HEWLETT PACKARD

INSTALLATION AND SERVICE MANUAL

HP 12979B INPUT/OUTPUT EXTENDER

Manual part no. 12979-90016
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OPTIONS COVERED

This manual covers option 015 as well as the basic extender.

ACCESSORIES COVERED

This manual covers the HP 12781A Dual Computer Kit, which is an extender accessory.

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LIST OF EFFECTIVE PAGES

Changed pages are identified by a change number adjacent to the page number. Changed information is indicated by a vertical line in the outer margin of the page. Original pages do not include a change number and are indicated as change number 0 on this page. Insert latest changed pages and destroy superseded pages.

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PREFACE

This manual contains installation and service information on the Hewlett-Packard 12979B Input/Output Extender. The extender provides 16 additional input/output (I/O) channels as an extension of the HP 21MX E-/M-Series Computer vectored priority I/O system. A second extender may be used in this system to provide additional I/O channels. The following is a list of available supporting documentation.

- *HP 12979B Input/Output Extender Operating and Reference Manual,* part no. 12979-90014.
- Your *HP 1000 Computer Series Operating and Reference Manual,* part no. 02111-90001.
- Your *HP 1000 Computer Series Installation and Service Manual,* part no. 02111-90002.
- *HP 12898A Dual-Channel Port Controller Installation Manual,* part no. 12898-90001.

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SAFETY CONSIDERATIONS

KEEP WITH MANUAL

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

SAFETY SYMBOLS

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

Indicates hazardous voltages.

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

WARNING

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

CAUTION

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

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

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

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

SERVICING

WARNING

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

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

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

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

INSTALLATION

SECTION I

This section provides installation instructions for the HP 12979B 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 site preparation guide for your system.

1-2. ENVIRONMENTAL LIMITATIONS

Environmental limitations for operating and nonoperating conditions of the I/O extender are specified in table 1-1. The envionmental 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:	50,000 feet (15,240 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 770 watts. Reconfiguring from 110V ac operation to 220V ac operation (or vice versa) is described in paragraph 3-48.

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 223 millimeters (8-3/4 inches) of vertical rack space and a depth of 622 millimeters (24-1/2 inches), including cables. The extender must be mounted in the same rack cabinet as the computer.

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.

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 1-39. Retain the shipping container(s) and packing material for examination in the settlement of claims or for future use.

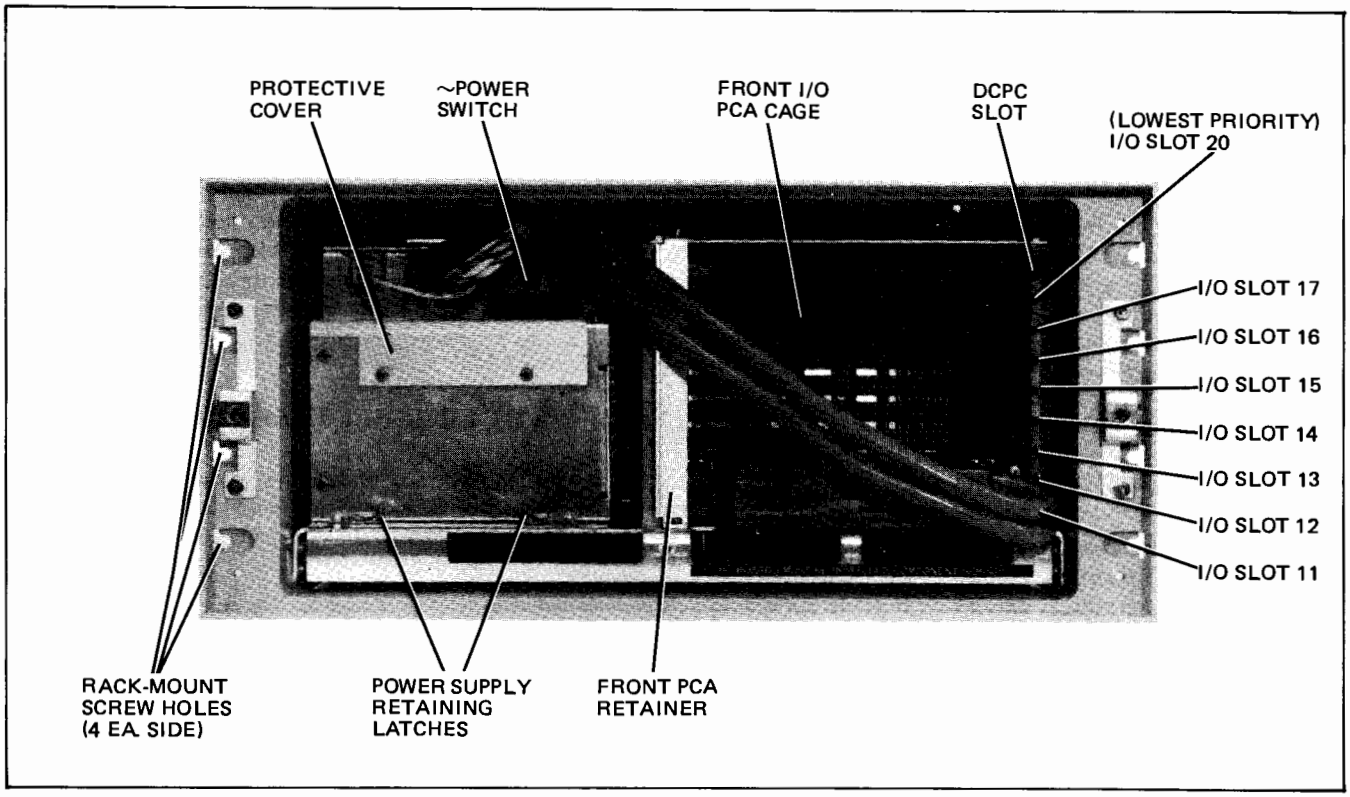

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Figure 1-1. HP 12979B I/O Extender Front View

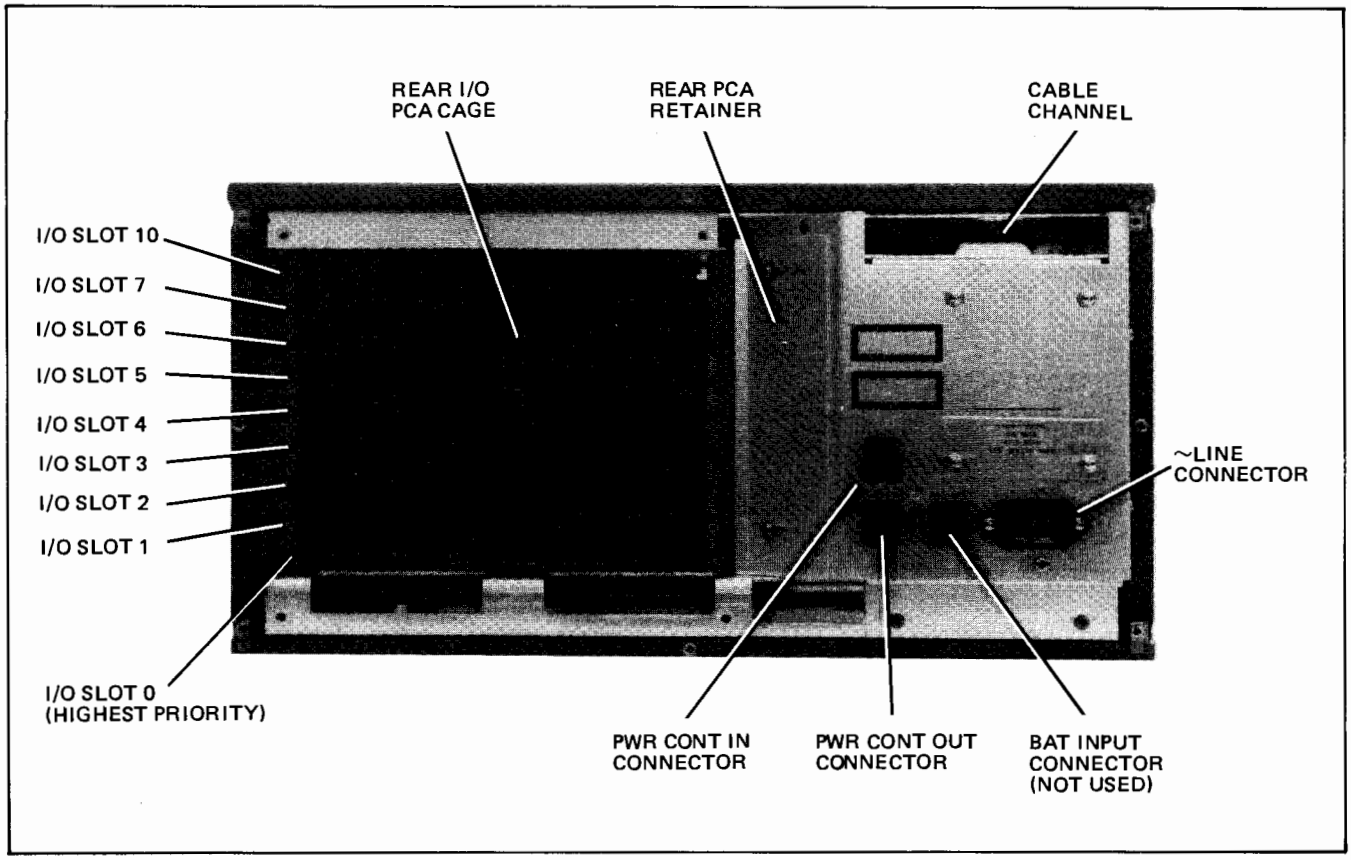

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Figure 1-2. HP 12979B I/O Extender Rear View

1-7 PHYSICAL INVENTORY

1-8. EQUIPMENT

The extender serial number is stamped on an identification label affixed to the front frame (behind front panel). 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.

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 wing 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.

Remove the rear cover by loosening the four captive screws. 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 buffer PCA, part no. 12979-60022, by pulling outward on the PCA extractor levers. Replace the rear cover.

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 operating and reference manual have been received.

1-10. MANUALS

Check to ensure that the operating and reference manual has been received. Perform any updating that may be required for the extender documentation. Undating instructions (if any) are provided in a supplement accompanying the appropriate document.

1-11. INSTALLATION REQUIREMENTS

1-12. EXTENDER PRIORITY

The computer may use up to two I/O extenders, each of which provides 16 additional I/O slots for interfacing the computer to peripheral devices. To eliminate extender priority conflicts, rocker switches located on the extender control PCA in each extender are used to establish the relative priority of the extenders. See figure 1-3.

When only one I/O extender is used, the base select code (BSC) switch (A1S1) on the extender control PCA is set for operation in the manner indicated in figure 1-3a. As shown, switch A1S2 sets the extender to receive priority from the computer at Port A and switch A1S3 locks the input to Port A. When two extenders are used for additional I/O, then the extender control PCA switches in the second extender are set as indicated in figure 1-3b. As shown, the second extender receives priority from the first; therefore, extender number one will have the higher priority I/O PCA's and extender number two will have the lower priority I/O PCA's.

The I/O extender is configured at the factory for extender priority when integrated 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.

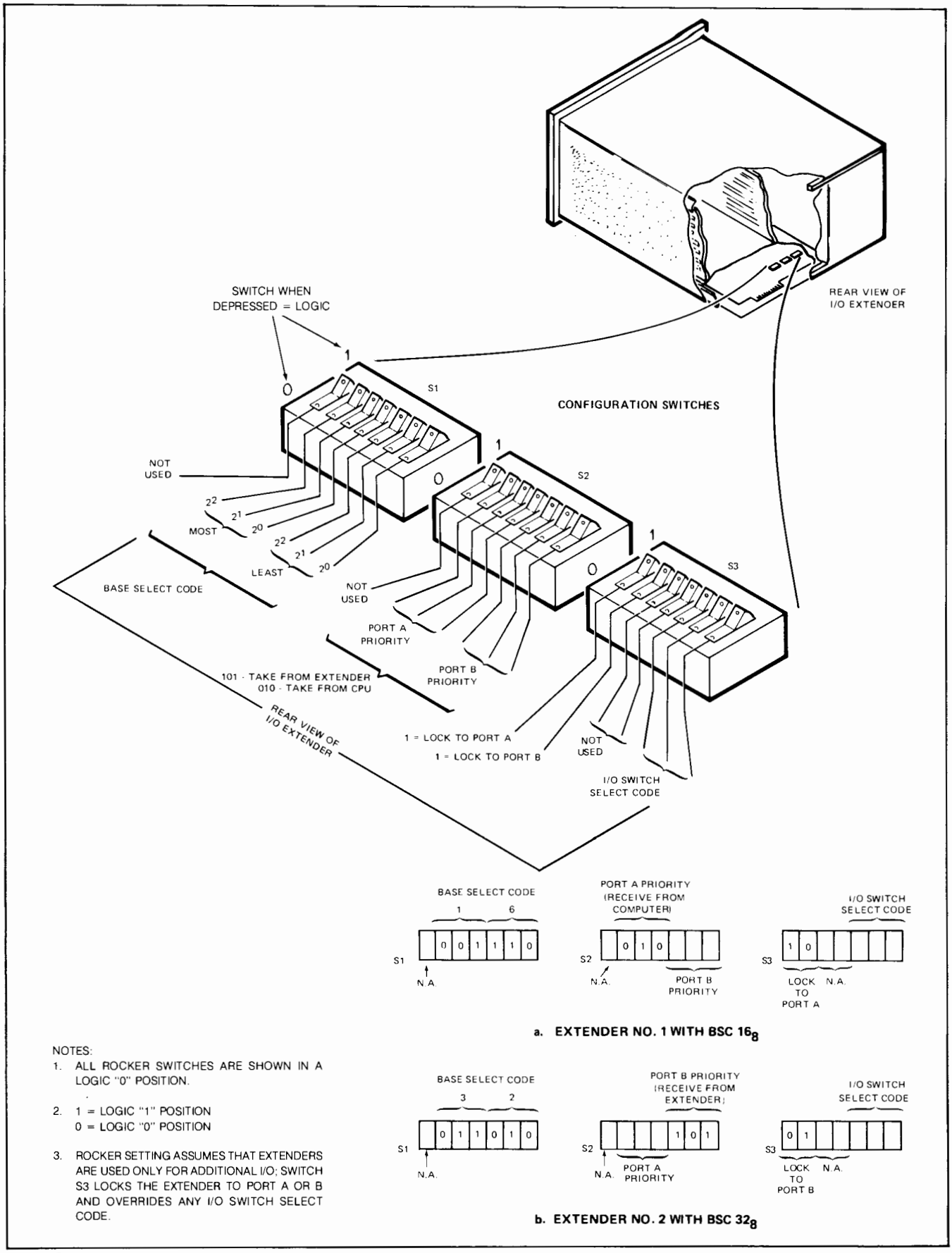
1-13. I/O PRIORITY ASSIGNMENT

Each peripheral device in the extended system must be connected to the I/O extender through an interface PCA. A priority chain connects all interface PCA's in series to resolve simultaneous interrupt requests from two or more peripherals. The priority of an 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 I/O 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 the standpoint of time, it is more efficient to assign 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 individual interface or subsystem documentation for details concerning power requirements, I/O PCA jumper requirements (if any), and priority considerations. Note that I/O PCA power requirements must be taken into consideration with reference to the I/O power available in the computer and in the extender; these factors may influence the assignment of I/O PCA priorities.

The extended I/O system is configured at the factory for I/O priority assignments when integrated as part of a complete system. The I/O buffer PCA interfaces the computer to the extender and is placed in the lowest priority I/O slot used in the computer. In other words, there may be vacant I/O slots in the computer following the installed I/O buffer PCA. For example, if the last I/O interface PCA installed in the computer I/O PCA cage is in slot 15, then the I/O buffer PCA is installed in slot 16 with the remaining I/O slots in the computer left vacant.



NOTES:

1. ALL ROCKER SWITCHES ARE SHOWN IN A LOGIC "0" POSITION.
2. 1 = LOGIC "1" POSITION
   0 = LOGIC "0" POSITION
3. ROCKER SETTING ASSUMES THAT EXTENDERS ARE USED ONLY FOR ADDITIONAL I/O; SWITCH S3 LOCKS THE EXTENDER TO PORT A OR B AND OVERRIDES ANY I/O SWITCH SELECT CODE.

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Figure 1-3. Extender Control PCA Rocker Switch Settings

On the extender control PCA, the base select code (BSC) is usually set to agree with the select code normally assigned to the computer I/O slot occupied by the I/O buffer PCA. (Actually, the extender BSC is independent of the I/O buffer PCA and may be higher (but not lower) than the assigned select code of the I/O slot. Refer to section II.) If the I/O buffer PCA occupies the I/O slot assigned select code 16_8, then the BSC switch (A1S1) on the extender is set to 16_8 and this becomes the select code of the highest priority I/O PCA in the extender. Figure 1-3a shows the BSC switch setting for select code 16_8. Note that the least significant bit is on the right and that a "1" is set by depressing the top of a rocker.

1-14. PRIORITY OF SECOND EXTENDER

If an optional second I/O extender is used to increase the number of I/O devices, then its BSC is usually set to the next sequential select code following the last select code used in the first extender. For example, if the last select code in the first extender is 31_8, then the BSC switch on the second extender control PCA is set to 32_8. (See figure 1-3b.) The I/O buffer PCA for the second extender is placed next to that for the first but the base select code for the extender must not be the same as any select code already used.

If an optional second I/O extender is used to provide I/O redundancy, its BSC and the select codes of its I/O PCA's are identical to those of the first extender. The programmable I/O switches of the extenders enable the second extender to be used in the event of a malfunction in the first extender.

1-15. 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 the current specified on the rear of the extender.

Figure 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 potential, ac neutral, and earth ground. If the outlet is wired improperly, correction must be made by a qualified electrician. Local electrical codes must be observed if the installation is inside a building.

For safety reasons, it is *mandatory* that a connection be made between the 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.

1-16. EXTENDER MOUNTING

1-17. BENCH MOUNTING. As stated under paragraph 1-5, the extende 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.

1-18. 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. However, it is recommended that additional support be provided by chassis slides or slide rails.

1-19. INSTALLATION PROCEDURES

Assuming that I/O extender priority and I/O priority have been determined as described in paragraphs 1-12 and 1-13, extender installation procedures are given in the following paragraphs.

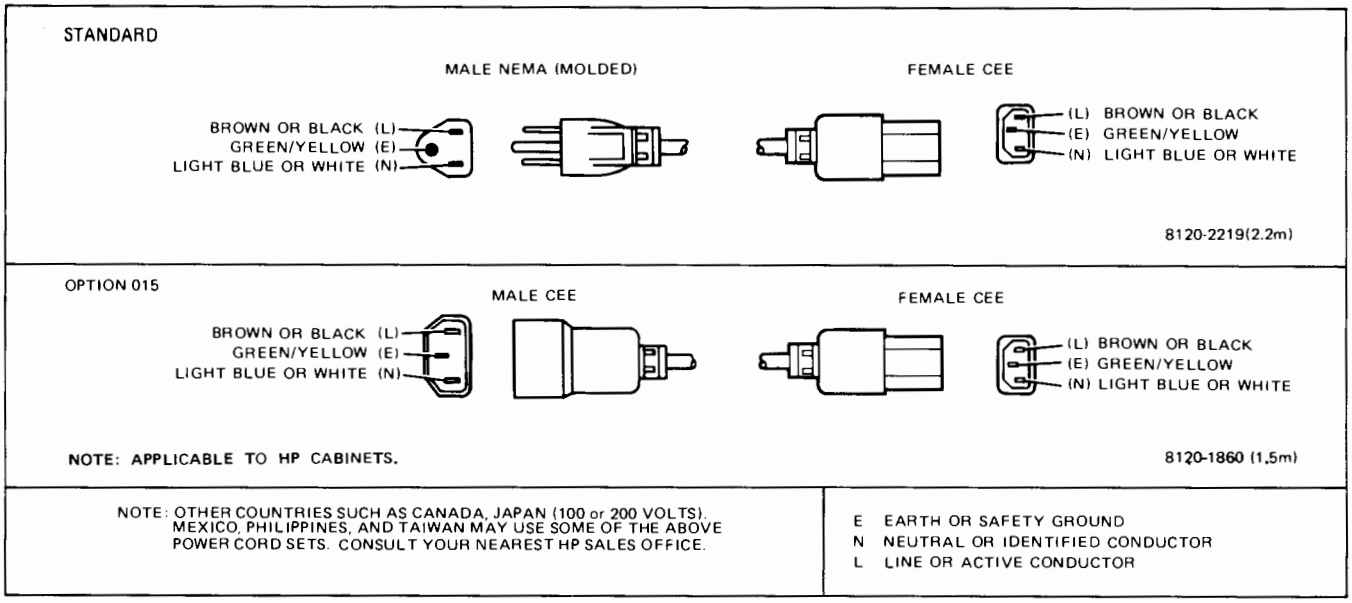

Figure 1-4. AC Power Cord Sets (USA)

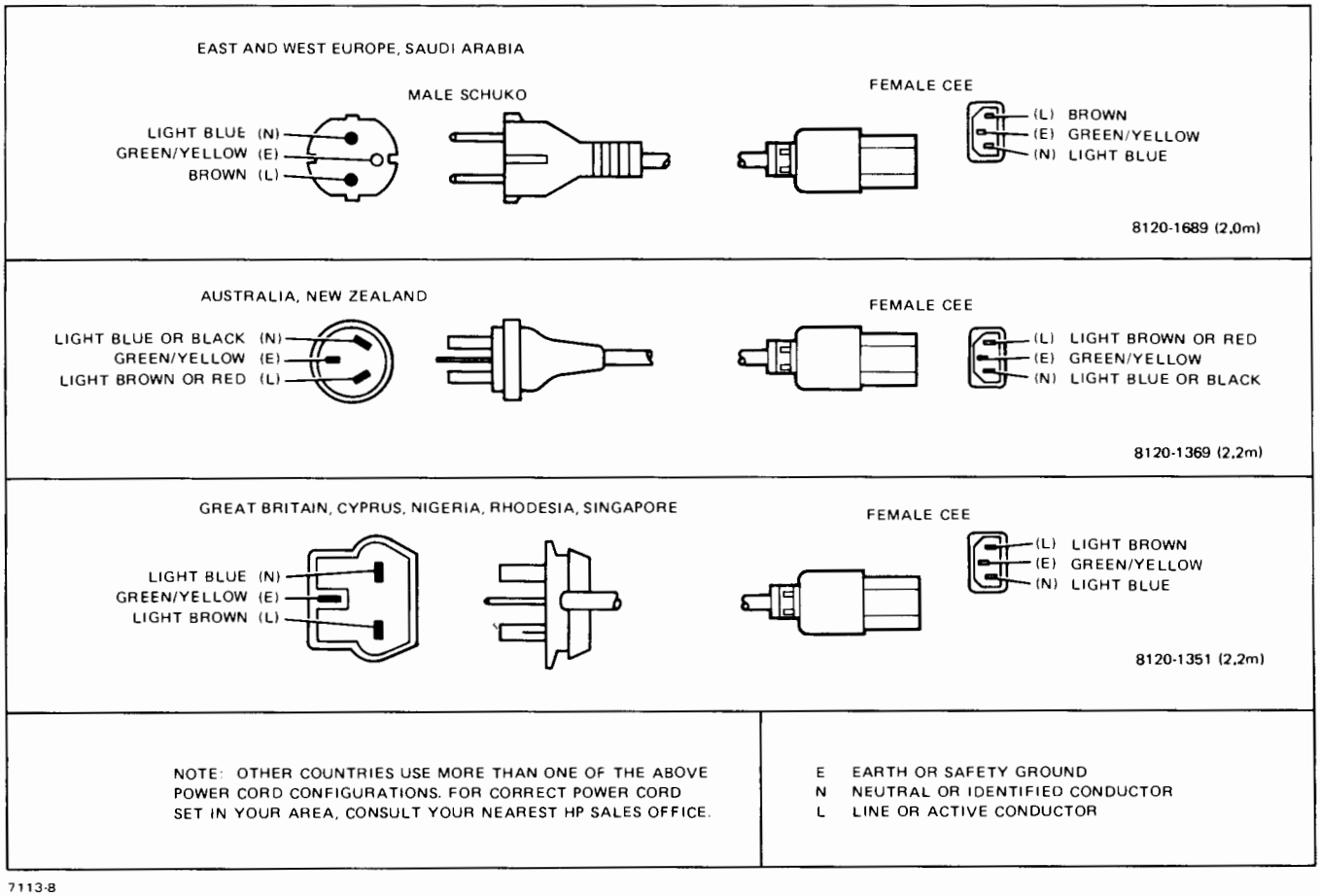

Figure 1-5. AC Power Cord Sets (Non-USA)

NOTE

The I/O extender power supply status is monitored by the computer(s) via the power control cable(s). A power failure or power shutdown in a computer or extender causes the computer to generate a power fail interrupt. The power control cables are required for orderly system shutdown because a power failure or power down in an extender generates spurious control and data signals that may cause unpredictable computer operation. Therefore, although use of power control cables limits full redundant operation, their installation is required as indicated in this manual.

1-20. SINGLE I/O EXTENDER INSTALLATION

Single I/O extender installation provides either: 1) 16 additional I/O slots to one computer; 2) 16 additional I/O slots to be shared by two computers; or 3) redundant computer capability for two computers.

1-21. ONE EXTENDER; ONE COMPUTER. Figure 1-6 is a cabling diagram for one computer and one I/O extender. Proceed as follows to set up the configuration shown in figure 1-6:

WARNING

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

a. Loosen the two wing fasteners and remove front panel. Set the ~POWER switch to OFF and disconnect the power cord.

b. On the computer, turn off the primary ac line power and disconnect the power cord. If the power fail recovery system is installed, set the battery switch to OFF and disconnect battery cable from BAT. INPUT connector.

c. On the extender, loosen the four captive screws securing the rear I/O PCA cage cover and remove cover.

d. Remove any I/O PCA's in the cage to gain access to the rocker switches (figure 1-3) on the extender control PCA. These switches can be seen through an opening in the deck of the extender.

e. Set the rockers on switch A2S1 (the left-hand rocker switch) to the desired base select code (octal). Note that the least significant bit is on the right and that a "1" is set by depressing the top of a rocker. (See figure 1-3.)

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

g. If extender Port A is to be used (the selection of Port A or B is arbitrary), proceed as follows:

   1. Loosen the two screws securing connector retainer near extender control PCA connector A1J6. (See figure 1-7.) Slide retainer away from A1J6.

   2. Pass one end of I/O extension cable 12979-60024 through right-hand opening in rear of extender deck and connect it to connector A1J6.

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

h. If extender Port B is to be used, follow the procedure given in the preceding step but use extender control PCA connector A1J3 instead of A1J6 (figure 1-7).

i. For Port A use, connect middle connector of flat I/O extension cable 12979-60008 to connector A1J1 (left-hand opening in rear of extender deck).

NOTE

The colored stripe on the flat I/O extension cable must always be farthest from the power supply whether the cable is connected to the extender or the computer. (See figure 1-6.)

j. For Port B use, connect middle connector of the flat I/O extension cable to connector A1J2 (middle opening in rear of extender deck).

