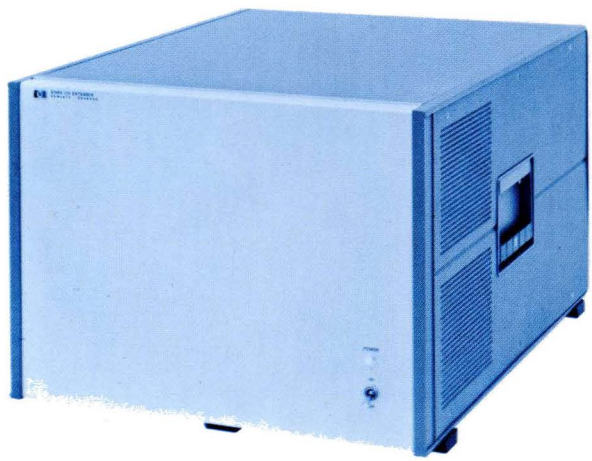
OPERATING AND SERVICE MANUAL

2155A
INPUT/OUTPUT EXTENDER



HEWLETT hp PACKARD

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OPERATING AND SERVICE MANUAL

MODEL 2155A
INPUT/OUTPUT EXTENDER

SERIAL NUMBERS COVERED

This manual applies directly to Model 2155A Extenders having serial numbers prefixed 1128, 1139, 1220, 1229, 1231, 1244, 1245, 1249, 1250, and 1304. Extenders with higher prefix numbers will be covered in manual updating supplements.

OPTIONS COVERED

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

ACCESSORIES COVERED

This manual covers the 12896A Direct Memory Access Accessory Kit. Field installation of the accessory kit is covered in a separate manual.

02155-90002

HEWLETT-PACKARD COMPANY
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GENERAL INFORMATION

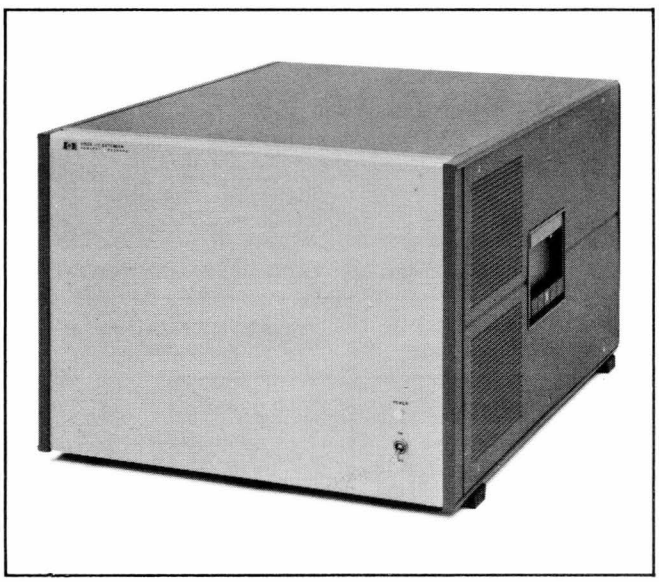
SECTION I

1-1. INTRODUCTION.

1-2. This operating and service manual provides general information, installation and operation instructions, theory of operation, troubleshooting, maintenance instructions, replaceable parts information, and diagrams for the Hewlett-Packard Model 2155A Input/Output Extender (see figure 1-1). Information in this manual is applicable to 2155A I/O Extenders having serial numbers with the prefixes listed on the title page of this manual. This manual is one of two manuals that document the extender. The other manual, part no. 5951-3038, provides operating and service instructions for the Power Supply, part no. 02100-60053, which is part of the extender.

1-3. The basic extender expands the input/output (I/O) capacity of the HP 2100 Computer to 45 I/O channels (one I/O channel in the computer is used to interface the computer to the extender). The additional extender channels can be used in conjunction with the computer 12895A Direct Memory Access (DMA) Accessory Kit by installing the 12896A DMA Accessory Kit in the basic extender. Then, any I/O device connected to the extender can be operated under DMA control.

1-4. If the optional DMA accessory kit is included in the initial purchase order for the extender, the kit is installed in the extender at the factory. If added after shipment, the kit is furnished as a separate item to be installed in the field. Instructions for installing the kit are contained in the 12896A DMA Accessory Kit Installation Manual, part no. 12896-90001.



2153-2

Figure 1-1. HP 2155A Input/Output Extender

1-5. GENERAL DESCRIPTION.

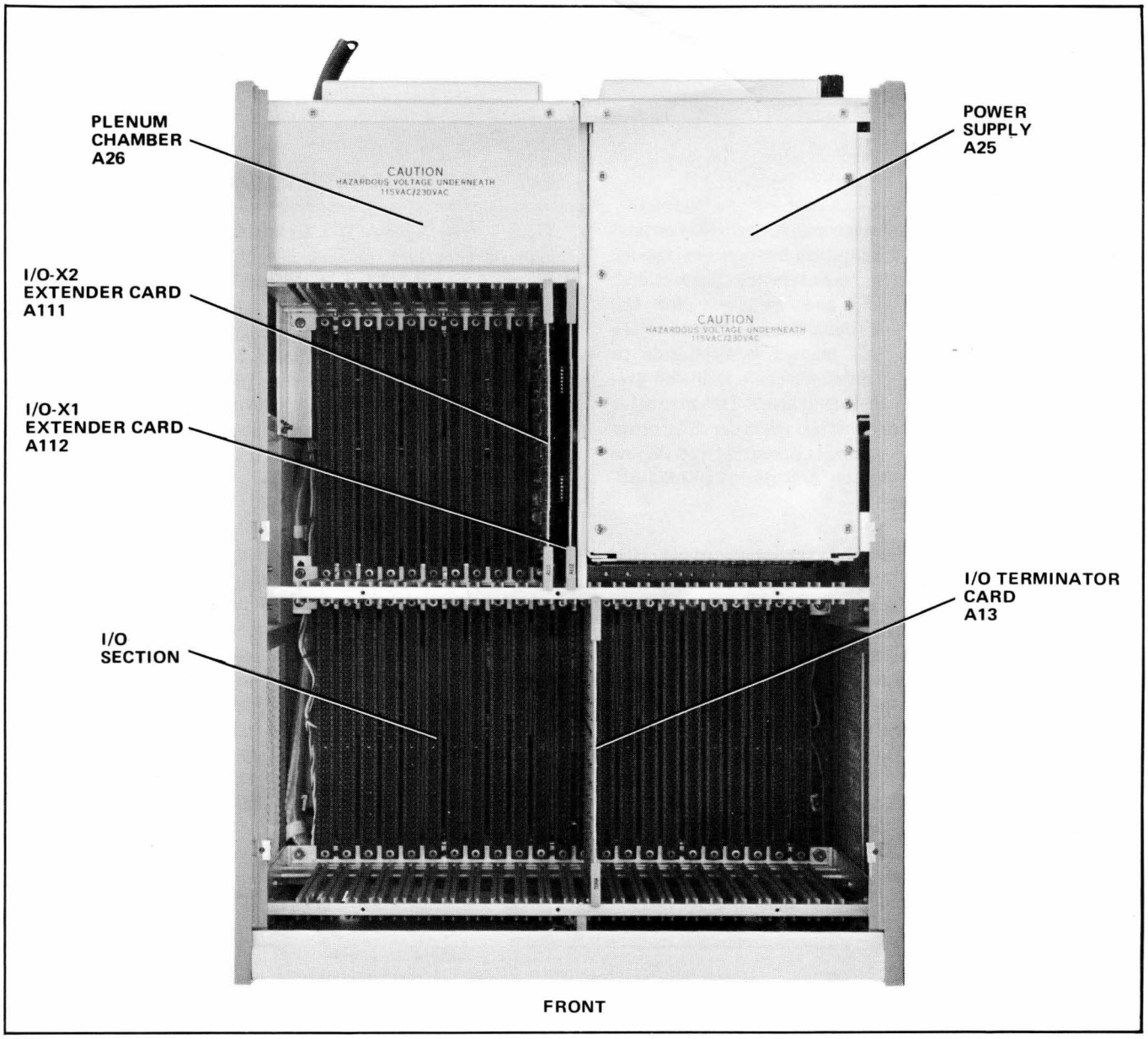
1-6. The 2155A I/O Extender is housed in the same type chassis and cabinet as the 2100 Computer. (See figures 1-2 and 1-3.) The cabinet contains the backplane connectors and interconnecting wiring, card cage assembly, back and front panel wiring, fan assemblies, and power supply assembly. The card cage assembly consists of two card racks which make up the I/O section. Access to the card racks is obtained by removing the top cover of the extender. Access to the power supply assembly and backplane connectors is obtained by removing the top and bottom covers of the extender.

1-7. The backplane connectors for the I/O section of the extender are wired to accept standard I/O plug-in cards. The items comprising the basic extender (refer to paragraph 1-13) must be installed in the extender and the computer before the computer can use the extender I/O capability. The basic extender items include the printed-circuit cards and interconnecting cables for interfacing the computer I/O system to the 32 I/O channels in the extender I/O section. The extender channels can be used in conjunction with the DMA circuits in the computer by installing the 12896A DMA Accessory Kit in the basic extender to extend the DMA circuits to the I/O devices connected to the extender.

1-8. The extender power supply can operate from either a 115- or 230-volt ac power source by selecting the proper connections at the input circuit of the power transformer. Extender power supply voltages are independent of computer power supply voltages. The extender power supply is controlled by the POWER switch on the front panel of the extender. Power control circuits between the extender and computer provide power failure detection signals.

1-9. The power supply section is located at the rear of the extender cabinet. Access to this part of the extender is gained by removing the top panel of the cabinet. The power supply section consists of plenum chamber assembly A26 and power supply assembly A25. The plenum chamber houses a line filter, line fuses, and two cooling fans. The extender operating voltages are also connected to test points mounted on the back panel of the plenum chamber. The function of the plenum chamber is to provide air pressure for cooling the I/O section and to prevent dust from entering through the exhaust ports.

1-10. The power supply assembly, comprised of 12 subassemblies, furnishes the five regulated dc voltages required by the extender and any I/O interface cards installed in the card cage. All optional units external to the extender cabinet furnish their own ac and dc voltages



2153-3

Figure 1-2. I/O Extender, Top View (Panel Removed)

derived from a separate connection to the primary ac power line. Table 1-1 lists the power supply currents available to the I/O section for I/O interface card operation.

1-11. The backplane assembly is located under the card cage and contains the circuit card connectors and interconnecting wiring for the plug-in cards (A1 through A23 and A101 through A112). (See figure 1-3.)

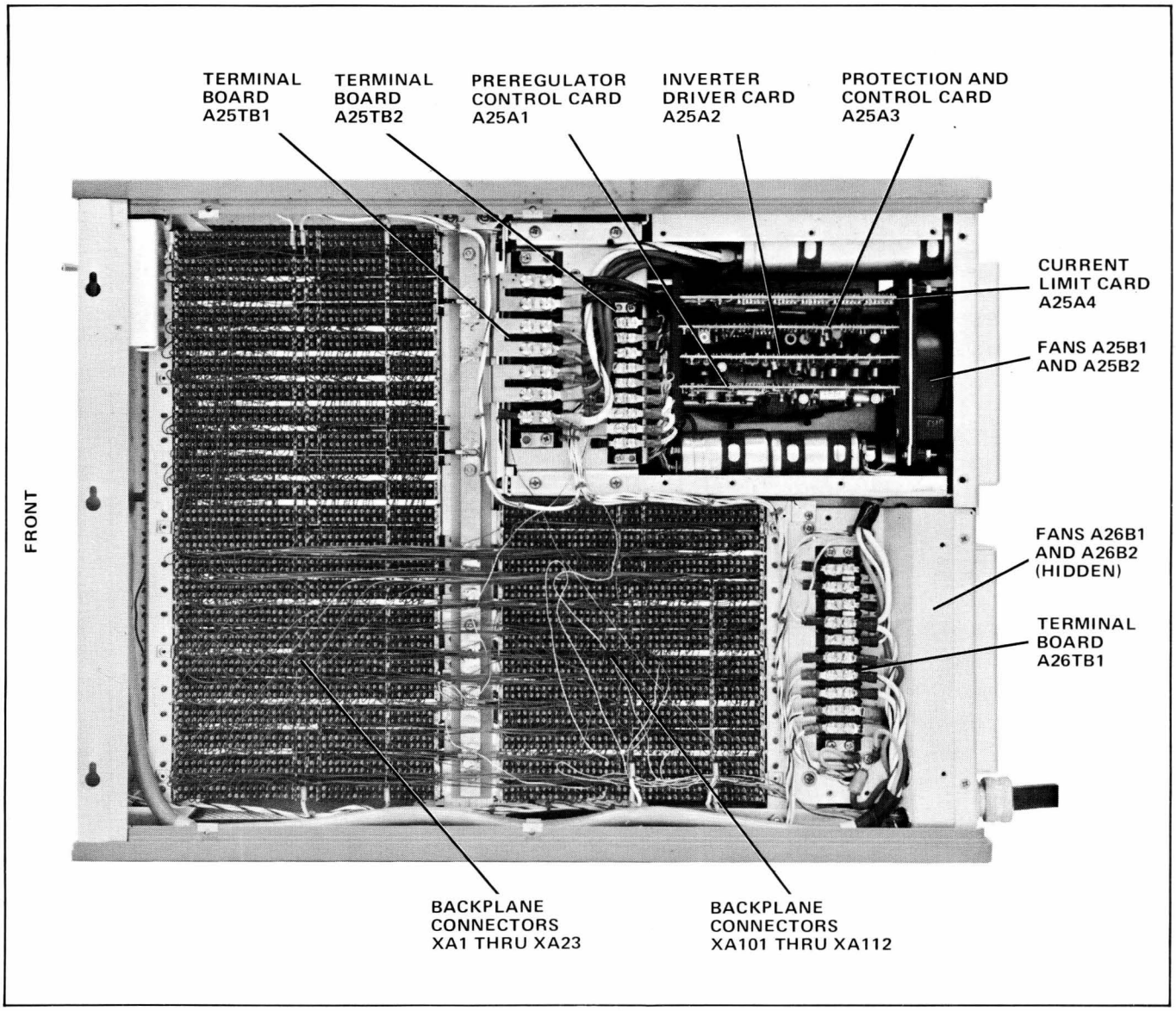
1-12. BASIC 2155A I/O EXTENDER.

1-13. The basic extender is comprised of the following items:

Table 1-1. Power Supply Currents Available for I/O Interface Cards (with DMA extension)

SUPPLY VOLTAGE	CURRENT AVAILABLE (AMPERES)
+30	0.1A
+12.0	5.0A
+4.85	45.8A
-2.0	19.5A
-12.0	5.0A

Note: The currents specified are available with the DMA accessory kit installed.



2153-4

Figure 1-3. I/O Extender, Bottom View (Panels Removed)

a. Power supply assembly, part no. 02100-60053.

b. Backplane assembly, part no. 02155-60006.

c. I/O extender card, part no. 02155-60003. (Installed in slot 10 of computer.)

d. I/O X-1 extender card, part no. 02155-60001.

e. I/O X-2 extender card, part no. 02155-60002.

f. I/O terminator card, part no. 02100-60060.

g. I/O extension cable, part no. 02155-60011.

h. I/O extension cable, part no. 02155-60012.

i. IPU interconnection cable, part no. 8120-1810.

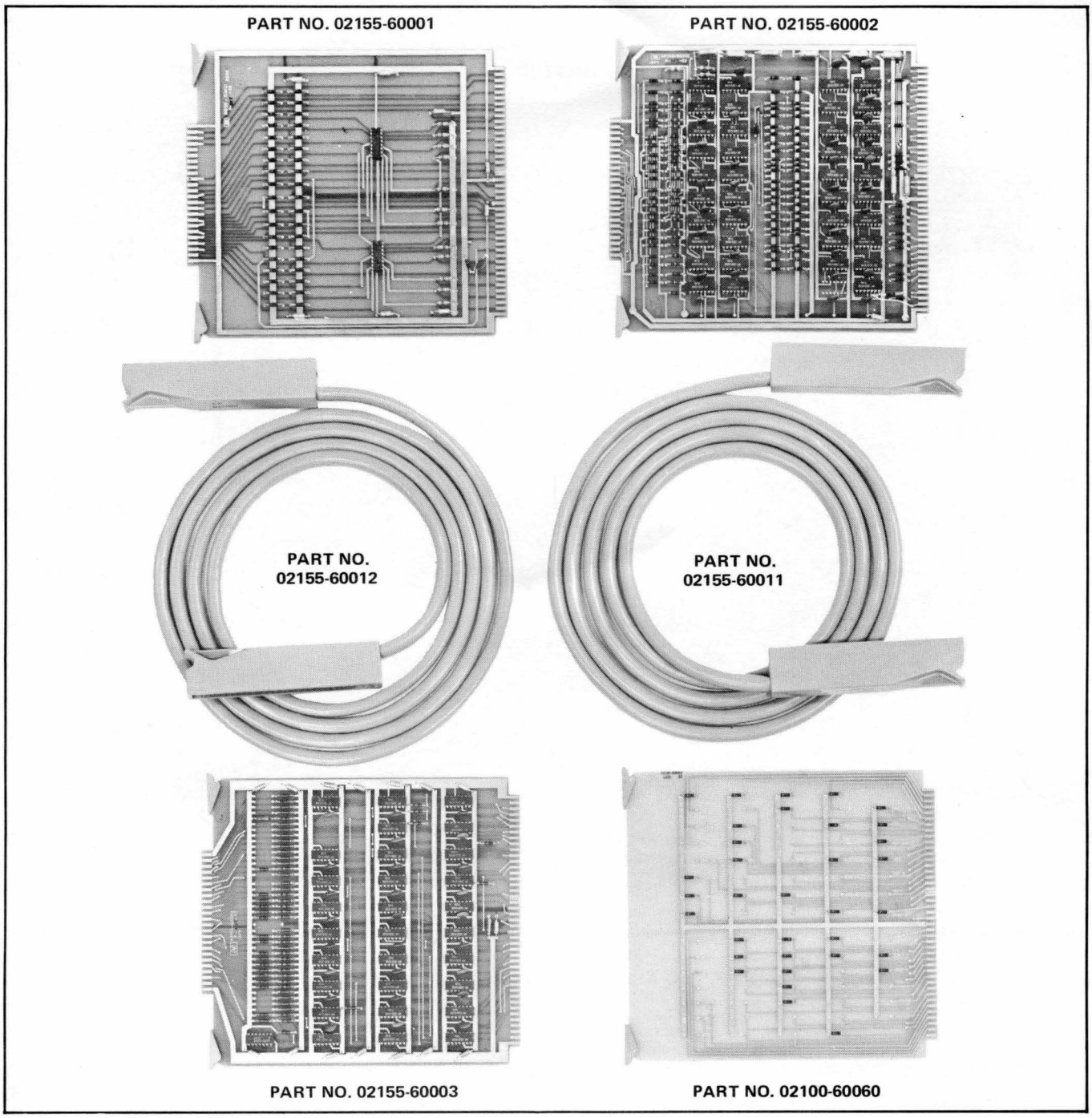
j. Jumpers, part no. 5080-0058. (Fourteen jumpers are supplied for installation on the I/O control card in the computer.)

1-14. The plug-in extender cards and extension cables listed in paragraph 1-13 are shown in figure 1-4. The physical and functional relationship between these items, the computer, and the extender is shown in figure 3-2.

1-15. DIRECT MEMORY ACCESS (DMA) ACCESSORY KIT.

1-16. The computer DMA capability (12895A DMA Accessory Kit) can be extended to the basic extender by installing the 12896A DMA Accessory Kit (see figure 1-5) in the extender. The kit consists of the following items:

a. DMA extender card, part no. 12896-60001.
b. DMA extension cable, part no. 12896-60002.



2153-5

Figure 1-4. I/O Extender Cards and Cables

1-17. STANDARD ACCESSORIES AND SERVICE ITEMS.

1-18. The following standard accessories and service items are supplied with the basic extender:

a. Rack mounting kit, part no. 5060-8744.

b. Operating and Service Manual, part no. 02155-90002.

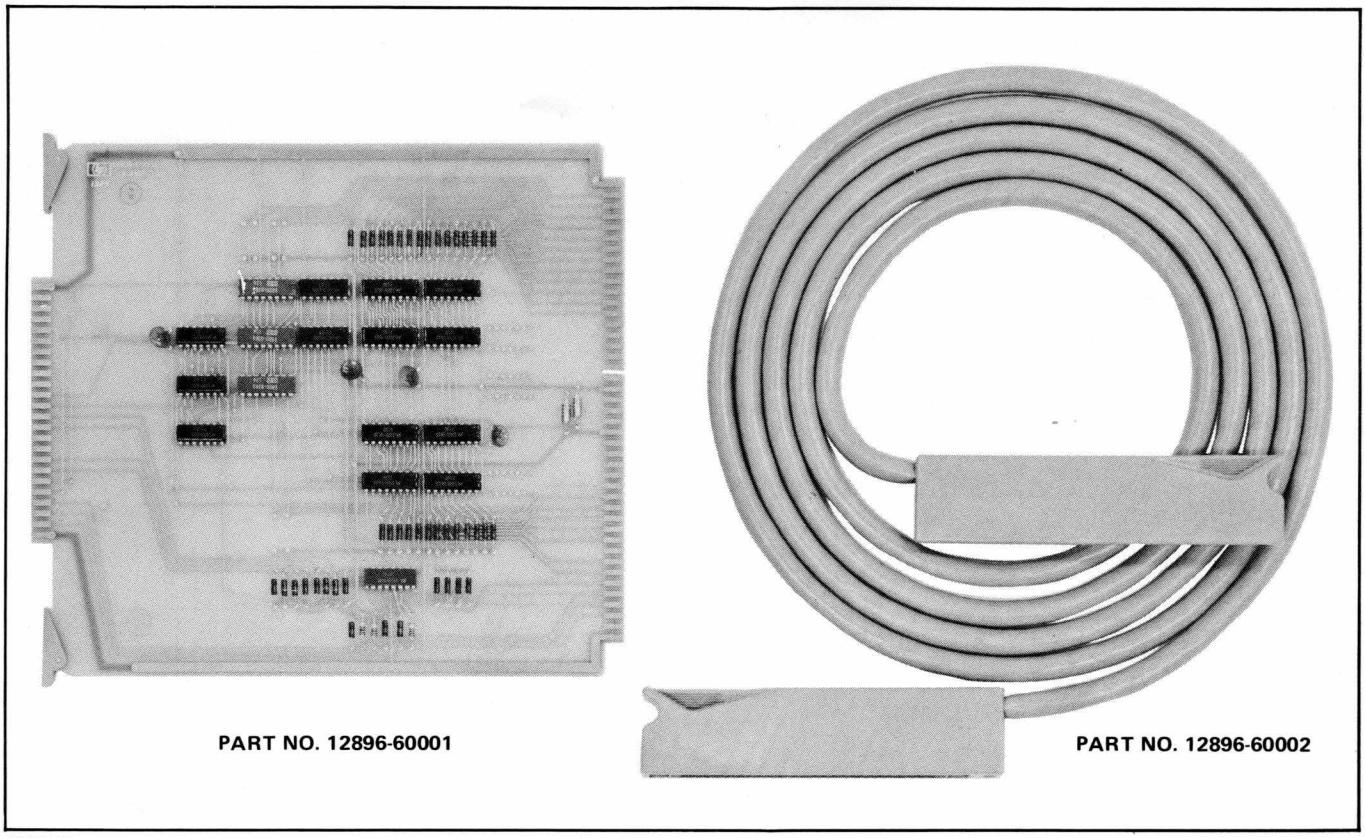
c. Power Supply Operating and Service Manual, part no. 5951-3038.

1-19. RACK MOUNTING KIT.

1-20. The rack mounting kit provides the necessary hardware for mounting the extender in a standard 19-inch equipment rack.

1-21. OPERATING AND SERVICE MANUALS.

1-22. This manual and the power supply manual provides hardware documentation (see paragraph 1-2) for the 2155A I/O Extender as used with the 2100 Computer.



2153-6

Figure 1-5. 12896A DMA Accessory Kit

1-23. OPTION 015.

1-24. Option 015 is a factory-installed option which permits the I/O extender to operate from 230 volts ac. Movable jumpers located under the plenum chamber assembly permit operation from the 230-volt source. The jumpers are placed in the appropriate position and the ac power cable fitted with a NEMA type 6-15P connector before shipment to the customer.

1-25. SPECIFICATIONS.

1-26. Specifications for the I/O extender are given in table 1-2. Note that the +20-volt and -20-volt supplies are not listed since they are not used for I/O extender operation. Dimensional details are shown in figure 1-6.

1-27. IDENTIFICATION.

1-28. This operating and service manual is identified on the title page by the model designation and nomenclature of the unit to which it applies, the option numbers which it documents, the serial number prefix of the basic unit configuration to which it is directly applicable, the manual part number (at the lower left corner of the page), and the publication date (at the lower right corner of the page). To ensure that this manual applies to the unit being installed or serviced, refer to the information presented in paragraph 1-2 and in paragraphs 1-29 through 1-41.

1-29. I/O EXTENDER MODEL NUMBER.

1-30. The model designation for the basic extender described in this manual consists of four digits and a letter (2155A). The model designation is marked on the identification label (18, figure 1-8) on the back of the unit. The model designation is also marked on the front of the unit. If the model designation on your unit does not agree with that on the title page of this manual, this manual does not apply to your unit. Obtain the proper manual from the nearest HP Sales and Service Office. (Sales and Service Offices are listed at the back of this manual.)

1-31. I/O EXTENDER SERIAL NUMBER.

1-32. The extender is identified by a 9-digit 1-letter (0000A00000) serial number marked on the identification label (18, figure 1-8) on the back of the extender. The first four digits are a serial-number prefix used to indicate design changes. If the serial-number prefix on the extender does not agree with the prefix number on the title page of this manual, refer to the manual-change information contained in a supplement accompanying this manual. The letter

Table 1-2. I/O Extender Specifications

POWER REQUIREMENTS

LINE VOLTAGE: 115V ac ± 10%, single phase, 12A, or
230V ac ± 10%, single phase, 6A

LINE FREQUENCY: 47.5 to 66 Hz (See paragraph 2-30.)

POWER CONSUMPTION: 800 watts (1400 volt-amperes), maximum

POWER CABLE

LENGTH: 10 feet (304,8 centimeters)

CONNECTOR: NEMA Type 5-15P (for 115V ac operation), or
NEMA Type 6-15P (for 230V ac operation)

DC SUPPLY VOLTAGES AND CURRENTS

+30V, 0.1A
+12V, 5A
+4.85V, 50A
-2V, 23A
-12V, 5A

ENVIRONMENTAL LIMITS

AMBIENT TEMPERATURE RANGE:

Operating: 0° to 55°C (32° to 131°F)
Non-operating: -40° to 75°C (-40° to 167°F)

RELATIVE HUMIDITY: 50 to 95% at 25° to 40°C (77° to 104°F) without condensation

ALTITUDE:

Operating: 15,000 feet (4572 meters)
Non-operating: 25,000 feet (7620 meters)

VENTILATION

AIR FLOW: 400 cubic feet (11,3268 cubic meters) per minute

HEAT DISSIPATION: 2300 BTU (579,6 kilocalories) per hour, maximum

WEIGHT AND DIMENSIONS

WEIGHT: 115 pounds (52,21 kilograms) with card cage filled

HEIGHT: 12.03 inches (305,6 millimeters) for rack mounting
12.5 inches (317,5 millimeters) with stand-alone feet

WIDTH: 16.75 inches (425,5 millimeters)

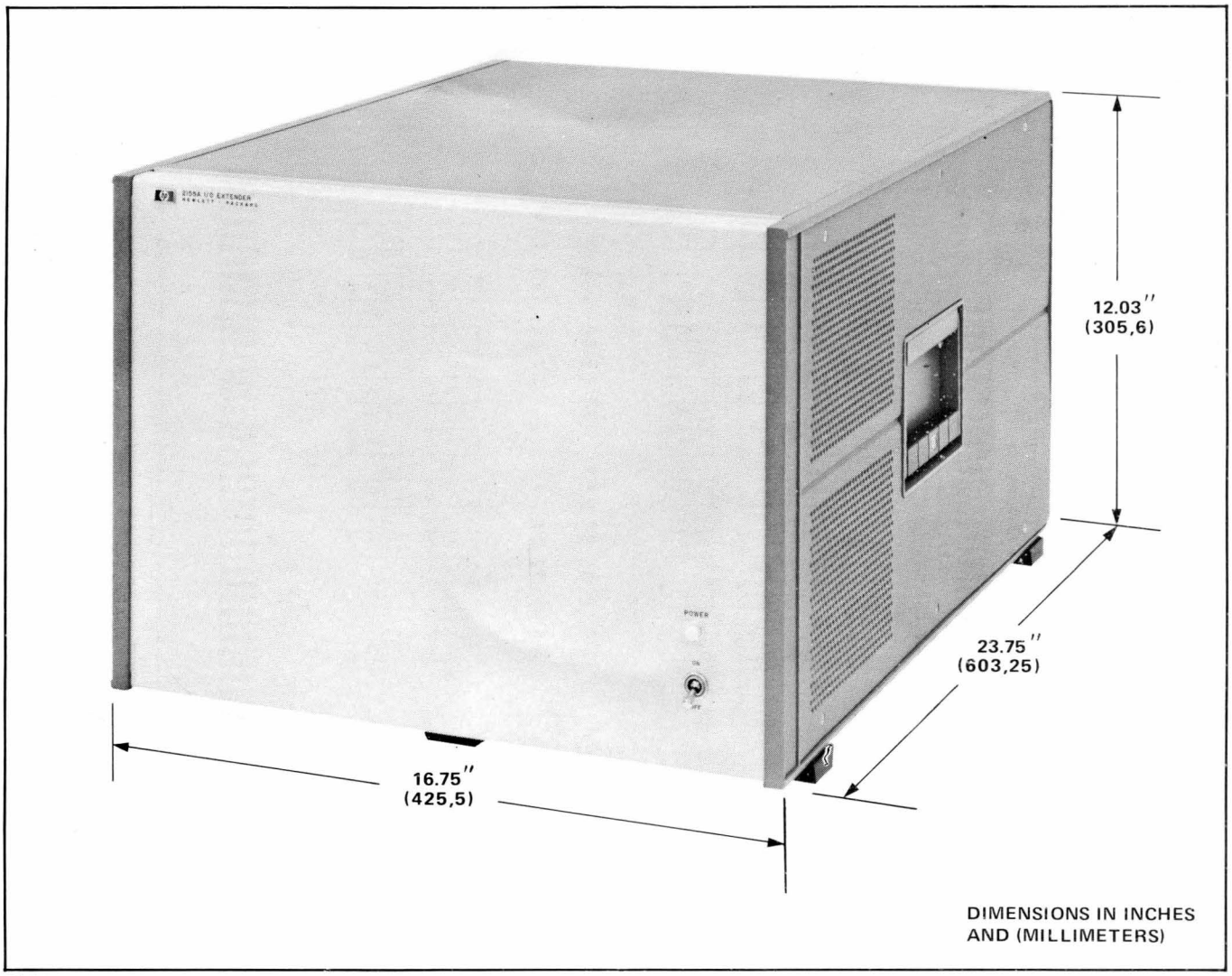
DEPTH: 23.75 inches (603,25 millimeters)

CLEARANCE REQUIREMENTS

RECOMMENDED CABLE CLEARANCE AT REAR: 5 inches (127 millimeters), minimum

RECOMMENDED AIR EXHAUST CLEARANCE AT TOP: 3 inches (76,2 millimeters), minimum

RECOMMENDED AIR EXHAUST CLEARANCE AT SIDES: 2 inches (50,8 millimeters), minimum



2153-8

Figure 1-6. I/O Extender Dimensions

designates the country in which the extender was manufactured ("A" indicates the United States). The remaining five digits are a sequential suffix number that changes with each extender manufactured.

1-33. OPTION NUMBERS.

1-34. On the option label (17, figure 1-8) at the rear of the extender is marked the identifying number of each factory-installed optional feature. When optional features are supplied for installation in the field, the installation instructions require that the appropriate option number be marked in the same place as for a factory-installed option.

