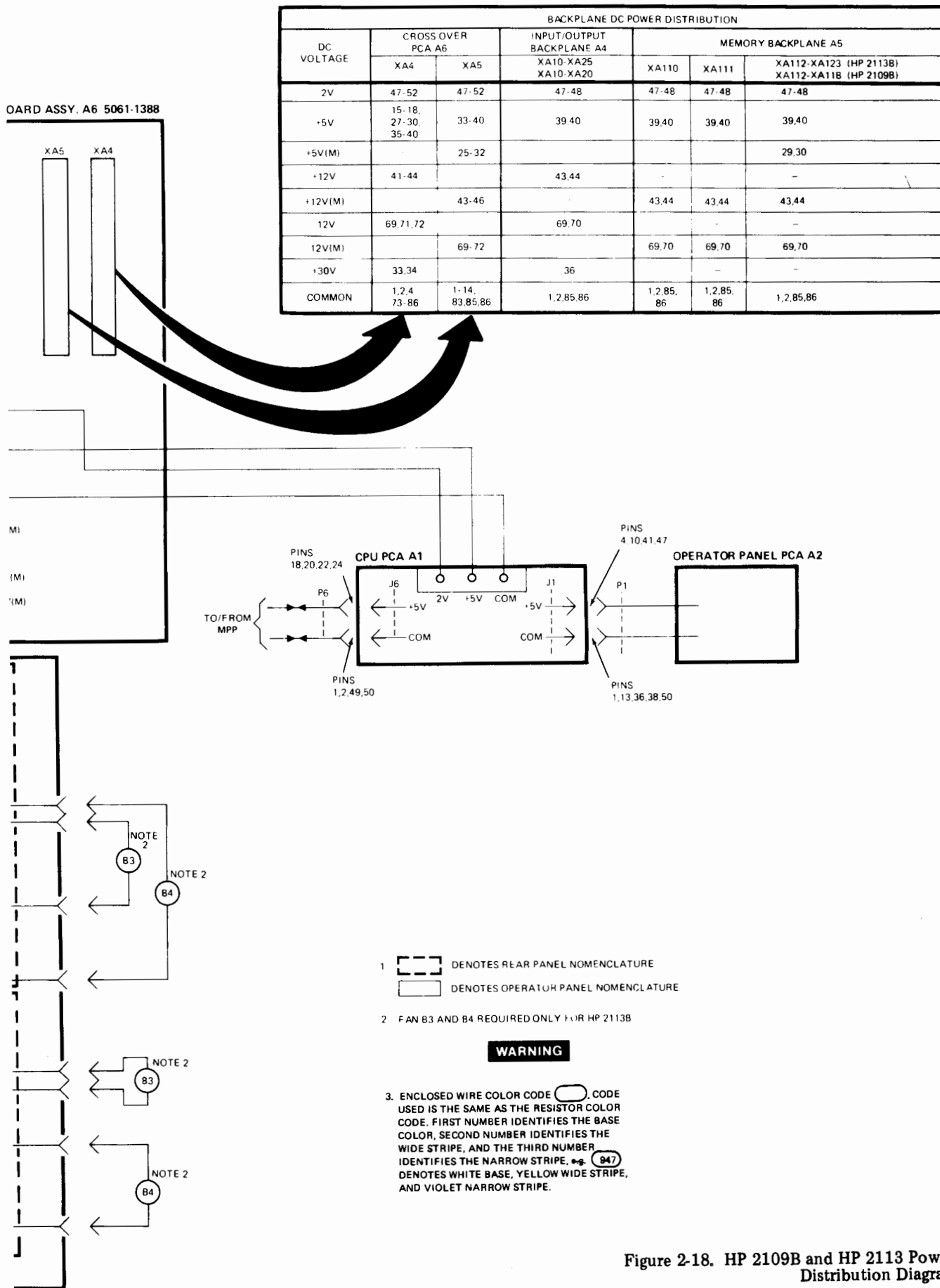
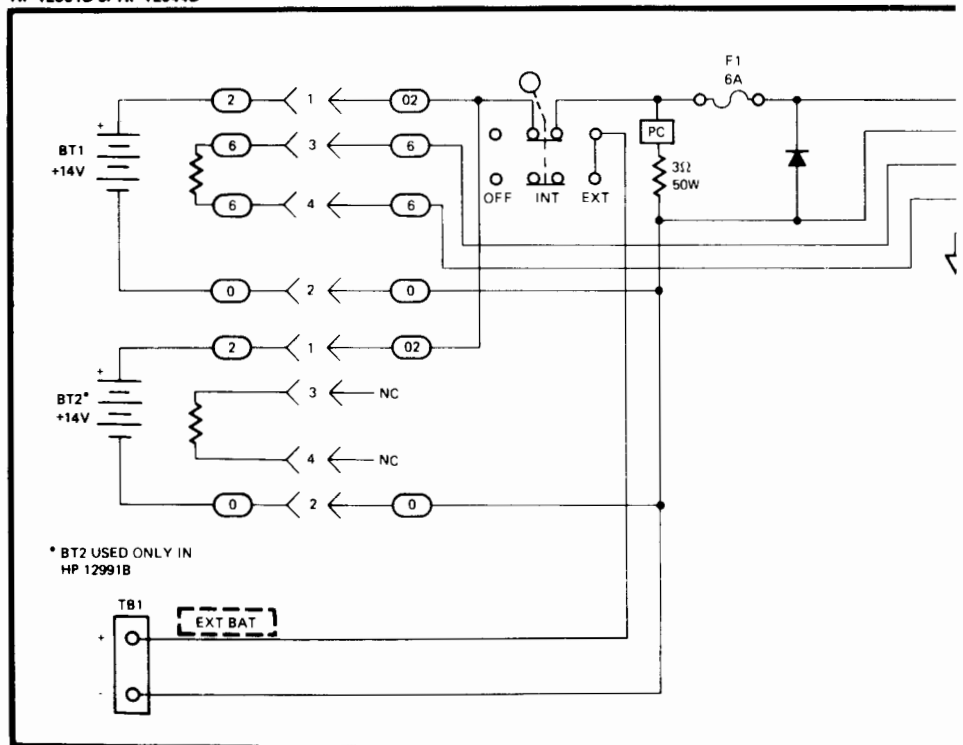


