INSTALLATION AND SERVICE MANUAL

HP 12979A
INPUT/OUTPUT EXTENDER

Serial Numbers Prefixed: 1430, 1445, 1512
Manual part no. 12979-90006
Microfiche part no. 12979-90008

Printed: MAY 1975

HEWLETT PACKARD

HEWLETT hp PACKARD

CERTIFICATION

Products, materials, parts, and services furnished on this order have been provided in accordance with all applicable Hewlett-Packard specifications. Actual inspection and test data pertaining to this order is on file and available for examination.

Hewlett-Packard's calibration measurements are traceable to the National Bureau of Standards to the extent allowed by the Bureau's calibration facilities.

The Hewlett-Packard Quality Program satisfies the requirements of MIL-Q-9858, MIL-I-45208, and MIL-C-45662.

HEWLETT PACKARD

INSTALLATION AND SERVICE MANUAL

HP 12979A
INPUT/OUTPUT EXTENDER

Serial Numbers Prefixed: 1430, 1445, 1512
Manual part no. 12979-90006
Microfiche part no. 12979-90008

Printed: MAY 1975

OPTIONS COVERED

This manual covers option 001,010, and 015 as well as the basic extender.

HEWLETT-PACKARD COMPANY
11000 WOLFE ROAD, CUPERTINO, CALIFORNIA, U.S.A.

LIST OF EFFECTIVE PAGES

Pages	Issue
Title	30 May 1975
ii	30 May 1975
iii thru v	Original
1-1 thru 1-3	Original
1-4	31 Jan 1975
1-5 thru 1-12	Original
1-13	30 May 1975
1-14, 1-15	Original
2-1 thru 2-8	Original
3-1 thru 3-11	Original
3-12 (blank)	Original
3-13 thru 3-27	Original
3-28, 3-29	30 May 1975
3-30 (blank)	Original
3-31	30 May 1975
3-32, 3-33	Original
4-1 thru 4-8	Original
4-9	31 Jan 1975

PREFACE

This manual provides installation and service instructions for the Hewlett-Packard 12979A Input/Output Extender. The extender accommodates 16 additional channels as an extension of the HP 21MX Computer Series vectored priority input/output system. A second extender may be used in this system to provide additional channels of input/output.

Supporting documentation for the HP 12979A Input/Output Extender are as follows:

a. **HP 21 MX Computer Series Installation and Service Manual,** part no. 02108-90006.

b. **HP 21MX Computer Series Reference Manual,** part no. 02108-90002.

c. **HP 21MX Computer Series Operator's Manual,** part no. 02108-90004.

d. **Microprogramming HP 21MX Computers Operating and Reference Manual,** part no. 02108-90008.

e. **HP 12979A Input/Output Extender Operating and Reference Manual,** part no. 12979-90007.

f. **HP 12979A Input/Output Extender Installation and Service Manual,** part no. 12979-90006.

CONTENTS

ILLUSTRATIONS

TABLES

INSTALLATION

SECTION I

This section provides installation instructions for the HP 12979A Input/Output (I/O) Extender. Included in these instructions are site preparation data, unpacking and inspection, installation requirements and procedures, performance check, claims procedure, and recommended packing and shipping methods.

1-1. SITE PREPARATION

Site preparation information for the I/O extender includes environmental limitations, power requirements, and mounting considerations. If the I/O extender is purchased as part of a computer system, disregard the contents of paragraphs 1-2 through 1-5 and refer instead to the **Hewlett-Packard Computer Systems Site Preparation Manual,** part no. 02000-90097.

1-2. ENVIRONMENTAL LIMITATIONS

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

Table 1-1. I/O Extender Environmental Limitations

AMBIENT TEMPERATURE	
Operating:	0° to 55°C (32° to 131°F)
Nonoperating:	−40° to 75°C (−40° to 167°F)
ALTITUDE	
Operating:	15,000 feet (4,573 meters)
Nonoperating:	25,000 feet (7,622 meters)
RELATIVE HUMIDITY	
20 to 95% at 25° to 40°C (77° to 104°F) without condensation.	

1-3. POWER REQUIREMENTS

The I/O extender is shipped with the power supply configured to operate from single-phase power mains of 110 ± 20% volts (standard) or 220 ± 20% volts (option 015) as specified in the purchase order. The maximum power consumption is 525 watts.

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

1-4. COOLING REQUIREMENTS

There are no external cooling requirements for the extender. Two internal blowers provide adequate ventilation when operated within the environmental limitations specified in table 1-1.

1-5. MOUNTING CONSIDERATIONS

The extender may be used either as a freestanding device or mounted in a standard 19-inch (482.6-millimeter) equipment rack. The extender need not be fastened down when used in a land-based environment as a freestanding instrument on a shelf, bench, or table. When used in a mobile environment, the extender should be installed in a shock-mounted equipment rack. If the extender is to be rack-mounted, allow 8-3/4 inches (223 millimeters) of vertical rack space and a depth of 24-1/2 inches (622 millimeters), including cables. The extender must be mounted in the same rack cabinet as the processor.

1-6. UNPACKING AND INSPECTION

The extender 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 in any way, or if any container is waterstained, request the carrier's agent be present when that container is opened.

Open the shipping container(s) and locate the envelope marked "CUSTOMER RECORDS." One of the items in this envelope is a list of equipment shipped. 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 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 extender or accessories, follow the damage-claim procedure described in paragraph 1-31. Retain the shipping container(s) and packing material for examination in the settlement of claims or for future use.

1-7. PHYSICAL INVENTORY

1-8. EQUIPMENT

The extender serial number is stamped on an identification label affixed to the rear panel. Ensure that the serial number is identical with the serial number specified in the "CUSTOMER RECORDS" envelope.

All options are installed and tested at the factory. Each option installed at the factory is identified by a three-digit number (e.g., 001, 010, 015, etc.) stamped on the identification label. Check these numbers to verify the installation of the options specified in the "CUSTOMER RECORDS" envelope.

A visual inspection of the front input/output (I/O) printed-circuit assembly (PCA) cage must be made to verify the installation of the optional dual-channel port controller (DCPC) if specified in the purchase order. Loosen the two quarter-turn fasteners on the front panel and remove the front panel to access the front I/O PCA cage. As shown in figure 1-1, a special slot is dedicated to the DCPC PCA. Replace the front panel and tighten the two quarter-turn fasteners.

Remove the rear cover by pulling outward on the four plungers. Loosen the two screws securing the rear PCA retainer to the rear panel and slide retainer to the right. (See figure 1-2.) Remove the I/O extender PCA, part no. 02155-60003, by pulling outward on the PCA extractor levers. Replace the rear cover by pushing inward on the four plungers.

If optional interface PCA's have been ordered, refer to the appropriate interface or subsystem documentation for identification features of the associated interface PCA.

1-9. PROGRAM TAPES

Check the punched tapes received with the shipment to ensure that all tapes listed in the "CUSTOMER RECORDS" envelope have been received.

1-10. MANUALS

Check to ensure that all manuals listed in the "CUSTOMER RECORDS" envelope have been received. Perform any updating that may be required for the extender documentation. Updating instructions (if any) are provided in a supplement accompanying the appropriate document.

1-11. INSTALLATION REQUIREMENTS

1-12. EXTENDER PRIORITY

The processor may use up to two I/O extenders, each of which provides 16 additional I/O slots for interfacing the processor with peripheral devices. To eliminate extender priority conflicts, programmable jumpers located on each extender control PCA in each I/O extender are used to determine the relative priority of the I/O extenders used.

When one extender is used, for example, then the extender control PCA is configured for one extender as shown in figure 1-3A. If the optional second extender is used, then the extender control PCA in the second extender is configured for extender two as shown in figure 1-3B. Thus extender number 1 will have the higher priority device PCA's and extender number 2 will have the lower priority device PCA's.

The I/O extender is configured at the factory for extender priority as part of a complete system. If modification of the system is required, it is recommended that a qualified person or an HP service representative perform the reconfiguration of the extender priority.

1-13. I/O PRIORITY ASSIGNMENT

Each peripheral device in the extended system must be connected to the extender through an interface PCA. 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 0 having the highest priority and slot 20 having the lowest priority. (See figures 1-1 and 1-2.) 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 0 to 20 due to the priority chaining scheme except slots of lower priority than the last slot used. For example, if the last interface PCA is installed in slot 15, then slots 16, 17, and 20 can be left vacant.

From a standpoint of time, it is more economical to assign the higher priorities to high-speed devices and lower priorities to low-speed devices. However, if a subsystem could suffer catastrophic data 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 details concerning power requirements, I/O PCA jumper requirements (if any), and priority considerations. I/O interface PCA power requirements is an important consideration in determining the priority assignment of the peripheral devices to be used in the I/O system. Because of cabling requirements for the HP 12978A Writable Control Store (WCS) option, HP does not recommend installing this PCA in the I/O extender.

The extended I/O system is configured at the factory for I/O priority assignments as part of a complete system. The I/O extender PCA, part no. 02155-60003, interfaces the processor to the extender. The I/O extender PCA is located in the lowest used I/O slot in the processor. In other words, there may be vacant I/O slots in the

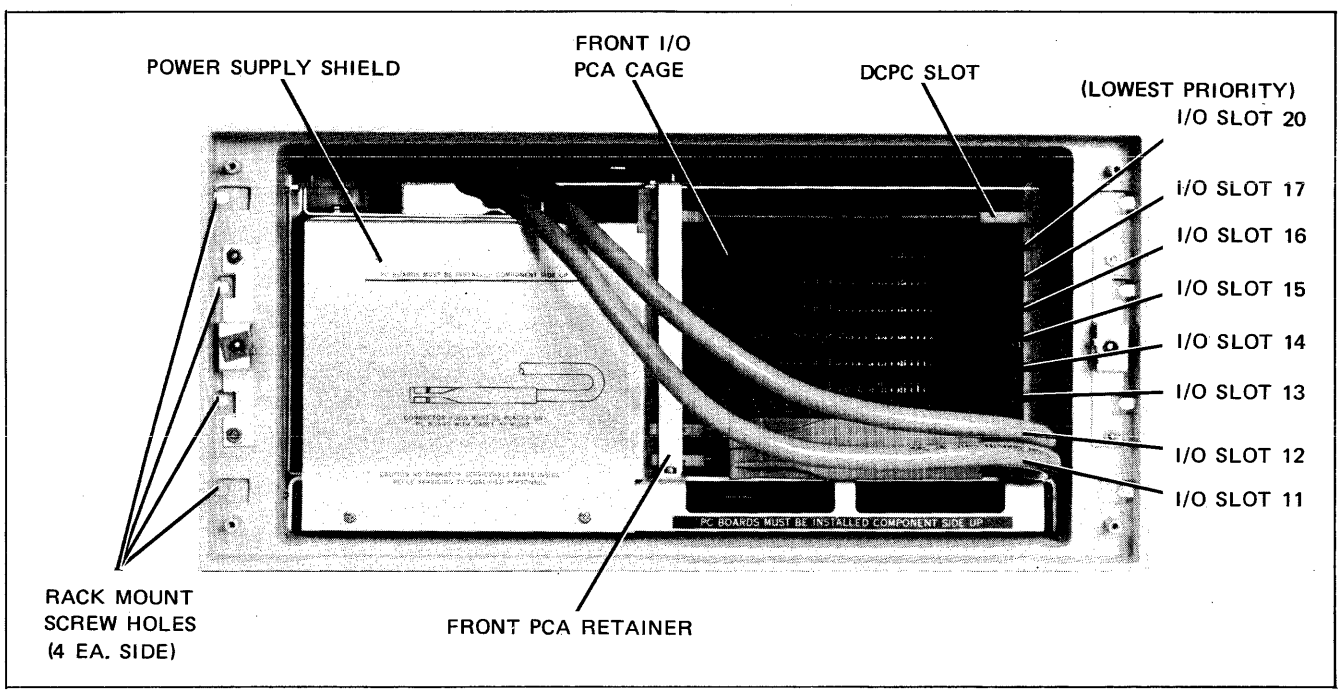


Figure 1-1. HP 12979A I/O Extender Front View

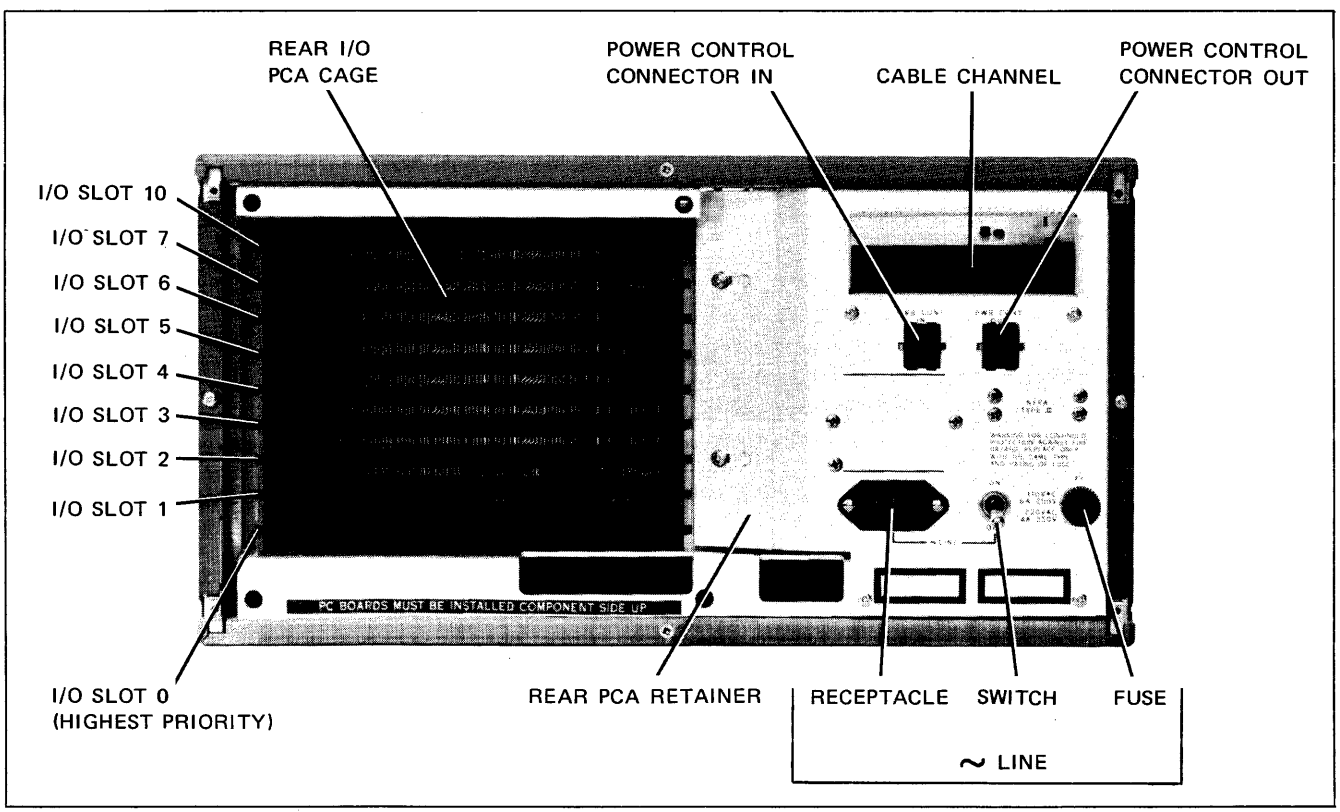
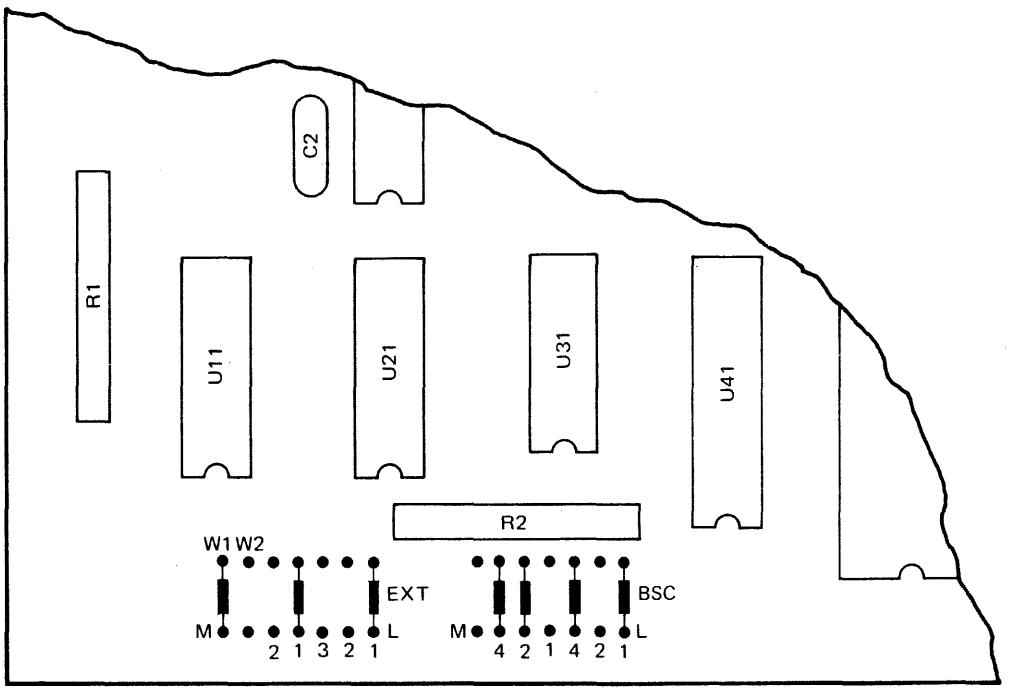
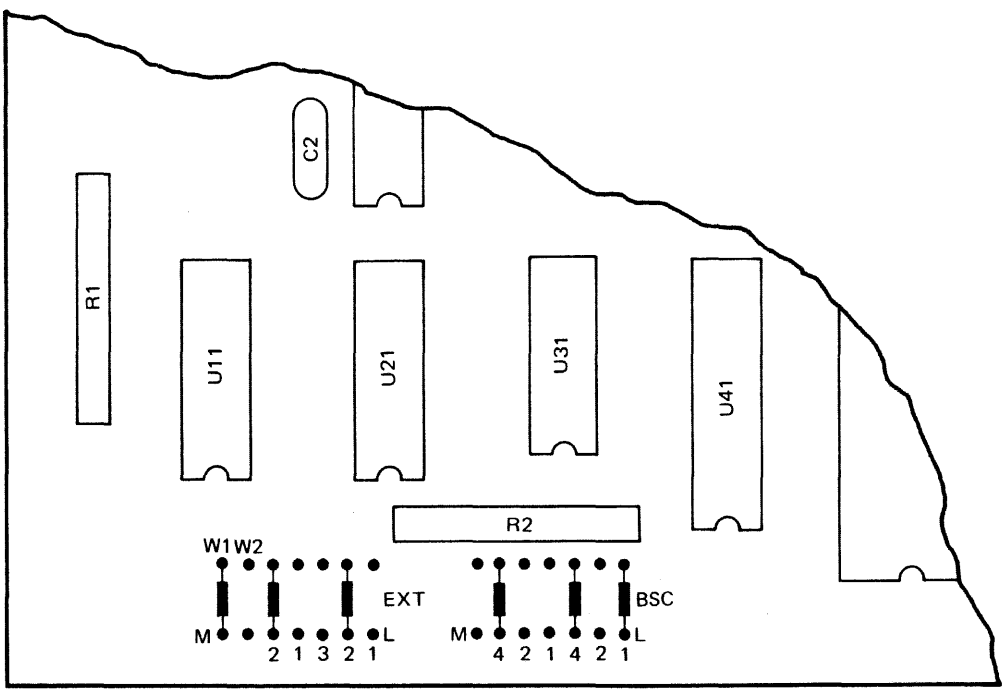


Figure 1-2. HP 12979A I/O Extender Rear View



A. EXTENDER NO. 1 WITH BSC 12_8



B. EXTENDER NO. 2 WITH BSC 32_8

NOTE: BSC JUMPER OUT = LOGIC 1

Figure 1-3. Extender Control PCA Jumper Positions

processor following the installed I/O extender PCA. For example, if the last I/O interface PCA installed in the processor I/O PCA cage is slot 11, then the I/O extender PCA is installed in slot 12 with the remaining I/O slots in the processor left vacant.

On the extender control PCA, the base select code (BSC) is configured in accordance to the select code that the I/O extender PCA occupies in the processor I/O section. (The I/O extender PCA is the lowest priority device used in the processor I/O section.) If the I/O extender PCA is installed in select code 12_8, then the BSC jumper configuration on the extender control PCA is configured as BSC 12_8, which completes the priority chain between the processor and the I/O extender. Figure 1-3A illustrates the BSC jumper configuration required for select code 12_8. Note that the **absence** of a jumper is a logic 1.

If the optional second I/O extender is used, then the BSC in the second I/O extender is assigned the next sequential select code following the last select code used in the first extender. For example, if the last select code used in the first I/O extender is select code 31_8, then the BSC jumper configuration on the extender control PCA in the second I/O extender is configured as BSC 32_8. (See figure 1-3B.) The priority chain is thus completed between the processor, the first I/O extender, and the second I/O extender.

If modification of the system is required, it is recommended that a qualified person or an HP service representative perform the reconfiguration of the I/O priority assignment.

1-14. AC POWER MAINS OUTLET AND EXTERNAL GROUND

The female power outlet to be used to supply ac mains power to the extender must be checked by a qualified electrician to ensure that it furnishes the proper voltage for which the extender is configured. Furthermore, the outlet and its associated wiring and fuses (or circuit breakers) must be capable of carrying at least 6 amperes for 110-volt operation or 4 amperes for 220-volt operation.

Figures 1-4 and 1-5 illustrate and provide the necessary details of the various ac power cord configurations. If the extender 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 extender.

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

If the line voltage is in the correct range, have a qualified electrician also check the power outlet to ensure that it is wired correctly with respect to ac high potnetial, 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 extender chassis and earth ground. For installation in a mobile environment (e.g., ship, aircraft, motor vehicle, or train), the earth ground wire in the extender ac power cord must be connected to the hull or metal frame of the vehicle.

1-15. EXTENDER MOUNTING

1-16. BENCH MOUNTING. As stated under paragraph 1-5, the extender need not be fastened down when 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. Bear also in mind that a minimum 12 inches (305 millimeters) of clearance for both the extender front and rear panels is required when removing and installing I/O interface PCA's.

1-17. RACK MOUNTING. The HP 12903B Slide Mounting Kit is available for rack mounting the extender. If a slide mounting kit has been ordered, mount the components to the sides of the extender and to the inside of the rack according to the instructions furnished with the kit. Then install the extender in the rack and secure it in place with the screws inserted through the mounting holes identified in figure 1-1. The extender is light enough to allow installation in the rack without being supported by any other means than the rack-mounting screws.

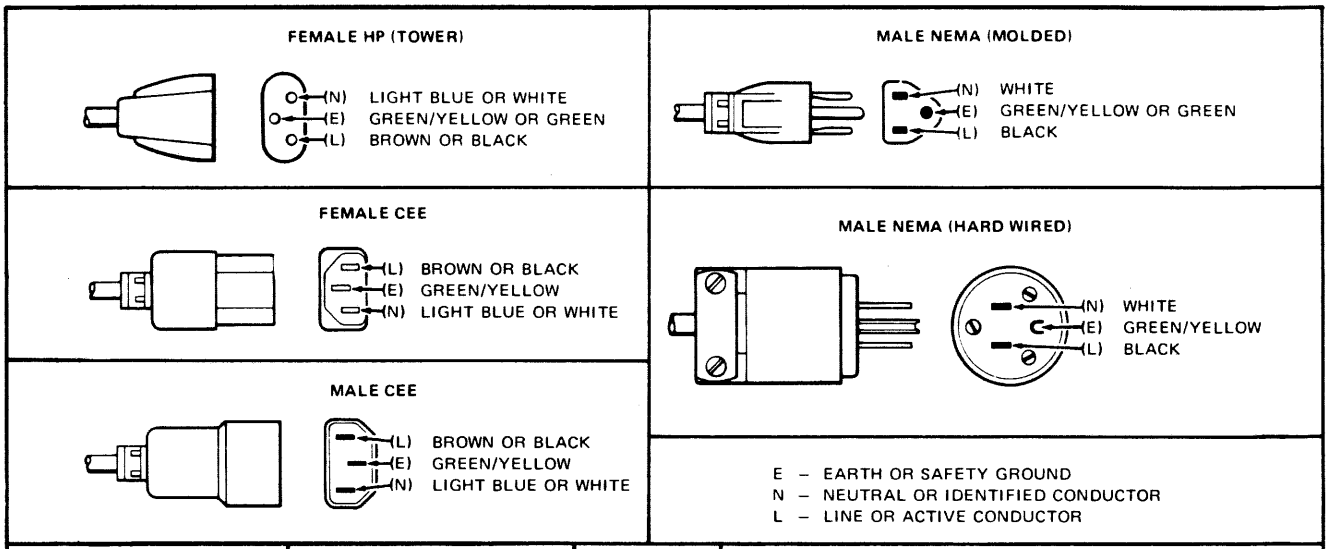
1-18. INSTALLATION PROCEDURES

1-19. SINGLE I/O EXTENDER INSTALLATION

Single I/O extender installation provides 16 additional I/O slots to the processor. The extender PCA's and cables interconnect the processor and the extender as shown in figure 1-6. Assuming that extender priority and I/O priority have been determined as described in paragraphs 1-12 and 1-13, proceed as follows:

WARNING

Hazardous voltages are present inside the extender mainframe!! Before installing the extender, ensure that ∼LINE switch is set to OFF and POWER CORD is DISCONNECTED!! Failure to observe this precaution can result in serious injury or DEATH!!



HP PART NUMBER	POWER CORD LENGTH		WIRE SIZE	CONNECTORS
8120-1406	2 1/2 ft.	(76 cm)	18/3	FEMALE HP (TOWER) to MALE CEE
8120-1396*	2 1/2 ft.	(76 cm)	18/3	FEMALE CEE to MALE CEE
8120-1900*	2 1/2 ft.	(76 cm)	16/3	FEMALE CEE to MALE CEE
8120-1625*	8.0 ft.	(2.4 m)	18/3	FEMALE CEE to MALE CEE
*USA OR NON-USA				
8120-1405	2 1/2 ft.	(76 cm)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1348	7 1/2 ft.	(2.2 m)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1395	8.0 ft.	(2.4.m)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1407	15.0 ft.	(4.5 m)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1933	2 1/2 ft.	(76 cm)	16/3	STRIPPED ENDS to MALE CEE
8120-1755	4.0 ft.	(1.22 m)	18/3	STRIPPED ENDS to MALE CEE
8120-1934	4.0 ft.	(1.22 m)	16/3	STRIPPED ENDS to MALE CEE
8120-1706	15.0 ft.	(4.5 m)	14/3	STRIPPED ENDS to MALE NEMA (HARD WIRED)
8120-1935	12.0 ft.	(3.6 m)	16/3	STRIPPED ENDS to MALE NEMA (HARD WIRED)
8120-1796	8.0 ft.	(2.4 m)	18/3	FEMALE CEE to MALE NEMA (HARD WIRED)
8120-1931	8.0 ft.	(2.4 m)	16/3	FEMALE CEE to MALE NEMA (HARD WIRED)
8120-1932	12.0 ft.	(3.6 m)	16/3	FEMALE CEE to MALE NEMA (HARD WIRED)

NOTE: OTHER COUNTRIES SUCH AS CANADA, JAPAN (100 or 200 VOLTS), MEXICO, PHILLIPPINES, AND TAIWAN MAY USE SOME OF THE ABOVE SETS. CONSULT YOUR NEAREST HP SALES OFFICE.