NOTE

Extender control PCA connectors A1J6 and A1J1 must be used in conjunction to select extender Port A; and connectors A1J3 and A1J2 must be used to select extender Port B.

k. Set rocker switch A1S2 (figure 1-3) to receive priority from the computer at either Port A or B, as appropriate for the cabling setup.

l. Set rocker switch A1S3 only to lock the computer to Port A or B, as appropriate.

m. Reinstall extender bottom cover.

n. On the computer, remove the I/O PCA cage cover. Loosen the screws that secure the I/O PCA retainer and slide retainer to right.

o. Install I/O buffer PCA 12979-60022 in the lowest I/O priority slot used in the computer.

p. Connect the loose end of the I/O extension cable 12979-60024 (from extender connector A1J6 or A1J3) to I/O buffer PCA.

q. Slide I/O PCA retainer to the left and secure in place by tightening the screws.

r. Connect one end of flat I/O extension cable (from extender connector A1J1 or A1J2) to CPU PCA connector A1J3 (middle opening in rear of computer deck). Observe correct colored stripe orientation on cable.

s. Take a sharp knife or pair of scissors and carefully remove the unused cable length and connector from the flat I/O extension cable.

t. Reinstall I/O PCA cage cover on computer.

u. Reconnect the power cables to the computer and the extender and turn on the ac line power switch of the extender and then of the computer. Press the RESET switch on the computer operator panel. If the power fail recovery system is installed, set the battery switch to INTERNAL.

v. After power is on, connect power control cable 12979-60025 from PWR CONT connector on computer to extender PWR CONT connector. (Use power control adapter 12979-60026 if the computer is a model "A"; i.e., 2109A, etc.) If the power fail recovery system is

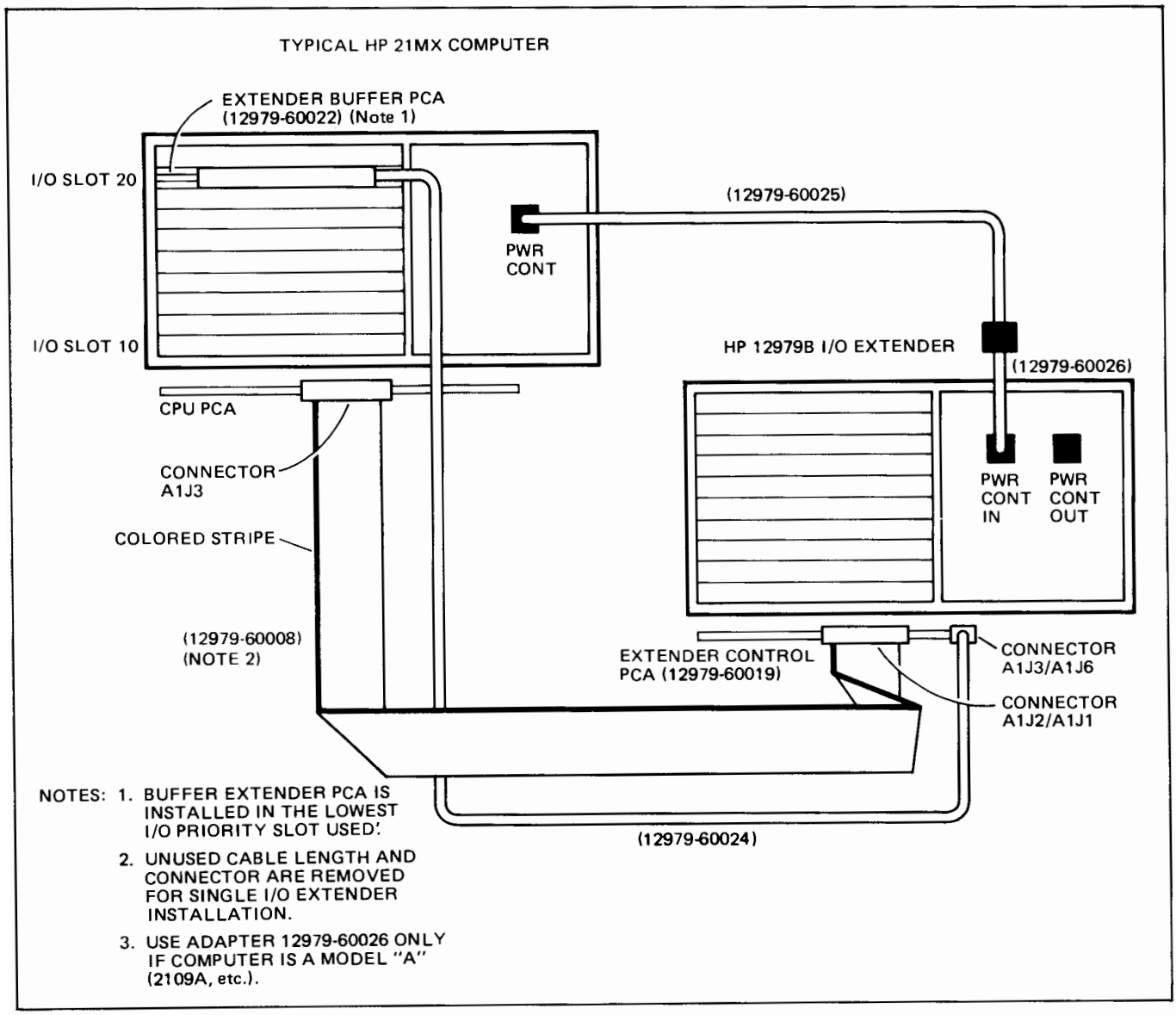

Figure 1-6. Single I/O Extender, Interface to Computer (Rear View)

installed in computer, connect battery cable to BAT. INPUT connector. Set the battery switch to OFF. Do not turn battery on until power has been restored to the computer.

w. Run the input/output channel diagnostic test discussed in paragraph 1-38.

1-22. ONE EXTENDER; TWO COMPUTERS. Figure 1-8 is a cabling diagram of one I/O extender and two computers with the HP 12781A Dual Computer Kit. The installation procedure is essentially the same as that given in the preceding paragraph. Each computer is cabled to the extender as though it were the only computer in the system. (Note that two I/O extender PCA's and two sets of I/O extension cables are required.) The differences are the settings of rocker switches A1S2 and A1S3 and are as follows:

a. Rocker switch A1S2 must be set so that both Port A and B of the extender can receive priority from the computer.

b. Rocker switch A1S3 must not be set to lock to either Port A or B but must be set for an individual I/O bus switch select code (octal 70 to 77). Note that only the least significant digit can be set; the most significant digit is built in.

NOTE

When A1S3 is not set to lock to a port the I/O extender is automatically switched to Port A when ac power is applied; this allows the computer connected to this port to supply the necessary preset to all I/O cards in the extender.

Information on programming the computers either to share the I/O extender or for the second computer to backup the first computer is given in the I/O extender operating and reference manual.

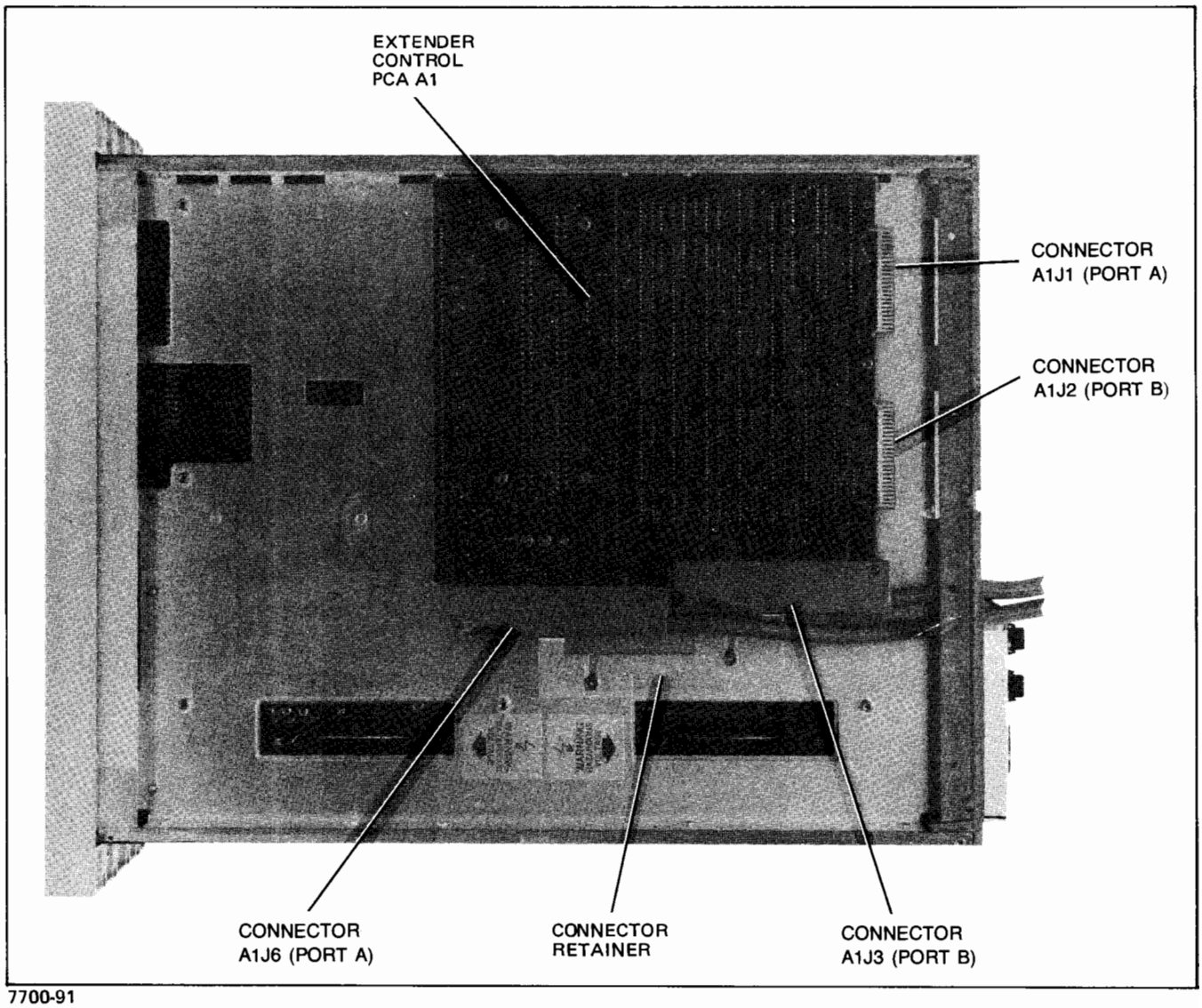

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Figure 1-7. HP 12979B I/O Extender Bottom View

1-23. DUAL I/O EXTENDER INSTALLATION

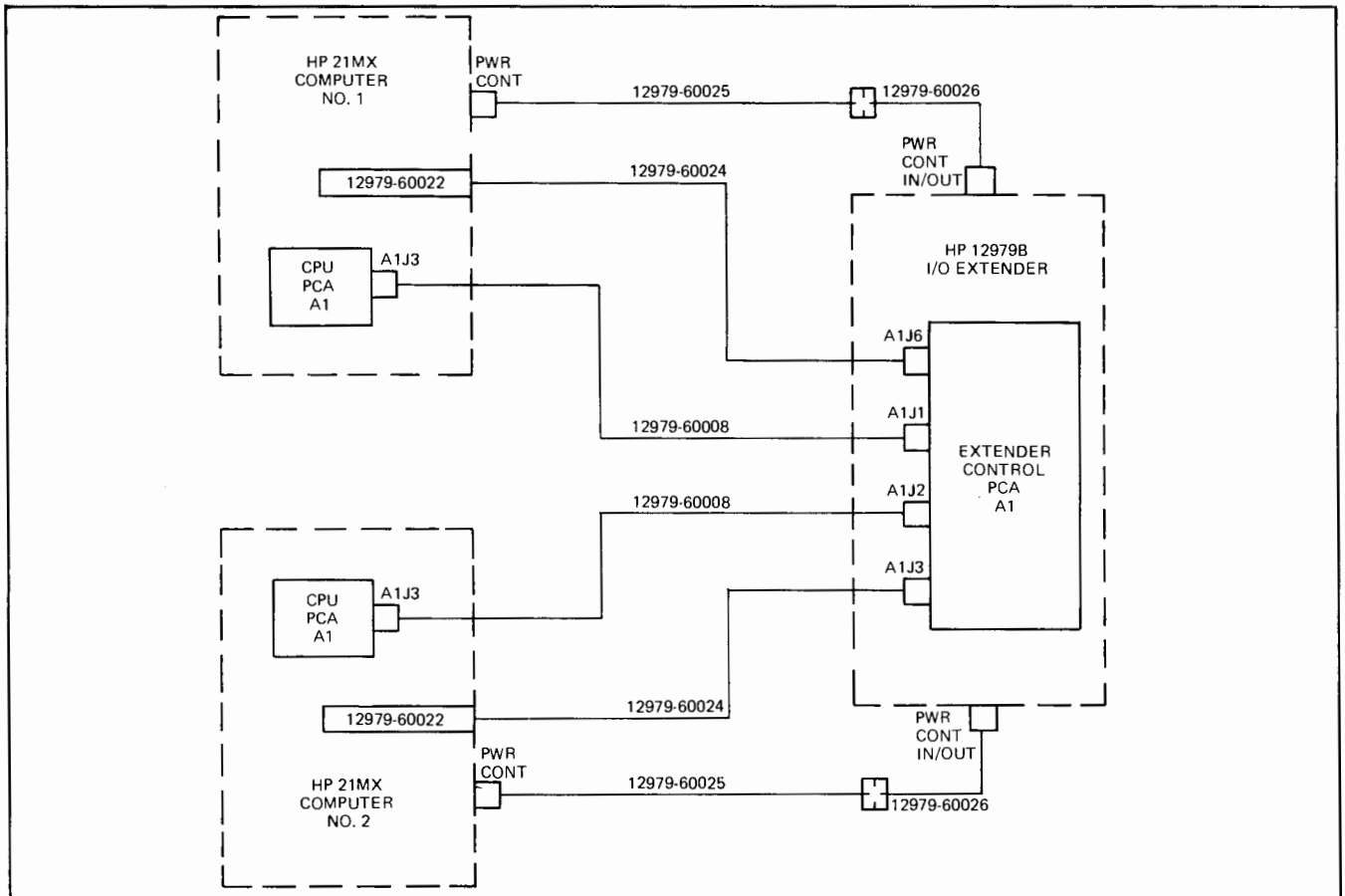
1-24. TWO EXTENDERS; ONE COMPUTER. As previously mentioned, two HP 12979B Extenders may be used with one compute One I/O buffer PCA (part no. 12979-60022) is required for each extender and the PCA's are installed in the lowest I/O priority slots used in the computer. The two I/O extenders are interconnected with the computer as shown in figure 1-9.

WARNING

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

To configure the system as shown in figure 1-9, perform the installation procedure given in paragraph 1-21, steps a through w, but do not modify the three-connector I/O extension cable at step s. Instead, connect the third connector either to connector A1J1 (Port A) or to A1J2 (Port B) of the extender control PCA in the second I/O extender.

If the second I/O extender is used for additional I/O, the BSC switches on the extenders should be set for sequential select codes as indicated in figure 1-3. Rocker switches A1S2 should be set so that the high priority extender receives priority from the computer and the other extender receives priority from the high priority extender. (Note, however, that these are not firm requirements; a gap may exist in the select code numbers between extenders e.g., the last select code in the first extender could be 35_8 and the first select code in the second could be 44_8. Also, the A1S2 switches could be set so that the higher select codes have I/O priority over the lower codes.) Rocker switches A1S3 should be set so that each extender locks to Port A or Port B, as appropriate for the cabling setup.



NOTES:
1. USE ADAPTER 12979-60026 IF POWER CONTROL CABLE 12979-60025 IS USED WITH A MODEL "A" COMPUTER (2109A, ETC.)
2. BOTH COMPUTERS CONNECTED TO EXTENDER(S) IN DUAL COMPUTER CONFIGURATION MUST BE EITHER 21XXA MODELS (WITH "A" POWER SUPPLY) OR 21XXB/E/F/M MODELS (WITH "B" POWER SUPPLY) IF POWER CONTROL CABLES ARE CONNECTED.

7700-54

Figure 1-8. One Extender, Two Computers

If the second I/O extender is used for I/O redundancy, then:

a. The BSC switch on both extenders must be set to the same select code.

b. Each I/O PCA in the second extender must have the same select code as its counterpart in the first extender.

c. The A1S2 switches must be set so that both extenders can receive priority from the computer.

d. The A1S3 switches must not be set to lock to either Port A or B but must be set for different bus switch select codes. Refer to paragraph 1-22.

Refer to the I/O extender operating and reference manual for information on programming the computer for I/O redundancy.

1-25. TWO EXTENDERS; TWO COMPUTERS. Figure 1-10 is a cabling diagram of two I/O extenders and two computers. This computer backup configuration allows each computer to be programmed to work with only one extender during normal operation and to work with both extenders if the other computer fails. For installation information, refer to paragraphs 1-21 and 1-24. Refer to the I/O extender operating and reference manual for programming information.

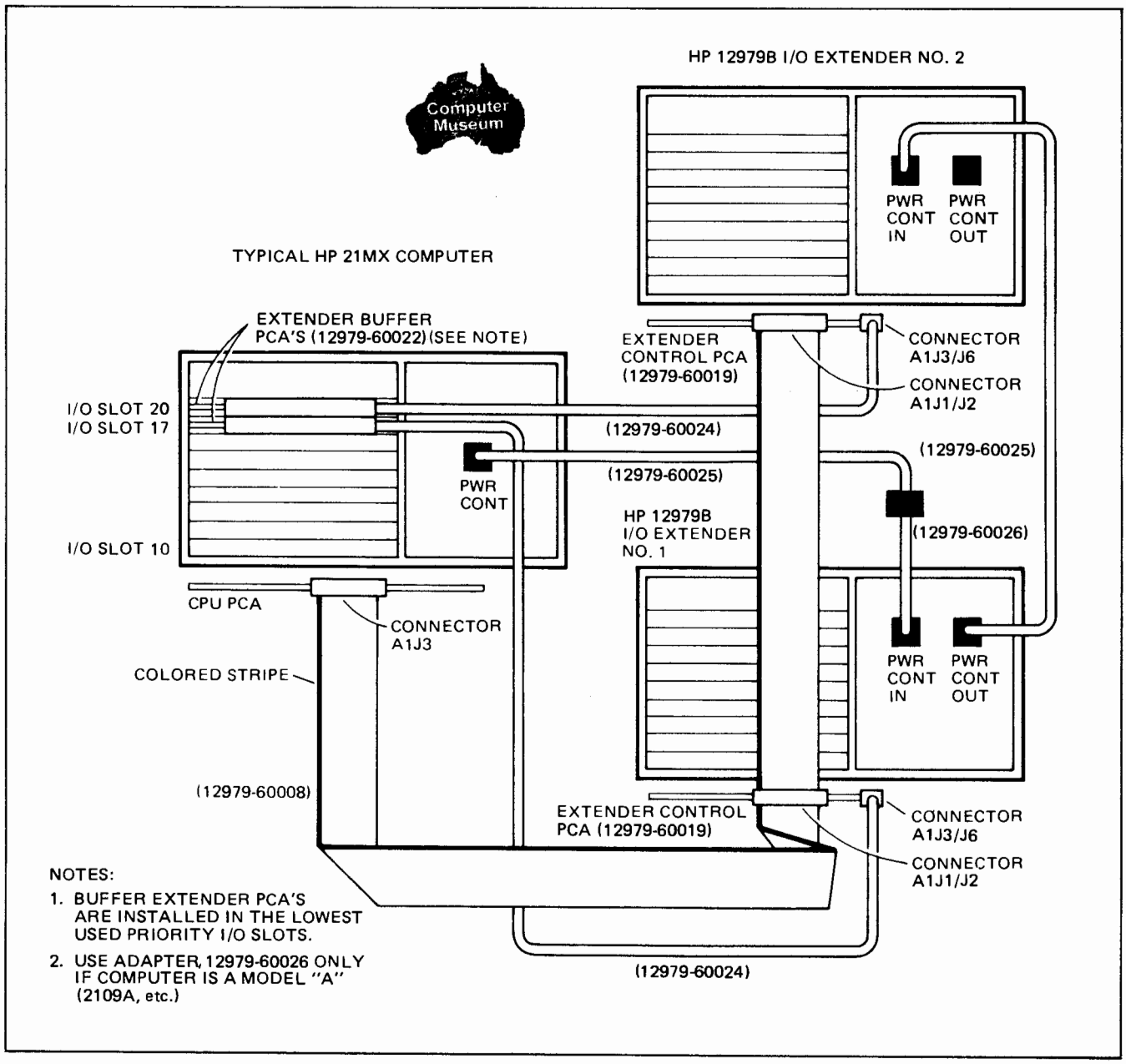


Figure 1-9. Dual I/O Extenders, Interface to Processor (Rear View)

1-26. ANOTHER CONFIGURATION

Figure 1-11 shows an extender-computer configuration having two computers and three I/O extenders. In this configuration, each computer has exclusive use of one extender; both computers are connected to the third extender. Essentially, this is an expansion of the configuration shown in figure 1-8 (refer to paragraph 1-22). The application might be that the third extender is shared by the two computers or that one computer is a backup to maintain I/O operations in the third extender.

1-27. I/O INTERFACE PCA INSTALLATION

1-28. INTERFACE CABLING. Cable requirements to interconnect the interface PCA's and the associated 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.

1-29. REAR I/O PCA CAGE. Install an I/O interface PCA in the rear I/O PCA cage as follows:

a. Set extender ~POWER switch to OFF.

b. Remove rear cover by loosening the four captive screws.

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.

1-30. FRONT I/O PCA CAGE. Install an I/O interface PCA in the front I/O PCA cage as follows:

a. Set extender ~POWER switch to OFF.

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

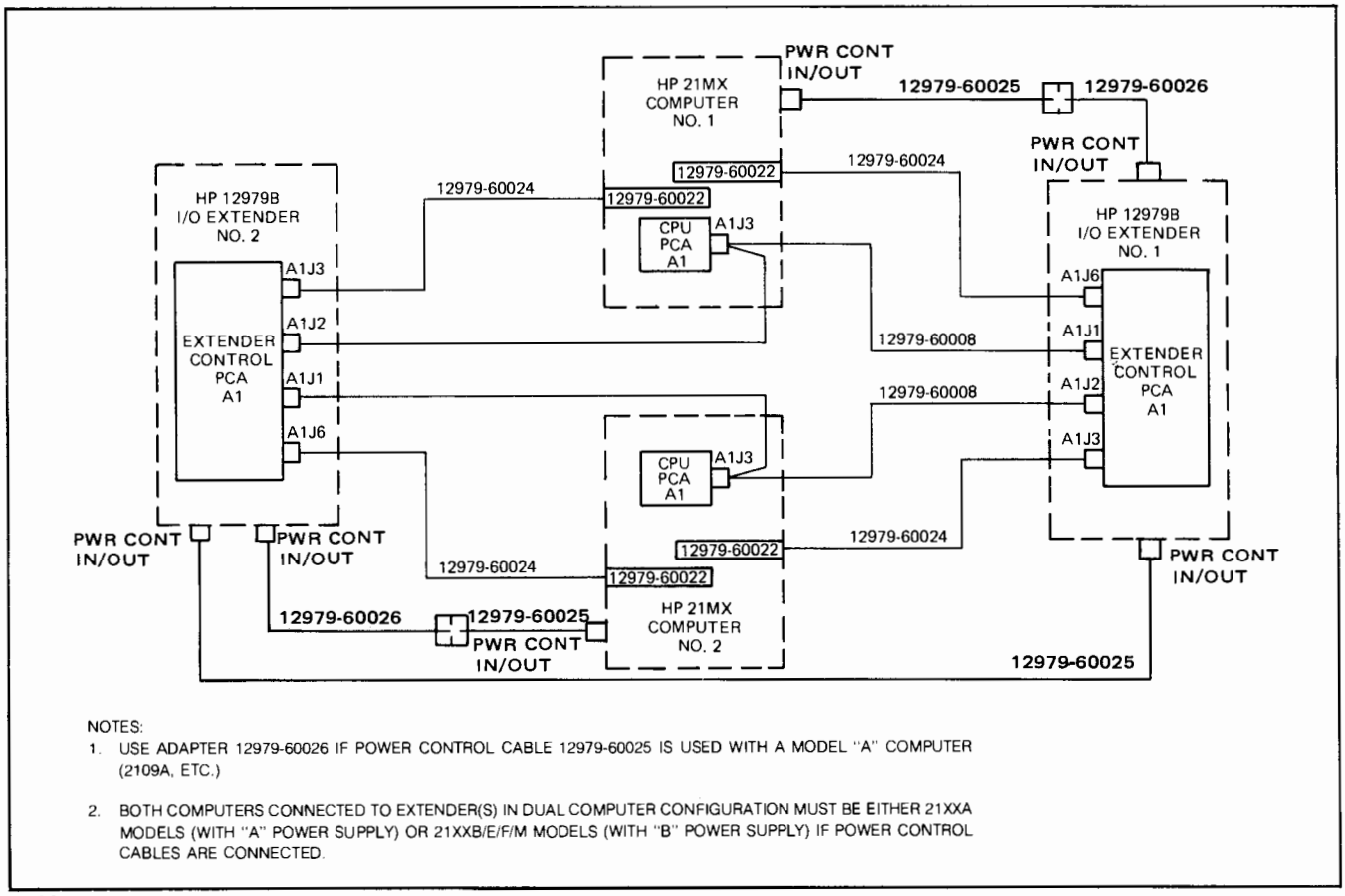


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Figure 1-10. Two Extenders, Two Computers

c. Install I/O interface PCA into desired I/O slot and secure in place by pushing inward on PCA extractor levers. Insert terminator PCA, part no. 02100-60060, in I/O slot 20 if not all I/O slots are used; otherwise, do not use the terminator PCA.

d. 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.)

NOTE

In some instances it may be desirable to install interface PCA's for a device in the rear I/O PCA cage simply because neither connector of the interface cable is small enough to pass through the cable channel (figure 1-2).

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

f. Reinstall extender front panel and secure in place.

1-31. PERFORMANCE CHECK

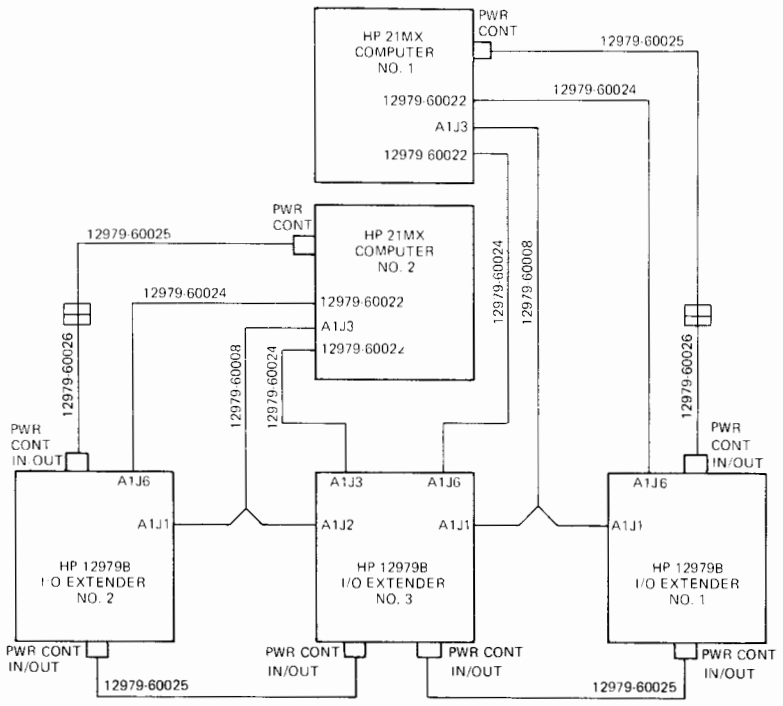
The performance check of the I/O extender consists of power supply check and a diagnostic check. Performance check of the I/O devices are described in the appropriate interface or subsystem documentation.

1-32. 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.

1-33. 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.



NOTES:
1. USE ADAPTER 12979-60026 IF POWER CONTROL CABLE 12979-60025 IS USED WITH A MODEL "A" COMPUTER (2109A, ETC.)

2. BOTH COMPUTERS CONNECTED TO EXTENDER(S) IN DUAL COMPUTER CONFIGURATION MUST BE EITHER 21XXA MODELS (WITH "A" POWER SUPPLY) OR 21XXB/E/F/M MODELS (WITH "B" POWER SUPPLY) IF POWER CONTROL CABLES ARE CONNECTED.

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Figure 1-11. Shared I/O and Independent I/O

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 3470 Digital Voltmeter with HP 34702A Multimeter.
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 3470A Digital Voltmeter with HP 34702A Multimeter.
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

1-34. 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 ~POWER switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury.

a. Set extender ~POWER switch to OFF and disconnect the power cord. Remove the top cover.

b. Remove the two screws and washers securing the protective cover to the power supply and remove.

c. Plug the extender power cord into the power outlet and set extender ~POWER switch to ON.

d. On the crossover PCA, connect positive lead of digital voltmeter to +5V test point and connect common lead to common test point. (See figure 3-3.)

e. Adjust +5V ADJ potentiometer to obtain voltmeter indication of 5.15 volts.

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

g. Disconnect voltmeter and replace the power supply shield.

h. Replace the front panel.

Table 1-3. Power Supply Voltage Tolerances

SUPPLY	TOLERANCE
+5V	+5.00V to +5.25V*
+12V	±0.60V
−2V	±0.20V
−12V	±0.60V
+30V	+12V, −8V

*+5.15 recommended

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.

1-35. 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.

Power-up threshold adjustment procedures for the extender when used with the HP 21MX Computer Series having a model number with suffix letter "B" (2109B, etc.) are given in paragraph 1-36; the procedures for use with model "A" (2109A, etc.) are given in paragraph 1-37.

1-36. Power-Up Threshold (Model "B" Computer). Assuming that the extender has been interfaced to a model "B" computer and that the computer'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 ~POWER switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury.

a. Remove extender front panel.

b. Set extender and computer ~POWER switches to OFF. Disconnect the extender and computer power cords. On the computer processor board, set the auto-restart switch (A1S2) to the ARS position.

c. Remove the two screws and washers securing the protective cover to the extender power supply. Remove the protective cover to access the power-up threshold potentiometer. (See figure 1-12.)

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

e. 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).

f. Plug extender power cord into autotransformer power output receptacle. Set extender ~POWER switch to ON. Plug the computer power cord into power outlet and set ~POWER switch to ON. Press the computer RUN switch to set the computer in the run mode (RUN indicator lighted).