Figure 2-18. HP 2109B and HP 2113 Power Distribution Diagram

2-17/2-18

HP 12991B or HP 12944B



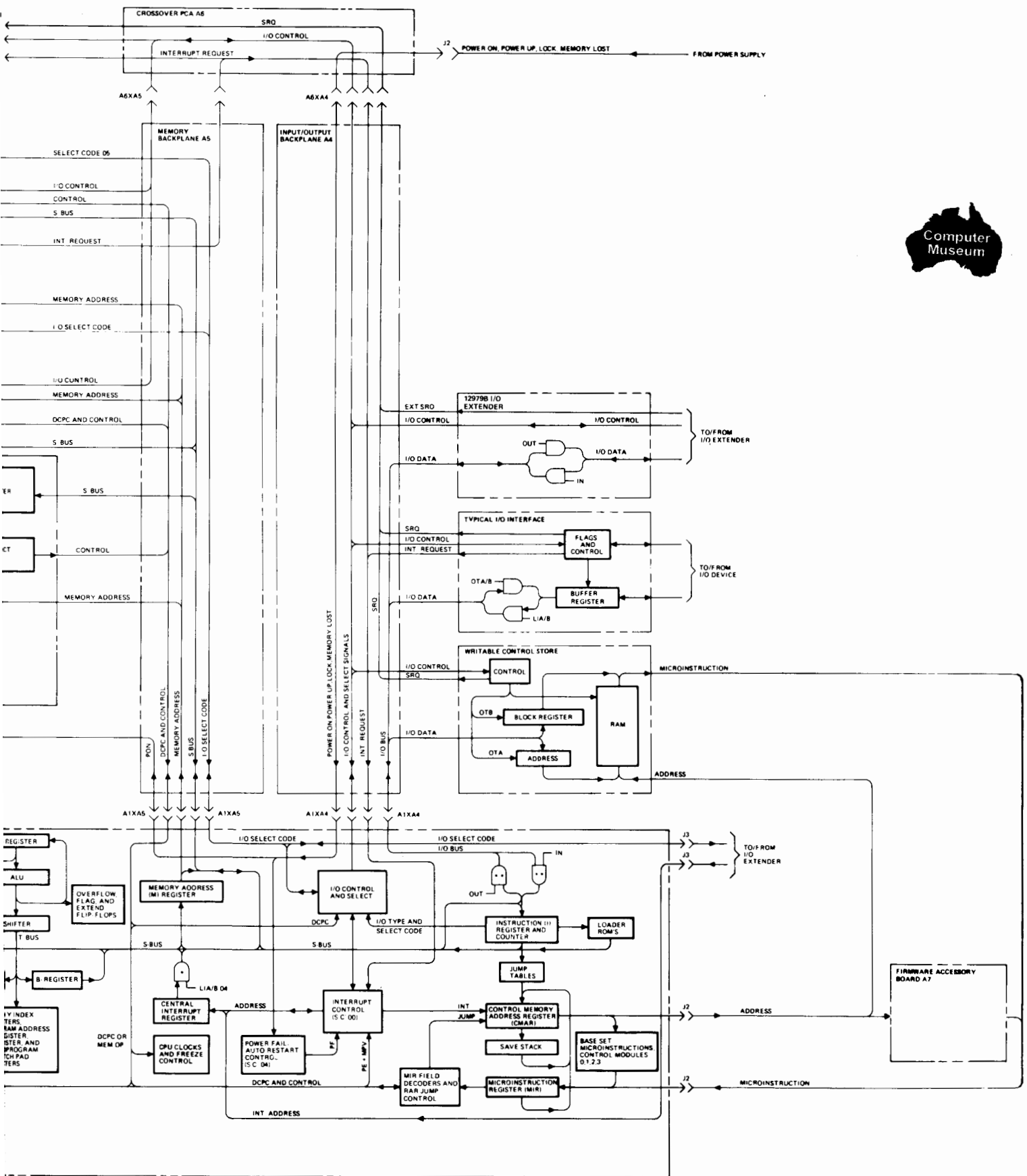
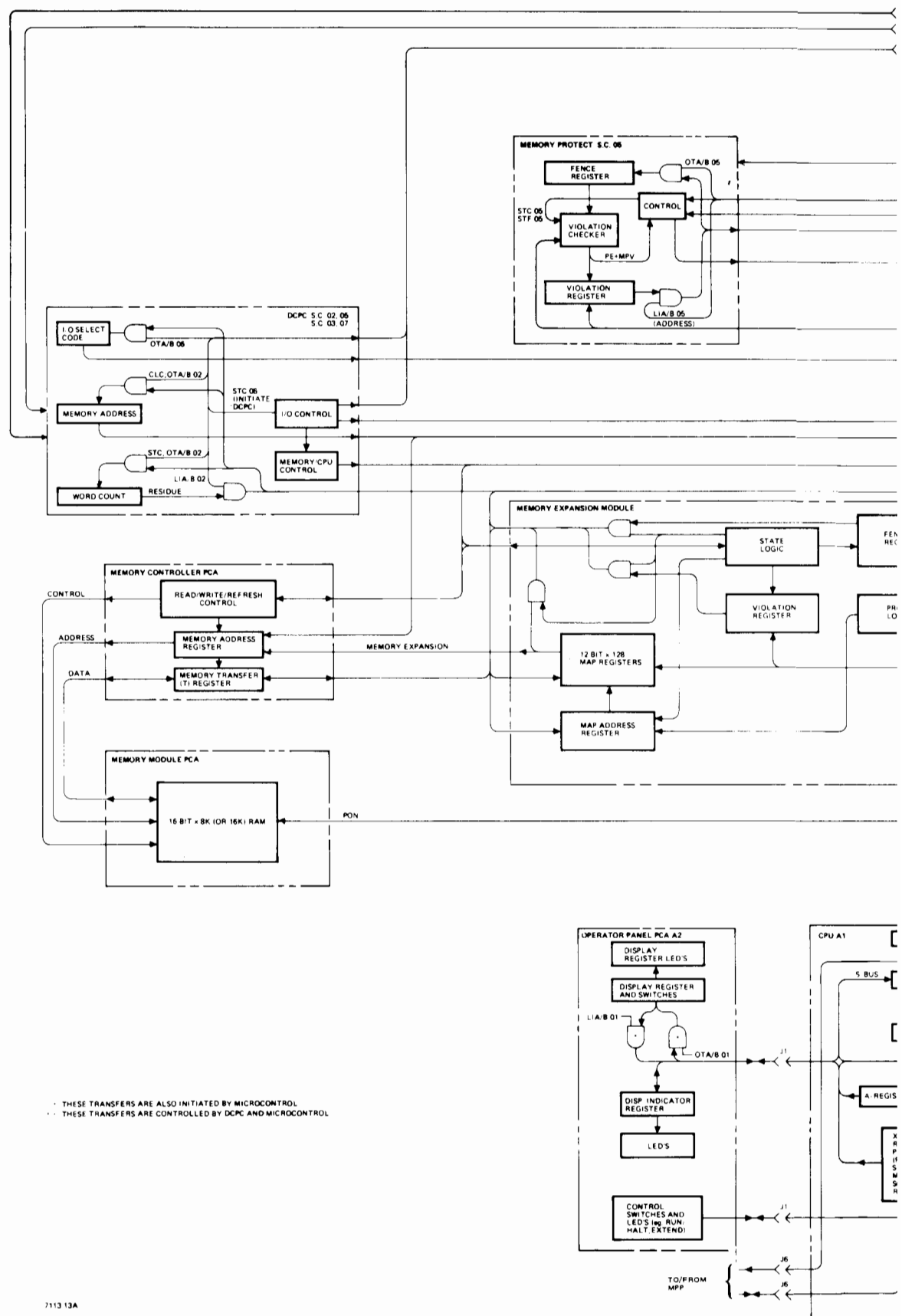