Figure 1-4. AC Power Cord Sets (USA)

a. Set ~LINE switch to OFF and remove power cord.

b. Loosen screw located in rear fold of extender bottom cover. Slide bottom cover toward rear and remove.

c. If reconfiguring of extender priority or I/O priority assignment is not required, proceed with step k.

d. Remove the six screws and washers securing extender control PCA to bottom of extender mainframe.

e. Carefully disengage extender control PCA from I/O backplanes to access terminal block TB1. (See figure 3-2.)

f. Loosen the three screws on TB1 and disconnect each wire. Carefully remove extender control PCA.

g. On extender control PCA component side, install or remove extender (EXT) or base select code (BSC) jumpers in accordance with the extender and I/O priorities established previously. (See figure 1-3.)

h. Slide spade lug of each wire under washer of appropriate connection on TB1 and tighten screw. Observe color code of each wire for proper connection.

i. Reinstall extender control PCA onto I/O backplanes.

j. Replace the six screws and washers securing extender control PCA to bottom of extender mainframe.

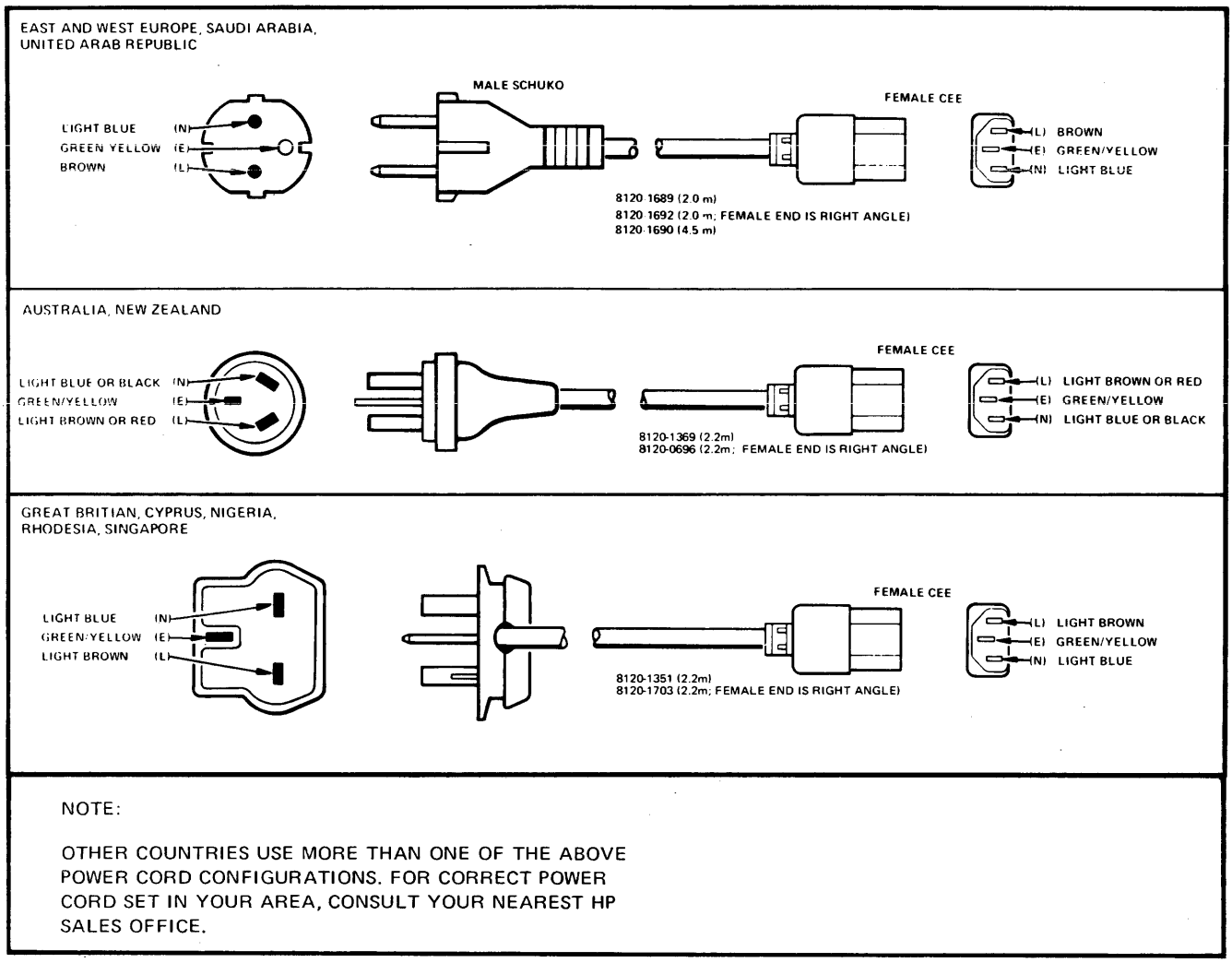


Figure 1-5. AC Power Cord Sets (Non-USA)

k. Loosen the two screws securing connector retainer to bottom of extender mainframe. Slide retainer away from extender control PCA connector A1J3. (See figure 1-7.)

l. Pass one end of I/O extension cable assembly (part no. 12979-60006) through opening at rear of extender and connect it to extender control PCA connector A1J3. (See figure 1-6.)

m. Slide connector retainer against cable connector hood and secure retainer in place by tightening the two screws.

n. Reinstall extender bottom cover.

o. On processor operator panel, rotate key-operated switch to STANDBY.

p. If power fail recovery system is installed in processor, set BATTERY switch to OFF and disconnect battery cable from BAT. INPUT connector.

q. Remove processor I/O PCA cage cover by loosening the four captive screws (HP 2105A) or pulling outward on the four plungers (HP 2108A).

r. Loosen one screw (HP 2015A) or two screws (HP 2108A) that secure I/O PCA retainer to rear panel and slide retainer to right.

s. Install I/O extender PCA (part no. 02155-60003) in lowest used I/O priority slot in processor.

t. Connect other end of I/O extension cable assembly (part no. 12979-60006) to I/O extender PCA connector.

u. Slide I/O PCA retainer to the left and secure in place by tightening the screw (HP 2105A) or the two screws (HP 2108A).

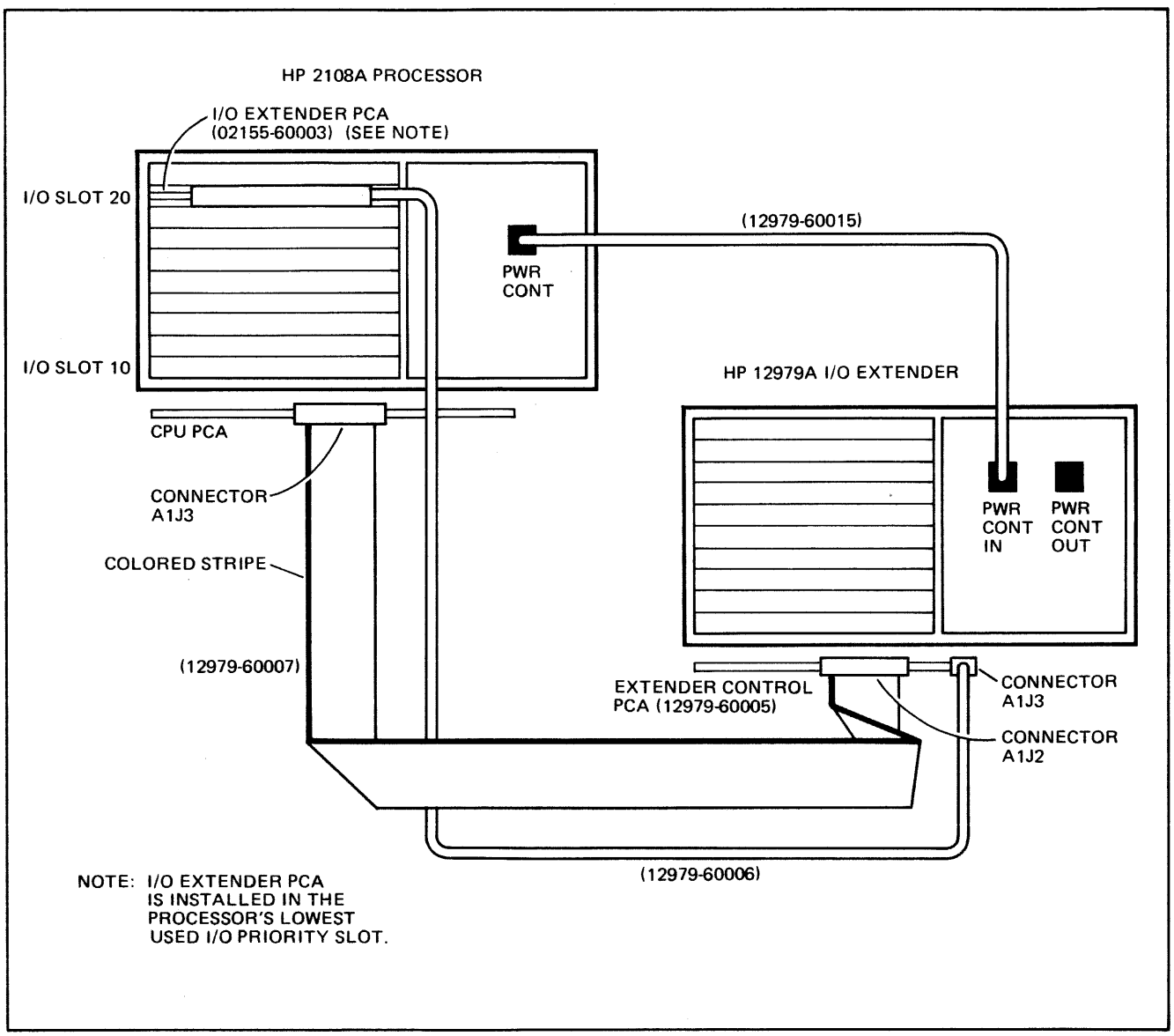


Figure 1-6. Single I/O Extender, Interface to Processor (Rear View)

v. Pass one end of other I/O extension cable assembly (part no. 12979-60007) through opening at rear of processor and connect it to CPU PCA connector A1J3. Observe colored stripe on cable assembly for correct orientation.

Note: Ensure that I/O extension cable is connected to CPU PCA connector A1J3 and **not** connected to a ROM PCA.

w. Pass other end of I/O extension cable assembly through opening at rear of extender and connect it to extender control PCA connector A1J2.

x. Reinstall processor I/O PCA cage cover and secure in place by tightening the four captive screws (HP 2105A) or pushing inward on the four plungers (HP 2108A).

y. Connect power control cable assembly (part no. 12979-60015) from processor PWR CONT connector to extender PWR CONT IN connector.

z. On extender rear panel, set ∿LINE switch to ON.

aa. If power fail recovery system is installed in processor, connect battery cable assembly to BAT. INPUT connector and set BATTERY switch to ON.

ab. On processor operator panel, rotate key-operated switch to R (reset) then to OPERATE.

ac. Run the input/output channel diagnostic test discussed in paragraph 1-30.

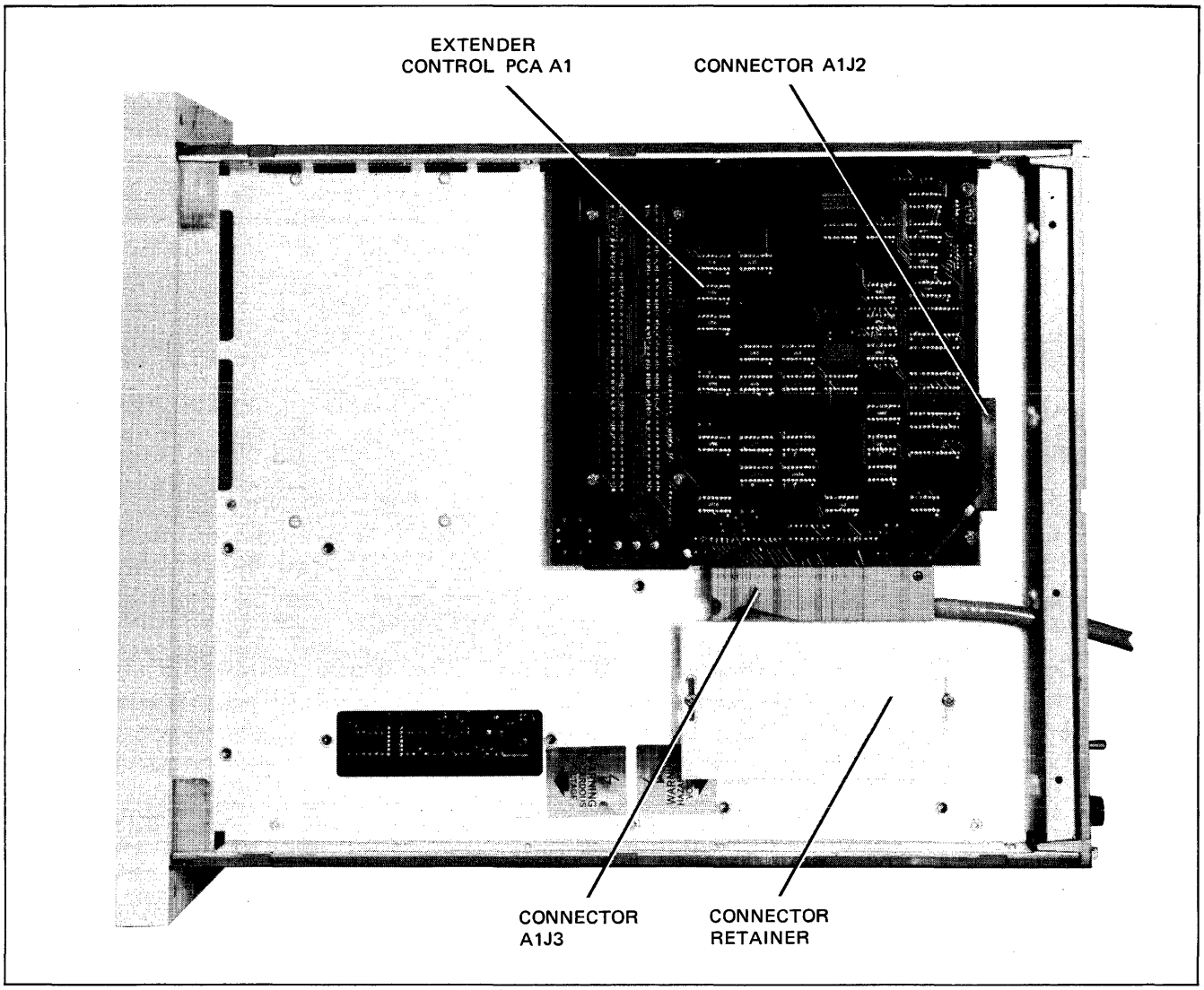


Figure 1-7. HP 12979A I/O Extender Bottom View

1-20. DUAL I/O EXTENDER INSTALLATION (OPTION 010)

As previously mentioned, up to two HP 12979A I/O Extenders may be used with each processor. One I/O extender PCA (part no. 02155-60003) is required for each I/O extender, and the PCA's are installed in the processor's lowest used I/O priority slots. The two I/O extenders are interconnected with the processor as shown in figure 1-8. Note that a three-connector I/O extension cable assembly (part no. 12979-60008) is required to interconnect the processor with the two I/O extenders.

WARNING

Hazardous voltages are present inside the extender mainframe!! Before installing the dual I/O extenders, ensure that both ~LINE switches are set to OFF and both POWER CORDS are DISCONNECTED!! Failure to observe this precaution can result in serious injury or DEATH!!

Proceed with the installation procedure as described in paragraph 1-19, steps a through ac, except use the three-connector I/O extension cable assembly in step v and a second power control cable assembly in step y to interconnect the processor with the two extenders.

1-21. I/O INTERFACE PCA INSTALLATION

1-22. INTERFACE CABLING. Cable requirements to interconnect the interface PCA's and the associated

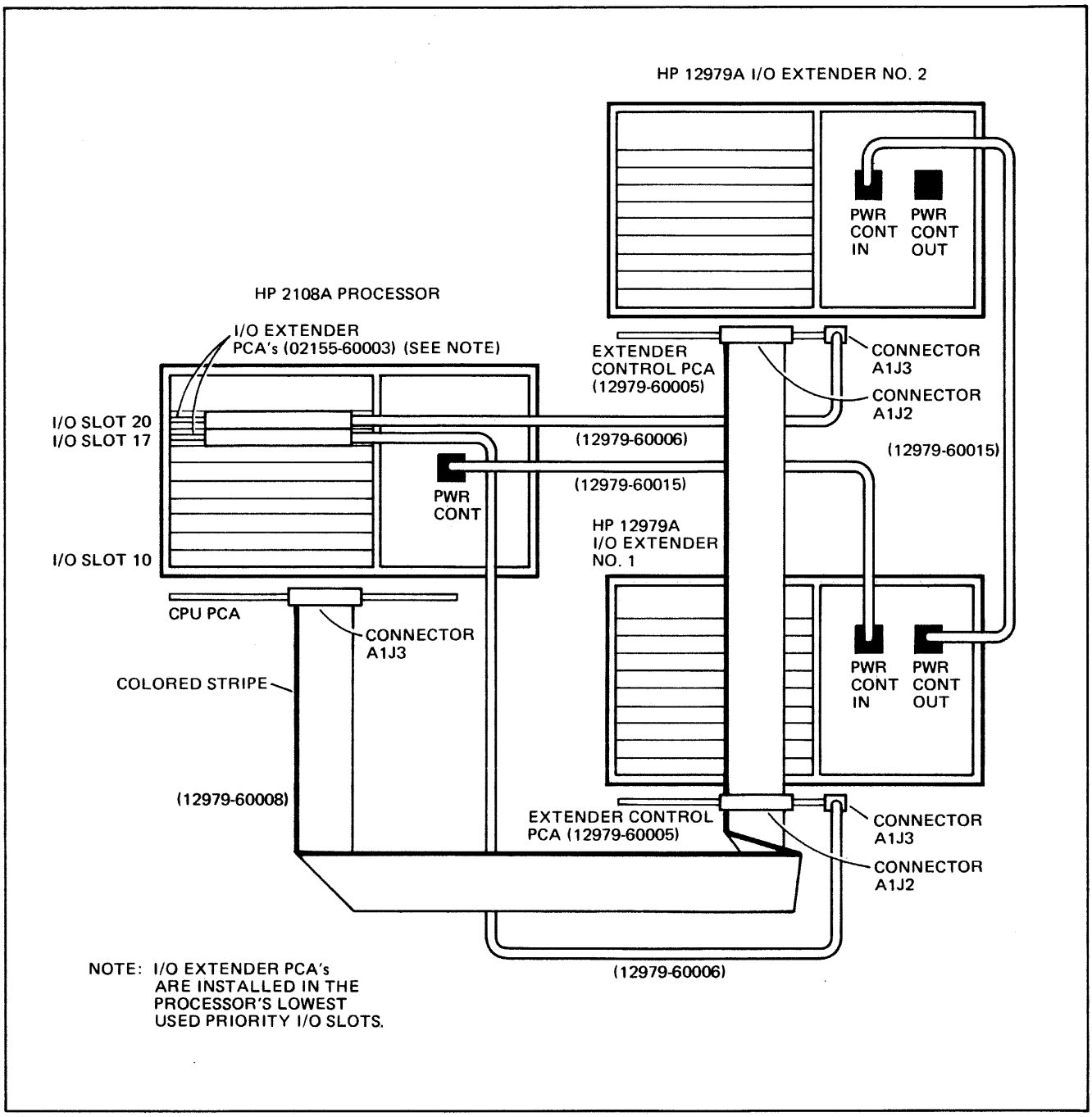


Figure 1-8. Dual I/O Extenders, Interface to Processor (Rear View)

peripheral devices are specified in the appropriate interface kit or subsystem documentation. After all interface cables have been assembled, proceed with the following I/O interface installation.

1-23. REAR I/O PCA CAGE. Install an I/O interface PCA in the rear I/O PCA cage as follows:

a. Set extender ∿LINE switch to OFF.

b. Remove rear cover by pulling outward on the four plungers.

c. Loosen the two screws securing rear PCA retainer to rear panel and slide retainer to the right.

d. Install I/O interface PCA into desired I/O slot and secure in place by pushing inward on PCA extractor levers.

e. Connect hooded I/O cable connector onto edge connector of I/O interface PCA. Connect opposite end of cable to appropriate peripheral device.

f. Slide rear PCA retainer to the left and secure in place by tightening the screws.

g. Reinstall rear cover and secure in place by pushing inward the four plungers.

1-24. **FRONT I/O PCA CAGE.** Install an I/O interface PCA in the front I/O PCA cage as follows:

a. Set extender ~LINE switch to OFF.

b. Loosen the two quarter-turn fasteners and remove front panel.

c. Remove the screw from front PCA retainer. Lift retainer off standoff and remove.

d. Install I/O interface PCA into desired I/O slot and secure in place by pushing inward on PCA extractor levers.

e. Connect mating I/O cable connector to mating connector on appropriate peripheral device. Pass hooded I/O cable connector through opening in rear of extender and route it via the cable channel to the front I/O PCA cage. Connect hooded I/O cable connector onto edge connector of I/O interface PCA. (See figures 1-1 and 1-2.)

f. Reinstall front PCA retainer and secure in place by tightening the screw.

g. Reinstall extender front panel and secure in place by tightening the two quarter-turn fasteners.

1-25. PERFORMANCE CHECK

The performance check of the I/O extender consists of power supply check and a diagnostic check. Performance check of the I/O devices are described in the appropriate interface or subsystem documentation.

1-26. TOOLS AND TEST EQUIPMENT REQUIRED

No installation tools other than ordinary handtools are required. Test equipment required to verify the adequacy of the ac mains voltage and the proper adjustments of the I/O extender power supply are listed in table 1-2.

1-27. POWER SUPPLY CHECK

Verify the tolerances of the various power supply voltages and the setting of the power-up threshold as described in the following paragraphs.

1-28. **POWER SUPPLY ACCURACY.** Energize the digital voltmeter and allow sufficient warmup to reach its rated accuracy. Proceed as follows:

WARNING

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

Table 1-2. Installation Test Equipment

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED HP MODEL
Digital Voltmeter	At least four-digit readout. Minimum input impedance 10 megohms; full-scale ranges of 0.999 and 99.99 volts dc.	HP 3439A Digital Voltmeter with HP 3441A Range Selector.
AC Voltmeter	Expanded-scale or digital-readout type capable of measuring ac power mains to ±1.0%. Voltage range must be from 88 to 132 volts ac (standard) or 176 to 264 volts ac (option 015).	HP 3445 AC/DC Range Unit. (Also performs functions of HP 3441A Range Selector listed above. Requires an HP 3449A Digital Voltmeter.
Variable Autotransformer	Capable of reducing ac mains input to extender to 80 volts ac (standard) or 160 volts ac (option 015); rated at least 1100 volt-amperes.	None

a. Set extender ~LINE switch to OFF and disconnect the power cord.

b. Loosen the two quarter-turn fasteners on the front panel and remove.

c. Loosen the screw in the rear center fold of the top cover. Slide the top cover rearward approximately 6 inches (15 centimeters) to access the top screws securing the front power supply shield.

d. Remove the four screws and six washers securing the power supply shield to the extender mainframe and remove.

e. Plug the extender power cord into the power outlet and set extender ~LINE switch to ON.

f. Connect positive lead of digital voltmeter to J8-5 (+5V test point) and connect common lead to J8-2 (common test point). (See figure 1-9.)

g. Adjust +5V ADJ potentiometer to obtain voltmeter indication of +5.00 ± 0.05 volts.

h. Check tolerances of the remaining supplies; test points and tolerances are listed in table 1-3.

i. Disconnect voltmeter, replace the power supply shield, and secure the top cover in place.

j. Replace the front panel and tighten the two quarter-turn fasteners.

Note: If one or more power supplies 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.

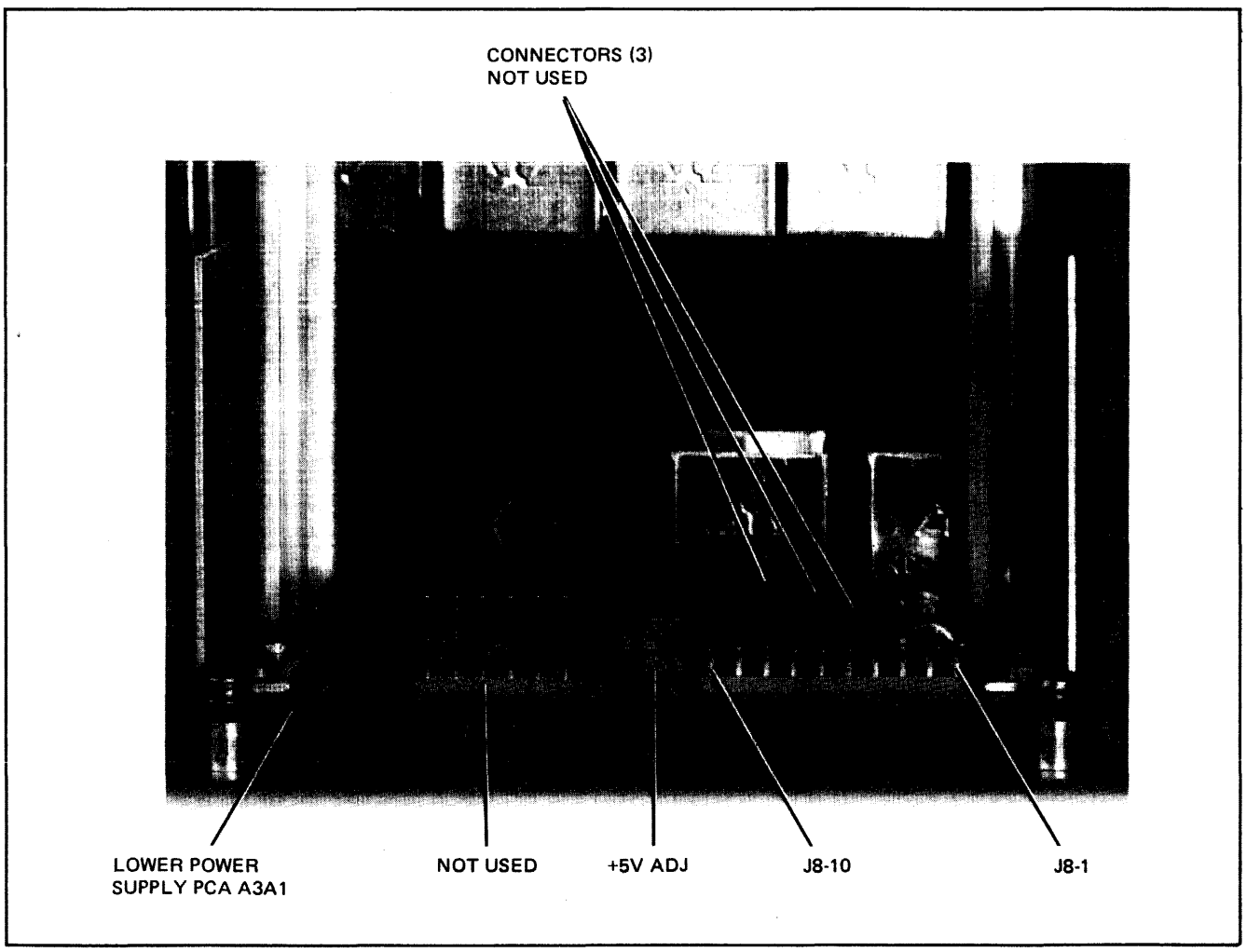


Figure 1-9. Power Supply Field Adjustment and Voltage Test Points

Table 1-3. Power Supply Voltage Tolerances

SUPPLY	TEST POINT*	TOLERANCE
-12V	J8-1	±0.6V
Common	J8-2	---
+12V	J8-3	±0.6V
-2V	J8-4	±0.1V
+5V	J8-5	±0.25V
---	J8-6	---
---	J8-7	---
$\overline{\text{PUUP}}$	J8-8	---
---	J8-9	---
---	J8-10	---

*J8 is mounted on the lower power supply PCA (A3A1).

