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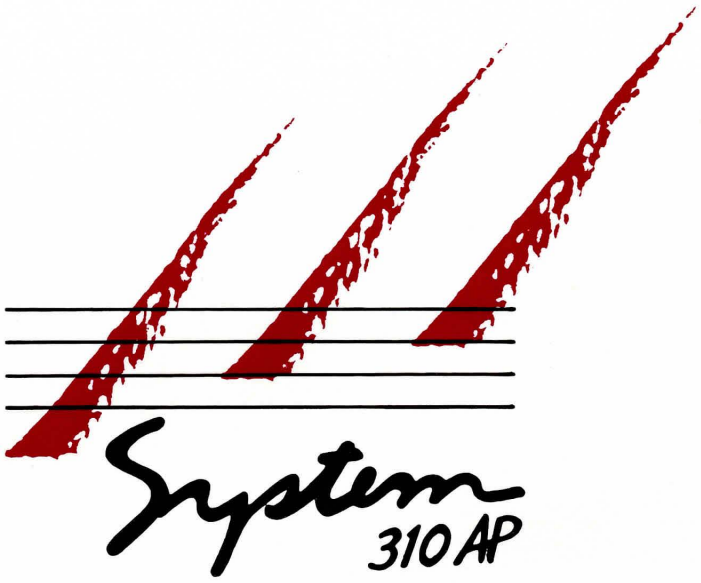
SYSTEM 310AP
MAINTENANCE MANUAL



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SYSTEM 310AP
HARDWARE MAINTENANCE MANUAL

Order Number: 175426-001

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CAUTION

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for Class A Computing Device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

WARNING

Risk of electric shock may be present on exposed metal parts unless this product is adequately grounded in accordance with the following guidelines.

A) An insulated grounding conductor, at least as suitable in size, insulation material, and thickness as the building AC line circuit conductors, must be installed as part of the building wiring.

B) The grounding conductor mentioned in item A is to be grounded to the earth at suitable building earth ground such as the steel frame or water pipe of a building if it is suitably earth grounded.

C) The wall outlets in the vicinity of this product must be of the grounding type and must be constructed and connected as described in items A and B.

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-001	Original issue	05/86

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CHAPTER 1
GENERAL INFORMATION

This manual contains information necessary for servicing the Intel System 310AP Microcomputer at the field-replaceable module level.

Except where it shows how the various components function together as a system, this manual contains no detailed circuit-level information. For detailed information on most modules, refer to the hardware reference manuals listed in Appendix E.

Installation and start-up information is in the *System 310AP Owner's Manual*; see Appendix E, "Related Publications," in this manual for the order number.

Audience

This manual is intended for use by qualified service technicians with a basic understanding of computer science and electronics.

Manual Organization

Summarized by chapter and appendix, the topics covered in this manual are as follows:

1. **General Information**--describes the components of the System 310AP and shows how they function together as a system.

2. **Maintenance**—contains preventive maintenance procedures and troubleshooting information.

3. **Removal and Replacement Procedures**--contains removal and replacement procedures for field-replaceable components.

4. **Maintenance Diagrams**--contains schematics and wiring diagrams.

A. **Standard System Configuration**--describes the factory-standard version of the System 310AP and provides jumper settings and other configuration information for major system components.

B. **Specification**--lists environmental, electrical, and physical specifications for the System 310AP.

C. **Service Information**--describes how to obtain service from Intel.

D. **Installing the System in a Rack**—Describes how to install the system for operation in a rack.

E. **Related Publications**--tells where to obtain additional information about the System 310AP and related topics.

Notational Conventions

An asterisk following a signal name indicates that the signal is asserted or true in the low electrical state.

System Overview

Figure 1-1 is a block diagram of the System 310AP, showing the functional relationships among the components of the system. As the block diagram shows, the System 310AP is organized around a system bus over which the various parts of the system communicate.

The System 310AP consists of the following major components:

- MULTIBUS® and hsi (high-speed synchronous interface) backplane
- Processor board
- Memory, contained on the processor board and optional memory expansion boards
- Flexible and Winchester disk drives, tape drives, and their controller
- Power supply

The system accommodates additional components, such as memory and intelligent communications controllers. Figures 1-2 and 1-3 show the locations of the major System 310AP components. Figure 1-2 shows the interior of the chassis; Figure 1-3 is a view from the rear of the chassis, showing the processor board and peripheral controller board housed within the cardcage.

Bus Structure

The System 310AP uses Intel's industry-standard MULTIBUS architecture for the system bus. A special bus, the hsi (high-speed synchronous interface), is used for fast access to the system expansion memory. The MULTIBUS architecture also includes the iSBX™ bus, which is primarily for I/O expansion.

The MULTIBUS® System Bus

The MULTIBUS system bus is a versatile, general-purpose bus architecture for transferring data between the various circuit boards that make up the core of the System 310AP. Because it is a general-purpose bus, the system bus is designed to have a wide range of capabilities that include a multilevel interrupt structure and a means for different bus masters to exchange control of the bus.