Figure 2-19. HP 1000 E-Series Computer Simplified Block Diagram



• THESE TRANSFERS ARE ALSO INITIATED BY MICROCONTROL
 • THESE TRANSFERS ARE CONTROLLED BY DCPC AND MICROCONTROL

REPLACEABLE PARTS

SECTION

III

This section provides a field-replaceable parts listing and an illustrated parts breakdown of the HP 2109B and HP 2113B Microprogrammable Computers. Component parts of most printed-circuit assemblies (PCA's) are not included, since these parts are considered replaceable only at the factory or a depot. Included in this section is a listing of subassemblies that comprise the Standard Performance, High Performance, and Fault Control Memory Systems and the power supply.

3-1. COMPUTER REPLACEABLE PARTS

Tables 3-1 and 3-2 and figures 3-1 and 3-2 list and illustrate the field-replaceable parts of the HP 2109B and HP 2113B Microprogrammable Computers. The replaceable parts are referenced to the exploded views by index numbers. The columns in the index numbered lists provide the following information for each part:

- a. **FIG & INDEX NO.** The figure and index number where the replaceable parts are shown in an exploded view.
- b. **HP PART NO.** The HP part number for each replaceable part.
- c. **DESCRIPTION.** The description of each replaceable part and its applicable reference designation.
- d. **MFR CODE.** A five digit code that denotes the manufacturer of the part. Refer to table 3-5 for a listing of the manufacturers that correspond to the codes.
- e. **MFR PART NO.** The manufacturer's part number for each replaceable part. Commercially obtainable parts are designated OBD (order by description).
- f. **UNITS PER ASSY.** The total quantity of each replaceable part of the computer or memory system.

3-2. POWER SUPPLY REPLACEABLE PARTS

Figure 3-3 and table 3-3 illustrates and lists the field-replaceable parts of the power supply.

3-3. MEMORY SYSTEM REPLACEABLE PARTS

Table 3-4 lists the field-replaceable parts of the Standard Performance, High Performance, and Fault Control Memory Systems.

3-4. ORDERING INFORMATION

To order replaceable parts, address the order to the local Hewlett-Packard Sales and Service Office listed at the end of this manual. (For I/O interface PCA or I/O device ordering information, refer to their respective manuals.) The following information should be included in the order for each replaceable parts:

- a. Complete model number (including options and accessories) and serial number.
- b. Hewlett-Packard part number for each part.
- c. Complete description for each part as provided in the replaceable parts lists.

Table 3-1. HP 2109B Computer Replaceable Parts

INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS/ ASSY.
1	02108-00034	Memory PCA Cage Cover	28480	02108-00034	1
2	5061-1341	Central Processor Unit A1	28480	5061-1341	1
**3	—	Memory PCA Cage Assembly	28480	—	1
*4	13304-60001	Firmware Accessory Board A7	28480	13304-60001	1
5	5061-1945	Bottom Cover	28480	5061-1945	1
6	5020-8838	Corner Struts	28480	5020-8838	4
7	5061-1336	Connector Assembly	28480	5061-1336	1
8	5000-8087	Universal Deck	28480	5000-8087	1
**9	—	I/O PCA Cage Assembly	28480	—	1
10	5020-8808	Rear Frame	28480	5020-8808	1
11	02108-00017	Side Cover	28480	02108-00017	2
12	5000-8094	Rear Cover (Battery)	28480	5000-8094	1
*13	12944-60001	Battery Box Assembly	28480	12944-60001	1
14	5001-2627	Mounting Bracket	28480	5001-2627	1
15	5061-1945	Top Cover	28480	5061-1945	1
16	5001-2602	Card Retainer	28480	5001-2602	1
17	5001-2608	Top Bracket	28480	5001-2608	1
18	5061-6615	Power Supply Assembly A3	28480	5061-6615	1
19	5061-1388	Crossover Board Assembly A6	28480	5061-1388	1
20	5001-2604	Card Cage Shield	28480	5001-2604	1
21	5001-2696	Protective Cover (p/o 18)	28480	5001-2696	—
22	9220-2078	Foam Pad	02900	—	2
23	5020-7335	Front Frame	28480	5020-7335	1
24	5001-2612	Lock Retainer	28480	5001-2612	1
25	4040-0572	Operator Panel PCA Cover	28480	4040-0572	1
26	5061-1343	Operator Panel PCA	28480	5061-1343	1
26A	1990-0529	Light Emitting Diode	28480	1990-0529	28
26B	02108-00014	Spring Contact	28480	02108-00014	22
26C	5040-6076	Switch (Mint Gray)	28480	5040-6076	13
26C	5040-6077	Switch (Jade Gray)	28480	5040-6077	9
27	5001-2638	Lock Latch	28480	5001-2638	1
28	02109-00002	Front Panel Extension	28480	02109-00002	1
29	1390-0344	Lock Assembly	02694	15748/4T1427 (SPECIAL)	1
30	1390-0345	Key 4T1427 (p/o 29)	02694	8632C-R1/ 4T1427	2
31	5001-2635	Sub Front Panel	28480	5001-2635	1
32	8300-0013	Front Panel Cable	28480	8300-0013	1
33	0570-0528	Press-In Stud	01836	—	2
34A	5001-2640	Hinge Plate (Right)	28480	5001-2640	1
34B	5001-2641	Hinge Plate (Left)	28480	5001-2641	1
35	02108-60021	Memory Backplane A5	28480	02108-60021	1
36	02108-60007	I/O Backplane A4	28480	02108-60007	1
*37	12897-60002	DCPC Cable Assembly	28480	12897-60002	1
38	5061-6612	Crossover Cable Assembly	28480	5061-6612	1
39	5061-1364	Status Cable Assembly	28480	5061-1364	1
40	5061-1397	MPP Cable Assembly	28480	5061-1397	1
41	7120-7603	Front Panel Overlay	28480	7120-7603	1
A	5040-6309	Safety Cover	28480	5040-6309	1
*HP accessory; shown only for reference.					
**Not field replaceable; shown for reference only.					