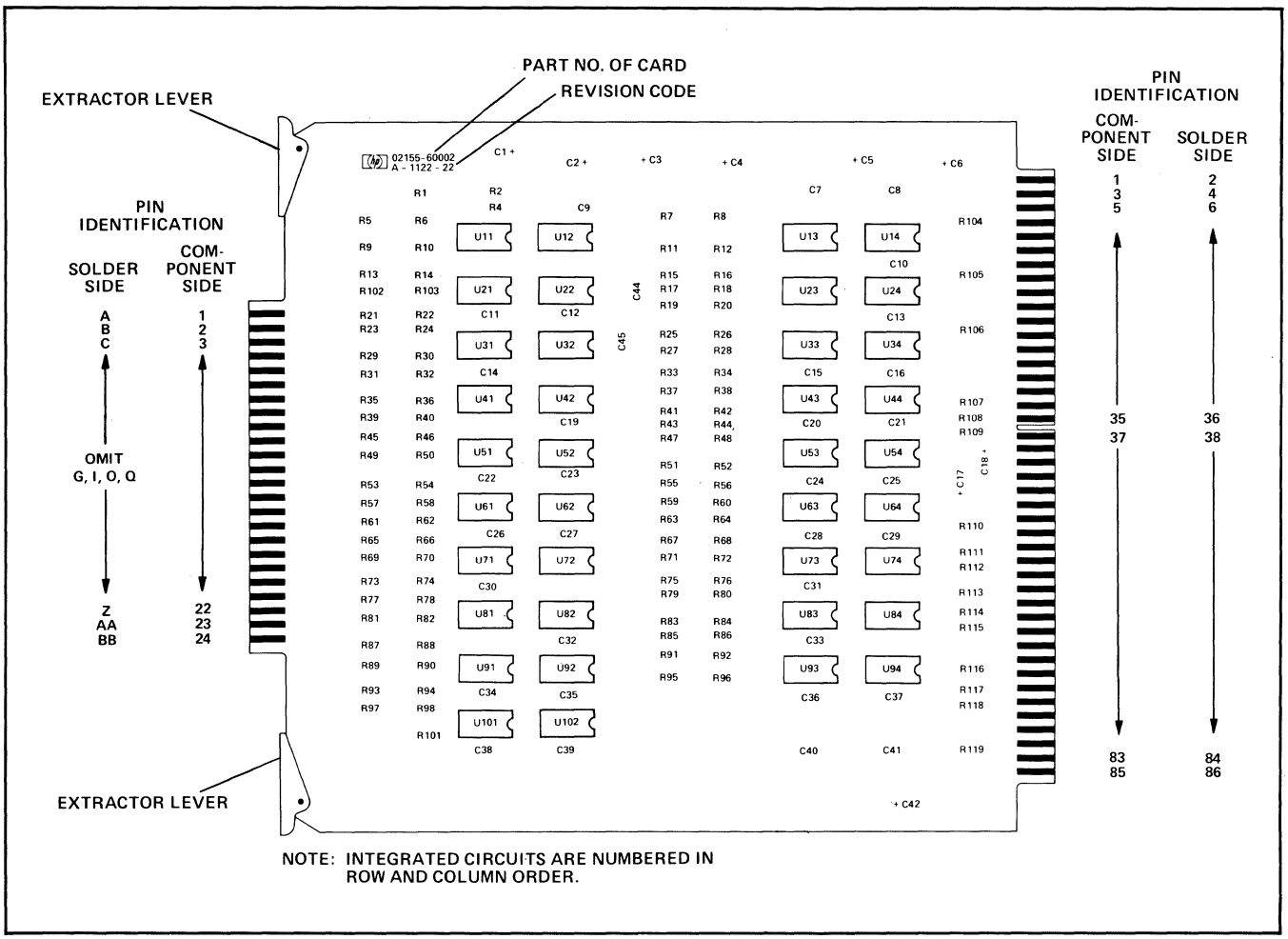
1-35. ASSEMBLY PART NUMBERS.

1-36. The majority of the electronic assemblies in the extender are plug-in printed-circuit cards. A typical card of the type installed in the card cage is shown in figure 1-7. In the illustration, the part number is in the upper left corner of the card. Also shown in the illustration are the identifying numbers and letters of the card pins, and the means used for identifying integrated circuits (microcircuits) mounted on the card.

1-37. Assemblies other than cards usually are not marked with their part number. Part numbers for these assemblies are found in Section VI of this manual, where all electronic assemblies are identified by their location in the extender.

1-38. PRINTED-CIRCUIT CARD REVISION CODES.

1-39. Marked beneath the part number on each printed-circuit card is a revision code (see figure 1-7). The first character of the code is a letter which identifies the etched-foil pattern on the card. The next four digits, referred to as a date code, identify the electrical characteristics of the card with components mounted. The date code is followed by a 1- or 2-digit number which identifies the Hewlett-Packard division which manufactured the assembly. The entire revision code is either stamped on the card with



NOTE: INTEGRATED CIRCUITS ARE NUMBERED IN ROW AND COLUMN ORDER.

2107-7

Figure 1-7. Typical Printed-Circuit Card

marking ink, or as part of the etched-foil pattern. If both a stamped and an etched code are used, the stamped revision code identifies the card with components mounted, and the etched revision code identifies the card without components.

1-40. POWER SUPPLY DATE CODE.

1-41. The power supply date code is marked on the power supply date code label (19, figure 1-8) at the rear of the extender. The date code, consisting of four digits, identifies the electrical configuration of the power supply assembly and is used to indicate design changes. If the date code marked on the label does not agree with the power supply date code on the title page of the power supply manual, refer to the manual change information contained in a supplement accompanying the power supply manual.

1-42. MAINTENANCE FEATURES.

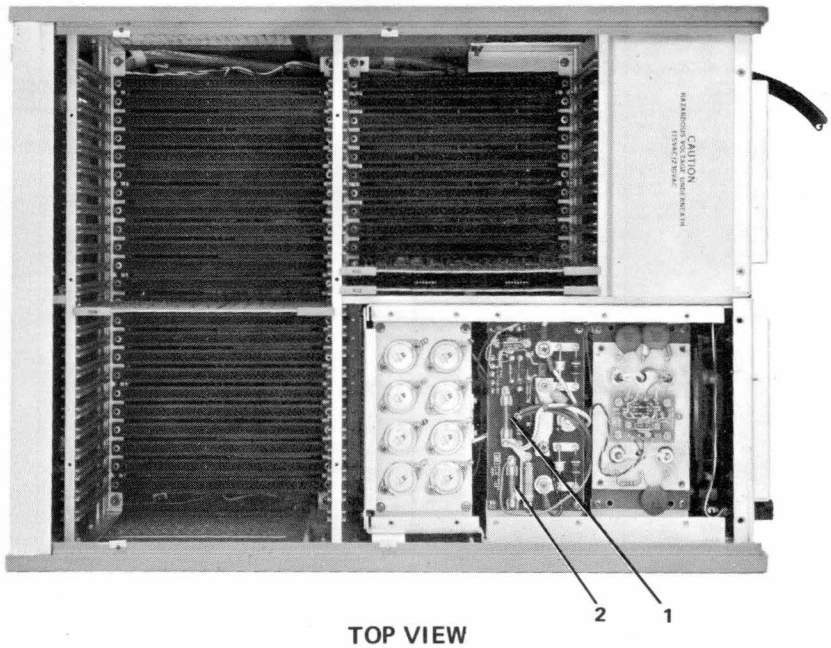
1-43. Major extender maintenance features for adjusting and servicing are shown in figure 1-8. The function of each feature is given in table 1-3.

1-44. MAINTENANCE TOOLS, PARTS, MATERIALS, AND EQUIPMENT.

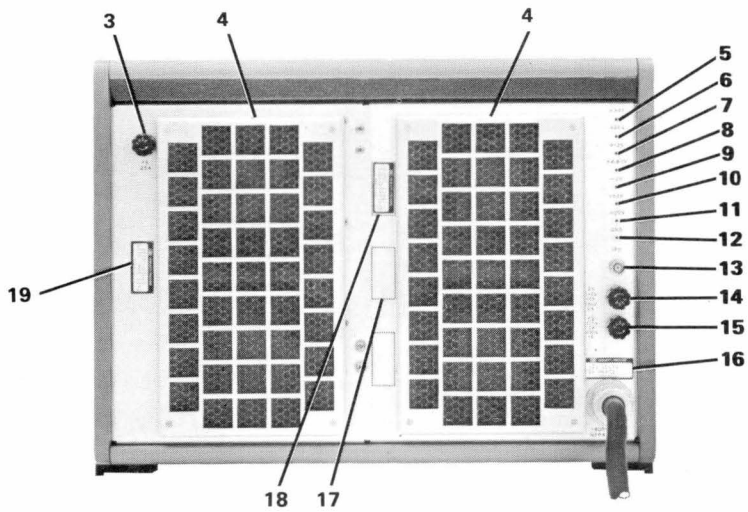
1-45. TOOLS.

1-46. A standard electronics tool kit will provide the tools required for normal servicing of the extender. The kit must include a soldering iron designed for removing and installing 14-, 16-, and 24-pin integrated circuits, and a rubber bulb with suction tube for withdrawing molten solder. Also required is a torque wrench, capable of indicating 15 pound-inches, with 3/8-inch, 7/16-inch, 1/2-inch, 9/16-inch and 11/16-inch sockets. The torque wrench is used when replacing stud-type semiconductor devices in the power supply as described in Section V of the Power Supply Operating and Service Manual.

1-47. If changes are made to the backplane wiring, wire wrapping tools are required to connect and disconnect the solderless wrapped connections on the backplane terminals. Suitable types of wire wrapping tools are listed in table 1-4. The tool part numbers listed in the table specify the proper size for the extender backplane terminals and wires. The



TOP VIEW
(TOP COVER AND POWER SUPPLY COVER REMOVED)



REAR VIEW

2153-9

Figure 1-8. Maintenance Features of the I/O Extender

manual wrapping tool (straight shaft) listed in table 1-4 is appropriate for use only when a few wire connections are to be wrapped at infrequent intervals. The manual wrapping tool with the pistol grip is appropriate when wiring changes are made frequently. Power-operated wire wrapping tools for more extensive wiring changes are available from the manufacturers listed.

1-48. In addition to the wiring tools, the following tool is required if a contact in a backplane connector must be replaced: A-MP TERMI-TWIST Contact Replacement Tool, Amp part no. 69514-1, for 0.031 by 0.062 inch wiring post.

1-49. The A-MP tool may be obtained from Amp Incorporated, Harrisburg, Pennsylvania. However, this tool is rarely required and it may be preferable to have backplane wiring work done by Hewlett-Packard service personnel. (Hewlett-Packard Sales and Service Offices are listed at the back of this manual.)

Table 1-3. I/O Extender Maintenance Feature Functions

FIGURE 1-8, INDEX NO.	NAME	REFERENCE DESIGNATION	FUNCTION
1	250 VDC, 2.5A Fuse	A25A5F1	160-volt protection for inverter assembly A25A8.
2	250 VDC, 2.5A Fuse	A25A5F2	160-volt protection for inverter assembly A25A8.
3	250 VDC, 0.25A Fuse	A25F1	+40-volt protection for I/O card slots.
4	Air Filter	–	Filters cooling air.
5	+30V Test Point	A26TP1	+30-volt supply test point.
6	+20V Test Point	A26TP2	+20-volt supply test point.
7	+12V Test Point	A26TP3	+12-volt supply test point.
8	+4.85V Test Point	A26TP4	+4.85-volt supply test point.
9	-2V Test Point	A26TP5	-2-volt supply test point.
10	-12V Test Point	A26TP6	-12-volt supply test point.
11	-20V Test Point	A26TP7	-20-volt supply test point.
12	GND Test Point	A26TP8	Ground-return test point.
13	IPU connector	A26J1	Connection for Internal Power Up signal to computer.
14	250 VAC, 12A Fuse (115V operation) 250 VAC, 6A Fuse (230V operation)	A26F1	Line voltage protection for preregulator assembly A25A7.
15	250 VAC, 2A Fuse (115V operation) 250 VAC, 1A Fuse (230V operation)	A26F2	Line voltage protection for preregulator control card A25A1.
16	Power Specification Label	–	Specifies the power line frequency for which power failure circuits are adjusted.
17	Option Label	–	Identifies the optional features installed in the extender.
18	Identification Label	–	Identifies extender model number and serial number to determine technical manual effectivity.
19	Date Code Label	–	Provides power supply part no. and a date code which identifies the electrical characteristics of the power supply assembly and determines technical manual effectivity.

Table 1-4. Backplane Wiring Tools, Bits, and Sleeves

TYPE	MANUFACTURER'S PART NO.	MANUFACTURER
Manual Wrapping Tool (Straight Shaft Handle Only)	2682	Ostby and Barton 487 Jefferson Blvd. Warwick, R. I. 02886
Manual Wrapping Bit and Sleeve Assembly (For Straight Shaft Handle)	26509HW	Ostby and Barton 487 Jefferson Blvd. Warwick, R. I. 02886
Manual Unwrapping Bit and Sleeve Assembly (For Straight Shaft Handle)	20260	Ostby and Barton 487 Jefferson Blvd. Warwick, R. I. 02886
Wrapping Tool (Pistol Grip Model)	Model 963	Standard Pneumatic P. O. Box 745 Whittier, Cal. 90608
	Model 14H-IC	Gardner-Denver Co. Grand Haven, Mich. 49417
Wrapping Bit (For Pistol Grip Model)	OB-26509	Standard Pneumatic P. O. Box 745 Whittier, Cal. 90608
	37006	Gardner-Denver Co. Grand Haven, Mich. 49417
Wrapping Sleeve (For Pistol Grip Model)	OB-40200	Standard Pneumatic P. O. Box 745 Whittier, Cal. 90608
	17611-2	Gardner-Denver Co. Grand Haven, Mich. 49417

1-50. PARTS AND MATERIALS.

1-51. Spare parts that may be required for the extender are listed in Section VI of this manual. Part numbers and ordering information are included.

1-52. Materials and chemicals normally used for electronics service work must be available to the serviceman. These must include heat-conductive silicone compound (Wakefield 120-2 Thermal Joint Compound, HP part no. 6040-0239, or equivalent. When ordering the above compound, specify a 2-ounce jar.)

1-53. SERVICING EQUIPMENT.

1-54. Equipment recommended for maintenance, troubleshooting, and repair of the extender is listed in table 1-5. Equipment equivalent to that specified may be substituted.

1-55. EXTENDER CONFIGURATIONS.

1-56. Table 1-6 lists the serial-number prefix (see paragraph 1-32) of the extenders covered by this manual, together with the revision code (see paragraph 1-39) of each printed-circuit card used in the extender. The extender serial-number prefix and card revision codes reflect the configuration as originally manufactured and shipped from the factory. Notes explain changes made to assemblies other than the printed-circuit cards.

1-57. Because of field modifications, repairs, board exchange, and other factors that may alter the shipped configurations, the configurations existing in the field may not always agree with the information presented in table 1-6.

1-58. FIELD OFFICE ASSISTANCE.

1-59. Should servicing assistance be required, contact the nearest Hewlett-Packard Sales and Service Office. These offices are listed at the back of this manual.

Table 1-5. Recommended Test Equipment and Servicing Devices

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED HP MODEL
Dual-trace oscilloscope	Rise time: ≤10 ns. Vertical deflection: 1 volt/division and 10 volts/division (including attenuator probe, if used). Horizontal sweep speed: 0.1 microsecond/division to 1 second/division.	HP 180A Oscilloscope with 10004A Probe and the following plug-in units: HP 1801A Dual Channel Vertical Amplifier HP 1820A Time Base or HP 1821A Time Base and Delay Generator.
Digital voltmeter	At least 4-digit readout. Minimum input resistance: 10 megohms. Full-scale ranges: 9.999 and 99.99V dc.	HP 3439A Digital Voltmeter with HP 3441A Range Selector
AC voltmeter	Expanded-scale or digital-readout type, capable of reading the ac voltage supplied to the extender to ±1%. Voltage range must be at least 100-115 volts (for a 115-volt extender), or 200-230 volts (for a 230-volt extender).	HP3445A AC/DC Range Unit. (Also performs functions of HP 3441A Range Selector listed above. Requires HP 3439A Digital Voltmeter.)
Multimeter	Accuracy: ±3% of full scale. Full-scale ranges: 100 mV to 300V (dc and ac), 10 ohms center-scale to 10 megohms center-scale.	HP 427A
Logic probe	Indication: logic true >+1.4 volts.	HP 10525A
Variable auto-transformer	Capable of reducing extender input line-voltage to 98 volts rms (196 volts for a 230-volt extender), and able to furnish the power required by the extender (up to 1400 volt-amperes, depending on the accessory features installed).	None
Centigrade thermometer	General-purpose type, accurate to ±1°C.	HP 0440-0004
High-pressure air source	25-50 psi pressure	None
Vacuum cleaner	Must have flexible hose with small nozzle, vacuum port for hose, and pressure port for hose.	None
IC test clip	None	None

NOTES:

1. The logic probe is optional. Operating voltage for the probe can be obtained from terminals 4 and 5 of A25TB1 located beneath the power supply.
2. Ambient-temperature and humidity specifications of test equipment must suit the extender environment.

Table 1-6. I/O Extender Configurations

EXTENDER SERIAL NUMBER PREFIX	CARD REVISION CODE					POWER SUPPLY DATE CODE	REMARKS
	A10 (IN COMPUTER)	A13	A110	A111	A112		
1128	1201	1131	1122	1147	1147	1149 or 1150	(Note 1)
1139	1201	1131	1122	1147	1147	1150	(Note 2)
1220	1201	1131	1122	1147	1147	1215	
1229	1201	1131	1122	1147	1147	1220	
1231	1201	1131	1122	1147	1147	1229	
1244	1201	1131	1122	1147	1147	1240	
1245	1201	1131	1122	1147	1147	1243	
1249	1201	1131	1122	1147	1147	1249	
1250	1201	1131	1122	1147	1147	1250	
1304	1201	1131	1122	1147	1147	1250	(Note 3)

NOTES:
1. Power supplies with date codes lower than 1149 must not be used.
2. Changes in some of the wire colors (see figure 7-2) changed the serial number prefix from 1128 to 1139.
3. No major assemblies changed. Color-coded strips on the card cage and color-coded extractor handles were added.

2-1. INTRODUCTION.

2-2. This section presents installation instructions and operating information for the 2155A I/O Extender. Installation instructions include initial inspection and installation of the extender. Also described are claims procedures and methods of repacking the extender for reshipment. Operating information includes extender slot and address identification, priority network, interrupt priority continuity, extender power supply operation, and programming.

2-3. INSPECTION OF SHIPMENT.

2-4. The extender and its accessories may be shipped in more than one container. When the shipment is received, check the carrier's papers to ensure that the correct number of containers has been received.

2-5. If external damage to a shipping container is evident, or if a container is water-stained, ask the carrier's agent to be present when the container is opened.

2-6. When ready to unpack the shipment, open the containers and find the envelope marked "CUSTOMER RECORDS". Included in this envelope is a list of the equipment shipped. Check this against the original ordering papers sent to Hewlett-Packard to ensure that all items correspond.

2-7. Unpack the containers and examine each item for external damage. Look for such things as broken parts, dented corners, bent panels, and scratches. Also check the rigid foam-plastic cushioning material (if used) for signs of deformation which could indicate rough handling in transit.

2-8. Remove the top panel of the extender and check for loose parts inside the extender. Examine the interior of the extender for broken parts or other signs of damage.

2-9. If the above examination reveals damage to the extender or its accessories, follow the damage-claim procedure described in paragraph 2-18. Retain the shipping containers and packaging materials for examination in the settlement of claims, or for reshipment.

2-10. Upon completing the inspection for damage in transit, proceed with a physical inventory of the material received, as described in the following paragraphs.

2-11. PHYSICAL INVENTORY.

2-12. MANUALS.

2-13. Check to ensure that all manuals listed in the "CUSTOMER RECORDS" envelope have been received.

2-14. EQUIPMENT.

2-15. Check the model number marked on the front door of the extender to ensure that a 2155A has been received.

2-16. Check the model number marked on the back of the extender to ensure that a 2155A is indicated. Also check the serial number on the back of the extender and the number given in the "CUSTOMER RECORDS" envelope to ensure that the numbers conform. Compare the list of optional features marked on the back of the extender to be sure that it includes all optional features listed in the "CUSTOMER RECORDS" envelope.

2-17. Insofar as possible, check to ensure that each equipment item listed in the "CUSTOMER RECORDS" envelope has been received. In the case of certain optional features, it may be necessary to refer to the Operating and Service Manual for the optional feature to determine how to identify it. If an option consists of more than one physical unit, make sure that all parts have been received.

2-18. CLAIMS.

2-19. If the extender is incomplete or damaged when received and fails to meet specifications, notify the nearest Hewlett-Packard Sales and Service Office. (Sales and Service Offices are listed at the back of this manual.) 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.

2-20. PACKAGING FOR RESHIPMENT.

2-21. RESHIPMENT USING ORIGINAL PACKAGING.

2-22. The same containers and materials used in factory packing can be used for reshipment of the extender. Alternatively, containers and packaging 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 return address, the type of service required, the extender model number, and the full serial number of the extender. Mark the container "FRAGILE" to assure careful handling. In any correspondence, refer to the extender by model number and full serial number.

2-23. RESHIPMENT USING NEW PACKAGING.

2-24. The following instructions should be followed when packaging the extender with commercially available materials:

a. Wrap the 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, the extender model number, and full serial number.

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

c. Use enough shock absorbing material (3- to 4-inch layer) on all sides of the extender to provide a firm cushion and to prevent movement inside the container. Use particular care to protect the corners.

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

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

2-25. INSTALLATION REQUIREMENTS.

2-26. ENVIRONMENTAL REQUIREMENTS.

2-27. The extender must be installed in a location where the ambient temperature is between 0° and 55°C (32° and 131°F) when the extender is operating. Relative humidity must be between 50 and 95 percent within the temperature range of 25° to 40°C; no moisture condensation, water drips, or spray is permissible. When the extender is turned off, the permissible temperature range is -40° to 75°C (-40° to 167°F).

2-28. To maintain proper cooling, there must be at least 2 inches of clear space at the sides of the extender, and 3 inches above the extender. Clearance at the back must be at least 5 inches for passage of air and to prevent sharp bends in cables entering the extender.

2-29. POWER REQUIREMENTS.

2-30. The extender operates from a power source supplying an ac voltage of 115 or 230 volts rms ±10 percent, single-phase. The required power frequency is 47.5 to 66 Hz, however, the power fail circuits in the power supply are line-frequency sensitive and must be adjusted to operate at the line frequency available. A label located at the rear of the extender (see item 16, figure 1-8) specifies the line frequency for which the power fail circuits were adjusted before shipment from the factory. If the available line frequency is different from that marked on the label, the power fail circuits will require readjustment (refer to the Power Supply Operating and Service Manual). Power consumption is up to 800 watts, depending on the optional features included in the extender. Note that optional I/O devices not within the extender cabinet, and which make separate connection to the power line, have their own power specifications, and the power they require is additional to that consumed by the extender.

2-31. Movable jumpers and the proper ac power cable in the extender permit use of either 115- or 230-volt power sources. The extender is shipped with the proper ac power cable and with these jumpers connected in accordance with the customer's order (standard 115 volts or 230-volt option 015). However, before the extender is connected to the power line, the jumpers must be checked to ensure that they are correctly connected. This is done as follows:

a. Make sure the ac power cable is not plugged into a voltage source.

b. Remove the bottom panel of the extender to expose terminal board A26TB1. This terminal board is mounted beneath the plenum chamber.

c. Check the jumpers on the terminal board to ensure that they are properly connected. (See figure 2-1.)

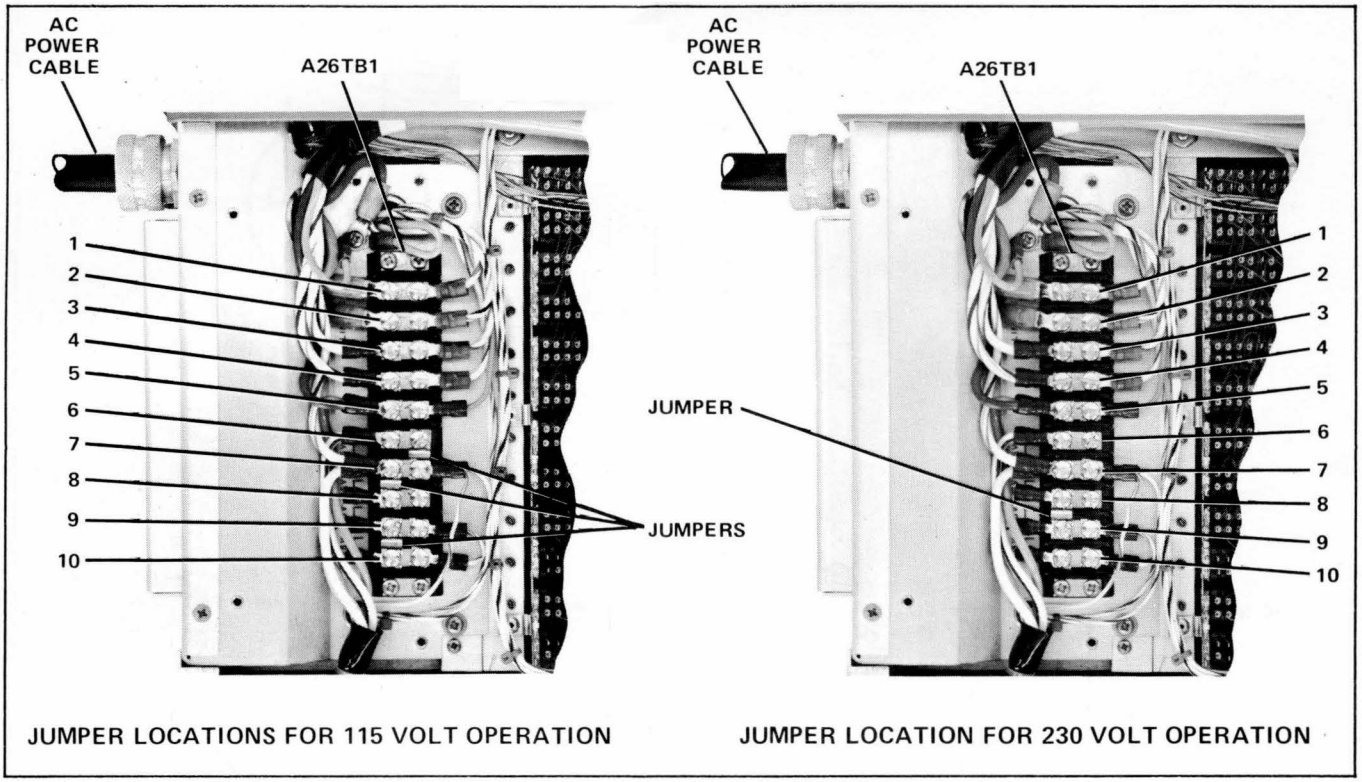
d. Replace the bottom panel.

2-32. AC POWER OUTLET AND EXTERNAL GROUND.

2-33. The ac outlet which will supply power to the extender must be checked to ensure that it furnishes the voltage for which the extender is connected. Furthermore, the ac outlet and its associated wiring and fuses (or circuit breakers) must be capable of carrying at least 12 amperes for a 115-volt extender or 6 amperes for a 230-volt extender.

2-34. If the extender is shipped for 115-volt operation, the ac power cable will fit a NEMA (National Electrical Manufacturers Association) type 5-15R or 5-20R female power outlet (figure 2-2). If the extender is shipped for 230-volt operation, the ac power cable will fit a NEMA type 6-15R or 6-20R female power outlet (figure 2-3). (The 5-15R or 5-20R connector must never be used for 230-volt operation.) Before installation, make sure that the local electrical codes permit the use of these types of electrical outlets for the line voltage and load current used by the extender. If necessary, change the plug on the ac power cable to fit the acceptable type of outlet (see WARNING in paragraph 2-39).

2-35. Check the ac outlet with a voltmeter to be sure the required voltage is supplied, and that it is single-phase. If the extender is connected for 115-volt operation, the voltage must be 103.5 to 126.5 volts ac (rms). For 230-volt operation, the voltage must be 207 to 253 volts ac (rms). Bear in mind that the electrical load imposed by the extender and its optional features may reduce the line voltage below the no-load value.



2153-7

Figure 2-1. Jumper Locations for 115-Volt and 230-Volt Operation

2-36. If the voltage is in the correct range, check the ac outlet to ensure that it is correctly wired with respect to high-potential ac voltage, ac neutral, and earth ground. Use a low impedance voltmeter, 20,000 ohms per volt or less, for making these measurements. If the outlet is improperly wired, correction must be made by a qualified electrician, and local electrical codes must be observed.

2-37. The extender will operate with the earth ground lead in the ac power cable unconnected. However, for safety reasons, it is strongly recommended that attachment be made to a good earth ground through the ac power cable used by the extender.

2-38. For installation in a ship, airplane, motor vehicle, or train, the earth ground wire in the extender ac power cable must be connected to the hull or metal frame of the vehicle.

2-39. AC POWER CABLE.

WARNING

If the connector at the end of the ac power cable is changed, the replacement connector must be correctly wired to the cable. If the replacement connector is incorrectly wired, fuses A26F1 and A26F2 in the extender will not remove voltage from some of the extender ac circuits when the fuse blows. The resulting high voltage at exposed terminals inside the extender presents a hazard to the extender serviceman. A similar situation applies when an extension cable is used.

2-40. Check the 10-foot (304,8 centimeters) ac power cable to be sure it is long enough to connect the extender to the ac outlet to be used. If a longer cable length is required (20 feet or 609,6 centimeters maximum length allowable) the ac power cable must be cut to 1-foot to 2-foot length, fitted with a proper connector, and an extension cable added. Also, make sure the connector on the extension cable fits the ac outlet. Any added cabling must have three conductors. Wire insulation on the extension cable must safely withstand at least 230 volts, and the size of each conductor must be as follows:

a. For a cable 10 to 15 feet (304,8 to 457,2 centimeters) in length:

(1) No. 12 American Wire Gauge (AWG).
(2) No. 14 British Standard Wire Gauge (SWG).
(3) No. 20 Metric Wire Gauge.

b. For a cable 15 to 20 feet (457,2 to 609,6 centimeters) in length:

(1) No. 10 AWG.
(2) No. 12 SWG.
(3) No. 25 Metric Wire Gauge.

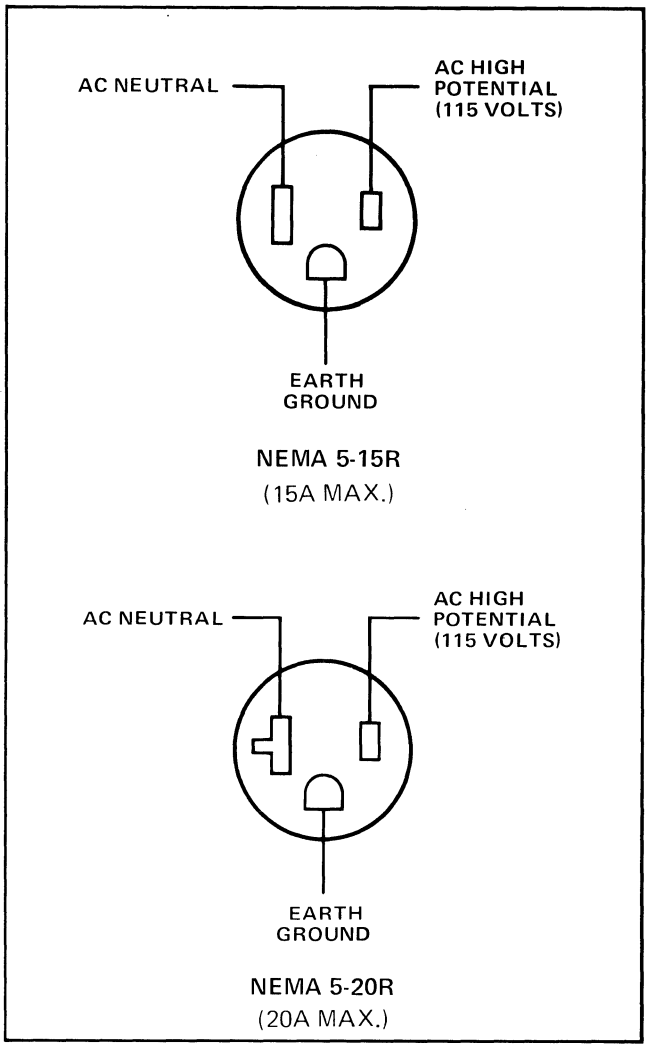


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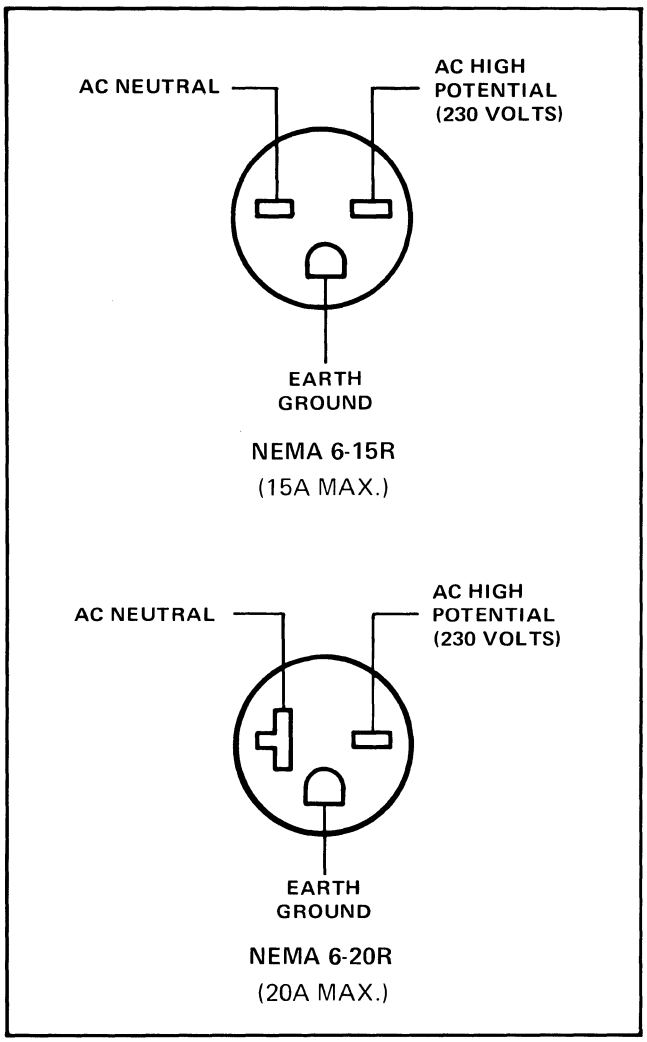
Figure 2-2. NEMA Type 5-15R and 5-20R AC Outlet, Mating Side



2133-5A

Figure 2-3. NEMA Type 6-15R and 6-20R AC Outlet, Mating Side

2-41. If an extension cable is used, or if the connector at the end of the ac power cable has been replaced, make sure that fuses A26F1 and A26F2 remain on the high-potential side of the power line. This is done as follows:

a. Plug the extension cable, if used, into the power cable. Do not make connection with the ac power source.

b. Remove the bottom panel of the extender and turn the POWER switch at the front of the extender to ON.

c. Set an ohmmeter to the R X 100 scale, and zero the meter.