1-29. POWER-UP THRESHOLD. The extender is shipped with the power-up threshold set just below the lower limit of the mains voltage configuration. That is, if the extender is configured for 110-volt operation, the power-up threshold is set at 88 volts rms; if the extender is configured for 220-volt operation, the power-up threshold is set at 176 volts rms. If one or more peripheral devices in the extender system will not operate properly when the mains voltage drops below say 100 volts rms (standard) or 200 volts rms (option 015), it may be necessary to raise the power-up threshold to this level. Verify and, if desired, readjust the power-up threshold. Assuming that the extender has been interfaced with a processor as shown in figure 1-6, and that the processor's power-up threshold has been set, proceed as follows:

WARNING

Hazardous voltages are present inside the extender mainframe!! Only qualified service personnel should perform the power-up threshold check. Before performing the power-up threshold check, set ∿LINE switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury or DEATH!!

a. Set extender and processor ∿LINE switches to OFF and disconnect the extender and processor power cords.

b. Loosen the two quarter-turn fasteners on the extender front panel and remove.

c. Loosen the screw in the rear center fold of the top cover. Slide the top cover rearward approximately 6 inches (15 centimeters) to access the top screws securing power supply shield to cable channel.

d. Remove the four screws and six washers securing the power supply shield to the extender mainframe. Remove the power supply shield to access the power-up threshold potentiometer. (See figure 1-10.)

e. Energize ac voltmeter and allow sufficient warmup to reach its rated accuracy.

f. Connect ac voltmeter leads across autotransformer output. Plug autotransformer power cord into power outlet and set its output to approximately 110 volts rms (standard) or 220 volts rms (option 015).

g. Plug extender power cord into autotransformer power output receptacle. Plug processor power cord into power outlet, set the processor ∿LINE to ON, and rotate key-operated switch to R (reset) then to OPERATE. Set the extender ∿LINE switch to ON.

h. Slowly reduce autotransformer output until all processor operator panel indicators extinguish, indicating that the extender has switched automatically to the standby mode. The voltmeter should indicate 75 ± 5 volts rms (standard) or 150 ± 10 volts rms (option 015).

i. If a power fail recovery system is installed in the processor, omit this step. If a power fail recovery system is not installed:

   (1) Set autotransformer output to 85 ± 0.1 volts rms (standard) or 170 ± 0.2 volts rms (option 015). Rotate key-operated switch to R (reset) and then to OPERATE. Operator panel indicators should remain extinguished.

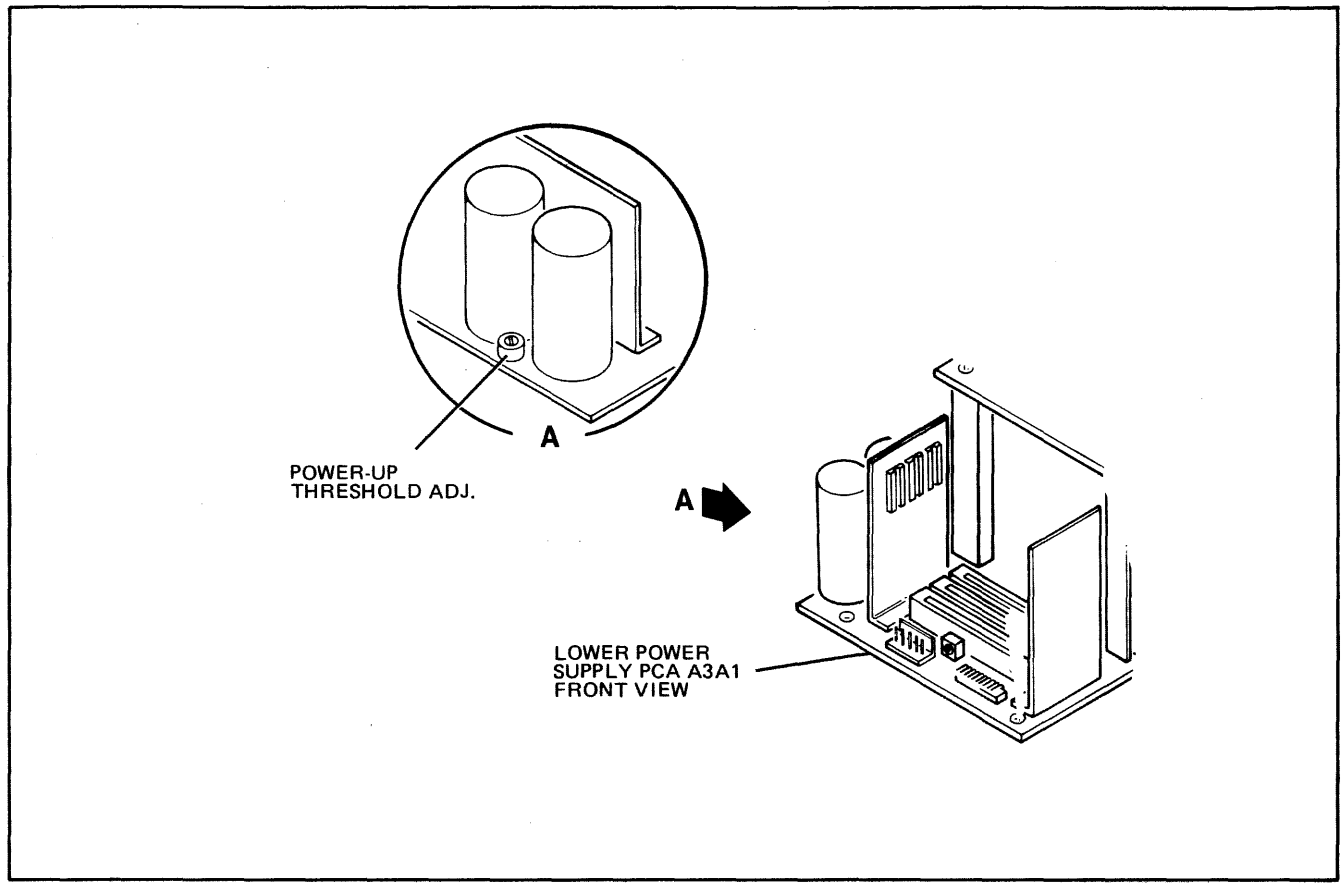
   (2) Set autotransformer output to 87 ± 0.1 volts rms (standard) or 174 ± 0.2 volts rms (option 015). Rotate key-operated switch to R (reset) and then to OPERATE. Operator panel indicators should light. Proceed with step k.

Note: There is up to a 1-second delay from the time that the upper threshold is detected until the processor operator panel indicators light. Perform the following step very carefully.

j. **Slowly** increase the autotransformer output until the processor operator panel indicators light. The voltmeter should indicate 87 ± 0.5 volts rms (standard) or 174 ± 1.0 volts rms (option 015).

k. If the upper threshold is not within tolerance, or if it is desired to adjust both thresholds to a higher voltage, continue with step l. Otherwise disconnect the test setup and continue with the installation.

l. Reduce autotransformer output until processor operator panel indicators extinguish. Set power-up threshold potentiometer fully clockwise.



7022-5

Figure 1-10. Power-Up Threshold Adjustment

m. Set autotransformer output to the desired upper threshold. Adjust power-up threshold potentiometer **slowly** counterclockwise until processor operator panel indicators light.

n. **Slowly** decrease autotransformer output until processor operator panel indicators extinguish. The ac voltmeter should indicate 10 to 20 volts lower than the desired upper threshold.

After verifying that the power-up threshold has been properly adjusted, disconnect the test setup. Set processor and extender ~LINE switches to OFF. Replace the power supply shield and the front panel, and secure the top cover in place.

Note: The difference between the upper and lower thresholds varies with the computer configuration. A more heavily loaded computer configuration will change to standby at a higher line voltage than a less heavily loaded configuration, even though both configurations change from standby to operate at the same line voltage.

1-30. DIAGNOSTIC CHECK

The diagnostic check of the I/O extender consists of performing diagnostic test programs and evaluating them. A description of the diagnostic test program procedures is given in the appropriate reference manual in the **Manual of Diagnostics**. The following tapes and reference manuals are used in the diagnostic check:

DIAGNOSTICS	MANUAL	TAPE
Input/Output Channel	12979-90010	12979-16001
Power Fail/Auto Restart	02100-90216	24321-16001

If the diagnostic tests are completed without an error halt, the I/O extender is operating correctly. If the diagnostic tests indicate an error halt, refer to the troubleshooting flowchart in figure 3-1.

1-31. 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.

1-32. REPACKAGING FOR SHIPMENT

1-33. SHIPMENT USING ORIGINAL PACKAGING

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

1-34. SHIPMENT USING NEW PACKAGING

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

a. Wrap extender in heavy paper or sheet plastic. If shipping the extender back to the factory, first attach a tag to the extender with the return address and indicating the type of service required. Include the extender model number and full serial number.

b. Use a strong shipping container. A double-wall carton constructed of 350-pound test material is adequate.

c. Use sufficient shock-absorbing material on all sides of the extender to provide a firm cushion and to prevent movement inside the container. Use particular care to protect the extender corners and front and rear panels.

d. Seal the shipping container securely and mark it "FRAGILE".

e. In any subsequent correspondence with the factory, refer to the extender by model number and full serial number.

THEORY OF OPERATION

SECTION II

This section describes the operation of the circuits comprising the HP 12979A I/O Extender and its optional Dual-Channel Port Controller (DCPC) feature. Description of the circuits is grouped into two functional areas. These are the I/O section and the optional DCPC feature. Figure 2-1 shows a functional block diagram of the extender and its relationship to the processor.

The I/O section is an extension of the processor I/O section. The device interfacing circuits accommodate standard I/O interface PCA's that control signal exchange between external input or output devices and the processor. I/O signals flowing between the processor and the extender are routed through the I/O section interfacing circuits installed in both the processor and the extender mainframes.

The power supply operates from a 110-volt (220-volt adaptable), single phase, 50- to 60-Hz power source which it converts to regulated dc supply voltages for the operation of the I/O section. When turned on, the extender power supply provides status signals used for power failure detection at the processor. The extender power supply is similar to the processor power supply.

The I/O section is described in paragraphs 2-3 through 2-13, and the optional DCPC feature is described in paragraphs 2-14 through 2-17. The description of each functional area consists of a general description at block diagram level, followed by a description of the circuits at a logic level.

2-1. REFERENCE INFORMATION

Signal abbreviations are used in the theory discussion of this section. Abbreviated designations of signal mnemonics are defined in table 3-3.

2-2. INTERFACE TO PROCESSOR

Initialization, control, timing, priority, and I/O bus signals are transferred between the I/O extender PCA in the processor and the extender control PCA A1 in the extender through an I/O extension cable assembly. (See figure 2-2.) Address and interrupt signals are transferred between CPU PCA A1 in the processor and extender control PCA A1 in the extender through a second I/O extension cable assembly.

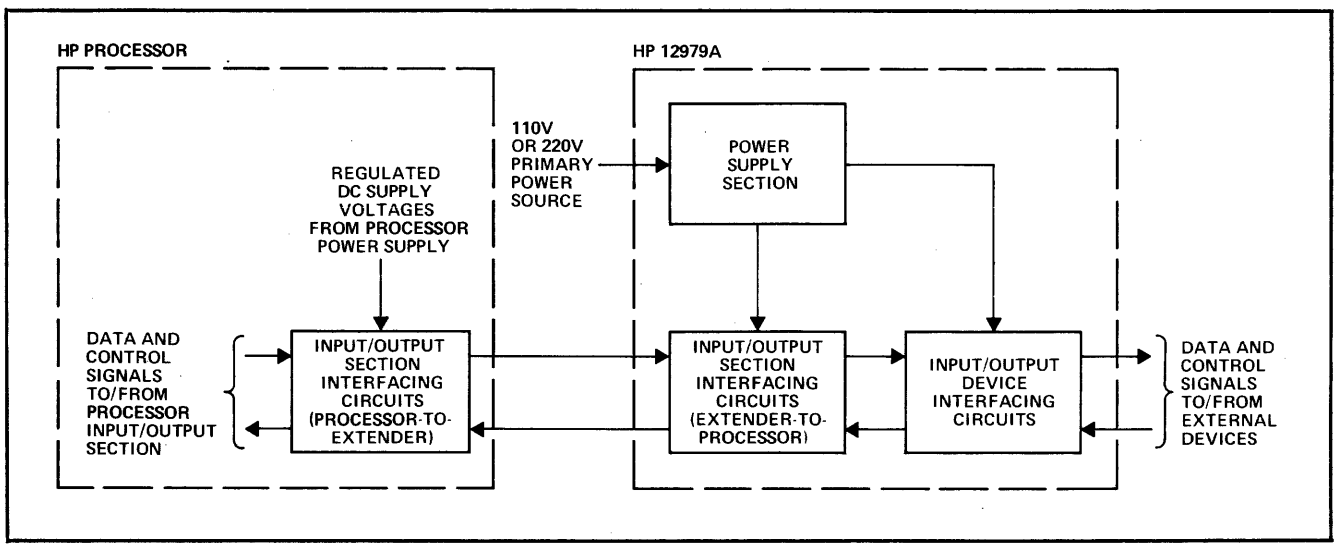


Figure 2-1. I/O Extender, Functional Block Diagram

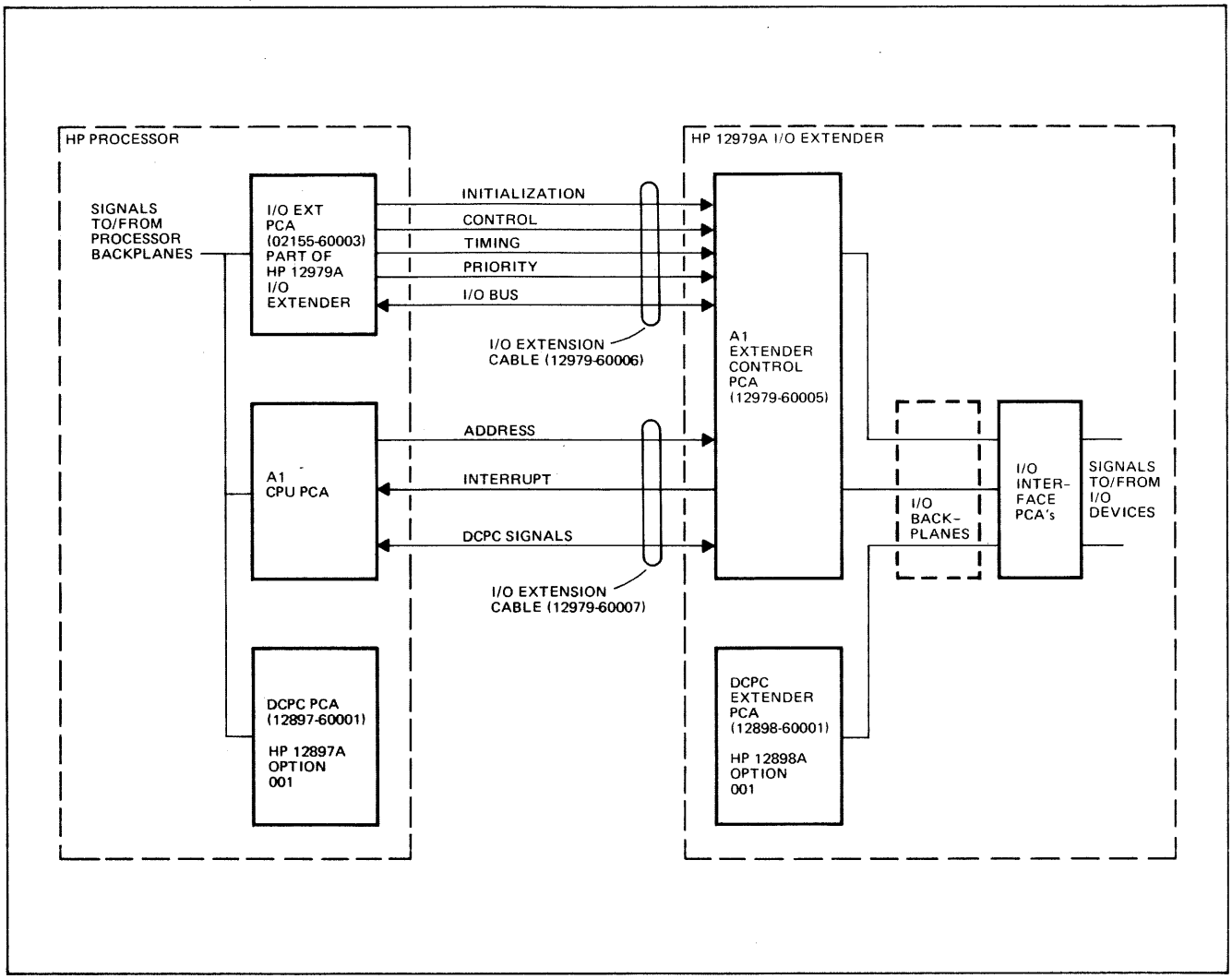


Figure 2-2. I/O Extender, Interface to Processor

Input/output interface PCA's plugged into I/O PCA slots of the extender operate in the same manner as when used in the processor I/O PCA slots. If interface PCA's for the I/O devices that operate under DCPC control are installed in the extender, the HP 12898A DCPC option must be installed in the extender and the HP 12897A DCPC option must be installed in the processor to interface the processor-to-extender DCPC control signals.

2-3. INPUT/OUTPUT SECTION

The I/O section consists of the extender I/O PCA slots, the I/O backplane PCA's, the extender control PCA, and the I/O extender PCA. (See figure 2-2.) The I/O extender PCA and extension cable interface the I/O PCA cage on the processor to the I/O PCA cages on the extender I/O backplanes. This puts the I/O section of the extender under processor control, and in effect, serially extends the I/O capacity of the processor to include the extender I/O section.

2-4. I/O DATA TRANSFER

The following paragraphs represent an overall view of how data is actually tansferred under interrupt control in the I/O system.

2-5. INPUT TRANSFER

Figure 2-3 illustrates the sequence of operations for an input transfer. Note that some of the operations are under control of the computer program (programmer's responsibility) and some of the operations are automatic. The operation begins with a programmed instruction to set control and clear flag on the addressed interface PCA (1). In this example it is assumed that the interface PCA is installed in the slot for select code 32; thus the instruction is STC 32,C. Setting the control bit causes the interface PCA to issue a start command (2) to the external device. The device then proceeds with its electromechanical process of reading a character. When it has done so, it

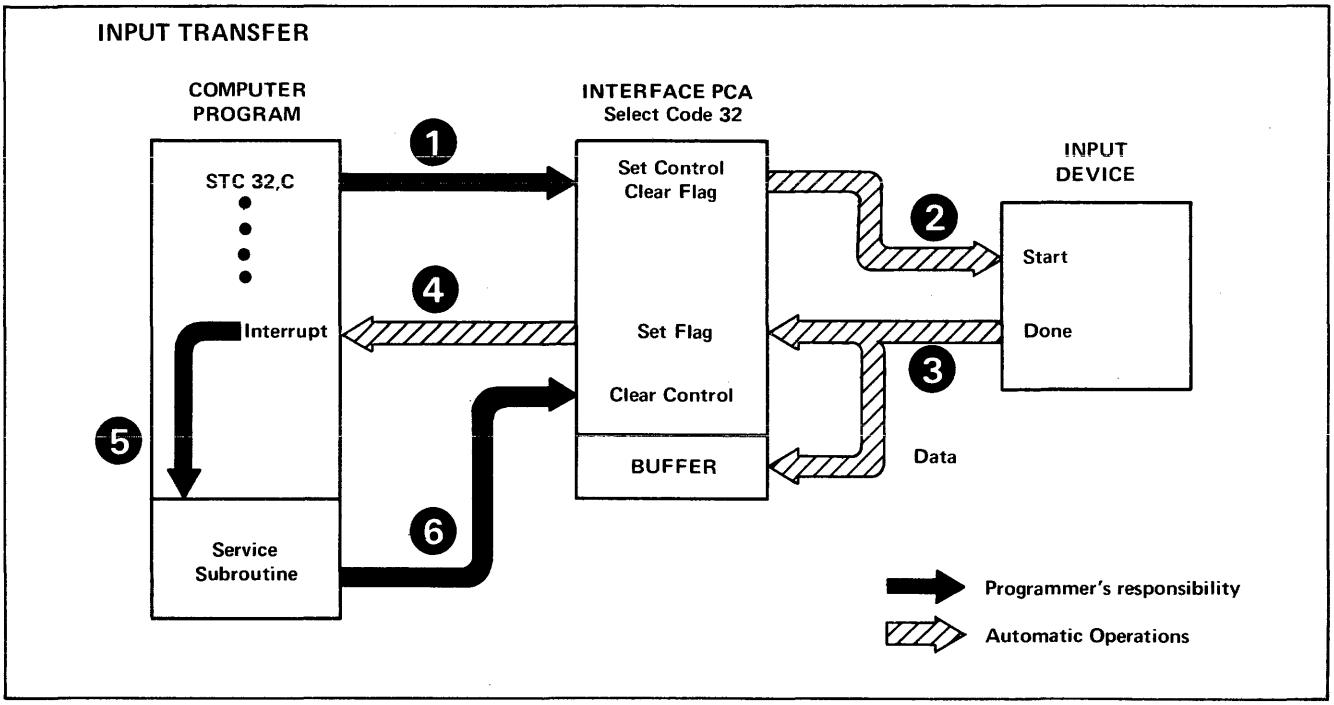


Figure 2-3. Input Data Transfer

sends a signal (Done) back to the interface PCA along with data character (3). At the interface PCA the "Done" signals set the flag bit. The flag, in turn, generates an interrupt (4) which causes the computer program to be suspended, and control is transferred to a service subroutine (5). The subroutine may then issue further STC 32,C commands to transfer additional characters. One of the final instructions in the service subroutine must be a clear control (CLC 32 in this case). This step (6) allows lower priority devices to interrupt and restores the channel to its static "ready" condition.

2-6. OUTPUT TRANSFER

Figure 2-4 illustrates the sequence of operations for an output transfer. Again note the distinction between programmed and automatic operations. It is assumed that the data to be transferred has been loaded into the A-register and is in a form suitable for output. The interface PCA is assumed to be installed in the slot for select code 33. The operation begins with a programmed instruction to transfer the data from the A-register to the interface buffer (1). The instruction in this example is OTA 33. This is followed (2) by an instruction to set control and clear flag (STC 33,C). Setting the control bit causes the interface PCA to read out the buffer data to the device and to issue a start command (3). The device proceeds to write data, and when it has finished the device sends a signal (Done) back to the interface PCA (4). At the interface PCA the "Done" signal sets the flag bit. The flag in turn, generates an interrupt (5) which causes the computer program to be suspended, and control is transferred to a service subroutine (6). The subroutine may then output further data to the interface PCA and re-issue the STC 33,C command for additional character transfers. A clear control instruction (CLC 33) allows lower priority devices to interrupt and restores the channel to its ready condition. At the end of the subroutine, control is returned to the interrupted program via previously established linkages.

2-7. CIRCUIT ANALYSIS

The following paragraphs describe the circuits used in the I/O extender.

2-8. I/O EXTENDER PCA

The I/O extender PCA, part no. 02155-60003, is used in the lowest priority slot in the processor I/O section to transfer signals between the processor I/O section and the extender I/O section. The 48-pin edge connector on this PCA mates with one end of a 48-conductor I/O extension cable. (See figure 2-2.) The other end of the I/O extension cable mates with the 48-pin edge connector on the extender control PCA located under the rear I/O PCA cage of the extender.

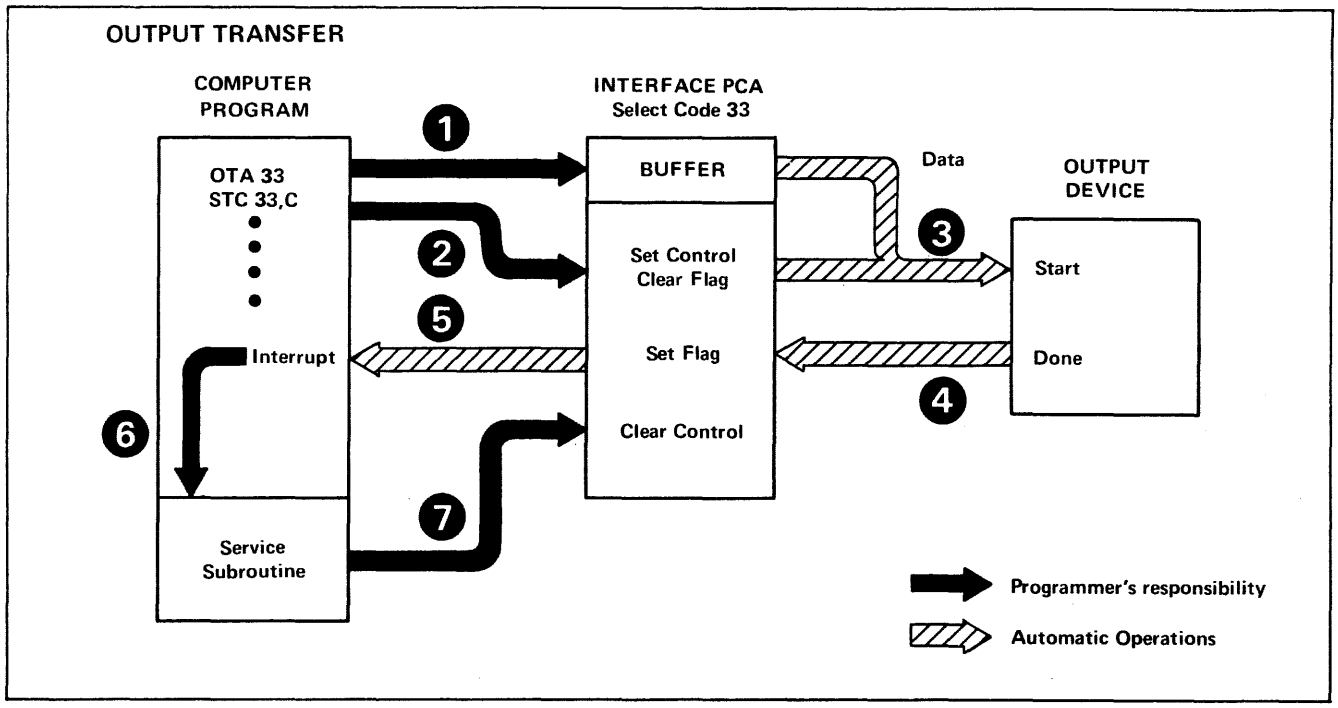


Figure 2-4. Output Data Transfer

The I/O extender PCA consists primarily of two input "and" gate drivers. The IOB0 through IOB15 lines are connected through two groups of gates. One group of gates transfers the IOBI bits from the extender to the processor when the gates are enabled by a true IOI signal. The other group of gates transfers IOB0 bits from the processor to the extender when the gates are enabled by a false IOI signal. One input of the remaining gates on the PCA is connected to a signal line from either the processor I/O backplane PCA or the extender I/O backplane PCA's. The second input of each gate is connected to +5.00 volts dc. Consequently, any gate receiving a positive-true input signal produces a positive-true output signal which is transferred to either the processor I/O backplane PCA or the extender I/O backplane PCA's.

2-9. EXTENDER CONTROL PCA

The extender control PCA transfers signals between the extender I/O section and the processor I/O section. The 48-pin connector J3 on the extender control PCA mates with one end of a 48-conductor I/O extension cable. (See figure 2-2.) The other end of the I/O extension cable mates with the 48-pin connector on the I/O extender PCA located in the lowest priority slot in the processor. The 50-pin connector J2 on the extender control PCA mates with one end of a 50-conductor I/O extension cable. (See figure 2-2.) The other end of this I/O extension cable mates with the 50-pin connector J3 on the CPU PCA located below the I/O PCA cage of the processor.

The extender control PCA consists of four functional logic blocks: the select code scaling and decoding logic, the select code restoration logic, the line driver/buffer logic, and the priority and enable logic.

2-10. SELECT CODE SCALING AND DECODING LOGIC. The select code scaling and decoding logic determines the real select code of the I/O device being used. The base select code (BSC) is programmable selected on the extender control PCA by configuring the jumper positioning in accordance with the select code that the I/O extender PCA occupies in the processor I/O section. The actual device select code is sent by the processor in binary and is compared with the BSC through a subtractor. (See figure 2-5.) The difference is decoded from binary to octal through a decoder. Then the actual select code which is the difference is now driven through a buffer to the I/O channel being used in the extender.