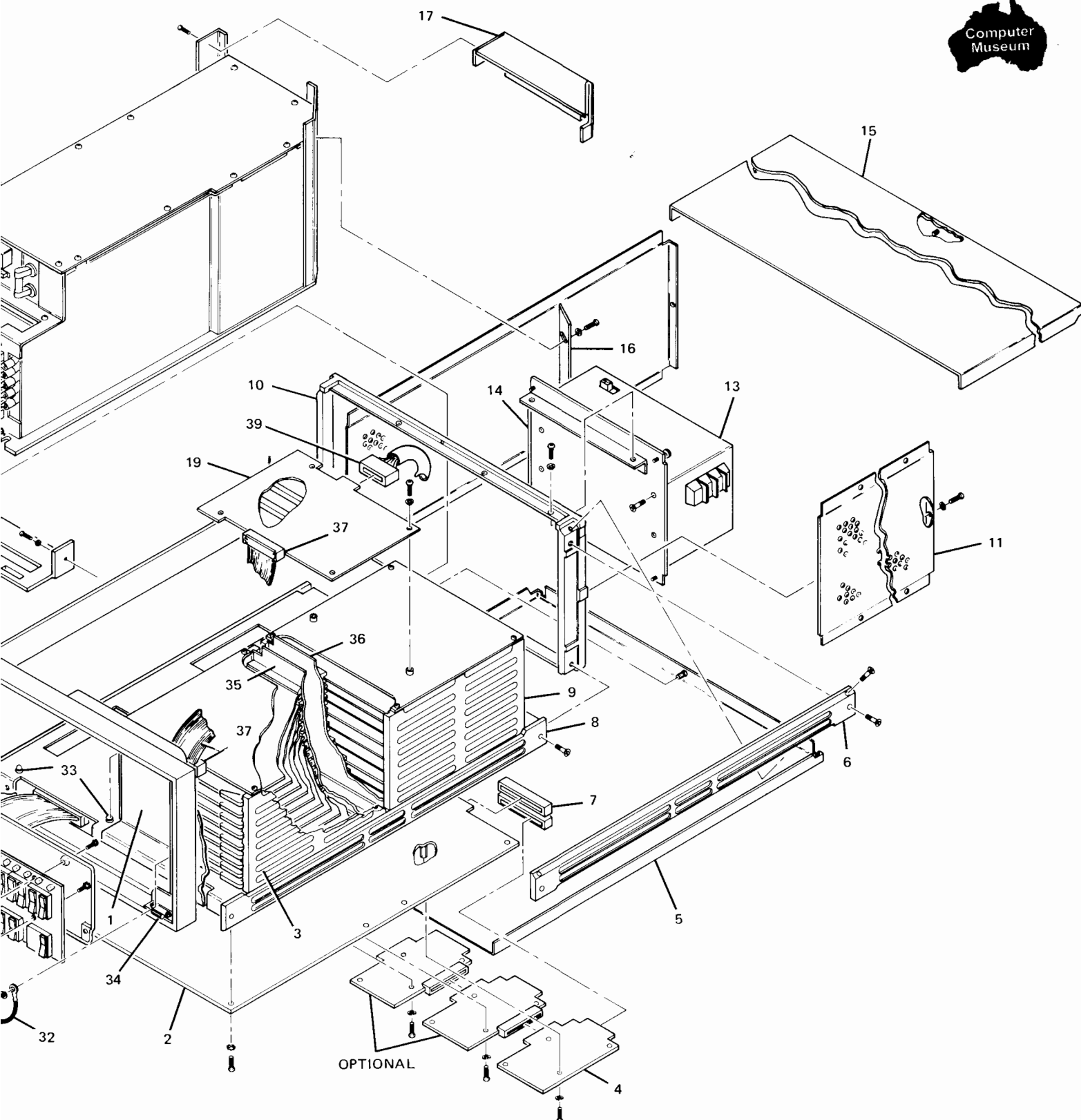
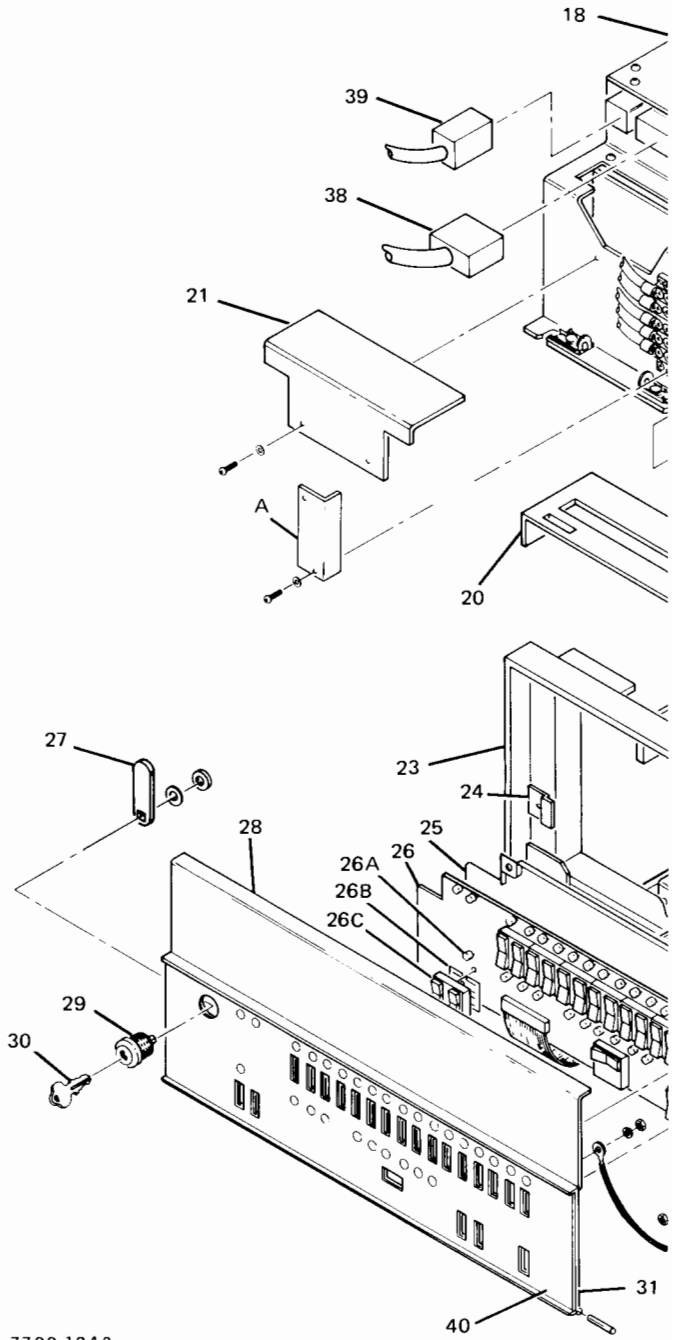