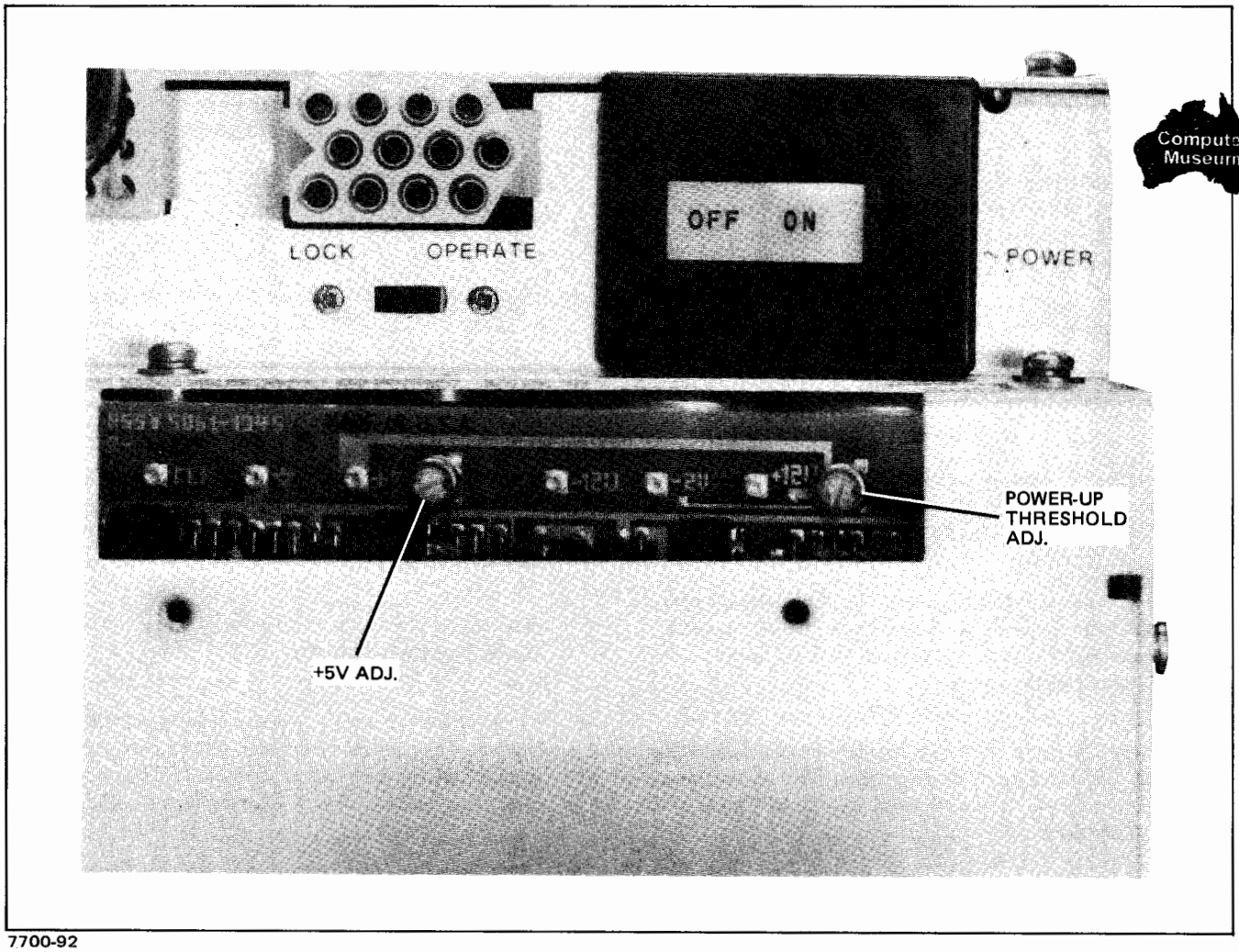

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Figure 1-12. Power Supply Adjustment

g. Slowly reduce autotransformer output until the computer RUN indicator extinguishes, indicating that the computer has sensed a lack of power in the extender and halted. The voltmeter should indicate 75 ±5 volts rms (standard) or 150 ±10 volts (option 015).

h. If a power fail recovery system is installed in the computer, omit this step; if not, then:

1. Set atuotransformer output to 85 ±0.1 volts rms (standard) or 170 ±0.2 volts rms (option 015). Press the computer RUN switch; the RUN indicator should remain extinguished.

2. Set autotransformer output to 87 ±0.1 volts rms (standard) or 174 ±0.2 volts rms (option 015). Press the computer RUN switch; the RUN indicator should light. Proceed with step j.

NOTE

There is up to a 1-second delay from the time that the upper threshold is detected and the computer RUN indicator can light (RUN switch pressed). Perform the following step very carefully.

i. **Slowly** increase the autotransformer output until the computer RUN indicator lights. The voltmeter should indicate 87 ±0.5 volts rms (standard) or 174 ±1.0 volts rms (option 015).

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

k. Reduce autotransformer output until computer RUN indicator extinguishes. Set power-up threshold potentiometer (figure 1-12) fully clockwise.

l. Set autotransformer output to the desired upper threshold. Adjust the power-up threshold potentiometer **slowly** counterclockwise until computer RUN indicator lights.

m. **Slowly** decrease autotransformer output until computer RUN indicator extinguishes. The ac voltmeter should indicate 10 to 20 volts less than the desired upper threshold.

After verifying that the power-up threshold has been properly adjusted, disconnect the test setup. Set extender and computer ~POWER switches to OFF. Replace the extender power supply shield and front panel.

NOTE

The difference between the upper and lower thresholds varies with the extender-computer configuration. A heavily loaded configuration will halt the computer at a higher line voltage than a lightly loaded configuration even though both may change from halt to run at the same line voltage.

1-37. Power-Up Threshold (Model "A" Computer). Assuming that the extender has been interfaced to a model "A" computer and that the computer'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 ~POWER switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury.

a. Remove extender front panel.

b. Set extender ~POWER switch to OFF. Set computer ~LINE switch OFF. Disconnect the extender and computer power cords. On the computer processor board, set the auto-restart switch (A1S2) to the ARS position.

c. Remove the two screws and washers securing the protective cover to the extender power supply. Remove the protective cover to access the power-up threshold potentiometer. (See figure 1-12.)

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

e. 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).

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

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

h. If a power fail recovery system is installed in the computer, 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 j.

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.

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

j. 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.

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

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

m. **Slowly** decrease autotransformer output until 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 computer and extender ac line switches to OFF. Replace the protective cover and the extender front panel.

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.

1-38. 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	02100-90213	24318-16001
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. If your extender includes the optional DCPC, run the DCPC diagnostic test also.

1-39. 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.

1-40. REPACKAGING FOR SHIPMENT

1-41. 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.

1-42. 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.

PRINCIPLES OF OPERATION

SECTION II

This section describes the operation of the circuits comprising the HP 12979B 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 computer.

The I/O section is an extension of the computer 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 computer. I/O signals flowing between the computer and the extender are routed through the I/O section interfacing circuits installed in both the computer and the extender mainframes.

The power supply operates from a 110-volt (220-volt adaptable), single phase, 47.5 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 computer. The extender power supply is similar to the computer power supply.

The I/O section is described in paragraphs 2-3 through 2-14, and the optional DCPC feature is described in paragraphs 2-15 through 2-18. 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 COMPUTER

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

Input/output interface PCA's plugged into I/O PCA slots of the extender operate in the same manner as when used in the computer 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 12897B DCPC option must be installed in the computer to interface the computer-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 backplanes, the extender control PCA, and the I/O

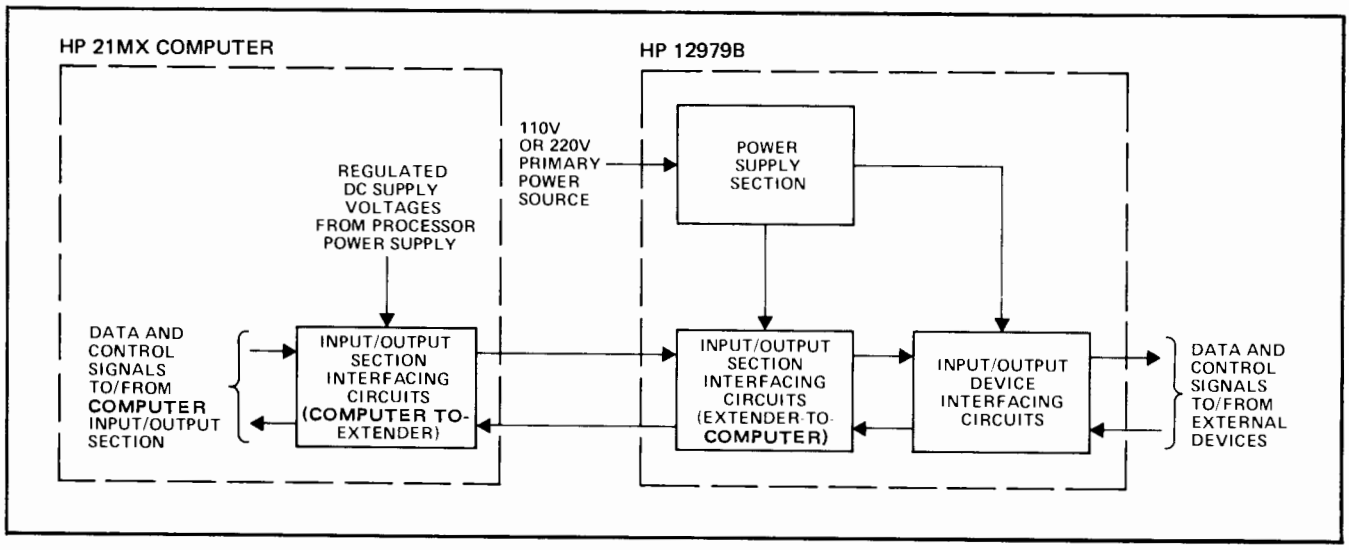


Figure 2-1. I/O Extender, Functional Block Diagram

buffer PCA. (See figure 2-2.) The I/O buffer PCA and extension cable interface the I/O PCA cage on the computer to the I/O PCA cages on the extender I/O backplanes. This puts the I/O section of the extender under computer control, and in effect, serially extends the I/O capacity of the computer 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 transferred 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 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 pro-

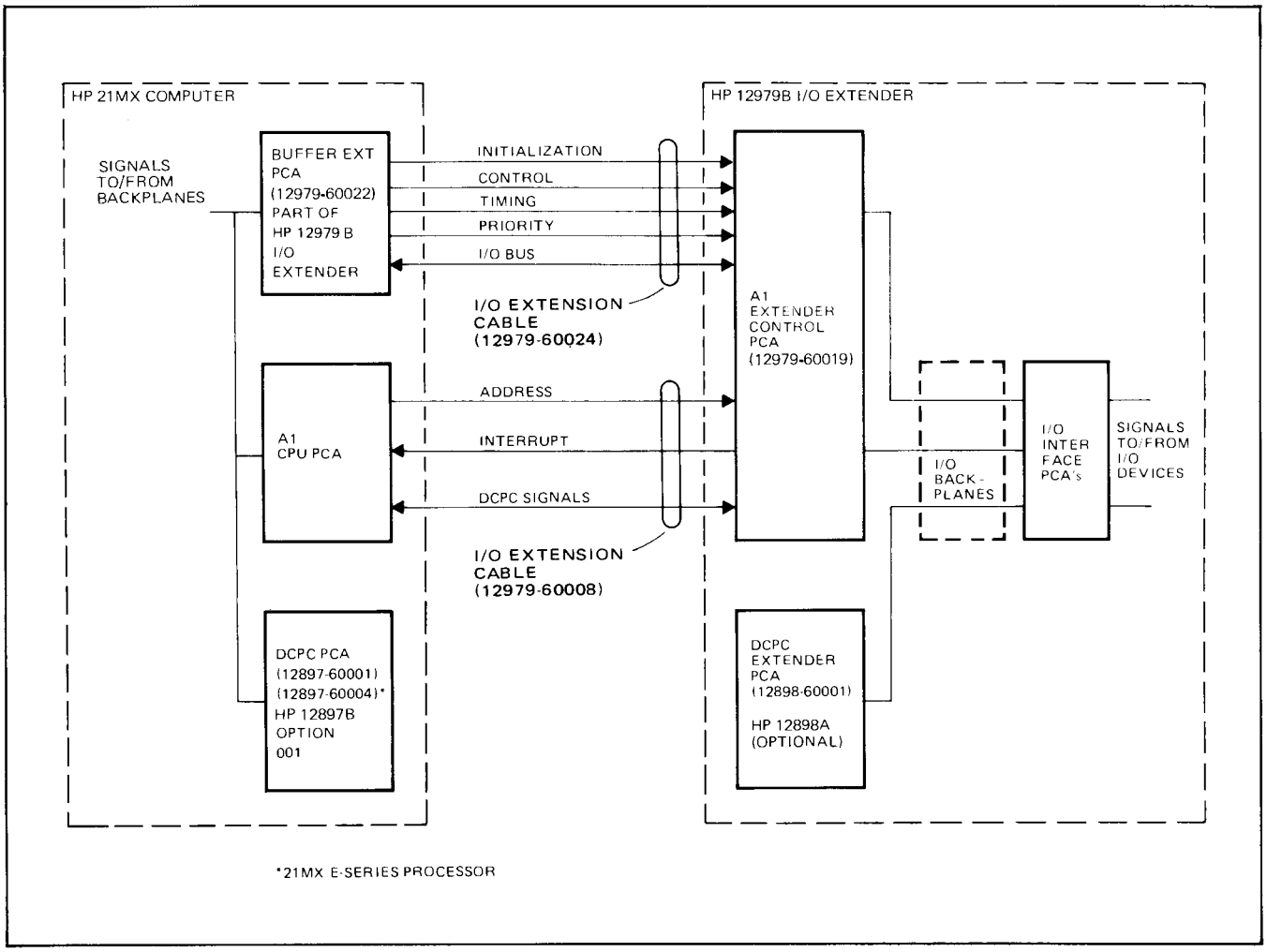


Figure 2-2. I/O Extender, Interface to Processor

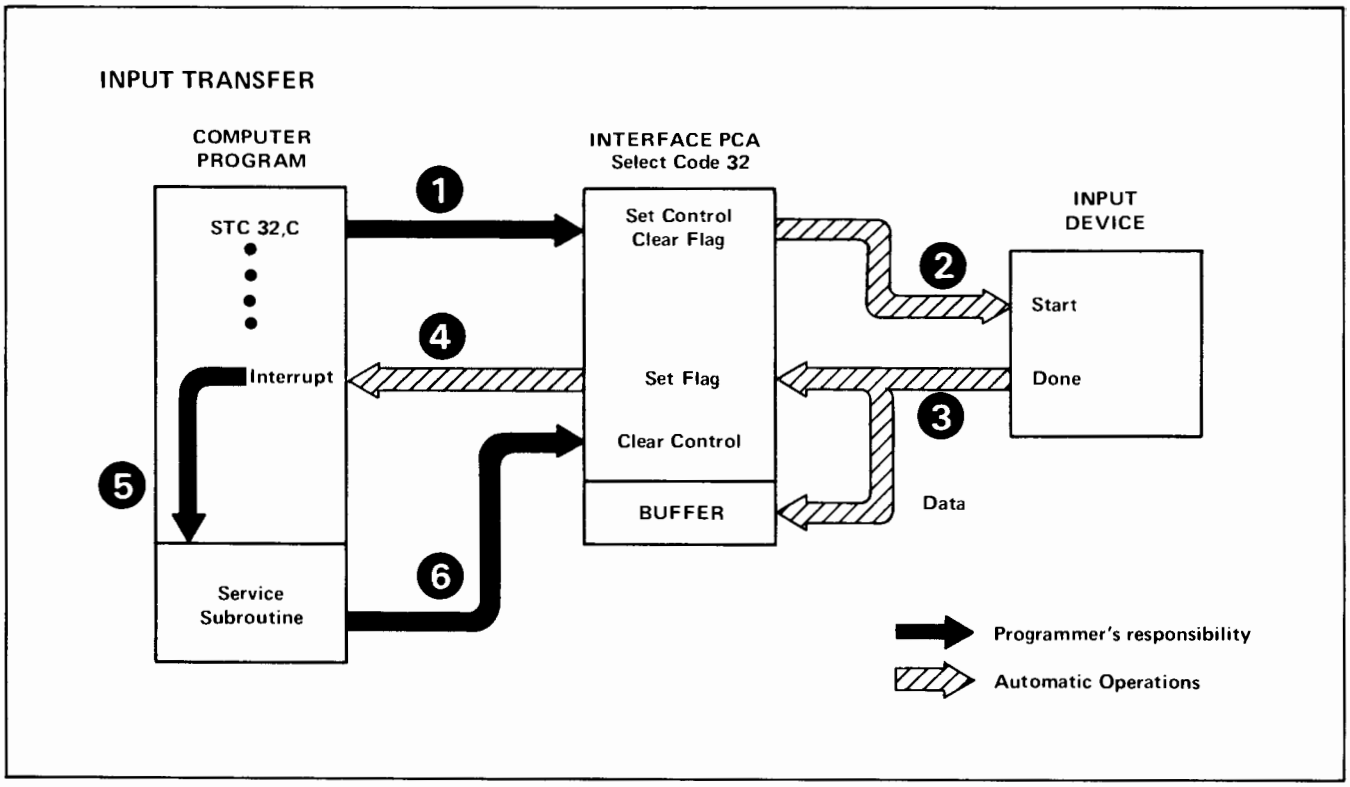


Figure 2-3. Input Data Transfer

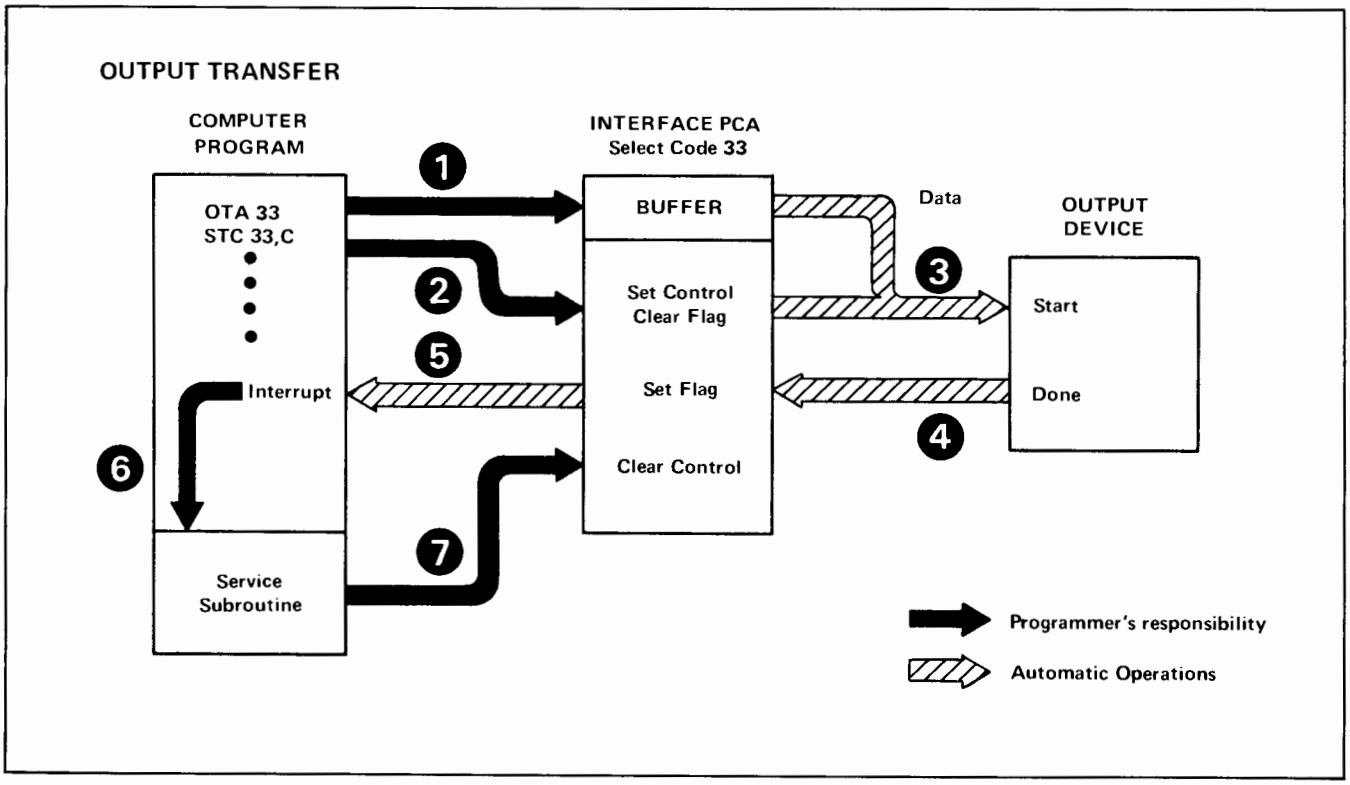


Figure 2-4. Output Data Transfer

grammed and automatic operations. It is assumed that the data to be transferred has been loaded into the A-register 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 DESCRIPTION

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

2-8. I/O BUFFER PCA

The I/O buffer PCA, part no. 12979-60022, is placed in the lowest priority I/O slot used in the computer and transfers signals between the computer and extender I/O sections. The edge connector on this PCA mates with one end of an I/O extension cable (see figure 2-2); the other end of this cable mates with an edge connector on the extender control PCA.

The I/O buffer 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 computer when the gates are enabled by a true IOI signal and the IOB16 signal from the extender. The other group of gates transfers IOBO bits from the computer to the extender when the gates are enabled by a false IOI signal and the IOB16 signal.

One input of the remaining gates on the PCA is connected to a signal line from either the computer backplane or the I/O extender. The second input of each gate is connected to +5.0 volts dc. Consequently, any gate receiving a positive-true input signal produces a positive-true output signal which is transferred to either the computer I/O backplane or the I/O extender backplanes.

2-9. EXTENDER CONTROL PCA

The extender control PCA transfers signals between the extender and the computer I/O sections. Connector J6 (extender Port A) or J3 (extender Port B) is connected by an I/O extension cable to an edge connector on an I/O buffer PCA located in the lowest priority I/O slot in the computer. Connector J1 (Port A) or J2 (Port B) on the extender control PCA is connected by another extension cable to connector J3 on the CPU PCA of the computer. (See figure 2-2.)

The extender control PCA consists of five functional logic blocks: the select code scaling and decoding logic, the select code restoration logic, the line driver/buffer logic, the priority and enable logic, and the I/O bus switch 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 selected on the extender control PCA by setting BSC switch S1 with an appropriate select code. (Refer to section I.) The actual device select code is sent by the computer 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 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 computer.

2-12. LINE DRIVER/BUFFER LOGIC. Control signals from the computer 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 computer 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 base select code (BSC) switch (S1) and the extender priority switch (S2) on the extender control PCA must be appropriately set. (Refer to section I.) 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. I/O BUS SWITCH. Figure 2-6 is a functional diagram showing the I/O bus switch in an installation where one I/O extender is connected to two computers. The programmable I/O bus switch circuit on the extender control PCA receives signals from the computers via both sets of I/O extension cables. The flat cable (12979-60008) carries signals from connector A1J3 of the computer CPU board; these signals include the select code bus and the interrupt acknowledge bus. The other cable carries the I/O bus and the I/O control signals from the I/O buffer PCA placed in the computer. (For simplicity, figure 2-6 only illustrates output transfer logic; the I/O bus switch also controls input transfers.)

The select code and I/O buses may be driven continually by the two computers but the signals are gated to the interface PCA's in the extender by the output of the I/O switch. The I/O buses from the I/O extender PCA's are controlled by the IOB16 signal from the I/O switch; therefore, the setting of the switch determines which computer can fully access the extender. The switch itself is programmatically controlled to pass I/O bus signals received through extender Port A or B as described in the extender operating and reference manual.

2-15. 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, therefore, can transfer data at rates up to 616,000 words per second with an M-Series Computer or up to 1,140,000 words per second with an E-Series Computer.* 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.

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

*Refer to the HP 21MX E-Series Computer Reference Manual for information on DCPC transfer rate variations.

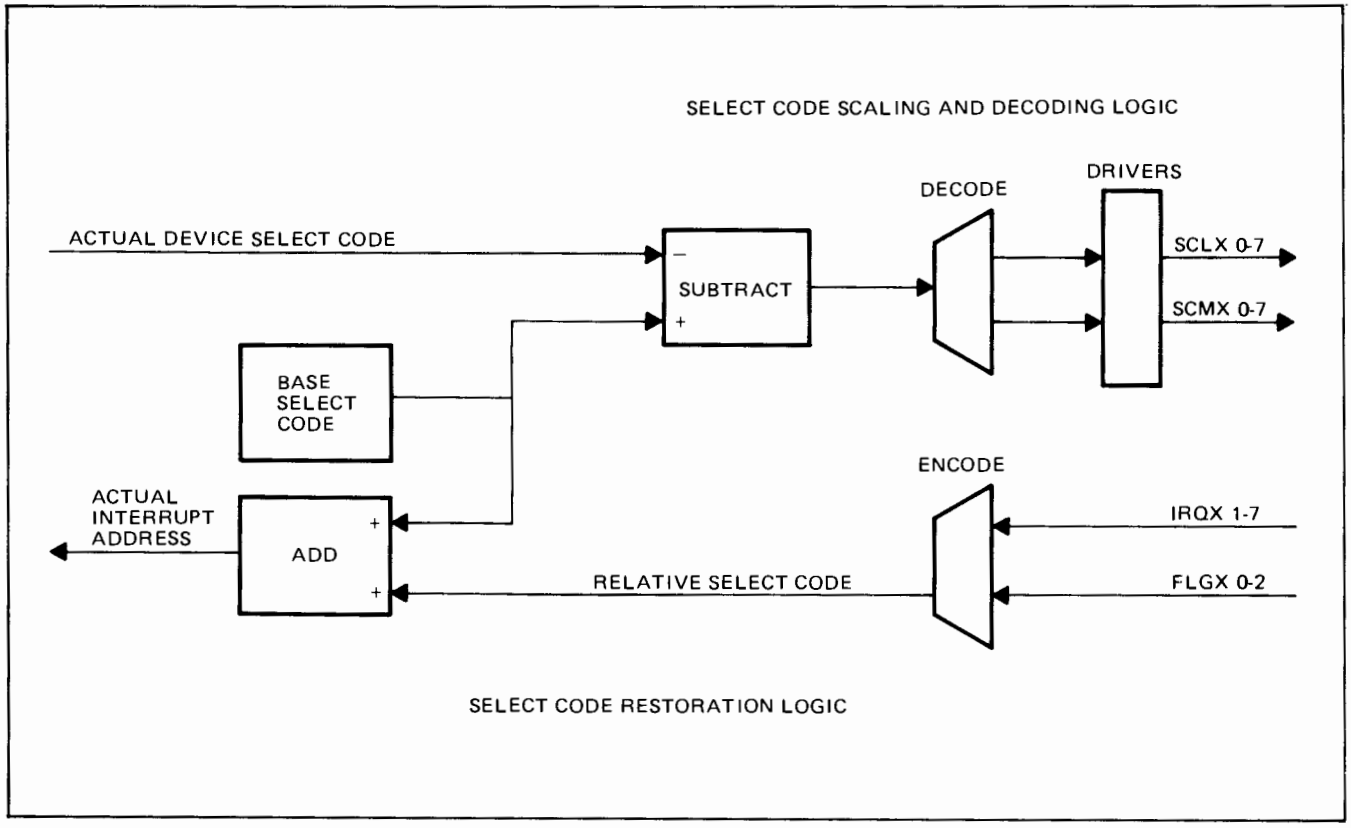


Figure 2-5. Extender Control PCA, Functional Diagram

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.

2-16. DCPC OPERATION

Figure 2-7 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 2-7 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.)

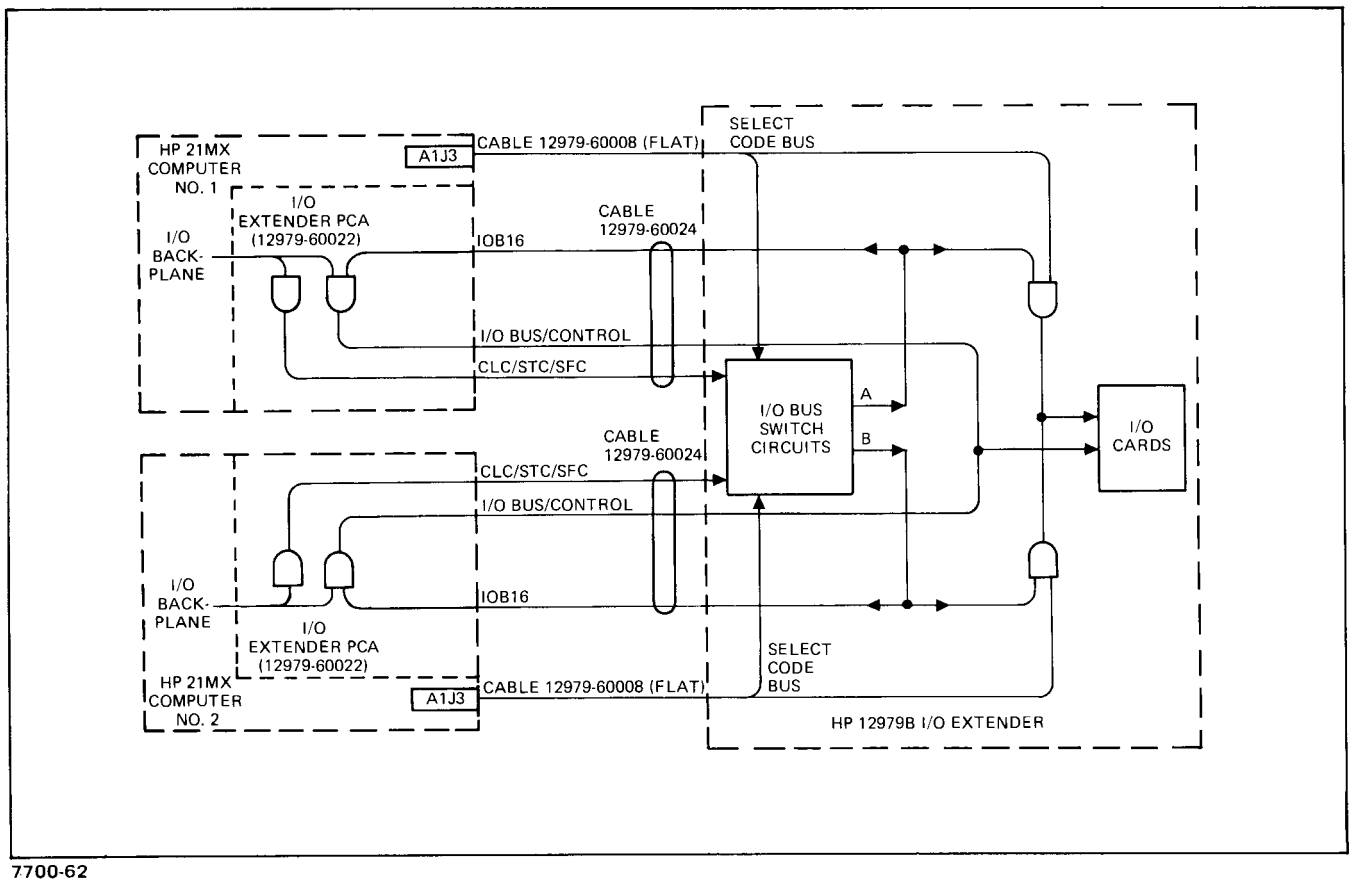
The initialization routine sets up the control registers on the DCPC (1) and issues the first start command (STC 32,C) directly to the interface PCA. (If the operation is an output, the interface PCA buffer is also loaded at this time.) The DCPC logic is now turned on and the computer program continues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

2-17. 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.