2-11. SELECT CODE RESTORATION LOGIC. This circuitry forms the actual interrupt address. (See figure 2-5.) The relative of address of an interrupting device appears as an octal select code on the FLGX and IRQX lines. This octal select code is accepted by an encoder which encodes the octal select code into a binary coded address. The real select code (interrupt address) is formed through an adder that adds this binary coded address to the base select code, thus boosting the relative select code to the proper real select code for the processor.

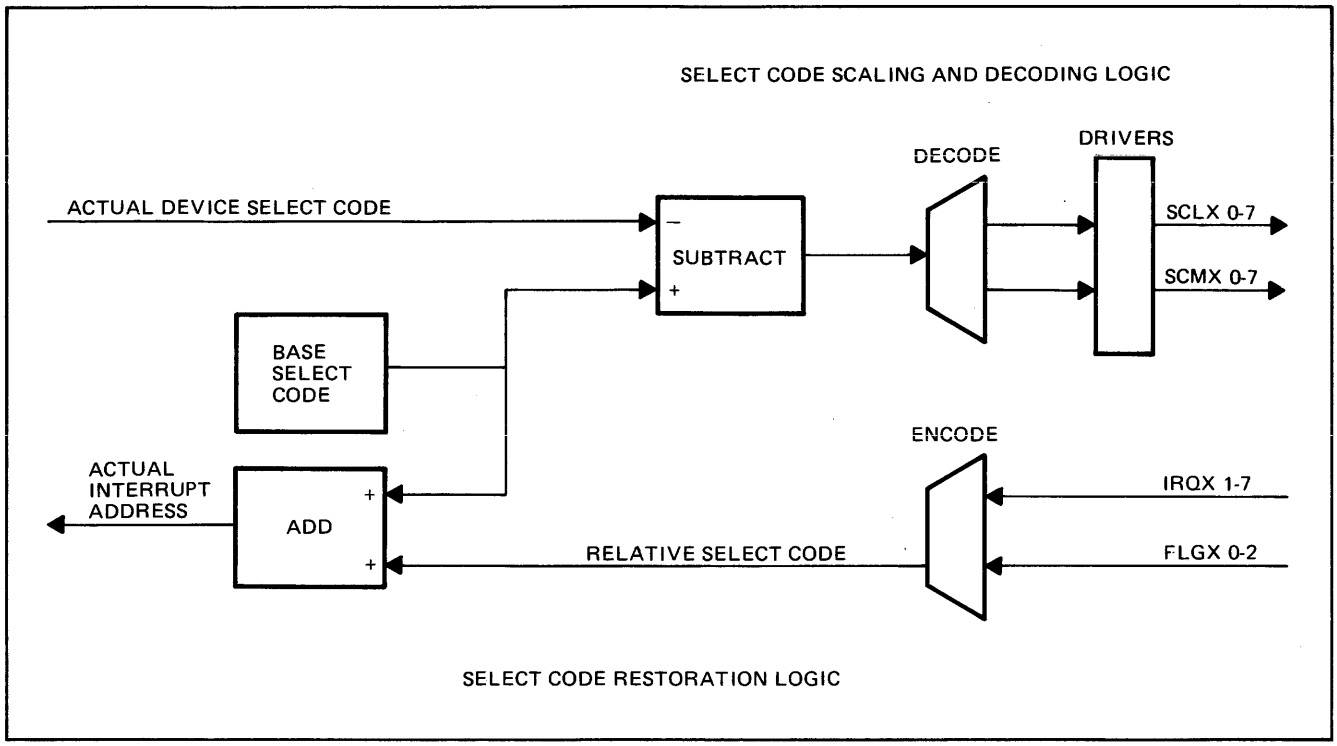


Figure 2-5. Extender Control PCA, Functional Diagram

2-12. **LINE DRIVER/BUFFER LOGIC.** Control signals from the processor reach the I/O interface PCA's in the extender by the control line drivers on the extender control PCA. The I/O bus driver logic section is designed to allow bidirectional I/O bus operation from the processor both to enable drivers on the I/O bus-output (IOBO) lines during output operations, and to accept data from the I/O bus-input (IOBI) lines during input operations.

2-13. **PRIORITY AND ENABLE LOGIC.** To eliminate extender priority conflicts, the user programmable BSC jumpers and the extender priority jumpers are configured during system configuration by the system programmer. This is determined by setting the BSC jumpers to the select code that the extender I/O PCA occupies in the processor. An open link is a logic one. The priority and enable logic preserves the priority chain in the extender, enhances the fast dump routine during an interrupt, and produces the driving capability to enable all I/O interface PCA's. Since an interrupting device must turn off all lower priority I/O interface PCA's within a certain critical time interval, the "and" gates are used to accelerate this sequence by promptly lowering the enable lines of the I/O interface PCA's as soon as an interrupt is detected.

2-14. DUAL-CHANNEL PORT CONTROLLER

The optional dual-channel port controller (DCPC) provides a direct data path, software assignable, between memory and a high-speed peripheral device; the DCPC accomplishes this by stealing an I/O cycle instead of interrupting to a service subroutine. The DCPC logic is capable of stealing every consecutive I/O cycle and can therefore transfer data at rates up to 616,666 words per second.

There are two DCPC channels, each of which may be separately assigned to operate with any I/O interface PCA. When both DCPC channels are operating simultaneously, channel 1 has priority over channel 2. The combined maximum transfer rate for both channels operating together is 616,666 words per second; the rate available to channel 2 is therefore the rate difference between 616,666 and the actual operating rate of channel 1.

Transfers via the DCPC are on a full-word basis; hardware packing and unpacking of bytes are not provided. The word count register is a full 16 bits in length, and data transfers are accomplished in blocks. The transfer is initiated by an initialization routine, and from then on the operation is under automatic control of the hardware. The initialization routine specifies the direction of the data transfer (in or out), where in memory to read or write, which I/O channel to use, and how much data to transfer. Completion of the block transfer is signalled by an interrupt to location 00006 (for channel 1) or to location 00007 (for channel 2) if the interrupt system is enabled. It is also possible to check for completion by testing the status of the flag for select code 06 or 07, or by interrogating the word count register with an LIA/B to select code 02 (for channel 1) or to select code 03 (for channel 2). A block transfer in process can be aborted with an STF 06 or 07 instruction.

2-15. DCPC OPERATION

Figure 2-6 illustrates the sequence of operations for a DCPC input data transfer. A comparison with the conventional interrupt method (figure 2-3) shows that much more of the DCPC operation is automatic. Remember that the procedure in figure 2-3 must be repeated for each word or character. In figure 2-6 the automatic DCPC operation will transfer a block of data of any size limited only by the available memory space. The sequence of events is as follows. (An input data transfer is illustrated; the minor differences for an output transfer are explained in text.)

The initialization routine sets up the control registers on the DCPC (1) and issues the first start command (STC 32,C) directly to the interface PCA. (If the operation is an output, the interface PCA buffer is also loaded at this time.) The DCPC logic is now turned on and the computer program continues with other instructions.

Setting the Control and clearing the Flag flip-flops (2) causes the interface PCA to send a Start signal (with a data word if it is an output transfer) to the external device (3). The device goes through a read or write cycle and returns a Done signal (with a data word if it is an input transfer). The Done signal (4) sets the PCA Flag flip-flop which, regardless of priority, immediately requests the DCPC logic to steal an I/O cycle (5) and transfer a word into (or out of) memory. The process now repeats back to the beginning of this paragraph to transfer the next word.

After the specified number of words have been transferred, the interface PCA Control flip-flop is cleared (7) and the DCPC logic generates a completion interrupt (8). The program control is now forced to a completion routine (9), the contents of which is the programmer's responsibility.

2-16. DCPC INITIALIZATION

The information required to initialize the DCPC (direction, memory allocation, I/O channel assignment, and block length) are given by three control words. These three words must be addressed specifically to the DCPC. Figure 2-7 illustrates the format of the three control words. Control Word 1 (CW1) identifies the I/O channel to be used and provides two options selectable by the programmer:

Bit 15
- 1 = give STC (in addition to CLF) to I/O channel at end of each DCPC cycle (except on last cycle, if input)
- 0 = no STC

Bit 13
- 1 = give CLC to I/O channel at end of block transfer
- 0 = no CLC

Control Word 2 (CW2) gives the starting memory address for the block transfer and bit 15 determines whether data

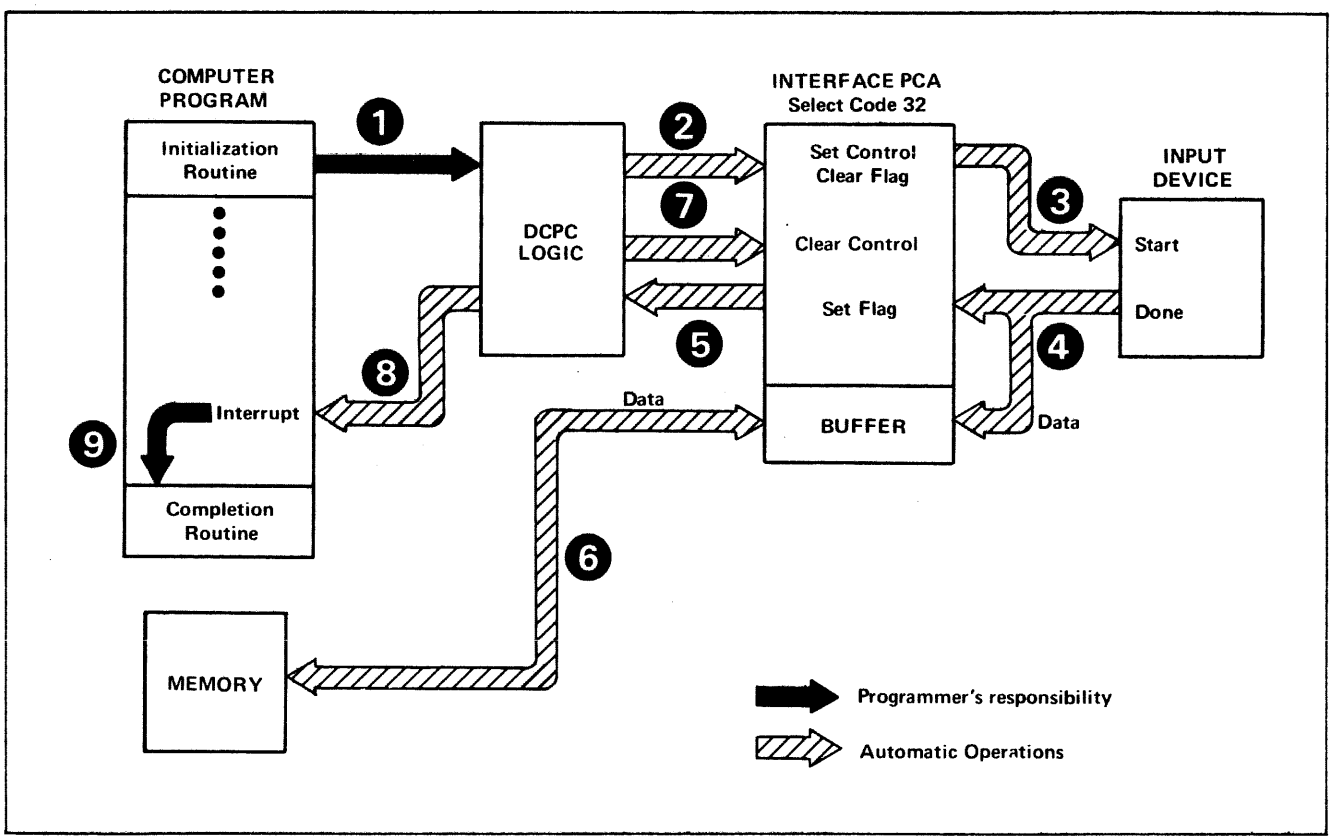


Figure 2-6. DCPC Input Data Transfer

is to go into memory (logic 1) or out of memory (logic 0). Control Word 3 (CW3) is the two's complement of the number of words to be transferred into or out of memory (i.e., the block length). This number can be from −1 to 32,768, although it is limited in the practical case by available memory.

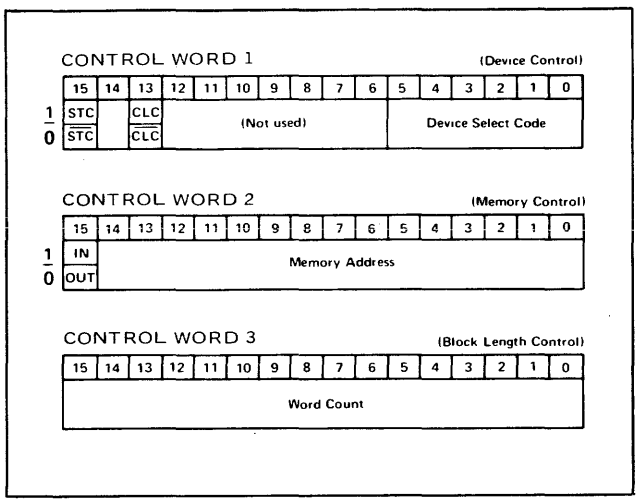


Figure 2-7. DCPC Control Word Formats

2-17. EXTENDER DCPC PCA

The functional logic blocks of the extender DCPC PCA are shown in figure 2-8. The select code scaling and loading logic transforms the actual select code of the device under DCPC control to a relative select code for the extender, and loads this into a latch for the duration of the DCPC assignment. This logic becomes enabled during any DCPC initialization routine when either an OTA6 or OTA7 software instruction is executed. Either of two eight-input "and" gates recognizes one of the conditions by raising the clock to its latch. At this time the select code of the I/O device itself appears as the least significant six-bits on the IOBO lines. Similar to the select code scaling logic on the extender control PCA, a subtraction circuit reduces the actual select code by an amount equal to the base select code.

The compare logic units consist of two multiplexers and are constantly monitoring all SRQX lines (which indicate an interrupt pending on an I/O interface PCA) with respect to the latched relative select code of the device under DCPC control. A coincidence signal REQ1 or REQ2 is returned to the processor when the device under DCPC control is ready.

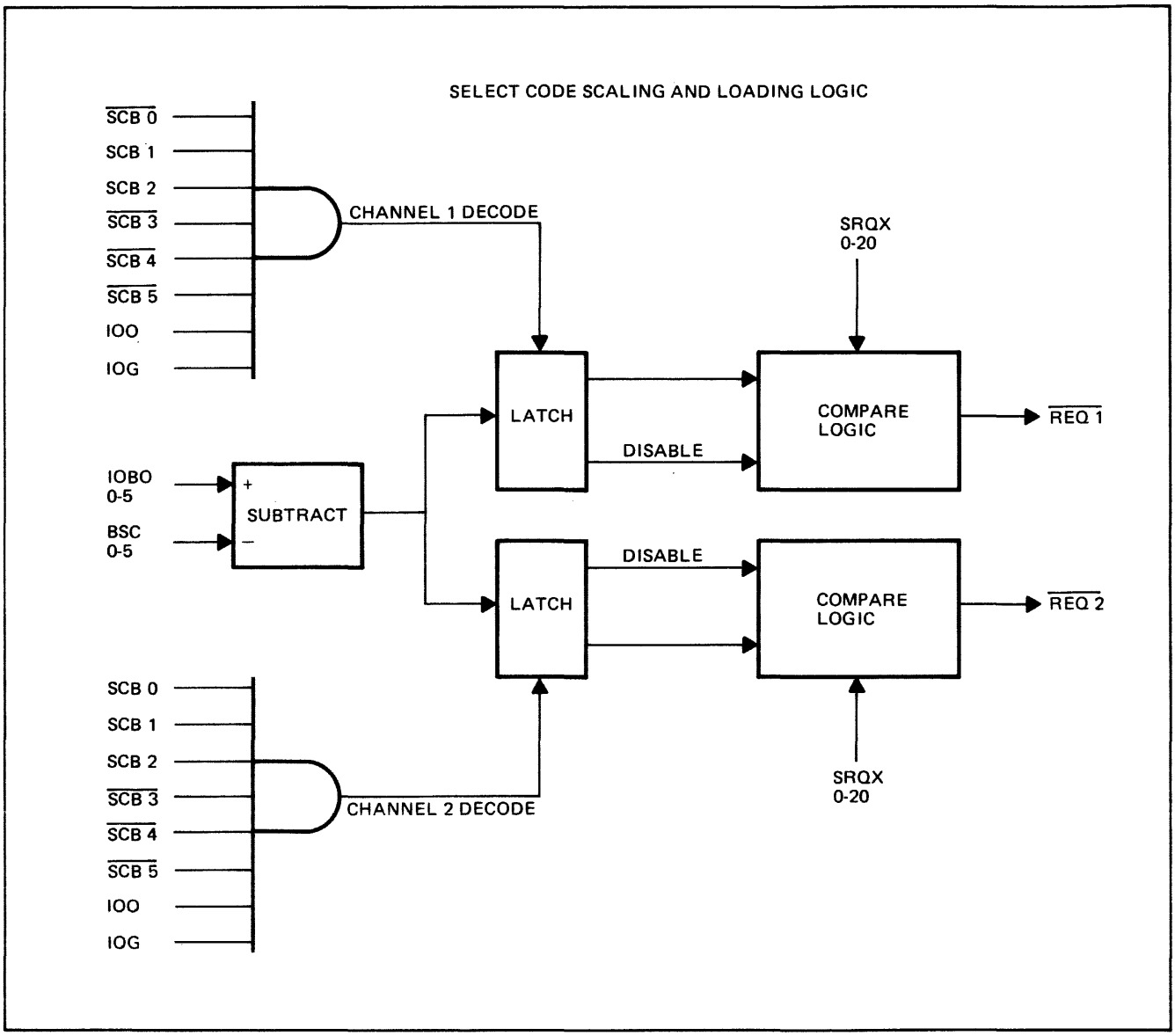


Figure 2-8. Extender DCPC PCA, Functional Diagram

SERVICE

SECTION III

This section describes troubleshooting and maintenance procedures for the HP 12979A I/O Extender. Also included are a listing of signal mnemonics and their definitions, a listing of backplance signal sources and their destinations, a power distribution diagram, and printed-circuit assembly diagrams.

3-1. TROUBLESHOOTING

Troubleshooting consists of test and troubleshooting data for the extender I/O section. The test data is used to check the overall performance of the extender. The troubleshooting data is used to check the extender sections at the circuit level.

3-2. TEST DATA

Performing the basic checkout test procedure is the first step of extender testing. Diagnostic test programs are used to dynamically check the operation of the circuits in the I/O section of the extender. Trouble symptoms are indicated by error halts displayed at the processor operator panel. By carefully analyzing the error halt condition, the cause of the trouble can be traced to one or more instructions in the test program which the processor failed to process. References are provided to detailed troubleshooting data for the circuits suspected of causing the failure. If no error halts are detected in the course of performing the diagnostic checkout procedure, the extender is assumed to be ready to resume normal operation.

3-3. TROUBLESHOOTING DATA

The troubleshooting data in this section is used for checking the extender at the circuit level to isolate trouble symptoms, which are detected during the course of extender testing, to a replaceable assembly or part. Troubleshooting data included in this section consists of test procedures and a troubleshooting diagram. Information in other sections of this manual which will be required during troubleshooting includes the circuit descriptions presented in section II and the replaceable parts information presented in section IV. Total familiarity with the content, purpose and use of the information presented in these sections is recommended before attempting to troubleshoot or repair the extender.

3-4. INFORMATION IN OTHER MANUALS

Information which may be helpful during troubleshooting is given in the following manuals:

a. **HP 21MX Computer Series Reference Manual,** part no. 02108-90002.

b. **HP 21MX Computer Series Operator's Manual,** part no. 02108-90004.

c. **HP 21MX Computer Series Installation and Service Manual,** part no. 02108-90006.

d. **HP 12979A Input/Output Extender Operating and Reference Manual,** part no. 12979-90007.

e. The following reference manuals are contained in the **Manual of Diagnostics:**

   (1) Input/Output Channel Diagnostic, part no. 12979-90010.

   (2) Power Fail/Auto Restart Diagnostic, part no. 02100-90216.

3-5. BASIC CHECKOUT

The basic checkout test procedure is performed using operating switches and indicators on a properly functioning HP 21MX Computer Series Processor to check the overall performance of the extender. This test procedure should be conducted immediately after the extender is installed, and as required thereafter as part of a regularly scheduled preventive maintenance program, as the first step of troubleshooting, and after repairs or modifications are made to the extender. The basic checkout should always be performed prior to attempting to perform the diagnostic checkout. Successful completion of all test steps in the basic checkout procedure ensure that the extender is operational.

3-6. TEST EQUIPMENT REQUIRED

Only a digital voltmeter is required for basic checkout procedure. However, it is recommended that the test equipment listed in table 3-1 be available for troubleshooting.

Table 3-1. Recommended Test Equipment and Servicing Devices

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED HP MODEL
Dual-trace oscilloscope	Rise time: ≤10 ns. Vertical deflection: 1 volt/division and 10 volts/division (including attenuator probe, if used). Horizontal sweep speed: 0.1 microsecond/division to 1 second/division.	HP 180A Oscilloscope with 10004A Probe and the following plug-in units: HP 1801A Dual Channel Vertical Amplifier HP 1820A Time Base or HP 1821A Time Base and Delay Generator.
Digital voltmeter	At least four-digit readout. Minimum input resistance: 10 megohms. Full-scale ranges: 0.999 and 99.99 Vdc.	HP 3439A Digital Voltmeter with HP 3441A Range Selector
AC voltmeter	Expanded-scale or digital-readout type, capable of reading the ac voltage supplied to the extender to ±1%. Voltage range must be at least 88-132 volts (for a 110-volt extender), or 176-264 volts (for a 220-volt extender).	HP 3445A AC/DC Range Unit. (Also performs functions of HP 3441A Range Selector listed above. Requires HP 3439A Digital Voltmeter.)
Multimeter	Accuracy: ±3% of full scale. Full-scale ranges: 100 mV to 300V (dc and ac), 10 ohms center-scale to 10 megohms center-scale.	HP 427A
Logic probe	Indication: logic true >+1.4 volts.	HP 10525A
Variable autotransformer	Capable of reducing extender input line-voltage to 80 volts rms (160 volts for a 220-volt extender), and able to furnish the power required by the extender (up to 1100 volt-amperes, depending on the accessory features installed).	None
Centigrade thermometer	General-purpose type, accurate to ±1°C.	HP 0440-0004
High-pressure air source	25-50 psi pressure	None
Vacuum cleaner	Must have flexible hose with small nozzle, vacuum port for hose, and pressure port for hose.	None
IC test clip	None	None

3-7. TEST PROCEDURE

The basic checkout procedure consists of a series of tests that check the operation of key circuit functions in the extender. The purpose of these tests is to provide an expedient means of detecting obvious trouble symptoms. The results of each test, when compared to expected normal results, provides an indication as to whether or not the circuit under test is functioning normally. Instructions are included for analyzing trouble symptoms, and references are provided to troubleshooting data for the circuits most likely to be causing the trouble indication. Troubles encountered during the performance of the basic checkout must be corrected before diagnostic testing is attempted.

Instructions for performing the basic checkout procedure are contained in the following steps:

Note: If processor power is on at the start of this procedure, check the status of all operator panel indicators before turning the power off. If possible, check the indicators while the processor is in the run mode, and again while the processor is in the halt mode. Carefully note and record any trouble symptoms which are observed, as well as those reported by the system operator. This information may prove useful in the troubleshooting process.

a. At the rear panel of the extender, set the ~LINE switch to OFF.

b. Remove extender top and rear covers, and front panel.

WARNING

Dangerous ac line voltage is present in the extender even though the ~LINE switch has been turned off at the extender rear panel. Protective panels and covers installed on the power supply are designed to prevent personal contact with components that are wired directly to the hot side of the ac line. Use caution when servicing in these areas even though the protective panel and covers are in place. If it is necessary to remove a protective panel or cover during servicing, first turn off the extender and disconnect the extender ac power cord from the ac power source. If it is necessary to apply power to the extender while a protective panel or cover is removed, use extreme caution to avoid contact with the exposed area.

c. Inspect the electrical assemblies and parts comprising backplane and power supply for visible indications of trouble, such as burned wiring or printed-circuit traces, broken wiring connections, or plug-in PCA's installed in wrong slots or improperly seated in mating connectors. Also inspect for excess dirt accumulations or foreign matter that could restrict air flow through the cabinet and cause overheating. Take immediate action to correct any condition that may be the cause of the trouble. Note those conditions that do not require immediate corrective action, but which should be serviced when regularly scheduled preventive maintenance is performed.

d. At the operator panel of the processor, check all maintenance switches for proper operating positions. Refer to the **HP 21MX Computer Series Operator's Manual**, part no. 02108-90004.

e. Turn extender ~LINE switch to ON. Check that the two fans at the left side of the extender are operating. Check each fan for abnormal airflow and audible indications of defective motor bearings, fan blade obstructions, or other indications of abnormal operation.

CAUTION

Do not continue with this procedure unless both fans are operating normally. Loss of air flow from an inoperative or improperly operating fan may cause overheating which could result in serious damage to extender components. Turn off power and do not attempt further operation until the trouble has been corrected.

f. Perform the voltage checks for the power supply as described in paragraph 1-28.

3-8. DIAGNOSTIC CHECKOUT

Diagnostic checkout consists of running a series of test programs that automatically perform a dynamic test of extender operation by exercising major portions of the circuit functions. The diagnostic checkout test procedure should be conducted immediately after the extender is installed, as required thereafter as part of a regularly scheduled preventive maintenance program, during troubleshooting, and after making repairs or modifications to the extender. Information and instructions pertinent to performing the diagnostic checkout are presented in paragraphs 3-9 through 3-11.

3-9. REQUIRED DIAGNOSTIC PROGRAM TAPES AND PROCEDURES

Diagnostic test programs are stored in absolute form on punched tapes. Tapes required for testing are referenced by name and part number in diagnostic program procedures contained in the **Manul of Diagnostics.** For ease of identification, labels specifying program name and part number are affixed to the storage box containing the tape, and to the beginning of the tape itself. Procedures for loading diagnostic tapes and for performing diagnostic checkout are included in the **HP 21MX Computer Series Operator's Manual,** part no. 02108-90004.

The diagnostic program procedures in the **Manual of Diagnostics** also provide instructions for running the diagnostic test programs. Each procedure within the **Manual of Diagnostics** is identified by a part number printed on the title page of the document. The names and part numbers of the procedures used for running the test programs that check the basic circuits of the extender are as follows:

DIAGNOSTIC	MANUAL	TAPE
Input/Output Channel	12979-90010	12979-16001
Power Fail/Auto Restart	02100-90216	24321-16001

Note: Diagnostic test procedures for test programs used in testing optional interfacing circuits are referenced in the appropriate documentation furnished with the options.

3-10. TEST SEQUENCE

Perform the diagnostic program procedures for the extender listed in paragraph 3-9. The alter-skip, memory

reference, shift rotate and memory diagnostic tests for the processor should be conducted prior to the extender tests. If all the test programs run without error, the extender is ready for normal operation. If trouble is encountered, proceed to the following paragraph.

3-11. TROUBLESHOOTING FLOWCHART

The troubleshooting flowchart shown in figure 3-1 describes the steps to be taken when troubles (error halts) are encountered during diagnostic testing. The **Manual of Diagnostics** is used in conjunction with the flowchart to provide operating procedures and error halt information.

The troubleshooting test program shown in table 3-2 is used to check the interrupt capability of a selected I/O slot suspected of abnormal operation. The test program is manually loaded in at the processor operator panel. If the selected I/O slot interrupts properly, the processor goes to a normal halt. If the selected I/O slot does not interrupt, the program will loop and allow the signals at the extender backplances to be tested with a PCA extender and oscilloscope.