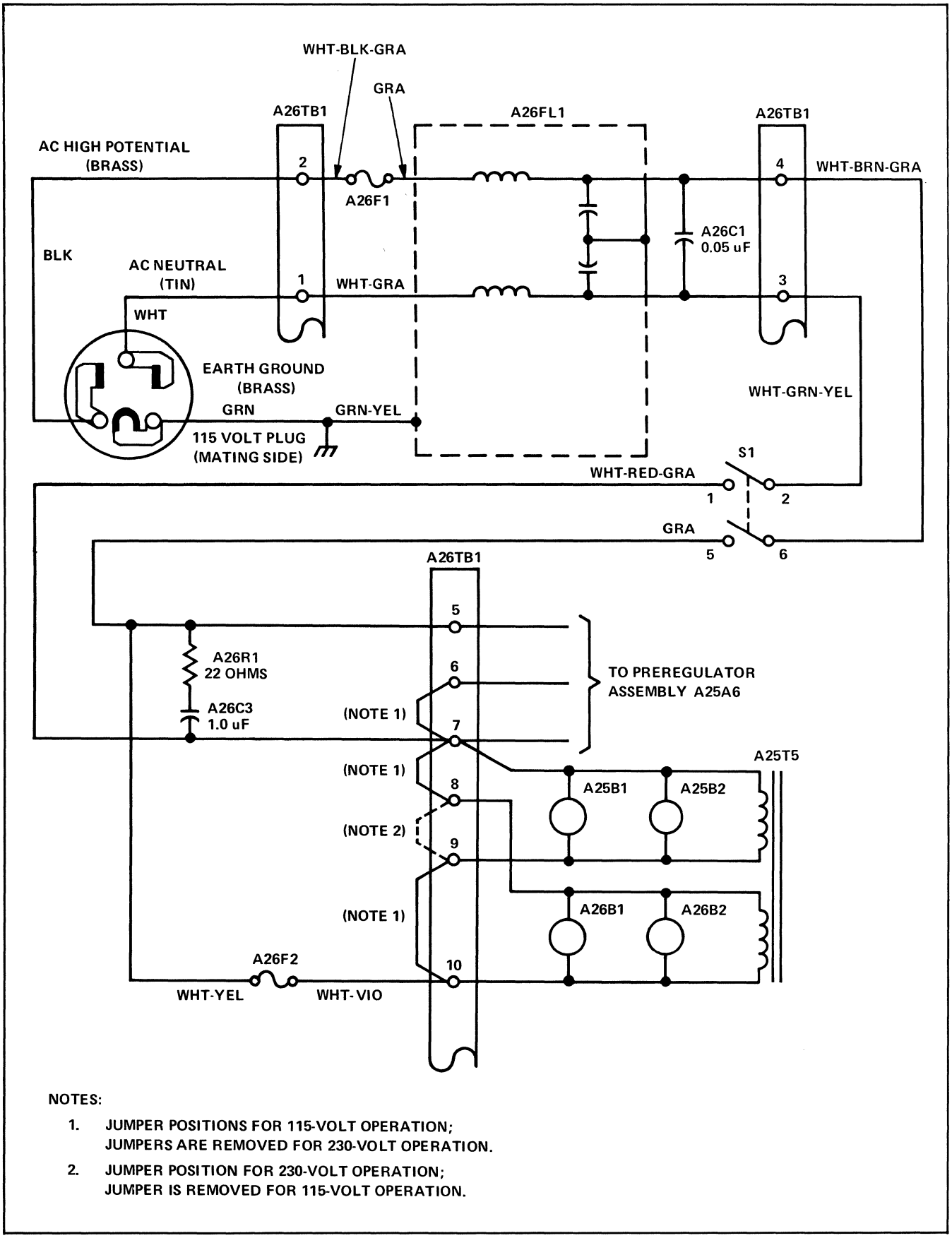
d. Connect one lead of the ohmmeter to the high-potential prong of the male connector which will plug into the ac source. (Refer to figure 2-2 or 2-3.)

e. Connect the other ohmmeter lead to terminal 5 of terminal board A26TB1. (See figure 2-1.)

f. Check the ohmmeter reading. If an open circuit is indicated, turn the POWER switch at the front of the extender to ON to close the contacts of switch S1 in the extender (see figure 2-4). With the switch contacts closed, the ohmmeter reading should be approximately zero. If the reading is not approximately zero, the power cable connections are incorrect. Make the necessary corrections as described in step "h" below.

g. If the test in step "f" is correct, turn the POWER switch to OFF to open the switch contacts. The ohmmeter should indicate infinite. If the reading is not infinite, the power cable connections are incorrect.

h. If either of the preceding measurements is incorrect, make the necessary changes in connector wiring. If an extension cable is used, change connections in one of the extension cable connectors, rather than in the factory-wired ac power cable. After making the correction, repeat the entire procedure, starting with step "c".



NOTES:

1. JUMPER POSITIONS FOR 115-VOLT OPERATION; JUMPERS ARE REMOVED FOR 230-VOLT OPERATION.
2. JUMPER POSITION FOR 230-VOLT OPERATION; JUMPER IS REMOVED FOR 115-VOLT OPERATION.

2153-10A

Figure 2-4. AC Power Connection Check Diagram

2-42. MOUNTING.

2-43. The extender is designed either for bench installation or for mounting in a standard 19-inch equipment rack. When installed on a shelf, bench, or table, the extender need not be fastened down except for shipboard, aircraft, or other mobile use. Shock mounts must be used for mobile installations. When installed in a rack, mount the extender in accordance with the instructions included in the rack-mounting kit. For mobile installations, the entire rack must be shock-mounted.

2-44. After the extender has been mounted, connect it to the computer as described in the following paragraphs.

2-45. INSTALLATION.

2-46. Installation instructions apply to installation of the basic extender (paragraph 2-47) and to installation of the extender containing a 12896A DMA Accessory Kit (paragraph 2-49).

2-47. INSTALLATION OF BASIC EXTENDER.

2-48. The basic extender provides 32 additional I/O slots to the 2100 Computer. The extender cards and cables are installed to interconnect the computer and extender as shown in figure 2-5. Proceed as follows:

a. At the front panel of the extender and the computer, turn the POWER switch to OFF.

b. Disconnect the extender and the computer ac power cables from the power source.

WARNING

Dangerous line voltage is present in the extender and the computer even when the POWER switch is off. Do not proceed further until complying with step "b" above. Failure to heed this warning could result in injury or death.

c. Remove the top panel from the computer and from the extender and install the cards in the slots specified in table 2-1 and figure 2-5. Remove the I/O Control Card (part no. 02100-60024) from the computer. Install jumpers (part no. 5080-0058) W1 through W6 and W9 through W16 in position A. See figure 2-6. Re-install card. Mark the schematic diagram for the A7 I/O Control Card in the computer Diagrams Manual (part no. 02100-90003 for 2100A or part no. 02100-90164 for 2100S), to show the jumpers in position A.

Note: The I/O terminator card does not contain a priority bus circuit. Therefore I/O interface cards must not be installed in card slots with higher octal addresses than the slot containing the I/O terminator card (see figure 2-8). Otherwise, the interrupt system will not function properly. Remove the I/O terminator card when its card slot and higher octal address card slots are to be used for interface cards.

d. Connect the I/O extension cable (part no. 02155-60011) from the 48-pin connector of the I/O control card located in slot 7 of the computer to the 48-pin connector of the I/O-X1 extender card located in slot 112 of the extender. Figure 2-5 shows the interface cabling and table 2-2 provides cable information.

e. Connect the other I/O extension cable (part no. 02155-60012) from the 48-pin connector of the I/O extender card located in slot 10 of the computer to the 48-pin connector of the I/O-X2 extender card located in slot 111 of the extender. Table 2-3 provides cable information.

f. Replace the top panels on the computer and the extender.

g. Connect the IPU interconnection cable (part no. 02155-60015) from the IPU connector on the rear of the extender to the IPU connector on the rear of the computer.

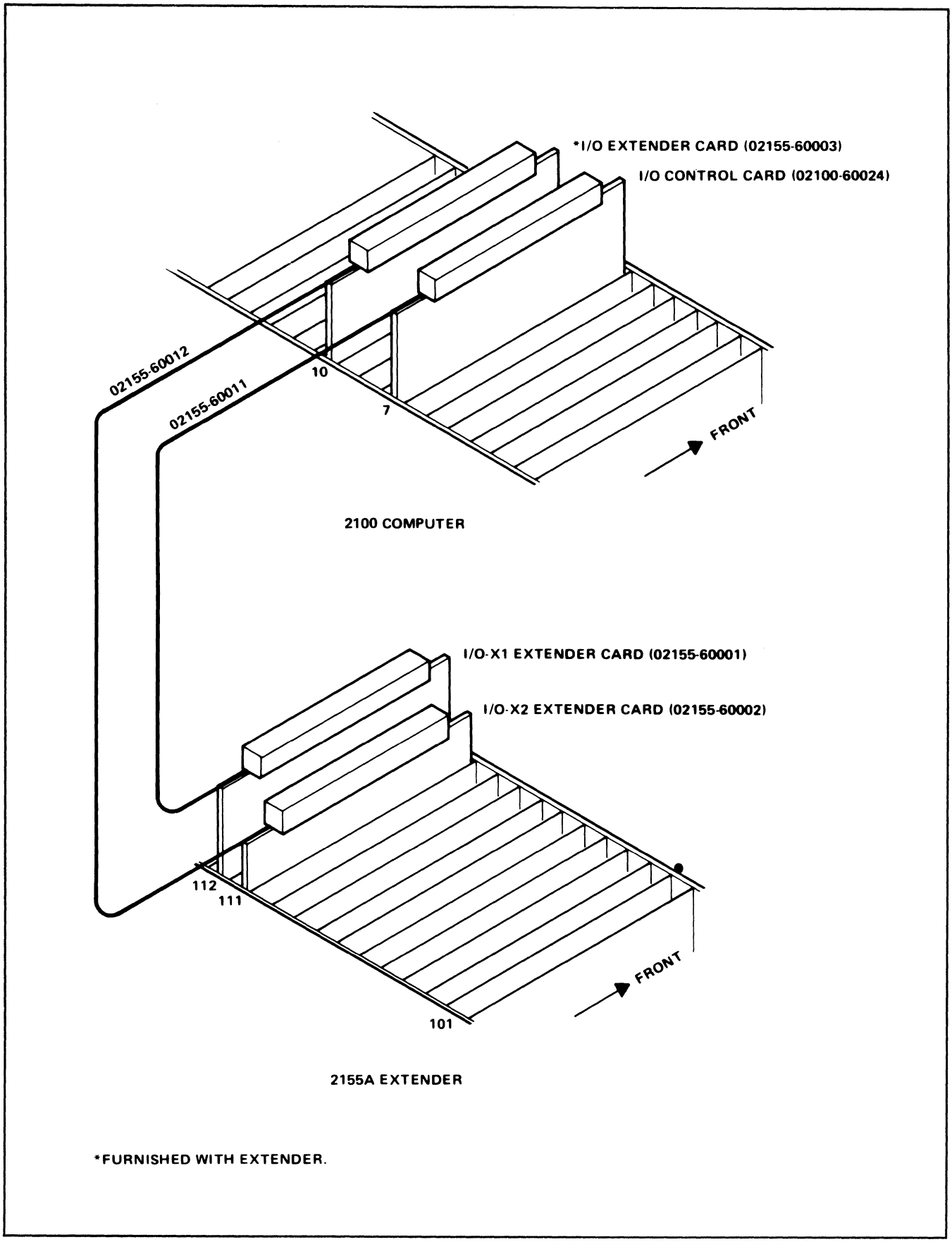
h. Connect the computer and extender ac power cables to the power source.

i. At the extender and the computer front panel, turn the POWER switch to ON.

j. Check the voltages at the test jacks on the rear panel of the extender as described in Section V of the Power Supply Operating and Service Manual.

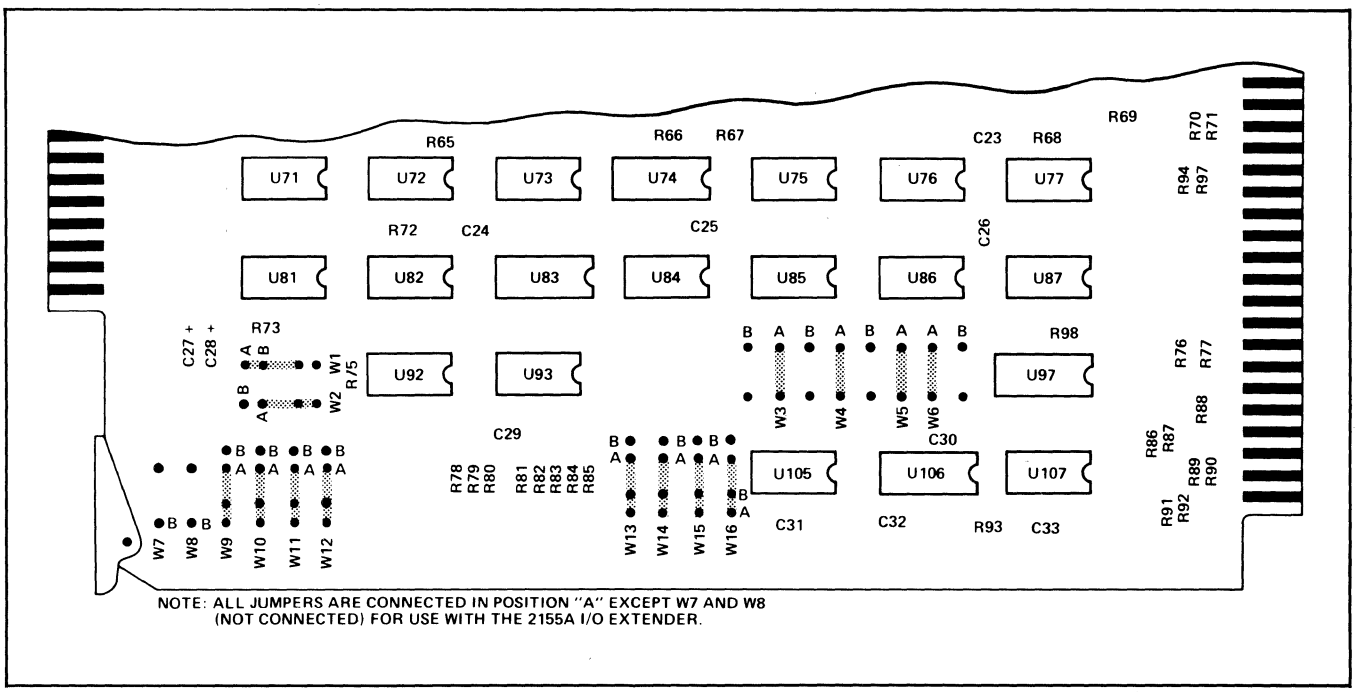
Table 2-1. Basic Extender, Card Locations

ASSEMBLY	HP PART NO.	CARD SLOT
I/O-X1 Extender Card	02155-60001	112 of the extender
I/O-X2 Extender Card	02155-60002	111 of the extender
I/O Extender Card	02155-60003	10 of the computer
I/O Terminator Card	02100-60060	13 of the extender



2153-12A

Figure 2-5. Basic I/O Extender Interface to Computer



2153-11

Figure 2-6. I/O Control Card Jumper Positions

Table 2-2. I/O Extension Cable (02155-60011), Connector Pin Assignments

PIN	SIGNAL	PIN	SIGNAL
A	Spare	1	GND
B	Spare	2	FLG6
C	Spare	3	FLG2X
D	Spare	4	FLG5
E	Spare	5	Not connected
F	Spare	6	Not connected
H	Spare	7	Not connected
J	Spare	8	Not connected
K	Spare	9	Not connected
L	Not connected	10	SCM6
M	SCM2X	11	Not connected
N	SCM3	12	Not connected
P	SCM4	13	SCM5
R	Not connected	14	IRQ1X
S	Not connected	15	IRQ2X
T	Not connected	16	IRQ3X
U	SCL0X	17	IRQ4X
V	SCL1X	18	IRQ5X
W	SCL2X	19	IRQ6X
X	SCL3X	20	IRQ7X
Y	SCL4X	21	FLG3
Z	SCL5X	22	PWUX
AA	SCL6X	23	Not connected
BB	SCL7X	24	GND

Table 2-3. I/O Extension Cable (02155-60012), Connector Pin Assignments

PIN	SIGNAL	PIN	SIGNAL
A	GND	1	GND
B	SFC	2	CLF
C	IEN	3	STF
D	IAK	4	T3IO
E	SKF	5	CRS
F	IOG	6	POPIO
H	IOBI16	7	IOO
J	CLC	8	STC
K	PRH25	9	IOI
L	SFS	10	SIR
M	IOB0	11	IOB1
N	IOB2	12	IOB4
P	SPARE	13	SPARE
R	ENF	14	IOB3
S	IOB5	15	RUN
T	IOB6	16	IOB7
U	IOB9	17	IOB8
V	IOB10	18	IOB12
W	IOB13	19	IOB11
X	IOB14	20	EDT
Y	PON	21	Spare
Z	LDS	22	Spare
AA	IOB15	23	Spare
BB	GND	24	GND

k. Load the interrupt test diagnostic program tape into the computer and run the test according to the procedures contained in program procedure part number 02100-90025 located in the Manual of Diagnostics.

Note: **The letter which follows program tape numbers identifies a particular revision of the tape and is subject to change. Always use the latest revision of a program tape even if different from that specified, together with the appropriate diagnostic program procedure contained in the Manual of Diagnostics.**

2-49. INSTALLATION OF EXTENDER WITH 12896A DMA ACCESSORY KIT.

2-50. The extender with DMA accessory kit allows DMA operation with any I/O device connected to one of the 32 I/O slots of the extender. The extender cards and cables are installed to interconnect the computer and extender as shown in figure 2-7. Proceed as follows:

a. At the front panel of the extender and the computer, turn the POWER switch to OFF.

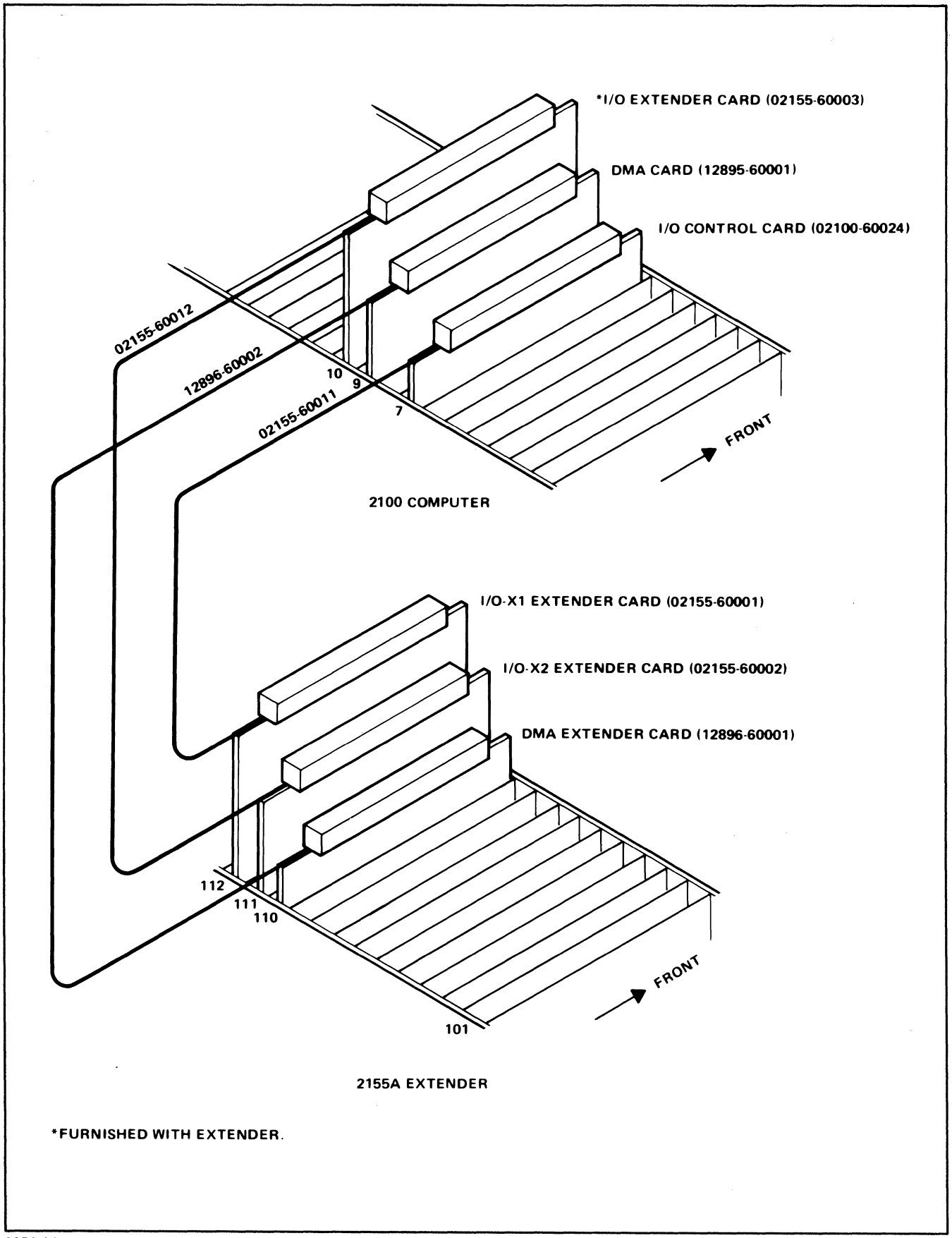
b. **Disconnect the extender and the computer ac power cables from the power source.**

WARNING

Dangerous line voltage is present in the extender and the computer even when the POWER switch is off. Do not proceed further until complying with step "b" above. Failure to heed this warning could result in injury or death.

c. Remove the top panel from the computer and from the extender and install the cards in the slots specified in table 2-4 and figure 2-7. Check that the I/O Control Card (part no. 02100-60024) and the DMA Card (part no. 12895-60001) are installed in the computer. Remove the I/O control card from the computer and install jumpers (part no. 5080-0058) W1 through W6 and W9 through W16 in position A. See figure 2-6. Re-install card. Mark the schematic diagram for the A7 I/O Control Card in the computer Diagrams Manual (part no. 02100-90003 for 2100A or part no. 02100-90164 for 2100S), to show the jumpers in position A.

Note: The I/O terminator card does not contain a priority bus circuit. Therefore I/O interface cards must not be installed in card slots with higher octal addresses than the slot containing the I/O terminator card (see figure 2-8). Otherwise, the interrupt system will not function properly. Remove the I/O terminator card when its card slot and higher octal address card slots are to be used for interface cards.

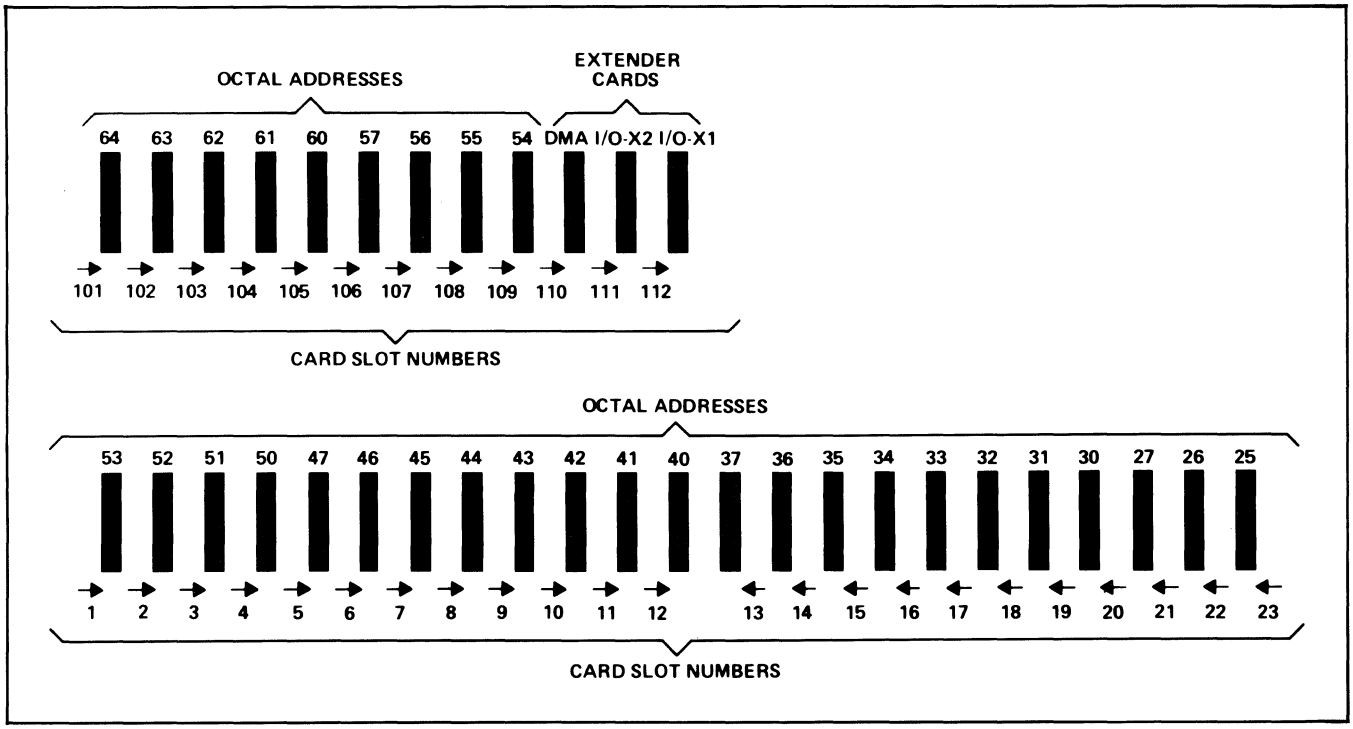


2153-13A

Figure 2-7. I/O Extender with 12896A DMA Kit, Interface to Computer

Table 2-4. Extender with DMA, Card Locations

ASSEMBLY	HP PART NO.	CARD SLOT
I/O-X1 Extender Card	02155-60001	112 of the extender
I/O-X2 Extender Card	02155-60002	111 of the extender
I/O Extender Card	02155-60003	10 of the computer
DMA Extender Card	12896-60001	110 of the extender
I/O Terminator Card	02100-60060	13 of the extender



2153-14

Figure 2-8. Card Slot Numbering and I/O Address Locations (Front View)

d. Connect the I/O extension cable (part no. 02155-60011) from the 48-pin connector of the I/O control card located in slot 7 of the computer to the 48-pin connector of the I/O-X1 extender card located in slot 112 of the extender. Figure 2-7 shows the interface cabling and table 2-2 provides cable information.

e. **Connect the other I/O extension cable (part no. 02155-60012) from the 48-pin connector of the I/O extender card located in slot 10 of the computer to the 48-pin connector of the I/O-X2 extender card located in slot 111 of the extender. Table 2-3 provides cable information.**

f. Connect the DMA extension cable (part no. 12896-60002) from the 48-pin connector of the DMA card located in slot 9 of the computer to the 48-pin connector of the DMA extender card (part no. 12896-60001) located in slot 110 of the extender. Figure 2-7 shows the interface cabling and table 2-5 provides cable information.

g. Replace the top panels on the computer and the extender.

h. Connect the IPU interconnection cable (part no. 02155-60015) from the IPU connector on the rear of the extender to the IPU connector on the rear of the computer.

i. Connect the computer and extender ac power cable to the power source.

j. At the extender and the computer front panel, turn the POWER switch to ON.

k. Check the voltages at the test jacks on the rear panel of the extender as described in Section V of the Power Supply Operating and Service Manual.

l. Load the DMA test diagnostic program tape into the computer and run the test according to the procedures contained in program procedure part no. 12578-90014 located in the Manual of Diagnostics.

Table 2-5. DMA Extension Cable (12896-60002), Connector Pin Assignments

PIN	SIGNAL	PIN	SIGNAL
A	GND	1	GND
B	Not connected	2	Not connected
C	Not connected	3	Not connected
D	Not connected	4	Not connected
E	Not connected	5	Not connected
F	Not connected	6	Not connected
H	Not connected	7	Not connected
J	Not connected	8	Not connected
K	Not connected	9	Not connected
L	Not connected	10	Not connected
M	SSSR2	11	Not connected
N	SSSR1	12	Not connected
P	SCM5	13	Not connected
R	SCM6	14	Not connected
S	Not connected	15	Not connected
T	Not connected	16	Not connected
U	SCM3	17	Not connected
V	SCM4	18	Not connected
W	EREQ1	19	Not connected
X	EREQ2	20	Not connected
Y	SRQ25X	21	Not connected
Z	SRQ26X	22	Not connected
AA	SRQ27X	23	Not connected
BB	GND	24	GND

Note: The letter which follows program tape numbers identifies a particular revision of the tape and is subject to change. Always use the latest revision of a program tape even if different from that specified, together with the appropriate diagnostic program procedure contained in the Manual of Diagnostics.

2-51. SLOT AND ADDRESS IDENTIFICATION.

2-52. Card slots in the extender are identified by decimal numbers. These numbers are located on the card cage between the card guides. Above these numbers are arrows which point to the specific slot. Figure 2-8 illustrates the card slot numbering and the I/O octal address locations.

Note: Beginning with serial numbers prefixed 1304, the card cage and the extractor handles on the cards are color coded. This is intended to prevent accidental installation of a card into a slot not intended for that card. (Installing a card into a wrong slot can result in damage to the card or to the extender.)

2-53. PRIORITY NETWORK.

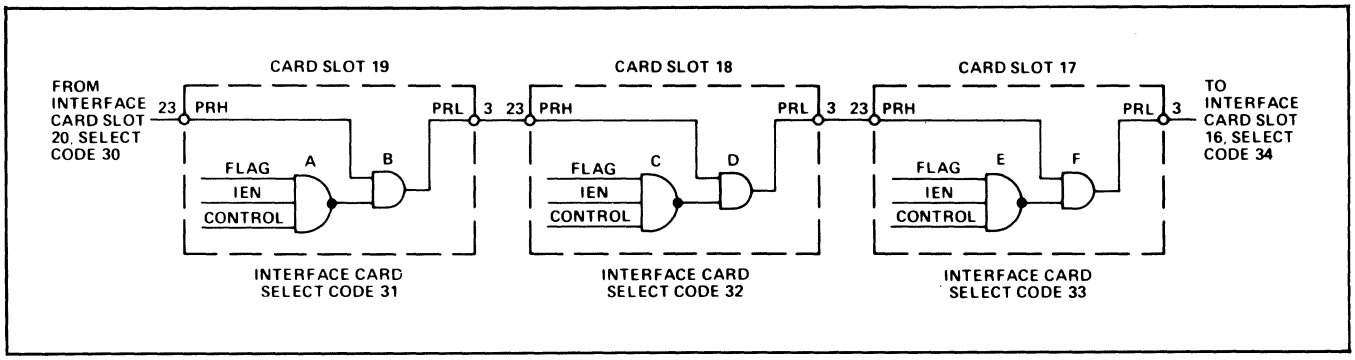
2-54. A priority network on the interface cards allows only one external device to interrupt the computer program regardless of the number of devices requesting an interrupt. Each of the interface card slots in the extender is allowed an interrupt priority corresponding to the select code assigned to the slot. The interrupt priority assignments of each slot remain fixed, but since any interface card can be plugged into any slot, the actual priority of a given device can be changed by plugging the I/O device interface card into a different slot.

2-55. Priority is established by a hardware-implemented priority chain. A typical interrupt priority chain is illustrated in figure 2-9. If the external device (whose interface card is located in card slot 19) is not ready to interrupt the computer program, the flag signal is false, making the output signal from gate A true. If a device of higher priority is not requesting an interrupt, the Priority High (PRH) signal is true. Therefore, the two inputs to "and" gate B are true, making the Priority Low (PRL) signal true, thus maintaining the priority chain. The true PRL signal is available to the next interface card (card slot 18) as a true PRH signal to that card.

2-56. If the interface card with select code 32 (card slot 18) requests an interrupt, all inputs to "nand" gate C are true (see figure 2-9). The false output from this gate will then apply a false input to "and" gate D. The output of gate D is then false, breaking the priority chain and preventing any interface card of lower priority from interrupting the computer program.

2-57. INTERRUPT PRIORITY CONTINUITY.

2-58. The interrupt priority chain shown in figure 2-9 must be maintained through all card slots in the extender as



2153-15

Figure 2-9. Interrupt Priority Chain, Simplified Logic Diagram

shown in figure 2-10. If an interface card is withdrawn from a slot, the priority chain is broken and the interrupt system cannot function properly until the card is re-installed or until a priority jumper card is installed in the slot to maintain the priority continuity.

2-59. While the PRL and PRH lines are only shown connected between groups of card slots in figure 2-10, it should be understood that the lines are connected between each card slot as shown in more detailed form in figure 2-9.

2-60. For a detailed description of the interrupt system, refer to the computer Reference Manual (part no. 02100-90001 for 2100A or part no. 02100-90160 for 2100S).

2-61. EXTENDER POWER SUPPLY.

2-62. The extender power supply provides regulated voltages for cards installed in the extender and for the front panel POWER indicator lamp. The extender power supply voltages are independent of the power supply voltages contained in the computer. The power failure detection circuits in the extender power supply provide a true Internal Power Up (IPU) signal to the computer to indicate normal power or a false IPU signal to indicate a power failure.

2-63. POWER FAILURE DETECTION.

2-64. When the extender is connected to the computer and a power failure occurs in the extender, the IPU signal generated by the power failure detection circuit goes false. This causes the power fail interrupt circuit, located on the I/O control card of the computer, to interrupt to a location where a halt instruction or the entry point to a power fail subroutine is stored. The subroutine performs an orderly shutdown, saving the contents of the computer registers.