7700-62

Figure 2-6. Interface of Computer and Extender with I/O Bus Switch

Figure 2-8 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 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.

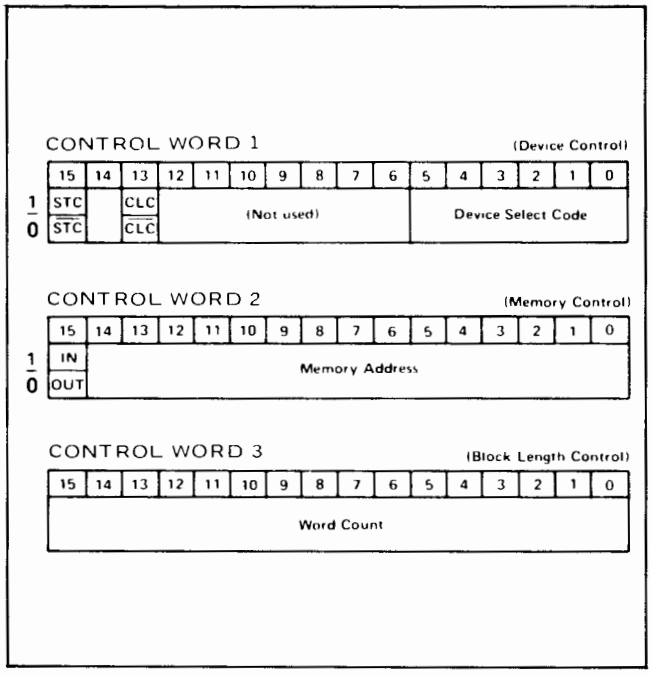


Figure 2-8. DCPC Control Word Formats

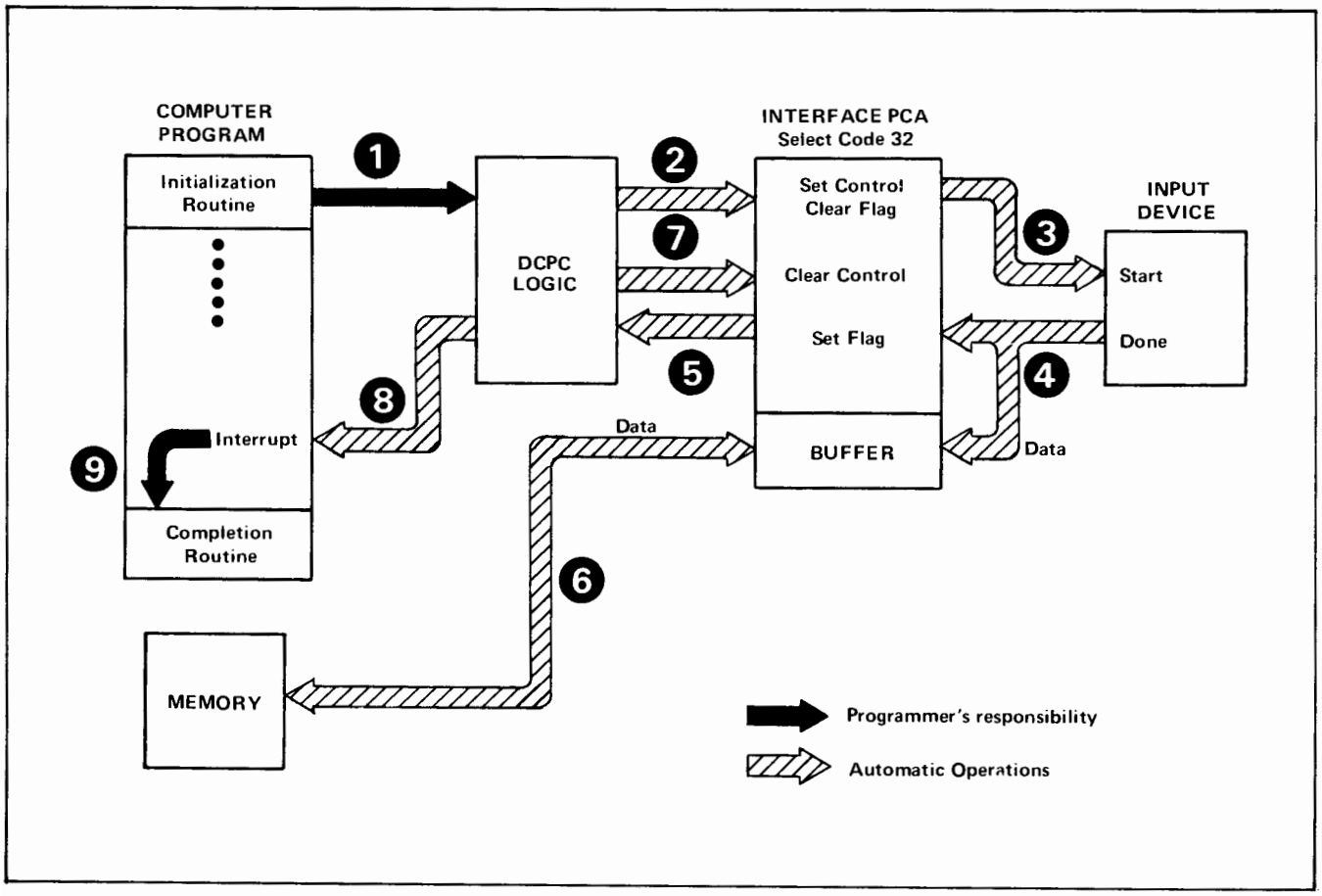


Figure 2-7. DCPC Input Data Transfer

2-18. EXTENDER DCPC PCA

The functional logic blocks of the extender DCPC PCA are shown in figure 2-9. 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 computer when the device under DCPC control is ready.

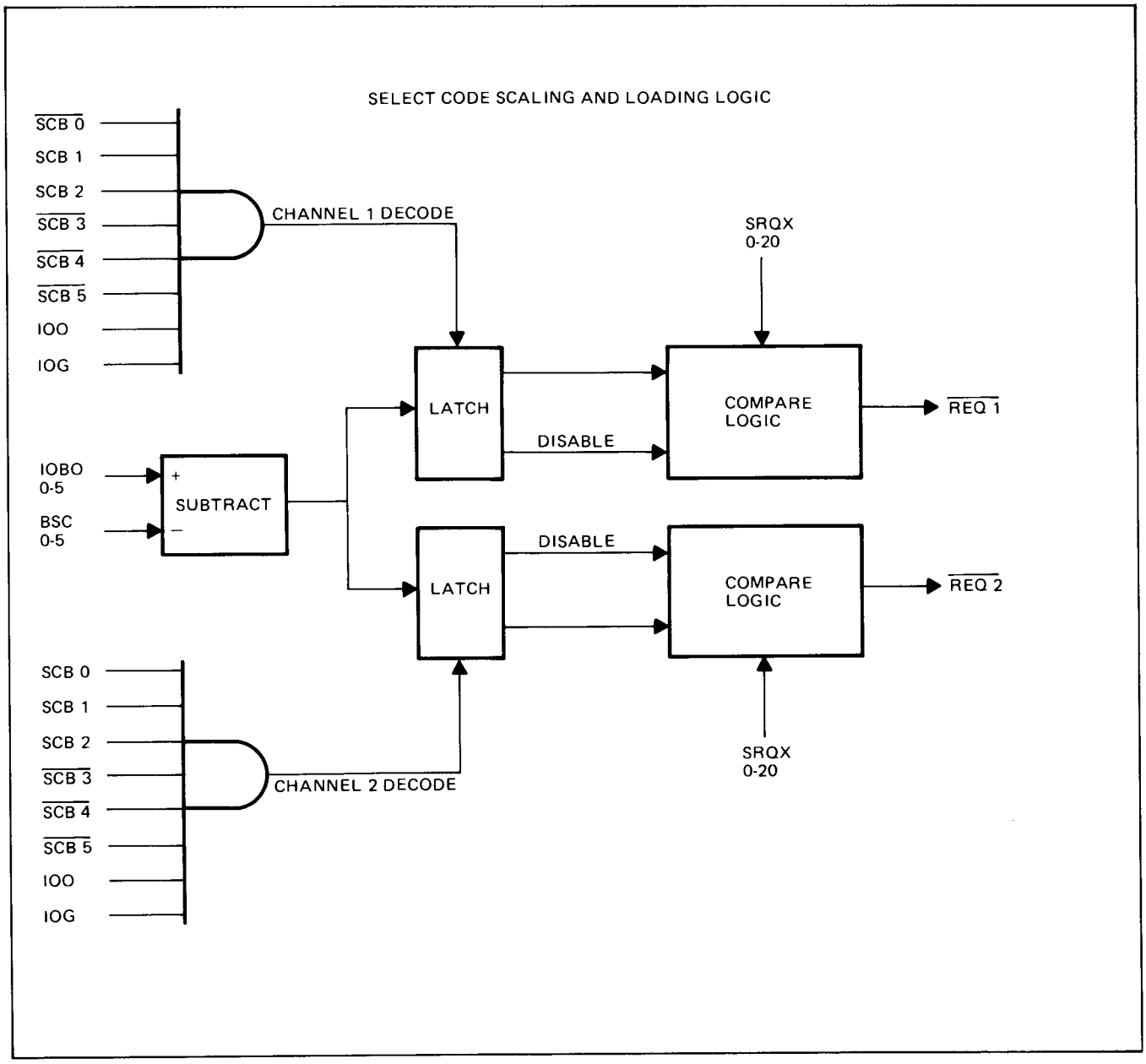


Figure 2-9. Extender DCPC PCA, Functional Diagram

SECTION III

SERVICE

This section describes troubleshooting and maintenance procedures for the HP 12979B I/O Extender. Also included are a listing of signal mnemonics and their definitions, a listing of backplane 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 computer 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 computer 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 manuals listed in the preface of this manual.

3-5. BASIC CHECKOUT

The basic checkout test procedure is performed using operating switches and indicators on a properly functioning HP 21MX Series Computer 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

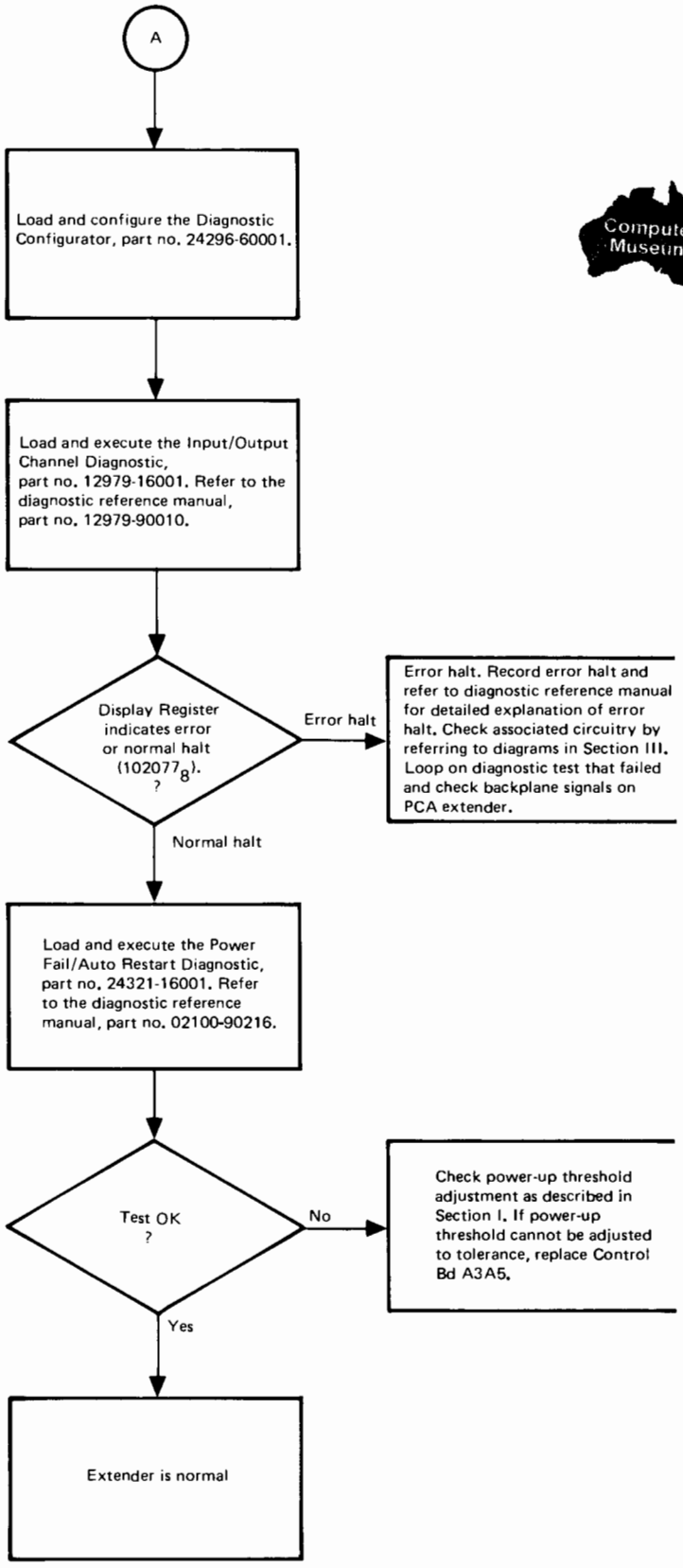
Only a digital voltmeter is required for basic checkout procedure. However, it is recommended that the test equipment listed in table 3-1 be available for troubleshooting.

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.

Table 3-1. Recommended Test Equipment and Servicing Devices

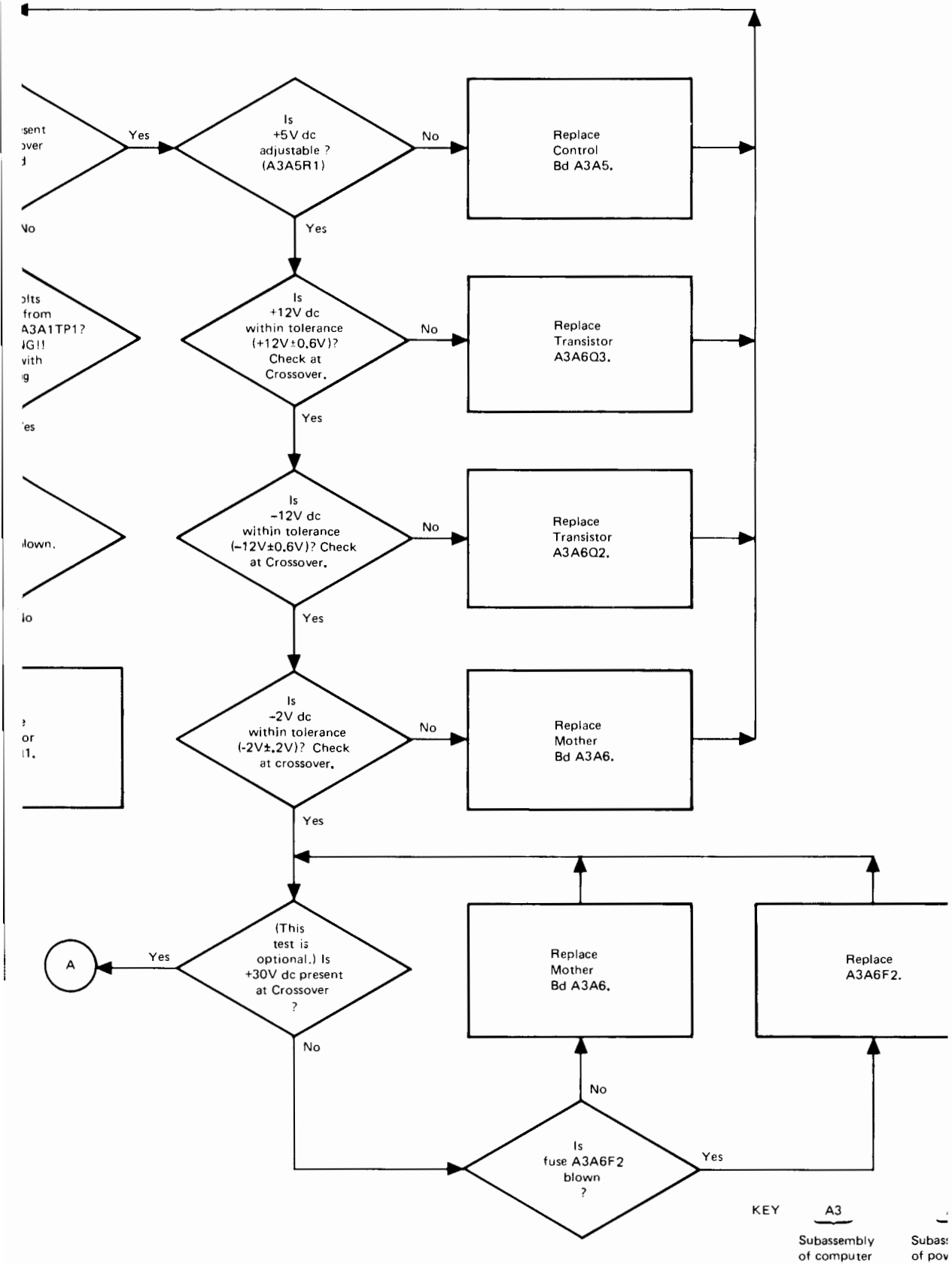
INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED HP MODEL
Dual-track oscilloscope	Rise time: ≤10 ns. Vertical deflection: 1 volt/division and 10 volts/division (including attenuator probe, if used). Horizontal sweep speed: 0.1 microsecond/division to 1 second/division.	HP 180A Oscilloscope with 10004A 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 3470 Digital Voltmeter with HP 34702A Multimeter.
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 3470 Digital Voltmeter with HP 34702A Multimeter.
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 =2.0V ±0.2V.	HP 10525T
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
Vacuum cleaner	Must have flexible hose with small nozzle, vacuum port for hose, and pressure port for hose.	None
IC test clip	None	None

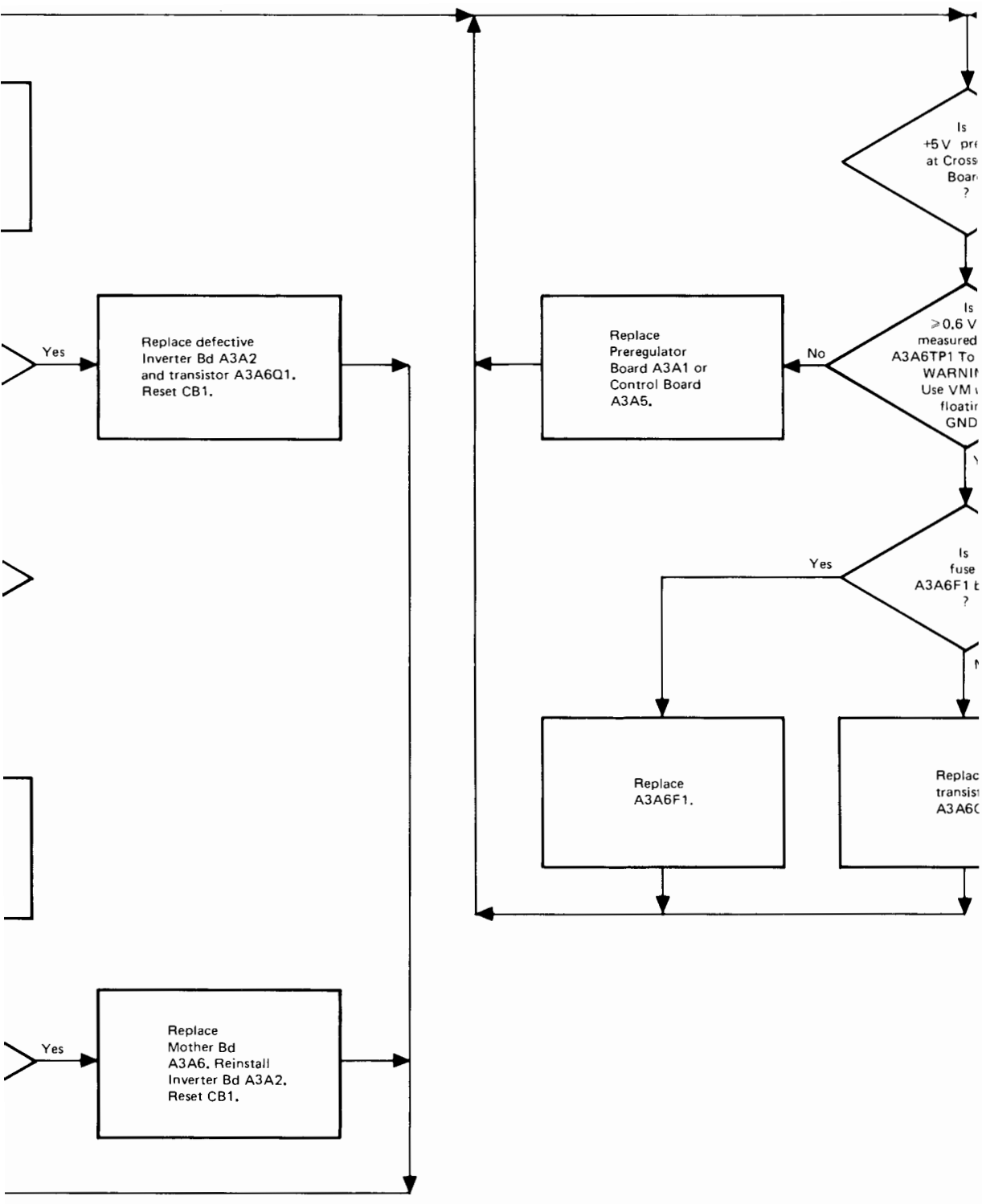


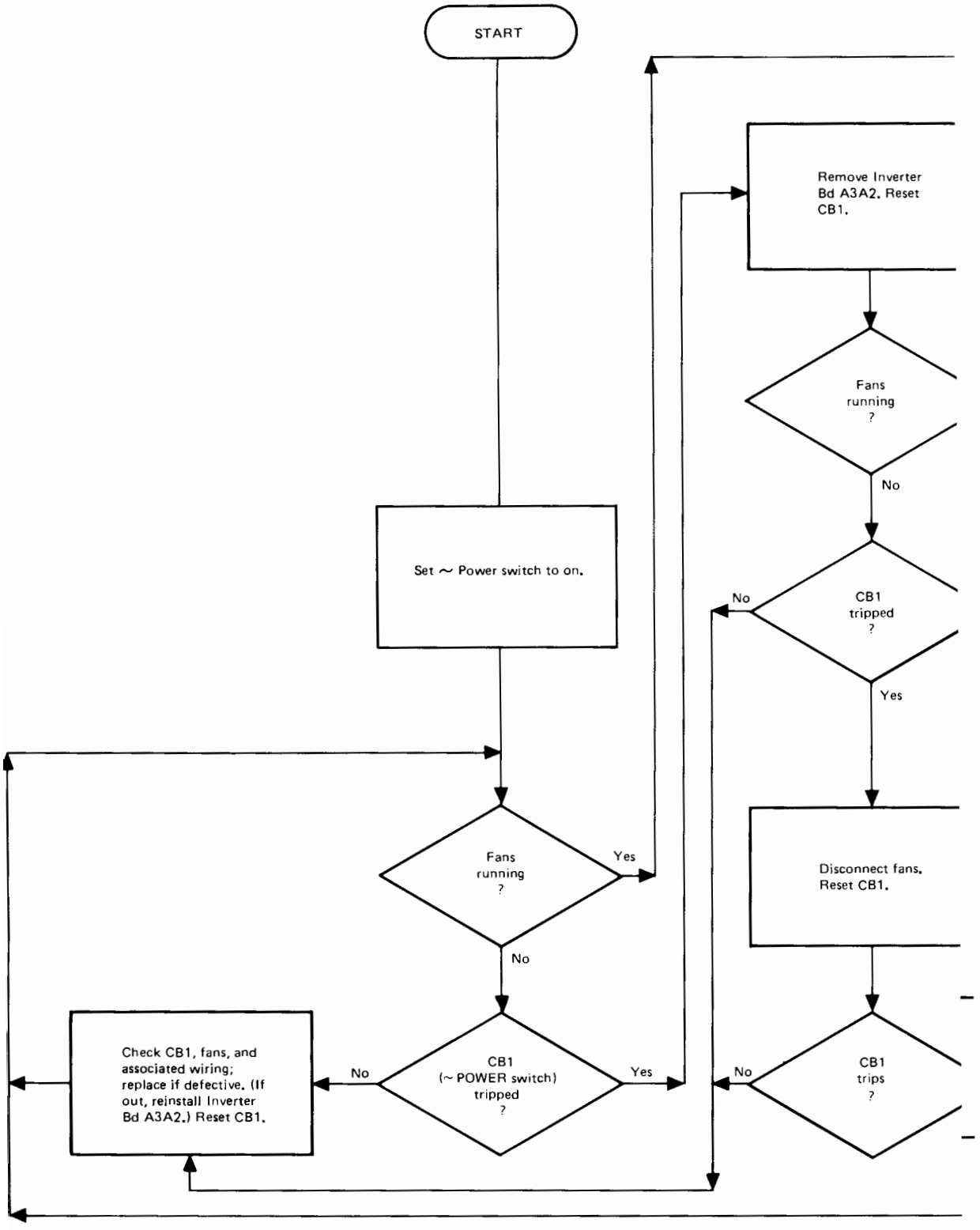
A1
embly
ver supply

TP1
Test point
on A1 Board

Figure 3-1. Troubleshooting Flowchart

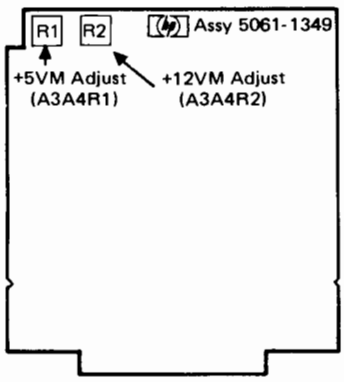

Yes
Is
+5V dc
adjustable ?
(A3A5R1)
No
Replace
Control
Bd A3A5.
Yes
Is
+12V dc
within tolerance
(+12V±0.6V)?
Check at
Crossover.
No
Replace
Transistor
A3A6Q3.
Yes
Is
-12V dc
within tolerance
(-12V±0.6V)? Check
at Crossover.
No
Replace
Transistor
A3A6Q2.
Yes
Is
-2V dc
within tolerance
(-2V±.2V)? Check
at crossover.
No
Replace
Mother
Bd A3A6.
Yes
(This
test is
optional.) Is
+30V dc present
at Crossover
?
Yes
A
No
Replace
Mother
Bd A3A6.
Replace
A3A6F2.
No
Is
fuse A3A6F2
blown
?
Yes
KEY
A3
Subassembly
of computer

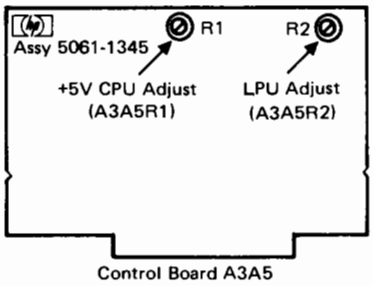

Is
+5 V pr
at Cross
Boar
?
Is
≥0.6 V
measured
A3A6TP1 To
WARNI
Use VM
floatir
GND
No
Replace
Preregulator
Board A3A1 or
Control Board
A3A5.
Yes
Replace defective
Inverter Bd A3A2
and transistor A3A6Q1.
Reset CB1.
Yes
Is
fuse
A3A6F1 b
?
Yes
Replace
A3A6F1.
Replac
transis
A3A6
Yes
Replace
Mother Bd
A3A6. Reinstall
Inverter Bd A3A2.
Reset CB1.