Figure 3-1. HP 2109B Computer Exploded View



7700-124A

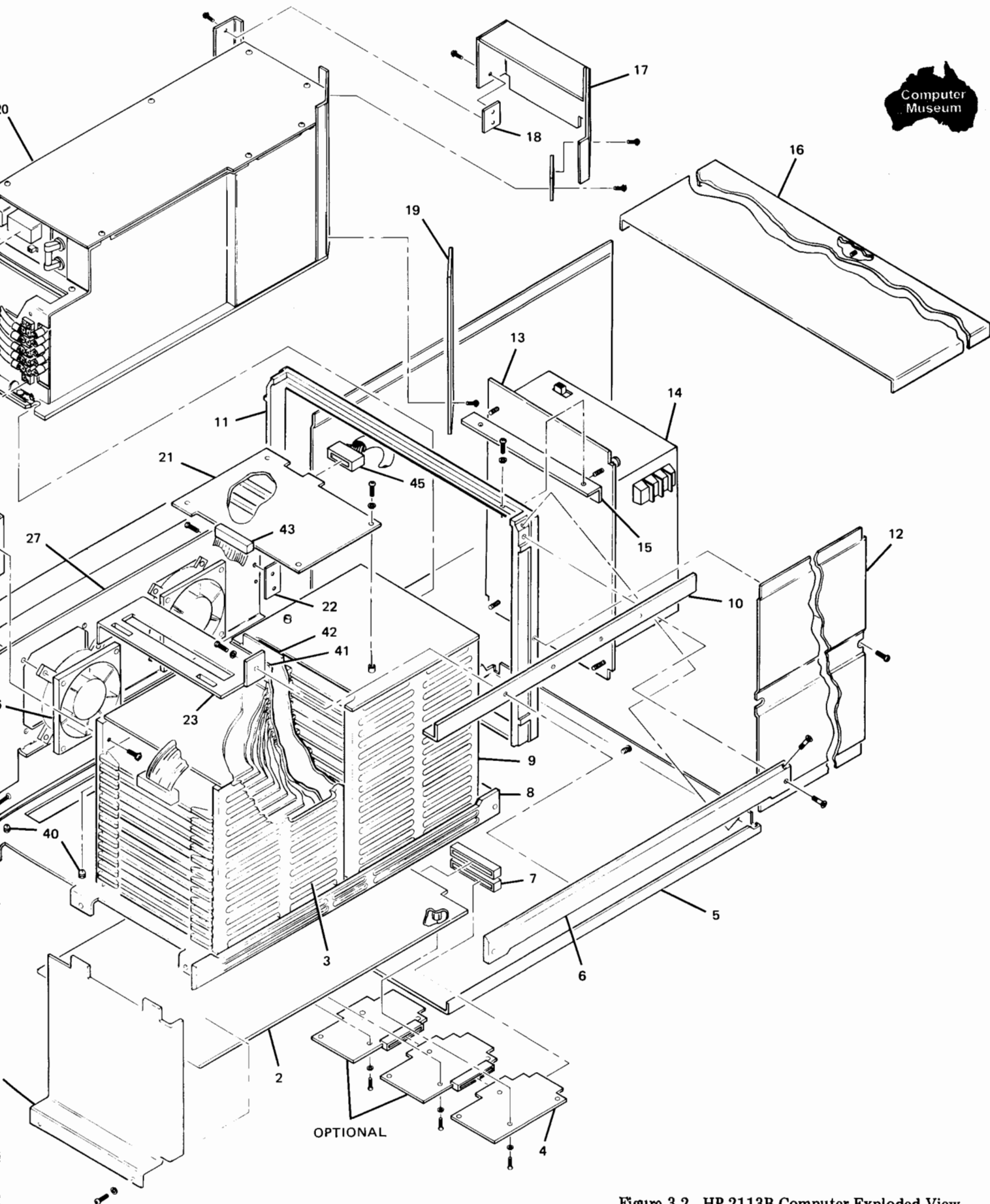


Figure 3-2. HP 2113B Computer Exploded View

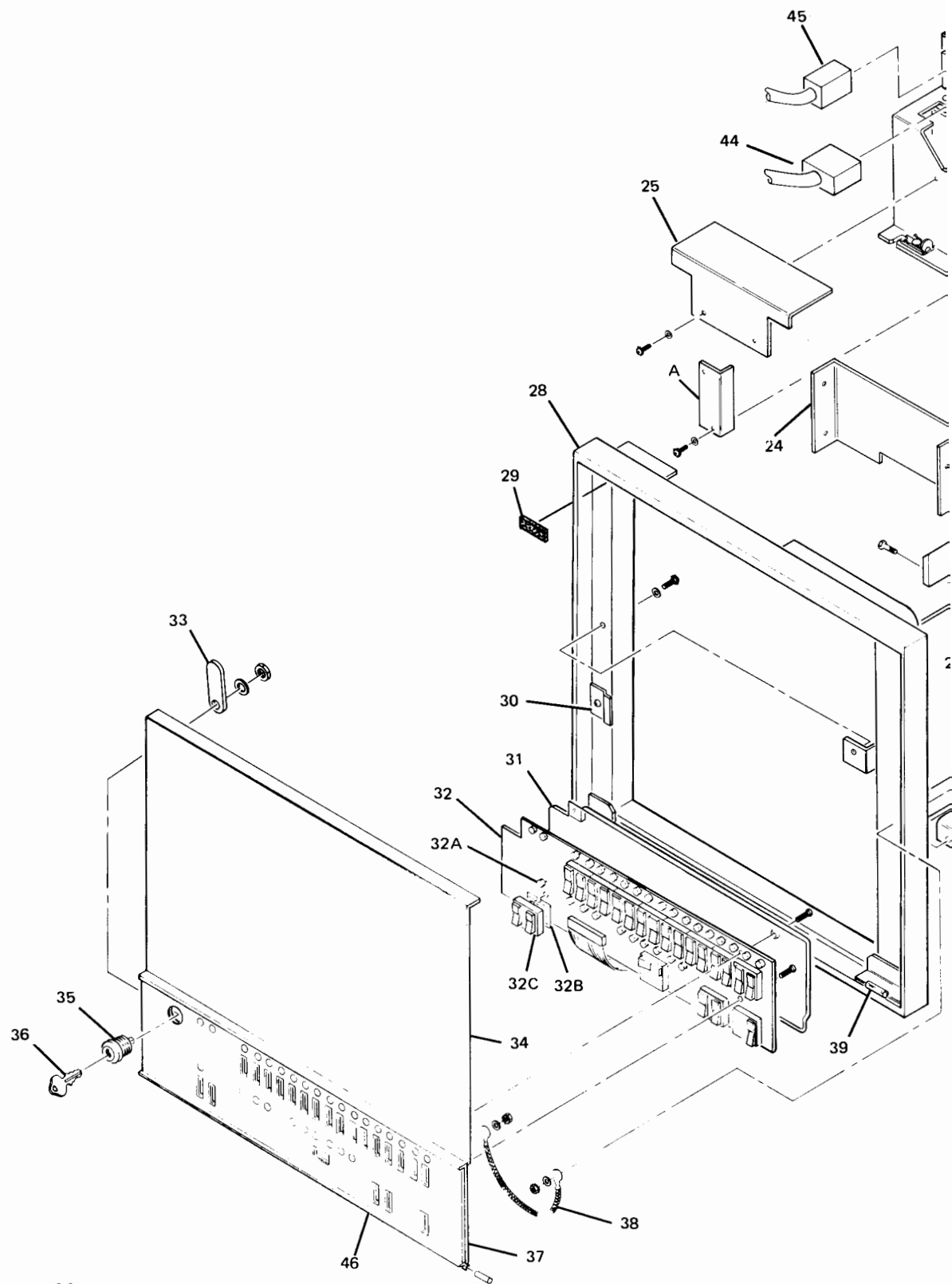


Table 3-2. HP 2113B Computer Replaceable Parts

INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS/ ASSY.
1	02112-00018	Memory PCA Cage Cover	28480	02112-00018	1
2	5061-1341	Central Processor Unit A1	28480	5061-1341	1
**3	—	Memory PCA Cage Assembly	28480	—	1
*4	13304-60001	Firmware Accessory Board A7	28480	13304-60001	1
5	5061-1945	Bottom Cover	28480	5061-1945	1
6	5020-8838	Corner Struts	28480	5020-8838	4
7	5061-1336	Connector Assembly	28480	5061-1336	1
8	5000-8087	Universal Deck	28480	5000-8087	1
9	—	I/O PCA Cage Assembly	28480	—	1
10	02112-00017	Support Bracket	28480	02112-00017	1
11	5020-8812	Rear Frame	28480	5020-8812	1
12	5060-9958	Side Cover	28480	5060-9958	2
13	02112-00029	Rear Cover (Battery)	28480	02112-00029	1
*14	12991-60001	Dual Battery Box Assembly	28480	12991-60001	1
15	12990-00019	Mounting Bracket	28480	12990-00019	1
16	5061-1945	Top Cover	28480	5061-1945	1
17	5000-8093	Rear Panel Extension	28480	5000-8093	1
18	5001-2636	Rear Panel Extension Bracket	28480	5001-2636	2
19	5001-2637	Card Retainer	28480	5001-2637	1
20	5061-6615	Power Supply Assembly A3	28480	5061-6615	1
21	5061-1388	Cross-over Board Assembly A6	28480	5061-1388	1
22	02112-00031	Fan Assembly Retainer	28480	02112-00031	1
23	02112-00016	Card Cage Shield	28480	02112-00016	1
24	5001-2639	Upper Level Shield	28480	5001-2639	1