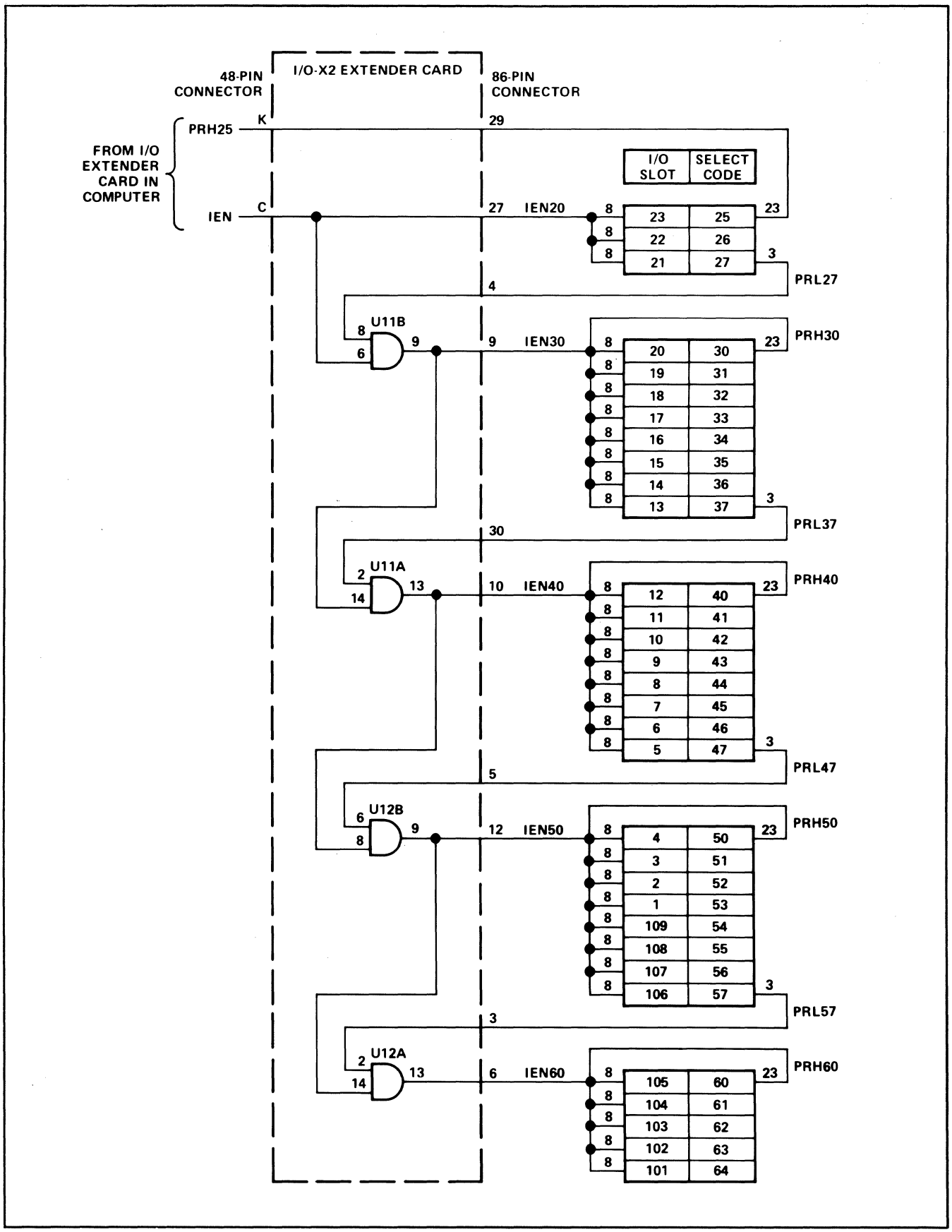
2-65. POWER RESTORATION.

2-66. When power is restored, the IPU signal is initially false, and within a specified delay, the IPU signal goes true. The true IPU signal causes the computer to again interrupt to the power fail subroutine location. This time a restart procedure is executed and all registers are restored to the state they were in at the time of the initial power failure. During the restart procedure, the power fail subroutine also returns control to the instruction in the user program that was to be executed at the time of the power failure interrupt.

2-67. PROGRAMMING.

2-68. Programming of extender functions is accomplished as a normal part of computer programming. This requires that the programs comprising the system software (e.g., system I/O drivers, Assemblers, FORTRAN compilers, Symbolic Editor, Basic Control System, etc.) be configured, or reconfigured, to specify the select code assignments and device unit number assignments available at the extender. Instructions on how to configure the system software to include these extender parameters are contained in the software documentation furnished with the computer or system.

2-69. After the system has been properly configured, normal methods and procedures can be used to code, compile, assemble, load and execute computer programs that reference the extender I/O functions. The working relationship between the computer registers and the I/O channels in the extender is the same as for I/O channels in the computer mainframe. Operations involving extender I/O channels are initiated and executed at the computer as before, with the required data and control signals transferred between the computer and extender through the appropriate interfacing circuits furnished as part of the extender.



2153-16

Figure 2-10. I/O Extender Priority Continuity

3-1. INTRODUCTION.

3-2. This section describes the operation of the circuits comprising the basic I/O Extender and its optional Direct Memory Access (DMA) feature. Description of the circuits is grouped into two functional areas. These are the I/O section and the DMA accessory feature. Figure 3-1 shows a functional block diagram of the extender and its relationship to the computer.

3-3. The I/O section is a 32-slot extension of the computer I/O section. The device interfacing circuits accommodate standard I/O interface cards 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.

3-4. The power supply operates from a 115-volt (230-volt adaptable), single-phase, 50- to 60-Hz power source which it converts to regulated dc supply voltages for the operation of the I/O section. When turned on, the extender power supply provides status signals used for power failure detection at the computer. The extender power supply is similar to the power supply in the computer. Detailed theory of operation for the power supply is contained in the Power Supply Operating and Service Manual.

3-5. The I/O section is described in paragraphs 3-23 through 3-39, and the DMA accessory feature is described in paragraphs 3-40 through 3-52. The description of each functional area consists of a general description at block diagram level, followed by a detailed description of the circuits at a logic or schematic diagram level.

3-6. REFERENCE INFORMATION.

3-7. The following paragraphs present general information which is required for understanding the theory discussions in this section.

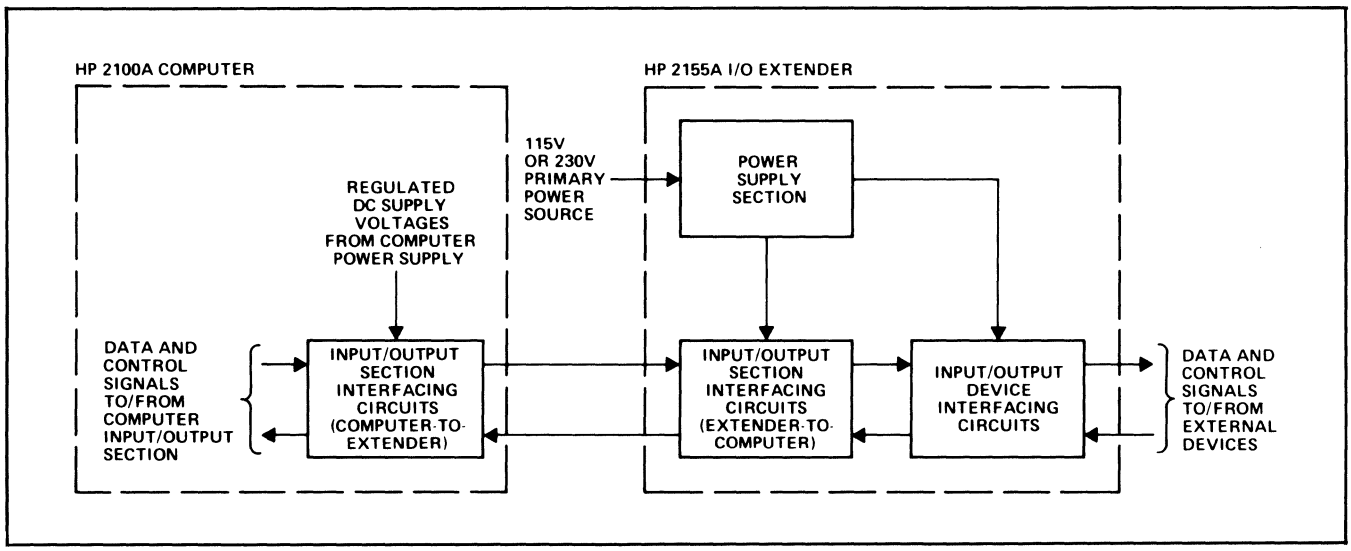
3-8. SIGNAL ABBREVIATIONS.

3-9. Abbreviations of flip-flop names and abbreviated designations of signals are defined in table 7-1.

3-10. BINARY VOLTAGE LEVELS.

3-11. The binary signal levels in the extender are approximately +2.3 volts and +0.2 volts. The levels may vary from these approximate amounts, depending on the type of integrated circuit providing the signal, its condition, and its load. The minimum and maximum input and output voltages for each type of integrated circuit are specified in figure 7-1.

3-12. In this manual, the +2.3-volt logic level is referred to by the term "true", and the +0.2-volt level is referred to as "false".



2153-17

Figure 3-1. I/O Extender, Functional Block Diagram

3-13. LOGIC CIRCUITS.

3-14. The logic circuits principally employ positive logic. That is, all inputs to an "and" or "nand" gate must be +2.3 volts for coincidence to occur. Similarly, if any input to an "or" or "nor" gate is +2.3 volts, the output is +2.3 volts for an "or" gate or +0.2 volts for a "nor" gate. The output from the "set" side of a flip-flop is approximately +2.3 volts when the flip-flop is set, and +0.2 volts when the flip-flop is cleared.

3-15. The logic symbols used in this manual are described in the Logic Symbology section of the computer Diagrams Manual (part no. 02100-90003 for 2100A or part no. 02100-90164 for 2100S).

3-16. SIGNAL NAMES.

3-17. Signals are named in one of the following ways:

a. As a condition which either exists or does not exist.

b. In accordance with the name of a flip-flop or panel switch which is the source of the signal.

c. In accordance with the name of the bus which carries the signal.

d. As a command or order, expressed in the imperative grammatical mode.

3-18. Since most circuits in the extender employ positive logic, signal names are positive-true. The following paragraphs describe the expression "positive-true name" as applied to each of the four types of signal names.

3-19. When a signal is named in accordance with a condition, the signal level is +2.3 volts when the condition exists, and +0.2 volts when the condition does not exist.

3-20. When a signal is named in accordance with the flip-flop which is its source, the signal taken from the set side of the flip-flop is +2.3 volts when the flip-flop is in the set condition, and +0.2 volts when the flip-flop is in the clear condition. For instance, when the Flag Buffer FF is in the set state, the FBFF signal is +2.3 volts.

3-21. When a signal is named in accordance with the bus which carries it, the signal is +2.3 volts when the bus carries a logic 1, and +0.2 volts when it carries a logic 0.

3-22. When a signal is named in the imperative mode, it becomes +2.3 volts to bring about the action commanded. For instance, the Flag FF is cleared when the CLF (clear flag) signal changes from +0.2 volts to +2.3 volts.

3-23. INPUT/OUTPUT SECTION.

3-24. The I/O section consists of the extender I/O card slots and associated backplane wiring, the I/O extender cards in slots 111 and 112 of the extender, and the I/O extender card in slot 10 of the computer. (See figure 3-2.) The I/O extender cards and extension cables interface the I/O wiring on the computer backplane to the I/O wiring on the extender backplane. 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 32 I/O channels in the extender.

3-25. INTERFACE TO COMPUTER.

3-26. Initialization, control, timing, priority, and I/O bus signals are transferred between I/O extender card A10 in the computer and I/O-X2 extender card A111 in the extender through an I/O extension cable assembly. (See figure 3-2.) Address and interrupt signals are transferred between I/O control card A7 in the computer and I/O-X1 extender card A112 in the extender through a second I/O extension cable assembly. The I/O extension cable connectors mate with the 48-pin edge connector of cards installed in corresponding card slots in the computer and extender. An I/O terminator card is installed in extender I/O slot 13 to provide proper loading for certain signal lines when only lower octal address I/O slots contain interface cards. The I/O terminator card is removed from the extender when its card slot and higher octal address card slots are to be used for interface cards.

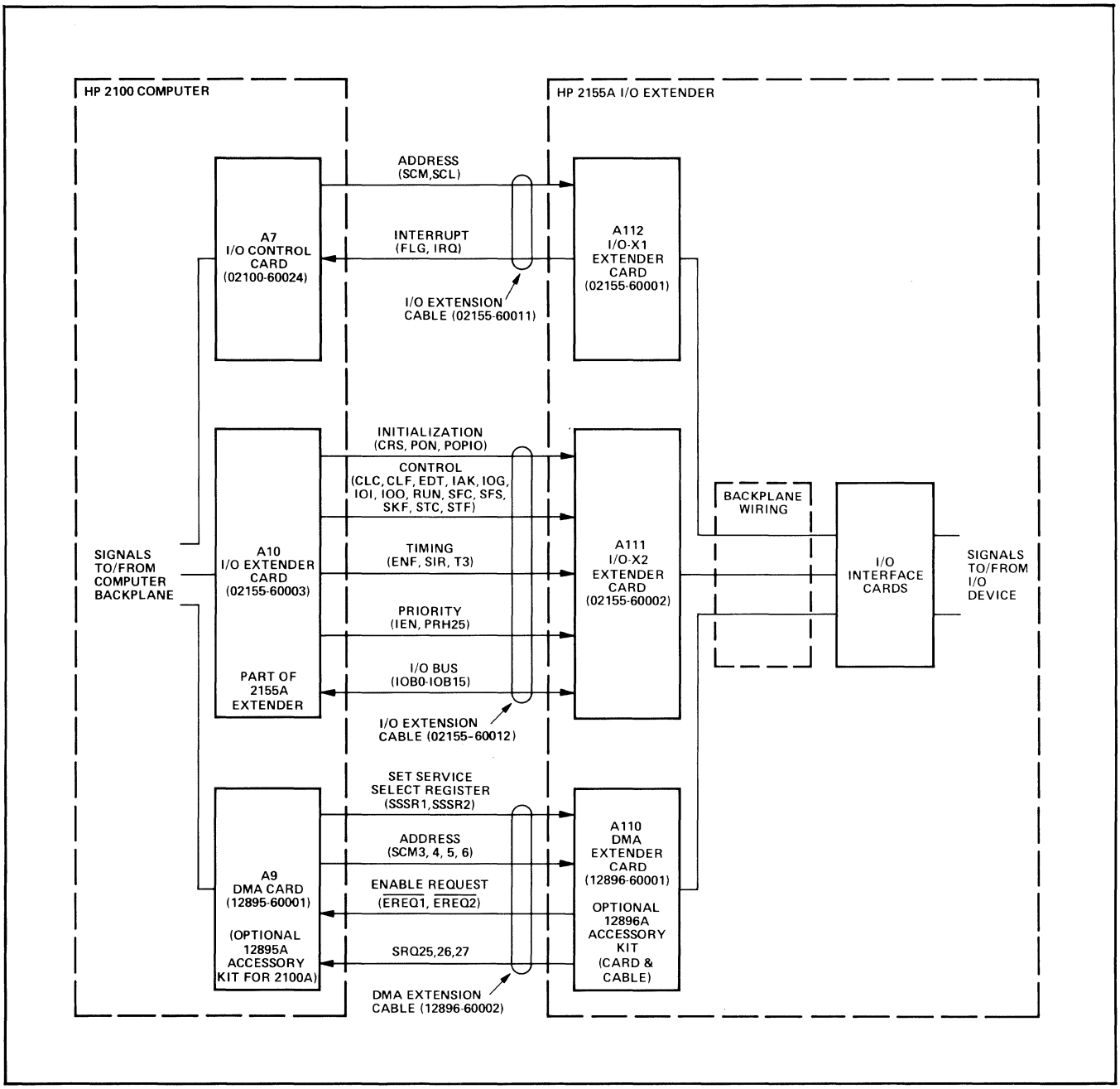
3-27. Input/output interface cards plugged into the I/O slots of the extender operate in the same manner as when used in computer I/O slots. If interface cards for I/O devices that operate under DMA control are installed in the extender, the 12896A DMA Accessory Kit must be installed in the extender and the 12895A DMA Accessory Kit must be installed in the computer to interface the computer-to-extender backplane DMA control signals. (See paragraph 3-40.)

3-28. CIRCUIT ANALYSIS.

3-29. Operation of the extender priority network and interrupt system is explained in paragraph 2-53. Operation of the extender I/O section is the same as for the computer I/O section. Theory of operation is presented in the computer Installation and Maintenance Manual (part no. 02100-90002 for 2100A or part no. 02100-90162 for 2100S). Additional information is given in the Operating and Service Manuals for I/O devices used with the computer. A further source of information is the computer Reference Manual (part no. 02100-90001 for 2100A or part no. 02100-90160 for 2100S).

3-30. SCHEMATIC DIAGRAM ANALYSIS.

3-31. I/O EXTENDER CARD. I/O Extender Card 02155-60003 (see figure 7-5) is used in slot 10 of the computer to transfer signals between the computer backplane and the extender I/O section. The 48-pin connector on this card mates with one end of a 48-conductor I/O extension cable. (See figure 3-2.) The other end of the I/O extension cable mates with the 48-pin connector on the I/O-X2 extender card located in slot 111 of the extender.



2153-18B

Figure 3-2. I/O Extender, Interface to Computer

3-32. As shown in figure 7-5, the I/O extender card 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. The other group of gates transfers the IOBO bits from the computer to the extender when the gates are enabled due to a false IOI signal. One input of the remaining gates on the card is connected to a signal line from either the computer backplane or the extender. The second input to each gate is connected to +4.85 volts dc. Consequently, any gate receiving a positive-true input signal produces a positive-true output signal which is transferred to either the computer backplane or the extender.

3-33. I/O-X2 EXTENDER CARD. I/O-X2 Extender Card 02155-60002 (see figure 7-8) is used in slot 111 of the extender to transfer signals between the extender backplane and the computer I/O section. The 48-pin connector on this card mates with one end of a 48-conductor I/O extension cable. (See figure 3-2.) The other end of the I/O extension cable mates with the 48-pin connector on the I/O extender card located in slot 10 of the computer.

3-34. As shown in figure 7-8, the I/O-X2 extender card consists primarily of two-input "and" gate drivers. All of the computer-to-extender signals, except the priority signals (described in paragraph 2-53), are transferred through parallel-connected gates to provide sufficient drive to the extender interface card circuits. The extender-to-computer

signals, such as IOBI, do not require drive gates and are conducted by direct lines on the I/O-X2 extender-card. One input to each parallel-connected gate is connected to a single line from the computer backplane. The second input is connected to +4.85 volts dc. Consequently, any parallel-connected gate receiving a positive-true input signal produces a positive-true output signal which is transferred to the extender backplane.

3-35. I/O-X1 EXTENDER CARD. I/O-X1 Extender Card 02155-60001 (see figure 7-9), is used in slot 112 of the extender to transfer signals between the extender backplane and the computer I/O section. The 48-pin connector on this card mates with one end of a 48-conductor I/O extension cable. (See figure 3-2.) The other end of the I/O extension cable mates with the 48-pin connector on the I/O control card located in slot 7 of the computer. An "X" suffix to the mnemonics in figure 7-9 matches the computer mnemonic which differentiates between external and backplane signals.

3-36. As shown in figure 7-9, the I/O-X1 extender card consists primarily of one-input drivers. The address signals (SCM, SCL) are transferred from the computer to the extender through the drivers to provide sufficient drive to the interface card circuits. The interrupt signals (FLG, IRQ) are conducted by direct lines on the I/O-X1 extender card from the extender to the computer.

3-37. I/O TERMINATOR CARD. I/O terminator card 02100-60060 (see figure 7-6) provides loading for signal lines terminating at the backplane connectors in the I/O section of the extender. These signal lines are insufficiently loaded if enough interface cards, which normally provide the required loading, are not installed in the extender. Proper loading is required to prevent the unused signal line terminations from generating transient noise that would otherwise be transmitted through the rest of the backplane wiring. This is accomplished by installing the I/O terminator card, as required, in card slot 13 of the extender.

3-38. As shown in figure 7-6, the I/O terminator card consists of thirty-two 220-ohm load resistors and two 1K resistors. One end of each resistor is connected to a signal line from the backplane; the other end of the resistor is connected to -2 volts dc through connector pins 47 and 48.

3-39. The I/O terminator card in slot 13 is no longer required, and must be replaced by the next I/O interface card, after card slots 23 through 14 have been filled.

Note: The I/O terminator card does not contain a priority bus circuit. Therefore, I/O interface cards must not be installed in card slots with higher octal addresses (see figure 2-8) than the slot containing the I/O terminator card. Otherwise, the interrupt system will not function properly. Remove the I/O terminator card when its card slot and higher octal address card slots are to be used for interface cards.

3-40. DIRECT MEMORY ACCESS ACCESSORY.

3-41. The basic extender can be equipped with the Direct Memory Access (DMA) accessory by installing the 12896A DMA Accessory Kit in the extender. The kit consists of the DMA extender card which is installed in slot 110 of the extender, and the DMA extension cable which interfaces the card with the DMA card (12895A DMA Accessory Kit) in the computer. (See figure 3-2.) The DMA extender card and cable provide an extension of the DMA circuits in the computer to the I/O interface cards in the extender. The additional circuits allow DMA operation with any I/O device connected to the extender.

3-42. COMPUTER DMA OPERATION.

3-43. A detailed description of the operation of DMA circuits (12895A DMA Accessory Kit) in the computer is presented in the computer Installation and Maintenance Manual (part no. 02100-90002 for 2100A or part no. 02100-90162 for 2100S). A thorough understanding of this information is necessary to understand the operation of the DMA circuits in the extender.

3-44. DMA INTERFACE.

3-45. The Set Service Select Register and Enable Request signals, for both DMA channels, are transferred between DMA card A9 in the computer and DMA extender card A110 in the extender through a DMA extension cable. (See figure 3-2.) The DMA extension cable connectors mate with the 48-pin edge connectors on each card. Additional signals that are transferred by the DMA extension cable are the SCM3, 4, 5, and 6 and the SRQ25X, 26X, and 27X signals, described in paragraph 3-52.

3-46. EXTENDER DMA OPERATION.

3-47. The DMA extender card contains set service select register (SSSR1 for channel 1 and SSSR2 for channel 2) and service request (SRQ) select circuits for the I/O devices connected to the extender. All other DMA circuitry is contained on the DMA card in the computer.

3-48. When DMA is initialized, the first control word (CW1) is sent to the DMA card in the computer. The lower six bits of CW1, which identify the select code of the selected I/O device, are also sent to the service select registers on the DMA extender card. When the selected extender I/O device is ready to transfer data to the computer, the Flag FF is set on the interface card and an SRQ signal is generated. The SRQ signal is compared with the decoded select code by the multiplexer circuits on the DMA extender card. When the select code and SRQ signals coincide, an Enable Request signal is sent to the DMA card to generate a phase 5 (DMA) cycle.

3-49. DMA EXTENDER CARD CIRCUIT ANALYSIS.

3-50. When the first control word (CW1) is sent to the computer DMA card by an OTA 6 (channel 1) or OTA 7 (channel 2) instruction in the main program, the lower six bits of CW1, IOB0 through IOB5, are sent to the DMA extender card as shown in figure 7-7. Bits 0, 1, and 2 identify the least significant octal digit and bits 3, 4, and 5 identify the most significant octal digit of the select code of the selected I/O device. Since the operation of channels 1 and 2 are identical, as shown in figure 7-7, the operation of channel 1 only is described in the following paragraph.

3-51. When the DMA card in the computer is initialized for channel 1 operation, the Set Service Select Register 1 (SSSR 1) signal is sent from the DMA card in the computer to the DMA extender card. The SSSR 1 signal clocks the IOBO bits 0, 1, and 2 into Service Select Register FFs U33A, B, and C, respectively, and clocks the IOBO bits 3, 4, and 5 into Service Select Register FFs U33D, U53B, and U53A, respectively. The outputs of the most significant bit registers (bits 3, 4, and 5) are combined in gates U42A, B, and C, and U52C. When all inputs to one of these gates are true, the output enables the appropriate 8-input multiplexer circuit for channel 1 (U35, U36, U75, or U76). When this same 8-input multiplexer receives the output of the least significant bit registers that corresponds to the least significant octal digit of the SRQ input, the output (through gate U34) results in the false Enable Request 1 ($\overline{\text{EREQ1}}$) signal. The $\overline{\text{EREQ1}}$ signal is sent to the DMA card in the computer and routed to the Cycle Request logic to generate the phase 5 (DMA) cycle.

3-52. The SRQ25X, 26X, and 27X lines and the SCM3, 4, 5, and 6 lines on the DMA extender card are routed from the extender backplane through the DMA extender card and extension cable to the DMA card in the computer. The SRQ25X, 26X, and 27X signals are processed by the 8-input multiplexer circuits in the DMA card in the same manner as the SRQ30 through 64 are processed on the DMA extender card. The SCM3, 4, 5, and 6 signals are sent from the computer DMA card through the extension cable and the DMA extender card to the extender backplane connectors. All other SCM and SCL signals are sent from the DMA card through the computer backplane, I/O control card and extension cable, and the I/O-X1 extender card to the extender backplane connectors. (See figure 3-2.) The "X" suffix to the mnemonics in figure 7-9 matches the computer mnemonic which differentiates between external and backplane signals.

SECTION IV TROUBLESHOOTING

4-1. INTRODUCTION.

4-2. 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.

4-3. TEST DATA.

4-4. 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 front 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.

4-5. TROUBLESHOOTING DATA.

4-6. 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 and related diagrams presented in Section VII and the replaceable parts information presented in Section VI. 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.

4-7. INFORMATION IN OTHER MANUALS.

4-8. Information in other manuals which may be required during troubleshooting includes that presented in the following:

a. Computer Installation and Maintenance Manual (part no. 02100-90002 for 2100A or part no. 02100-90162 for 2100S).

b. Computer Reference Manual (part no. 02100-90001 for 2100A or part no. 02100-90160 for 2100S).

c. Power Supply Operating and Service Manual (part no. 5951-3038).

d. The applicable diagnostic test procedures contained in the Manual of Diagnostics.

4-9. BASIC CHECKOUT.

4-10. GENERAL.

4-11. The basic checkout test procedure is performed using operating switches and indicators on a properly-functioning 2100 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.

4-12. REQUIRED TEST EQUIPMENT.

4-13. Only a digital voltmeter is required for basic checkout procedure. However, it is recommended that the following test equipment, or its equivalent (refer to table 1-5), be prepared for operation in the event it is required for troubleshooting:

a. HP 180A Plug-In Oscilloscope Main Frame.

b. HP 1801A Vertical Amplifier (plug-in for HP 180A).

c. HP 1820A Time Base (plug-in for HP 180A).

d. HP 10004A Miniature Resistive Divider Probes (10:1).

e. HP 3439A Plug-in Digital Voltmeter.

f. HP 3441A Range Selector (Plug-in for HP 3439A).

g. HP 427A Multi-Function Meter.

h. HP 10525A Logic Probe.

4-14. TEST PROCEDURE.

4-15. 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.

4-16. 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 front 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 computer/extender operator. This information may prove useful in the troubleshooting process.

a. At the front panel of the extender, turn the POWER switch to OFF.

b. Remove the top panel of the extender.

WARNING

Dangerous ac line voltage is present in the extender even though the POWER switch has been turned off at the extender front panel. Protective panels and covers installed on the power supply and on the bottom of the card cage 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 panels 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 cable 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. Refer to paragraph 5-7 for additional safety information before proceeding.

c. Inspect the electrical assemblies and parts comprising backplane and power supply for visible indications of trouble, such as burned wiring, broken wiring connections, loose or improper cable connections, or plug-in cards 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 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 front panel of the computer, check that the LOADER ENABLE switch-indicator is off. Check all maintenance switches for proper operating positions. Refer to Section I of the computer Installation and Maintenance Manual (part no. 02100-90002 for 2100A or part no. 02100-90162 for 2100S).

e. Turn the extender POWER switch to ON. Check that fans A25B1 and A25B2 at the rear of the power supply and A26B1 and A26B2 at the rear of the plenum chamber 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 all 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 Section V of the Power Supply Operating and Service Manual.

4-17. DIAGNOSTIC CHECKOUT.

4-18. GENERAL.

4-19. 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 paragraph 4-20 through 4-26 following.

4-20. REQUIRED DIAGNOSTIC PROGRAM TAPES AND PROCEDURES.

4-21. Diagnostic test programs are stored in absolute form on punched paper 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 and for performing diagnostic checkout are included in Section IV of the computer Installation and Maintenance Manual (part no. 02100-90002 for 2100A or part no. 02100-90162 for 2100S). The diagnostic tests necessary for checkout of the extender are listed in paragraph 4-22.

4-22. The diagnostic program procedures in the Manual of Diagnostics also provide instructions for running the diagnostic test programs. Each procedure within the Manual of Diagnostics is identified by a part number printed on the title page of the document. The names and part numbers of the procedures used for running the test programs that check the basic circuits of the extender are as follows:

a. HP 2100 Interrupt Test (part no. 02100-90025).

b. HP 2100 Direct Memory Access (DMA) Test (part no. 12578-90014).

c. HP 2100 Power Fail Test (part no. 02100-90020).

Note: Diagnostic test procedures for test programs used in testing optional interfacing circuits are referenced in the Operating and Service Manuals furnished with the options.

4-23. TEST SEQUENCE.

4-24. Perform the diagnostic program procedures for the extender listed in paragraph 4-22. The Direct Memory Access (DMA) test is applicable only to those extenders that are equipped with DMA. The alter-skip, memory reference, and shift-rotate tests for the computer should be conducted prior to the extender tests. If all test programs run without error, the extender is ready for normal operation. If trouble is encountered, proceed to the following paragraph.

4-25. TROUBLESHOOTING FLOWCHART.

4-26. The troubleshooting flowchart shown in figure 4-1 describes the steps to be taken when troubles (error halts) are encountered during diagnostic testing. The troubleshooting test program shown in table 4-1 is used in conjunction with the flowchart. The test program is toggled in at the computer front panel. If the selected I/O slot interrupts properly, the computer goes to a normal halt. If the selected I/O slot does not interrupt, the program will loop and allow the signals at the extender backplane to be tested with an oscilloscope.

4-27. POWER SUPPLY TROUBLESHOOTING.

4-28. If power supply voltages are incorrect and adjustments fail to correct the trouble, refer to the power supply troubleshooting procedures in Section IV of the Power Supply Operating and Service Manual. Measure the voltages and waveforms at the points shown to isolate the trouble to a replaceable part. If the trouble cannot be isolated and repaired, return the power supply to the factory as described in the power supply manual.

Table 4-1. Troubleshooting Test Program

LABEL	OPCODE	OPERAND	COMMENTS
START	CLF	0	Turn off interrupt system
	STC	(SC),C	Turn on selected I/O card
	STF	0	Turn on interrupt system
	STF	(SC)	Force interrupt condition on I/O card
	NOP		I/O card should
	NOP		interrupt
END	JMP	START	Did not interrupt, loop on program
	HLT	77	I/O card interrupted properly
	(in trap cell)		

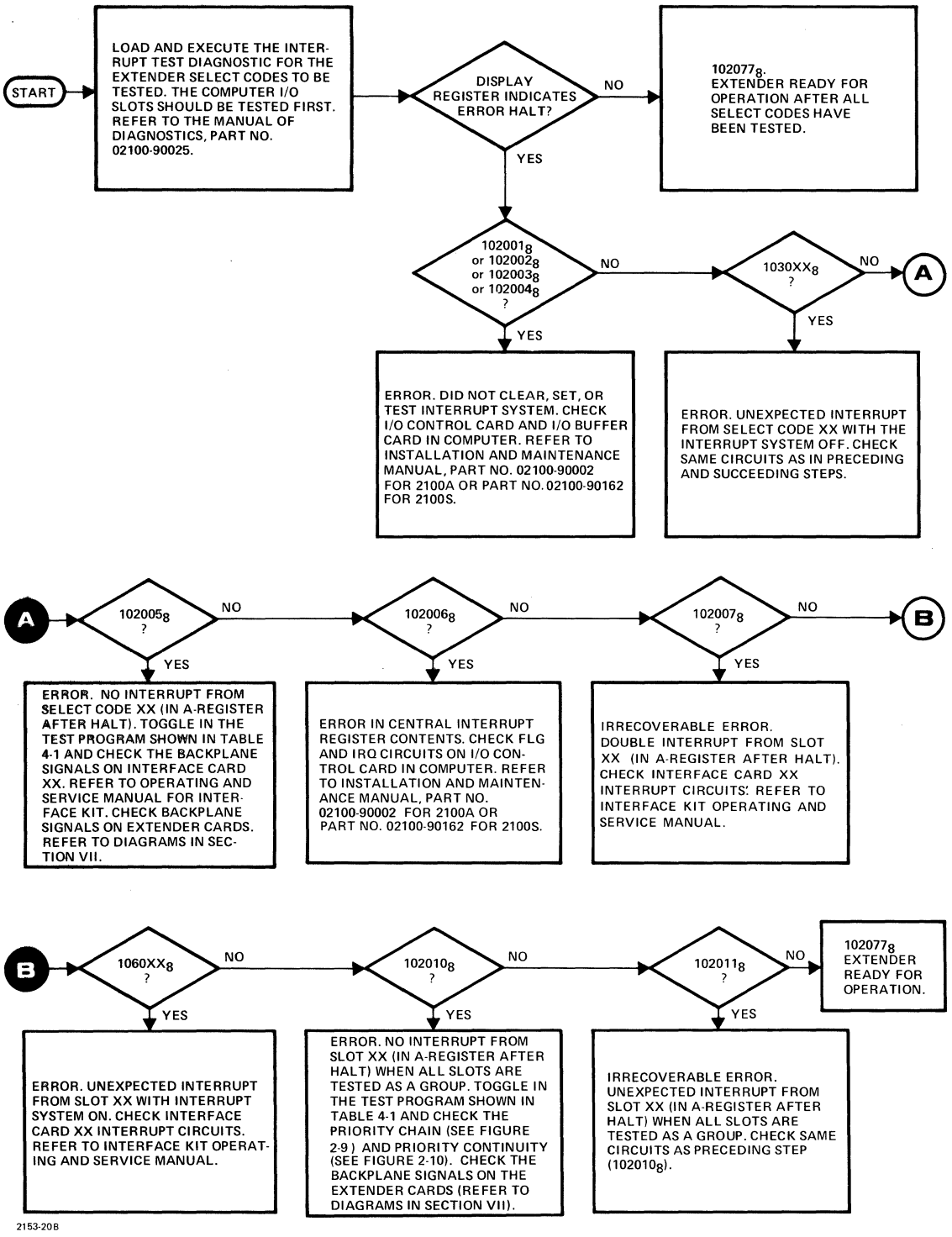


Figure 4-1. I/O Extender, Troubleshooting Flowchart

SECTION V MAINTENANCE

5-1. INTRODUCTION.