3-12. POWER SUPPLY TROUBLESHOOTING

Power supply troubleshooting is based on complete replacement of a faulty power supply. If power supply voltages are incorrect and adjustments fail to correct the trouble, notify your nearest HP Sales and Service Office. A list of HP Sales and Service Offices is found at the back of this manual.

3-13. MAINTENANCE

Maintenance consists of preventive maintenance, adjustments, and part-replacement procedures. Maintenance procedures for I/O devices or for I/O interface PCA's are provided in the appropriate documentation for these optional features.

Preventive maintenance is performed at scheduled intervals, and its purpose is to prevent or minimize equipment deterioration. Included in the preventive maintenance procedures are performance tests which check extender operation.

Adjustments and part-replacement procedures are performed when required, and their purpose is to restore normal operation to the extender after a fault has been isolated to a replaceable component.

3-14. PREVENTIVE MAINTENANCE

The following preventive maintenance procedures are performed at monthly or semimonthly intervals, the frequency depending upon the physical conditions prevailing at the particular site. Performance once per month is adequate for most sites. The monthly performance is applicable to extenders which operate 24 hours per day, seven days per week. The interval may be reduced in accordance with the amount of time the extender is turned off.

3-15. EQUIPMENT REQUIRED. The following items are required to perform preventive maintenance:

a. HP 21MX Computer Series Processor.

b. Vacuum cleaner for removing dust from the extender.

c. Digital voltmeter of the type listed in table 3-1.

Table 3-2. Troubleshooting Test Program

LABEL	I/O INSTRUCTION		MACHINE CODE (IN OCTAL)	COMMENTS
	OPCODE	OPERAND		
START	NOP		000000	
	CLF	00	103100	Turn off interrupt system
	STC	XX,C	1037XX	Turn on selected I/O PCA
	STF	00	102100	Turn on interrupt system
	STF	XX	1021XX	Force interrupt condition on I/O PCA
	NOP		000000	I/O PCA should interrupt
	NOP		000000	
END	JMP	START	024100	Did not interrupt, loop on program
	HLT	77	102077	I/O PCA interrupted properly (Halt in trap cell)

NOTE: XX is device octal select code.

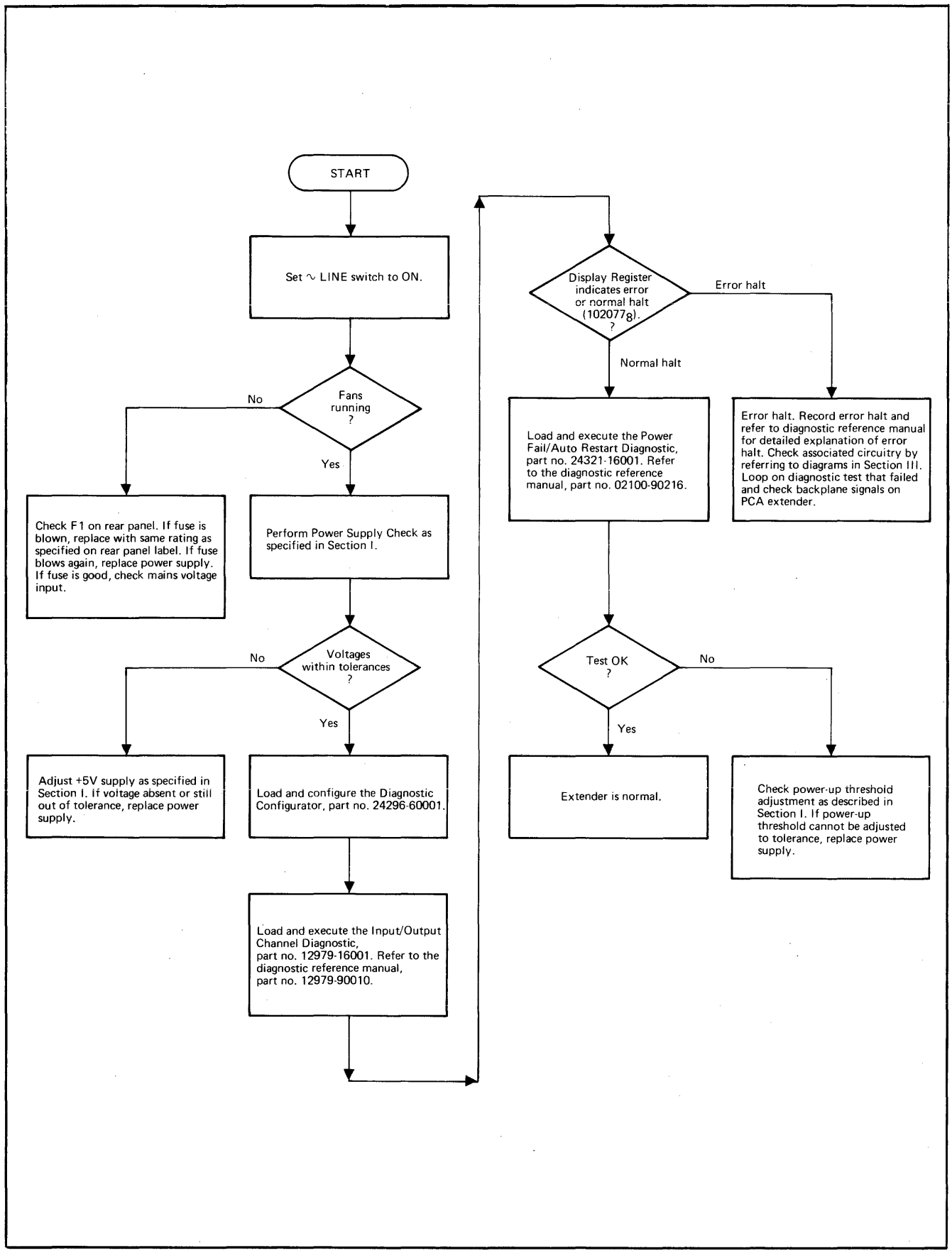


Figure 3-1. Troubleshooting Flowchart

3-16. **PROCEDURE.** Before starting preventive maintenance, connect extender to the HP 21MX Computer Series Processor as described in paragraph 1-19. Connect digital voltmeter to power source and turn it on. Then proceed as described in the following paragraphs.

WARNING

When the extender is on, use caution when working inside the extender mainframe. Many exposed conductors carry low dc voltages which are capable of supplying heavy currents if short-circuited, resulting in high heat and the possibility of painful burns. Use caution when manipulating metal tools or probes. A wrist watch, or a metal necklace, bracelet, or ring must not be worn. Avoid dropping tools, screws, or metal objects onto conductors. Remove power and recover dropped objects at once; if forgotten, damage could result later. AC power-line voltage is exposed when certain covers are removed. Exercise extreme caution when working in the extender with these covers removed, and never work under this condition unless another person is nearby and within sight. If feasible, unplug the ac power cord before performing any work inside the extender. Hazardous voltages exist even when power is turned off. Failure to observe these precautions can result in serious injury or death.

3-17. **Dust.** If required, remove dust and other light debris from extender using vacuum cleaner. Loosen encrusted dust with a soft-bristled brush, and pay particular attention to heat dissipating areas.

3-18. **Cables.** With the extender ~LINE switch set to OFF and the power cord disconnected, remove the front panel and top cover of the extender. Check extension cables and hood connectors for cracks, burns, or wear. Also inspect power cord, paying particular attention to portions of the cord near the connector and plug.

3-19. **Printed-Circuit Assemblies.** Remove extender front panel and rear cover. Check front and rear I/O PCA cages for proper seating of the PCA's installed.

3-20. **Ventilating Fans.** Set extender ~LINE to ON and check extender for proper operation of the two ventilating fans. Ensure that no object interferes with the rotation of the fan blades.

3-21. **Voltage Checks.** Make voltage checks as described in paragraph 1-28.

3-22. **Diagnostic Programs.** When feasible, run the diagnostic programs as described in paragraph 1-30.

3-23. **PREVENTIVE MAINTENANCE SUMMARY.** Preventive maintenance for the extender consists of the following:

a. Remove dust.
b. Check cables for wear.
c. Check PCA's for proper seating.
d. Check operation of the two ventilating fans.
e. Check operating voltages.
f. Run diagnostic programs.
g. Perform preventive maintenance for I/O devices.

3-24. **ADJUSTMENTS**

The only adjustments to be made in the extender are power supply adjustments. Refer to paragraphs 1-27 through 1-29 for power supply adjustment procedures.

3-25. REMOVAL AND REPLACEMENT PROCEDURES

The following paragraphs, which describe procedures for removing and replacing the various extender subassemblies shown in figure 4-1, assume that the extender is installed as a freestanding device. If the extender is rack mounted, read the entire subassembly removal procedure and refer to figure 4-1. When it is obvious that the procedure cannot be performed with the extender in the rack, proceed as follows:

WARNING

Hazardous voltages are present inside the extender mainframe!! Only qualified service personnel should perform the removal and replacement procedures for the extender. Before performing the removal and replacement procedures, set ~LINE switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury or DEATH!! Heed all WARNING — HAZARDOUS VOLTAGE labels.

a. Set extender ~LINE switch to OFF and remove power cord.

b. Disconnect all I/O cables, including I/O extension cable assemblies, and power control cable assembly.

c. Remove extender from rack.

3-26. TOP, SIDE, AND BOTTOM COVERS

WARNING

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

3-27. **REMOVAL.** Remove the top (1, figure 4-1), side (11), and bottom (5) covers as follows:

a. Loosen screw located in rear fold of top cover. Slide top cover toward rear and remove.

b. Remove chassis slides from side covers if present. Loosen screw located in rear fold of side cover and slide cover toward rear and remove.

c. Remove all I/O cables, including I/O extender cables, and power control cable. Loosen screw located in rear fold of bottom cover and slide cover toward rear and remove.

3-28. **REPLACEMENT.** Replace covers in the reverse order of the removal procedure.

3-29. EXTENDER CONTROL PCA

3-30. **REMOVAL.** Remove the bottom cover and proceed as follows:

a. Remove the six screws and washers securing extender control PCA (66, figure 4-1) to bottom of extender mainframe.

b. Carefully disengage extender control PCA from the I/O backplanes.

c. Lift extender control PCA away from extender mainframe to access terminal block TB1. (See figure 3-2.)

d. Each wire connected to TB1 is terminated with a spade lug. Loosen the three screws on TB1 and disconnect each wire.

e. Carefully remove extender control PCA.

3-31. **REPLACEMENT.** Install extender control PCA in the extender mainframe as follows:

a. Slide spade lug of each wire under washer of appropriate connection point on terminal block TB1 and tighten screw. Observe color code of each wire for proper connection.

b. Position extender control PCA receptacles in contact with the I/O backplane connectors.

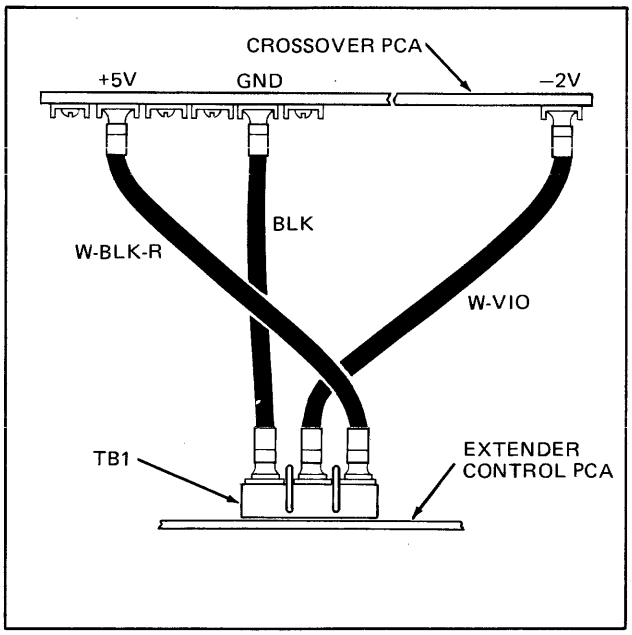


Figure 3-2. Extender Control Power Connections

c. Press inward on back of extender control PCA to seat I/O backplanes fully into extender control PCA receptacles.

d. Replace the six screws and washers securing extender control PCA to bottom of extender mainframe.

e. Reinstall bottom cover.

3-32. I/O INTERFACE PCA

3-33. **REMOVAL FROM REAR I/O PCA CAGE.** Remove an I/O interface PCA from the rear I/O PCA cage as follows:

a. Set ∿LINE switch to OFF.

b. Remove rear cover (25, figure 4-1) by pulling outward on the four plungers.

c. Loosen the two screws that secure rear PCA retainer (24) to rear panel (18) and 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.

3-34. **REMOVAL FROM FRONT I/O PCA CAGE.** Remove an I/O interface PCA from the front I/O PCA cage as follows:

a. Set ∿LINE switch to OFF.

b. Loosen the two quarter-turn fasteners on the front panel (17, figure 4-1) and remove.

c. Remove the screw from the front PCA retainer (75). Lift retainer off standoff and remove.

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.

3-35. **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.

3-36. DCPC (OPTION 001)

3-37. **REMOVAL.** Remove the dual-channel port controller (DCPC) PCA (if present) from the front I/O PCA cage as follows:

a. Set extender ~LINE switch to OFF.

b. Loosen the two quarter-turn fasteners on the front panel (17, figure 4-1) and remove.

c. Remove the screw from the front PCA retainer (75). Lift retainer off standoff and remove.

d. Remove DCPC PCA from dedicated slot labeled "DCPC" by pulling outward on the PCA extractor levers.

3-38. **REPLACEMENT.** Replace DCPC PCA in reverse order of the removal procedure.

3-39. CROSSOVER PCA

3-40. **REMOVAL.** Remove the crossover PCA from the extender mainframe as follows:

a. Remove the top cover.

b. Remove the four screws and washers securing crossover PCA (37, figure 4-1) to PCA cage covers (77).

c. Carefully lift crossover PCA to free it from backplane edge connectors; bend crossover PCA back to access terminal block TB1. (See figure 3-3.)

d. Each wire connected to TB1 is terminated with a spade lug. Loosen the 12 screws on TB1 and disconnect each wire.

e. Carefully remove crossover PCA.

3-41. **REPLACEMENT.** Install the crossover PCA as follows:

a. Slide spade lug of each wire under washer of appropriate connection point on terminal block and tighten screw.

b. Position crossover PCA with receptacles in contact with the I/O backplane connectors.

c. Press downward on back of receptacles to seat backplane connectors fully into crossover PCA receptacles. Secure crossover PCA to PCA cage covers using the four screws and washers.

d. Replace top cover.

3-42. I/O BACKPLANES

3-43. **REMOVAL.** Remove the I/O backplanes (78 and 79, figure 4-1) from the extender mainframe as follows:

a. Remove top cover.

b. Withdraw all front I/O interface PCA's and DCPC PCA (if used) approximately 2 inches (5 centimeters) to clear rear connectors from front I/O backplane receptacles.

c. Withdraw all rear I/O interface PCA's approximately 2 inches (5 centimeters) to clear rear connectors from rear I/O backplane receptacles.

d. Remove the four screws and washers securing crossover PCA (37) to PCA cage covers (77). Carefully lift crossover PCA to free it from backplane edge connectors; bend crossover PCA back to access both I/O backplanes.

e. Grasp front I/O backplane and lift up and out of front I/O PCA cage assembly.

f. Grasp rear I/O backplane and lift up and out of rear I/O PCA cage assembly.

3-44. **REPLACEMENT.** Replace both I/O backplanes in reverse order of the removal procedure. Be sure to check that all PCA's have been seated firmly into their mating receptacles.

3-45. POWER SUPPLY

WARNING

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

3-46. **REMOVAL.** Remove the top cover and the crossover PCA, then proceed as follows:

a. Loosen the two quarter-turn fasteners on the front panel (17, figure 4-1) and remove.

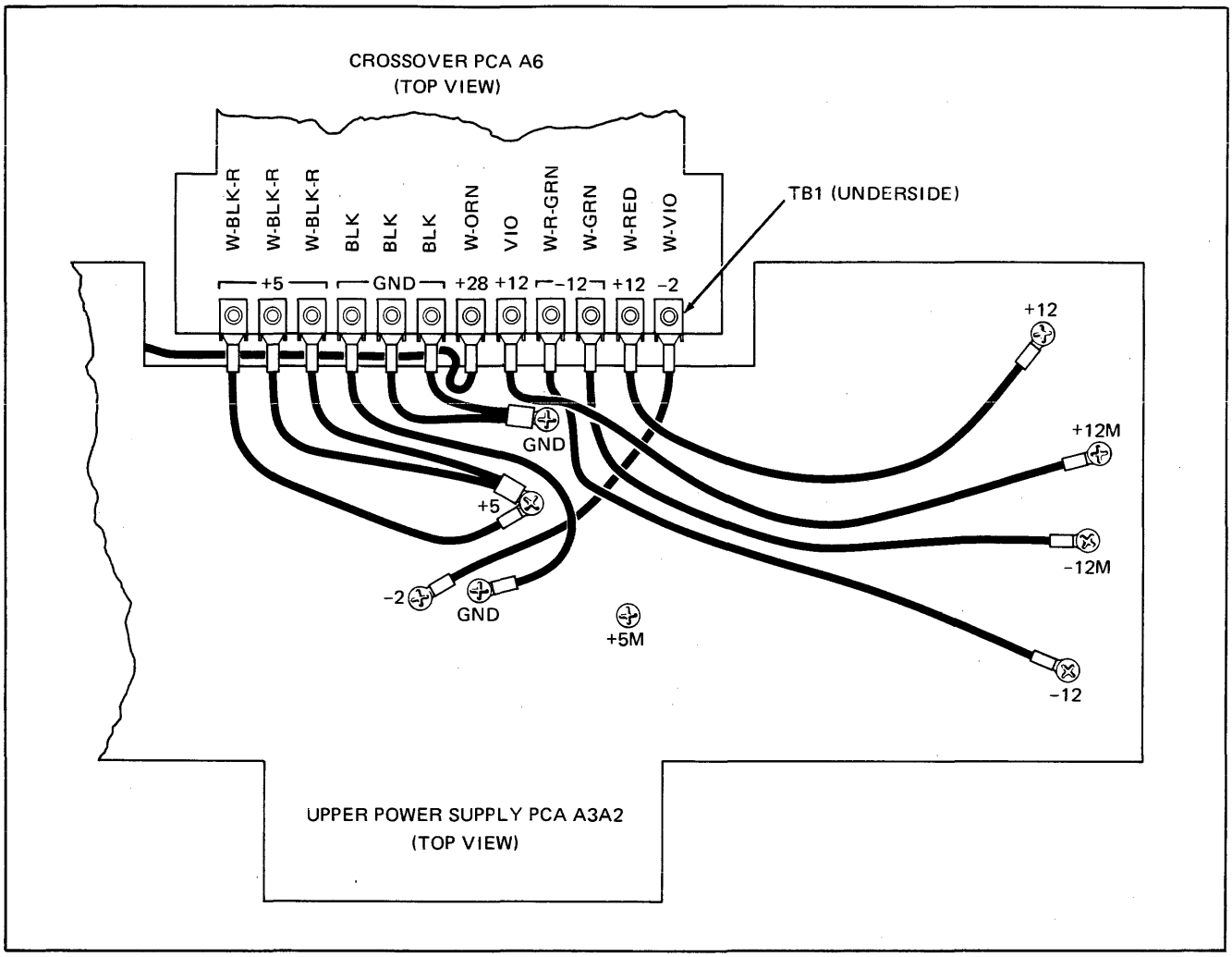


Figure 3-3. Crossover PCA Power Connections

b. Remove the four screws and six washers securing power supply shield (34) to extender mainframe and remove.

c. Remove rear cover (25) and loosen rear PCA retainer (24); slide retainer to the right.

d. Remove remaining four screws and washers securing cable channel (28) to extender mainframe and remove.

e. Remove the four screws securing rear panel (18) to extender mainframe.

f. Disconnect power supply cable assembly from upper power supply PCA.

g. Remove the eight long screws (41) and washers (42) securing upper power supply PCA to extender mainframe.

h. Remove the two screws (43) and washers (44) securing the lower power supply PCA to extender mainframe.

i. Lift power supply (40) up and out of extender mainframe.

3-47. **REPLACEMENT.** If installing a replacement power supply, configure the jumpers located on the component side of upper power supply PCA as required for the HP 12979A I/O Extender. (See figure 3-4.) After configuring the power supply jumpers, replace power supply in the reverse order of the removal procedure. Attach the crossover PCA to the upper power supply PCA as shown in figure 3-3.

3-48. VENTILATING FANS

WARNING

Hazardous voltages are present when working around the power supply area. Ensure that ac power cord is disconnected before proceeding.

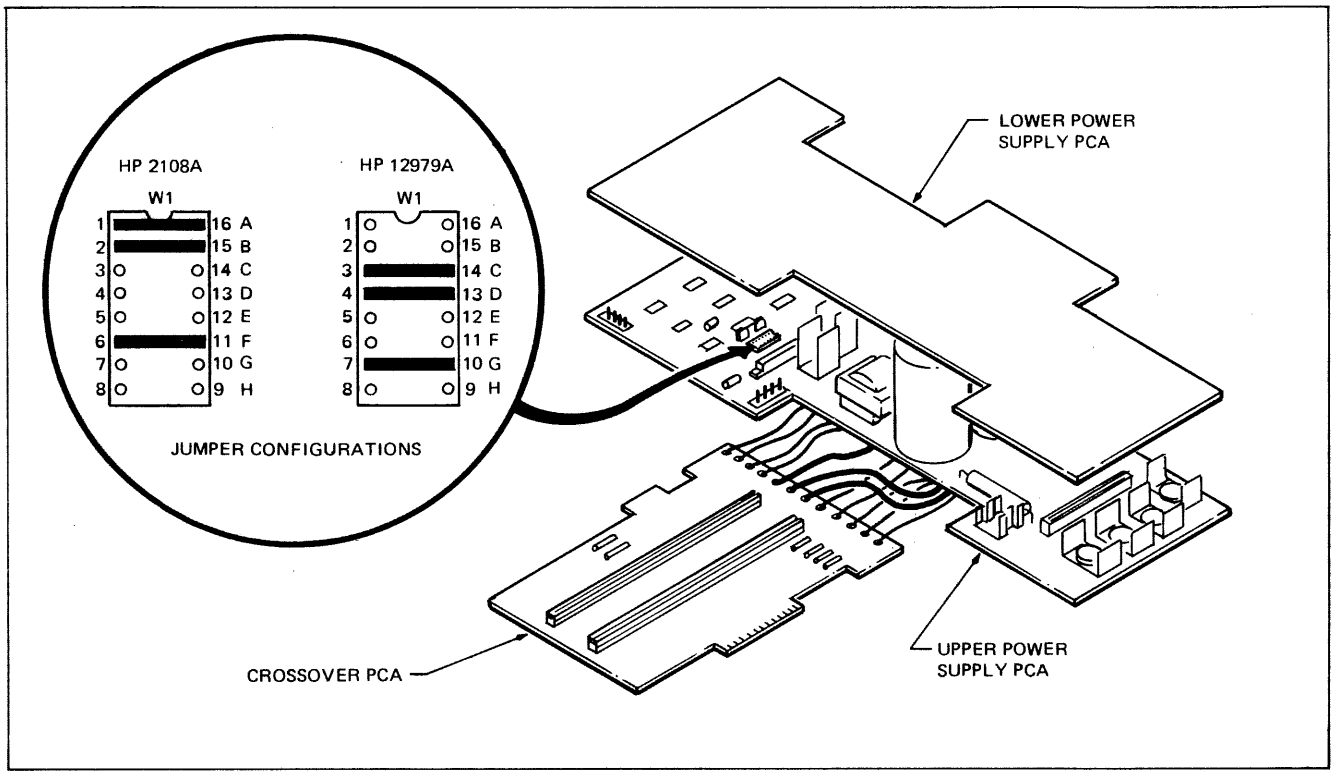


Figure 3-4. Power Supply Jumper Configurations

3-49. REMOVAL. Remove the top and left side covers, then proceed as follows:

a. Disconnect the power lead at the top of the fan (46, figure 4-1).

b. Remove the four self-tapping screws securing fan to extender mainframe. Pull fan upward and out of the mainframe.

3-50. REPLACEMENT. Replace the ventilating fans in the reverse order of the removal procedure.

3-51. INTEGRATED CIRCUITS

The following procedure is recommended for replacing an integrated circuit:

a. Clip the integrated circuit pins close to the integrated circuit pack with a pair of diagonal cutters. Remove integrated circuit.

b. Using a 30-watt soldering iron, unsolder and remove each pin from the PCA.

c. Using a rubber bulb with a suction tube, withdraw molten solder from each hole in the PCA.

d. Mount the integrated circuit on the PCA and solder each pin.