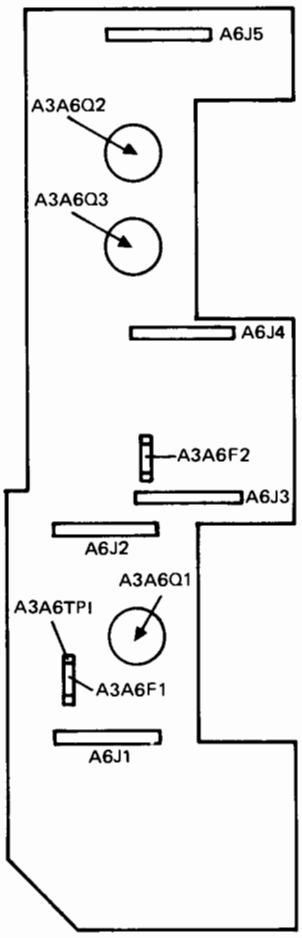

START
Set ~ Power switch to on.
Fans running ?
Yes
No
CB1 (~ POWER switch) tripped ?
No
Yes
Check CB1, fans, and associated wiring; replace if defective. (If out, reinstall Inverter Bd A3A2.) Reset CB1.
Remove Inverter Bd A3A2. Reset CB1.
Fans running ?
No
CB1 tripped ?
No
Yes
Disconnect fans. Reset CB1.
CB1 trips ?
No

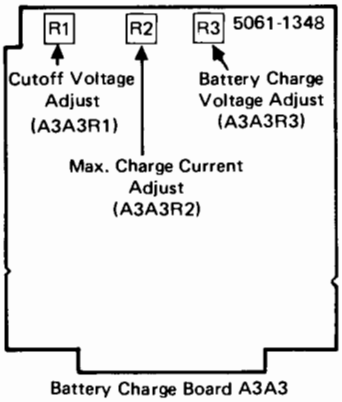
7700-331

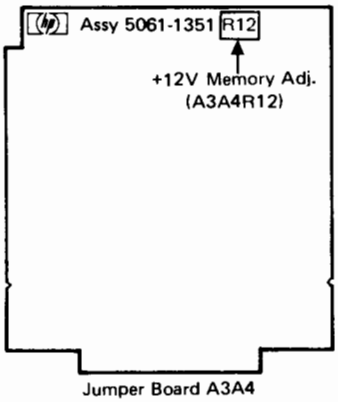
PARTS LOCATION BY ASSEMBLY FOR THE POWER SUPPLY

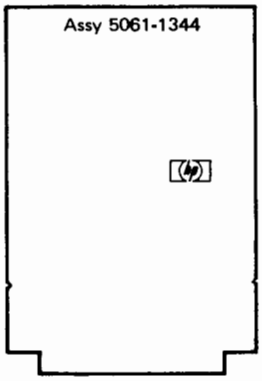


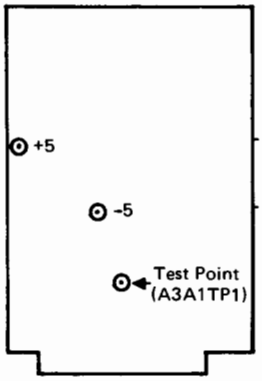












Description	New Part #	
Preregulator BD, A3A1	5061-1347	Pwr Supply A3. 5061-1356 (New)
Inverter BD, A3A2	5061-1344	
Jumper BD, A3A4	5061-1351	
Control BD, A3A5	5061-1345	
Mother BD, A3A6	5061-1371	

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

NOTE

If computer 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 computer is in the run mode, and again while the computer 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. Remove extender front panel; set the ~POWER switch to OFF.

b. Remove extender top and rear covers.

WARNING

Dangerous ac line voltage is present in the extender even though the ~POWER switch has been turned off. 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 computer, check all maintenance switches for proper operating positions.

e. Turn extender ~POWER 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 1-34.

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 **Manual 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 are included in the appropriate computer operating manual.

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

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.

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	02100-90213	24318-16001
Power Fail/Auto Restart	02100-90216	24321-16001

NOTE

When running the diagnostic test of an I/O card in the I/O extender, the extender's I/O bus switch must be locked to the port at which the test computer is connected.

3-10. TEST SEQUENCE

Perform the diagnostic program procedures for the extender listed in paragraph 3-9. (If your extender includes the optional DCPC, run the DCPC diagnostic test also.) 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 computer operator panel. If the selected I/O slot interrupts properly, the computer goes to a normal halt. If the selected I/O slots does not interrupt, the program will loop and allow the signals at the extender backplanes to be tested with a PCA extender and oscilloscope.

3-12. POWER SUPPLY TROUBLESHOOTING

Power supply troubleshooting is aimed at isolating and replacing a faulty power supply component or subassembly. (In some cases the entire power supply must be replaced.) If the power supply troubleshooting procedures given in the flowchart fail to correct the trouble, notify your nearest HP Sales and Service Office. A list of HP Sales and Service Offices is given in the rear 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 intervals of six months or less depending upon the physical conditions prevailing at the particular site. Performance once every six months is adequate for most sites.

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

a. HP 21MX Series Computer.

b. Vacuum cleaner for removing dust from the extender.

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

3-16. PROCEDURE. Before starting preventive maintenance, connect extender to the HP 21MX Computer Series 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.

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 ~POWER 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 connection 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 ~POWER 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 1-34.

3-22. Diagnostic Programs. When feasible, run the diagnostic programs as described in paragraph 1-38.

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 1-33 through 1-35 for power supply adjustment procedures.

3-25. REMOVAL AND REPLACEMENT PROCEDURES

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 ~POWER switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury. Heed all WARNING — HAZARDOUS VOLTAGE labels.

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:

a. Set extender ~POWER 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 (16, figure 4-1), side, and bottom 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 bottom cover and proceed as follows:

a. Remove the nuts and washers from power terminals located on PCA. (See figure 3-2.)

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

c. Carefully disengage extender control PCA from I/O backplanes and remove PCA.

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

a. Carefully insert power terminals through extender control PCA (figure 3-2) and secure terminals to PCA with the nuts and washers.

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

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

d. Secure extender control PCA to bottom of extender mainframe using screws and washers.

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 ~POWER switch to OFF.

b. Remove I/O PCA cage cover (14, figure 4-1).

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.

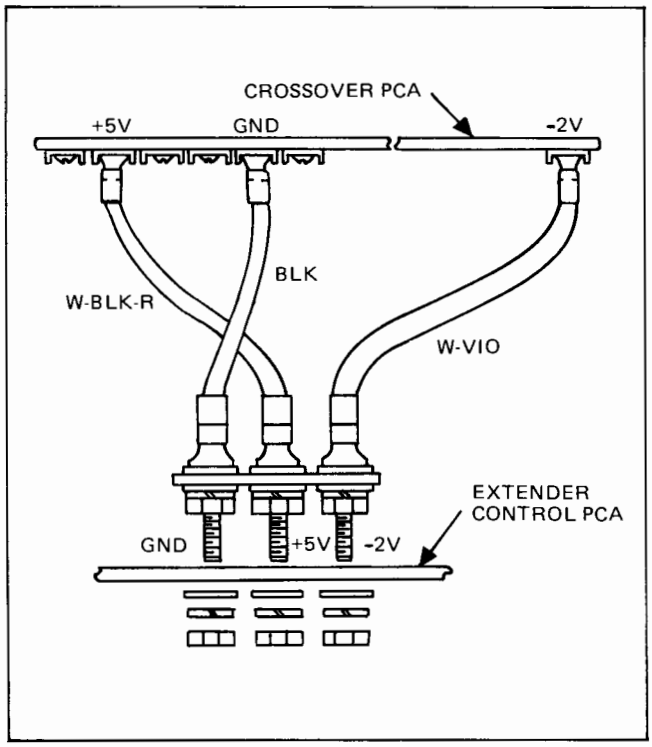


Figure 3-2. Extender Control Power Connections

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 ~POWER switch to OFF.

b. Remove the screw from I/O PCA retainer (15, figure 4-1). Lift retainer off standoff and remove.

c. 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

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 ~POWER switch to OFF.

b. Remove the screw from I/O PCA retainer (15, figure 4-1). Lift retainer off standoff and remove.

c. 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 top cover.

b. Remove all cable connections from crossover PCA. (See figure 3-3.)

c. Remove screws and washers securing crossover PCA to I/O PCA cage covers.

d. Carefully remove crossover PCA.

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

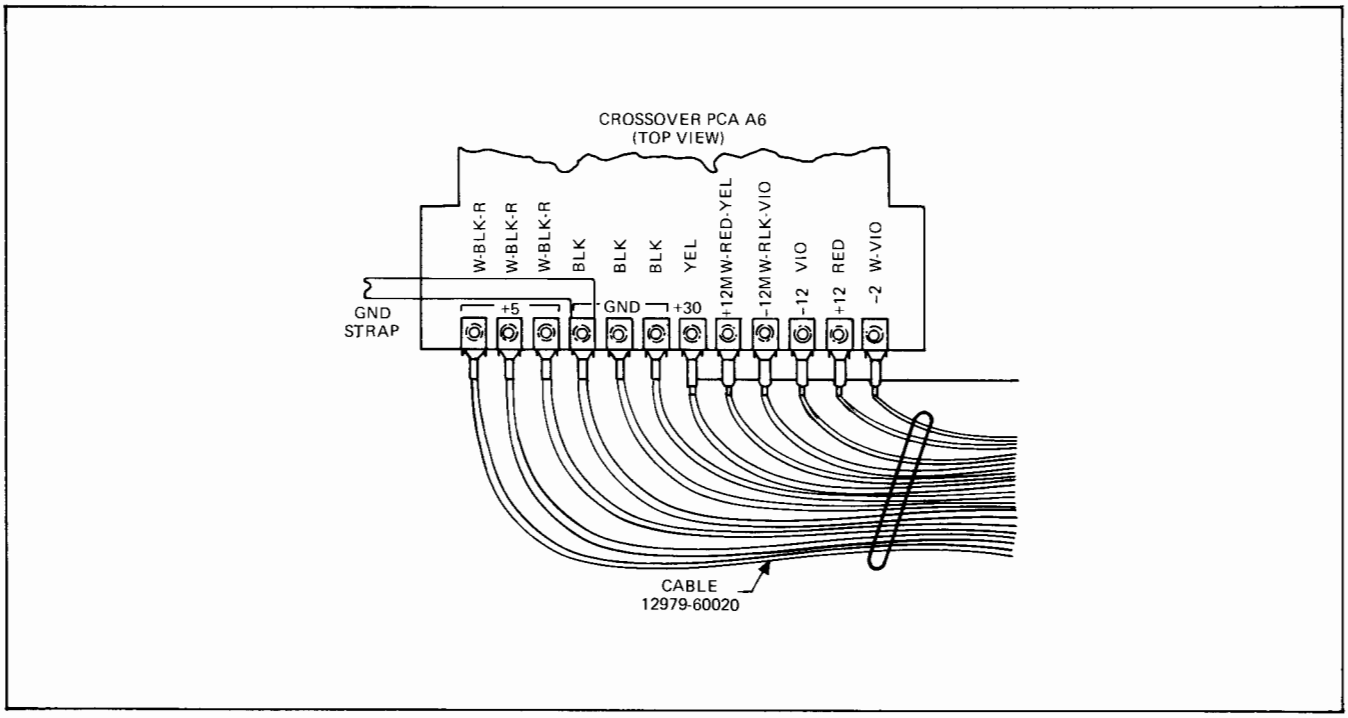
a. Position crossover PCA with receptacles in contact with the I/O backplane connectors.

b. Press downward on back of receptacles to seat backplane connectors fully into crossover PCA receptacles.

c. Secure crossover PCA to I/O PCA cage covers using the screws and washers.

d. Reconnect all cable connections to crossover PCA (figure 3-3).

e. Replace top cover.



7700-60

Figure 3-3. Crossover PCA Power Connections

3-42. I/O BACKPLANES

3-43. REMOVAL. Remove the I/O backplanes (6 and 7, 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 screws and washers securing crossover PCA to PCA cage covers. 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 front panel and proceed as follows:

a. Slide the two power supply retaining latches towards each other so that they disengage from the mainframe deck studs.

b. Disconnect the two cables from the front of the power supply.

c. Remove the two screws and washers from the bottom of the power supply rear panel.

d. Carefully withdraw the power supply from the rear of the extender.

3-47. REPLACEMENT. Replace power supply in reverse order of the removal procedure.

3-48. 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 3-4 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 ~POWER switch to OFF and DISCONNECT THE POWER CORD!! Failure to observe this precaution can result in serious injury.

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

b. Remove the power supply from the extender and remove power supply top cover.

c. Remove the two screws securing the terminal block cover at the rear of the power supply and remove the cover.

d. For 110V ac operation, disconnect jumper wire indicated by the dashed line on the terminal block (TB1) cover; connect jumper wires as shown by the solid lines. Connect the wires to the circuit breaker (~POWER switch) as shown on top of the circuit breaker for 120 VAC.

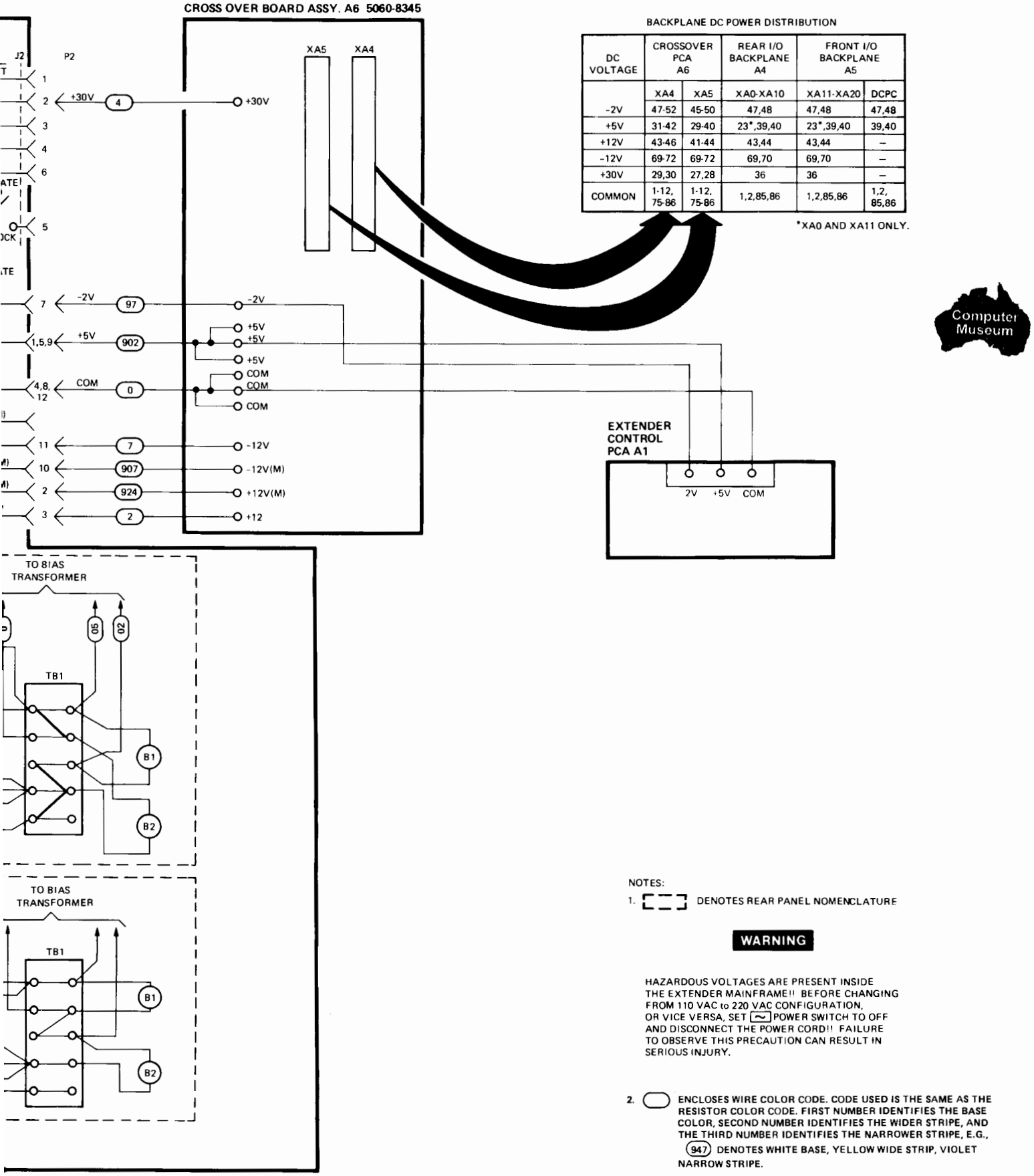
e. For 220V ac operation, disconnect jumper wires from the terminal block as indicated by the solid lines on the terminal block (TB1) cover; connect a jumper wire on the terminal block as shown by the dashed line. Connect the wires to the circuit breaker (~POWER switch) as shown on top of the circuit breaker for 230 VAC.

f. Replace the power supply top cover and replace power supply in the extender.

g. On rear of power supply, remove metal plate showing line voltage data; reverse plate and reinstall to show line data as reconfigured.

3-49. 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.



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	23*,39,40	23*,39,40	39,40
+12V	43-46	41-44	43,44	43,44	–
-12V	69-72	69-72	69,70	69,70	–
+30V	29,30	27,28	36	36	–
COMMON	1-12, 75-86	1-12, 75-86	1,2,85,86	1,2,85,86	1,2, 85,86

*XA0 AND XA11 ONLY.

NOTES:

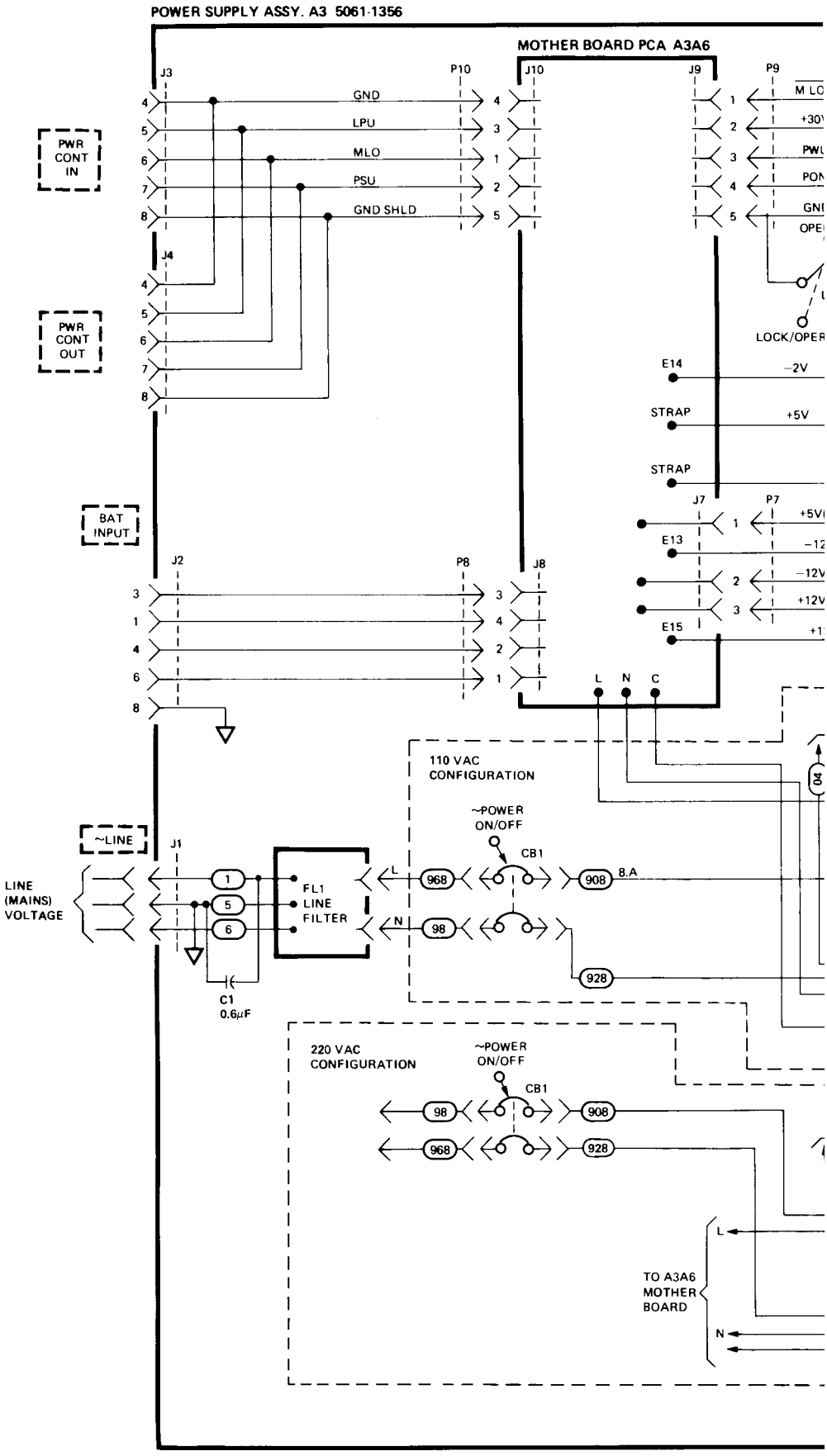
1. [ ] DENOTES REAR PANEL NOMENCLATURE

WARNING

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

2. ( ) ENCLOSES WIRE COLOR CODE. CODE USED IS THE SAME AS THE RESISTOR COLOR CODE. FIRST NUMBER IDENTIFIES THE BASE COLOR, SECOND NUMBER IDENTIFIES THE WIDER STRIPE, AND THE THIRD NUMBER IDENTIFIES THE NARROWER STRIPE, E.G., (947) DENOTES WHITE BASE, YELLOW WIDE STRIP, VIOLET NARROW STRIPE.

Figure 3-4. Power Distribution Diagram


POWER SUPPLY ASSY. A3 5061-1356
MOTHER BOARD PCA A3A6
PWR CONT IN
PWR CONT OUT
BAT INPUT
~LINE
J3
P10
J10
J9
P9
J4
J2
P8
J8
J7
P7
J1
GND
LPU
MLO
PSU
GND SHLD
E14
STRAP
E13
E15
L
N
C
110 VAC CONFIGURATION
~POWER ON/OFF
CB1
LINE (MAINS) VOLTAGE
FL1 LINE FILTER
C1 0.6μF
8.A
220 VAC CONFIGURATION
TO A3A6 MOTHER BOARD
7700-81A

3-50. 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 referrred 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.

3-51. 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.

3-52. POWER DISTRIBUTION

Figure 3-4 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.

3-53. INPUT/OUTPUT TIMING

The input/output timing diagram in figure 3-5 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.

3-54. PARTS LOCATION AND SCHEMATIC DIAGRAMS

Figures 3-6 through 3-8 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.

Replaceable parts for the extender power supply are indicated and listed in section IV.

3-55. 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.

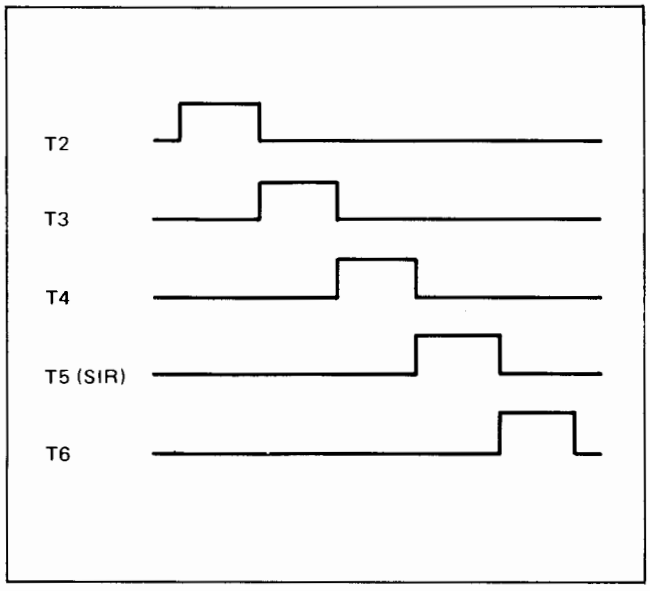


Figure 3-5. Input/Output Timing

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
IENXR	Interrupt Enable Extender Rear I/O Cage	23
IENXF	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
$\overline{\text{PEN}}$	"Not" Port Enable	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
PRLX	Priority Low Extender	85
PON	Power On	87
POPIO	Power On Preset I/O	88
PRL	Priority Low CPU	89
PRLXR	Priority Low Extender Rear I/O Cage	90
PRLXF	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. 1	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" DMA Channel 1 Request	108
$\overline{\text{REQ2}}$	"Not" DMA Channel 2 Request	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
SCLX1	Extender Select Code Least Significant bit 1	118

Table 3-3. Signal Index (Continued)

SIGNAL MNEMONIC	DEFINITION	REF. NO.
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
$\overline{\text{DMAREQ1}}$	"Not" DMA Channel 1 Request	152
$\overline{\text{DMAREQ2}}$	"Not" DMA Channel 2 Request	153

Table 3-4. Signal Distribution Lists

INPUT/OUTPUT BACKPLANE A4					FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
													72			1
													76			2
													78			3
													80			4
													81			5
													82			6
21	21	21	21	21	21	21	21	21	21	21	21	21				7
7	7	7	7	7	7	7	7	7	7	7	7	7				8
13	13	13	13	13	13	13	13	13	13	13	13	13				9
62	62	62	62	62	62	62	62	62	62	62	62	62				10
46	46	46	46	46	46	46	46	46	46	46	46	46				11
4/49	4/49	4/49	4													12
			49	4/49	4/49	4/49	4/49	4/49	4/49	4/49	4					13
											49	4/49				14
10	10	10	10	10	10	10	10	10	10	10	10	10				15
																16
																17
																18
																19
																20
																21
																22
8	8	8	8	8												23
					8/23†	8	8	8	8	8	8	8				24
																25

DENOTES BIDIRECTIONAL SIGNAL

REF. NO.	SIGNAL	EXTENDER CONTROL PCA A1				POWER SUPPLY A3	REAR BA			
		TO CPU J3	TO I/O EXT PCA							
		J1/J2	J3/J6	XA4	XA5	**	XA0	XA1	XA2	XA3
1	BSC0				68					
2	BSC 1				70					
3	BSC2				72					
4	BSC3				74					
5	BSC4				75					
6	BSC5				76					
7	CLC		J	21	21		21	21	21	21
8	CLF		2	7	7		7	7	7	7
9	CRS		5	13	13		13	13	13	13
10	EDT		20	67	62		62	62	62	62
11	ENF		R	53	48		46	46	46	46
12	FLGX0			3	56		4 / 49	4 / 49	4 / 49	4 / 4
13	FLGX1			6	49					
14	FLGX2				51					
15	IAK		D	10	10		10	10	10	10
16	$\overline{IA0}$	48								
17	$\overline{IA1}$	46								
18	$\overline{IA2}$	44								
19	$\overline{IA3}$	42								
20	$\overline{IA4}$	40								
21	$\overline{IA5}$	38								
22	IEN		C							
23	IENXR			23	54		8 / 23†	8	8	8
24	IENAF			8	8					
25	$\overline{INTX}$	36								

* PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

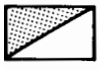
** SEE FIGURE 3-5

† +5V FROM CROSSOVER PCA A6

DENOTES SIGNAL SOURCE

Table 3-4. Signal Distribution Lists (Continued)

PUT/OUTPUT PLANE A4					FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
																26
																27
																28
																29
																30
																31
																32
																33
																34
																35
																36
																37
																38
																39
																40
																41
18	18	18	18	18	18	18	18	18	18	18	18	18				42
26	26	26	26	26	26	26	26	26	26	26	26	26				43
29	29	29	29	29	29	29	29	29	29	29	29	29				44
30	30	30	30	30	30	30	30	30	30	30	30	30				45
64	64	64	64	64	64	64	64	64	64	64	64	64				46
77	77	77	77	77	77	77	77	77	77	77	77	77				47
80	80	80	80	80	80	80	80	80	80	80	80	80				48
81	81	81	81	81	81	81	81	81	81	81	81	81				49
84	84	84	84	84	84	84	84	84	84	84	84	84				50

 DENOTES BIDIRECTIONAL SIGNAL

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REAR IN BACK				
		J1/J2	J3/J6	XA4	XA5	**	XA0	XA1	XA2	XA3	
26	IOB0		M								
27	IOB1		11								
28	IOB2		N								
29	IOB3		14								
30	IOB4		12								
31	IOB5		S								
32	IOB6		T								
33	IOB7		16								
34	IOB8		17								
35	IOB9		U								
36	IOB10		V								
37	IOB11		19								
38	IOB12		18								
39	IOB13		W								
40	IOB14		X								
41	IOB15		AA								
42	$\overline{\text{PEN}}$		H	18	18		18	18	18	18	
43	IOBI0			26	26		26	26	26	26	
44	IOBI1			29	29		29	29	29	29	
45	IOBI2			30	30		30	30	30	30	
46	IOBI3			68	64		64	64	64	64	
47	IOBI4			77	77		77	77	77	77	
48	IOBI5			80	80		80	80	80	80	
49	IOBI6			81	81		81	81	81	81	
50	IOBI7			84	84		84	84	84	84	

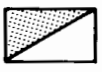
*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

Table 3-4. Signal Distribution Lists (Continued)