5-2. This section describes preventive maintenance, adjustments, and part-replacement procedures for the 2155A I/O Extender. Maintenance procedures for I/O devices or for I/O interface cards are not included. Maintenance information for these items is provided in the documentation for the optional feature concerned.

5-3. 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.

5-4. 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. Fault isolation methods are presented in section IV.

5-5. The preventive maintenance procedure is described in full in this section and the detailed description is followed by a summary which repeats the main features of the procedure. This summary may be used as a guide for the performance of maintenance after the reader has become familiar with the detailed description and has put it to practical use at least once.

5-6. To determine the appearance and location of components and assemblies for the performance of maintenance, refer to the exploded view presented in figure 5-1 and to the parts location diagrams in Sections VI and VII.

5-7. SAFETY PRECAUTIONS.

WARNING

When the extender is on, use caution when working inside the extender cabinet. 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 other metal objects onto conductors. Remove power and recover dropped objects at once; if forgotten, damage could result later. AC power-line voltage and 160 volts dc are exposed when certain covers are removed; these covers are described in the following paragraph. 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 cable before performing any work inside the extender. Dangerous voltage exists even when power is turned off. If working in the power supply section, wait 3 minutes for filter capacitors to discharge after removing power. To prevent explosion resulting from internal heating, always be sure that a replacement filter capacitor is properly connected with respect to polarity. Danger of death or serious injury exists if the precautions above are not observed.

5-8. HIGH-VOLTAGE POINTS.

5-9. The highest ac voltage in the extender is the ac line voltage. The highest dc voltage in the extender is 160 volts in the power supply. The ac line voltage is exposed when the bottom cover of the extender and the cover of terminal board A26TB1 (on the bottom of the plenum chamber) is removed. The 160 volts dc is exposed at several points within the power supply when the top or bottom power supply covers are removed.

5-10. TEST EQUIPMENT GROUND.

5-11. If test equipment has a metal case, the negative test lead preferably should not be internally connected to the case. Instead, the case should be connected to a good earth ground through the test equipment power cord. This precaution prevents the danger of shock or possiblity of a short when the negative lead is connected to a point not at ground potential.

5-12. PREVENTIVE MAINTENANCE.

5-13. GENERAL.

5-14. The following preventive maintenance procedures are performed at monthly or semimonthly intervals, the frequency depending upon the physical conditions prevailing at the particular site. Performance once per month is adequate for most sites. The monthly performance is applicable to extenders which operate 24 hours per day, seven days per week. The interval may be reduced in accordance with the amount of time the extender is turned off.

5-15. EQUIPMENT REQUIRED.

5-16. The following items are required to perform preventive maintenance:

a. HP 2100 Computer.

b. Source of compressed air for cleaning filters, or two cleaned filters.

c. Vacuum cleaner for removing dust from the extender.

d. Digital voltmeter of the type listed in table 1-5.

e. Oscilloscope of the type listed in table 1-5.

5-17. PROCEDURE.

5-18. Before starting preventive maintenance, connect the extender to the 2100 Computer as described in paragraph 2-48. Plug in the digital voltmeter and turn it on. Then proceed as described in the following paragraphs.

5-19. AIR FILTERS. Clean the air filters at the rear of the extender using the following procedure:

a. Remove the two air filters from the extender by pulling firmly on the filter frame. (The filters are held in place by metal banana plugs attached to each corner of the filter frame.)

b. Remove the filters from the extender room and using compressed air, blow the dirt from each filter. Blow in the opposite direction from that in which air normally moves through the filter. Reinstall each filter. If compressed air is not available at the extender site, install two spare filters which have been cleaned.

5-20. DUST. If required, remove dust and other light debris from the extender, using the vacuum cleaner. Loosen encrusted dust with a soft-bristled brush, and pay particular attention to heat dissipating areas.

5-21. CABLES. With the extender POWER switch off and the ac power cable disconnected, remove the top panel of the extender and check the extension cables and hood connectors for cracks, burns, or wear. Also inspect the ac power cable, paying particular attention to the portions of the cable near the connector and the cable clamp. Repair if necessary.

5-22. CIRCUIT CARDS. Remove the bottom and top panels of the extender, then remove the bottom power supply cover. Check all circuit cards for proper seating. Adjust where necessary.

5-23. FANS. Turn on the extender POWER switch and check the extender for proper operation of the four cooling fans. Ensure that no object interferes with the rotation of the fan blades.

5-24. VOLTAGE CHECKS. Make the voltage checks as described in Section V of the Power Supply Operating and Service Manual.

5-25. DIAGNOSTIC PROGRAMS. When feasible, run the diagnostic programs as described in paragraph 4-22.

5-26. Upon completing the preventive maintenance procedures for the extender, correct any defects found and rerun the diagnostic programs; then proceed with preventive maintenance for the I/O devices.

5-27. PREVENTIVE MAINTENANCE SUMMARY.

5-28. Preventive maintenance for the extender consists of the following:

a. Clean air filters.

b. Remove dust.

c. Check cables for wear.

d. Check circuit cards for proper seating.

e. Check operation of the four fans.

f. Check the dc operating voltages at the rear of the extender.

g. Run the diagnostic programs.

h. Perform preventive maintenance for I/O devices.

5-29. POWER SUPPLY SERVICING.

5-30. Power supply servicing is covered in Section V of the Power Supply Operating and Service Manual.

5-31. ADJUSTMENTS.

5-32. The only adjustments to be made in the extender are power supply adjustments. Refer to Section V of the Power Supply Operating and Service Manual.

5-33. REMOVAL AND REPLACEMENT PROCEDURES.

5-34. The following paragraphs describe the methods for removing and installing various assemblies and units in the extender. Before performing any of the procedures, read the entire description of the procedure. Heed all **WARNING** and **CAUTION** notices.

5-35. CARD REMOVAL AND REPLACEMENT.

CAUTION

Failure to observe the following procedures may result in damage to components on circuit cards.

5-36. Before removing or installing cards in the card cage, turn off power and allow at least 15 seconds for bypass capacitors to discharge.

5-37. To remove a card from the card cage, first take off the card retainer. Remove the top connector from the card (if any), and loosen the card by pulling upward on the plastic levers at the top of the card.

5-38. When removing or installing cards in the card cage or the power supply, use extreme care not to damage traces or protruding components on the card or on adjacent cards.

5-39. Cards must be installed in the card cage with the components on the left as viewed from the front of the extender.

5-40. Cards in the card cage are keyed to prevent full insertion if a card is inserted with the components on the right, but they are not keyed to prevent installation in the wrong slot. Therefore, make sure that the reference designation on the card extractor lever corresponds to the number of the slot being used. If there is no reference designation on the extractor lever, refer to figure 7-4 for card locations. Also make sure that the four cards in the power supply are not interchanged.

Note: Beginning with serial numbers prefixed 1304, the extractor handles and the card cage are color coded. Therefore, when installing a card, be sure that the color of the extractor handle matches the color of the strip adjacent to the card slot. Otherwise, the card or the extender may be damaged when power is turned on.

5-41. INTEGRATED CIRCUIT REPLACEMENT.

5-42. The following procedure is recommended for replacing an integrated circuit:

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

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

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

d. Mount the new integrated circuit on the card and solder each pin.

5-43. BACKPLANE CONNECTOR REPLACEMENT.

5-44. Because of the numerous wires attached to backplane connectors, replacement of a connector should not be attempted in the field. If replacement is necessary, return the extender to the factory for installation of a new backplane. See paragraph 2-20 for information on packing the extender for shipment.

5-45. REPLACEMENT OF BACKPLANE CONNECTOR CONTACTS AND BACKPLANE WIRING.

CAUTION

Do not attempt to solder any of the backplane wires instead of using the proper wire wrapping tools. Solder drops may cause shorts in the backplane wiring.

5-46. For replacing backplane connector contacts, and for removing and installing wires to these contacts, use tools listed in paragraph 1-45. Instructions for using the contact replacement tools are furnished in the following pamphlet published by AMP Incorporated, Harrisburg, Pennsylvania: A-MP TERMI-TWIST Contact Replacement Tool, Amp publication no. IS 2038.

5-47. The following information is pertinent to the use of wiring tools:

a. Wiring post size is 0.031 by 0.062 inch.

b. Wires between backplane connectors are 26 gauge (American Wire Gauge) solid, silver-plated copper, Kynar insulation 5 mils thick. Outer diameter is 0.026 ± 0.0015 inch.

5-48. WIRE BUNDLING.

5-49. If it becomes necessary to remove the ties which hold a wire bundle together, do not replace the ties with lacing cord. There are wires as small as 26 gauge (American Wire Gauge) in some bundles; lacing cord can sever the conductors in these wires, leaving no external evidence on the wire insulation. For wire bundling, use the following ties, tighten lightly with a pair of pliers:

a. Cable strap (HP part no. 1400-0493), for wire bundles 1/16 inch to 1-1/8 inches in diameter.

b. Cable clamp (HP part no. 1400-0482), for wire bundles from 1/4 inch to 3 inches in diameter.

5-50. POWER SUPPLY REMOVAL AND INSTALLATION.

5-51. Prior to removing the power supply assembly, heed the following warning:

WARNING

Turn extender power off, disconnect, extender ac power cable, and allow 3 minutes for the filter capacitors to discharge before attempting to remove the power supply assembly. Failure to heed this warning could result in injury or death.

a. Place the extender on its side with the side adjacent to the power supply assembly facing up.

b. Remove the top panel (1, figure 5-1), the bottom panel (2), and side panel (3) adjacent to the power supply assembly.

c. Remove the four screws (4) and washers (5) and remove plenum chamber safety cover (6).

d. Disconnect and tag each of the backplane wires and bus strips from terminal boards A25TB1 (7) and A25TB2 (8).

e. Disconnect and tag each of the power supply wires from terminal board A26TB2 (9).

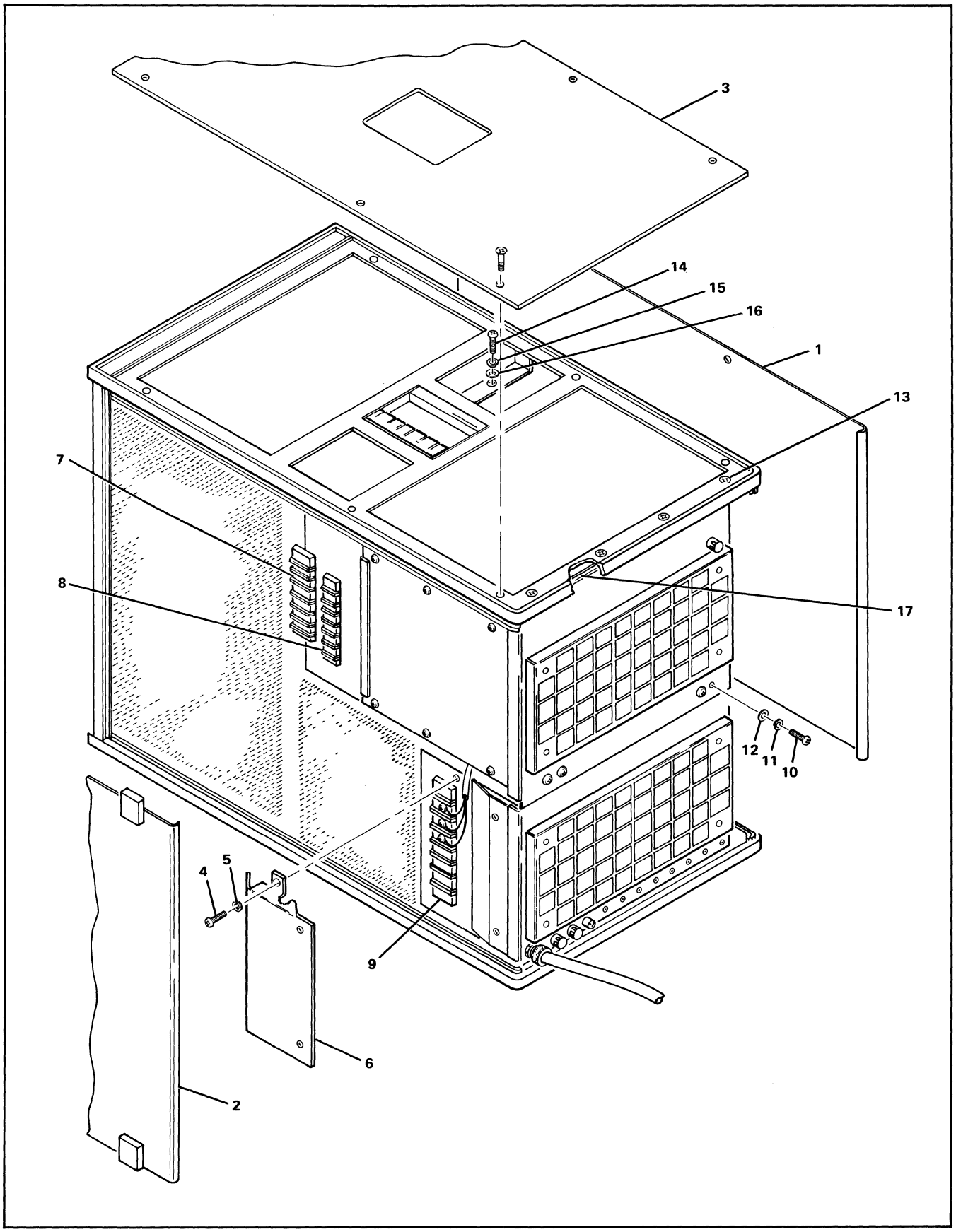
f. Remove the four screws (10), and washers (11,12) that secure the power supply rear panel to the rear card cage support.

g. Remove the four screws (13) that secure the back of the side frame and back panel spacer to the power supply assembly.

h. Remove the screw (14) and washers (15,16) from the side bracket that secure the forward section of the power supply assembly.

i. Lift the back of the side frame slightly and carefully pull the power supply assembly from the rear of the extender. Save the spacer (17) for reinstallation of the power supply.

j. Installation procedures for the power supply assembly are essentially the reverse of the removal procedures. If a replacement power supply is being installed, be sure that the 825-ohm resistor (part no. 0757-0421) is connected between terminals 7 and 9 of A25TB2 (see figure 7-2).



2153-25

Figure 5-1. Power Supply Removal, Exploded View

SECTION VI REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section provides information on ordering replacement parts for the 2155A Extender. The parts are listed in tables 6-1 through 6-4, and illustrated in figures 6-1 through 6-4. The tables and figures are presented in disassembly sequence. Index numbers on exploded views also are in disassembly sequence.

6-3. Table 6-5 provides a listing of all electrical parts and table 6-6 furnishes a listing of all mechanical parts used by the extender. In tables 6-5 and 6-6 parts are listed in part-number sequence.

6-4. Table 6-7 defines abbreviations and reference designations used in the parts tables and in other portions of this manual.

6-5. The last table in this section, table 6-8, identifies the manufacturers indicated by the manufacturer code numbers in the parts tables.

6-6 Not included in tables 6-1 through 6-4 are parts installed on printed-circuit cards in the card cage and parts for the power supply. For convenience when troubleshooting the extender, information on printed-circuit card parts is included with the schematic diagrams in Section VII. Information on the power supply parts is contained in the Power Supply Operating and Service Manual (see paragraph 1-2).

6-7. DESCRIPTION OF PARTS TABLES.

6-8. The three major assemblies in the extender are the plenum chamber assembly, the card cage assembly, and the power supply assembly. These are listed in table 6-1 together with the attaching parts for these assemblies. (Attaching parts are the parts which hold the assemblies in place.) Also included in table 6-1 are the parts which comprise the extender cabinet.

6-9. Tables 6-2, 6-3, and 6-4 list parts for the major assemblies with the exception of the power supply assembly. Parts information for the power supply assembly is contained in the Power Supply Operating and Service Manual.

6-10. The parts tables furnish the following information:

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

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

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

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

d. The "MFR CODE" column in the parts tables is a number identifying the manufacturer of each item. Table 6-8 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.

6-11. When an assembly part number is included in a parts table, the assembly covered by the table can be ordered as an assembled unit. If the assembly part number is not included in the table, only component parts of the assembly can be supplied.

6-12. ORDERING PROCEDURE.

6-13. 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 6-8. To order parts from Hewlett-Packard, or to obtain further 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. Extender model number.

b. Extender serial number and power supply date code number.

c. Hewlett-Packard part number.

d. Description of part.

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

f. If the part is installed on an etched circuit card or board, give the revision code stamped in ink on the card or board. 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 I/O-X1 extender card A112 by the reference designation A112C1.

6-14. 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 6-1. HP 2155A I/O Extender, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-	2155A	I/O EXTENDER	28480	2155A	1
1	02155-00002	* Cover Access top	28480	02155-00002	1
		(Attaching Parts)			
2	2360-0200	* Screw, Machine, flh, No. 6-32, 1/2 in.	00000	OBD	4
		- - - x - - -			
3	02100-00015	* Retainer, Printed-Circuit Card	28480	02100-00015	1
	02155-60003	* I/O Extender Card (A10) (Used in 2100A Computer only) (see figure 7-5)	28480	02155-60003	1
4	02100-60060	* I/O Terminator Card (A13) (see figure 7-6)	28480	02100-60060	1
5	12896-60001	* DMA Extender Card (A110) (optional) (see figure 7-7)	28480	12896-60001	1
6	02155-60002	* I/O-X2 Extender Card (A111) (see figure 7-8)	28480	02155-60002	1
7	02155-60001	* I/O-X1 Extender Card (A112) (see figure 7-9)	28480	02155-60001	1
8	5060-8716	* Cover, Access, bottom	28480	5060-8716	1
		(Attaching Parts)			
9	2360-0200	* Screw, Machine, flh, No. 6-32, 1/2 in.	00000	OBD	5
		- - - x - - -			
10	5060-0767	* Foot, Rubber	28480	5060-0767	5
11	02100-00041	* Cover, Access, side	28480	02100-00041	2
		(Attaching Parts)			
12	2360-0200	* Screw, Machine, flh, No. 6-32, 1/2 in.	00000	OBD	6
		- - - x - - -			
13	0757-0421	* Resistor, Fxd, Flm, 825 ohms, 1%, 1/8W (R1)	28480	0757-0421	1
14	02100-00123	* Cover, Safety	28480	02100-00123	1
		(Attachine Parts)			
	2360-0192	* Screw, Machine, ph, No. 6-32, 1/4 in.	00000	OBD	4
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
		- - - x - - -			
15	02100-60053	* Power Supply Assembly (A25) (see manual part no. 5951-3038)	28480	02100-60053	1
		(Attaching Parts)			
16	2510-0050	* Screw, Assembled washer, flh, No. 8-32, 1/2 in.	00000	OBD	4
17	2510-0107	* Screw, Machine, ph, No. 8-32, 1/2 in.	00000	OBD	2
18	2190-0076	* Washer, Lock, split, No. 8	00000	OBD	2
19	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
20	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
21	3050-0227	* Washer, Flat, No. 6	00000	OBD	4
		- - - x - - -			
22	5000-2595	* Spacer, Plate, power supply	28480	5000-2595	1
23	02100-60041	* Plenum Chamber Assembly (A26) (see figure 6-2)	28480	02100-60041	1
		(Attaching Parts)			
24	2510-0050	* Screw, Assembled washer, flh, No. 8-32, 1/2 in.	00000	OBD	4
25	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
26	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
27	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
28	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
		- - - x - - -			
29	5000-2595	* Spacer, Plate, plenum chamber assembly	28480	5000-2595	1
30	02100-60057	* Handle Assembly	28480	02100-60057	2
		(Attaching Parts)			
	2510-0103	* Screw, Machine, ph, No. 8-32, 3/8 in.	00000	OBD	2
	2190-0073	* Washer, Lock, split, No. 8	00000	OBD	2
		- - - x - - -			
31	1400-0126	* Clamp, Cable	09922	HP-4N	3
		(Attaching Parts)			
	2510-0123	* Screw, Machine, flh, No. 8-32, 1/2 in.	00000	OBD	1
	2190-0076	* Washer, Lock, split, No. 8	00000	OBD	1
	3050-0139	* Washer, Flat, No. 8	00000	OBD	1
	2580-0004	* Nut, Plain, Hexagon, No. 8	00000	OBD	1
		- - - x - - -			
32	02100-00029	* Molding, metal (adhesive backed)	28480	02100-00029	2
		- - - x - - -			

Table 6-1. HP 2155A I/O Extender, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
33	0590-0053	* Nut, Sheet Spring	78553	C17859-632-24D	4
34	02100-20015	* Frame, left side	28480	02100-20015	1
		(Attaching Parts)			
35	2510-0123	* Screw, Assembled washer, flh, No. 8-32, 1/2 in.	00000	OBD	16
		- - - x - - -			
36	02100-00166	* Bracket, Mounting, power supply	28480	02100-00166	1
		(Attaching Parts)			
	2510-0123	* Screw, Assembled washer, ph, No. 8-32, 1/2 in.	00000	OBD	2
		- - - x - - -			
37	02100-20015	* Frame, right side	28480	02100-20015	1
		(Attaching Parts)			
	2510-0123	* Screw, Assembled washer, flh, No. 8-32, 1/2 in.	00000	OBD	12
		- - - x - - -			
38	02100-00138	* Bracket, Protective, shield	28480	02100-00138	1
		(Attaching Parts)			
39	0520-0089	* Screw, Machine, flh, No. 2-56, 3/8 in.	00000	OBD	2
		- - - x - - -			
40	3101-0730	* Switch, Power (S1)	27191	7320-K3	1
		(Attaching Parts)			
41	0590-0012	* Nut, Self-Locking, Knurled, No. 15/32, 32	04009	899U-3	1
42	2190-0102	* Washer, Lock, int tooth	00000	OBD	1
43	No Number	* Nut, Plain, Hexagon (furnished with item 42)			
		- - - x - - -			
44	1450-0749	* Lamp, Indicator	20902	6-607-white	1
45	1450-0167	* Holder, Lamp	72765	4428-002	1
46	02100-00006	* Front Panel	28480	02100-00006	1
47	No Number	* Card Cage Assembly (cannot be ordered as a complete unit) (see figure 6-3)			1
		(The following items are part of the 2155A Extender but are not shown in figure 6-1.)			
	02155-90002	* HP 2155A Operating and Service Manual	28480	02155-90002	1
	02155-60011	* I/O Extension Cable	28480	02155-60011	1
	02155-60012	* I/O Extension Cable	28480	02155-60012	1
	5060-8744	* Kit, Rack Mounting	28480	5060-8744	1
	5080-0058	* Jumpers	28480	5080-0058	14
	5951-3038	* Power Supply Operating and Service Manual	28480	5951-3038	1
	8120-1810	* IPU Interconnection Cable	28480	8120-1810	1

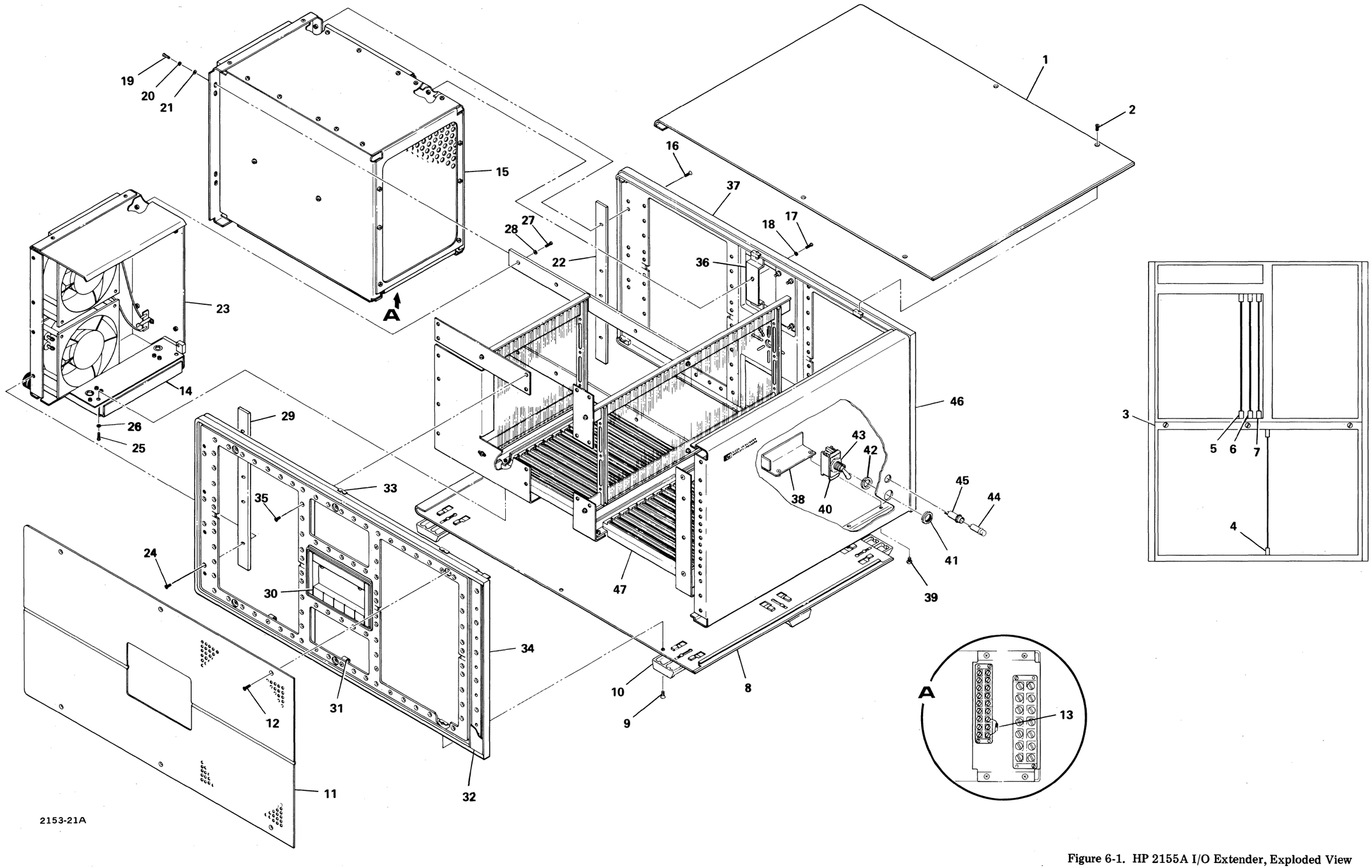
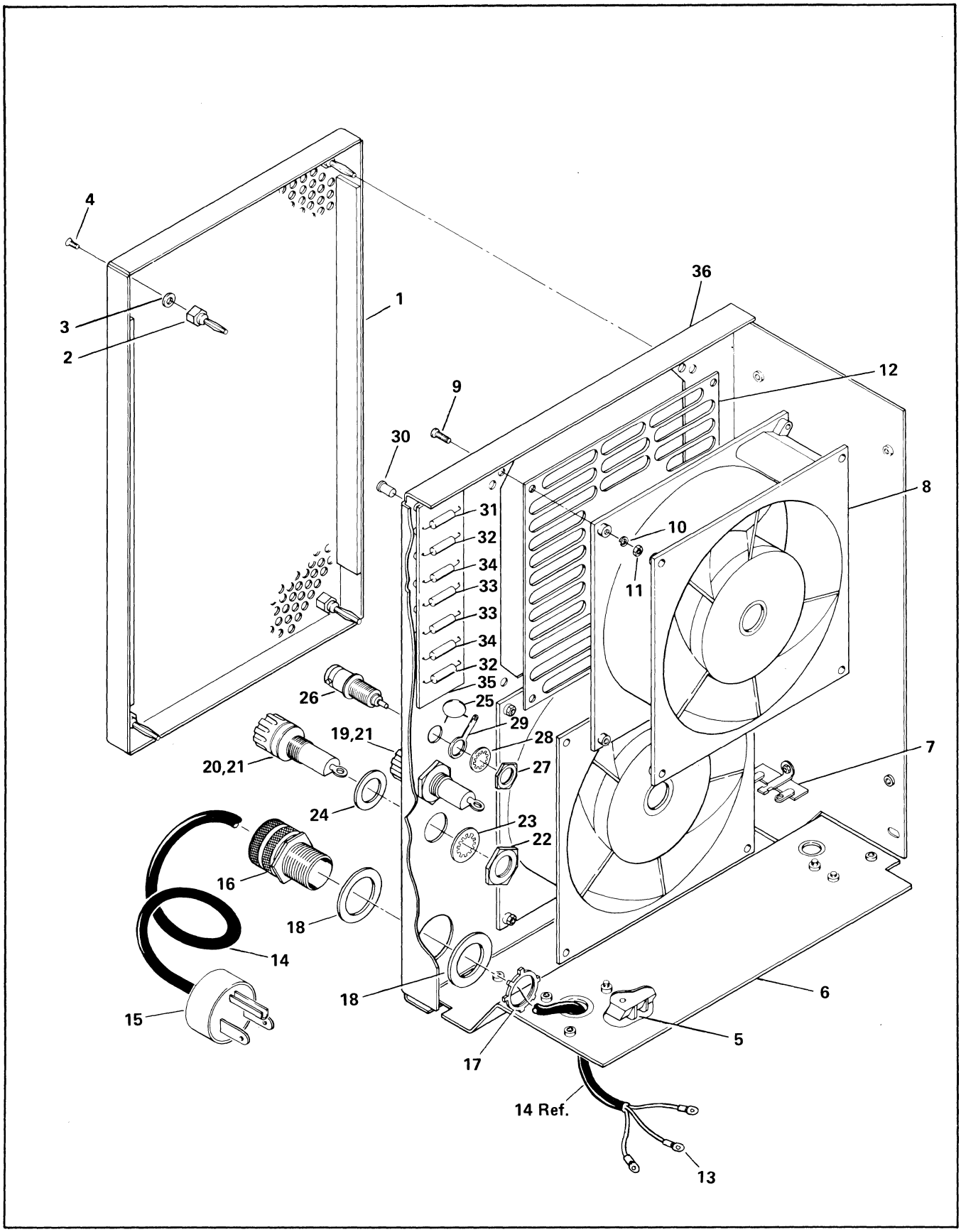


Figure 6-1. HP 2155A I/O Extender, Exploded View

Table 6-2. Plenum Chamber Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-2-	02100-60041	PLENUM CHAMBER ASSEMBLY (A26) (23, figure 6-1)		02100-60041	1
1	02100-00021	* Filter, rear	28480	02100-00021	1
2	1251-0013	** Fastener, Spring Tension, Trim	78947	152239	4
		(Attaching Parts)			
3	2190-0006	** Washer, Lock, split, No. 6	00000	OBD	4
4	0570-1029	** Stud, threaded, 1/4 in. long	00000	OBD	4
		– – – x – – –			
5	0360-1317	* Block, Terminal	76530	354-11-10-001	1
		(Attaching Parts)			
	2360-0203	* Screw, Machine, ph, No. 6-32, 5/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, Split, No. 6	00000	OBD	2
		– – – x – – –			
6	02100-00124	* Cover, Access, bottom	28480	02100-00124	1
		(Attaching Parts)			
	2360-0192	* Screw, Machine, ph, No. 6-32, 1/4 in.	00000	OBD	2
		– – – x – – –			
7	0360-0015	* Strip, Terminal	76530	332-14-03-011	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	1
		– – – x – – –			
8	3160-0224	* Fan, Tubeaxial (B1, B2)	28480	3160-0224	2
		(Attaching Parts)			
★9	2360-0205	* Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	4
★10	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
★11	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	4
		– – – x – – –			
12	5000-8015	* Guard, Fan	28480	5000-8015	2
13	0362-0143	* Terminal Lug, No. 8	00000	OBD	3
14	8120-1851	* Cable, 10 feet long	28480	8120-1851	1
15	1251-0313	* Connector, Plug, AC, 3 pin (P1) (shown in figure 6-2)	00000	OBD	1
	1251-2207	* Connector, Plug, AC, 3 pin (P1) (used for option 015)	00000	OBD	1
16	0100-0434	* Collar, Cable, Tension	49367	DB-10	1
		(Attaching Parts)			
17	0100-0433	* Nut, Lock, conduit	22421	141	1
18	0100-0432	* Washer, Reducing, 3/4 in. ID, 1-5/8 in. OD	74201	1365	2
		– – – x – – –			
19	2110-0249	* Fuse, 12A, 250V (F1)	75915	314012	1
	2110-0451	* Fuse, 6A, 250V (F1) (used for Option 015)	75915	314006	1
20	2110-0002	* Fuse, 2A, 250V (F2)	75915	312002	1
	2110-0001	* Fuse, 1A, 250V (F2) (used for Option 015)	75915	312001	1
21	1400-0084	* Fuseholder (XF1, XF2)	75915	342014	2
		(Attaching Parts)			
22	2950-0038	* Nut, Plain, Hexagon, 1/2-24	00000	OBD	1
23	2190-0068	* Washer, Lock, int-tooth, 1/2 in. ID	00000	OBD	1
24	1400-0090	* Gasket, Neoprene, 5/8 in. OD	00000	OBD	2
		– – – x – – –			
25	0150-0096	* Capacitor, Fxd, Cer. 0.05 uF, +80 -20%, 100 VDCW (C2)	91418	TA	1
26	1250-0118	* Connector, Receptacle (J1)	24931	28JR128-1	
		(Attaching Parts)			
27	2950-0001	* Nut, Plain, Hexagon, 3/8-32	00000	OBD	1
28	2190-0016	* Washer, Lock, int-tooth, 3/8 in. ID	00000	OBD	1
		– – – x – – –			
29	0360-0024	* Terminal, Lug, 1-5/8 in. long	79963	508-H380	1
	02100-60050	* Test Point Board Assembly	28480	02100-60050	1
		(Attaching Parts)			
30	0360-1149	* Jack, Tip (J2 thru J9)	00866	1600B	7
		– – – x – – –			
31	0698-0089	** Resistor, Fxd, Met Flm, 1.780 ohms, 1%, 1/2W (R7)	28480	0698-0089	1
32	0757-0818	** Resistor, Fxd, Met Flm, 825 ohms, 1%, 1/2W (R1, R6)	28480	0757-0818	2
33	0757-1000	** Resistor, Fxd, Met Flm, 51.1 ohms, 1%, 1/2W (R3, R4)	28480	0757-1000	2
34	0757-1092	** Resistor, Fxd, Met Flm, 287 ohms, 1%, 1/2W (R2, R5)	28480	0757-1092	2
35	02100-80050	** Printed-Circuit Board	28480	02100-80050	1
36	02100-00126	* Panel Rear	28480	02100-00126	1

★Items 9, 10, and 11 may be replaced by a tapping screw, no. 8-32, 3/4 in.