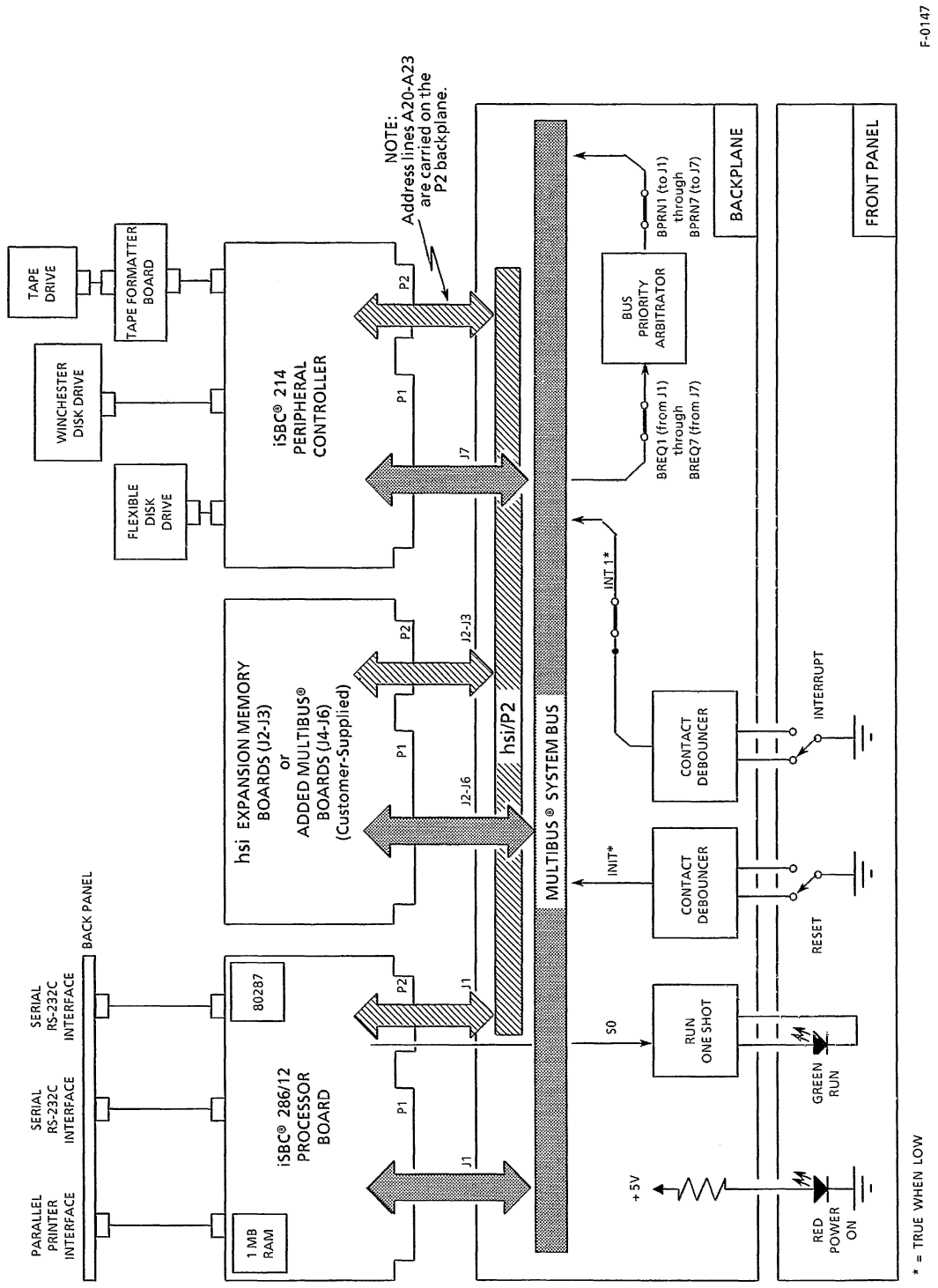

Figure 1-1. System 310AP Block Diagram

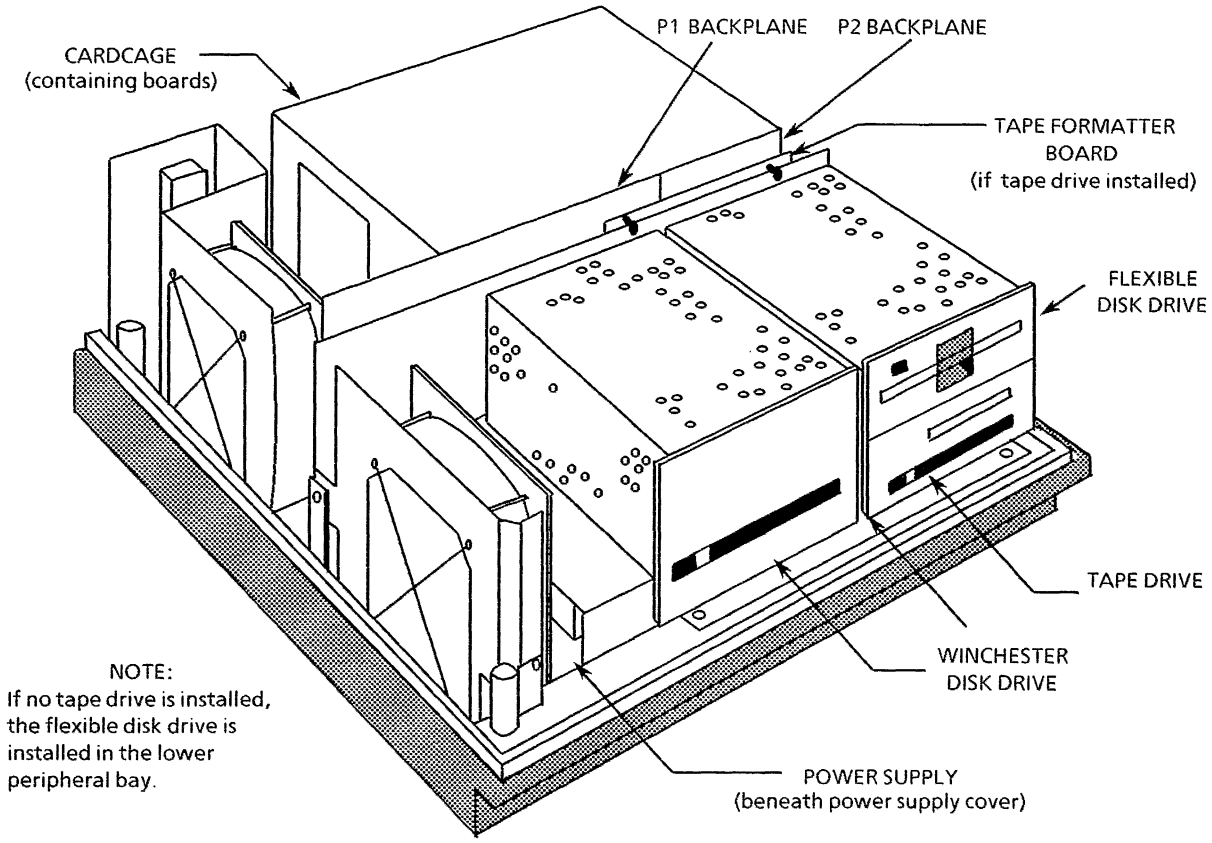

Figure 1-2. Major System 310AP Components

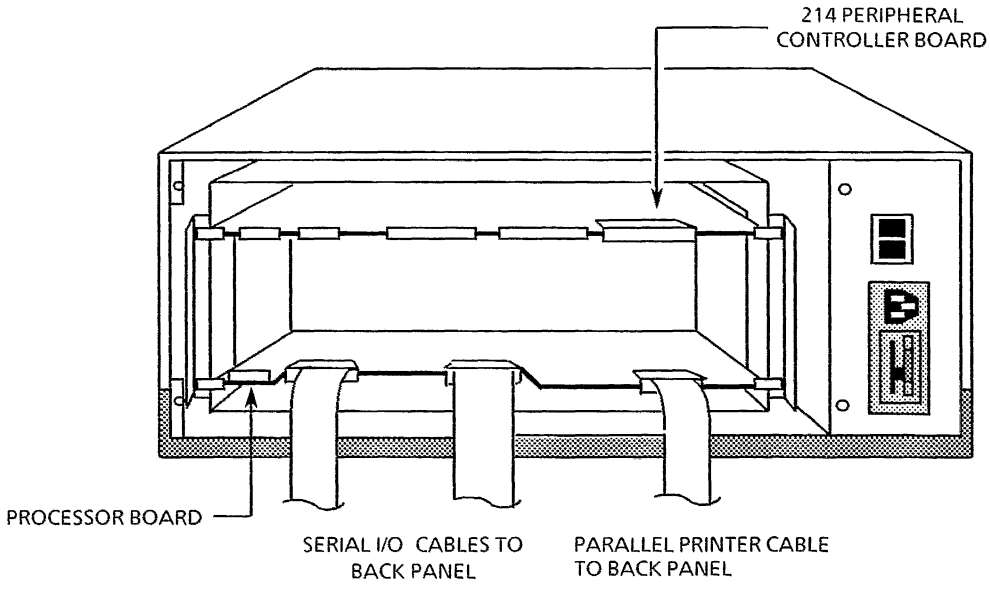

Figure 1-3. Boards in the Cardcage

MULTIBUS-compatible boards are of two types: bus masters, which initiate and control bus operations and can exchange control of the bus through arbitration, and slaves, which participate in bus operations under control of the masters. The processor board and the iSBC 214 Peripheral Controller Board are both bus masters; memory boards are examples of bus slaves.

MULTIBUS boards have a standard physical configuration or "form factor," shown in Figure 1-4. The edge connector labeled P1 carries the MULTIBUS system bus interface. This 86-pin connector mates with a female connector on the system backplane, which provides the bus interconnection. The connector labeled P2 carries various auxiliary signals and the upper four address bits of the system address bus. (On circuit boards with hsi capability, the P2 connector also carries the hsi bus.)

CAUTION

Do not insert non-hsi boards into cardcage slots reserved for hsi boards or hsi boards into non-hsi slots. Doing so can damage the circuitry and disrupt system operation. In the System 310AP, the lower three slots (1 through 3) are reserved for hsi circuit boards. A plastic insert is installed in the P1 backplane connector for any unoccupied hsi-configured slot to prevent inadvertent installation of a non-hsi board.