3-52. 110/220 VAC RECONFIGURATION

To reconfigure the extender to operate from 220-volt mains instead of 110-volt mains (or vice versa), refer to figure 3-5 and proceed as follows:

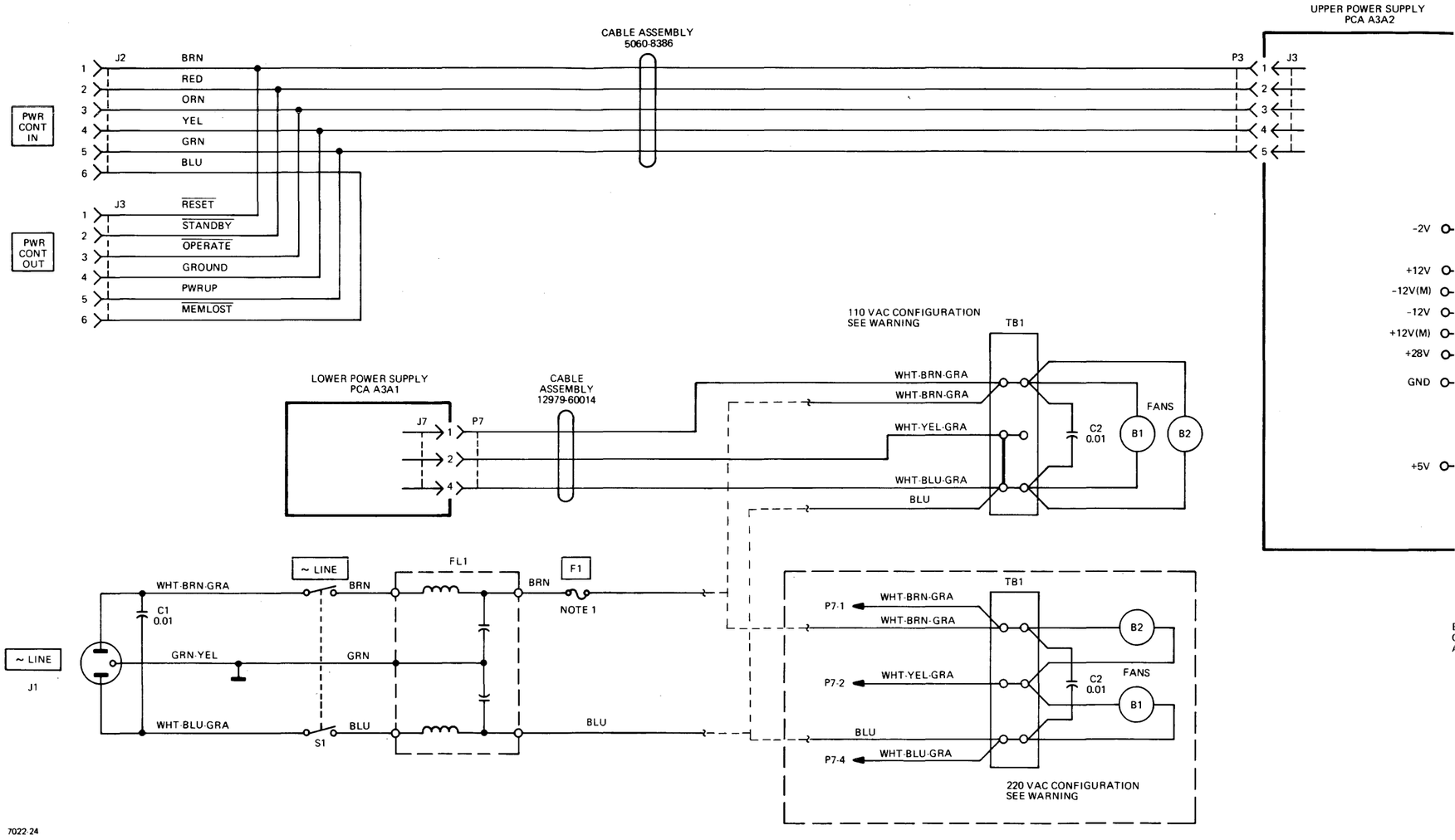
WARNING

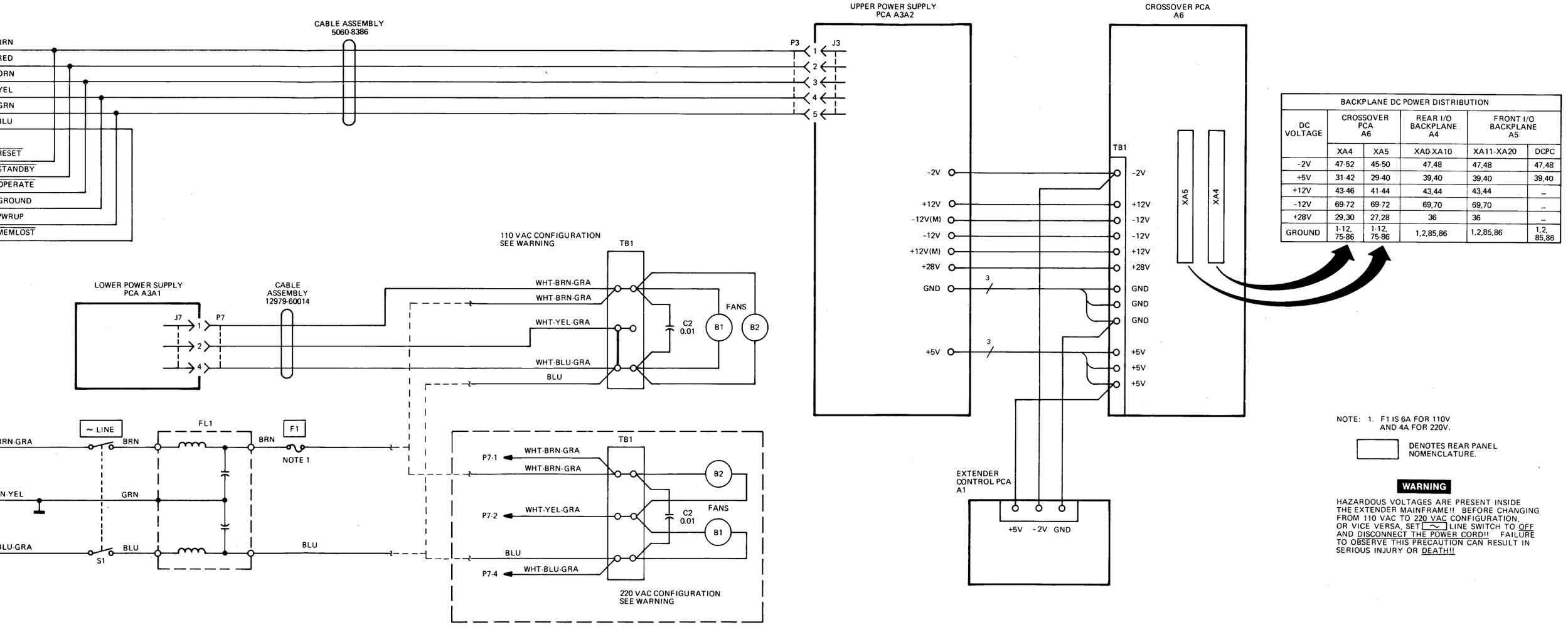
Hazardous voltages are present inside the extender mainframe!! Before changing from 110V ac to 220V ac configuration, or vice versa, set ~LINE switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury or DEATH!!

a. Set ~LINE switch to OFF and remove power cord.

b. Remove top cover of extender.

c. Remove the four mounting screws and lockwashers that secure rear panel (18, figure 4-1) to extender frame. (Two screws are located at the top of the panel and two screws are located at the bottom of the panel.)


CABLE ASSEMBLY
5060-8386
UPPER POWER SUPPLY
PCA A3A2
PWR CONT IN
J2
BRN
RED
ORN
YEL
GRN
BLU
P3
J3
PWR CONT OUT
J3
RESET
STANDBY
OPERATE
GROUND
PWRUP
MEMLOST
-2V
+12V
-12V(M)
-12V
+12V(M)
+28V
GND
+5V
110 VAC CONFIGURATION
SEE WARNING
TB1
LOWER POWER SUPPLY
PCA A3A1
CABLE
ASSEMBLY
12979-60014
J7
P7
WHT-BRN-GRA
WHT-BRN-GRA
WHT-YEL-GRA
WHT-BLU-GRA
BLU
FANS
C2
0.01
B1
B2
~ LINE
FL1
F1
WHT-BRN-GRA
BRN
BRN
NOTE 1
C1
0.01
~ LINE
J1
GRN-YEL
GRN
WHT-BLU-GRA
BLU
S1
BLU
TB1
P7-1
WHT-BRN-GRA
WHT-BRN-GRA
B2
FANS
C2
0.01
B1
P7-2
WHT-YEL-GRA
BLU
P7-4
WHT-BLU-GRA
220 VAC CONFIGURATION
SEE WARNING
7022-24



BACKPLANE DC POWER DISTRIBUTION					
DC VOLTAGE	CROSSOVER PCA A6		REAR I/O BACKPLANE A4	FRONT I/O BACKPLANE A5	
	XA4	XA5	XA0-XA10	XA11-XA20	DCPC
-2V	47-52	45-50	47,48	47,48	47,48
+5V	31-42	29-40	39,40	39,40	39,40
+12V	43-46	41-44	43,44	43,44	–
-12V	69-72	69-72	69,70	69,70	–
+28V	29,30	27,28	36	36	–
GROUND	1-12, 75-86	1-12, 75-86	1,2,85,86	1,2,85,86	1,2, 85,86

NOTE: 1. F1 IS 6A FOR 110V AND 4A FOR 220V.

DENOTES REAR PANEL NOMENCLATURE.

WARNING

HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE EXTENDER MAINFRAME!! BEFORE CHANGING FROM 110 VAC TO 220 VAC CONFIGURATION, OR VICE VERSA, SET [~] LINE SWITCH TO OFF AND DISCONNECT THE POWER CORD!! FAILURE TO OBSERVE THIS PRECAUTION CAN RESULT IN SERIOUS INJURY OR DEATH!!

Figure 3-5. Power Distribution Diagram

d. Carefully swing rear panel outward to expose terminal block TB1 (5, figure 4-2) and other components.

e. For **110V ac** operation, connect a jumper wire between the WHT-YEL-GRA and WHT-BLU-GRA leadwires on terminal block. Connect one side of each fan to the WHT-BRN-GRA leadwire on terminal block; connect other side of each fan to the WHT-BLU-GRA leadwire on terminal block.

f. For **220V ac** operation, remove jumper wire from between the WHT-YEL-GRA and WHT-BLU-GRA leadwires on termianl block. Connect one fan across the WHT-BRN-GRA and WHT-YEL-GRA leadwires; connect other fan across the WHT-YEL-GRA and WHT-BLU-GRA leadwires.

g. Position rear panel in place and secure with the four mounting screws and lockwashers. Replace top cover of extender.

3-53. DIAGRAMS

Reference information for troubleshooting and repair of the extender is contained in tables and diagrams that follow this paragraph. The information consists of a signal index (list of signal mnemonics and their definitions), signal distribution list, power distribution diagram, input/output timing diagram, parts location and schematic diagrams, and parts information.

3-54. SIGNAL INDEX

The signal index in table 3-3 lists all signals that enter or leave PCA's installed in the extender. Abbreviations of signal names (commonly referred to as mnemonic designations) are defined in the table and a reference number is provided for each signal. This number permits the signal to be found in the signal distribution list for the I/O backplanes in table 3-4 which shows the connections to the other extender assemblies.

3-55. BACKPLANE SIGNALS

Backplane signals are provided in the signal distribution listing in table 3-4. The signals are listed alphanumerically and are cross-indexed to the reference numbers in table 3-3. The headings at the top of the table are arranged to show the reference designation of each PCA installed in the extender. The pin numbers correspond to the pin numbers on the 86-pin edge of the PCA plugged into the connector. This information is used in conjunction with schematic diagrams to determine the signal sources and their destinations for the PCA's installed in the extender.

To trace a signal in the extender backplane, the reference number is selected from the signal index. Once the reference number is known the signal can be located in the signal distribution list by referring directly to the reference number in table 3-4. The signal enters or exits the plug-in PCA on the corresponding pin number of the 86-pin edge connector. This signal can be tested from the front or rear I/O PCA cages by using a PCA extender to gain access to the 86-pin edge connector. By referring to the schematic diagram for the plug-in PCA, the signal can be traced to all associated circuit components.

3-56. POWER DISTRIBUTION

Figure 3-5 shows the wiring between the backplanes, power supply, and other extender subassemblies. The diagram is not complete in itself but must be used with figure 3-3 to determine the point-to-point wiring between the components illustrated.

3-57. INPUT/OUTPUT TIMING

The input/output timing diagram in figure 3-6 shows the I/O timing associated with the I/O section of the extender. This information may be used in conjunction with the documentation provided with the I/O interface PCA's or devices installed in the extender for troubleshooting.

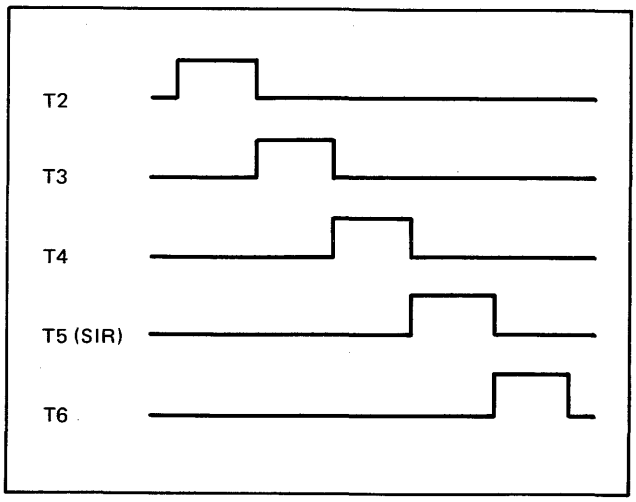


Figure 3-6. Input/Output Timing

3-58. PARTS LOCATION AND SCHEMATIC DIAGRAMS

Figures 3-7 through 3-9 are the parts location and schematic diagrams for the printed-circuit assemblies used in the extender and the dual-channel port controller option. The parts location diagram for each PCA is located adjacent to the schematic diagram and shows the location and appearance of electrical parts on each PCA. The parts are identified by reference designations used on the schematic diagrams. The PCA part number and

identification code is shown on the parts location diagram as it is marked on the PCA itself.

3-59. REPLACEABLE PARTS LISTS

Tables 3-5 through 3-7 are the replaceable parts lists for the printed-circuit assemblies used with the extender and are included in this section to supplement the parts location and schematic diagrams. Section IV provides a complete list of replaceable parts for the extender, description of the table columns, and parts ordering information. Parts are listed by reference designation and include an HP part number, description, manufacturer's code, and manufacturer's part number.

Table 3-3. Signal Index

SIGNAL MNEMONIC	DEFINITION	REF. NO.
BSC0	Base Select Code bit 0	1
BSC1	Base Select Code bit 1	2
BSC2	Base Select Code bit 2	3
BSC3	Base Select Code bit 3	4
BSC4	Base Select Code bit 4	5
BSC5	Base Select Code bit 5	6
CLC	Clear Control	7
CLF	Clear Flag	8
CRS	Control Reset	9
EDT	End Data Transfer	10
ENF	Enable Flag	11
FLGX0	Extender Flag bit 0	12
FLGX1	Extender Flag bit 1	13
FLGX2	Extender Flag bit 2	14
IAK	Interrupt Acknowledge	15
$\overline{\text{IA0}}$	"Not" Interrupt Address bit 0	16
$\overline{\text{IA1}}$	"Not" Interrupt Address bit 1	17
$\overline{\text{IA2}}$	"Not" Interrupt Address bit 2	18
$\overline{\text{IA3}}$	"Not" Interrupt Address bit 3	19
$\overline{\text{IA4}}$	"Not" Interrupt Address bit 4	20
$\overline{\text{IA5}}$	"Not" Interrupt Address bit 5	21
IEN	Interrupt Enable	22
IENXA	Interrupt Enable Extender Rear I/O Cage	23
IENXB	Interrupt Enable Extender Front I/O Cage	24
$\overline{\text{INTX}}$	"Not" Interrupt, External	25
IOB0	Input/Output Bus bit 0	26
IOB1	Input/Output Bus bit 1	27
IOB2	Input/Output Bus bit 2	28
IOB3	Input/Output Bus bit 3	29
IOB4	Input/Output Bus bit 4	30
IOB5	Input/Output Bus bit 5	31
IOB6	Input/Output Bus bit 6	32
IOB7	Input/Output Bus bit 7	33
IOB8	Input/Output Bus bit 8	34
IOB9	Input/Output Bus bit 9	35
IOB10	Input/Output Bus bit 10	36
IOB11	Input/Output Bus bit 11	37
IOB12	Input/Output Bus bit 12	38
IOB13	Input/Output Bus bit 13	39

Table 3-3. Signal Index (Continued)

SIGNAL MNEMONIC	DEFINITION	REF. NO.
IOB14	Input/Output Bus bit 14	40
IOB15	Input/Output Bus bit 15	41
IOB16	Input/Output Bus bit 16	42
IOBI0	Input/Output Bus Input bit 0	43
IOBI1	Input/Output Bus Input bit 1	44
IOBI2	Input/Output Bus Input bit 2	45
IOBI3	Input/Output Bus Input bit 3	46
IOBI4	Input/Output Bus Input bit 4	47
IOBI5	Input/Output Bus Input bit 5	48
IOBI6	Input/Output Bus Input bit 6	49
IOBI7	Input/Output Bus Input bit 7	50
IOBI8	Input/Output Bus Input bit 8	51
IOBI9	Input/Output Bus Input bit 9	52
IOBI10	Input/Output Bus Input bit 10	53
IOBI11	Input/Output Bus Input bit 11	54
IOBI12	Input/Output Bus Input bit 12	55
IOBI13	Input/Output Bus Input bit 13	56
IOBI14	Input/Output Bus Input bit 14	57
IOBI15	Input/Output Bus Input bit 15	58
IOBO0	Input/Output Bus Output bit 0	59
IOBO1	Input/Output Bus Output bit 1	60
IOBO2	Input/Output Bus Output bit 2	61
IOBO3	Input/Output Bus Output bit 3	62
IOBO4	Input/Output Bus Output bit 4	63
IOBO5	Input/Output Bus Output bit 5	64
IOBO6	Input/Output Bus Output bit 6	65
IOBO7	Input/Output Bus Output bit 7	66
IOBO8	Input/Output Bus Output bit 8	67
IOBO9	Input/Output Bus Output bit 9	68
IOBO10	Input/Output Bus Output bit 10	69
IOBO11	Input/Output Bus Output bit 11	70
IOBO12	Input/Output Bus Output bit 12	71
IOBO13	Input/Output Bus Output bit 13	72
IOBO14	Input/Output Bus Output bit 14	73
IOBO15	Input/Output Bus Output bit 15	74
IOG	Input/Output Group	75
IOI	Input/Output Input	76
IOO	Input/Output Output	77
IRQX1	Extender Interrupt Request bit 1	78

Table 3-3. Signal Index (Continued)

SIGNAL MNEMONIC	DEFINITION	REF. NO.
IRQX2	Extender Interrupt Request bit 2	79
IRQX3	Extender Interrupt Request bit 3	80
IRQX4	Extender Interrupt Request bit 4	81
IRQX5	Extender Interrupt Request bit 5	82
IRQX6	Extender Interrupt Request bit 6	83
IRQX7	Extender Interrupt Request bit 7	84
PLX1	Priority Low Extender 1	85
PLX2	Priority Low Extender 2	86
PON	Power On	87
POPIO	Power On Preset I/O	88
PRL	Priority Low	89
PRLXA	Priority Low Extender Rear I/O Cage	90
PRLXB	Priority Low Extender Front I/O Cage	91
PRLX0/PRHX1	Extender Priority Low S.C. 0/Extender Priority High S.C. 1	92
PRLX1/PRHX2	Extender Priority Low S.C. 1/Extender Priority High S.C. 2	93
PRLX2/PRHX3	Extender Priority Low S.C. 2/Extender Priority High S.C. 3	94
PRLX3/PRHX4	Extender Priority Low S.C. 3/Extender Priority High S.C. 4	95
PRLX4/PRHX5	Extender Priority Low S.C. 4/Extender Priority High S.C. 5	96
PRLX5/PRHX6	Extender Priority Low S.C. 5/Extender Priority High S.C. 6	97
PRLX6/PRHX7	Extender Priority Low S.C. 6/Extender Priority High S.C. 7	98
PRLX7/PRHX10	Extender Priority Low S.C. 7/Extender Priority High S.C. 10	99
PRLX11/PRHX12	Extender Priority Low S.C. 11/Extender Priority High S.C. 12	100
PRLX12/PRHX13	Extender Priority Low S.C. 12/Extender Priority High S.C. 13	101
PRLX13/PRHX14	Extender Priority Low S.C. 13/Extender Priority High S.C. 14	102
PRLX14/PRHX15	Extender Priority Low S.C. 14/Extender Priority High S.C. 15	103
PRLX15/PRHX16	Extender Priority Low S.C. 15/Extender Priority High S.C. 16	104
PRLX16/PRHX17	Extender Priority Low S.C. 16/Extender Priority High S.C. 17	105
PRLX17/PRHX20	Extender Priority Low S.C. 17/Extender Priority High S.C. 20	106
PWU	Power Up	107
$\overline{\text{REQ1}}$	"Not" Request 1	108
$\overline{\text{REQ2}}$	"Not" Request 2	109
RUN	Run	110
SCB0	Select Code bit 0	111
SCB1	Select Code bit 1	112
SCB2	Select Code bit 2	113
SCB3	Select Code bit 3	114
SCB4	Select Code bit 4	115
SCB5	Select Code bit 5	116
SCLX0	Extender Select Code Least Significant bit 0	117

Table 3-3. Signal Index (Continued)

SIGNAL MNEMONIC	DEFINITION	REF. NO.
SCLX1	Extender Select Code Least Significant bit 1	118
SCLX2	Extender Select Code Least Significant bit 2	119
SCLX3	Extender Select Code Least Significant bit 3	120
SCLX4	Extender Select Code Least Significant bit 4	121
SCLX5	Extender Select Code Least Significant bit 5	122
SCLX6	Extender Select Code Least Significant bit 6	123
SCLX7	Extender Select Code Least Significant bit 7	124
SCMX0	Extender Select Code Most Significant bit 0	125
SCMX1	Extender Select Code Most Significant bit 1	126
SCMX2	Extender Select Code Most Significant bit 2	127
SFC	Skip if Flag is Clear	128
SFS	Skip if Flag is Set	129
SIR	Set Interrupt Request	130
SKF	Skip on Flag	131
SRQX0	Extender Service Request S.C. 0	132
SRQX1	Extender Service Request S.C. 1	133
SRQX2	Extender Service Request S.C. 2	134
SRQX3	Extender Service Request S.C. 3	135
SRQX4	Extender Service Request S.C. 4	136
SRQX5	Extender Service Request S.C. 5	137
SRQX6	Extender Service Request S.C. 6	138
SRQX7	Extender Service Request S.C. 7	139
SRQX10	Extender Service Request S.C. 10	140
SRQX11	Extender Service Request S.C. 11	141
SRQX12	Extender Service Request S.C. 12	142
SRQX13	Extender Service Request S.C. 13	143
SRQX14	Extender Service Request S.C. 14	144
SRQX15	Extender Service Request S.C. 15	145
SRQX16	Extender Service Request S.C. 16	146
SRQX17	Extender Service Request S.C. 17	147
SRQX20	Extender Service Request S.C. 20	148
STC	Set Control	149
STF	Set Flag	150
T3	Time 3	151

Table 3-4. Signal Distribution List

REF. NO.	SIGNAL	EXTENDER CONTROL PCA A1				POWER SUPPLY A3	REAR INPUT/OUTPUT BACKPLANE A4									FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
		TO CPU J3	TO I/O EXT PCA																								
		J2	J3	XA4	XA5	**	XA0	XA1	XA2	XA3	XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
1	BSC0				68																			72			1
2	BSC 1				70																			76			2
3	BSC2				72																			78			3
4	BSC3				74																			80			4
5	BSC4				75																			81			5
6	BSC5				76																			82			6
7	CLC		J	21	21		21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21				7
8	CLF		2	7	7		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7				8
9	CRS		5	13	13		13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13				9
10	EDT		20	67	62		62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62				10
11	ENF		R	53	48		46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46				11
12	FLGX0			3	56		4/49	4/49	4/49	4/49	4/49	4/49	4/49	4													12
13	FLGX1			6	49									49	4/49	4/49	4/49	4/49	4/49	4/49	4/49	4					13
14	FLGX2				51																	49	4/49				14
15	IAK		D	10	10		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10				15
16	$\overline{IA0}$	48																									16
17	$\overline{IA1}$	46																									17
18	$\overline{IA2}$	44																									18
19	$\overline{IA3}$	42																									19
20	$\overline{IA4}$	40																									20
21	$\overline{IA5}$	38																									21
22	IEN		C																								22
23	IENXA			23	54		8/23	8	8	8	8	8	8	8	8												23
24	IENAB			8	8											8/23	8	8	8	8	8	8	8				24
25	$\overline{INTX}$	36																									25

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

DENOTES BIDIRECTIONAL SIGNAL

Table 3-4. Signal Distribution List (Continued)

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REAR INPUT/OUTPUT BACKPLANE A4									FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
		J2	J3	XA4	XA5	**	XA0	XA1	XA2	XA3	XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
26	IOB0		M																								26
27	IOB1		11																								27
28	IOB2		N																								28
29	IOB3		14																								29
30	IOB4		12																								30
31	IOB5		S																								31
32	IOB6		T																								32
33	IOB7		16																								33
34	IOB8		17																								34
35	IOB9		U																								35
36	IOB10		V																								36
37	IOB11		19																								37
38	IOB12		18																								38
39	IOB13		W																								39
40	IOB14		X																								40
41	IOB15		AA																								41
42	IOB16		H	18	18		18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18				42
43	IOB10			26	26		26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26				43
44	IOBI1			29	29		29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29				44
45	IOBI2			30	30		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30				45
46	IOBI3			64	64		64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64				46
47	IOBI4			77	77		77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77				47
48	IOBI5			80	80		80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80				48
49	IOBI6			81	81		81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81				49
50	IOBI7			84	84		84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84				50

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

DENOTES BIDIRECTIONAL SIGNAL

Table 3-4. Signal Distribution List (Continued)

REF. NO.	SIGNAL	EXTENDER CONTROL PCA A1				POWER SUPPLY A3	REAR INPUT/OUTPUT BACKPLANE A4									FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
		TO CPU J3	TO I/O EXT PCA																								
		J2	J3	XA4	XA5	**	XA0	XA1	XA2	XA3	XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
51	IOBI8			27	27		27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27				51
52	IOBI9			28	28		28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28				52
53	IOBI10			31	31		31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31				53
54	IOBI11			60	60		60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60				54
55	IOBI12			78	78		78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78				55
56	IOBI13			79	79		79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79				56
57	IOBI14			82	82		82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82				57
58	IOBI15			83	83		83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83				58
59	IOBO0			35			35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	28	21	59
60	IOBO1			38			38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	62	22	60
61	IOBO2			42			41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	54	24	61
62	IOBO3			46			45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	56	26	62
63	IOBO4			44			42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	53	23	63
64	IOBO5			57			51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	58	52	64
65	IOBO6			59			53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53		60	54	65
66	IOBO7			58			52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52		55	51	66
67	IOBO8			60			54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54		57	53	67
68	IOBO9			62			56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56		59	56	68
69	IOBO10			64			58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58		63	58	69
70	IOBO11			61			55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55		61	55	70
71	IOBO12			63			57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57		65	57	71
72	IOBO13			66			61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61		67	59	72
73	IOBO14			69			65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65		68	73	73
74	IOBO15			74			74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74		73	74	74
75	IOG		F	16	15		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15			75

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

DENOTES BIDIRECTIONAL SIGNAL

Table 3-4. Signal Distribution List (Continued)

REF. NO.	SIGNAL	EXTENDER CONTROL PCA A1				POWER SUPPLY A3	REAR INPUT/OUTPUT BACKPLANE A4									FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
		TO CPU J3	TO I/O EXT PCA																								
		J2	J3	XA4	XA5	**	XA0	XA1	XA2	XA3	XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
76	IOI		9	24	24		24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24				76
77	IOO		7	20	20		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20				77
78	IRQX1			33	23		33	6							33	6							33				78
79	IRQX2			34	34			33	6							33	6										79
80	IRQX3								33	6							33	6									80
81	IRQX4									33	6							33	6								81
82	IRQX5										33	6							33	6							82
83	IRQX6											33	6							33	6						83
84	IRQX7												33	6							33	6					84
85	PLX1	22																									85
86	PLX2	24																									86
87	PON		V	70	66		66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66				87
88	POPIO		6	17	19		17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17				88
89	PRL		K																								89
90	PRLXA			4	55										3												90
91	PRLXB				3																		3				91
92	PRLX0/PRHX1						3	23																			92
93	PRLX1/PRHX2							3	23																		93
94	PRLX2/PRHX3								3	23																	94
95	PRLX3/PRHX4									3	23																95
96	PRLX4/PRHX5										3	23															96
97	PRLX5/PRHX6											3	23														97
98	PRLX6/PRHX7												3	23													98
99	PRLX7/PRHX10													3	23												99
100	PRLX11/PRHX12															3	23										100

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

DENOTES BIDIRECTIONAL SIGNAL

Table 3-4. Signal Distribution List (Continued)

REF. NO.	SIGNAL	EXTENDER CONTROL PCA A1				POWER SUPPLY A3	REAR INPUT/OUTPUT BACKPLANE A4									FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
		TO CPU J3	TO I/O EXT PCA																								
		J2	J3	XA4	XA5	**	XA0	XA1	XA2	XA3	XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
101	PRLX12/PRHX13																3	23									101
102	PRLX13/PRHX14																	3	23								102
103	PRLX14/PRHX15																		3	23							103
104	PRLX15/PRHX16																			3	23						104
105	PRLX16/PRHX17																				3	23					105
106	PRLX17/PRHX20																					3	23				106
107	PWU	26																									107
108	$\overline{\text{REQ1}}$	20																						52			108
109	$\overline{\text{REQ2}}$	18																						56			109
110	RUN		15	56	50		50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50				110
111	SCB0	16			65																			68			111
112	SCB1	14			61																			67			112
113	SCB2	12			67																			71			113
114	SCB3	10			69																			74			114
115	SCB4	8			71																			77			115
116	SCB5	6			73																			79			116
117	SCLX0			43	17		16							34	16							34	16				117
118	SCLX1			45	41		34	16							34	16							34				118
119	SCLX2			47	33			34	16							34	16										119
120	SCLX3			48	35				34	16							34	16									120
121	SCLX4			49	38					34	16							34	16								121
122	SCLX5			50	40						34	16							34	16							122
123	SCLX6			51	42							34	16							34	16						123
124	SCLX7			52	47								34	16							34	16					124
125	SCMX0			14	53		14/37	14/37	14/37	14/37	14/37	14/37	14/37	14													125

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

DENOTES BIDIRECTIONAL SIGNAL

Table 3-4. Signal Distribution List (Continued)