INPUT/OUTPUT CKPLANE A4					FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
27	27	27	27	27	27	27	27	27	27	27	27	27				51
28	28	28	28	28	28	28	28	28	28	28	28	28				52
31	31	31	31	31	31	31	31	31	31	31	31	31				53
60	60	60	60	60	60	60	60	60	60	60	60	60				54
78	78	78	78	78	78	78	78	78	78	78	78	78				55
79	79	79	79	79	79	79	79	79	79	79	79	79				56
82	82	82	82	82	82	82	82	82	82	82	82	82				57
83	83	83	83	83	83	83	83	83	83	83	83	83				58
35	35	35	35	35	35	35	35	35	35	35	35	35	35	28	21	59
38	38	38	38	38	38	38	38	38	38	38	38	38	38	62	22	60
41	41	41	41	41	41	41	41	41	41	41	41	41	41	54	24	61
45	45	45	45	45	45	45	45	45	45	45	45	45	45	56	26	62
42	42	42	42	42	42	42	42	42	42	42	42	42	42	53	23	63
51	51	51	51	51	51	51	51	51	51	51	51	51	51	58	52	64
53	53	53	53	53	53	53	53	53	53	53	53	53		60	54	65
52	52	52	52	52	52	52	52	52	52	52	52	52		55	51	66
54	54	54	54	54	54	54	54	54	54	54	54	54		57	53	67
56	56	56	56	56	56	56	56	56	56	56	56	56		59	56	68
58	58	58	58	58	58	58	58	58	58	58	58	58		63	58	69
55	55	55	55	55	55	55	55	55	55	55	55	55		61	55	70
57	57	57	57	57	57	57	57	57	57	57	57	57		65	57	71
61	61	61	61	61	61	61	61	61	61	61	61	61		67	59	72
65	65	65	65	65	65	65	65	65	65	65	65	65		68	73	73
74	74	74	74	74	74	74	74	74	74	74	74	74		73	74	74
15	15	15	15	15	15	15	15	15	15	15	15	15	15			75



DENOTES BIDIRECTIONAL SIGNAL

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REAR BA			
		J1/J2	J3/J6	XA4	XA5	**	XA0	XA1	XA2	XA3
51	IOBI8			27	27		27	27	27	27
52	IOBI9			28	28		28	28	28	28
53	IOBI10			31	31		31	31	31	31
54	IOBI11			65	60		60	60	60	60
55	IOBI12			78	78		78	78	78	78
56	IOBI13			79	79		79	79	79	79
57	IOBI14			82	82		82	82	82	82
58	IOBI15			83	83		83	83	83	83
59	IOBO0			35			35	35	35	35
60	IOBO1			38			38	38	38	38
61	IOBO2			42			41	41	41	41
62	IOBO3			46			45	45	45	45
63	IOBO4			44			42	42	42	42
64	IOBO5			57			51	51	51	51
65	IOBO6			59			53	53	53	53
66	IOBO7			58			52	52	52	52
67	IOBO8			60			54	54	54	54
68	IOBO9			62			56	56	56	56
69	IOBO10			64			58	58	58	58
70	IOBO11			61			55	55	55	55
71	IOBO12			63			57	57	57	57
72	IOBO13			66			61	61	61	61
73	IOBO14			69			65	65	65	65
74	IOBO15			74			74	74	74	74
75	IOG		F	16	15		15	15	15	15

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

Table 3-4. Signal Distribution Lists (Continued)

'UT/OUTPUT 'LANE A4					FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
24	24	24	24	24	24	24	24	24	24	24	24	24				76
20	20	20	20	20	20	20	20	20	20	20	20	20				77
				33	6							33				78
					33	6										79
						33	6									80
6							33	6								81
33	6							33	6							82
	33	6							33	6						83
		33	6							33	6					84
																85
																86
66	66	66	66	66	66	66	66	66	66	66	66	66				87
17	17	17	17	17	17	17	17	17	17	17	17	17				88
																89
				3												90
												3				91
																92
																93
																94
23†																95
3	23†															96
	3	23†														97
		3	23†													98
			3	23†												99
					3	23†										100

DENOTES BIDIRECTIONAL SIGNAL

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REAR IN BACK			
		J1/J2	J3/J6	XA4	XA5	**	XA0	XA1	XA2	XA3
76	IOI		9	24	24		24	24	24	24
77	IOO		7	20	20		20	20	20	20
78	IRQX1			33	23		33	6		
79	IRQX2			34	34			33	6	
80	IRQX3								33	6
81	IRQX4									33
82	IRQX5									
83	IRQX6									
84	IRQX7									
85	PRLX	22								
86										
87	PON		Y	70	66		66	66	66	66
88	POPIO		6	17	19		17	17	17	17
89	PRL		K							
90	PRLXR			4	55					
91	PRLXF				3					
92	PRLX0/PRHX1						3	23†		
93	PRLX1/PRHX2							3	23†	
94	PRLX2/PRHX3								3	23†
95	PRLX3/PRHX4									3
96	PRLX4/PRHX5									
97	PRLX5/PRHX6									
98	PRLX6/PRHX7									
99	PRLX7/PRHX10									
100	PRLX11/PRHX12									

* PIN ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

** SEE FIGURE 3-5

† +5V FROM CROSSOVER PCA A6

DENOTES SIGNAL SOURCE

Table 3-4. Signal Distribution Lists (Continued)

INPUT/OUTPUT BACKPLANE A4					FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
						3	23†									101
							3	23†								102
								3	23†							103
									3	23†						104
										3	23†					105
											3	23†				106
																107
													52			108
													56			109
50	50	50	50	50	50	50	50	50	50	50	50	50				110
													68			111
													67			112
													71			113
													74			114
													77			115
													79			116
			34	16							34	16				117
				34	16							34				118
					34	16										119
						34	16									120
16							34	16								121
34	16							34	16							122
	34	16							34	16						123
		34	16							34	16					124
14/37	14/37	14/37	14													125

DENOTES BIDIRECTIONAL SIGNAL

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REAR I BAC			
		J1/J2	J3/J6	XA4	XA5	**	XA0	XA1	XA2	XA3
101	PRLX12/PRHX13									
102	PRLX13/PRHX14									
103	PRLX14/PRHX15									
104	PRLX15/PRHX16									
105	PRLX16/PRHX17									
106	PRLX17/PRHX20									
107	PWU	26								
108	$\overline{\text{REQ1}}$	20								
109	$\overline{\text{REQ2}}$	18								
110	RUN		15	56	50		50	50	50	50
111	SCB0	16			65					
112	SCB1	14			61					
113	SCB2	12			67					
114	SCB3	10			69					
115	SCB4	8			71					
116	SCB5	6			73					
117	SCLX0			43	17		16			
118	SCLX1			45	41		34	16		
119	SCLX2			47	33			34	16	
120	SCLX3			48	35				34	16
121	SCLX4			49	38					34
122	SCLX5			50	40					
123	SCLX6			51	42					
124	SCLX7			52	47					
125	SCMX0			14	53		14 / 37	14 / 37	14 / 37	14 / 37

* PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

** SEE FIGURE 3-5

† +5V FROM CROSSOVER PCA A6

DENOTES SIGNAL SOURCE

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REAR IN BACK			
		J1/J2	J3/J6	XA4	XA5	**	XA0	XA1	XA2	XA3
126	SCMX1			15	14					
127	SCMX2				16					
128	SFC		B	5	5		5	5	5	5
129	SFS		L	25	25		25	25	25	25
130	SIR		10	32	32		32	32	32	32
131	SKF		E	12	12		12	12	12	12
132	SRQX0						19			
133	SRQX1							19		
134	SRQX2								19	
135	SRQX3									19
136	SRQX4									
137	SRQX5									
138	SRQX6									
139	SRQX7									
140	SRQX10									
141	SRQX11									
142	SRQX12									
143	SRQX13									
144	SRQX14									
145	SRQX15									
146	SRQX16									
147	SRQX17									
148	SRQX20									
149	STC		8	22	22	22	22	22	22	22
150	STF		3	9	9	9	9	9	9	9

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

Table 3-4. Signal Distribution Lists (Continued)

PUT/OUTPUT PLANE A4					FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
			37	14/37	14/37	14/37	14/37	14/37	14/37	14/37						126
											37	14/37				127
5	5	5	5	5	5	5	5	5	5	5	5	5				128
25	25	25	25	25	25	25	25	25	25	25	25	25				129
32	32	32	32	32	32	32	32	32	32	32	32	32				130
12	12	12	12	12	12	12	12	12	12	12	12	12				131
													57			132
													58			133
													59			134
													60			135
19													65			136
	19												64			137
		19											63			138
			19										62			139
				19									61			140
					19								24			141
						19							23			142
							19						22			143
								19					21			144
									19				16			145
										19			17			146
											19		18			147
												19	19			148
22	22	22	22	22	22	22	22	22	22	22	22	22				149
9	9	9	9	9	9	9	9	9	9	9	9	9				150

DENOTES BIDIRECTIONAL SIGNAL

Table 3-4. Signal Distribution Lists (Continued)

INPUT/OUTPUT ːKPLANE A4					FRONT INPUT/OUTPUT BACKPLANE A5									CROSSOVER PCA A6		REF. NO.
XA4	XA5	XA6	XA7	XA10	XA11	XA12	XA13	XA14	XA15	XA16	XA17	XA20	DCPC	XA4*	XA5*	
11	11	11	11	11	11	11	11	11	11	11	11	11				151

DENOTES BIDIRECTIONAL SIGNAL

REF. NO.	SIGNAL	TO CPU J3	TO I/O EXT PCA	EXTENDER CONTROL PCA A1		POWER SUPPLY A3	REA B			
		J1/J2	J3/J6	XA4	XA5	**	XA0	XA1	XA2	XA
151	T3		4	11	11	11	11	11	11	11
152	$\overline{\text{DMAREQ1}}$				57					
153	$\overline{\text{DMAREQ2}}$				59					

*PINS ACCESSIBLE FOR MAINTENANCE AT TOP OF CROSSOVER PCA A6

**SEE FIGURE 3-5

DENOTES SIGNAL SOURCE

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

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1 thru C7, C9 thru C17, C19 thru C22, C29 thru C43	0160-2055	CAPACITOR, fxd, cer, 0.01 μF, +80 −20%, 100 VDCW	56289	C023F101F103ZS-CDH
C8, 18	0180-0228	CAPACITOR, tant. elec., 22 μF, 10%, 15 VDCW	56289	150D226X9015B2-DYS
C24 thru C28	0180-0548	CAPACITOR, tant. elec., 56 μF, 10%, 6 VDCW	56289	150D566X9006B2
CR1	1890-0327	DIODE, LED	28480	1890-0327
R, R3 thru R7, 9, 11, 12, 15	1810-0121	RESISTOR NETWORK, met flm, 8 x 1k ohms, 5%	56289	203C84
R2, 13, 14, 17	1810-0132	RESISTOR NETWORK, met flm, 8 x 500 ohms, 5%	56289	203C88
R10, 16, 18	1810-0163	RESISTOR NETOWRK, met flm, 8 x 200 ohms, 5%	56289	203C91
R19	0683-4715	RESISTOR, comp, 470 ohms, 5%, 1/4k	01121	CB4715
U23	1820-0535	INTEGRATED CIRCUIT, dual 2-input AND driver, TTL	01295	SN16150
U13, 14, 24, 33, 34, 43, 44, 53, 54, 61, 62, 63, 64, 71, 72, 73, 74	1820-1080	INTEGRATED CIRCUIT, dual line driver, TTL	18324	N8T13B
U32	1820-1197	INTEGRATED CIRCUIT, quad 2-input NAND gate, TTL	01295	SN53504
U21, 22, 31, 41	1820-1477	INTEGRATED CIRCUIT, hex tri-state buffer, TTL	18324	8T95B

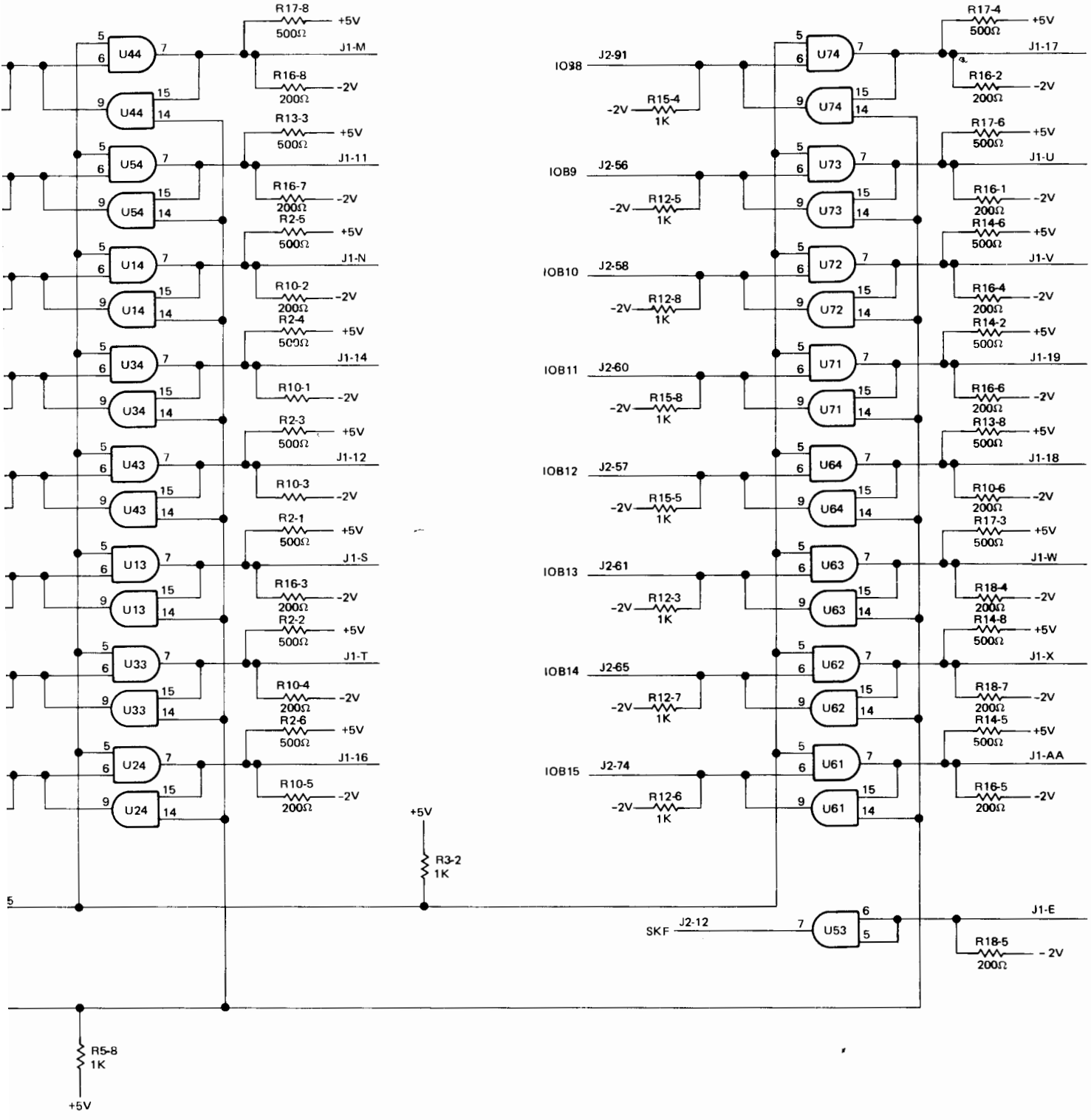
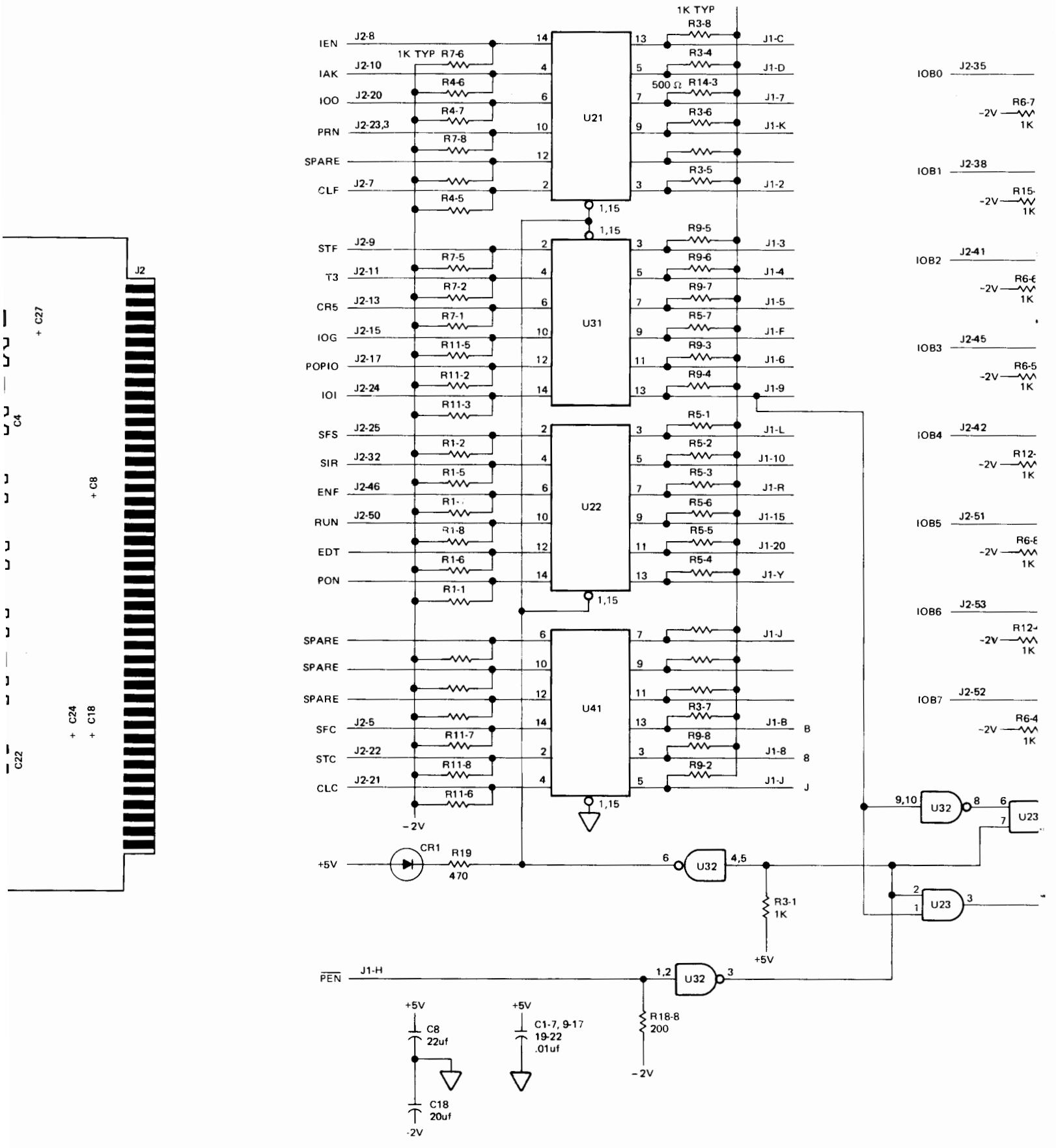
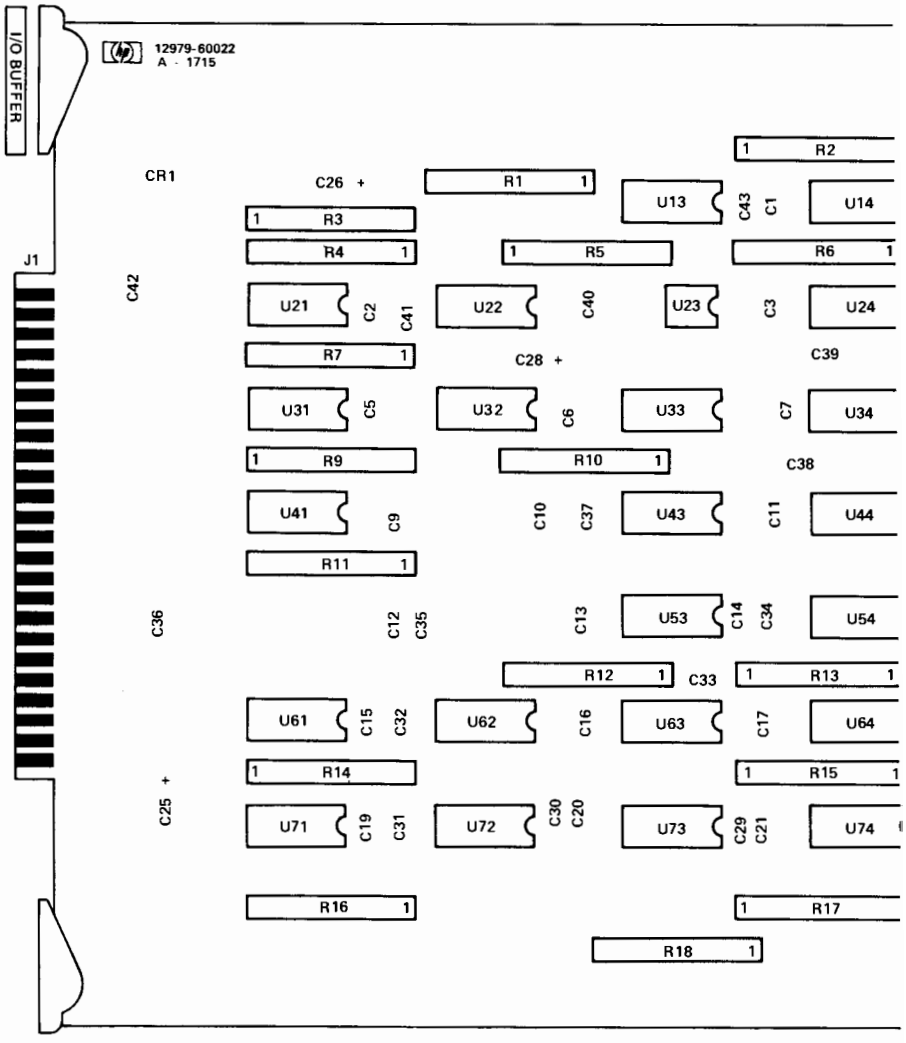


Figure 3-6. I/O Extender PCA (In Processor), Parts Location and Schematic Diagrams


1K TYP
IEN
J2-8
1K TYP R7-6
IAK
J2-10
IOO
J2-20
PRN
J2-23,3
SPARE
CLF
J2-7
R4-5
U21
R3-8
R3-4
500 Ω R14-3
R3-6
R3-5
J1-C
J1-D
J1-7
J1-K
J1-2
1,15
STF
J2-9
T3
J2-11
CR5
J2-13
IOG
J2-15
POPIO
J2-17
IOI
J2-24
R7-5
R7-2
R7-1
R11-5
R11-2
R11-3
U31
R9-5
R9-6
R9-7
R5-7
R9-3
R9-4
J1-3
J1-4
J1-5
J1-F
J1-6
J1-9
SFS
J2-25
SIR
J2-32
ENF
J2-46
RUN
J2-50
EDT
PON
R1-2
R1-5
R1-8
R1-6
R1-1
U22
R5-1
R5-2
R5-3
R5-6
R5-5
R5-4
J1-L
J1-10
J1-R
J1-15
J1-20
J1-Y
SPARE
SPARE
SPARE
SFC
J2-5
STC
J2-22
CLC
J2-21
R11-7
R11-8
R11-6
U41
R3-7
R9-8
R9-2
J1-J
J1-B
J1-8
J1-J
B
8
J
-2V
CR1
+5V
R19
470
U32
4,5
6
R3-1
1K
9,10
8
U23
2
1
3
PEN
J1-H
1,2
C8
22uf
C18
20uf
C1-7, 9-17
19-22
.01uf
R18-8
200
IOB0
J2-35
IOB1
J2-38
IOB2
J2-41
IOB3
J2-45
IOB4
J2-42
IOB5
J2-51
IOB6
J2-53
IOB7
J2-52
R6-7
R15-
R6-5
R12-
R6-4
1K
J2
C27
C4
C8
C24
C18
C22

7700-6B


I/O BUFFER
12979-60022
A - 1715
J1
CR1
C26 +
R1
U13
C43
C1
U14
R2
R3
R4
R5
R6
U21
C2
C41
U22
C40
U23
C3
U24
C42
R7
C28 +
C39
U31
C5
U32
C6
U33
C7
U34
R9
R10
C38
U41
C9
C10
C37
U43
C11
U44
R11
C36
C12
C35
C13
U53
C14
C34
U54
R12
C33
R13
U61
C15
C32
U62
C16
U63
C17
U64
R14
R15
C25 +
U71
C19
C31
U72
C30
C20
U73
C29
C21
U74
R16
R17
R18