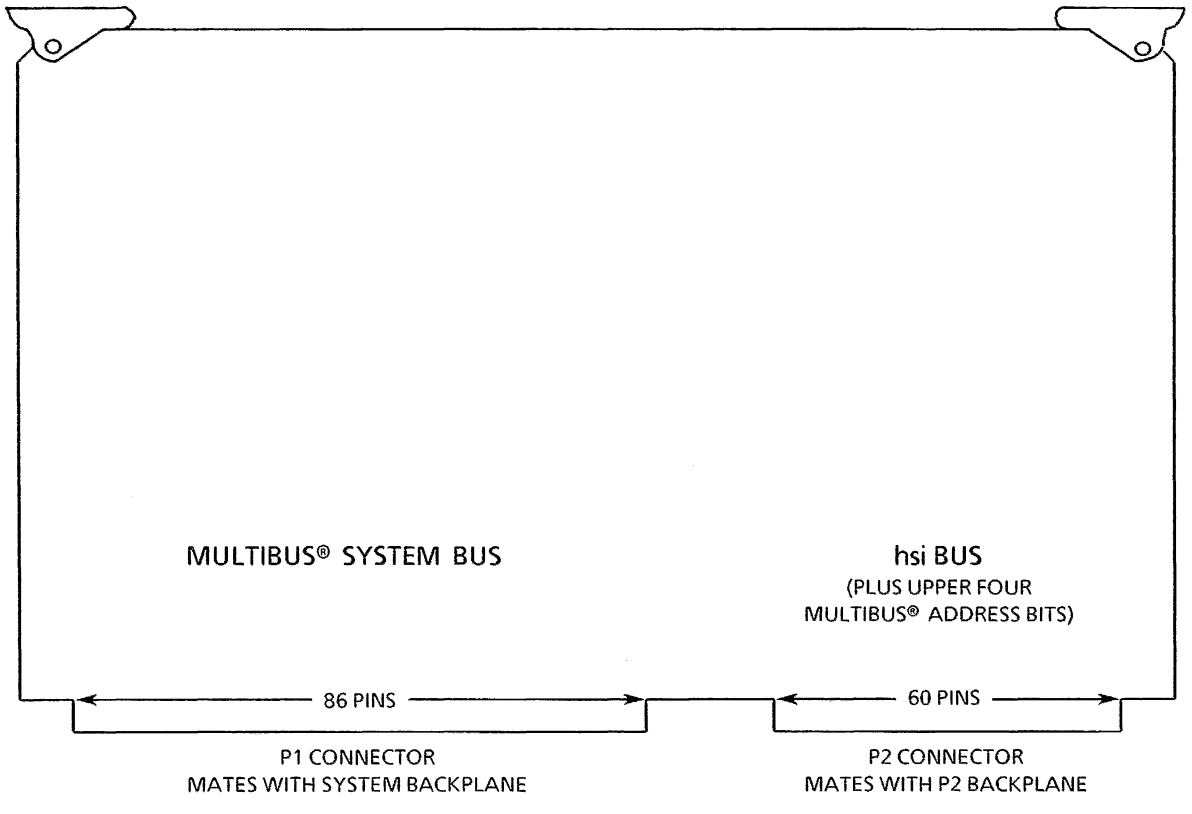

Figure 1-4. MULTIBUS® Form Factor

These signal lines make up the MULTIBUS system bus:

- A 16-bit data bus, which accommodates both 8-bit byte and 16-bit word transfers.
- A 24-bit address bus, which provides a 16-megabyte addressing capability. The lower 20 address lines are carried on the backplane, the upper 4 by an auxiliary interconnection.
- Control lines, which include the clock signals that synchronize bus operations, and command signals by which bus masters specify the kind of operation (read, write, memory, I/O) to be done.
- Interrupt request lines, which system components use to gain the attention of the processor when they need its intervention.
- Bus exchange lines, which the bus masters in the system use to gain control of the bus.

For detailed information on the MULTIBUS system bus, refer to the *Intel MULTIBUS Specification* or the *OEM Systems Handbook* listed in Appendix E.

The hsi Bus

The hsi (high-speed synchronous interface) bus provides high-speed access to a large system memory array. Since the hsi bus is an extension of the processor's on-board bus, the processor board can address off-board memory as if it were on board. Direct access is faster since the bus is synchronous.

The iSBX™ Bus

iSBX boards are installed on connectors on the processor board and I/O controller boards. They are used to expand the system serial I/O capabilities.

Processor: The iSBC® 286/12 Single Board Computer

Each System 310AP contains the iSBC 286/12 Single Board Computer. The 286/12 processor board is based on the 8 MHz 80286 microprocessor. Using a local bus, the 80286 communicates with the 286/12 board's resident functions:

- EPROM containing the system firmware
- 1 MB on-board, dual-port Dynamic Random Access Memory (DRAM) module with 0 wait-state performance and parity
- High-speed synchronous interface (hsi) operation over the board's P2 connector for 0 wait-state access to Intel's EX-series memory boards
- Two programmable RS-232C serial communications ports

- One parallel I/O port configured as a Centronics-compatible parallel printer interface
- Two programmable interval timers
- Two programmable interrupt controllers

You can expand on-board functions by adding circuit modules mounted directly on the 286/12 processor board. These modules connect to the processor board's local bus through one of two iSBX connectors.

For detailed information about the 286/12 processor board, see the *iSBC 286/12 Single Board Computer Hardware Reference Manual* (order number listed in Appendix E, "Related Publications").

System Interrupts

Figure 1-5 is a diagram of the standard interrupt configuration for the System 310AP. As the figure shows, the 286/12 board contains two programmable interrupt controllers (PICs) that have 16 interrupt inputs. A jumper matrix permits interrupt signals from various on-board and off-board sources to be routed to the PICs. Resident functions on the 286/12 board use six of the PICs interrupt inputs. Nine inputs come from off-board functions by way of the backplane: the 214 controller board uses INT5*; the INTERRUPT switch uses INT1*; and INT2* and INT3* are used for connection to I/O controller boards. (One input, IR7 of the master PIC, is used as the cascade input for the slave PIC.)

You can use the remaining MULTIBUS interrupts (INT4*, INT6*, INT7*) by setting jumpers on the board you are installing. For instructions, see the hardware reference manual for the board you want to install .

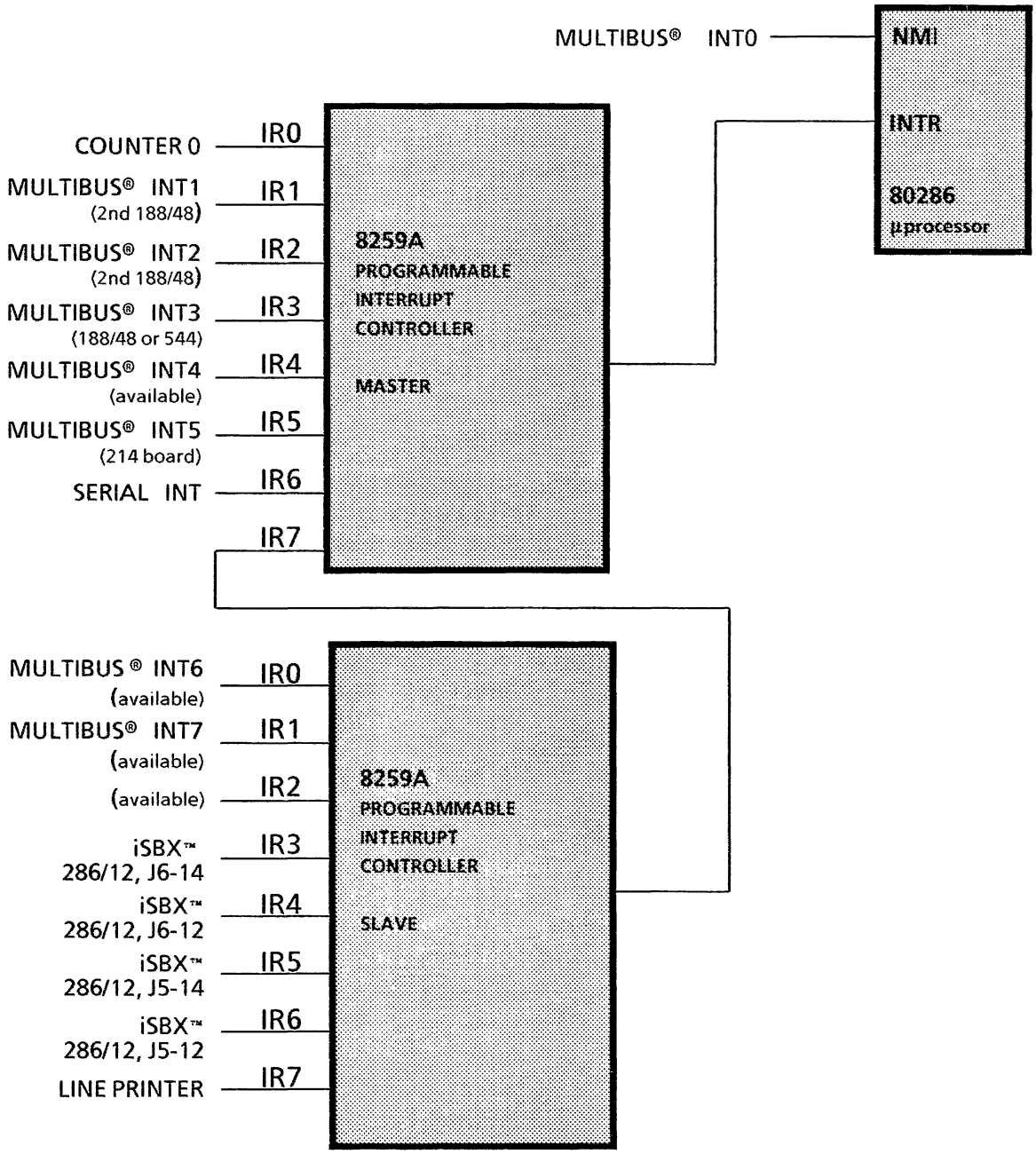

Figure 1-5. System 310AP Interrupts

Memory

The 286/12 processor board has a capacity of 1 MB of on-board RAM and an address range to 16 MB. Figure 1-6 shows a memory map for the System 310AP. EPROM occupies the high end of the memory address space, while RAM addresses start at the bottom of the address space and go up. The intermediate addresses are for any EX-series memory expansion boards that are installed. The following factors determine memory placement:

- The addresses of features (such as disk controllers) must not overlap.
- RAM must occupy contiguous address space, starting at 00000H; if memory is added, there must be no gaps between the end of one block of addresses and the beginning of the next.
- System firmware must start at a specific address depending on the type of processor board used.