2135-10B

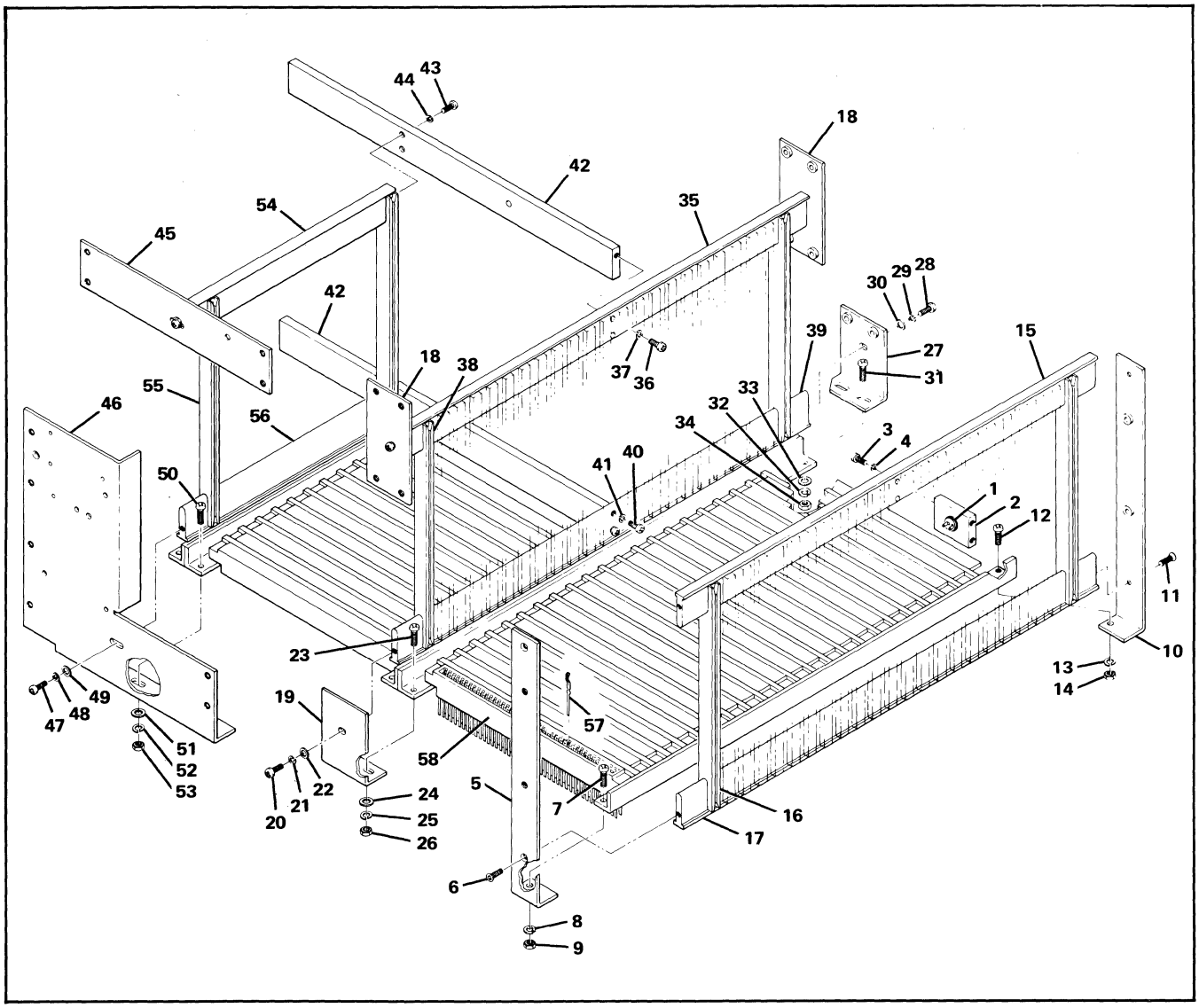
Figure 6-2. Plenum Chamber Assembly, Exploded View

Table 6-3. Card Cage Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-	No Number	CARD CAGE ASSEMBLY (49, figure 6-1) (Cannot be ordered as a complete unit)			1
1	3103-0015	* Switch, thermal (75°C) (S2)	14604	Type 3001	1
		(Attaching Parts)			
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
		– – – x – – –			
2	02100-20009	* Bar, front panel support	28480	02100-20009	1
		(Attaching Parts)			
3	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
4	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
		– – – x – – –			
5	02100-00005	* Bracket, Angle, Left	28480	02100-00005	1
		(Attaching Parts)			
6	2360-0196	* Screw, Machine, flh, No. 6-32, 3/8 in.	00000	OBD	2
7	2510-0107	* Screw, Machine, ph, No. 8-32, 1/2 in.	00000	OBD	1
8	2190-0076	* Washer, Lock, split, No. 8	00000	OBD	1
9	2580-0004	* Nut, Plain, Hexagon, No. 8-32	00000	OBD	1
		– – – x – – –			
10	02100-00006	* Bracket, Angle, Right	28480	02100-00006	1
		(Attaching Parts)			
11	2360-0196	* Screw, Machine, flh, No. 6-32, 3/8 in.	00000	OBD	2
12	2510-0107	* Screw, Machine, ph, No. 8-32, 1/2 in.	00000	OBD	1
13	2190-0076	* Washer, Lock, split, No. 8	00000	OBD	1
14	2580-0004	* Nut, Plain, Hexagon, No. 8-32	00000	OBD	1
		– – – x – – –			
15	02100-20003	* Support, Printed-Circuit Card Guide	28480	02100-20003	1
16	5040-6005	* Guide, Printed-Circuit Card	28480	5040-6005	23
17	02100-20003	* Support, Printed-Circuit Card Guide	28480	02100-20003	1
18	02100-00007	* Plate, Mounting	28480	02100-00007	2
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
	3050-0227	* Washer, Flat, No. 6	00000	OBD	1
		– – – x – – –			
19	02100-00003	* Bracket, Mounting	28480	02100-00003	1
		(Attaching Parts)			
20	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
21	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
22	3050-0227	* Washer, Flat, No. 6	00000	OBD	1
23	2510-0107	* Screw, Machine, ph, No. 8-32, 1/2 in.	00000	OBD	2
24	3050-0139	* Washer, Flat, No. 8	00000	OBD	2
25	2190-0076	* Washer, Lock, split, No. 8	00000	OBD	2
26	2580-0004	* Nut, Plain, Hexagon, No. 8-32	00000	OBD	2
		– – – x – – –			
27	02100-00004	* Bracket, Angle	28480	02100-00004	1
		(Attaching Parts)			
28	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
29	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
30	3050-0227	* Washer, Flat, No. 6	00000	OBD	1
31	2510-0107	* Screw, Machine, ph, No. 8-32, 1/2 in.	00000	OBD	2
32	2190-0076	* Washer, Lock, split, No. 8	00000	OBD	2
33	3050-0139	* Washer, Flat, No. 8	00000	OBD	2
34	2580-0004	* Nut, Plain, Hexagon, No. 8-32	00000	OBD	2
		– – – x – – –			
35	02100-20003	* Support, Printed-Circuit Card Guide	28480	02100-20003	1
		(Attaching Parts)			
36	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
37	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
		– – – x – – –			

Table 6-3. Card Cage Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-					
38	5040-6005	* Guide, Printed-Circuit Card	28480	5040-6005	23
39	02100-20003	* Support, Printed-Circuit Card Guide	28480	02100-20003	1
		(Attaching Parts)			
40	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
41	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
		– – – x – – –			
42	02100-20004	* Bar, Rear Support	28480	02100-20004	2
		(Attaching Parts)			
43	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
44	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
		– – – x – – –			
45	02100-00009	* Plate, Rear Mounting	28480	02100-00009	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
	3050-0227	* Washer, Flat, No. 6	00000	OBD	1
		– – – x – – –			
46	02100-00010	* Plenum Chamber Side Bracket (see figure 6-4)	28480	02100-00010	1
		(Attaching Parts)			
47	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
48	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
49	3050-0227	* Washer, Flat, No. 6	00000	OBD	1
50	2510-0107	* Screw, Machine, ph, No. 8-32, 1/2 in.	00000	OBD	2
51	2190-0076	* Washer, Flat, No. 8	00000	OBD	2
52	3050-0139	* Washer, Lock, split, No. 8	00000	OBD	2
53	2580-0004	* Nut, Plain, Hexagon, No. 8-32	00000	OBD	2
		– – – x – – –			
54	02100-20003	* Support, Printed-Circuit Card Guide	28480	02100-20003	1
55	5040-6005	* Guide, Printed-Circuit Card	28480	5040-6005	12
56	02100-20003	* Support, Printed-Circuit Card Guide	28480	02100-20003	1
57	No Number	* Connector Pin	00779	67628-2	AR
58	02155-60006	* Backplane Assembly	28480	02155-60006	1



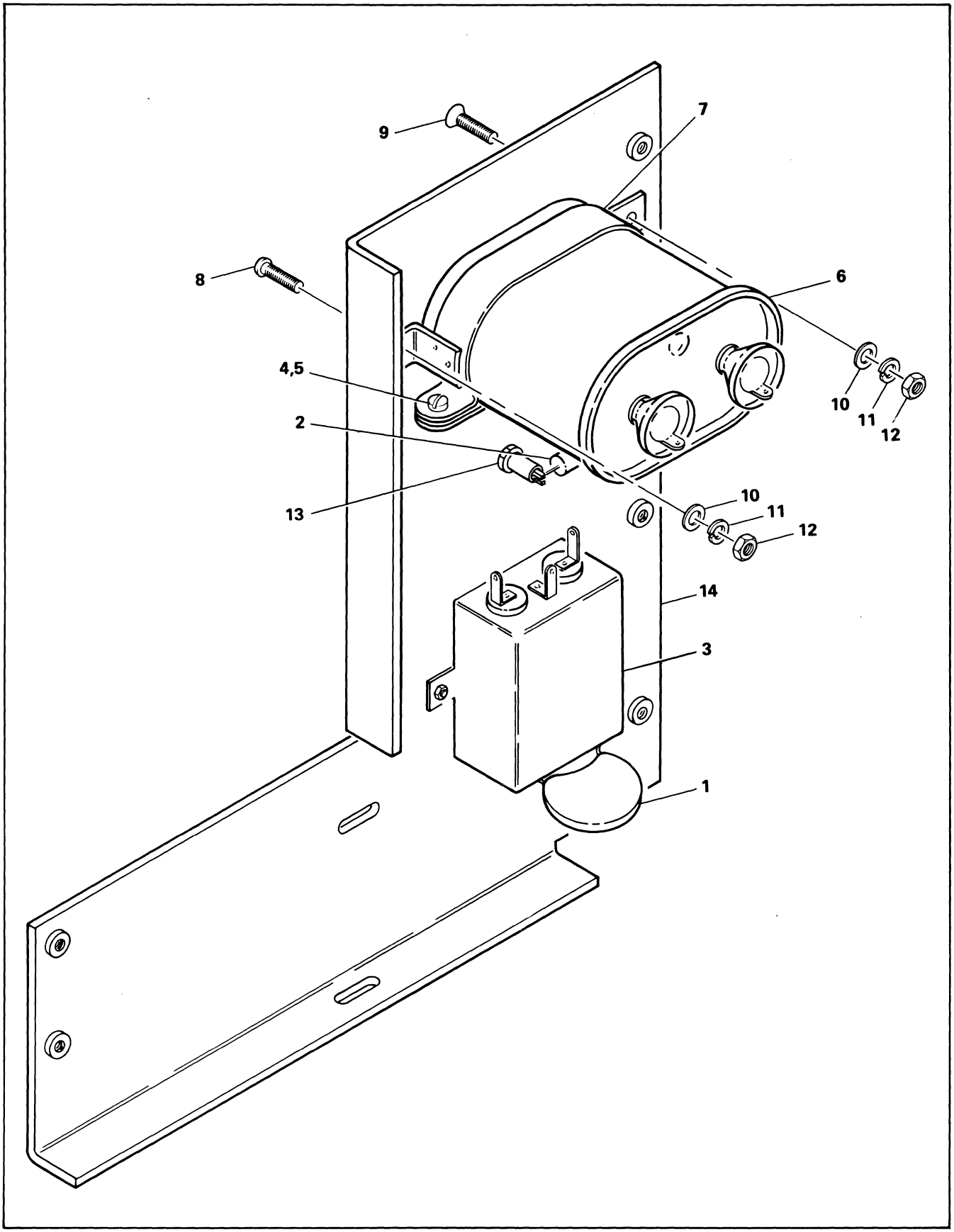
2153-24A

Figure 6-3. Card Cage Assembly, Exploded View

Table 6-4. Plenum Chamber Side Bracket, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-4-	No Number	PLENUM CHAMBER SIDE BRACKET (46, figure 6-3)		No Number	1
1	★0160-0904	* Capacitor, Fxd, Cer, 0.05 uF, 20%, 1000 VDCW (C1)	56289	41C169A4-CDH	1
2	0811-2988	* Resistor, Fxd, WW, 22 ohms, 1%, 7W (R1)	28480	0811-2988	1
3	★9100-3317	* Filter, Line (FL1)	05245	20B1	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, no. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		– – – x – – –			
4	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
5	2420-0001	* Nut, Assembled Washer, No. 6-32	00000	OBD	1
6	0160-3898	* Capacitor, Fxd, Paper, 1 uF, 440 VAC (C3)	14659	200P1449	1
7	1400-0189	* Clamp, Capacitor	24446	128A2244G21	1
		(Attaching Parts)			
8	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
9	2360-0196	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
10	3050-0227	* Washer, Lock, split, No. 6	00000	OBD	2
11	2190-0006	* Washer, Lock, split, No. 6	00000	OBD	2
12	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		– – – x – – –			
13	0360-0279	* Insulator, Standoff	17117	2304-54-1	2
		(Attaching Parts)			
	2200-0139	* Screw, Machine, ph, No. 4-40, 1/4 in.	00000	OBD	2
	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	2
		– – – x – – –			
14	02100-00010	* Bracket, Angle	28480	02100-00010	1

★Part no. 0160-0904 not used and item 3 part no. changed to part no. 9100-2947, Mfr Code 28480, Mfr part no. 9100-2947 starting with serial numbers prefixed 1231.



2135-9

Figure 6-4. Plenum Chamber Side Bracket, Exploded View

Table 6-5. Numerical Listing of Electrical Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0150-0096	Capacitor, Fxd, Cer, 0.05 uF, +80 -20%, 100 VDCW	91418	TA	1
0160-0154	Capacitor, Fxd, Mica My, 0.0022 uF, 10%, 200 VDCW	56289	192P22292-PTS	1
0160-0904	Capacitor, Fxd, Cer 0.05 uF, 20%, 1000 VDCW	56289	41C169A4-CDH	1
0160-2055	Capacitor, Fxd, Cer, 0.05 uF, +80 -20%, 100 VDCW	56289	C023F101F103ZS22-CDH	62
0160-3898	Capacitor, Fxd, Paper, 1 uF, 440 VAC	14659	200P1449	1
0180-0197	Capacitor, Fxd, Elect, 2.2 uF, 10%, 20 VDCW	56289	150D225X9020A2-DYS	24
0180-0229	Capacitor, Fxd, Elect, 33 uF, 10%, 10 VDCW	56289	150D336X9010B2-DYS	8
0360-1149	Jack, Tip	00866	1600B	1
0698-0082	Resistor, Fxd, Flm, 464 ohms, 1%, 1/8W	28480	0698-0082	15
0698-0089	Resistor, Fxd, Met Flm, 1.780 ohms, 1%, 1/2W	28480	0698-0089	2
0698-3132	Resistor, Fxd, Flm, 261 ohms, 1%, 1/8W	28480	0698-3132	11
0698-3437	Resistor, Fxd, Flm, 133 ohms, 1%, 1/8W	28480	0698-3437	24
0698-3438	Resistor, Fxd, Flm, 147 ohms, 1%, 1/8W	28480	0698-3438	42
0698-3443	Resistor, Fxd, Flm, 287 ohms, 1%, 1/8W	28480	0698-3443	16
0757-0421	Resistor, Fxd, Flm, 825 ohms, 1%, 1/8W	28480	0757-0421	1
0757-0276	Resistor, Fxd, Flm, 61.9 ohms, 1%, 1/8W	28480	0757-0276	16
0757-0279	Resistor, Fxd, Flm, 3.16k, 1%, 1/8W	28480	0757-0279	22
0757-0280	Resistor, Fxd, Flm, 1k, 1%, 1/8W	28480	0757-0280	15
0757-0402	Resistor, Fxd, Met Flm, 110 ohms, 1%, 1/8W	28480	0757-0402	16
0757-0403	Resistor, Fxd, Met Flm, 121 ohms, 1%, 1/8W	28480	0757-0403	1
0757-0417	Resistor, Fxd, Flm, 562 ohms, 1%, 1/8W	28480	0757-0417	43
0757-0420	Resistor, Fxd, Flm, 750 ohms, 1%, 1/8W	28480	0757-0420	11
0757-0818	Resistor, Fxd, Met Flm, 825 ohms, 1%, 1/2W	28480	0757-0818	2
0757-1000	Resistor, Fxd, Met Flm, 51.1 ohms, 1%, 1/2W	28480	0757-1000	2
0757-1092	Resistor, Fxd, Met Flm, 287 ohms, 1%, 1/2W	28480	0757-1092	1
0757-1094	Resistor, Fxd, Flm, 750 ohms, 1%, 1/8W	28480	0757-1094	2
0811-2988	Resistor, Fxd, WW, 22 ohms, 1%, 7W	28480	0811-2988	1
1250-0118	Connector, Receptacle	24931	28JR128-1	1
1400-0084	Fuseholder	75915	342014	2
1450-0167	Holder, Lamp	72765	4428-002	1
1450-0749	Lamp, Indicator	20902	6-607-white	1
1820-0186	Integrated Circuit, CTL	07263	U6A985649X	66
1820-0485	Integrated Circuit, CTL	07263	U6B981649X	2
1820-0952	Integrated Circuit, CTL	14433	MIC952	1
2110-0002	Fuse, 2A, 250V	75915	312002	1
2110-0249	Fuse, 12A, 250V	75915	314012	1
3101-0730	Switch, Power	27191	7320-K3	1
9100-3317	Filter, Line	05245	20B1	1
02100-60050	Test Point Board Assembly	28480	02100-60050	1
02100-60060	I/O Terminator Card	28480	02100-60060	1
02155-60001	I/O-X1 Extender Card	28480	02155-60001	1
02155-60002	I/O-X2 Extender Card	28480	02155-60002	1
02155-60003	I/O Extender Card	28480	02155-60003	1
02155-60006	Backplane Assembly	28480	02155-60006	1
02155-60011	I/O Extension Cable	28480	02155-60011	1
02155-60012	I/O Extension Cable	28480	02155-60012	1

Table 6-5. Numerical Listing of Electrical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
	For Direct Memory Access Accessory, perform the following:			
	Add the following entries:			
0698-3442	Resistor, Fxd, Met Flm, 237 ohms, 1%, 1/8W	28480	0698-3442	3
1820-0140	Integrated Circuit, TTL	04713	MC3026P	2
1820-0301	Integrated Circuit, TTL	01295	SN7475N	3
1820-0371	Integrated Circuit, TTL	01295	SN74H10N	3
1820-0615	Integrated Circuit, TTL	04713	SL16887	8
12896-60001	DMA Extender Card	28480	12896-60001	1
	Change the following entries:			
0160-2055	Add 4 to TQ listed.			
0180-0197	Add 2 to TQ listed.			
0698-3438	Add 4 to TQ listed.			
0698-3442	Add 3 to TQ listed.			
0757-0280	Add 3 to TQ listed.			
0757-0417	Add 27 to TQ listed.			
1820-0140	Add 2 to TQ listed.			
1820-0301	Add 3 to TQ listed.			
1820-0371	Add 3 to TQ listed.			
1820-0485	Add 1 to TQ listed.			
1820-0615	Add 8 to TQ listed.			
	For 230-Volt Option 015, perform the following:			
	Add the following entries:			
1251-2207	Connector, Plug, AC, 3 pin	00000	OBD	1
2110-0001	Fuse, 1A, 250V	75915	312001	1
2110-0451	Fuse, 6A, 250V	75915	314006	1
	Delete the following entries:			
1251-0313	Connector, Plug, AC, 3 pin	00000	OBD	1
2110-0002	Fuse, 2A, 250V	75915	312002	1
2110-0249	Fuse, 12A, 250V	75915	314012	1

Table 6-6. Numerical Listing of Mechanical Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0100-0432	Washer, Reducing, 3/4 in. ID, 1-5/8 in. OD	74201	1365	2
0100-0433	Nut, Lock, Conduit	22421	141	1
0100-0434	Collar, Cable, Tension	49367	DB-10	1
0360-0015	Strip, Terminal	76530	332-14-03-011	1
0360-0024	Terminal, Lug, 1-5/8 in. long	00000	OBD	1
0360-0279	Insulator, Standoff	17117	2304-54-1	2
0360-1317	Block Terminal	76530	354-11-10-001	1
0520-0089	Screw, Machine, flh, No. 2-56, 3/8 in.	00000	OBD	2
0570-1029	Stud, threaded, 1/4 in. long	00000	OBD	4
0590-0012	Nut, Self-Locking, Knurled, No. 15/32, 32	04009	899U-3	1
0590-0053	Nut, Sheet Spring, No. 6-32	78553	C17859-632-24D	8
1251-0013	Fastener, Spring Tension, trim	78947	152239	4
1400-0090	Gasket, Neoprene, 5/8 in. OD	00000	OBD	2
1400-0126	Clamp, Cable	09922	HP-4N	3
1400-0189	Clamp, Capacitor	24446	128A2244G21	1
2190-0003	Washer, Lock, split, No. 4	00000	OBD	2
2190-0006	Washer, Lock, split, No. 6	00000	OBD	3
2190-0016	Washer, Lock, int-tooth, 3/8 in. OD	00000	OBD	1
2190-0068	Washer, Lock, int-tooth, 1/2 in. OD	00000	OBD	2
2190-0073	Washer, Lock, split, No. 8	00000	OBD	4
2190-0076	Washer, Lock, split, No. 8	00000	OBD	11
2190-0102	Washer, Lock, int-tooth	00000	OBD	1
2190-0851	Washer, Lock, split, No. 6	00000	OBD	32
2200-0139	Screw, Machine, ph, No. 4-40, 3/8 in.	00000	OBD	2
2360-0192	Screw, Machine, ph, No. 6-32, 1/4 in.	00000	OBD	2
2360-0196	Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	6
2360-0197	Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	28
2360-0200	Screw, Machine, flh, No. 6-32, 1/2 in.	00000	OBD	14
2360-0203	Screw, Machine, ph, No. 6-32, 5/8 in.	00000	OBD	2
2360-0205	Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	4
2420-0001	Nut, Assembled Washer, No. 6-32	00000	OBD	1
2420-0002	Nut, Plain, Hexagon, No. 6-32	00000	OBD	10
2510-0050	Screw, Assembled Washer, No. 8-32, 1/2 in.	00000	OBD	42
2510-0103	Screw, Machine, ph, No. 8-32, 3/8 in.	00000	OBD	2
2510-0107	Screw, Machine, ph, No. 8-32, 1/2 in.	00000	OBD	9
2510-0123	Screw, Machine, flh, No. 8-32, 1/2 in.	00000	OBD	39
2580-0004	Nut, Plain, Hexagon, No. 8-32	00000	OBD	12
2950-0001	Nut, Plain, Hexagon, 3/8-32	00000	OBD	1
2950-0038	Nut, Plain, Hexagon, 1/2-24	00000	OBD	2
3030-0034	Screw, Cap, Socket Head, No. 10-24, 1/2 in.	00000	OBD	4
3050-0139	Washer, Flat, No. 8	00000	OBD	7
3050-0227	Washer, Lock, split, No. 6	00000	OBD	10
5000-2595	Spacer, Plate	28480	5000-2595	2
5000-8015	Guard, Fan	28480	5000-8015	2
5040-6005	Guide, Printed-Circuit Card	28480	5040-6005	57
5060-0222	Handle Assembly	28480	5060-0222	2
5060-0767	Foot, Rubber	28480	5060-0767	5
5060-8716	Cover, Access, bottom	28480	5060-8716	1
5060-8736	Retainer, Handle	28480	5060-8736	2
02100-00003	Bracket, Mounting	28480	02100-00003	1

Table 6-6. Numerical Listing of Mechanical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
02100-00004	Bracket, Angle	28480	02100-00004	1
02100-00005	Bracket, Angle, Left	28480	02100-00005	1
02100-00006	Bracket, Angle, Right	28480	02100-00006	1
02100-00007	Plate, Mounting	28480	02100-00007	2
02100-00009	Plate, Rear Mounting	28480	02100-00009	1
02100-00010	Bracket, Angle	28480	02100-00010	1
02100-00015	Retainer, Printed-Circuit Card	28480	02100-00015	1
02100-00018	Front Panel	28480	02100-00018	1
02100-00021	Filter, Rear	28480	02100-00021	1
02100-00029	Molding, metal (adhesive back)	28480	02100-00029	2
02100-00041	Cover, Access, side	28480	02100-00041	2
02100-00124	Cover, Access, bottom	28480	02100-00124	1
02100-00138	Bracket, Protective, shield	28480	02100-00138	1
02100-00166	Bracket, Mounting, power supply	28480	02100-00166	2
02100-20002	Support, Printed-Circuit Card	28480	02100-20002	2
02100-20003	Support, Printed-Circuit Card	28480	02100-20003	4
02100-20004	Bar, Rear Support	28480	02100-20004	2
02100-20009	Bar, front panel support	28480	02100-20009	1
02100-20015	Frame, side	28480	02100-20015	2
02155-00002	Cover, Access top	28480	02155-00002	1

Table 6-7. 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	MC	= microcircuit	V	= vacuum tube, photocell, etc.
CB	= circuit breaker	P	= plug connector	VR	= voltage regulator
CR	= diode	Q	= semiconductor device other than diode or microcircuit	W	= cable, jumper
DL	= delay line	R	= resistor	X	= socket
DS	= indicator	RT	= thermistor	Y	= crystal
E	= Misc electrical parts	S	= switch	Z	= tuned cavity, network
F	= fuse	T	= transformer		
FL	= filter				
J	= receptacle connector				

ABBREVIATIONS

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

Table 6-8. 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
00779	Amp. Inc.	Harrisburg, Pa.
00866	Goe Engineering Co.	City of Industry, Cal.
01121	Allen Bradley Co.	Milwaukee, Wis.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01961	Pulse Engineering Co.	Santa Clara, Cal.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
05245	Components Corp.	Chicago, Ill.
05277	Westinghouse Electric Corp., Semi-Conductor Dept.	Youngwood, Pa.
07263	Fairchild Camera & Instr. Corp., Semi-conductor Div.	Mountain View, Cal.
07910	Continental Device Corp.	Hawthorne, Cal.
09922	Burndy Corp.	Norwalk, Conn.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Cal.
12040	National Semiconductor	Danbury, Conn.
14268	Lidco, Inc.	Freeport, N.Y.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14604	Elmwood Sensors Inc.	Cranston, R.I.
14655	Cornell Dublier Electric Corp.	Newark, N.J.
14659	Sprague Electric Co.	Visalia, Cal.
17117	Electronic Molding Corp.	Pawtucket, R.I.
22421	Tomas and Betts Ltd.	Quebec, Canada
24446	General Electric Co.	Schenectady, N.Y.
24931	Specialty Connector Co.	Indianapolis, Ind.
28480	Hewlett-Packard Co.	Palo Alto, Cal.
49367	Pyle-National Co.	Chicago, Ill.
56289	Sprague Electric Co.	North Adams, Mass.
71279	Cambride Thermionics Corp.	Cambridge, Mass.
71785	Chinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
74201	Racon Corp.	New York, N.Y.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76493	J.W. Miller Co.	Los Angeles, Cal.
76530	Chinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Cal.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78947	Ucinite Co.	Newtonville, Mass.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80131	Electronic Industries Association. Any brand part meeting EIA Standards	Washington, D.C.
81640	Controls Co. of America, Control Switch Division	Folcroft, Pa.
81741	Chicago Lock Co.	Chicago, Ill.
82142	Jeffers Electronics, Div. of Speer Carbon Co.	DuBois, Pa.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
86684	Radio Corp. of America, Electronic Corp. & Devices Div.	Harrison, N.Y.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
93332	Sylvania Electric Prod. Inc., Semi-conductor Div.	Woburn, Mass.
95987	Wechesser Co.	Chicago, Ill.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98410	Etc, Inc.	Cleveland, Ohio
99800	Delevan Electronics Corp.	East Aurora, N.Y.

7-1. INTRODUCTION.

7-2. This section contains diagrams and tables of reference data for troubleshooting and repair of the extender. The information consists of integrated-circuit diagrams and characteristics, a signal index (list of signals and their sources), wiring information, schematic diagrams, and parts information.

7-3. INTEGRATED CIRCUIT DIAGRAMS.

7-4. The integrated circuit diagrams in figure 7-1 show each type of integrated circuit used on the I/O extender cards. Under each diagram of an integrated circuit is a characteristic number. By referring to this number in the tabular listing in the figure, the input and output logic-voltage levels of the unit can be determined. The tabular listing also gives the propagation delay of the integrated circuit, and indicates whether an open input acts as a logic 1 or a logic 0.

7-5. SIGNAL INDEX.

7-6. The signal index in table 7-1 lists all signals that enter or leave the cards installed in the card cage. Abbreviations of signal names (commonly referred to as mnemonic designations) are defined in the table and a reference number is provided for each signal. This number permits the signal to be found in the functional wiring list for the backplane, table 7-2, which shows the connections to the other cards in the card cage.

7-7. WIRING INFORMATION.

7-8. BACKPLANE WIRING.

7-9. Wiring information for the connectors located on the backplane assembly is shown in table 7-2 and figure 7-2. This information must be used in conjunction with the schematic diagrams to determine signal and power interconnections for the plug-in cards installed in the card cage assembly.

7-10. The headings at the top of table 7-2 are arranged to show the reference designation of each card installed in a connector slot and the corresponding select code. The pin numbers for each connector are listed under the appropriate headings for each column. These pin numbers correspond to the pin numbers on the 86-pin edge of the card plugged into the connector. The POWER SUPPLY column lists the terminal board numbers of the power supply voltages.

7-11. The numbers listed in the REFERENCE NUMBER column in the backplane wiring list (table 7-2) are correlated with the reference numbers in the signal index (table 7-1) and the reference numbers shown on the schematic diagrams (in brackets adjacent to the pin connections). To trace a signal in the extender backplane, the reference number is selected from the schematic diagram or the signal index. Once the reference number is known the signal can be located in the backplane wiring list by referring directly to the reference number in table 7-2. The signal enters or exits the plug-in card on the corresponding pin number of the 86-pin edge connector. This signal can be tested from the bottom of the extender by gaining access to the wiring side of the backplane assembly, or from the top of the extender by using an extender card to gain access to the 86-pin edge connector. By referring to the schematic diagram for the plug-in card, the signal can be traced to all associated circuit components.

7-12. Table 7-3 lists the point-to-point wiring between the backplane connectors and the power supply and plenum chamber. The list is in alphanumeric order of reference designations. Each connection is listed twice to enable determining leadwire terminations from either end of the leadwire. For example, the wht-vio leadwire from A25TB2-2 to XA101-69,70 is also listed as from XA101-69,70 to A25TB2-2.

7-13. Figure 7-2 depicts the wiring between the backplane, the power supply (A25), the plenum chamber (A26), and other components. The diagram is not complete in itself but must be used with tables 7-2 and 7-3 to determine the point-to-point wiring between the components illustrated.

7-14. PLENUM CHAMBER WIRING.

7-15. Table 7-4 lists the point-to-point wiring between the assemblies and components in the plenum chamber. The table also includes the wiring between the plenum chamber and the backplane, power switch, and power supply. The list is in alphanumeric order of reference designations. Each connection, except to the backplane, power switch, and power supply, is listed twice to enable determining leadwire terminations from either end of the leadwire. For example, the blk leadwire from B1-J1 to TB2-1 is also listed as from TB2-1 to B1-J1.

7-16. The wiring diagram, figure 7-3, supports table 7-4 by identifying the plenum chamber assemblies and components and their connecting points.

7-17. POWER SUPPLY WIRING.

7-18. Refer to the Power Supply Operating and Service Manual for all internal point-to-point wiring of the power supply.

7-19. ASSEMBLY LOCATIONS.

7-20. Figure 7-4 shows the location of the major assemblies of the extender, including the power supply, I/O extender cards, and I/O interface cards. I/O terminator card A13 is shown installed in slot 13 and must be removed when its card slot and higher address card slots are to be used for interface cards.

7-21. REPLACEABLE PARTS LISTS.