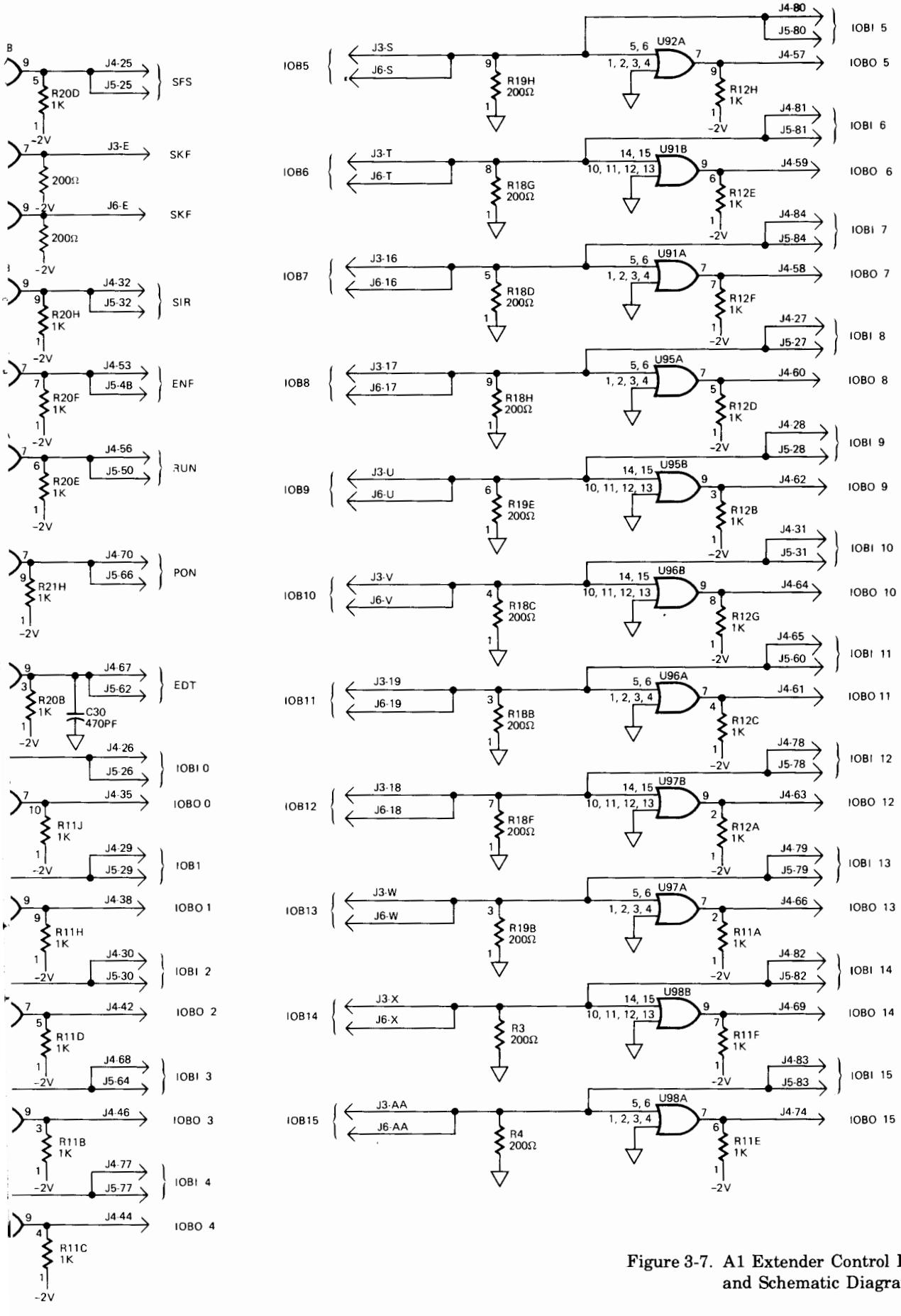
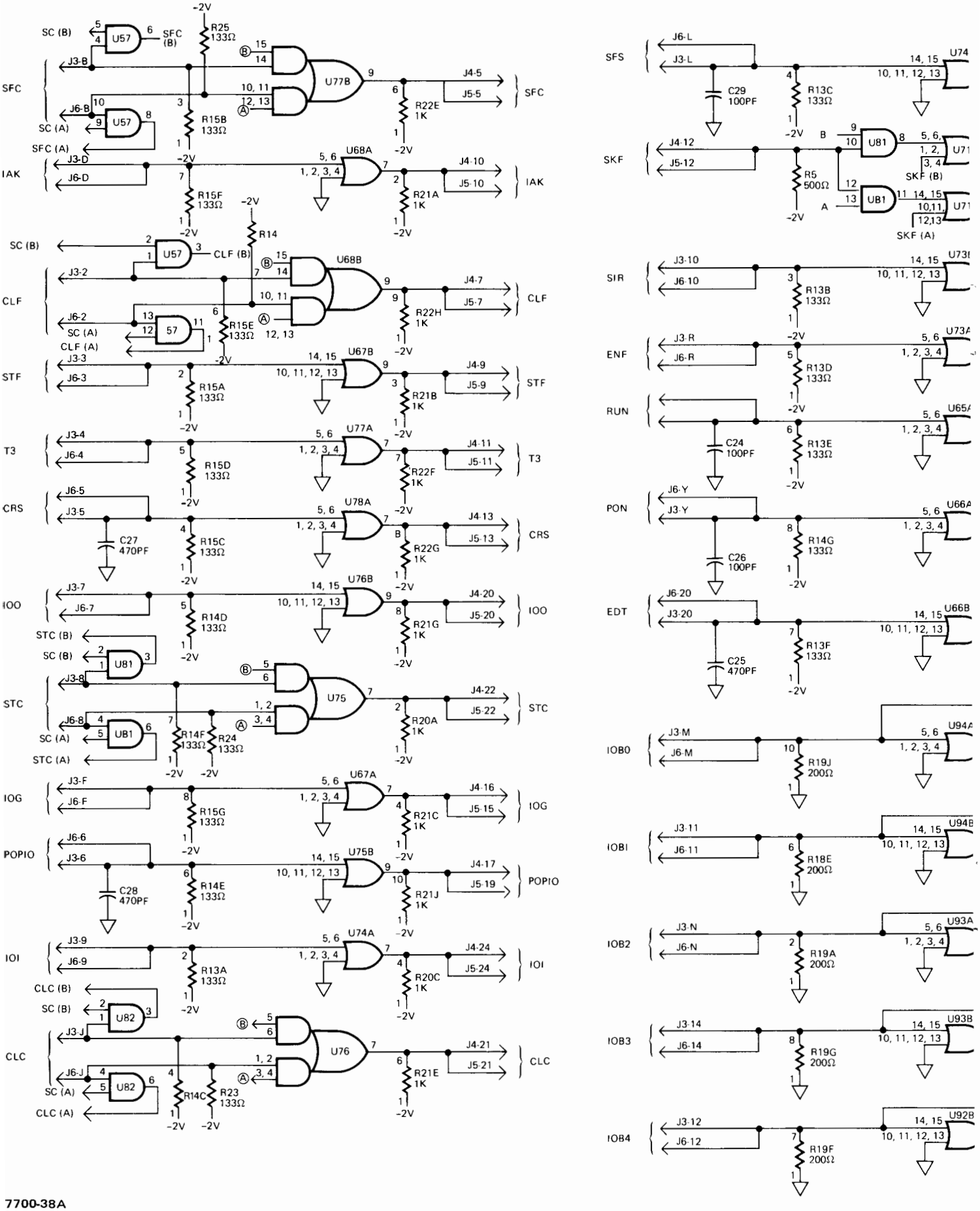
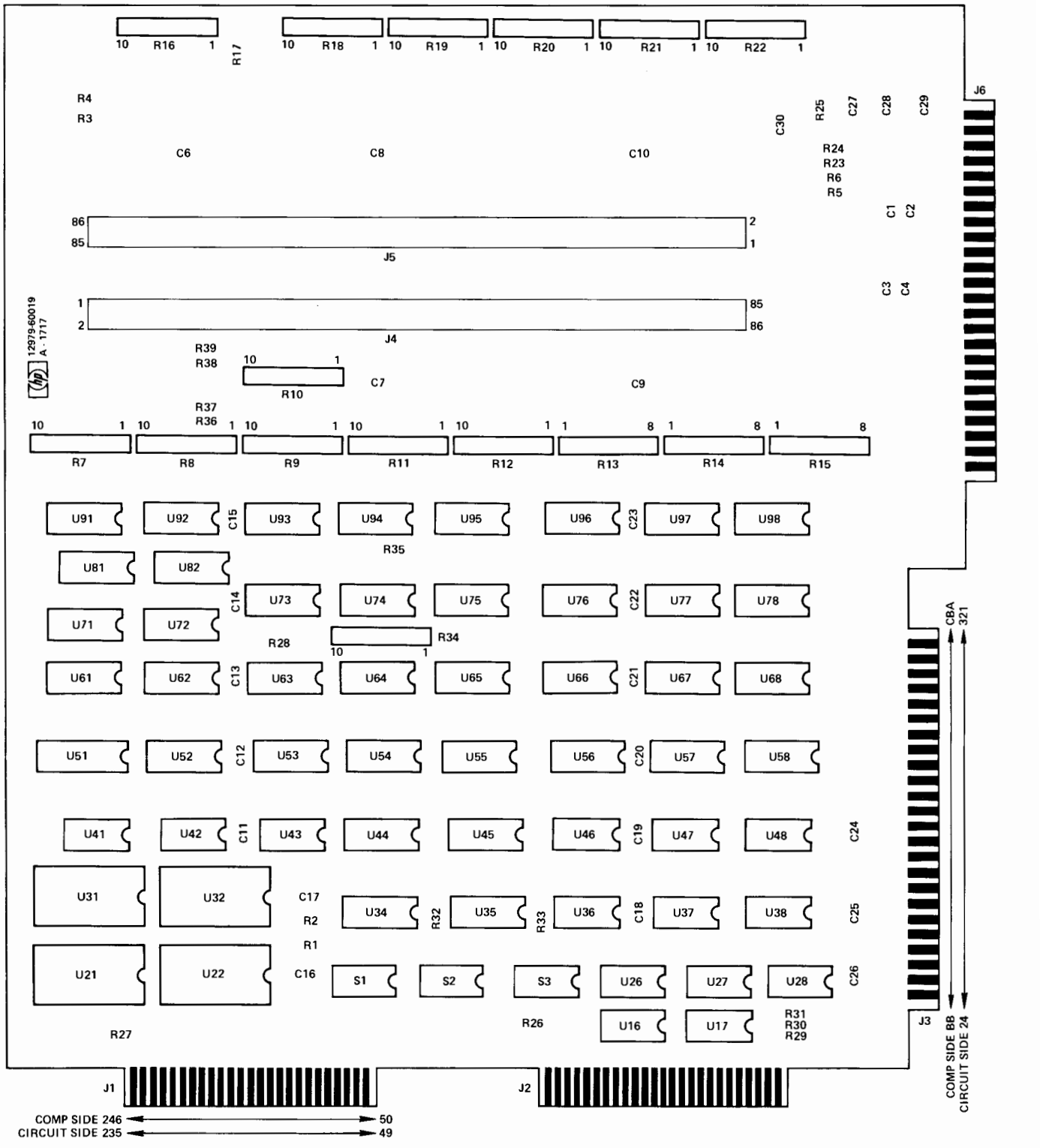


Figure 3-7. A1 Extender Control PCA, Parts Location and Schematic Diagrams (Sheet 1 of 3)


SC (B)
SFC (B)
SFC
SC (A)
SFC (A)
IAK
CLF
CLF (A)
STF
T3
CRS
IOO
STC (B)
STC
STC (A)
IOG
POPIO
IOI
CLC (B)
CLC
CLC (A)
SFS
SKF
SKF (B)
SKF (A)
SIR
ENF
RUN
PON
EDT
IOB0
IOB1
IOB2
IOB3
IOB4
-2V
U57
U77B
U68A
U68B
U67B
U77A
U78A
U76B
U81
U75
U67A
U75B
U74A
U82
U76
U74
U71
U73
U65
U66A
U66B
U94A
U94B
U93A
U93B
U92B
R25 133Ω
R15B 133Ω
R22E 1K
R15F 133Ω
R21A 1K
R14
R15E 133Ω
R22H 1K
R15A 133Ω
R21B 1K
R15D 133Ω
R22F 1K
R15C 133Ω
R22G 1K
R14D 133Ω
R21G 1K
R14F 133Ω
R24 133Ω
R20A 1K
R15G 133Ω
R21C 1K
R14E 133Ω
R21J 1K
R13A 133Ω
R20C 1K
R14C
R23 133Ω
R21E 1K
C27 470PF
C28 470PF
R13C 133Ω
C29 100PF
R5 500Ω
R13B 133Ω
R13D 133Ω
C24 100PF
R13E 133Ω
R14G 133Ω
C26 100PF
R13F 133Ω
C25 470PF
R19J 200Ω
R18E 200Ω
R19A 200Ω
R19G 200Ω
R19F 200Ω

7700-38A


10 R16 1
R17
10 R18 1
10 R19 1
10 R20 1
10 R21 1
10 R22 1
J6
R4
R3
C6
C8
C10
C30
R25
C27
C28
C29
R24
R23
R6
R5
C1
C2
86
85
2
1
J5
C3
C4
1
2
85
86
J4
12979-60019
A-1717
R39
R38
10 1
R10
C7
C9
R37
R36
10 1 10 1 10 1 10 1 10 1 1 8 1 8 1 8
R7
R8
R9
R11
R12
R13
R14
R15
U91
U92
C15
U93
U94
U95
U96
C23
U97
U98
R35
U81
U82
C14
U73
U74
U75
U76
C22
U77
U78
U71
U72
R28
10 1
R34
U61
U62
C13
U63
U64
U65
U66
C21
U67
U68
CBA
321
U51
U52
C12
U53
U54
U55
U56
C20
U57
U58
U41
U42
C11
U43
U44
U45
U46
C19
U47
U48
C24
U31
U32
C17
R2
R1
U34
R32
U35
R33
U36
C18
U37
U38
C25
U21
U22
C16
S1
S2
S3
U26
U27
U28
C26
R27
R26
U16
U17
R31
R30
R29
J3
J1
J2
COMP SIDE BB
CIRCUIT SIDE 24
COMP SIDE 246
CIRCUIT SIDE 235
50
49

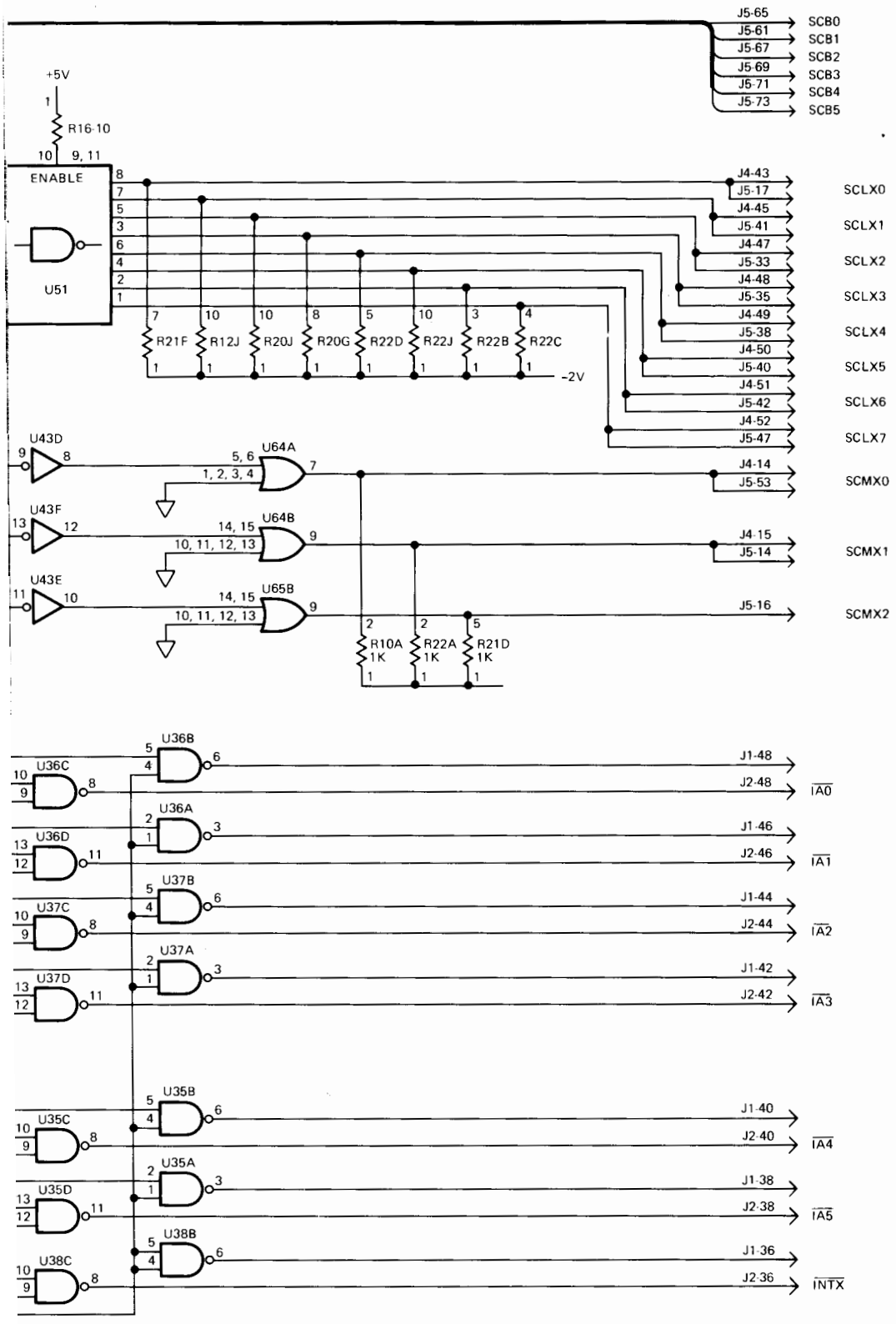
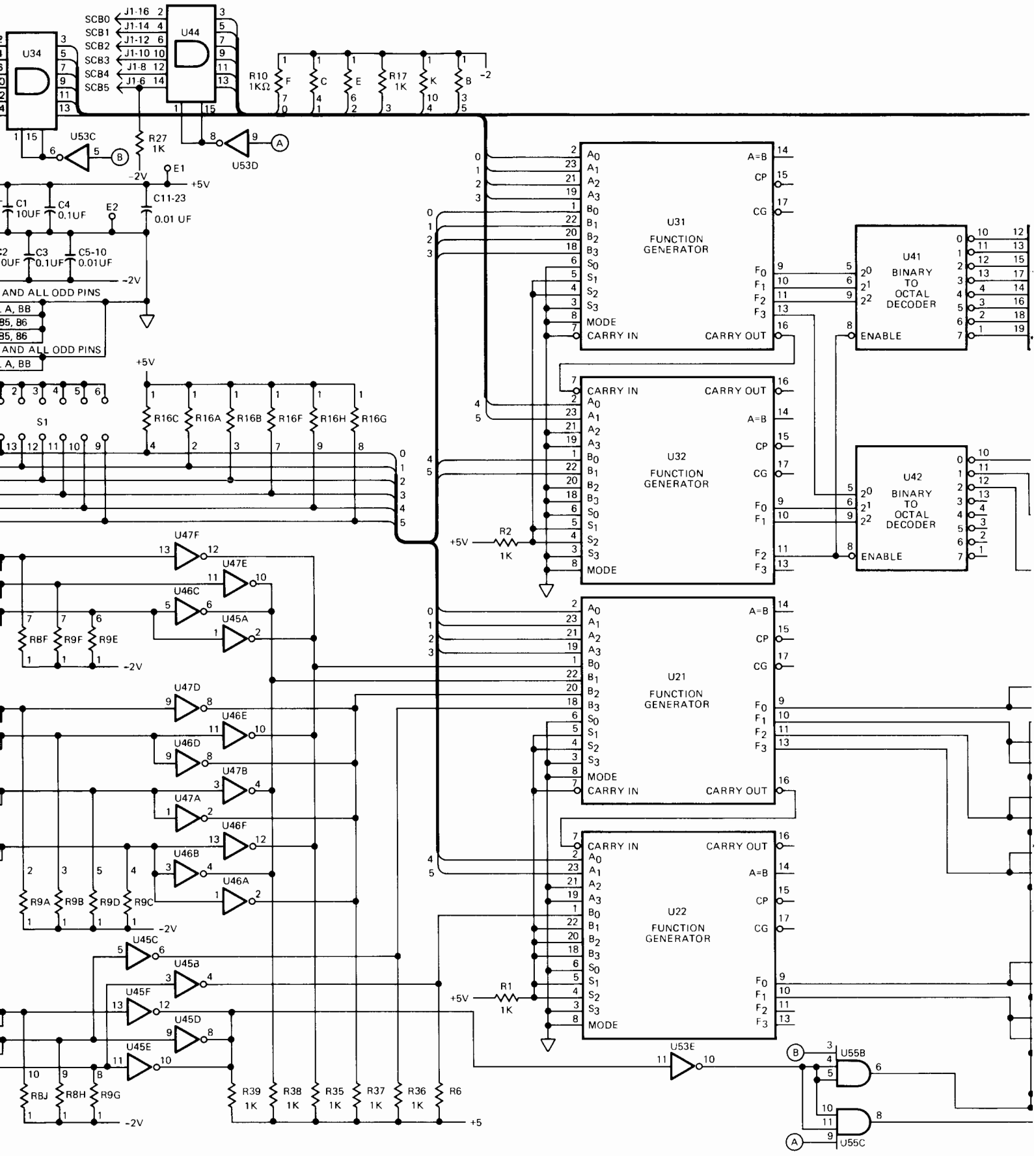
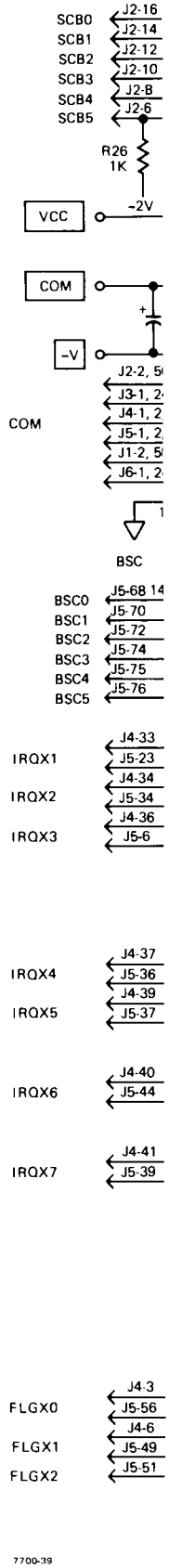


Figure 3-7. A1 Extender Control PCA, Parts Location and Schematic Diagrams (Sheet 2 of 3)


U34
U44
SCB0
SCB1
SCB2
SCB3
SCB4
SCB5
J1-16
J1-14
J1-12
J1-10
J1-8
J1-6
R10 1KΩ
R17 1K
U53C
U53D
R27 1K
-2V
E1
+5V
C1 10UF
C4 0.1UF
E2
C11-23 0.01 UF
C3 0.1UF
C5-10 0.01UF
AND ALL ODD PINS
S1
R16C
R16A
R16B
R16F
R16H
R16G
U31
U32
U21
U22
FUNCTION GENERATOR
A=B
CP
CG
CARRY IN
CARRY OUT
MODE
U41
U42
BINARY TO OCTAL DECODER
ENABLE
R2
R1
1K
U47F
U47E
U46C
U45A
U47D
U46E
U46D
U47B
U47A
U46F
U46B
U46A
U45C
U45a
U45F
U45D
U45E
RBF
R9F
R9E
R9A
R9B
R9D
R9C
RBJ
R8H
R9G
R39 1K
R38 1K
R35 1K
R37 1K
R36 1K
R6
U53E
U55B
U55C


SCB0
SCB1
SCB2
SCB3
SCB4
SCB5
J2-16
J2-14
J2-12
J2-10
J2-8
J2-6
R26
1K
-2V
VCC
COM
-V
COM
J2-2, 5
J3-1, 2
J4-1, 2
J5-1, 2
J1-2, 5
J6-1, 2
BSC
BSC0
BSC1
BSC2
BSC3
BSC4
BSC5
J5-68 14
J5-70
J5-72
J5-74
J5-75
J5-76
IRQX1
IRQX2
IRQX3
J4-33
J5-23
J4-34
J5-34
J4-36
J5-6
IRQX4
IRQX5
IRQX6
IRQX7
J4-37
J5-36
J4-39
J5-37
J4-40
J5-44
J4-41
J5-39
FLGX0
FLGX1
FLGX2
J4-3
J5-56
J4-6
J5-49
J5-51
7700-39

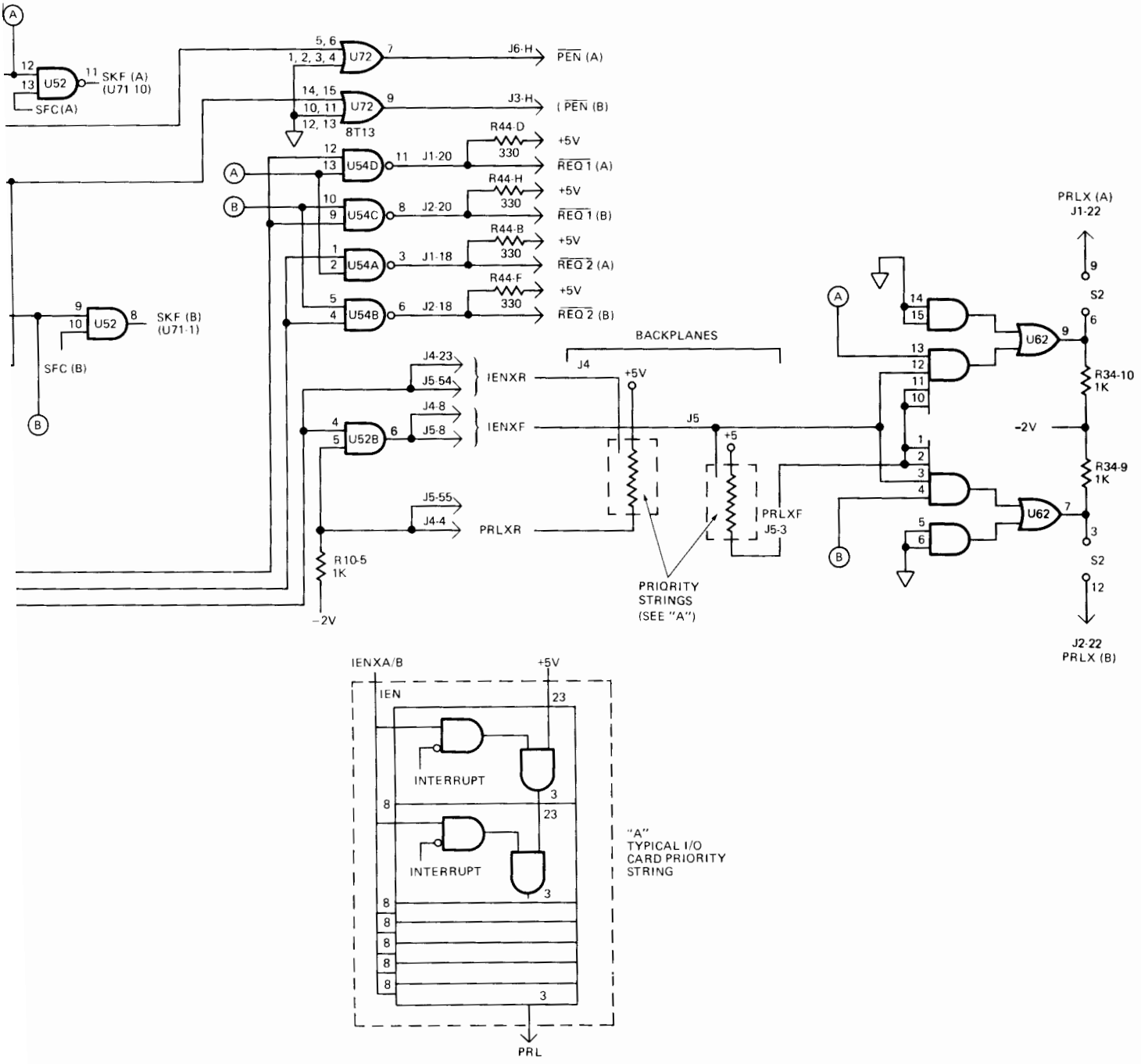
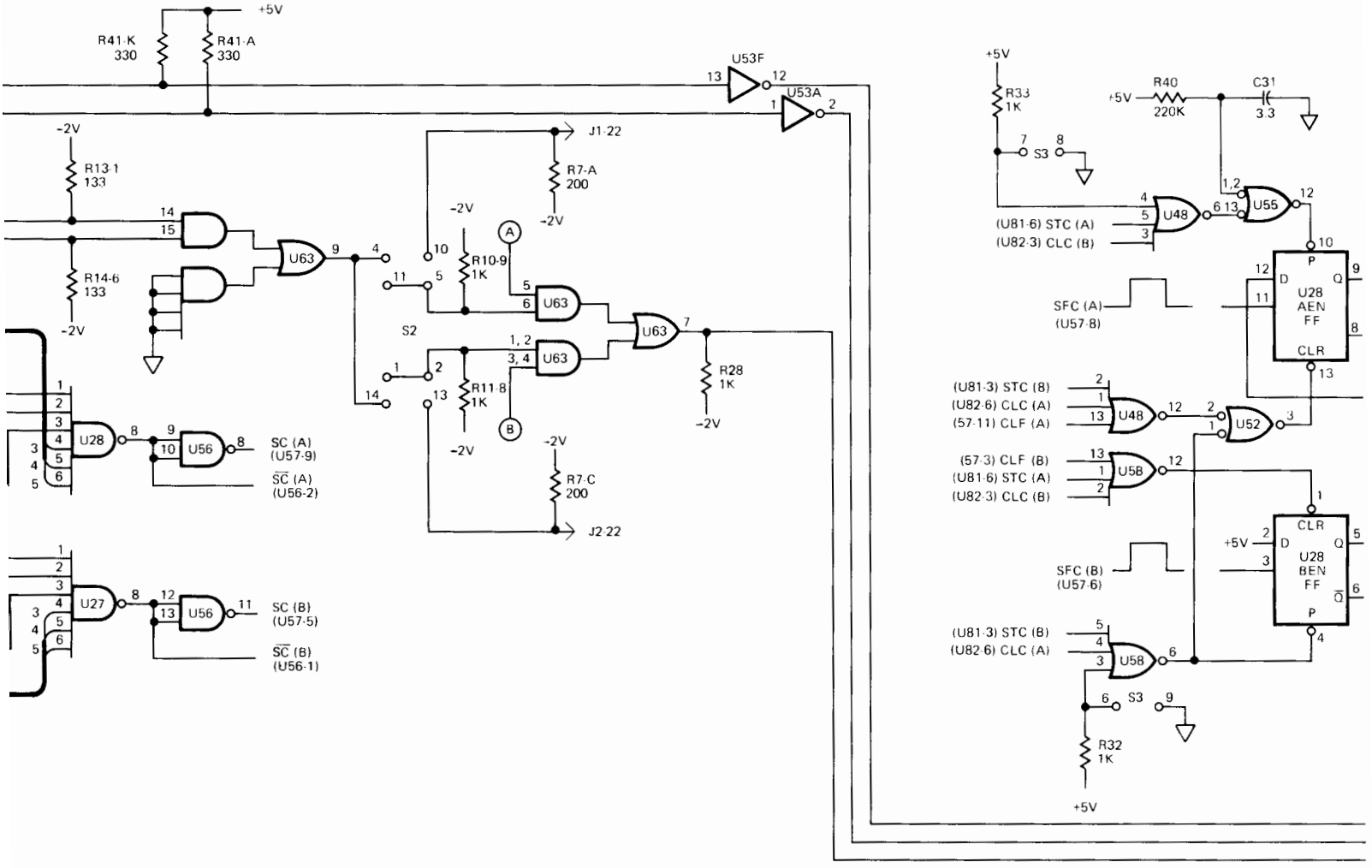
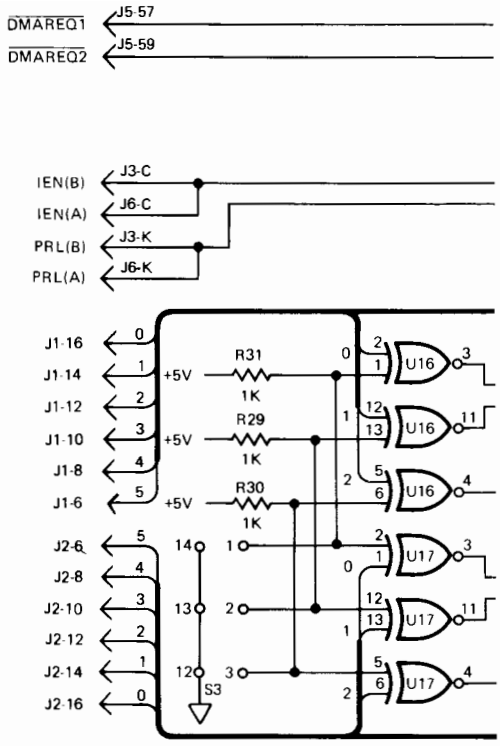


Figure 3-7. A1 Extender Control PCA, Parts Location and Schematic Diagrams (Sheet 3 of 3)


+5V
R41-K
330
R41-A
330
U53F
U53A
-2V
R13-1
133
R14-6
133
U63
J1-22
R7-A
200
R10-9
1K
A
S2
R11-8
1K
B
R7-C
200
J2-22
R28
1K
U28
U56
SC (A)
(U57-9)
SC (A)
(U56-2)
U27
SC (B)
(U57-5)
SC (B)
(U56-1)
R33
1K
S3
R40
220K
C31
3.3
U48
U55
(U81-6) STC (A)
(U82-3) CLC (B)
U28
AEN
FF
SFC (A)
(U57-8)
(U81-3) STC (B)
(U82-6) CLC (A)
(57-11) CLF (A)
U52
(57-3) CLF (B)
(U81-6) STC (A)
(U82-3) CLC (B)
U58
U28
BEN
FF
SFC (B)
(U57-6)
(U81-3) STC (B)
(U82-6) CLC (A)
R32
1K