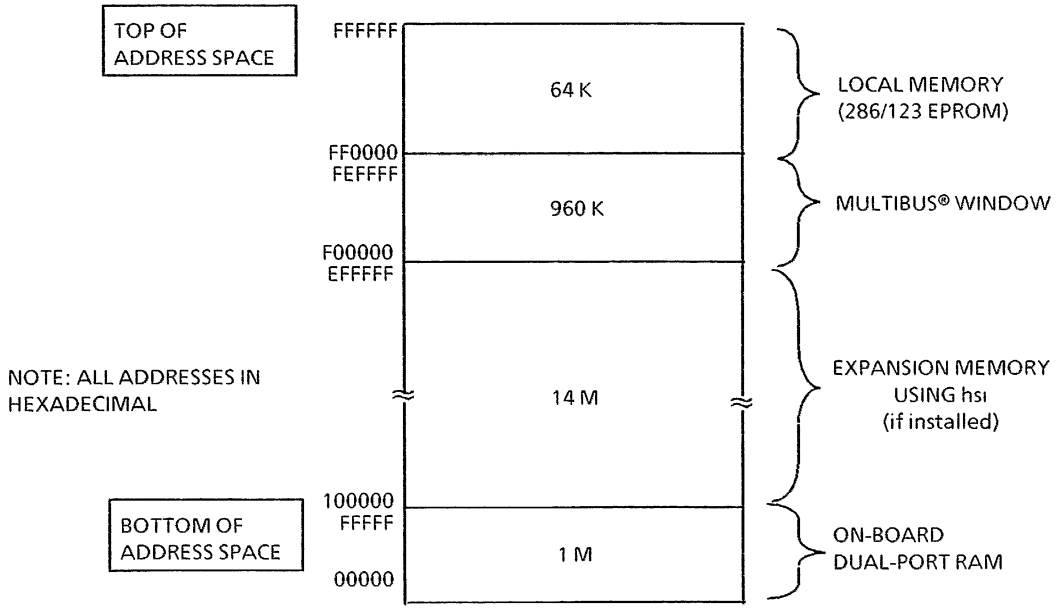

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Figure 1-6. System 310AP Memory Map as Viewed from MULTIBUS® (Protected Virtual Address Mode)

Disk Drives, Tape Drive, and Controller

Each System 310AP has a flexible disk drive. Typically, the system will also have an optional Winchester hard disk drive and an optional tape drive. As shown in Figure 1-1, the major system peripheral components include the following:

- The iSBC 214 Peripheral Controller is a programmable, intelligent controller with an 80186 processor. Once given instructions by the processor board, the iSBC 214 proceeds on its own, transferring data from disk via its on-board RAM to system memory.
- Drives (Winchester, flexible, and tape)
- A tape formatter board.

For detailed information on the controller board, see the *iSBC 214 Multiple Peripheral Controller Board Hardware Reference Manual* (order number in Appendix E, "Related Publications.")

System Backplane

The backplane serves four functions:

- It provides the MULTIBUS interconnections.
- It contains a bus-request priority-arbitration circuit.
- It contains the electrical interface between the front panel controls and the rest of the system.
- It distributes power to the MULTIBUS boards and the fans.

The system backplane is mounted on the rear of the cardcage. As shown in Figure 1-7, the cardcage has seven slots; these correspond to seven 86-pin MULTIBUS connectors on the backplane. The top and bottom slots in the cardcage have extra space for inserting boards with expansion modules mounted on them. The System 310AP has the 286/12 processor board mounted in the bottom slot (slot 1) and the 214 controller board in the top slot (slot 7). EX-series memory boards (if any) are mounted in the two slots adjacent to the 286/12 processor, starting with slot 2. For additional details of the backplane's physical layout and circuitry, refer to the backplane component location and schematic diagrams in Chapter 4.

Bus Priority Arbitrator

MULTIBUS circuit boards are of two types: bus masters, such as the 286/12 processor board or 214 controller board; and slaves, such as memory boards. Bus masters may request and take control of the bus to transfer data to or from slaves and other bus masters. Since a system may have more than one bus master, the task of the bus priority arbitrator circuit on the backplane is to take up to seven simultaneous bus requests and allow only the highest-priority requestor to gain control of the bus.

Each MULTIBUS connector on the backplane has a unique Bus Request signal line (BREQ1 through BREQ7) and a unique Bus Priority signal line (BPRN1 through BPRN7). A bus master asserts its BREQ signal to request control of the bus. The bus request priority arbitrator asserts only the BPRN signal belonging to the highest-priority bus master. The BREQ and BPRN signals connect to the bus request priority arbitrator through a jumper matrix that allows each slot to be assigned a priority level. The default for the System 310AP is for slot 1 to be given priority 1 (lowest), slot 2 to be given priority 2, and so on.

Conflicts are resolved using a parallel priority-resolution scheme.

Front Panel Control Circuits

The RESET and INTERRUPT switches on the front of the System 310AP each connect to a contact debouncing flip-flop on the backplane. The output of the interrupt debouncer drives the interrupt request line INT1* through a jumper matrix. Pressing the INTERRUPT switch generates a level 1 interrupt request to the processor; this causes the processor to jump to the system monitor program contained in EPROM on the processor board. Pressing the RESET switch causes its debouncing flip-flop to assert the INIT* (initialize) signal, resetting the system to its initial power-up state.

CAUTION

All data not stored on disk will be lost when RESET is pressed.

The run one-shot drives the run light on the front of the System 310AP. The run one-shot is triggered by S0 (Status Line 0) signal from the processor board. As long as S0 continues to switch state (meaning that the microprocessor is running), the one-shot is continuously retriggered and the run light remains on. The run light should go out only when the microprocessor on the processor board is in a "Wait" or "Halt" state. This can occur during direct memory access (DMA) operations by other bus masters, while the processor is waiting to regain control of the bus.

P2 Backplane

The hsi bus interconnections are carried by the P2 backplane circuit board, shown in Figure 1-7. The P2 backplane contains seven connectors; however, only the bottom three connectors (J1, J2, and J3) carry the hsi bus.

Pins 55 through 58 on all seven connectors are reserved for the upper four bits of the MULTIBUS system bus. On the lower three connectors, pins 55 through 58 are bused to each connector. For each of the upper four connectors, a set of jumper pins allows pins 55 through 58 to be connected to the upper four address bits. If a memory-mapped device requiring 24-bit addressing (such as the iSBC 544A Intelligent Communications Controller) is installed in one of the upper four slots, you must install jumpers on the board to connect the upper four MULTIBUS address bits. (In the factory-default system, the jumpers are installed.)