REF. NO.	SIGNAL	EXTENDER CONTROL PCA A1				POWER SUPPLY A3	REAR INPUT/OUTPUT BACKPLANE A4									FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
		TO CPU J3	TO I/O EXT PCA																								
		J2	J3	XA4	XA5	**	XA0	XA1	XA2	XA3	XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
126	SCMX1			15	14									37	14 / 37	14 / 37	14 / 37	14 / 37	14 / 37	14 / 37	14 / 37						126
127	SCMX2				16																	37	14 / 37				127
128	SFC		B	5	5		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5				128
129	SFS		L	25	25		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25				129
130	SIR		10	32	32		32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32				130
131	SKF		E	12	12		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12				131
132	SRQX0						19																	57			132
133	SRQX1							19																58			133
134	SRQX2								19															59			134
135	SRQX3									19														60			135
136	SRQX4										19													65			136
137	SRQX5											19												64			137
138	SRQX6												19											63			138
139	SRQX7													19										62			139
140	SRQX10														19									61			140
141	SRQX11															19								24			141
142	SRQX12																19							23			142
143	SRQX13																	19						22			143
144	SRQX14																		19					21			144
145	SRQX15																			19				16			145
146	SRQX16																				19			17			146
147	SRQX17																					19		18			147
148	SRQX20																						19	19			148
149	STC		6	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22				149
150	STF		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9				150

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

DENOTES BIDIRECTIONAL SIGNAL

Table 3-4. Signal Distribution List (Continued)

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REAR INPUT/OUTPUT BACKPLANE A4									FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
		J2	J3	XA4	XA5	**	XA0	XA1	XA2	XA3	XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
151	T3		4	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11				151

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

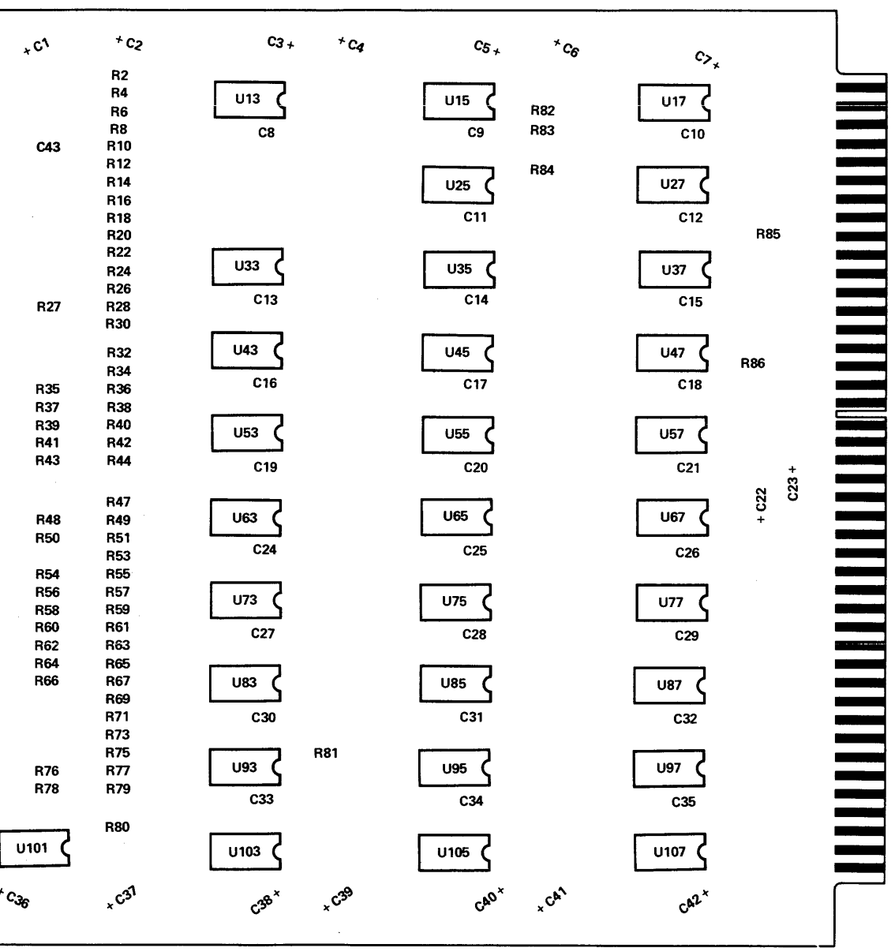
**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

DENOTES BIDIRECTIONAL SIGNAL

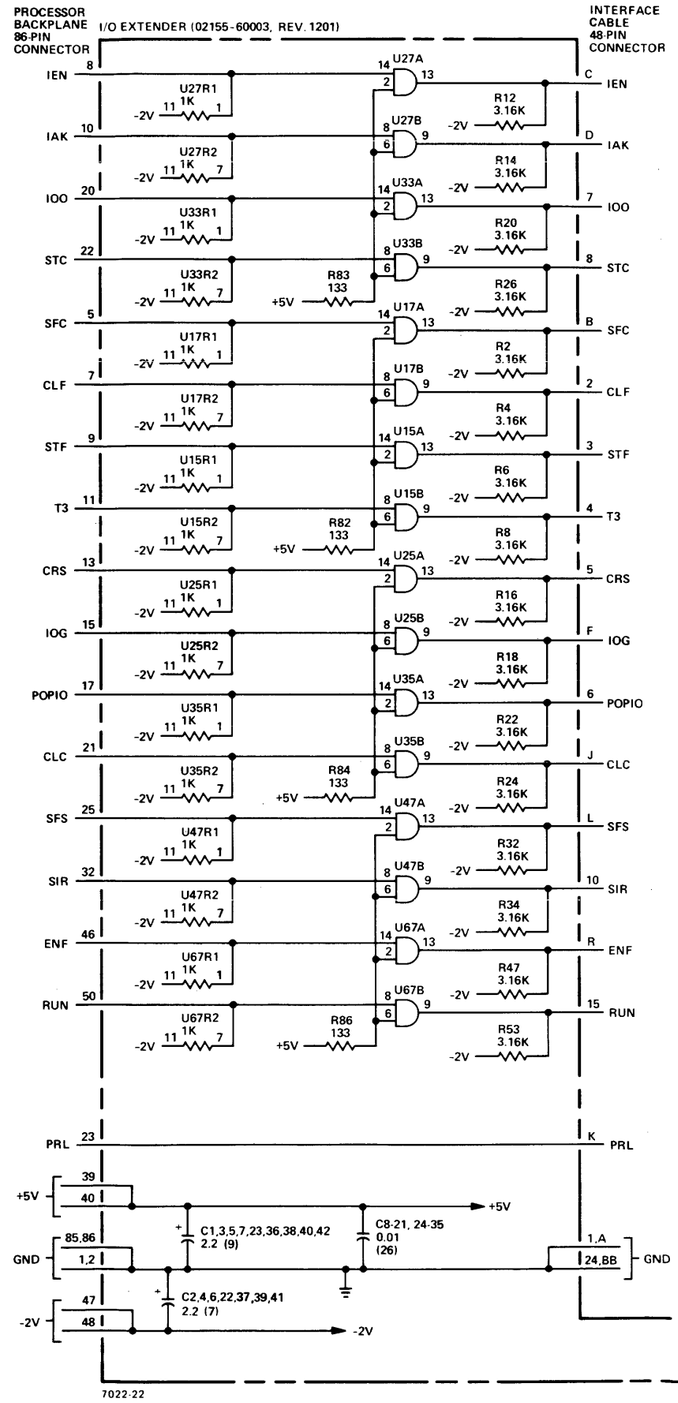
Table 3-5. I/O Extender PCA (In Processor), Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1 thru C7,22,23, 36 thru 42	0180-0197	CAPACITOR, fxd, elect, 2.2 μF, 10%, 20 VDCW	56289	150D225X9020A2-DYS
C8 thru C21, 24 thru 35	0160-2055	CAPACITOR, fxd, cer, 0.01 μF, +80 -20%, 100 VDCW	56289	C023F101F103ZS22-CDH
C43	0160-0154	CAPACITOR, fxd, mica, 0.0022 μF, 10%, 200 VDCW	56289	192P22292-PTS
R2,4,6,8,12,14,16, 18,20,22,24,26,30, 32,34,47,53,69,71, 73,75	0757-0279	RESISTOR, fxd, film, 3.16k, 1%, 1/8W	28480	0757-0279
R10,28,36,38,40, 42,44,49,51,55, 57,59,61,63,65, 67,77,79	0698-3438	RESISTOR, fxd, film, 147 ohms, 1%, 1/8W	28480	0698-3438
R27,35,37,39,41, 43,48,50,54,66, 76,78,80	0757-0417	RESISTOR, fxd, film, 562 ohms, 1%, 1/8W	28480	0757-0417
R81 thru R86	0698-3437	RESISTOR, fxd, film, 133 ohms, 1%, 1/8W	28480	0698-3437
U13,15,17,25,27, 33,35,37,43,45, 47,53,55,57,63, 65,67,73,75,77, 83,85,87,93,95, 97,103,105,107	1820-0186	INTEGRATED CIRCUIT, dual 2-input and gate, CTL	07263	U6A985649X
U101	1820-0952	INTEGRATED CIRCUIT, dual 2-input nor gate, CTL	14433	MIC952



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS AND CAPACITANCES ARE IN MICROFARADS.
2. A 0.01 MICROFARAD CAPACITOR IS CONNECTED FROM PIN 12 (V_{CC}) OF EACH INTEGRATED CIRCUIT (EXCEPT U101) TO GROUND.



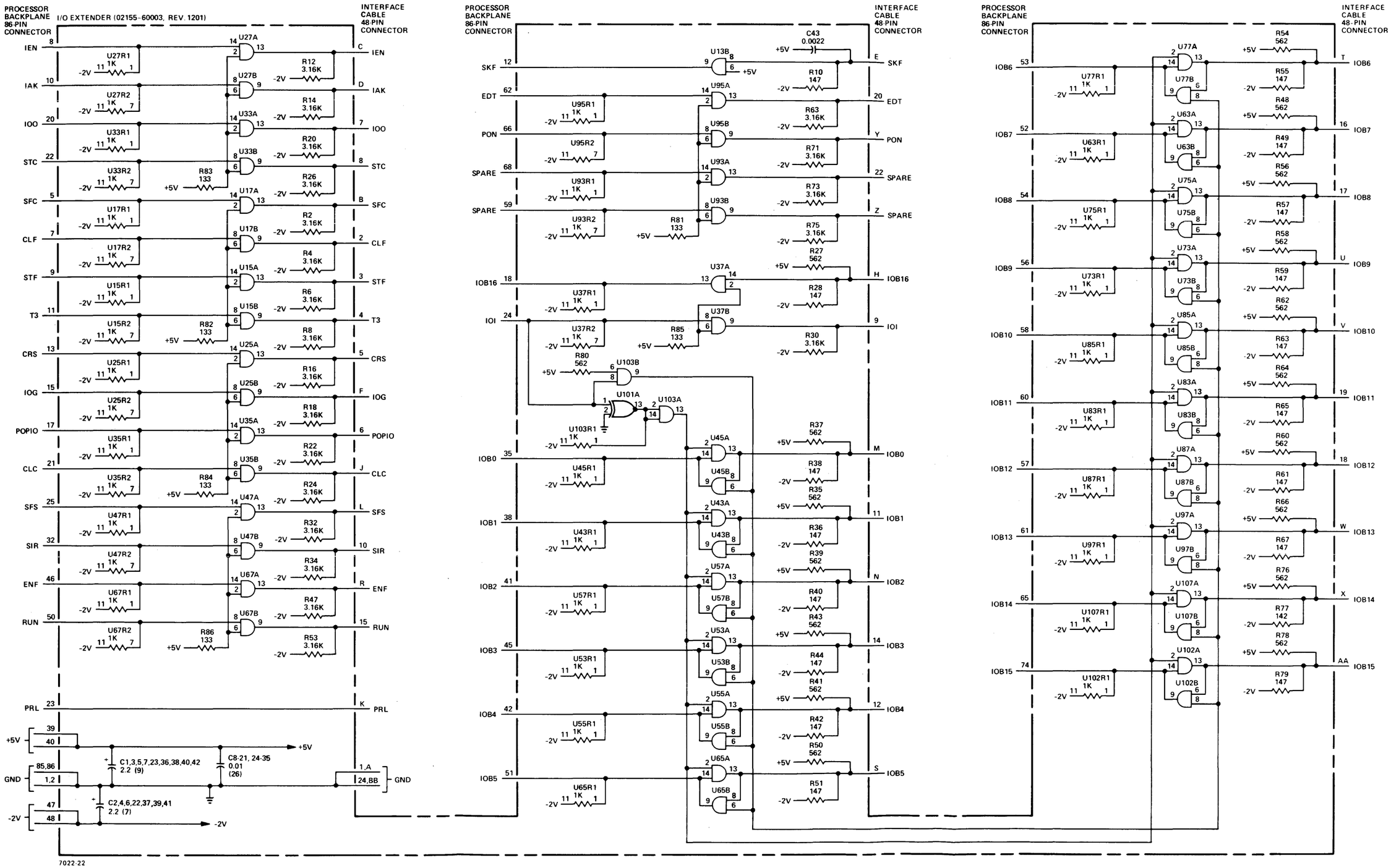


Figure 3-7. I/O Extender PCA (In Processor), Parts Location and Schematic Diagrams

Table 3-6. A1 Extender Control PCA, Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
*C1 thru 17,21	0160-2055	CAPACITOR, fxd, cer, 0.01 μF, +80 -20%, 100 VDCW	56289	C023F101F103-ZS22-CDH
**C1 thru 8,10, 12,14,15, 17,21	0160-2055	CAPACITOR, fxd, cer. 0.01 μF, +80 -20%, 100 VDCW	56289	C023F101F103-ZS22-CDH
ΔC9,11,13,16	0160-2204	CAPACITOR, fxd, mica, 100pF, ±5%, 300 VDCW	72136	OBD
†C9,11,16	0160-2204	CAPACITOR, fxd, mica, 100pF, ±5%, 300 VDCW	72136	OBD
†C13,23,24	0160-3533	CAPACITOR, fxd, mica, 470pF, ±5%, 100 VDCW	72136	OBD
C18,22	0150-0121	CAPACITOR, fxd, cer, 0.1 μF, +80 -20%, 50 VDCW	56289	160P22296PMD
C19,20	0180-0374	CAPACITOR, fxd, elect, 10 μF, ±10%, 20 VDCW	56289	150D106X902-OB2-DYS
R1 thru 3,5 10 thru 12,14,15	1810-0030	RESISTOR NETWORK, met film, 7x 1K, 5%	56289	200C1618-CRR
R4	0698-5852	RESISTOR, fxd, film, 500 ohms, 1%, 1/8W	28480	0698-5852
R6,7	1810-0123	RESISTOR NETWORK, met film, 7 x 330 ohms, 5%	56289	200C1857-CRR
R8,13,16,18,20	0757-0280	RESISTOR, fxd, film, 1K, 1%, 1/8W	28480	0757-0280
R17,26,27	1810-0063	RESISTOR NETWORK, met film, 7 x 133 ohms, 5%	56289	200C-1847
R19, 21 thru 23	0757-0407	RESISTOR, fxd, film, 200 ohms, 1%, 1/8W	28480	0757-0407
R24,25	1810-0045	RESISTOR NETWORK, met film, 7 x 200 ohms, 5%	56289	200C-1792
TB1	0360-0560	TERMINAL BLOCK	75382	699-2120-3
U11,21,23,35 36,46,56,64,65, 73 thru 76,82, 94 thru 96,104, 105,113,116	1820-1080	INTEGRATED CIRCUIT, digital line driver, TTL	01295	SN74S157N
U22	1820-0424	INTEGRATED CIRCUIT, hex inverter, TTL	01295	SN74H04N
U31,42	1820-0608	INTEGRATED CIRCUIT, binary to octal decoder, TTL	04713	MC4006P
U41	1820-0756	INTEGRATED CIRCUIT, 8-bit driver inverting (tri-state), TTL	28480	1820-0756
U51,61,81,91	1820-0606	INTEGRATED CIRCUIT, function generator, TTL	01295	SN74181N
U52,62,92	1820-0613	INTEGRATED CIRCUIT, hex inverter, TTL	01295	SN74H05N
U102,111	1820-0621	INTEGRATED CIRCUIT, quad 2-input nand buffer, TTL	01295	SN7438N

* PCA series 1430 only.
** PCA series 1445 and higher.
ΔPCA series 1445 only.
†PCA series 1508 and higher.

CHANGE	REFERENCE	REVISION/PREFIX
A	ORIG.	A-1410-22
B	22-2264	A-1430-22

NOTES:
1. RESISTOR NETWORK VALUES ARE AS FOLLOWS:

R1, R2, R3, R5, R10, R11, R12, R14, R15	1K	
R6, R7		330Ω
R17, R26, R27		133Ω
R24, R25		200Ω

12979-60005 TITLE: EXTENDER CONTROL PCA

Figure 3-8. A1 Extender Control PCA, Parts Location and Schematic Diagrams (Sheet 1 of 2)

CHANGE	REFERENCE	REVISION/PREFIX
A	ORIG.	A-1410-22
B	22-2264	A-1430-22
C	22-2392	A-1445-22
D	22-2512	A-1508-22

NOTE:

1. C9, 11, 13, AND 16 ARE 0.01UF ON PCA SERIES 1430.
2. C13 IS 100PF ON PCA SERIES 1445.
3. C23 AND C24 FIRST USED ON PCA SERIES 1508.

12979-60005 TITLE SHEET 2 OF 2

EXTENDER CONTROL PCA

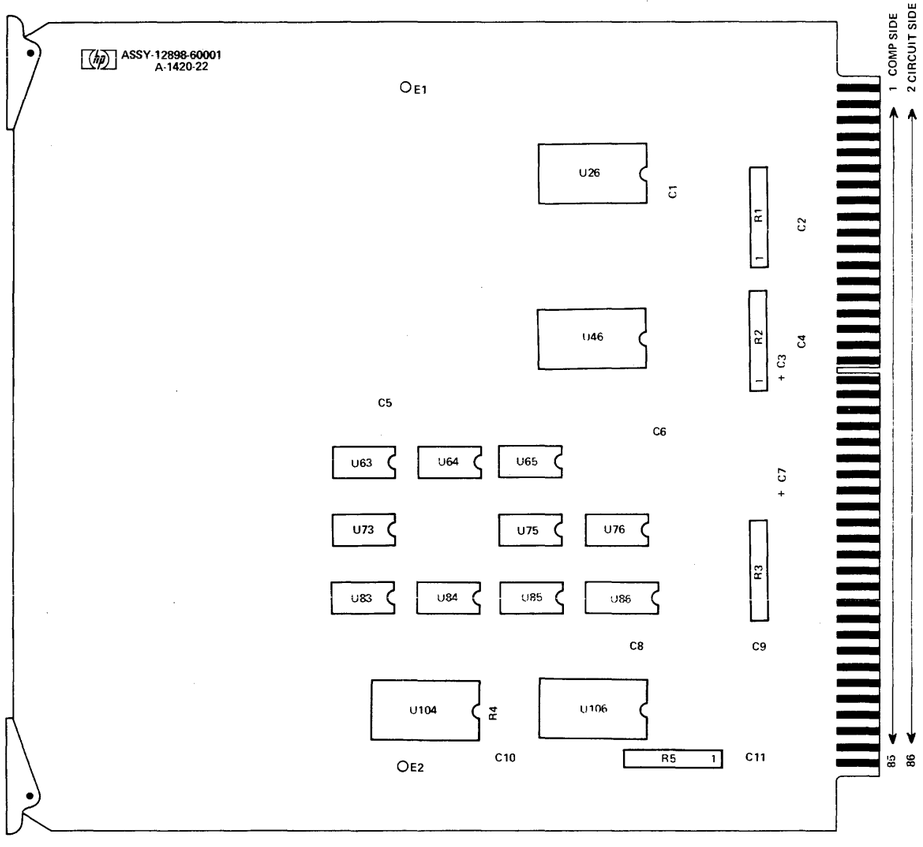
ENGINEER | APPROVED | DATE

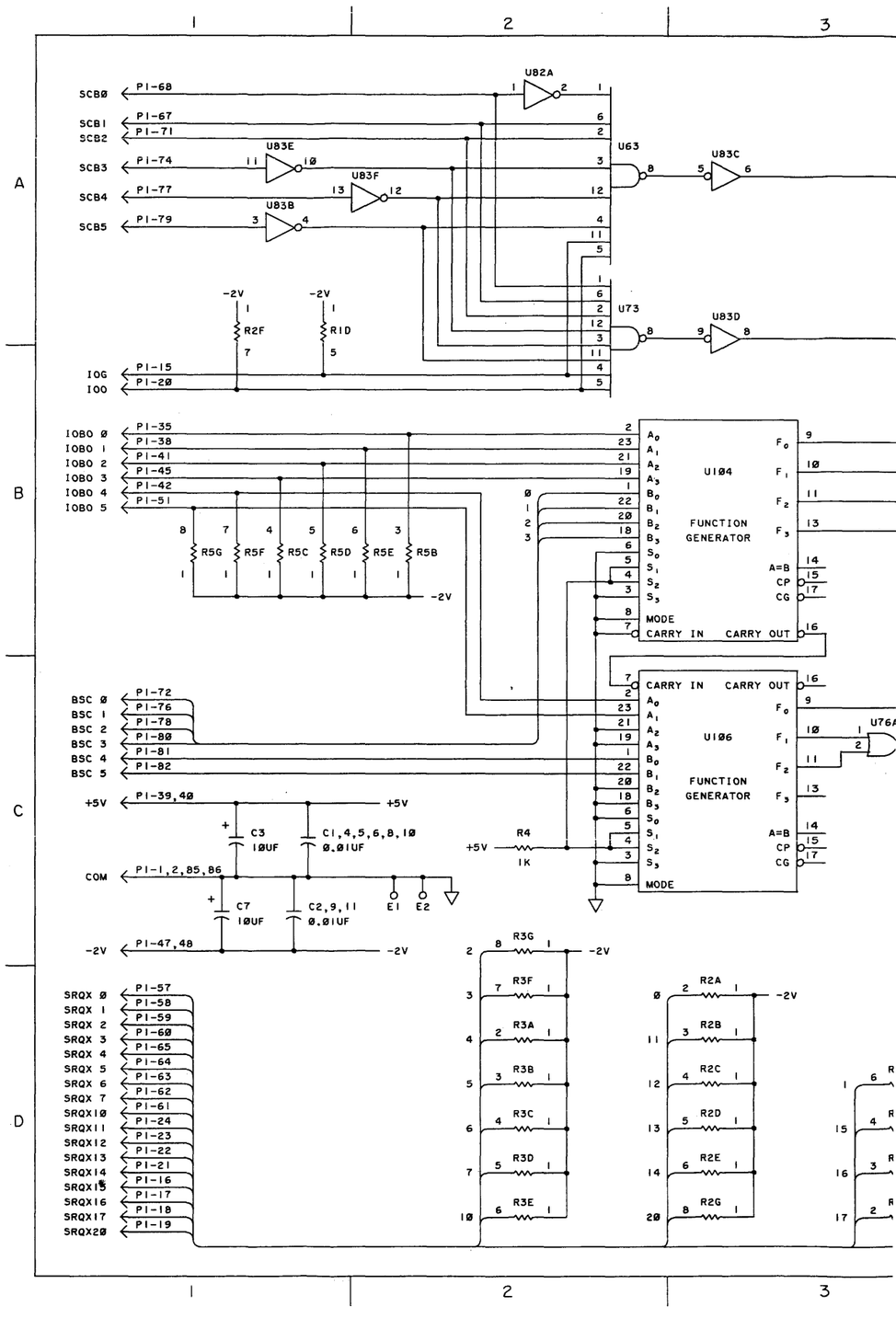
HEWLETT PACKARD CO.
DATA SYSTEMS DEVELOPMENT DIVISION

Figure 3-8. A1 Extender Control PCA, Parts Location and Schematic Diagrams (Sheet 2 of 2)

Table 3-7. DCPC PCA (Optional), Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1,2,4 thru 6, 8 thru 11	0160-2055	CAPACITOR, fxd, cer, 0.01 μF, +80 -20%, 100 VDCW	56289	C023F101F103-ZS22-CDH
C3,7	0180-0374	CAPACITOR, fxd, elect, 10 μF, ±10%, 20 VDCW	56289	150D106X902-OB2-DYS
R1 thru 3	1810-0030	RESISTOR NETWORK, met film, 7 x 1K, 5%	56289	200C1618-CRR
R4	0683-1025	RESISTOR, fxd, film, 1K, 5%, 1/4W	01121	CB1025
R5	1810-0080	RESISTOR NETWORK, met film, 7 x 500 ohms, 5%	56289	200C1854-CRR
U26,46, U63 thru 65	1820-0640	INTEGRATED CIRCUIT, 16-input multiplexer, TTL	01295	SN74150N
U73	1820-0375	INTEGRATED CIRCUIT, 8-input nand gate, TTL	01295	SN74H30N
U75	1820-0513	INTEGRATED CIRCUIT, 2-input and gate, TTL	01295	SN7409N
U76	1820-0205	INTEGRATED CIRCUIT, quad 2-input or gate, TTL	04713	MC3003P
U83	1820-0424	INTEGRATED CIRCUIT, hex inverter, TTL	01295	SN74H04N
U84 thru 86	1820-0301	INTEGRATED CIRCUIT, quad bistable D latch, TTL	01295	SN7475N
U104,106	1820-0606	INTEGRATED CIRCUIT, function generator, TTL	01295	SN74181N


ASSY-12898-60001
A-1420-22
1 COMP SIDE
2 CIRCUIT SIDE
E1
E2
U26
U46
U63
U64
U65
U73
U75
U76
U83
U84
U85
U86
U104
U106
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
R1
R2
R3
R4
R5
85
86


1
2
3
A
B
C
D
SCB0
SCB1
SCB2
SCB3
SCB4
SCB5
P1-68
P1-67
P1-71
P1-74
P1-77
P1-79
U82A
U83E
U83F
U83B
U63
U83C
U73
U83D
R2F
R1D
-2V
IOG
IOO
P1-15
P1-20
IOBO 0
IOBO 1
IOBO 2
IOBO 3
IOBO 4
IOBO 5
P1-35
P1-38
P1-41
P1-45
P1-42
P1-51
R5G
R5F
R5C
R5D
R5E
R5B
U104
FUNCTION GENERATOR
MODE
CARRY IN
CARRY OUT
U106
U76A
BSC 0
BSC 1
BSC 2
BSC 3
BSC 4
BSC 5
P1-72
P1-76
P1-78
P1-80
P1-81
P1-82
+5V
P1-39,40
C3
10UF
C1,4,5,6,8,10
0.01UF
R4
1K
COM
P1-1,2,85,86
C7
10UF
C2,9,11
0.01UF
E1
E2
P1-47,48
SRQX 0
SRQX 1
SRQX 2
SRQX 3
SRQX 4
SRQX 5
SRQX 6
SRQX 7
SRQX10
SRQX11
SRQX12
SRQX13
SRQX14
SRQX15
SRQX16
SRQX17
SRQX20
P1-57
P1-58
P1-59
P1-60
P1-65
P1-64
P1-63
P1-62
P1-61
P1-24
P1-23
P1-22
P1-21
P1-16
P1-17
P1-18
P1-19
R3G
R3F
R3A
R3B
R3C
R3D
R3E
R2A
R2B
R2C
R2D
R2E
R2G

CHANGE	REFERENCE	REVISION/PREFIX
A	ORIG.	A-1420-22

SCB0 P1-68
SCB1 P1-67
SCB2 P1-71
SCB3 P1-74
SCB4 P1-77
SCB5 P1-79
U82A U83E U83F U83B U63 U83C U73 U83D
-2V R2F R1D
IOG P1-15
IOO P1-20
IOBO 0 P1-35
IOBO 1 P1-38
IOBO 2 P1-41
IOBO 3 P1-45
IOBO 4 P1-42
IOBO 5 P1-51
R5G R5F R5C R5D R5E R5B
U104 FUNCTION GENERATOR
MODE CARRY IN CARRY OUT A=B CP CG
U106 FUNCTION GENERATOR
BSC 0 P1-72
BSC 1 P1-76
BSC 2 P1-78
BSC 3 P1-80
BSC 4 P1-81
BSC 5 P1-82
+5V P1-39,40
C3 10UF C1,4,5,6,8,10 0.01UF
COM P1-1,2,85,86
C7 10UF C2,9,11 0.01UF E1 E2
-2V P1-47,48
R4 1K
SRQX 0 P1-57
SRQX 1 P1-58
SRQX 2 P1-59
SRQX 3 P1-60
SRQX 4 P1-65
SRQX 5 P1-64
SRQX 6 P1-63
SRQX 7 P1-62
SRQX10 P1-61
SRQX11 P1-24
SRQX12 P1-23
SRQX13 P1-22
SRQX14 P1-21
SRQX15 P1-16
SRQX16 P1-17
SRQX17 P1-18
SRQX20 P1-19
R3G R3F R3A R3B R3C R3D R3E
R2A R2B R2C R2D R2E R2G
R1E R1C R1B R1A
U84 U85 U86 CLOCK CLOCK(0,1) CLOCK(2,3)
U46 16-TO-1 MULTIPLEXER STROBE
U26 16-TO-1 MULTIPLEXER STROBE
U76D U76A U76C U64 U65 U75B U75C
P1-52 REQ1
P1-56 REQ2

NOTES:
1. RESISTOR NETWORKS R1 THRU R3 ARE 1K. RESISTOR NETWORK R5 IS 500 OHMS.