25	5001-2696	Protective Cover (p/o 20)	28480	5001-2696	—
26	02112-60019	Upper Ventilating Fan w/cable	28480	02112-60019	2
27	02112-90007	Upper Ventilating Fan Assy	28480	02112-90007	1
28	5020-7333	Front Frame	28480	5020-7333	1
29	9220-2078	Foam Pad	02900	—	2
30	5001-2612	Lock Retainer	28480	5001-2612	1
31	4040-0572	Operator Panel PCA Cover	28480	4040-0572	1
32	5061-1343	Operator Panel PCA A2	28480	5061-1343	1
32A	1990-0529	Light Emitting Diode	28480	1990-0529	28
32B	02108-00014	Spring Contact	28480	02108-00014	22
32C	5040-6076	Switch (Mint Gray)	28480	5040-6076	13
32C	5040-6077	Switch (Jade Gray)	28480	5040-6077	9
33	5001-2638	Lock Latch	28480	5001-2638	1
34	02113-00002	Front Panel Extension	28480	02113-00002	1
35	1390-0344	Lock Assembly	02694	15748/4T1427 (SPECIAL)	1
36	1390-0345	Key 4T1427 (p/o 35)	02694	8632C-R1/ 4T1427	2
37	5001-2635	Sub Front Panel	28480	5001-2635	1
38	8300-0013	Front Panel Cable	28480	8300-0013	1
39A	5001-2640	Hinge Plate (Right)	28480	5001-2640	1
39B	5001-2641	Hinge Plate (Left)	28480	5001-2641	1
40	0570-0528	Press-In Stud	01836	—	2
41	02112-60002	Memory Backplane A5	28480	02112-60002	1
42	02112-60001	I/O Backplane A4	28480	02112-60001	1
*43	12897-60002	DCPC Cable Assembly	28480	12897-60002	1
44	5061-6612	Crossover Cable Assembly	28480	5061-6612	2
45	5061-1364	Status Cable Assembly	28480	5061-1364	1
46	5061-1397	MPP Cable Assembly	28480	5061-1397	1
47	7120-7603	Front Panel Overlay	28480	7120-7603	1
A	5040-6309	Safety Cover	28480	5040-6309	1