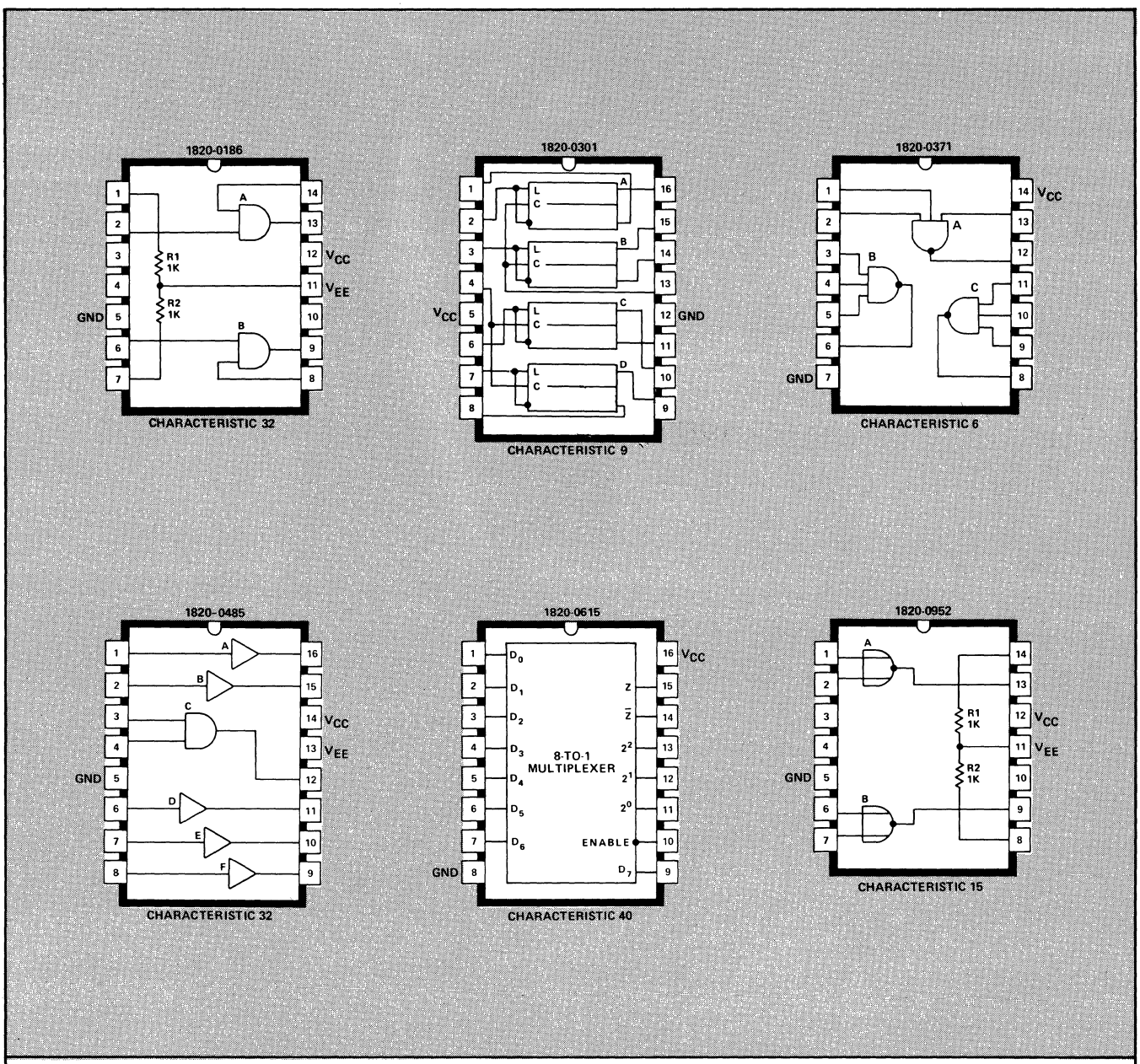
7-22. Tables 7-5 through 7-9 are the replaceable parts lists for the printed-circuit cards used with the extender and are included in this manual to supplement the parts location and schematic diagrams. Section VI provides a complete list of replaceable parts for the extender, descriptions of the table columns, and parts ordering information.

7-23. Parts are listed by reference designation and include an HP part number, description, manufacturer's code, and manufacturer's part number.

7-24. PARTS LOCATION AND SCHEMATIC DIAGRAMS.

7-25. Figures 7-5 through 7-9 are the parts location and schematic diagrams for the printed-circuit cards used in the basic extender and the DMA accessory. The parts location diagram for each card is located adjacent to the schematic diagram and shows the location and appearance of the electrical parts on each card. The parts are identified by the reference designations used on the schematic diagrams. The card part number and identification code is shown on the parts location diagram as it is marked on the card itself. Refer to paragraph 1-39 for a description of the identification code.

7-26. The schematic diagrams use either conventional schematic symbols or logic symbols. The logic symbols are described in the Logic Symbology section of the computer Diagrams Manual (part no. 02100-90003 for 2100A and part no. 02100-90164 for 2100S). The numbers shown in brackets at the pin connections on the schematic diagrams are reference numbers that correlate with the reference numbers in the signal index (table 7-1) and the backplane wiring list (table 7-2).



CHARACTERISTIC	INPUT LEVEL		OUTPUT LEVEL		OPEN INPUT ACTS AS:	MAXIMUM PROPAGATION DELAY	
	LOGIC 1 (VOLTS, MIN)	LOGIC 0 (VOLTS, MAX)	LOGIC 1 (VOLTS, MIN)	LOGIC 0 (VOLTS, MAX)		TO LOGIC 1 (NANOSECONDS)	TO LOGIC 0 (NANOSECONDS)
6	2.0	0.8	2.4	0.4	Logic 1	10	10
9	*2.0	0.8	2.4	0.4	Logic 1	40	25
15	1.25	0.5	2.35	-0.36	Logic 0	14	12
32	1.25	0.5	2.35	-0.36	Logic 0	8	8
40	2.0	0.8	2.4	0.4	—	21	27

*Note: Required pulse widths; clock 30 ns minimum, data 75 ns minimum.

2153-1

Figure 7-1. Integrated Circuit Diagrams and Characteristics

Table 7-1. Signal Index

SIGNAL MNEMONIC	REF NO.	DEFINITION
-2V	1	Supply voltage
+4.75V	2	Supply voltage
-12V	3	Supply voltage
+12V	4	Supply voltage
+30V (Unreg)	5	Supply voltage
CLC	6	Clear control signal
CLF	7	Clear flag
CRS	8	Control reset to I/O
EDT	9	End data transfer
ENF	10	Enable flag
SPARE	11	Spare line
FLG2	12	Flag bit 2
FLG3	13	Flag bit 3
FLG4	14	Flag bit 4
FLG5	15	Flag bit 5
FLG6	16	Flag bit 6
GND	17	Ground
GND	18	Ground
IAK	19	Interrupt acknowledge
IEN20	20	Interrupt enable
IEN30	21	Interrupt enable
IEN40	22	Interrupt enable
IEN50	23	Interrupt enable
IEN60	24	Interrupt enable
IOBI 0	25	Input/output bus, input bit 0
IOBI 1	26	Input/output bus, input bit 1
IOBI 2	27	Input/output bus, input bit 2
IOBI 3	28	Input/output bus, input bit 3
IOBI 4	29	Input/output bus, input bit 4
IOBI 5	30	Input/output bus, input bit 5
IOBI 6	31	Input/output bus, input bit 6
IOBI 7	32	Input/output bus, input bit 7
IOBI 8	33	Input/output bus, input bit 8
IOBI 9	34	Input/output bus, input bit 9
IOBI 10	35	Input/output bus, input bit 10
IOBI 11	36	Input/output bus, input bit 11
IOBI 12	37	Input/output bus, input bit 12
IOBI 13	38	Input/output bus, input bit 13
IOBI 14	39	Input/output bus, input bit 14
IOBI 15	40	Input/output bus, input bit 15
IOBI 16	41	Input/output bus, input bit 16
IOBO 0	42	Input/output bus, output bit 0
IOBO 1	43	Input/output bus, output bit 1
IOBO 2	44	Input/output bus, output bit 2
IOBO 3	45	Input/output bus, output bit 3
IOBO 4	46	Input/output bus, output bit 4
IOBO 5	47	Input/output bus, output bit 5
IOBO 6	48	Input/output bus, output bit 6
IOBO 7	49	Input/output bus, output bit 7
IOBO 8	50	Input/output bus, output bit 8
IOBO 9	51	Input/output bus, output bit 9
IOBO 10	52	Input/output bus, output bit 10
IOBO 11	53	Input/output bus, output bit 11
IOBO 12	54	Input/output bus, output bit 12
IOBO 13	55	Input/output bus, output bit 13
IOBO 14	56	Input/output bus, output bit 14

Table 7-1. Signal Index (Continued)

SIGNAL MNEMONIC	REF NO.	DEFINITION
IOBO 15	57	Input/output bus, output bit 15
IOBO 16	58	Input/output bus, output bit 16
IOG	59	Input/output instruction group
IOI	60	Input/output, input
IOO	61	Input/output, output
IRQ1	62	Interrupt request 1
IRQ2	63	Interrupt request 2
IRQ3	64	Interrupt request 3
IRQ4	65	Interrupt request 4
IRQ5	66	Interrupt request 5
IRQ6	67	Interrupt request 6
IRQ7	68	Interrupt request 7
LDS	69	Not used
PON	70	Power on normal
POPIO	71	Power on pulse to I/O
PRH25/PRL24	72	Priority high select code 25/priority low select code 24
PRH26/PRL25	73	Priority high select code 26/priority low select code 25
PRH27/PRL26	74	Priority high select code 27/priority low select code 26
PRH31/PRL30	75	Priority high select code 31/priority low select code 30
PRH32/PRL31	76	Priority high select code 32/priority low select code 31
PRH33/PRL32	77	Priority high select code 33/priority low select code 32
PRH34/PRL33	78	Priority high select code 34/priority low select code 33
PRH35/PRL34	79	Priority high select code 35/priority low select code 34
PRH36/PRL35	80	Priority high select code 36/priority low select code 35
PRH37/PRL36	81	Priority high select code 37/priority low select code 36
PRH41/PRL40	82	Priority high select code 41/priority low select code 40
PRH42/PRL41	83	Priority high select code 42/priority low select code 41
PRH43/PRL42	84	Priority high select code 43/priority low select code 42
PRH44/PRL43	85	Priority high select code 44/priority low select code 43
PRH45/PRL44	86	Priority high select code 45/priority low select code 44
PRH46/PRL45	87	Priority high select code 46/priority low select code 45
PRH47/PRL46	88	Priority high select code 47/priority low select code 46
PRH51/PRL50	89	Priority high select code 51/priority low select code 50
PRH52/PRL51	90	Priority high select code 52/priority low select code 51
PRH53/PRL52	91	Priority high select code 53/priority low select code 52
PRH54/PRL53	92	Priority high select code 54/priority low select code 53
PRH55/PRL54	93	Priority high select code 55/priority low select code 54
PRH56/PRL55	94	Priority high select code 56/priority low select code 55
PRH57/PRL56	95	Priority high select code 57/priority low select code 56
PRH61/PRL60	96	Priority high select code 61/priority low select code 60
PRH62/PRL61	97	Priority high select code 62/priority low select code 61
PRH63/PRL62	98	Priority high select code 63/priority low select code 62
PRH64/PRL63	99	Priority high select code 64/priority low select code 63
PRH65/PRL64	100	Priority high select code 65/priority low select code 64
PRL27	101	Priority low select code 27
PRL37	102	Priority low select code 37
PRL47	103	Priority low select code 47
PRL57	104	Priority low select code 57
RUN	105	Run signal
SCL0	106	Select code least significant digit, octal 0
SCL1	107	Select code least significant digit, octal 1
SCL2	108	Select code least significant digit, octal 2
SCL3	109	Select code least significant digit, octal 3
SCL4	110	Select code least significant digit, octal 4
SCL5	111	Select code least significant digit, octal 5
SCL6	112	Select code least significant digit, octal 6

Table 7-1. Signal Index (Continued)

SIGNAL MNEMONIC	REF NO.	DEFINITION
SCL7	113	Select code least significant digit, octal 7
SCM2	114	Select code most significant digit, octal 0
SCM3	115	Select code most significant digit, octal 3
SCM4	116	Select code most significant digit, octal 4
SCM5	117	Select code most significant digit, octal 5
SCM6	118	Select code most significant digit, octal 6
SFC	119	Skip if flag clear, decoded
SFS	120	Skip if flag set, decoded
SIR	121	Service interrupt request
SKF	122	Skip on flag signal
SPARE	123	Spare line
SRQ25	124	Service request from select code 25
SRQ26	125	Service request from select code 26
SRQ27	126	Service request from select code 27
SRQ30	127	Service request from select code 30
SRQ31	128	Service request from select code 31
SRQ32	129	Service request from select code 32
SRQ33	130	Service request from select code 33
SRQ34	131	Service request from select code 34
SRQ35	132	Service request from select code 35
SRQ36	133	Service request from select code 36
SRQ37	134	Service request from select code 37
SRQ40	135	Service request from select code 40
SRQ41	136	Service request from select code 41
SRQ42	137	Service request from select code 42
SRQ43	138	Service request from select code 43
SRQ44	139	Service request from select code 44
SRQ45	140	Service request from select code 45
SRQ46	141	Service request from select code 46
SRQ47	142	Service request from select code 47
SRQ50	143	Service request from select code 50
SRQ51	144	Service request from select code 51
SRQ52	145	Service request from select code 52
SRQ53	146	Service request from select code 53
SRQ54	147	Service request from select code 54
SRQ55	148	Service request from select code 55
SRQ56	149	Service request from select code 56
SRQ57	150	Service request from select code 57
SRQ60	151	Service request from select code 60
SRQ61	152	Service request from select code 61
SRQ62	153	Service request from select code 62
SRQ63	154	Service request from select code 63
SRQ64	155	Service request from select code 64
STC	156	Set control
STF	157	Set flag
T3IO	158	Time period 3 to I/O

Table 7-2. Backplane, Functional Wiring List

REF NO.	SIGNAL	INPUT/OUTPUT																																			POWER SUPPLY	REF NO.
		SELECT CODE 53	SELECT CODE 52	SELECT CODE 51	SELECT CODE 50	SELECT CODE 47	SELECT CODE 46	SELECT CODE 45	SELECT CODE 44	SELECT CODE 43	SELECT CODE 42	SELECT CODE 41	SELECT CODE 40	SELECT CODE 37	SELECT CODE 36	SELECT CODE 35	SELECT CODE 34	SELECT CODE 33	SELECT CODE 32	SELECT CODE 31	SELECT CODE 30	SELECT CODE 27	SELECT CODE 26	SELECT CODE 25	SELECT CODE 64	SELECT CODE 63	SELECT CODE 62	SELECT CODE 61	SELECT CODE 60	SELECT CODE 57	SELECT CODE 56	SELECT CODE 55	SELECT CODE 54	DMA	I/O-X2	I/O-X1		
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	
1	-2V	47/48	←										BUS										→	47/48	47/48	←					BUS					47/48	TB1-2,3	1
2	+4.85V	39/40	←										BUS										→	39/40	39/40	←					BUS					39/40	TB1-4,5	2
3	-12V	69/70	←										BUS										→	69/70	69/70	←			BUS			→	69/70				TB2-2	3
4	+12V	43/44	←										BUS										→	43/44	43/44	←			BUS			→	43/44				TB2-3	4
5	+30V (UNREG)	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36				TB2-4	5
6	CLC	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21		67			6
7	CLF	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		17			7
8	CRS	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13		43			8
9	EDT	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62		46			9
10	ENF	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46		8			10
11	SPARE																																					11
12	FLG2																					4	4/49	4/49												10		12
13	FLG3													4	4/49	4/49	4/49	4/49	4/49	4/49	4/49	49														64		13
14	FLG4					4	4/49	4/49	4/49	4/49	4/49	4/49	4/49	49																							4		14
15	FLG5	4/49	4/49	4/49	4/49	49																								4	4/49	4/49	4/49			14		15
16	FLG6																								4/49	4/49	4/49	4/49	4/49	49						6		16
17	GROUND	1/2	←										BUS										→	1/2	1/2	←					BUS				→	1/2	TB1-6,7	17
18	GROUND	85/86	←										BUS										→	85/86	85/86	←					BUS				→	85/86		18
19	IAK	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10		24			19
20	IEN20																					8	8	8											27			20
21	IEN30													8	8	8	8	8	8	8	8/23														9			21
22	IEN40					8	8	8	8	8	8	8	8/23																						10			22
23	IEN50	8	8	8	8/23																									8	8	8	8		12			23
24	IEN60																								8	8	8	8	8/23						6			24
25	IOBI 0	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26		64			25
26	IOBI 1	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29		70			26
27	IOBI 2	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30		76			27
28	IOBI 3	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64		81			28
29	IOBI 4	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77			11			29
30	IOBI 5	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80		18			30
31	IOBI 6	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81		25			31
32	IOBI 7	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84		34			32
33	IOBI 8	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27		41			33
34	IOBI 9	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28		42			34
35	IOBI 10	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31		50			35
36	IOBI 11	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60		58			36
37	IOBI 12	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78		60			37
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	

Table 7-2. Backplane, Functional Wiring List (Continued)

REF NO.	SIGNAL	INPUT/OUTPUT																																		POWER SUPPLY	REF NO.
		SELECT CODE 53	SELECT CODE 52	SELECT CODE 51	SELECT CODE 50	SELECT CODE 47	SELECT CODE 46	SELECT CODE 45	SELECT CODE 44	SELECT CODE 43	SELECT CODE 42	SELECT CODE 41	SELECT CODE 40	SELECT CODE 37	SELECT CODE 36	SELECT CODE 35	SELECT CODE 34	SELECT CODE 33	SELECT CODE 32	SELECT CODE 31	SELECT CODE 30	SELECT CODE 27	SELECT CODE 26	SELECT CODE 25	SELECT CODE 64	SELECT CODE 63	SELECT CODE 62	SELECT CODE 61	SELECT CODE 60	SELECT CODE 57	SELECT CODE 56	SELECT CODE 55	SELECT CODE 54	DMA	I/O-X2	I/O-X1		
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	
38	IOBI 13	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79		65			38
39	IOBI 14	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82		68			39
40	IOBI 15	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83	83		71			40
41	IOBI 16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18		80			41
42	IOBO 0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	10	61			42
43	IOBO 1	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	8	74			43
44	IOBO 2	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	6	73			44
45	IOBO 3	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	4	82			45
46	IOBO 4	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	60	7			46
47	IOBO 5	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	62	16			47
48	IOBO 6	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53		23			48
49	IOGO 7	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52		32			49
50	IOBO 8	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54		38			50
51	IOBO 9	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56		36			51
52	IOBO 10	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58		51			52
53	IOBO 11	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55		56			53
54	IOBO 12	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57		54			54
55	IOBO 13	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61		63			55
56	IOBO 14	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65		66			56
57	IOBO 15	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74		69			57
58	SPARE																																					58
59	IOG	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15		52			59
60	IOI	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24		53			60
61	IOO	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20		31			61
62	IRQ1			6	33							6	33							6	33							6	33						34			62
63	IRQ2		6	33							6	33							6	33							6	33							38			63
64	IRQ3	6	33							6	33							6	33							6	33								42			64
65	IRQ4	33							6	33							6	33							6	33							6		49			65
66	IRQ5							6	33							6	33							6	33							6	33		50			66
67	IRQ6						6	33							6	33							6	33							6	33			56			67
68	IRQ7					6	33							6	33							6	33							6	33				58			68
69	LDS	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59		72			69
70	PON	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66		26			70
71	POPIO	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17		62			71
72	PRH25L24																							23											29			72
73	PRH26L25																						23	3														73
74	PRH27L26																					23	3															74
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	

Table 7-2. Backplane, Functional Wiring List (Continued)

REF NO.	SIGNAL	INPUT/OUTPUT																																					REF NO.
		SELECT CODE 53	SELECT CODE 52	SELECT CODE 51	SELECT CODE 50	SELECT CODE 47	SELECT CODE 46	SELECT CODE 45	SELECT CODE 44	SELECT CODE 43	SELECT CODE 42	SELECT CODE 41	SELECT CODE 40	SELECT CODE 37	SELECT CODE 36	SELECT CODE 35	SELECT CODE 34	SELECT CODE 33	SELECT CODE 32	SELECT CODE 31	SELECT CODE 30	SELECT CODE 27	SELECT CODE 26	SELECT CODE 25	SELECT CODE 64	SELECT CODE 63	SELECT CODE 62	SELECT CODE 61	SELECT CODE 60	SELECT CODE 57	SELECT CODE 56	SELECT CODE 55	SELECT CODE 54	DMA	I/O-X2	I/O-X1	POWER SUPPLY	
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	
75	PRH31L30																			23	3																	75
76	PRH32L31																		23	3																		76
77	PRH33L32																	23	3																		77
78	PRH34L33																23	3																			78
79	PRH35L34															23	3																				79
80	PRH36L35														23	3																					80
81	PRH37L36													23	3																						81
82	PRH41L40											23	3																								82
83	PRH42L41										23	3																									83
84	PRH43L42									23	3																										84
85	PRH44L43								23	3																											85
86	PRH45L44							23	3																												86
87	PRH46L45						23	3																													87
88	PRH47L46					23	3																														88
89	PRH51L50			23	3																																89
90	PRH52L51		23	3																																	90
91	PRH53L52	23	3																																		91
92	PRH55L53	3																															23				92
93	PRH55L54																															23	3				93
94	PRH56L55																														23	3					94
95	PRH57L56																													23	3						95
96	PRH61L60																											23	3								96
97	PRH62L61																										23	3									97
98	PRH63L62																									23	3										98
99	PRH64L63																								23	3											99
100	PRH65L64																								3												100
101	PRL27																					3												4			101
102	PRL37													3																				30			102
103	PRL47					3																												5			103
104	PRL57																													3							104
105	RUN	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	15			105
106	SCL0				16	34							16	34							16	34							16	34						46		106
107	SCL1			16	34							16	34							16	34						16	34								52		107
108	SCL2		16	34							16	34							16	34						16	34								54		108
109	SCL3	16	34							16	34							16	34						16	34								60		109
110	SCL4	34							16	34							16	34							16	34							16			68		110
111	SCL5							16	34							16	34							16	34							16	34			76		111
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	

Table 7-2. Backplane, Functional Wiring List (Continued)

REF NO.	SIGNAL	INPUT/OUTPUT																																		POWER SUPPLY	REF NO.
		SELECT CODE 53	SELECT CODE 52	SELECT CODE 51	SELECT CODE 50	SELECT CODE 47	SELECT CODE 46	SELECT CODE 45	SELECT CODE 44	SELECT CODE 43	SELECT CODE 42	SELECT CODE 41	SELECT CODE 40	SELECT CODE 37	SELECT CODE 36	SELECT CODE 35	SELECT CODE 34	SELECT CODE 33	SELECT CODE 32	SELECT CODE 31	SELECT CODE 30	SELECT CODE 27	SELECT CODE 26	SELECT CODE 25	SELECT CODE 64	SELECT CODE 63	SELECT CODE 62	SELECT CODE 61	SELECT CODE 60	SELECT CODE 57	SELECT CODE 56	SELECT CODE 55	SELECT CODE 54	DMA	I/O-X2	I/O-X1		
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	
112	SCL6						16	34							16	34							16	34							16	34				80		112
113	SCL7					16	34							16	34							16	34							16	34				84		113
114	SCM2																					14	14_{37}	14_{37}											18		114
115	SCM3													14	14_{37}	14_{37}	14_{37}	14_{37}	14_{37}	14_{37}	14_{37}	37													77		22		115
116	SCM4					14	14_{37}	14_{37}	14_{37}	14_{37}	14_{37}	14_{37}	14_{37}	37																					79		30		116
117	SCM5	14_{37}	14_{37}	14_{37}	14_{37}	37																								14	14_{37}	14_{37}	14_{37}	76		26		117
118	SCM6																								14_{37}	14_{37}	14_{37}	14_{37}	14_{37}	37				75		16		118
119	SFC	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		20			119
120	SFS	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25		79			120
121	SIR	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32		84			121
122	SKF	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12		83			122
123	SPARE	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68		35			123
124	SRQ25																							19										78				124
125	SRQ26																						19											80				125
126	SRQ27																					19												82				126
127	SRQ30																				19													21				127
128	SRQ31																			19														19				128
129	SRQ32																		19															17				129
130	SRQ33																	19																15				130
131	SRQ34																19																	13				131
132	SRQ35															19																		11				132
133	SRQ36														19																			9				133
134	SRQ37													19																				7				134
135	SRQ40												19																					26				135
136	SRQ41											19																						24				136
137	SRQ42										19																							22				137
138	SRQ43									19																								20				138
139	SRQ44								19																									18				139
140	SRQ45							19																										16				140
141	SRQ46						19																											14				141
142	SRQ47					19																												12				142
143	SRQ50				19																													57				143
144	SRQ51			19																														61				144
145	SRQ52		19																															63				145
146	SRQ53	19																																59				146
147	SRQ54																																19	54				147
148	SRQ55																															19		67				148
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	

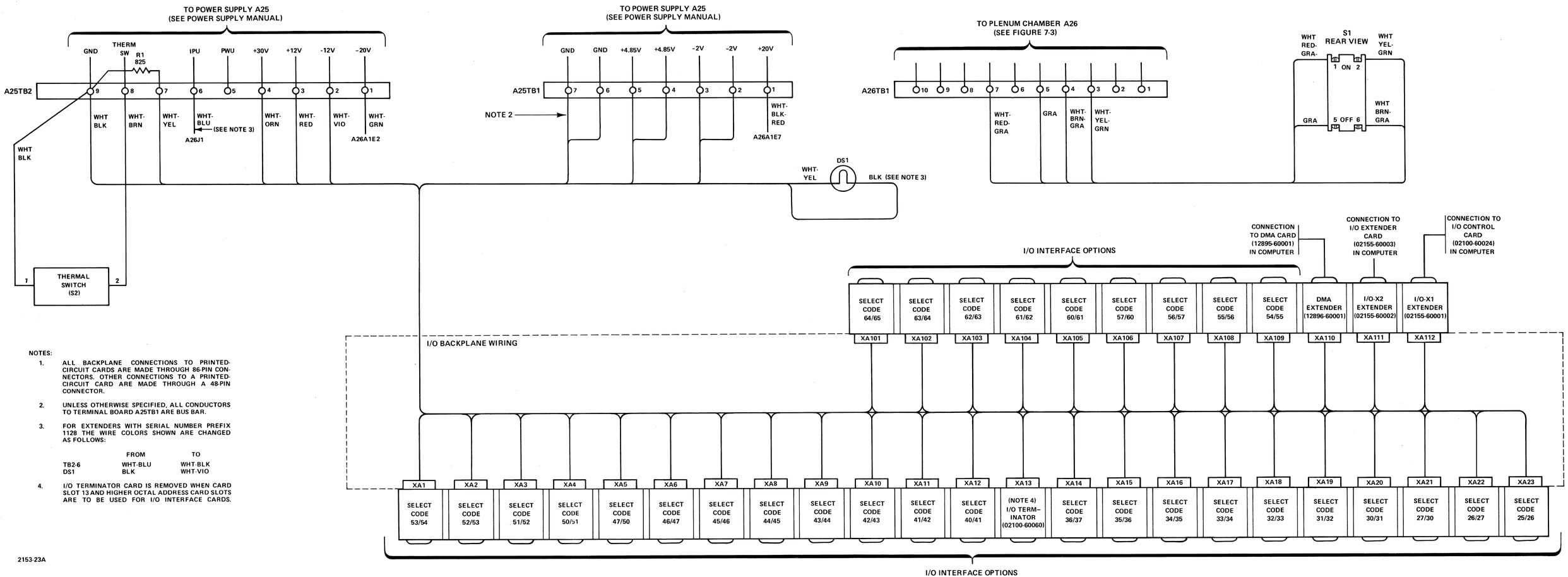
Table 7-2. Backplane, Functional Wiring List (Continued)

REF NO.	SIGNAL	INPUT/OUTPUT SELECT CODE 53 A1	SELECT CODE 52 A2	SELECT CODE 51 A3	SELECT CODE 50 A4	SELECT CODE 47 A5	SELECT CODE 46 A6	SELECT CODE 45 A7	SELECT CODE 44 A8	SELECT CODE 43 A9	SELECT CODE 42 A10	SELECT CODE 41 A11	SELECT CODE 40 A12	SELECT CODE 37 A13	SELECT CODE 36 A14	SELECT CODE 35 A15	SELECT CODE 34 A16	SELECT CODE 33 A17	SELECT CODE 32 A18	SELECT CODE 31 A19	SELECT CODE 30 A20	SELECT CODE 27 A21	SELECT CODE 26 A22	SELECT CODE 25 A23	SELECT CODE 64 A101	SELECT CODE 63 A102	SELECT CODE 62 A103	SELECT CODE 61 A104	SELECT CODE 60 A105	SELECT CODE 57 A106	SFLECT CODE 56 A107	SELECT CODE 55 A108	SELECT CODE 54 A109	DMA A110	I/O-X2 A111	I/O-X1 A112	POWER SUPPLY A25	REF NO.
149	SRQ56																														19			71				149
150	SRQ57																													19				73				150
151	SRQ60																												19					64				151
152	SRQ61																											19						66				152
153	SRQ62																										19							68				153
154	SRQ63																									19								72				154
155	SRQ64																								19									74				155
156	STC	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22		44			156
157	STF	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9		22			157
158	T3IO	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11		28			158
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A101	A102	A103	A104	A105	A106	A107	A108	A109	A110	A111	A112	A25	

Table 7-3. Power Distribution, Point-to-Point Wiring List

FROM	TO	COLOR	FROM	TO	COLOR
A25TB1-1	A26A1E7	wht-blk-red	S1-1	A26TB1-7	wht-red-gra
A25TB2-1	A26A1E2	wht-grn	S1-2	A26TB1-3	wht-yel-grn
A25TB2-2	XA101-69,70	wht-vio	S1-5	A26TB1-5	gra
A25TB2-2	XA23-69,70	wht-vio	S1-6	A26TB1-4	wht-brn-gra
A25TB2-3	XA101-43,44	wht-red	S3-1	A25TB2-9	wht-blk
A25TB2-3	XA23-43,44	wht-red	S3-2	A25TB2-8	wht-brn
A25TB2-4	XA101-36	wht-orn	XA1-69,70	XA102-69,70	wht-vio
A25TB2-5	XA112-72	wht-brn-blk (wht-blu)	XA1-43,44	XA102-43,44	wht-red
A25TB2-8	S3-2	wht-brn	XA22-1,2	DS-1	blk (wht-vio)
A25TB2-9	S3-1	wht-blk	XA23-39,40	DS-1	wht-yel
A26A1E1	XA101-85	blk	XA23-43,44	A25TB2-3	wht-red
A26A1E2	A25TB2-1	wht-grn	XA23-69,70	A25TB2-2	wht-vio
A26A1E3	XA102-73	wht-vio	XA101-36	A25TB2-4	wht-orn
A26A1E4	XA101-48	vio	XA101-40	A26A1E5	orn
A26A1E5	XA101-40	orn	XA101-43,44	A25TB2-3	wht-red
A26A1E6	XA102-14	wht-red	XA101-48	A26A1E4	vio
A26A1E7	A25TB1-1	wht-blk-red	XA101-69,70	A25TB2-2	wht-vio
A26A1E8	XA112-18	wht-orn	XA101-85	A26A1E1	blk
A26TB1-3	S1-2	wht-yel-grn	XA102-14	A26A1E6	wht-red
A26TB1-4	S1-6	wht-brn-gra	XA102-43,44	XA1-43,44	wht-red
A26TB1-5	S1-5	gra	XA102-69,70	XA1-69,70	wht-vio
A26TB1-7	S1-1	wht-red-gra	XA102-73	A26A1E3	wht-vio
DS-1	XA22-1,2	blk (wht-vio)	XA112-18	A26A1E8	wht-orn
DS-1	XA23-39,40	wht-yel	XA112-72	A25TB2-5	wht-brn-blk (wht-blu)

NOTE: Colors shown in parenthesis are used in extenders that have serial number prefix 1128.



NOTES:

1. ALL BACKPLANE CONNECTIONS TO PRINTED-CIRCUIT CARDS ARE MADE THROUGH 86-PIN CONNECTORS. OTHER CONNECTIONS TO A PRINTED-CIRCUIT CARD ARE MADE THROUGH A 48-PIN CONNECTOR.
2. UNLESS OTHERWISE SPECIFIED, ALL CONDUCTORS TO TERMINAL BOARD A25TB1 ARE BUS BAR.
3. FOR EXTENDERS WITH SERIAL NUMBER PREFIX 1128 THE WIRE COLORS SHOWN ARE CHANGED AS FOLLOWS:

	FROM	TO
TB2-6	WHT-BLU	WHT-BLK
DS1	BLK	WHT-VIO

4. I/O TERMINATOR CARD IS REMOVED WHEN CARD SLOT 13 AND HIGHER OCTAL ADDRESS CARD SLOTS ARE TO BE USED FOR I/O INTERFACE CARDS.