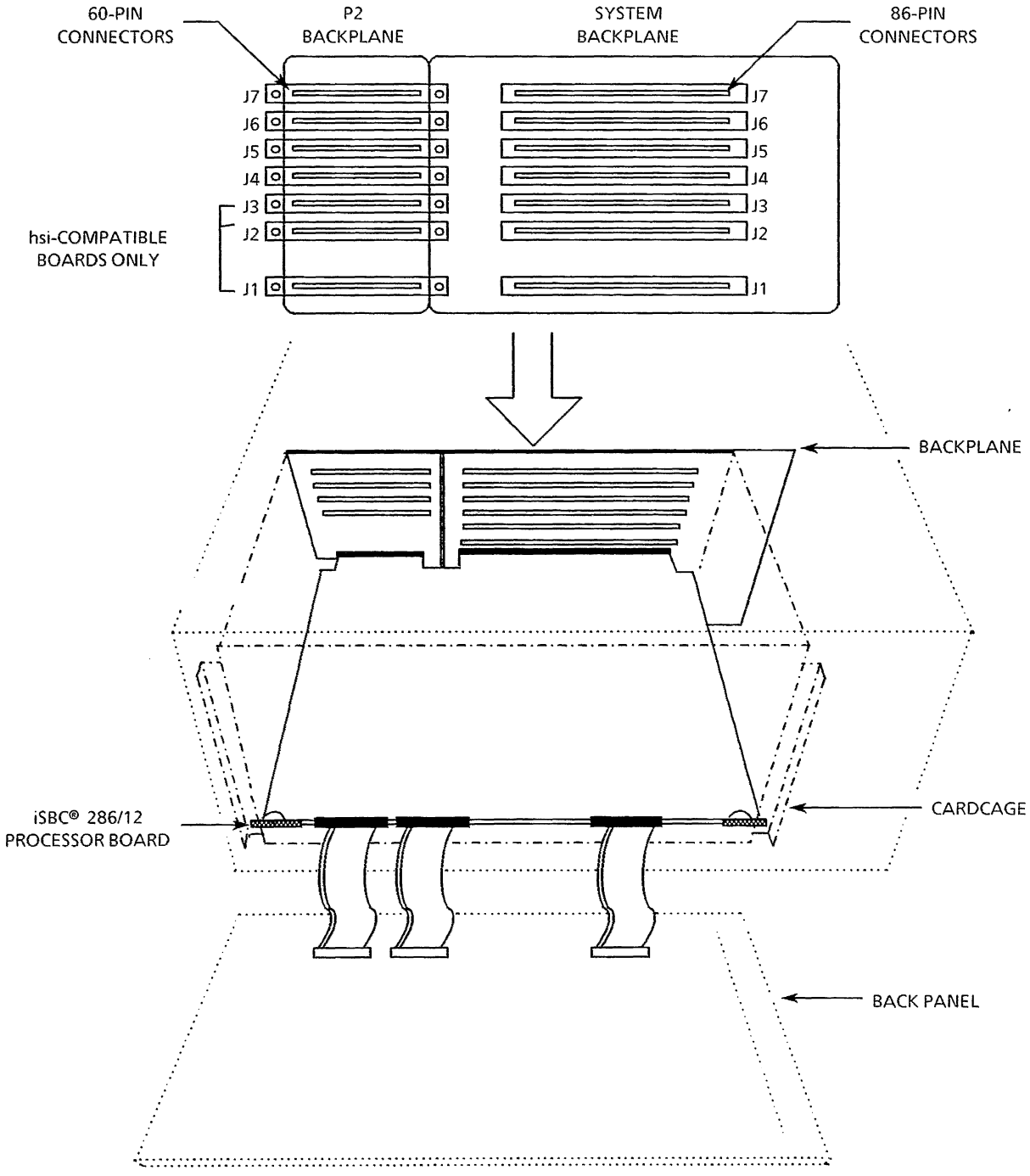

Figure 1-7. System Backplane and P2 Backplane

CAUTION

Do not insert non-hsi boards into cardcage slots reserved for hsi boards or hsi boards into non-hsi slots. Doing so can damage the circuitry and disrupt system operation. In the System 310AP, the lower three slots (1 through 3) are reserved for hsi circuit boards. A plastic insert is installed in the P1 backplane connector for any unoccupied hsi-configured slot to prevent inadvertent installation of a non-hsi board.

Power Supply and Power Distribution

DC Power

DC power in the System 310AP is supplied by a 360-watt switching power supply with these outputs:

- +5 VDC at 45.0A maximum
- +12 VDC at 8.0A maximum
- -12 VDC at 2.5A maximum

NOTE

The maximum combined power must not exceed 360W. Erratic operation may result.

Each of the DC outputs is protected from current overload by automatic shut-down circuitry. The +5 VDC supply for the backplane is carried by two high-current leads connected to the backplane by terminal lugs. A cable assembly carries +12 VDC and -12 VDC to the backplane, +5 VDC and +12 VDC to the tape formatter board, and +5 VDC and +12 VDC to the disk drives. The front and rear fans receive power through the backplane. Both fans are connected to -12 VDC, each one through a 3-ohm resistor. The red power light on the front panel connects to the +5 VDC supply through a resistor on the backplane; it indicates only the presence of voltage on the +5 VDC output. Chapter 4 contains a diagram of the DC power distribution.

Standard DC Current Consumption

Table 1-1 lists the standard DC current consumption of boards and devices that are available in the factory-standard System 310AP.

Table 1-1. Maximum DC Current Consumption

Voltage Total amps available Component Name	+ 5 VDC 45 Amps	+ 12 VDC 8 Amps	-12 VDC 2.5 Amps
Fans	-	-	1.20 (av.=0.60)
286/12 processor board	9.75	0.05	0.05
214 controller board	3.60	0.05	-
188/48 communications board	7.50	0.20	0.18
544A communications board	2.70	0.33	0.20
552 OpenNET/Ethernet board	5.90	0.50	-
354 communications board	0.50	0.05	0.05
010 EX memory board	5.00	-	-
020 EX memory board	5.20	-	-
040 EX memory board	5.50	-	-
5¼-inch flexible disk drive	0.70	1.00	-
¼-inch tape drive	2.40	4.15 peak (av.=2.50)	-
19 MB Winchester disk drive	1.50	3.50 peak (av.=1.70)	-
42 MB Winchester disk drive	1.50	5.00 peak (av.=2.00)	-
86 MB Winchester disk drive	2.10	4.80 peak (av.=1.60	-
140 MB Winchester disk drive	2.10	4.80 peak (av.=1.60)	-

AC Power

There are three AC input leads to the power supply: one neutral, one for the 88 to 132 VAC range, and one for the 176 to 264 VAC range. A line voltage selector sets the supply to the correct range.

Chapter 4 contains a diagram of AC power distribution. Line current enters the System 310AP through a standard connector in the AC receptacle assembly on the back panel and is distributed as follows:

High side	Neutral side
• fuse	• power switch
• power switch	• line filter
• line filter	• voltage selector
• power supply	• power supply

Modifying the System

After setting up the system and running the start-up tests to make sure the system is working properly, you may need to modify the system for your application.

Adding or Removing Boards

Most hardware modifications involve adding or removing MULTIBUS boards or MULTIMODULE boards. The general procedure for this task is given in the "Removal and Replacement Procedures" chapter. Another hardware modification might involve changing jumpers on a communications board to support your number of users under a given operating system.

If you plan to add boards to the system, note the following caution about board and slot compatibility.

CAUTION

In the system cardcage, the P2 connector for slots 1, 2, and 3 is configured as a high-speed synchronous interface (hsi) that is not compatible with the iLBX (Local Bus eXtension). Only Intel's EX-series memory boards allow hsi operation. Thus, install only hsi boards in hsi slots, and do not put hsi boards in non-hsi slots. Figure 1-8 shows the hsi slots. Factory-standard System 310APs have a plastic insert in the P1 backplane connector for any unoccupied hsi slot.

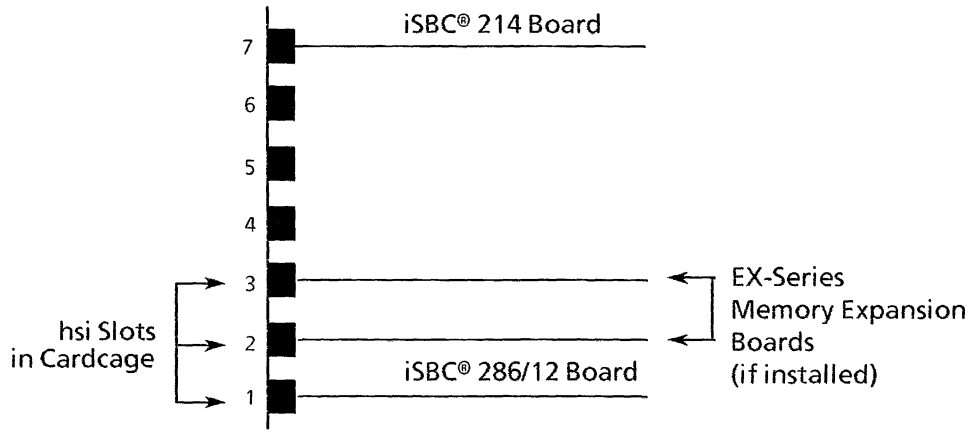

Figure 1-8. Board and Slot Compatibility

Making Changes to Support Multiple Users

Other changes depend on your application and number of users. For example, setting up your network using BITBUS is an application-specific change that can't be covered here because the possibilities are too varied and numerous. For installation and configuration details in such a case, we refer you to manuals that support a given board or device.