DMAREQ1
J5-57
DMAREQ2
J5-59
IEN(B)
J3-C
IEN(A)
J6-C
PRL(B)
J3-K
PRL(A)
J6-K
J1-16
J1-14
J1-12
J1-10
J1-8
J1-6
J2-6
J2-8
J2-10
J2-12
J2-14
J2-16
+5V
R31
1K
R29
1K
R30
1K
S3
U16
U17

7700-40A

(B)

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

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MRF 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	1810-0063	RESISTOR NETWORK, met flm, 7 x 133 ohm, 5%	56289	200C1847-CRR
R4	0683-1025	RESISTOR, fxd, flm, 1k, 5%, 1/4W	01121	CB1025
R5	1810-0080	RESISTOR NETWORK, met flm, 7 x 500 ohms, 5%	56289	200C1854-CRR
U26, 46	1820-0640	INTEGRATED CIRCUIT, 16-input multiplexer, TTL	01295	SN74150N
U63 thru 65, U73	1820-0375	INTEGRATED CIRCUIT, 8-input NAND gate, TTL	01295	SN74H30N
U75	1820-1448	INTEGRATED CIRCUIT, 2-input AND gate, TTL	01295	SN74S09N
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

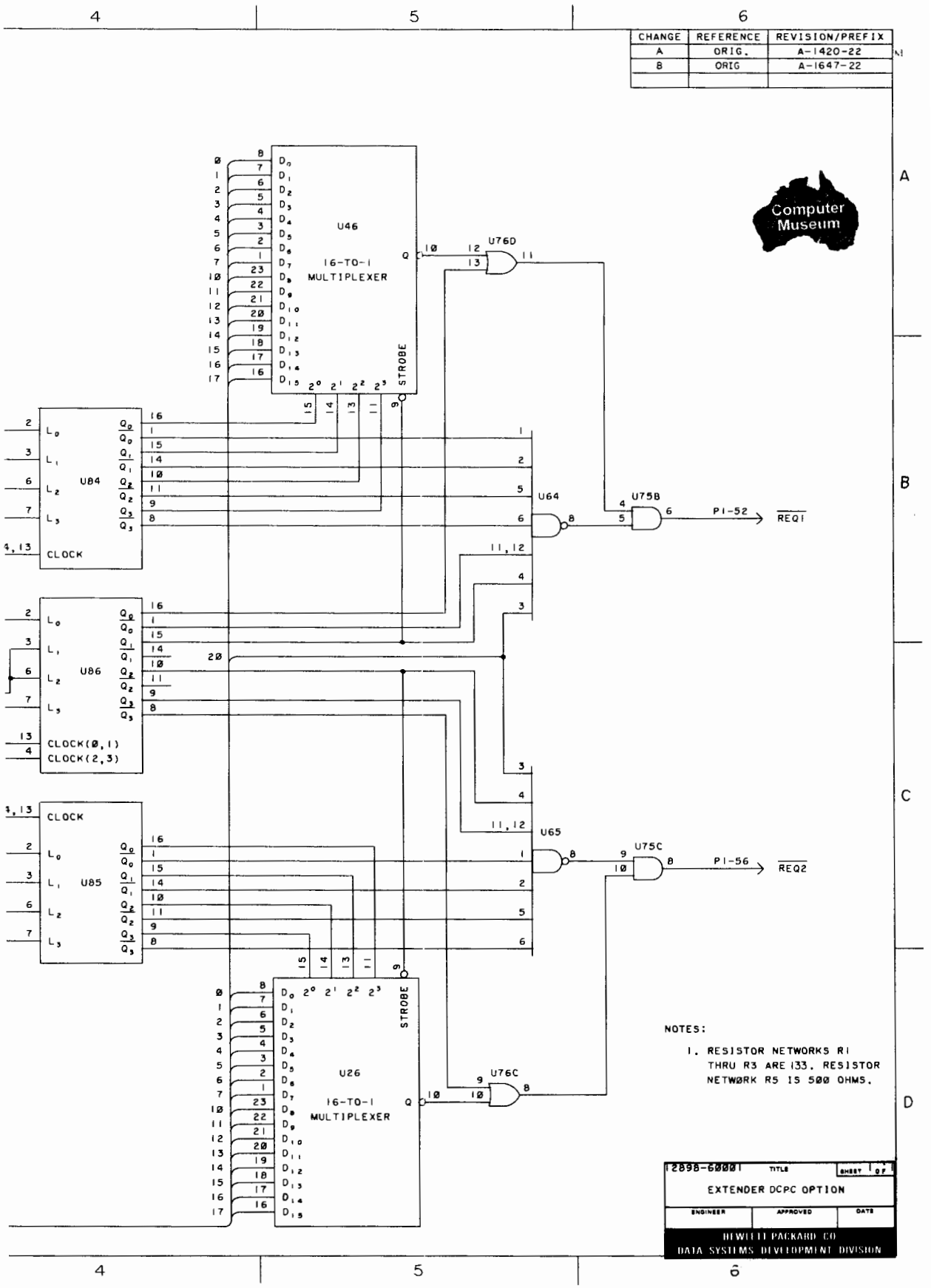
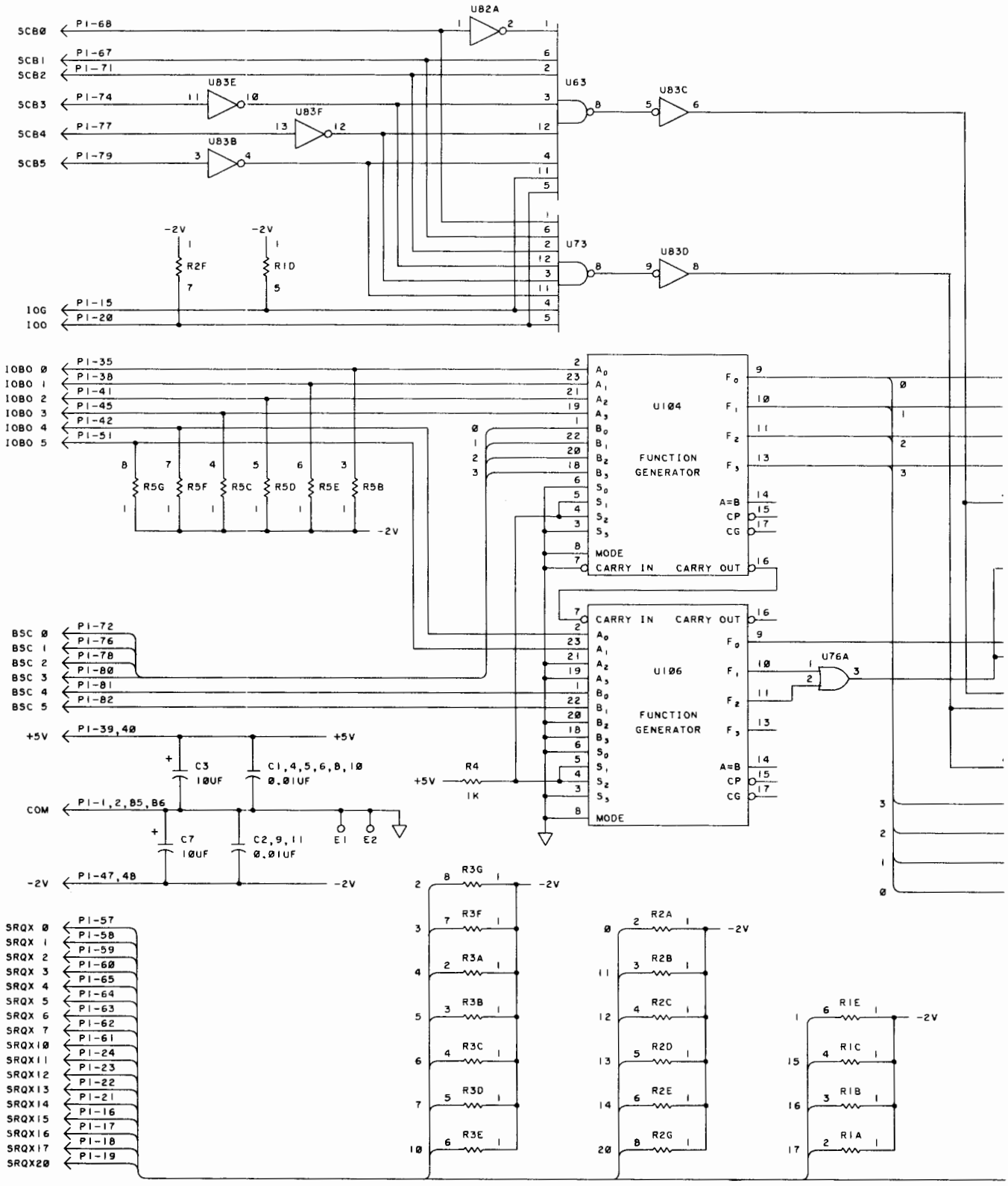
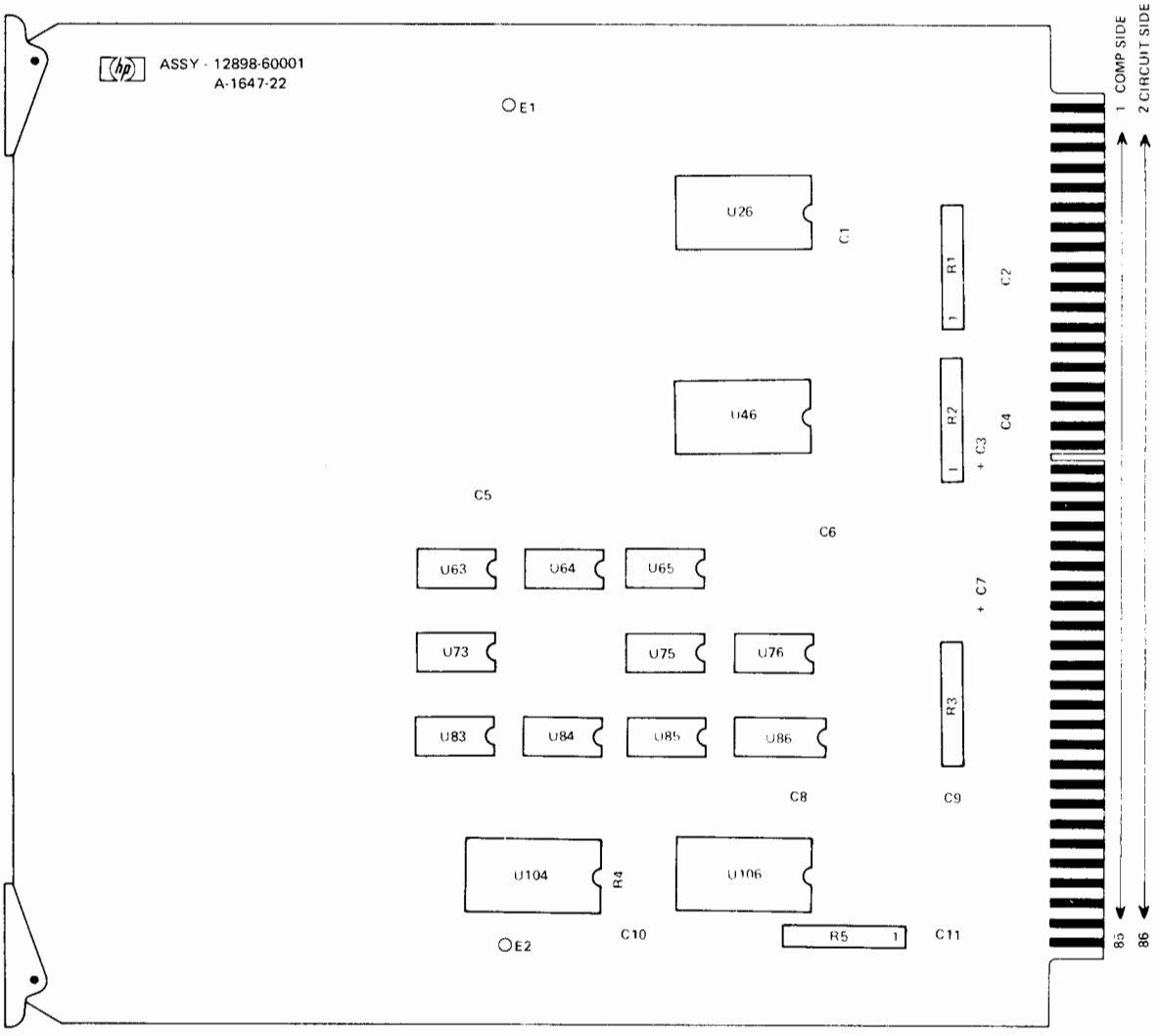


Figure 3-8. DCPC PCA (Optional), Parts Location and Schematic Diagrams


1
2
3
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
-2V
R2F
R1D
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
A=B
CP
CG
BSC 0
BSC 1
BSC 2
BSC 3
BSC 4
BSC 5
P1-72
P1-76
P1-78
P1-80
P1-81
P1-82
U106
U76A
+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
R3G
R3F
R3A
R3B
R3C
R3D
R3E
R2A
R2B
R2C
R2D
R2E
R2G
R1E
R1C
R1B
R1A
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


ASSY - 12898-60001
A-1647-22
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
1 COMP SIDE
2 CIRCUIT SIDE
85
86

REPLACEABLE PARTS

SECTION IV

This section provides information on ordering replacement parts for the HP 12979B I/O Extender. The parts are listed in tables 4-1 and 4-2, and illustrated in figures 4-1 and 4-2.

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.

4-1. DESCRIPTION OF PARTS TABLES

The major assemblies in the extender are listed in table 4-1. 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.

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.

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 etched 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 12979B I/O Extender Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
4-1-	12979B	INPUT/OUTPUT EXTENDER	28480	12979B	1
1	12979-60023	Front Panel	28480	12979-60023	1
2	5061-1356	Power Supply Assy	28480	5061-1356	1
3	— — —	Protective Cover (p/o 2)	28480		
4	12979-60020	Crossover Cable Assy	28480	12979-60020	1
5	12979-60001	Crossover PCA	28480	12979-60001	1
6	12979-60002	Front Backplane Assy	28480	12979-60002	1
7	12979-60003	Rear Backplane Assy	28480	12979-60003	1
8	12979-00008	Card Cage Cover	28480	12979-00008	2
9	02108-00033	I/O PCA Retainer	28480	02108-00033	1
10	12979-00010	Hood Retainer	28480	12979-00010	1
11	12979-60019	Extender Control PCA	28480	12979-60019	1
12	5061-1945	Bottom Cover	28480	5061-1945	1
13	02108-00017	Side Cover	28480	02108-00017	2
14	5000-8094	I/O PCA Cage Cover	28480	5000-8094	1
15	5001-2602	I/O PCA Retainer	28480	5001-2602	1
16	5061-1945	Top Cover	28480	5061-1945	1
17	0570-0528	Press-In Stud	28480	0570-0528	2

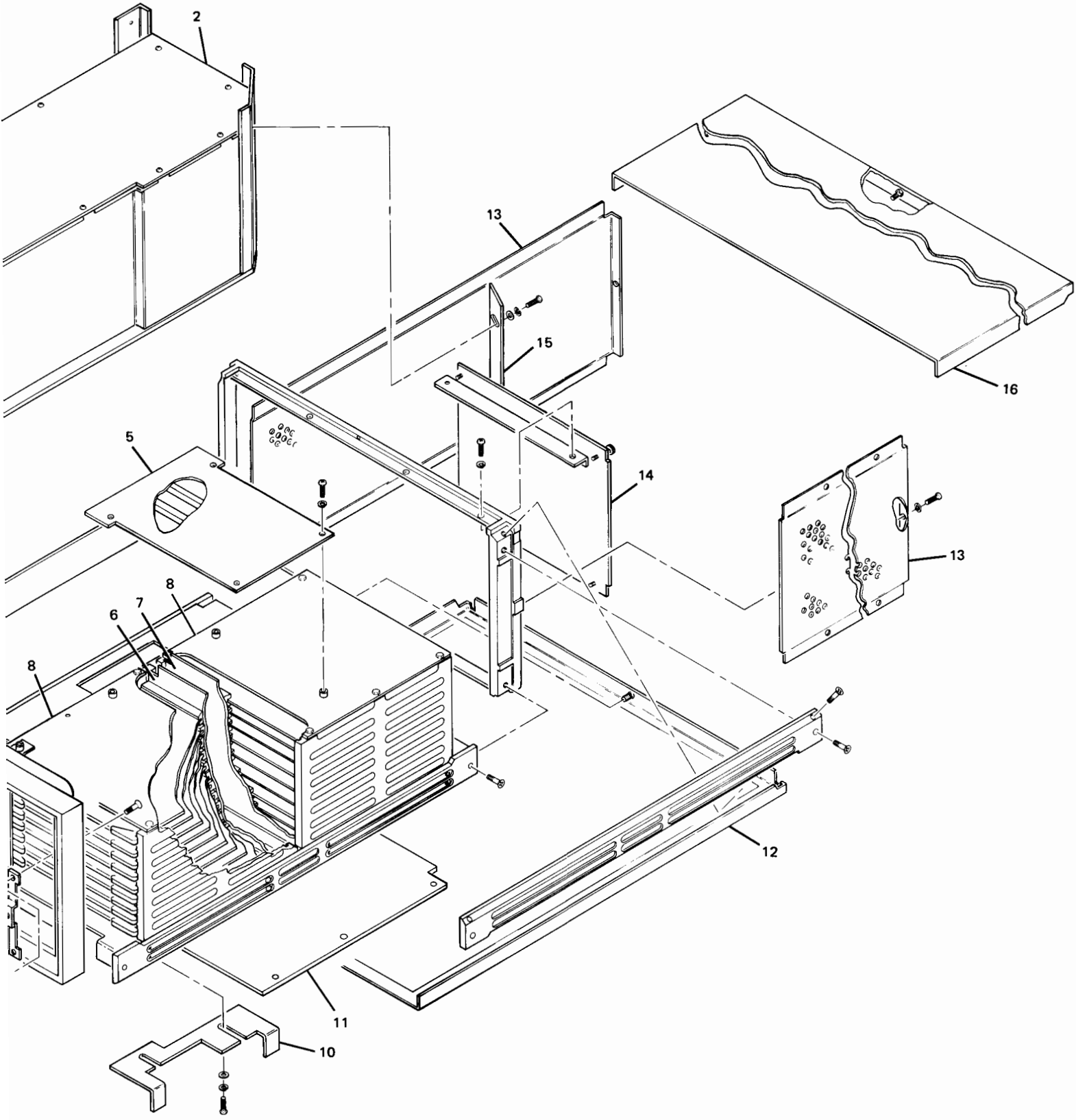


Figure 4-1. HP 12979B I/O Extender, Exploded View

12979B

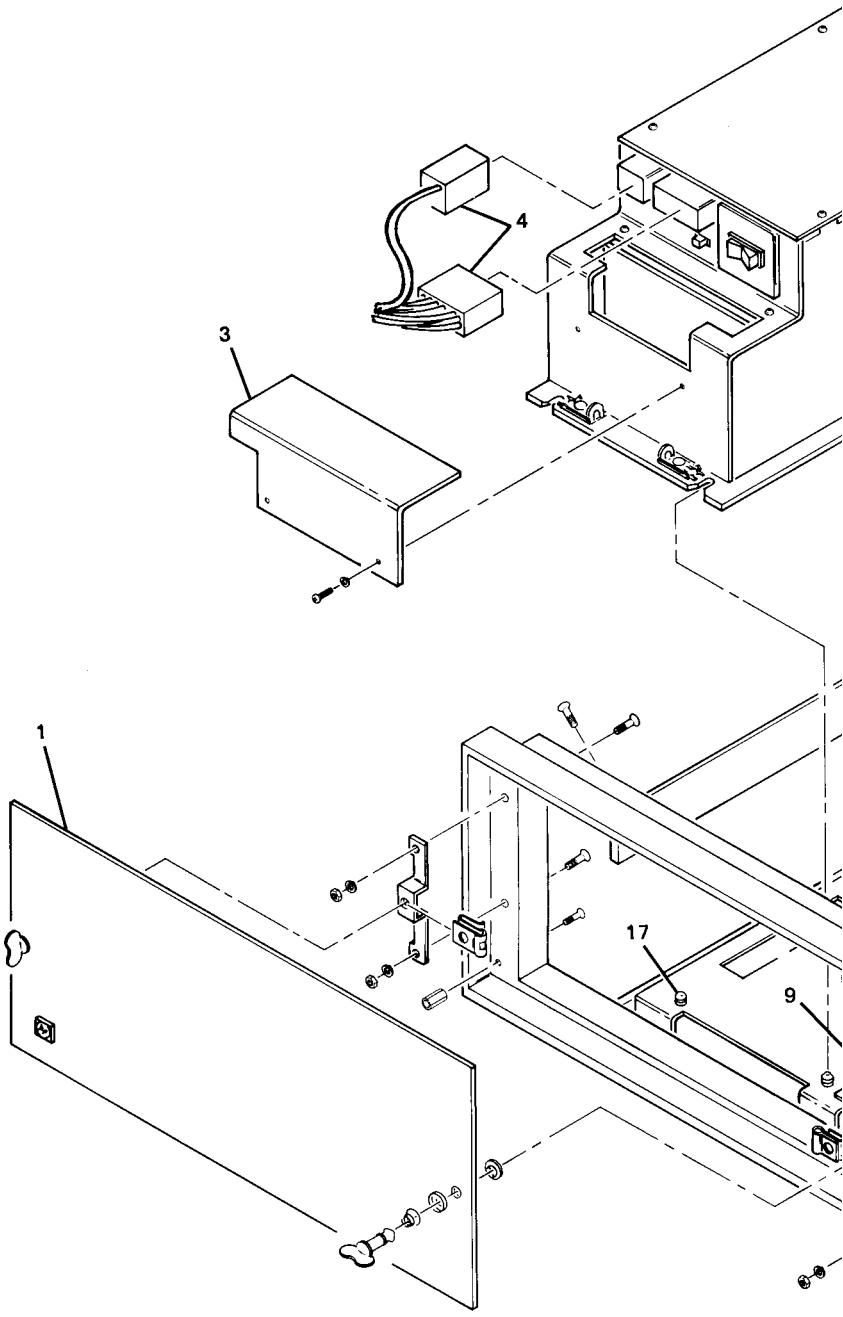
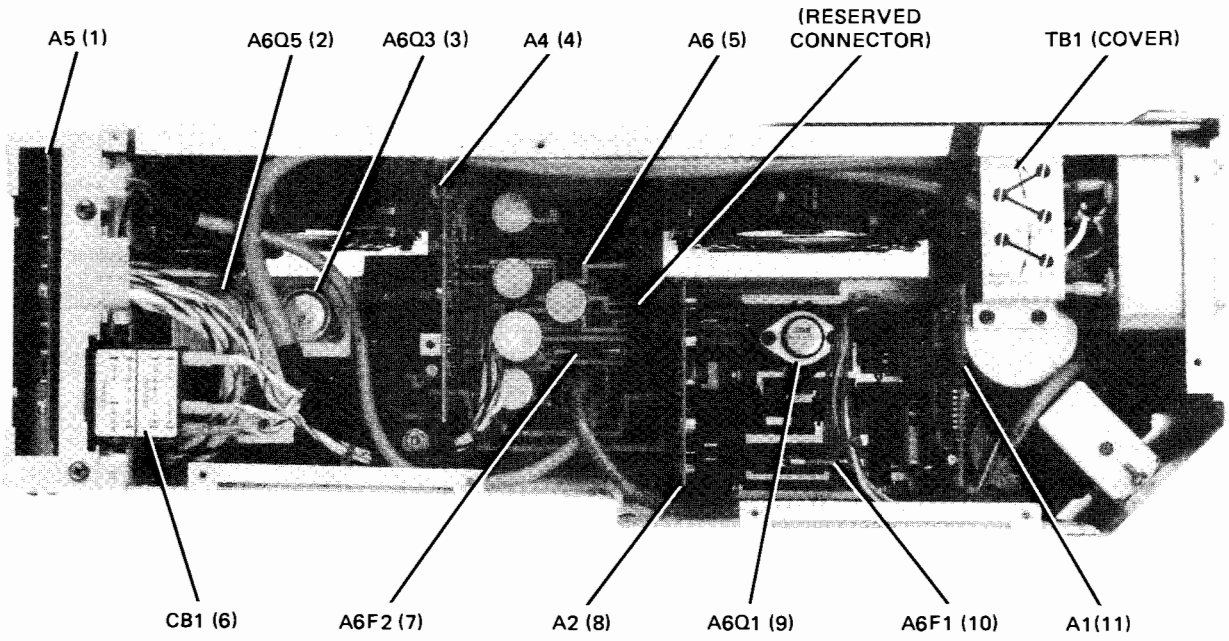


Table 4-2. Power Supply, Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
4-2-	5061-1356	POWER SUPPLY ASSEMBLY	28480	5061-1356	1
1	5061-1345	Control Board (A5)	28480	5061-1345	1
2	1853-0351	Transistor (A6Q2)	04713	2N6053	1
3	1813-0093	12V Voltage Regulator (A6Q3)	07263	UA78H12KC	1
4	5061-1351	Jumper Board (A4)	28480	5061-1351	1
5	5061-1371	MOTHER BOARD (A6)	28480	5061-1371	1
6	3105-0079	Circuit Breaker (CB1; ~POWER)	05008	203-13-4451-1	1
7	2110-0001	Fuse, 1A, normal blow (A6F2)	71400	AGC-1	1
8	5061-1344	Inverter Board (A2)	28480	5061-1334	1
9	1854-0718	Preregulator Transistor (A6Q1)	28480	1854-0718	1
10	2110-0001	Fuse, 1A, normal blow (A6F1)	71400	AGC-1	1
11	5061-1347	Preregulator Board (A1)	28480	5061-1347	1
—	2110-0056	Fuse, 6A, normal blow	71400	MTH-6	1
—	5061-1387	Frame Subassembly (NOTE 1)	28480	5061-1387	1
—	3160-0301	Power Supply Fans (B1, B2)	28480	3160-0301	1
—	5061-1359	Power Supply Fan Cables	28480	5061-1359	2

NOTE 1. Frame subassembly includes all power supply parts except printed circuit assemblies.



NOTES:

1. Reference designations are shown without assembly A3 prefix (e.g., A5 is A3A5).
2. Number in parenthesis is the index number listed in Table 4-2.

7700-93

Figure 4-2. Power Supply, Parts Location

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	pwv	= 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	rwv	= 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	Ta	= tantalum
dc	= direct current	mintr	= miniature	td	= time delay
dr	= drive			Ti	= titanium
DTL	= diode-transistor logic	n	= nano (10^{-9})	tgl	= toggle
depc	= deposited carbon	nc	= normally closed or no connection	thd	= thread
dpdt	= double-pole, double-throw			tol	= tolerance
dpst	= double-pole, single-throw	Ne	= neon	TTL	= transistor transistor logic
		no.	= number		
em	= emitter	n.o.	= normally open	U(μ)	= micro (10^{-6})
ECL	= emitter-coupled logic	np	= nickel plated		
ext	= external	NPN	= negative-positive-negative	V	= volt(s)
encap	= encapsulated	NPO	= negative-positive zero (zero temperature coefficient)	var	= variable
elctlt	= electrolytic			vio	= violet
		NSR	= not separately replaceable	Vdcw	= direct current working volts
F	= farads	NRFR	= not recommended for field replacement		
FF	= flip-flop			W	= watts
flh	= flat head			ww	= wirewound
flm	= film	OD	= outside diameter	wht	= white
fxd	= fixed	OBD	= order by description	WIV	= working inverse voltage
filh	= fillister head	orn	= orange		
		ovh	= oval head	yel	= yellow
G	= giga (10^9)	oxd	= oxide		
Ge	= germanium				
gl	= glass	p	= pico (10^{-12})		
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.
01295	Texas Instruments Inc., Components Group	Dallas, Texas
03038	International Rectifier Semicon Div.	El Segundo, Ca.
04713	Motorola Inc. Semiconductor Products Div.	Phoenix, Arizona
07263	Fairchild Camera and Instr. Corp., Semiconductor Div.	Mt. View, Ca.
14433	ITT Semiconductor, Div. of Int. Telephone and Telegraph Corp.	West Palm Beach, Fla.
18324	Signetics Corporation	Sunnyvale, Ca.
23936	Pamotor Division of Wm. J. Purdy Co.	Burlingame, Ca.
28480	Hewlett-Packard Co.	Palo Alto, Ca.
04387	Dale Electronics Inc.	Columbus, Nebr.
05008	AirPax Electronics Inc.	Cambridge, Mo.
56289	Spraque Electric Co.	North Adams, Mass.
71400	Bussman Manufacturing Div. McGraw-Edison Co.	St. Louis, Mo.
72136	Electro Motive Mfg. Co., Inc.	Williamantic, Conn.
75382	Kulka Electric Corp.	Mt. Vernon, N.Y.
75915	Littlefuse, Inc.	Des Plain, Ill.
81073	Grayhill Inc.	La Grange, Ill.
82389	Switchcraft Inc.	Chicago, Ill.
83014	Hartwell Corp.	Los Angeles, Ca.
94222	Southco Inc.	Lester, Pa.
94707	Control Switch Inc.	El Segundo, Ca.

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Cable: BERSAL

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