2153-23A

Figure 7-2. Backplane, Wiring Diagram

Table 7-4. Plenum Chamber A26, Point-to-Point Wiring List

FROM	TO	COLOR	FROM	TO	COLOR
A1E1	XA101-85	blk	TB1-2	XF1-1	wht-blk-gra
A1E2	XA103-75	wht-grn	TB1-2	P1-1	blk
A1E3	XA102-73	wht-vio	TB1-3	S1-2	wht-yel-grn
A1E4	XA101-48	vio	TB1-3	FL1-4	wht-yel-grn
A1E5	XA101-40	orn	TB1-4	FL1-5	wht-brn-gra
A1E6	XA102-14	wht-red	TB1-4	S1-6	wht-brn-gra
A1E7	XA104-10	wht-blk-red	TB1-5	S1-5	gra
A1E8	XA112-18	wht-orn	TB1-5	XF2-1	wht-yel
B1-J1	TB2-1	blk	TB1-5	A25A6E1	gra
B1-J1	TB2-2	blk	TB1-6	A25A6E3	wht-blu-gra
B2-J1	TB2-1	blk	TB1-7	S1-1	wht-red-gra
B2-J1	TB2-2	blk	TB1-7	TB2-1	wht-red-gra
C3-1	E10	wht-grn-gra	TB1-7	A25A6E2	wht-red-gra
C3-2	TB1-1	wht-red-gra	TB1-7	A25TB3-11	wht-red-gra
E9	P1-3	grn	TB1-8	A25TB3-6	wht-yel-gra
E9	FL1-2	grn-yel	TB1-9	TB2-2	wht-grn-gra
E9	Shield*	grn-yel	TB1-9	A25TB3-12	wht-grn-gra
E10	C3-1	wht-grn-gra	TB1-10	XF2-2	wht-vio
E11	XF2-1	gra	TB1-10	A25TB3-5	wht-vio-gra
FL1-1	TB1-1	wht-gra	TB2-1	B1-J1	blk
FL1-2	E9	grn-yel	TB2-1	B2-J1	blk
FL1-3	XF1-2	gra	TB2-1	TB1-7	wht-red-gra
FL1-4	TB1-3	wht-yel-grn	TB2-2	B1-J1	blk
FL1-5	TB1-4	wht-brn-gra	TB2-2	B2-J1	blk
J1	XA112-22	wht-blu	TB2-2	TB1-9	wht-grn-gra
P1-1	TB1-2	blk	XF1-1	TB1-2	wht-blk-gra
P1-2	TB1-1	wht	XF1-2	FL1-3	gra
P1-3	E9	grn	XF2-1	TB1-5	wht-yel
TB1-1	C3-2	wht-red-gra	XF2-1	E11	gra
TB1-1	FL1-1	wht-gra	XF2-2	TB1-10	wht-vio
TB1-1	P1-2	wht			

* Shield is located on wiring to switch S1.

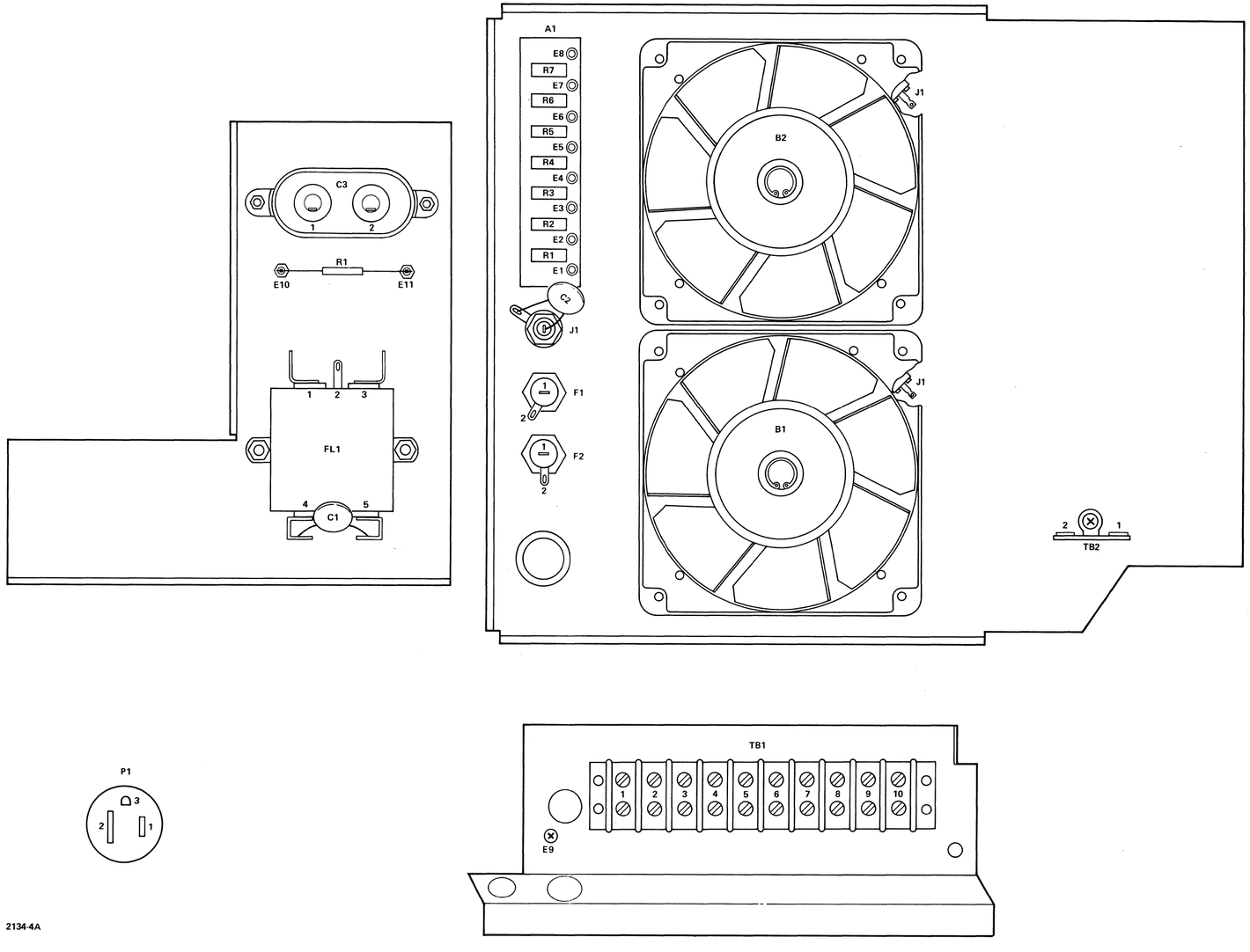
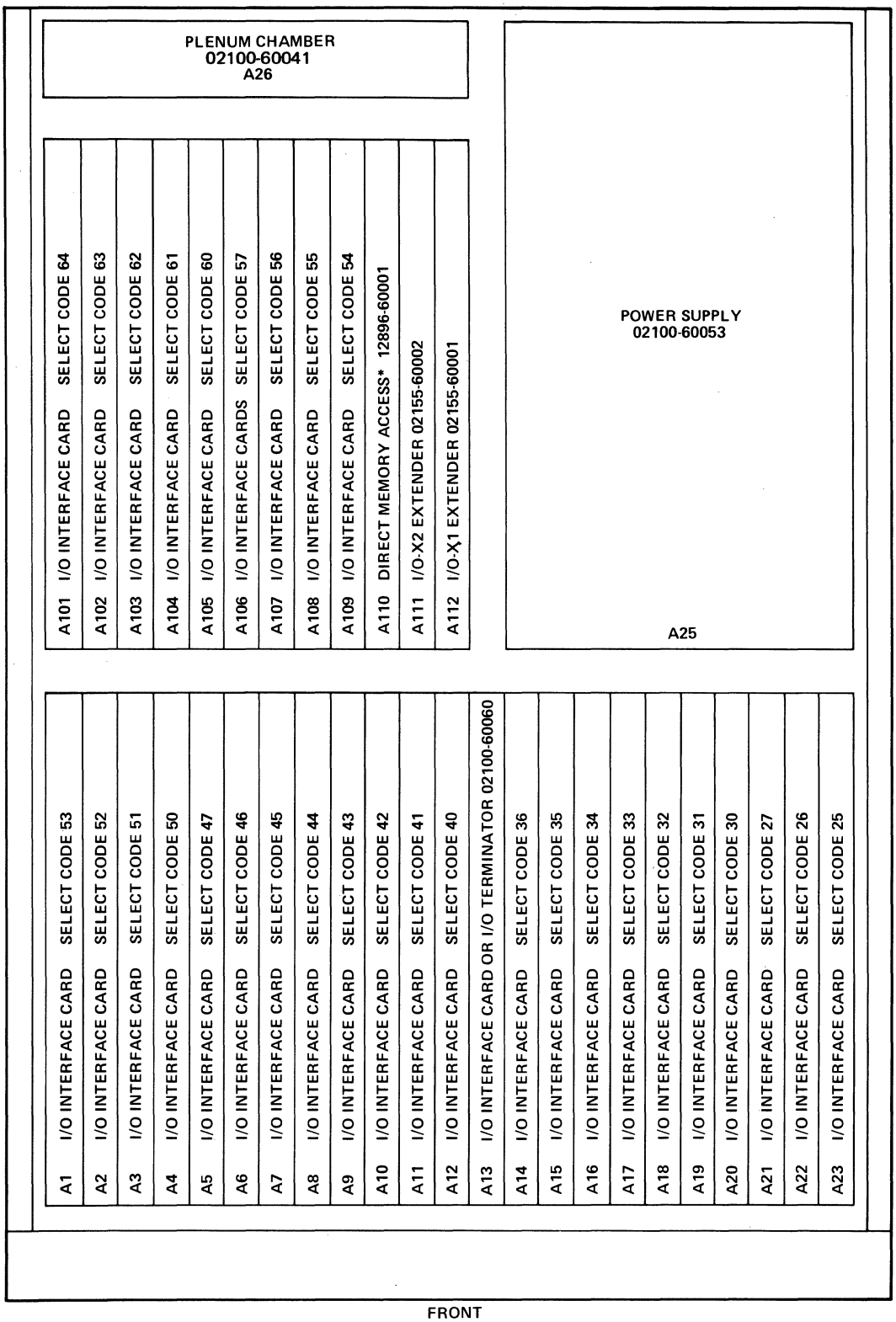


Figure 7-3. A26 Plenum Chamber, Wiring Diagram



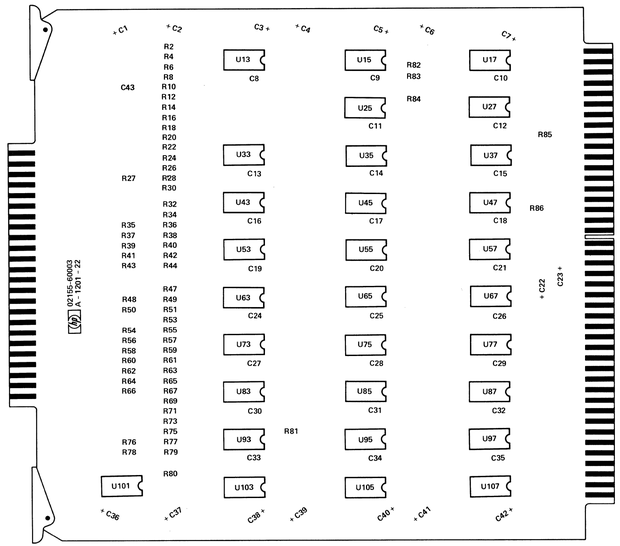
NOTE: *DIRECT MEMORY ACCESS CARD IS AN ACCESSORY TO THE EXTENDER AND IS NOT PART OF THE BASIC CONFIGURATION.

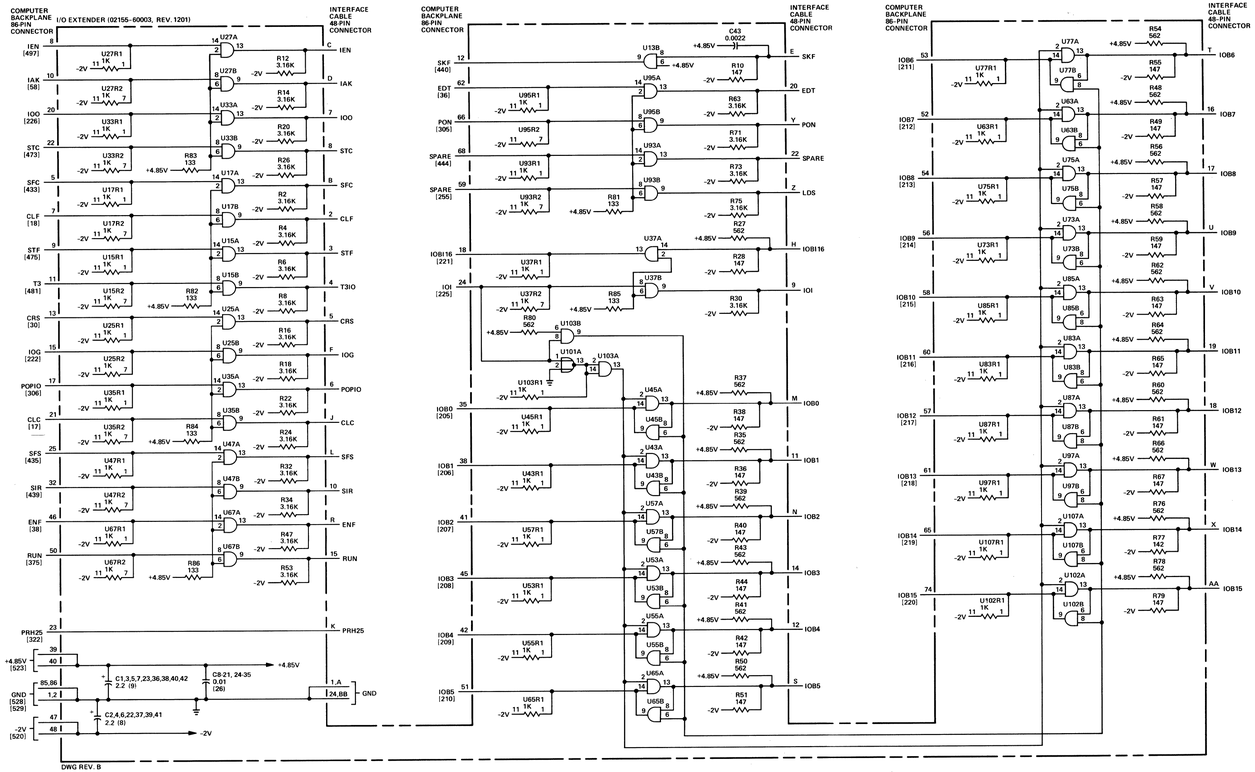
2153-22A

Figure 7-4. Location of Assemblies in I/O Extender

Table 7-5. A10 (In Computer) I/O Extender Card, Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1 thru C7,22,23, 36 thru 42	0180-0197	Capacitor, Fxd, Elect, 2.2 uf, 10%, 20 VDCW	56289	150D225X9020A2-DYS
C8 thru C21,24 thru 35	0160-2055	Capacitor, Fxd, Cer, 0.01 uf, +80 -20%, 100 VDCW	56289	C023F101F103 ZS22-CDH
C43	0160-0154	Capacitor, Fxd, Mica, 0.0022 uf, 10%, 200 VDCW	56289	192P22292-PTS
R2,4,6,8,12,14,16,18,20,22, 24,26,30,32,34,47,53,69, 71,73,75	0757-0279	Resistor, Fxd, Flm, 3.16k, 1%, 1/8W	28480	0757-0279
R10,28,36,38,40,42,44,49, 51,55,57,59,61,63,65,67, 77,79	0698-3438	Resistor, Fxd, Flm, 147 ohms, 1%, 1/8W	28480	0698-3438
R27,35,37,39,41,43,48,50,54, 66,76,78,80	0757-0417	Resistor, Fxd, Flm, 562 ohm, 1%, 1/8W	28480	0757-0417
R81 thru R86	0698-3437	Resistor, Fxd, Flm, 133 ohms, 1%, 1/8W	28480	0698-3437
U13,15,17,25,27,33,35,37, 43,45,47,53,55,57,63, 65,67,73,75,77,83,85,87, 93,95,97,103,105,107	1820-0186	Integrated Circuit, CTL	07263	U6A985649X
U101	1820-0952	Integrated Circuit, CTL	14433	MIC952





NOTES:

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

Figure 7-5. A10 (In Computer) I/O Extender Card, Parts Location and Schematic Diagrams

Table 7-6. A13 I/O Terminator Card, Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
R1 thru R15, R17 thru R21, R23 thru R34	0683-2215	Resistor, Fxd, Comp, 220 ohms, 5%, 1/4W	01121	CB 2215
R16,R22	0683-1025	Resistor, Fxd, Comp, 1k, 5%, 1/4W	01121	CB 1025

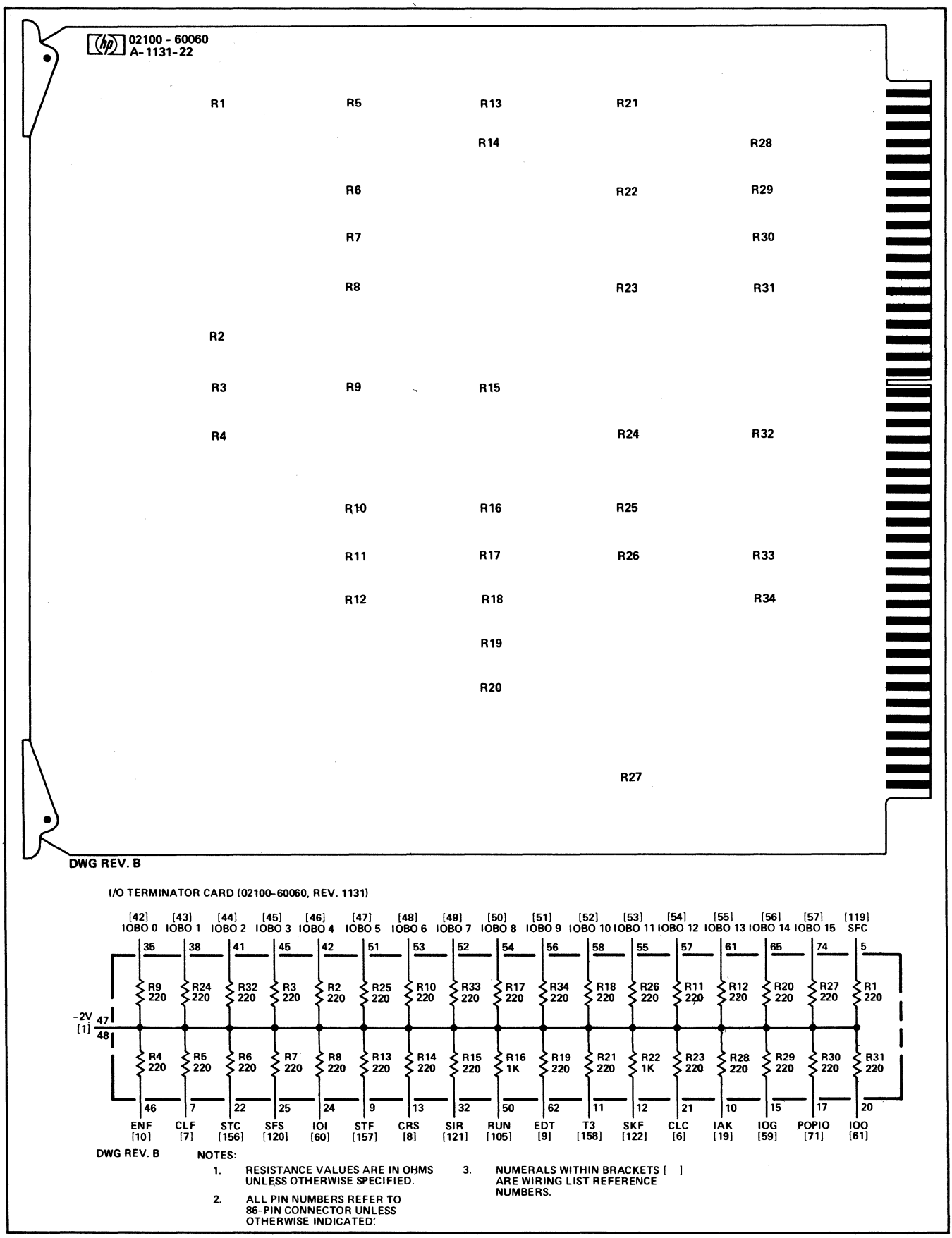
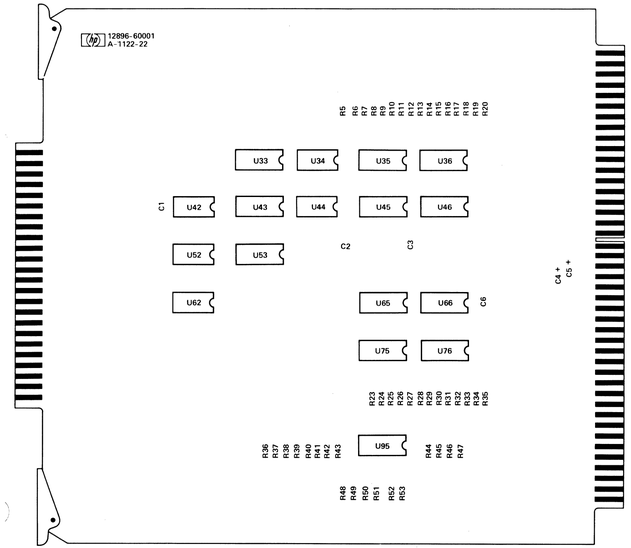
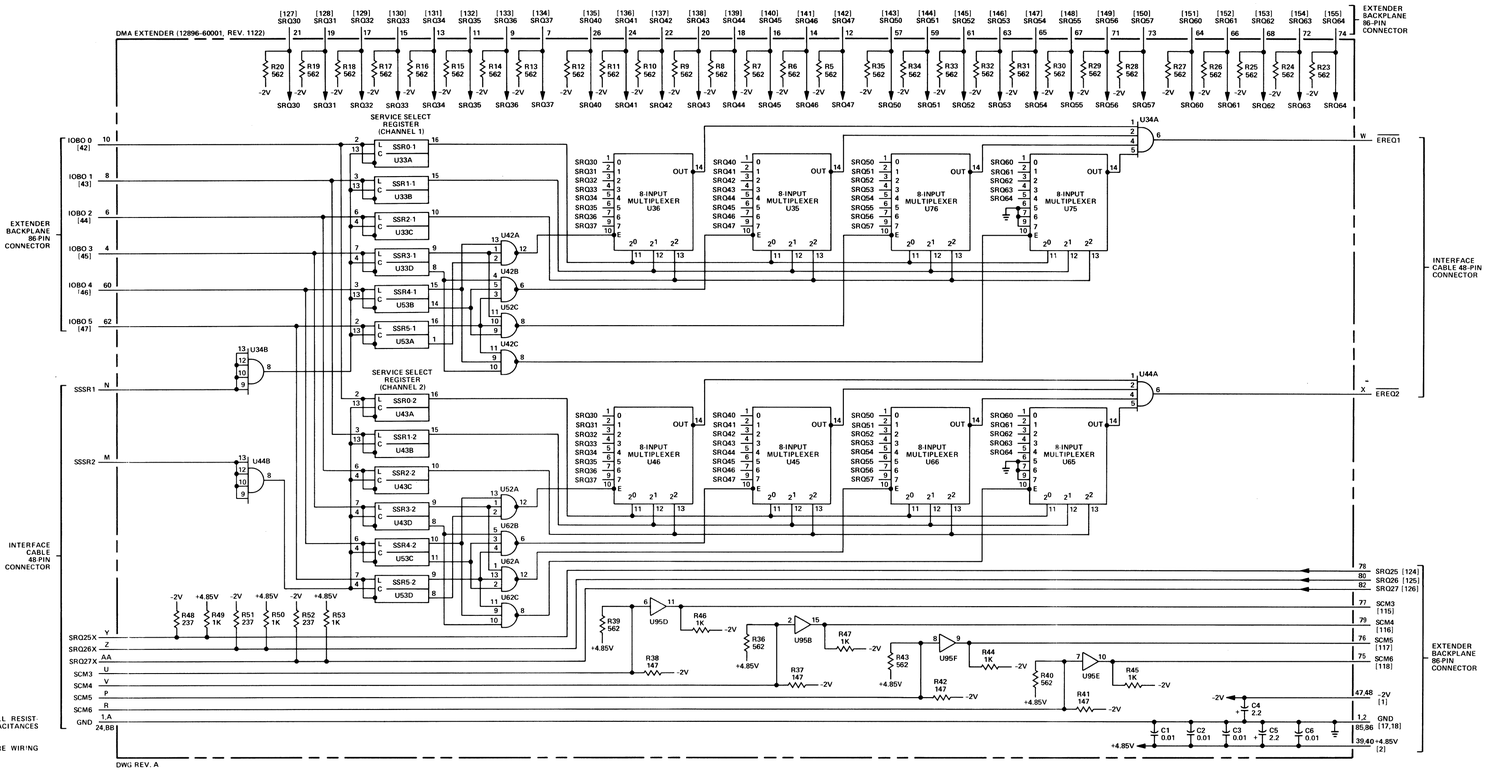


Figure 7-6. A13 I/O Terminator Card, Parts Location and Schematic Diagrams

Table 7-7. A110 DMA Extender Card (Optional), Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1 thru C3,6	0160-2055	Capacitor, Fxd, Cer, 0.01 uf, +80 -20%, 100 VDCW	56289	C023F101F103ZS22-CDH
C4,5	0180-0197	Capacitor, Fxd, Elect, 2.2 uf, 10%, 20 VDCW	56289	150D225X9020A2-DYS
R5 thru R20, 23 thru 36, 39,40, 43 thru 47	0757-0417	Resistor, Fxd, Flm, 562 ohm, 1%, 1/8W	28480	0757-0417
R37,38,41,42	0698-3438	Resistor, Fxd, Flm, 147 ohms, 1%, 1/8W	28480	0698-3438
R48,51,52	0698-3442	Resistor, Fxd, Flm, 237 ohms, 1%, 1/8W	28480	0698-3442
R49,50,53	0757-0280	Resistor, Fxd, Flm, 1K, 1%, 1/8W	28480	0757-0280
U33,43,53	1820-0301	Integrated Circuit, Quad Bistable Latch	01295	SN7475N
U34,44	1820-0140	Integrated Circuit, TTL	04713	MC3026P
U35,36,45,46, 60,65,75,76	1820-0615	Integrated Circuit, TTL	07263	U7B931259X
U42,52,62	1820-0371	Integrated Circuit, TTL	01295	SN74H10N
U95	1820-0485	Integrated Circuit, CTL	07263	U6B981649X





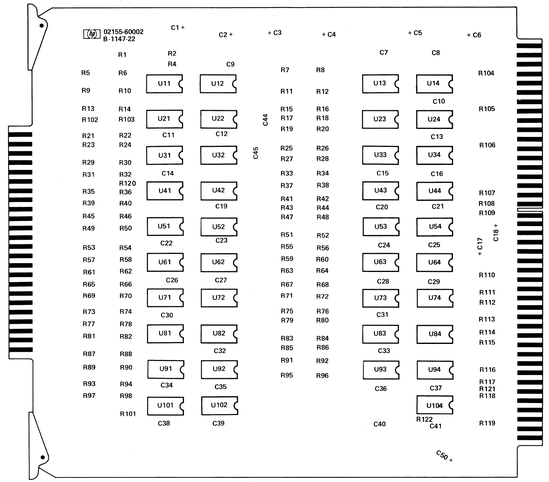
NOTES:

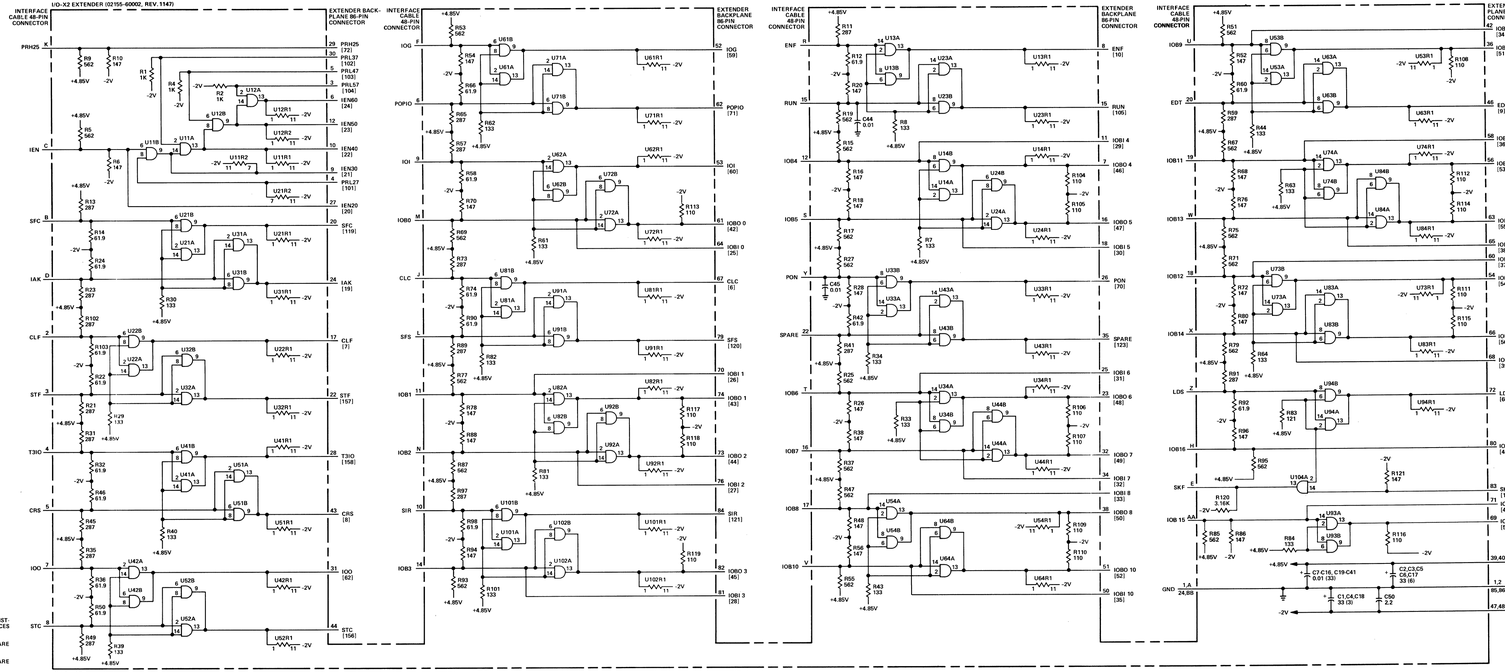
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. NUMERALS IN BRACKETS [ ] ARE WIRING LIST REFERENCE NUMBERS.

Figure 7-7. A110 DMA Extender Card (Optional), Parts Location and Schematic Diagrams

Table 7-8. A111 I/O-X2 Extender Card, Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1 thru C6,17,18	0180-0229	Capacitor, Fxd, Elect, 33 uf, 10%, 10 VDCW	56289	150D336X9010B2-DYS
C7 thru C16, C19 thru C41, 44,45	0160-2055	Capacitor, Fxd, Cer, 0.01 uf, +80 -20%, 100 VDCW	56289	C023F101F103 ZS22-CDH
C50	0180-0197	Capacitor, Fxd, Elect, 2.2 uf, 10%, 20 VDCW	56289	150D225X9020A2-DYS
R1,2,4	0757-0280	Resistor, Fxd, Flm, 1k, 1%, 1/8W	28480	0757-0280
R5,9,15,17,19,25,27,37, 41,47,51,53,55,67,69, 71,75,77,79,85,87,93,95	0757-0417	Resistor, Fxd, Flm, 562 ohm, 1%, 1/8W	28480	0757-0417
R6,10,16,18,20,26,28,38, 42,48,52,54,56,68,70,72, 76,78,80,86,88,94,96,121	0698-3438	Resistor, Fxd, Flm, 147 ohms, 1%, 1/8W	28480	0698-3438
R7,8,29,30,33,34,39,40,43, 44, 61 thru 64,81,82, 84,101	0698-3437	Resistor, Fxd, Flm, 133 ohms, 1%, 1/8W	28480	0698-3437
R11,13,21,23,31,35,45,49, 57,59,65,73,89,91, 97,102	0698-3443	Resistor, Fxd, Flm, 287 ohms, 1%, 1/8W	28480	0698-3443
R12,14,22,24,32,36,46,50, 58,60,66,74,90,92, 98,103	0757-0276	Resistor, Fxd, Flm, 61.9 ohm, 1%, 1/8W	28480	0757-0276
R83	0757-0403	Resistor, Fxd, Flm, 121 ohms, 1%, 1/8W	28480	0757-0403
R104 thru R119	0757-0402	Resistor, Fxd, Flm, 110 ohms, 1%, 1/8W	28480	0757-0402
R120	0757-0279	Resistor, Fxd, Flm, 3.16k, 1%, 1/8W	28480	0757-0279
U11 thru U14, U21 thru U24, U31 thru U34, U41 thru U44, U51 thru U54, U61 thru U64, U71 thru U74, U81 thru U84, U91 thru U94, 101,102,104	1820-0186	Integrated Circuit, CTL	07263	U6A985649X





NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ALL MICROCIRCUIT INTERNAL RESISTORS ARE 1K OHMS.
3. NUMERALS WITHIN BRACKETS [ ] ARE WIRING LIST REFERENCE NUMBERS.

Figure 7-8. A111 I/O-X2 Extender Card, Parts Location and Schematic Diagrams

SALES & SERVICE OFFICES

UNITED STATES

ALABAMA
P.O. Box 4207
2003 Byrd Spring Road S.W.
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA
2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 244-1361
TWX: 910-951-1330

5737 East Broadway
Tucson 85711
Tel: (602) 298-2313
TWX: 910-952-1162

CALIFORNIA
1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000
TWX: 910-592-1288

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

6305 Arizona Place
Los Angeles 90045
Tel: (213) 649-2511
TWX: 910-328-6148

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2220 Watt Ave.
Sacramento 95825
Tel: (916) 482-1463
TWX: 910-367-2092

9606 Aero Drive
San Diego 92123
Tel: (714) 279-3200
TWX: 910-335-2000

COLORADO
7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel: (203) 389-6551
TWX: 710-465-2029

FLORIDA
P.O. Box 24210
2806 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099

P.O. Box 13910
6177 Lake Ellenor Dr.
Orlando, 32809
Tel: (305) 859-2900
TWX: 810-850-0113

GEORGIA
P.O. Box 28234
450 Interstate North
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

HAWAII
2875 So. King Street
Honolulu 96814
Tel: (808) 955-4455

ILLINOIS
5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA
3839 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 810-341-3263

LOUISIANA
P.O. Box 856
3239 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND
6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-9157

P.O. Box 1648
2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS
32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN
21840 West Nine Mile Road
Southfield 48075
Tel: (313) 353-9100
TWX: 810-224-4882

MINNESOTA
2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI
11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

148 Weldon Parkway
Maryland Heights 63043
Tel: (314) 567-1455
TWX: 910-764-0830

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Las Vegas
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1060 N. Kings Highway
Cherry Hill 08034
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TWX: 710-892-4945

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