Different Drives

You may also want to add or change peripheral drives after receiving the base system. For example, if your system was ordered with only a flexible disk drive, you may want to add a Winchester or tape drive at some time. Or, you may want to change to a larger capacity Winchester drive. For information about available upgrade kits, contact your Intel sales representative.

System Compatibility

This section shows how to determine if a hardware device or circuit board can be used in the System 310AP. Before replacing a device or circuit board or integrating new devices or circuit boards into the System 310AP, be sure the device or board meets the following three compatibility requirements:

- Physical compatibility--the component must fit into the System 310AP chassis.
- Electrical compatibility--the component must electrically interface with the system and must not draw more power than the system can provide for it.
- Operational compatibility--the component must not conflict with the operation of other components in the system; for example, addresses must not overlap.

Physical Compatibility

This section describes how to determine if a hardware device or circuit board will fit into the System 310AP.

Mass Storage Devices

The System 310AP has space for mounting mass storage devices. The exact size of this space is as follows:

Width	30.0 cm (11-3/4 in)
Height	8.5 cm (3-3/8 in)
Depth	22.0 cm (8-3/4 in)

All devices must be shielded and grounded. The system provides standard mounting holes for the mass storage devices, and filler panels are available to cover any space not occupied.

I/O Port Connectors

All system I/O ports are located on the back panel. The various connector sizes and number of cutouts are listed below:

GPIB	1
15-pin D subminiature connectors	2
25-pin D subminature connectors (RS-232C)	21
50/37-pin connectors	3
50-ohm BNC connectors	5
parallel printer connector	1

Circuit Boards

The System 310AP has a cardcage assembly that accommodates up to seven MULTIBUS-compatible boards. These boards must be 6.75 inches by 12 inches and have the general MULTIBUS form shown in Figure 1-4.

The cardcage assembly consists of a metal cardcage and a backplane. The cardcage holds up to seven MULTIBUS boards and has two extra-wide slots (top and bottom) to accommodate boards with MULTIMODULE boards attached. The MULTIBUS boards plug into connectors on the backplane. The backplane contains the standard IEEE-796 MULTIBUS interface.

Electrical Compatibility

The System 310AP contains a 360-watt power supply. A new device or board may not draw (or cause the system to draw) more power than the system can supply.

Table 1-1 lists the power consumption of the devices available in a factory-configured system and some of the boards and devices you can add.

The amount of current each slot in the cardcage can handle is limited by the edge connector. Refer to the *Intel MULTIBUS Specification* listed in Appendix E for more information.

Table 1-2 is a worksheet for calculating total DC power consumption for the system. Power consumption (in watts) is calculated by multiplying the voltage by the amperage for each board, then summing for all boards, and then adding the power consumed by the fans. To use Table 1-2, do the following:

1. For each cardcage slot occupied by a circuit board, compute the number of watts drawn by the board at each voltage level and write the figures in the appropriate column. That is, multiply the voltage by the current for the board. (The current should be listed in the documentation supplied with the board.)

2. Total all the columns.

3. Sum the three totals across the bottom row to arrive at a grand total.

The grand total must be less than 360 watts.

We've supplied values for the boards and fans that are common to all System 310APs.

Table 1-2. Power Usage Calculation

Slot Number	Watts			Totals
	+ 5 VDC	+ 12 VDC	-12 VDC	
1 286/12 Processor	39.0	0.6	0.6	40.2
2				
3				
4				
5				
6				
7 214 Controller	18.0	0.6		18.6
Winchester disk drive				
Flexible disk drive				
Tape drive				
Fans			7.2	7.2
Totals	+	+	=	
Not to exceed	225W	76W	30W	≤360W

Operating Compatibility

This section covers the three areas of operating compatibility that must be considered when modifying a system: port and device addressing, system interrupts, and bus contention.

Port and Device Addressing

The processor board regulates the amount of memory that can be addressed. Other than that, the system hardware imposes only three other restrictions on memory placement:

- The port addresses of features (such as disk controllers) must not overlap.
- RAM must occupy contiguous address space, starting at 00000H.
- The memory addresses of features, such as I/O controllers must not overlap.

Interrupts

The system has 16 system interrupts; seven of these are used for disk control, front panel switches, I/O control, and similar system functions. The remaining interrupts are available for the user by setting jumpers on the board being installed. See the section "System Interrupts" under "System Overview" in this chapter.

Bus Contention

To prevent bus contention, a priority number is assigned to each slot in the cardcage. This number describes the order in which conflicting bus requests are resolved.

The 310AP slots are ordered in the cardcage from the bottom up; for example, slot 1 is the bottom slot and has the lowest priority. Bus priority can be changed in two ways: by changing the order of the boards in the cardcage (which changes the board's position in the priority ordering) and by removing jumpers and adding wire-wrap connections (which changes the priority ordering of the slots).

To change the priority ordering of the slots, you must first decide how you want to order the slots. A typical change would be to move the 214 board out of the top slot (slot one) to another slot (for example, slot five) to make the top slot available (more space is open on the top slot) for a board that has MULTIMODULE boards installed. However, since the 214 board is a peripheral controller, it requires top priority for bus access. Refer to Figure 4-7 as you read the following explanation of how this change would be made.

Pin 18 of the backplane connector carries the bus request signal (BREQ). Stake pins E33 through E46 allow BREQ to be directed to the bus priority circuitry. In this example, we want to exchange the BREQ signals for J1 and J3. To do this the jumpers between E45 and E46, and E41 and E42 are removed; wire-wrap connections are then added between E45 and E42, and E41 and E46. This directs the BREQ signal from J1 to the number 3 position in priority and the BREQ signal from J3 to the number 1 position.

The bus priority circuitry uses the bus priority in (BPRN) signal to grant access to the bus. Stake pins E19 through E32 are used to direct this signal to the appropriate slot. In our example the signals for J1 and J3 must be exchanged. To do this the jumpers between E31 and E32, and E27 and E28 are removed; wire-wrap connections are then made between E31 and E28, and E27 and E32.

In cases of bus contention, the System 310AP uses a parallel priority resolution scheme, rather than serial priority resolution, so any board being added to the system must be set for parallel resolution. Consult the board documentation to determine what jumpers must be changed, if any, to accommodate parallel priority resolution.

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CHAPTER 2
MAINTENANCE

This chapter contains preventive maintenance procedures, the System Confidence Test (SCT) descriptions, and troubleshooting procedures. The procedures should be performed only by qualified service technicians. Appendix C has instructions for obtaining service from Intel.

WARNINGS

Some of the procedures in this chapter expose you to hazardous voltages. To prevent possibly lethal electrical shock, observe the following precautions:

1. Service the System 310AP only if you are technically qualified to do so.

2. Always unplug the AC power cord from the system before removing or replacing any component.

3. If it is necessary to perform any troubleshooting procedure with AC power applied, always use an isolation transformer between the System 310AP and the AC mains. Use only the standard IEC three-wire power cord supplied with the System 310AP and connect the power cord only to a standard three-wire outlet with a non-resistive earth ground.

The System 310AP weighs approximately 22.7 kg (50 pounds). To avoid injury, have someone help you whenever you need to lift it.

Preventive Maintenance

Preventive maintenance for the System 310AP consists of cleaning the read/write heads in the flexible disk drive and tape drive, cleaning the air intake grills on the chassis, inspecting the various components of the system, and correcting potential problems.

Each time you service the System 310AP (during disk drive head cleaning, for example), perform a general check of the system's condition, as follows:

Step	Task
1	Thoroughly check the system's operation by running the diagnostic programs. (See "Using the SCT" later in this chapter.) Make sure both fans are operating.
2	Check the system's installation and ventilation: see that there is adequate space (5-7 cm) around the cabinet for ventilation and that the fans are operating and not blocked.
3	Remove any foreign material from the grills covering the air intakes on each side of the chassis. Use a vacuum cleaner with a brush attachment to remove the material. If you need to remove the top cover, refer to Chapter 3.
4	Make sure the system is operating within the environmental limits specified in Appendix B of this manual. The system should not be operated in areas where it can be severely jarred or subjected to high humidity or vibration.
5	Make sure the interconnecting cables are not being chafed or pinched by any equipment and that the connectors are secure.

Cleaning the Flexible Disk Drive Head

The read/write heads in the flexible disk drive must be cleaned after 150 hours of drive use. Use the procedure in "Utility Descriptions" to do this.

Cleaning the Tape Drive Head

The tape drive head should be cleaned after every eight hours of actual tape motion. The head should also be cleaned after a new tape cartridge is used or, if only new tape cartridges are used, after every two hours of tape motion.