*HP accessory; shown only for reference.

**Not field replaceable; shown only for reference.

Table 3-3. Power Supply, 5061-3476 Replaceable Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
5061-3476	COMPLETE POWER SUPPLY ASSEMBLY	28480	5061-3476	1
5061-3455	Control Board (A5)	28480	5061-3455	1
5061-1351	Jumper Board (A4)	28480	5061-1351	1
5061-1371	Mother Board (A6)	2P480	5061-1371	1
3105-0106	Circuit Breaker (CB1; ~ POWER)	—	—	1
2110-0001	Fuse, 1A, normal blow (A6F2)	71400	AGC-1	1
5061-3454	Inverter Board (A2)	28480	5061-3454	1
1854-0896	Preregulator Transistor (A6Q1)	28480	1854-0896	1
2110-0001	Fuse, 1A, normal blow (A6F1)	71400	AGC-1	1
5061-3457	Preregulator Board (A1)	28480	5061-3457	1
3160-0341	Power Supply Fans (B1, B2)	28480	3160-0341	1
5061-1359	Power Supply Fan Cables	28480	5061-1359	2
5061-3403	Output Regulator Board (A3A6A1) (NOTE 1)	28480	5061-3403	1
5061-1349	Battery Backup Board (A4)	28480	5061-1349	Note 2
5061-1348	Battery Charge Board (A3)	28480	5061-1348	Note 2
NOTES 1. See Figure 2-1 for output regulator replaceable parts. 2. Part of HP 12991B and 12944B Power Fail Recovery System.				