12898-60001 TITLE EXTENDER DCAC OPTION
SHEET 1 OF 1
ENGINEER APPROVED DATE
HEWLETT-PACKARD CO
DATA SYSTEMS DIVISION

Figure 3-9. DCPC PCA (Optional), Parts Location and Schematic Diagrams

REPLACEABLE PARTS

SECTION IV

This section provides information on ordering replacement parts for the HP 12979A I/O Extender. The parts are listed in tables 4-1 and 4-2, and illustrated in figures 4-1 and 4-2. The tables and figures are presented in disassembly sequence. Index numbers on exploded views are also in disassembly sequence. Attaching parts immediately follow the parts they attach.

Table 4-3 defines abbreviations and reference designations used in the parts tables and other portions of this manual. Table 4-4 identifies the manufacturers indicated by the manufacturer code numbers in the parts tables.

For convenience when troubleshooting the extender, information on printed-circuit assembly parts is included with the schematic diagrams in section III. Information on the power supply parts is not included, since these parts are considered replaceable only at the factory or service depot.

4-1. DESCRIPTION OF PARTS TABLES

The major assemblies in the extender are listed in tables 4-1 and 4-2 together with the attaching parts for these assemblies. (Attaching parts are the parts which hold assemblies in place.) Also included in table 4-1 are the parts which comprise the extender cabinet. The parts tables furnish the following information:

a. The "FIG. & INDEX NO." column is headed by an identification of the illustration which shows the parts listed in the table. Below this is the index number (callout number) which identifies each part in the illustration.

b. The "HP PART NO." column lists the Hewlett-Packard part number for each part.

c. The "DESCRIPTION" column names and describes the part. In the case of electronic components, also included is the reference designation of the part, as given on the appropriate schematic diagram. Items in the "DESCRIPTION" column are indented, and preceded by one or more asterisks, to indicate the relationship of the part with preceding parts listed. One asterisk indicates a subassembly of the previous assembly listed, or attaching parts for the subassembly. (Attaching parts are always listed after the item which they attach.) Two asterisks indicate a subassembly of the previous assembled item which has one asterisk, or an attaching part for such a subassembly. Indentation is as follows:

MAJOR ASSEMBLY
*Subassembly
*Attaching Parts for Subassembly
**Subassembly Parts
**Attaching Parts for Subassembly Parts

d. The "MFR CODE" column in the parts tables is a number identifying the manufacturer of each item. Table 4-4 gives the names and addresses of the manufacturers.

e. The "MFR PART NO." column gives the manufacturer's part number for each item listed.

f. The "UNITS PER ASSY" column states the quantity of each part used per assembly or subassembly.

When an assembly part number is included in a parts table, the assembly covered by the table can be ordered as an assembled unit. If the assembly part number is not included in the table, only component parts of the assembly can be supplied.

4-2. ORDERING PROCEDURE

Parts made by manufacturers other than Hewlett-Packard can be ordered either from the manufacturer or from Hewlett-Packard. To order from manufacturers other than Hewlett-Packard, send the order to the address listed in table 4-4. To order parts from Hewlett-Packard, or to obtain additional information about parts, address the order or inquiry to the nearest Hewlett-Packard Sales and Service Office. (These offices are listed at the back of this manual.) When ordering from Hewlett-Packard, give the following information for each part:

a. Complete model number (including options).

b. Complete serial number.

c. Hewlett-Packard part number for each part.

d. Complete description for each part as provided in the replaceable parts lists.

e. Circuit reference designation, if part is an electronic component.

f. If the part is installed on an etched printed-circuit assembly (PCA), give the revision code stamped in ink on the PCA. If there is no inked number, quote the metal eteched number.

g. Include assembly reference designation as a prefix. For instance, order capacitor C1 of extender control PCA A1 by reference designation A1C1.

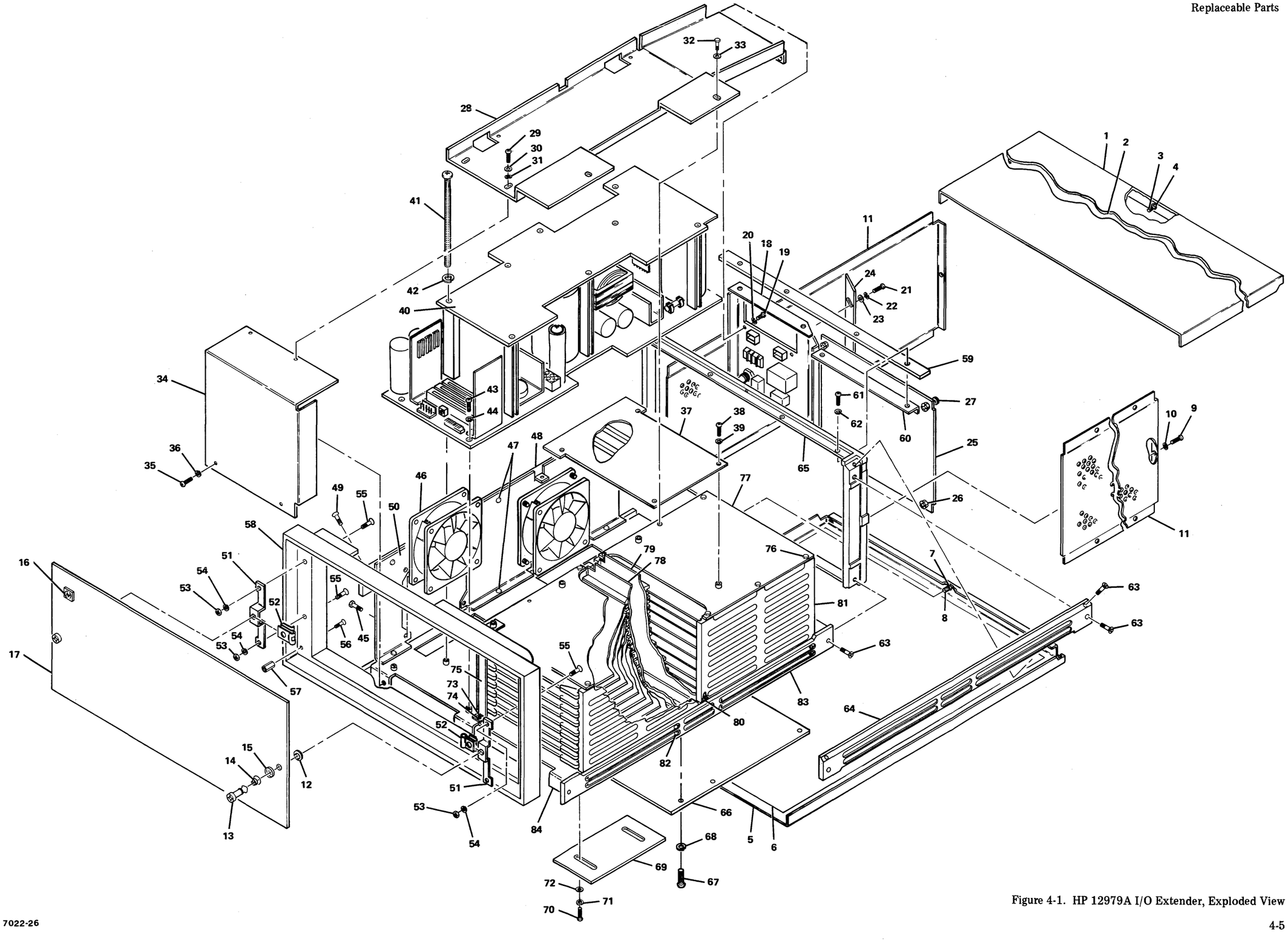
To order a part not listed in the replaceable parts tables, give a complete description of the part, and describe its function and location.

Table 4-1. HP 12979A I/O Extender, Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
4-1-	12979A	I/O EXTENDER	28480	12979A	1
1	5060-9836	* COVER, top	28480	5060-9836	1
2	3040-0541	* INSULATION	28480	3040-0541	1
3	0500-0510	* SCREW, captive, flh, no. 6-32, 0.460 in.		OBD	1
4	0570-1171	* RETAINER, E-ring		OBD	1
5	5060-9836	* COVER, bottom	28480	5060-9836	1
6	3040-0541	* INSULATION	28480	3040-0541	1
7	0500-0510	* SCREW, machine, no. 6-32, 0.460 in.		OBD	1
8	0570-1171	* RETAINER, E-ring		OBD	1
9	2360-0201	* SCREW, machine, ph, no. 6-32, 0.500 in.		OBD	2
10	2190-0851	* WASHER, splitlock, no. 6		OBD	2
11	02108-00017	* COVER, side	28480	02108-00017	2
12	1390-0257	* FASTENER, washer	94222	82-32-101-17	2
13	1390-0294	* STUD, quarter-turn	94222	82-19-300-16	2
14	1390-0293	* SPRING, helical, compression	94222	43-13-1-24	2
15	1390-0071	* WASHER, cup, Nylon	94222	82-46-101-41	2
16	7120-1254	* H.P. LOGOGRAM, studback	28480	7120-1254	1
17	12979-00004	* FRONT PANEL	28480	12979-00004	1
18	12979-60013	* REAR PANEL ASSEMBLY (see figure 4-2)	28480	12979-60013	1
		(Attaching Parts)			
19	2360-0201	* SCREW, machine, ph, no. 6-32, 0.500 in.		OBD	6
20	2190-0851	* WASHER, splitlock, no. 6		OBD	6
		– – – X – – –			
21	2360-0197	* SCREW, machine, ph, no. 6-32, 0.375 in.		OBD	2
22	2190-0851	* WASHER, splitlock, no. 6		OBD	2
23	3050-0227	* WASHER, flat, no. 6		OBD	2
24	02108-00010	* PCA RETAINER, rear	28480	02108-00010	1
25	02108-00027	* COVER, rear	28480	02108-00027	1
		(Attaching Parts)			
26	1390-0104	* GROMMET	83014	H559-3-1	4
27	1390-0281	* PLUNGER	83014	H323-3-4-1	4
		– – – X – – –			
28	12979-00005	* CABLE CHANNEL	28480	12979-00005	1
		(Attaching Parts)			
29	2360-0197	* SCREW, machine, ph, no. 6-32, 0.375 in.		OBD	6
30	2190-0851	* WASHER, splitlock, no. 6		OBD	6
31	3050-0227	* WASHER, flat, no. 6		OBD	4
32	0624-0309	* SCREW, self-tapping, hex head, no. 6-19, 0.375 in.		OBD	2
33	3050-0227	* WASHER, flat, no. 6		OBD	2
		– – – X – – –			
34	12979-00007	* POWER SUPPLY SHIELD	28480	12979-00007	1
		(Attaching Parts)			
35	2360-0197	* SCREW, machine, ph, no. 6-32, 0.375 in.		OBD	2
36	2190-0851	* WASHER, splitlock, no. 6		OBD	2
		– – – X – – –			
37	12979-60001	* CROSSOVER PCA	28480	12979-60001	1
		(Attaching Parts)			
38	2360-0197	* SCREW, machine, ph, no. 6-32, 0.375 in.		OBD	4
39	2190-0851	* WASHER, splitlock no. 6		OBD	4
		– – – X – – –			
40	02108-60023	* POWER SUPPLY ASSEMBLY	28480	02108-60023	1
		(Attaching Parts)			
41	2520-0014	* SCREW, machine, ph, no. 8-32, 4.00 in.		OBD	8
42	2190-0073	* WASHER, splitlock, no. 8		OBD	8
43	2570-0105	* SCREW, machine, ph, no. 6-32, 0.437 in.		OBD	2
44	2190-0851	* WASHER, splitlock, no. 6		OBD	2
		– – – X – – –			

Table 4-1. HP 12979A I/O Extender, Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
45	0624-0248	* SCREW, self-tapping, hex head, no. 8-32, 0.750 in.		OBD	8
46	3160-0224	* TUBEAXIAL FAN	23936	4550	2
47	0361-1083	* RIVET, blind	28480	0361-1083	14
48	5020-8838	* STRUT	28480	5020-8838	2
49	2360-0202	* SCREW, machine, flh, no. 6-32, 0.625 in.		OBD	8
50	12979-00003	* FAN BRACKET	28480	12979-00003	1
51	02105-00012	* FRONT PANEL MOUNTING BRACKET	28480	02105-00012	2
52	1390-0091	* SPLIT RETAINER, quarter-turn	94222	82-47-104-15	2
53	2420-0002	* NUT, hex, no. 6		OBD	4
54	2190-0851	* WASHER, splitlock, no. 6		OBD	4
55	2360-0202	* SCREW, machine, flh, no. 6-32, 0.625 in.		OBD	4
56	2360-0202	* SCREW, machine, flh, no. 6-32, 0.625 in.		OBD	4
57	0380-0847	* STANDOFF, hex, 0.25, 0.625 in. no. 6		OBD	4
58	5020-7335	* FRONT FRAME	28480	5020-7335	1
59	02108-00008	* SPACER	28480	02108-00008	1
60	02108-00001	* MOUNTING BRACKET	28480	02108-00001	1
61	0624-0309	* SCREW, machine, ph, no. 6-32, 0.500 in.		OBD	4
62	2190-0851	* WASHER, splitlock, no. 6		OBD	4
63	2360-0202	* SCREW, flh, no. 6-32, 0.625 in.		OBD	4
64	5020-8838	* STRUT	28480	5020-8838	1
65	5020-8808	* REAR FRAME	28480	5020-8808	1
66	12979-60005	* EXTENDER CONTROL PCA	28480	12979-60005	1
		(Attaching Parts)			
67	2360-0197	* SCREW, machine, ph, no. 6-32, 0.375 in.		OBD	6
68	2190-0851	* WASHER, splitlock, no. 6		OBD	6
		- - - X - - -			
69	12979-00001	* CONNECTOR RETAINER	28480	12979-00001	1
		(Attaching Parts)			
70	2360-0197	* SCREW, machine, ph, no. 6-32, 0.375 in.		OBD	2
71	2190-0851	* WASHER, splitlock, no. 6		OBD	2
72	3050-0010	* WASHER, flat, no. 6		OBD	2
		- - - X - - -			
73	2360-0197	* SCREW, machine, ph, no. 6-32, 0.375 in.		OBD	1
74	2190-0851	* WASHER, splitlock, no. 6		OBD	1
75	02108-00003	* PCA RETAINER, front	28480	02108-00003	1
76	0624-0309	* SCREW, self-tapping, hex head, no. 6-19, 0.375 in.		OBD	10
77	12979-00008	* PCA CAGE COVER	28480	12979-00008	2
78	12979-60002	* I/O BACKPLANE, front	28480	12979-60002	1
79	12979-60003	* I/O BACKPLANE, rear	28480	12979-60003	1
80	0624-0309	* SCREW, self-tapping, hex head, no. 6-19, 0.375 in.		OBD	12
81	02108-40001	* PCA GUIDE	28480	02108-40001	4
82	0361-1083	* RIVET, blind	28480	0361-1083	4
83	5020-8838	* STRUT	28480	5020-8838	1
84	12979-00002	* DECK	28480	12979-00002	1



7022-26

Figure 4-1. HP 12979A I/O Extender, Exploded View

Table 4-2. Rear Panel, Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
4-2-	12979-60013	REAR PANEL ASSEMBLY (18, figure 4-1)	28480	12979-60013	1
1	0400-0133	* GROMMET CHANNEL, 7.5 in.	28480	0400-0133	1
2	2420-0003	* NUT, hex, no. 6		OBD	4
3	2190-0851	* WASHER, splitlock, no. 6		OBD	4
4	2360-0201	* SCREW, machine, ph, no. 6-32, 0.500 in.		OBD	4
5	0360-0623	* HIGH BARRIER TERMINAL BLOCK	75382	620A-3	1
6	0360-1309	* MARKER STRIP, phenolic	28480	0360-1309	1
7	2950-0054	* NUT, hex, no. 1/2-28		OBD	1
8	2190-0037	* WASHER, internal lock, 0.789 OD, 0.512 ID		OBD	1
9	1400-0000	* WASHER, neoprene, 0.625 OD, 0.51 ID		OBD	1
10	2110-0470	* FUSE HOLDER BODY	75915	345001-010	1
11	2110-0056	* FUSE, normal blow, 6A, 110V operation		OBD	1
	2110-0055	* FUSE, normal blow, 4A, 220V operation		OBD	1
12	2110-0465	* FUSE HOLDER CAP	75915	345002-020	1
13	0590-0012	* NUT, knurled, no. 15/32-32		OBD	1
14	2190-0102	* WASHER, internal lock, 7/16 in. ID, 1/2 in. OD		OBD	1
15	2950-0035	* NUT, hex, no. 15/32-32		OBD	1
16	3101-0646	* SWITCH, toggle, spst		OBD	1
17	0361-0139	* RIVET, blind	28480	0361-0139	2
18	1251-2357	* AC POWER RECEPTACLE	82389	EAC-301	1
19	2420-0003	* NUT, hexagon, no. 6		OBD	1
20	0360-0268	* SOLDER LUG, no. 6		OBD	1
21	2420-0003	* NUT, hex, no. 6		OBD	1
22	2420-0003	* NUT, hex, no. 6		OBD	1
23	0360-0268	* SOLDER LUG, no. 6		OBD	1
24	2360-0201	* SCREW, machine, ph, no. 6-32, 0.500 in.		OBD	1
25	2420-0003	* NUT, hex, no. 6		OBD	1
26	2190-0851	* WASHER, splitlock, no. 6		OBD	1
27	9135-0018	* LINE FILTER	05245	IOB3	1
28	12979-60015	* CONTROL CABLE ASSEMBLY	28480	12979-60015	1
29	12979-00006	* REAR PANEL	28480	12979-00006	1

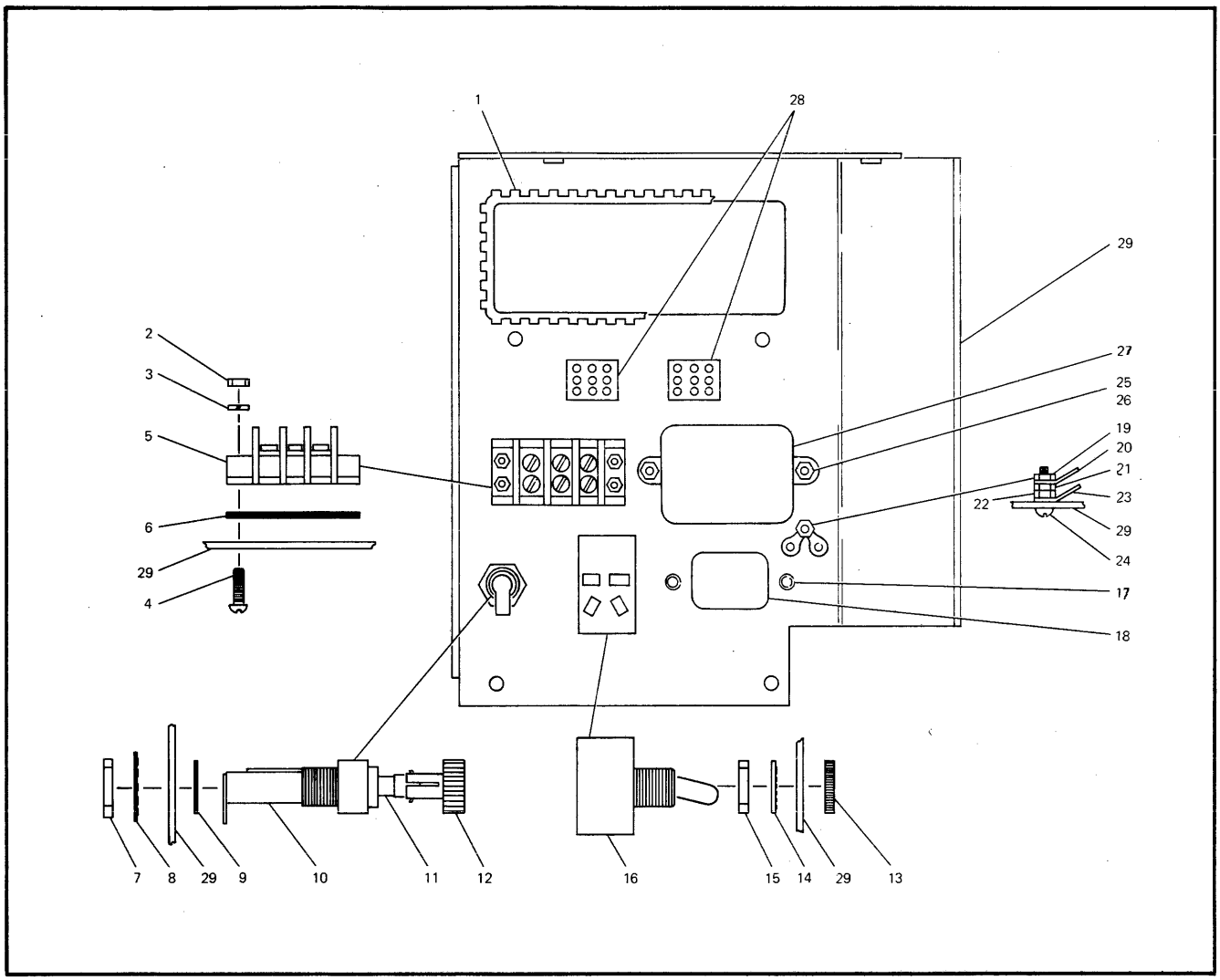


Figure 4-2. Rear Panel

Table 4-3. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

A	= assembly	K	= relay	TB	= terminal board
B	= motor, synchro	L	= inductor	TP	= test point
BT	= battery	M	= meter	U	= integrated circuit, non-repairable assembly
C	= capacitor	P	= plug connector	V	= vacuum tube, photocell, etc.
CB	= circuit breaker	Q	= semiconductor device other than diode or integrated circuit	VR	= voltage regulator
CR	= diode	R	= resistor	W	= jumper wire
DL	= delay line	RT	= thermistor	X	= socket
DS	= indicator	S	= switch	Y	= crystal
E	= Misc electrical parts	T	= transformer	Z	= tuned cavity, network
F	= fuse				
FL	= filter				
J	= receptacle connector				

ABBREVIATIONS

A	= amperes	gra	= gray	PCA	= printed-circuit assembly
ac	= alternating current	grn	= green	PWB	= printed-wiring board
Ag	= silver			phh	= phillips head
Al	= aluminum	H	= henries	pk	= peak
ar	= as required	Hg	= mercury	p-p	= peak-to-peak
adj	= adjust	hr	= hour(s)	pt	= point
assy	= assembly	Hz	= hertz	prv	= peak inverse voltage
		hdw	= hardware	PNP	= positive-negative-positive
b	= base	hex	= hexagon, hexagonal	pww	= peak working voltage
bp	= bandpass			porc	= porcelain
bpi	= bits per inch	ID	= inside diameter	posn	= position(s)
blk	= black	IF	= intermediate frequency	pozi	= pozidrive
blu	= blue	in.	= inch, inches		
brn	= brown	I/O	= input/output	rf	= radio frequency
brs	= brass	int	= internal	rdh	= round head
Btu	= British thermal unit	incl	= include(s)	rms	= root-mean-square
Be Cu	= beryllium copper	insul	= insulation, insulated	rww	= reverse working voltage
		impgrg	= impregnated	rect	= rectifier
cpi	= characters per inch	incand	= incandescent	r/min	= revolutions per minute
coll	= collector	ips	= inches per second	RTL	= resistor-transistor logic
cw	= clockwise				
ccw	= counterclockwise	k	= kilo (10^3), kilohm	s	= second
cer	= ceramic			SB, TT	= slow blow
com	= common	lp	= low pass	Se	= selenium
crt	= cathode-ray tube			Si	= silicon
CTL	= complementary-transistor logic	m	= milli (10^{-3})	scr	= silicon controlled rectifier
		M	= mega (10^6), megohm	sst	= stainless steel
cath	= cathode	My	= Mylar	stl	= steel
Cd pl	= cadmium plate	mfr	= manufacturer	spcl	= special
comp	= composition	mom	= momentary	spdt	= single-pole, double-throw
conn	= connector	mtg	= mounting	spst	= single-pole, single-throw
compl	= complete	misc	= miscellaneous		
		met. ox.	= metal oxide		
dc	= direct current	mintr	= miniature	Ta	= tantalum
dr	= drive			td	= time delay
DTL	= diode-transistor logic	n	= nano (10^{-9})	Ti	= titanium
depc	= deposited carbon	nc	= normally closed or no connection	tgl	= toggle
dpdt	= double-pole, double-throw			thd	= thread
dpst	= double-pole, single-throw	Ne	= neon	tol	= tolerance
		no.	= number	TTL	= transistor transistor logic
em	= emitter	n.o.	= normally open		
ECL	= emitter-coupled logic	np	= nickel plated		
ext	= external	NPN	= negative-positive-negative		
encap	= encapsulated	NPO	= negative-positive zero (zero temperature coefficient)	U(μ)	= micro (10^{-6})
elctlt	= electrolytic				
		NSR	= not separately replaceable	V	= volt(s)
F	= farads	NRFR	= not recommended for field replacement	var	= variable
FF	= flip-flop			vio	= violet
flh	= flat head			Vdcw	= direct current working volts
flm	= film	OD	= outside diameter		
fxd	= fixed	OBD	= order by description	W	= watts
filh	= fillister head	orn	= orange	ww	= wirewound
		ovh	= oval head	wht	= white
G	= giga (10^9)	oxd	= oxide	WIV	= working inverse voltage
Ge	= germanium				
gl	= glass	p	= pico (10^{-12})	yel	= yellow
gnd	= ground(ed)	PC	= printed circuit		

Table 4-4. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 and H4-2, and the latest supplements.

CODE NO.	MANUFACTURER	ADDRESS
01121	Allen Bradley Co.	Milwaukee, Wis.
01245	Texas Instruments Inc., Components Group	Dallas, Texas
04713	Motorola Inc. Semiconductor Products Div.	Phoenix, Arizona
07263	Fairchild Camera and Instr. Corp., Semiconductor Div.	Mountain View, Cal.
14433	ITT Semiconductor, Div. of Int. Telephone and Telegraph Corp.	West Palm Beach, Fla.
23936	Pamotor Div. of William J. Purdy Co.	Burlingame, Cal.
28480	Hewlett-Packard Co.	Palo Alto, Cal.
56289	Spraque Electric Co.	North Adams, Mass.
75382	Kulka Electric Corp.	Mt. Vernon, N.Y.
75915	Littlefuse, Inc.	Des Plaines, Ill.
82389	Switchcraft Inc.	Chicago, Ill.
83014	Hartwell Corp.	Los Angeles, Cal.
94222	Southco Inc.	Lester, Pa.

PRINTED IN U.S.A.