Step	Cleaning the Tape Drive Head
1	Turn the system off.
2	Dip a clean, lintless swab into an isopropyl alcohol solution, wetting it thoroughly.
3	Inserting the swab through the loading aperture, swab the tape drive head with the alcohol solution, taking care that the solution does not get onto adjacent parts.
4	Dry with a clean, dry swab to remove all residue from the head before inserting a tape cartridge.

Troubleshooting Using Diagnostics

This section will help you determine the cause of System 310AP malfunctions. The procedures given are intended primarily to isolate problems to a field-replaceable module or assembly.

The System 310AP has three types of diagnostic programs that you can use for troubleshooting:

1. Intel's Menu-Driven Diagnostic Executive (iMDDX™) and iMDDX tests (the executive and tests are ordered separately from the system)
2. System Analysis Test (SAT) (part of the operating system)
3. System Confidence Test (SCT)

The SAT will not be discussed in this manual; refer to the operating system documentation. The iMDDX diagnostic software is discussed in the *iMDDX Diagnostic Executive User's Guide*.

The System Confidence Test (SCT) is a self-test program supplied as part of the system firmware in the System 310AP. The SCT runs automatically whenever the system is powered up or reset.

Using the SCT

Designed to detect most system problems, including disk drive and internal cabling faults, the SCT is the principal troubleshooting aid for field service. It performs the following functions:

- Processor--initializes and tests most of the programmable subsystems, such as the serial ports and interrupt controllers
- Memory--initializes and tests system RAM (first 896 KB)
- Disks and Controllers--initializes and tests the flexible disk, Winchester disk, and tape drives and their controllers

The following sections describe how to use the SCT for troubleshooting. For your reference, detailed test descriptions are also included.

Running the SCT

To run the SCT, the processor board must be at least partly functional--the microprocessor must be running and able to access at least part of the on-board ROM and RAM, and the RS-232C port must be working well enough for the test results to be sent to the terminal.

At power-up, two levels of the SCT are available:

- Unattended--runs automatically and does not require user action. The unattended level of the SCT reports only the results of the major subsystem tests and does not display details of the tests, showing only PASS/FAIL information.

- Attended--requires user action. The attended level displays detailed results of the tests. It also offers the option of exiting from the test routine into the system monitor where further testing can be done.

A "no-test" option is also available at power-up and after resetting the system. See the section in this chapter "No-Test Option."

Figure 2-1 shows the general structure of the SCT. The tables that follow the figure give details for each level of the SCT.

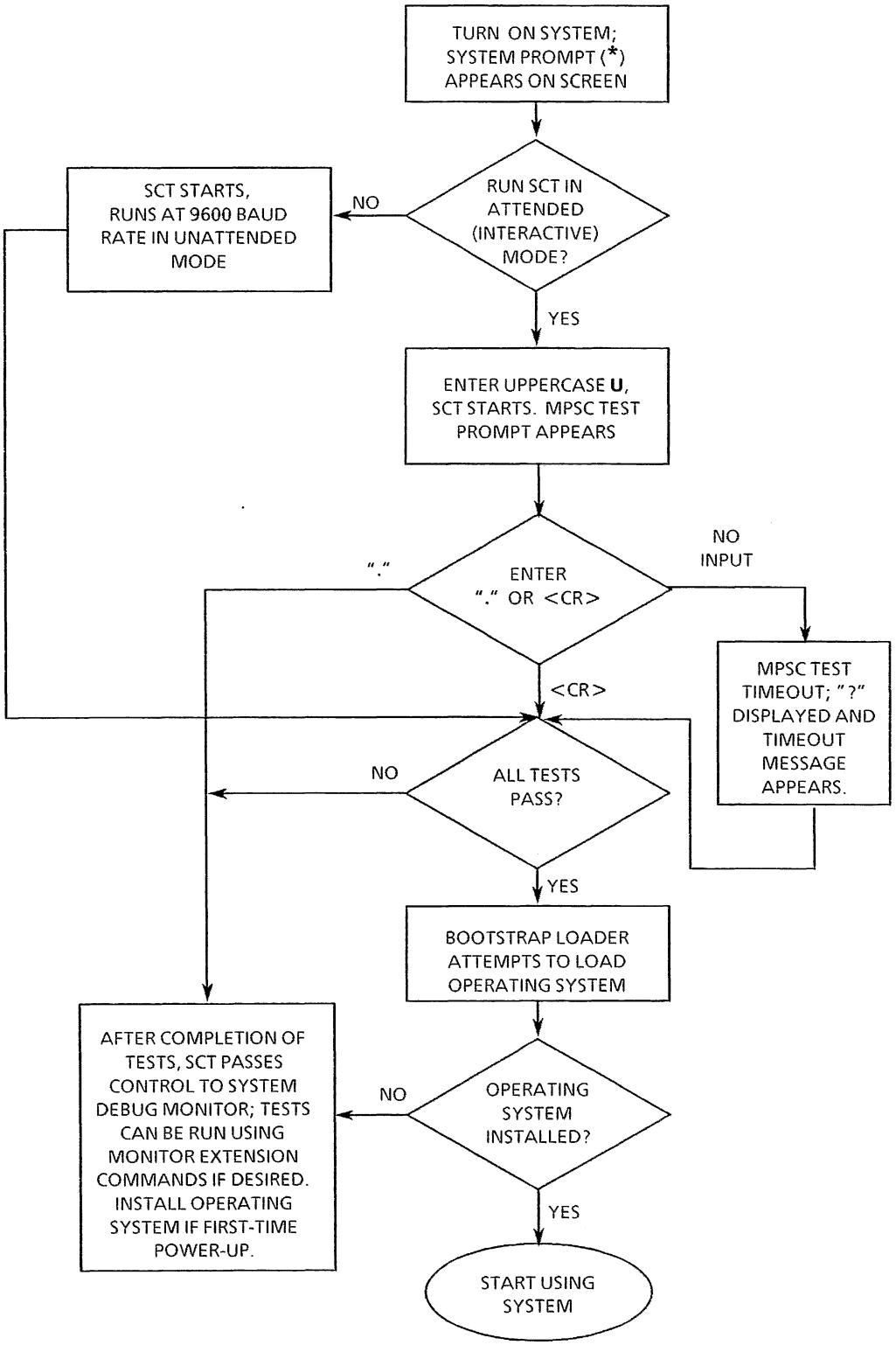


Figure 2-1. Power-Up Sequence

Step	Run the SCT and Load the Operating System
1	Set the system console terminal for 9600 baud operation, with parity off. Connect the terminal cable to Connector J31 on the system back panel (J31 connects to the processor board's RS-232C port). Turn on the terminal and let it warm up.
2	Turn on the system. If it is already on, press the R (reset) switch on the front panel. After a few seconds, if the terminal is set to 9600 baud, the system displays a single asterisk. Within 18 seconds, do 2a or 2b:

2a	Make no entry; the default 9600 baud rate will be set automatically. The SCT will run in unattended level and send test results to the terminal.
	
	After an unattended SCT has run and successfully passed all three major subsystem tests, the screen display should be similar to the following:
	
	`SYSTEM CONFIDENCE TEST [286-W-] Version X.Y`
	`Copyright 1984,1985 Intel Corporation`
	
	`Processor Subsystem Tests.....PASS`
	`Memory Subsystem Tests..(896 K tested)..PASS`
	`Boot Subsystem Tests.....PASS`
	
	NOTE
	Even if expansion memory boards are installed, the SCT tests only the processor board's on-board RAM.

2b	Within 18 seconds, enter a shift "U". The baud rates currently supported are 300, 1200, 2400, 4800, 9600, and 19200. When the prompt appears, enter a <CR> (entering a "." causes control to pass to the system debug monitor). The SCT runs, displaying detailed test results.
3	After the SCT has run successfully, the bootstrap loader loads the operating system; you'll see a screen display similar to the following: (continued)

Step	Run the SCT and Load the Operating System (continued)

```
SYSTEM CONFIDENCE TEST  [286-W-] Version X.Y
Copyright 1984,1985 Intel Corporation

Processor Subsystem Tests:
PROCESSOR SUBSYSTEM.....................PASS

Memory Subsystem Tests:
MEMORY SUBSYSTEM...(896 K tested).......PASS

Boot Subsystem Tests:
:w0:Wini:        READY
:wf0:Floppy      READY
BOOT SUBSYSTEM..........................PASS

SCT PASSED . . . entering BOOTLOADER
```

NOTE

Even if expansion memory boards are installed, the SCT tests only the processor board's on-board RAM.

4 If the system fails to respond:

4a Remove the back panel (procedure is described in Chapter 3).

4b Turn the system off and on again. Press the R(eset) switch, then check the red LEDs on the back edge of the processor board; this board is in the bottom slot (slot 1) in the cardcage. If an LED begins flashing, there is a failure in the first 16KB of system RAM, and the SCT will not run.

4c Then check to make sure the processor board and the memory board (if installed in your system) are correctly installed:

- Boards are in the correct slots (processor, J1; memory, J2).
- All boards are seated firmly in the backplane.
- Ejector levers are closed to hold boards in place.

(continued)

Step	Run the SCT and Load the Operating System (continued)
5	If the system still fails to respond, replace system components in the following order (see Chapter 3): • Processor board--if the processor subsystem or memory subsystem fails • 214 controller board **NOTE** A flexible disk or tape drive may be reported OFFLINE if no disk or tape is installed or the drive is disconnected. This is not considered a test failure.

SCT Failures

The SCT diagnoses failures to the board level. Make sure that the boards are installed correctly by checking the seating in the cardcage and the cabling. If a board still fails SCT, it should be replaced.

- Processor subsystem test failures indicate that the 286/12 processor board should be replaced.
- Memory subsystem tests check only the RAM on the 286/12 processor board; therefore, these failures indicate that the 286/12 processor board should be replaced.
- Boot subsystem tests check the parts of the system that are used to bootload the system (that is, the 214 peripheral controller board, the flexible disk drive, and the Winchester disk drive). Since any of these components may be replaced individually, the boot subsystem test returns detailed results to isolate which part of the subsystem needs replacing. See the section in this chapter, "Test Descriptions--Boot Subsystem Tests," for more information.

Bypassing the SCT

Ordinarily the SCT runs automatically at each start-up. But you can choose to bypass the SCT if, for example, you are doing software debugging and thus resetting the system frequently. To bypass the SCT, select the no-test option described later in this chapter.

CAUTION

Always run the complete SCT (either the attended or unattended level) at least once when you start the system. If you select the no-test option before running the SCT at least once, system operation is unpredictable: the hardware is not adequately initialized, and the results of booting the system software or diagnostics may be unreliable. In general, we recommend that you run the complete SCT unless doing specific debugging tasks.

System Debug Monitor

A system debug monitor (SDM) resides in system PROM. The SDM is useful for troubleshooting both hardware and software problems.

To reach the SDM, enter a period, "." in response to the prompt during the attended SCT or press (R)eset and (I)nterrupt simultaneously. The SDM prompt "." will appear.

For information about how to use the SDM, see the *iSDM 286 System Debug Reference Manual* listed in Appendix D, "Related Publications."

Bootloader

To load and run any disk-resident code, including the operating system and diagnostic tests, use the bootloader. Start the bootloader by using the "b" command from the iSDM 286 command line. The first stage of the bootloader resides in the SCT firmware; it contains the physical device drivers. The second stage is operating system dependent and must be found on track 0 of the device selected; this stage contains the default boot filename and all file system drivers.

Test Descriptions--Processor Subsystem Tests

The SCT routine descriptions include the subsystem being tested, possible error messages, and whether the test is a standard routine or an optional routine. The error messages listed are displayed only when you run the SCT "attended" level (by typing "U"). In general, if one of these error messages appears, after checking that the processor board is installed properly (seating and cabling correct), the next action is replacement of the failing board. No board component repair is intended; these descriptions are provided for your reference only.

iSBC28612

The iSBC28612 routine provides software resets to sensitive areas of the iSBC 286/12 board and then polls the front panel interrupt for the NO TEST option. If the NO TEST option is selected, the test breaks directly to the iSDM 286 cold start entry point without doing any testing or altering memory. If the NO TEST option is not selected, iSBC28612 tests the first 16KB of on-board RAM. When iSBC28612 finds the first 16KB of RAM inoperable, an attempt is made to flash the red LEDs on the processor board. This SCT routine has no screen display while running and cannot be called through the monitor extension.

80286 Register Ops

This test checks the validity of the iAPX 80286 processor registers and the ability of the system to properly execute a subset of the 80286 (real address mode) instruction set. This test emphasizes register addressing, data retention, logical operations, and conditional jumps. iAPX 286 (mem): tests instructions using memory operands.

80286 Memory Ops

The iAPX 286 (mem): routine tests the remainder of the iAPX 80286 real address mode instruction set. This test emphasizes memory addressing modes and indirect jumps through registers and pointers.

If either of the 80286 Ops tests fails, the system displays the following error message and no other tests are executed. The appropriate NOT TESTED messages are displayed, and the SCT exits to the iSDM 286 monitor.

iAPX 286 (xxx): Instruction Test Failed

8254 Programmable Interval Timer (PIT)

All three timers of the 8254 PIT are tested for their ability to initialize, count down, and match predetermined count values for a given count time (accuracy ±1%). The timers are again initialized according to their default rates. The ChB Console Baud Rate Timer uses the value obtained during the baud rate scan. On the processor board, LED(0) should be lighted during this test. Errors during this routine produce the following message:

8254 PIT Counter #n Failed

where n=timer number

8274 Multi-Protocol Serial Controller (MPSC)

The 8274 MPSC test checks that the MPSC is ready to operate on Channels A and B (ChA and ChB). ChA testing uses the loopback feature controlled by the 8255 PPI (Programmable Peripheral Interface) port C. Also, ChA flags are tested using various enabled/disabled conditions, and error circuitry is checked for operational readiness. The initial status of ChB following a reset is checked, and the transmit/receive capabilities of both channels are tested. The console receive interrupt is tested by having the user respond to the prompt

8274 MPSC: Enter "." or <cr>

The terminal echoes the character entered. Possible error messages are

8274 MPSC
ChA Flags Error
ChA Transmit/Receive Error
ChB Flags Error
ChB Interrupt Timeout
ChB Interrupt Error

If no character is entered, a "?" is displayed and the following message appears:

ChB Rx Interrupt Failed
TIMEOUT Waiting for input...

27256 EPROM

Checksums are computed for each of the two 27256 EPROMs in which the SCT/iSDM 286 code is located. These checksums are word values and are compared against the values stored in the first four words of the EPROM.

If any of the checksums differs from the expected values, the SCT/iSDM code is suspect, and other SCT routines are not run. When an error occurs, a displayed message identifies the suspect EPROM; a separate message appears for each suspect EPROM.

27256 EPROM : Checksum for Socket #U nn Failed

where U nn=the board location of the faulty EPROM

8259A Programmable Interrupt Controller (PIC)

Master and slave PICs are initialized and tested for their ability to load and hold a wide range of mask patterns. Selected interrupts, including the line printer and fail-safe timer, are sent through the PICs to verify their operation. The serial interrupt is tested during the 8274 MPSC test. Failure of the test causes all interrupts to be disabled and the Winchester controller interrupt test to fail. The routine produces the following error messages:

8259A PIC	**Master PIC Masks Error**
	Slave PIC Masks Error
	PIC Interrupts Error

8255 Programmable Peripheral Interface (PPI)

The PPI initialization uses the same mode as iSDM 286, which sets up port A for output, port B for input, and port C for eight lines of board controls (output). Port A's ability to receive and latch a wide range of data patterns is tested. The 8259A PIC routine uses port B to generate a dummy line printer interrupt for PIC testing. Port C implements the loopback feature used by the 8274 MPSC ChA routines. Test failures produce the following error message:

8255 PPI Parallel Port Error

8274 MPSC Channel A (ChA) Loopback

This test exercises the Channel A (ChA) external buffering, RS-232C logic, and cabling. It requires an external loopback connector and is therefore not run as part of the automatic SCT. The test can be called from the SCT monitor extension command line (see "Using the SCT Monitor Extension"). To make the loopback connector, connect pins 2 and 3 on the RS-232C cable. The test produces the following error messages:

ChA Loopback:	**(Test Connector Required)**
	ChA Transmit Failed
	ChA Receive Failed
	ChA Data Error, Tx=nn Rx=nn

where nn=standard ASCII code in hex

Lineprinter (LPT) Loopback

This test exercises the interface drivers and cabling for the line printer interface. It requires a special loopback connector to be installed and is therefore not run as part of the automatic SCT. The test can be called from the SCT monitor extension command line (see "Using the SCT Monitor Extension"). To make the line printer loopback connector, connect the following pairs of pins on the Centronics cable: 1-12, 2-10, 9-13. The test can produce the following error messages:

:