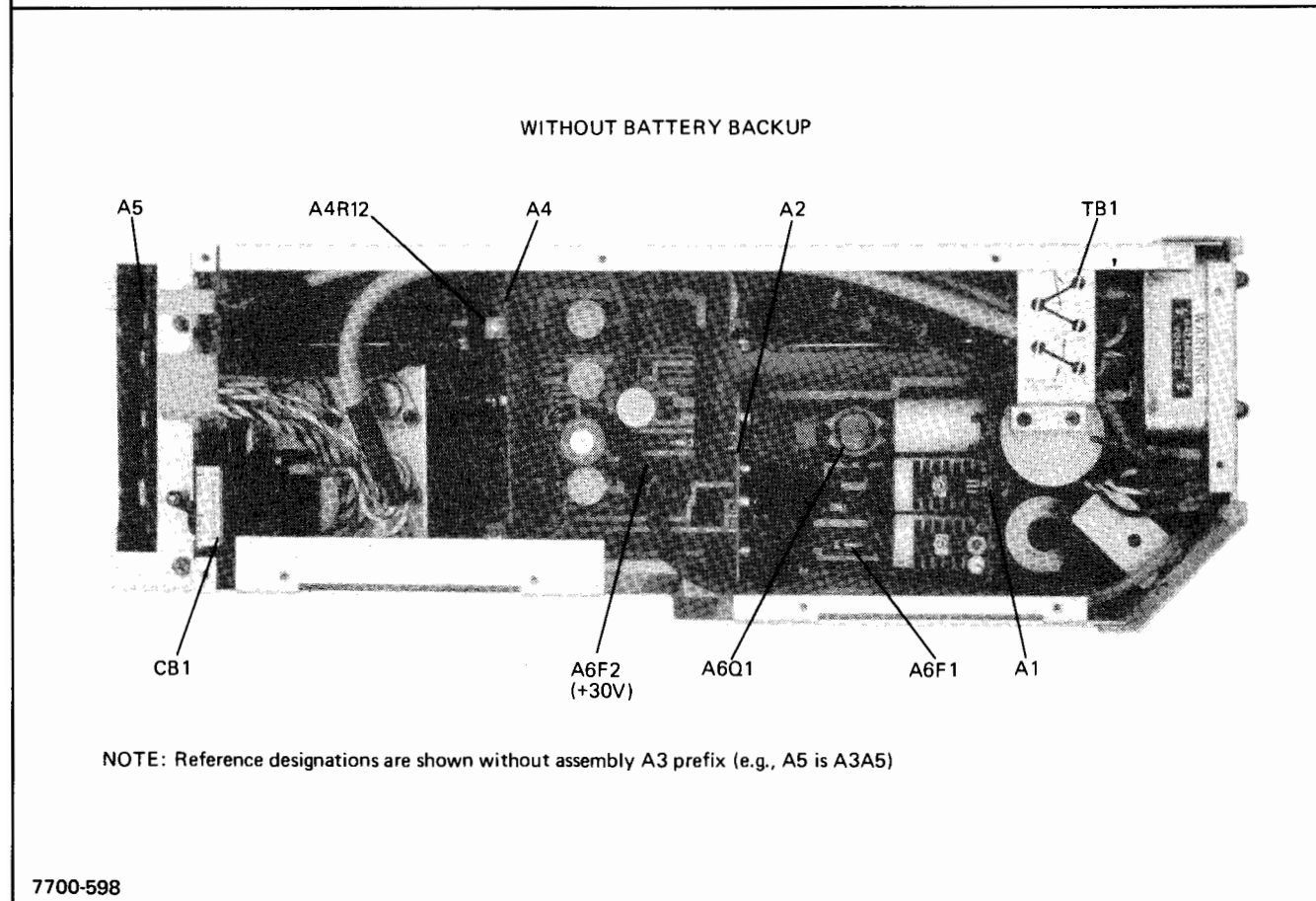
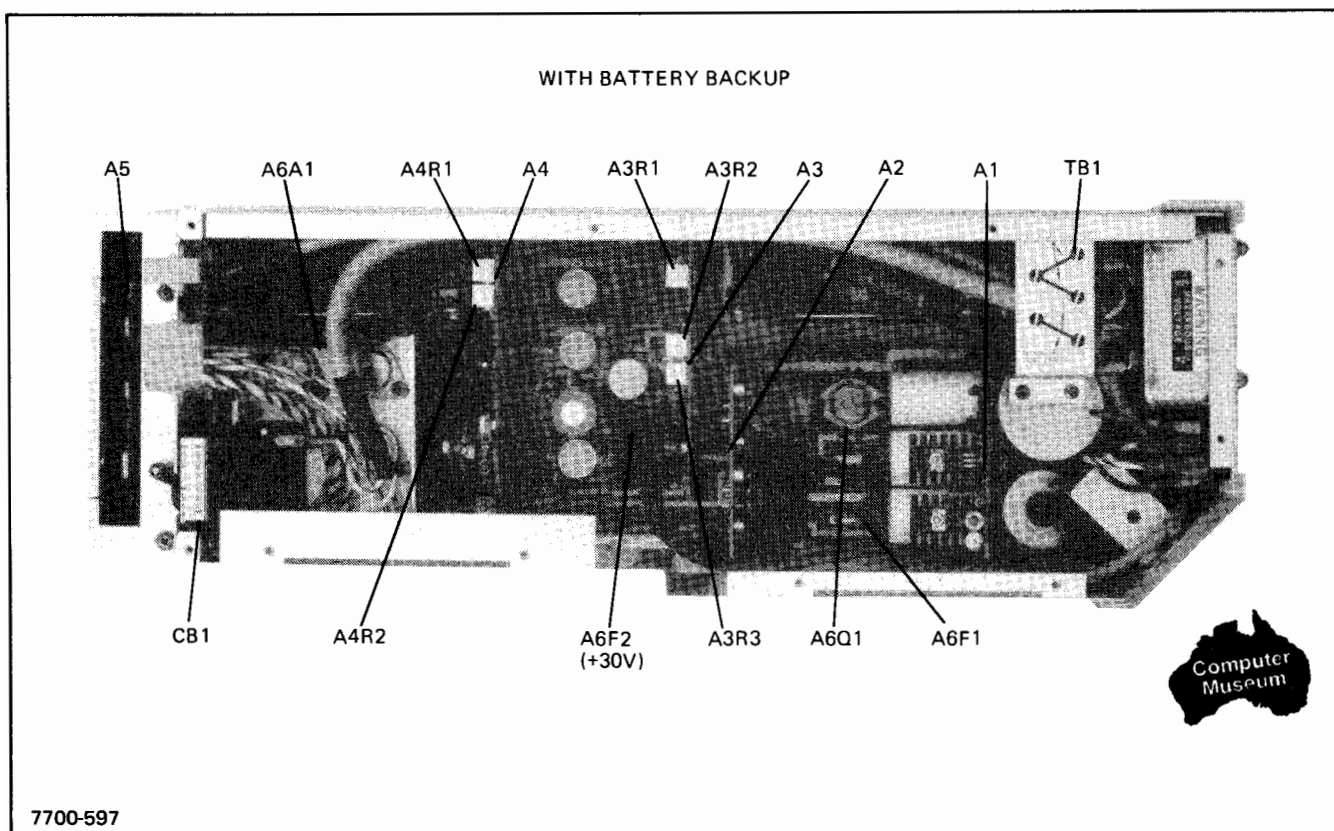


Figure 3-3. Power Supply Interior View, With and Without Battery Backup Boards

Table 3-4. Memory Systems and Accessories Replaceable Parts

HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS/ ASSY.
2102B	MOS STANDARD PERFORMANCE MEMORY SYSTEM	28480	2102B	1
5060-8360	Memory Controller PCA	28480	5060-8360	1
12747A	128k Byte Memory Module	28480	12747A	Note 1
13187B	32k Byte Memory Module	28480	13187B	Note 1
12998A	16k Byte Memory Module	28480	12998A	Note 1
02112-60016	Memory System Cable	28480	02112-60016	1
2102C	FAULT CONTROL MEMORY SYSTEM	28480	2102C	1
02102-60001	Fault Control Memory Controller PCA	28480	02102-60001	1
12779A	Fault Control Check Bit Array	28480	12779A	Note 1
12780A	Fault Control Check Bit Array	28480	12780A	Note 1
02108-60041	Memory System Cable	28480	02108-60041	1
02108-60016	Memory System Cable	28480	02108-60016	1
2102E	MOS HIGH PERFORMANCE MEMORY SYSTEM	28480	2102E	1
02102-60002	Memory Controller PCA	28480	02102-60002	1
12741A	32k Byte Memory Module	28480	12741A	Note 1
02112-60016	Memory System Cable	28480	02112-60016	1
	ACCESSORIES			
12892B	Memory Protect	28480	12892-60003	1
12897A	Dual-Channel Port Controller	28480	12897-60001	1
12897-60002	DCPC Cable Assembly	28480	12897-60002	1

Note 1: Depends on particular installations.

Table 3-5. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufactures Cataloging Handbooks H4-1 and H4-2 and their latest supplements.					
CODE NO.	MANUFACTURER	ADDRESS	CODE NO.	MANUFACTURER	ADDRESS
01836	Asco Screw Co.	San Carlos, Ca.	04713	Motorola Inc.	
02694	Corbin Cabinet Lock Div.			Semiconductor Prod. Div.	Phoenix, Az.
	Emhart Corp.	Berlin, Ct.	05008	AirPax Electronics Inc.	Cambridge, Mo.
02900	Wilshire Foam Products Inc.	Torrence, Ca.	07263	Fairchild Camera and Instrument Corp.	
03038	International Rectifier			Semiconductor Div.	Mt. View, Ca.
	Semicon Div.	El Segundo, Ca.	71400	Bussman Manufacturing Div.	
03495	IMC Magnetics Corp. NH Div.	Rochester, N.H.		McGraw-Edison Co.	St. Louis, Mo.

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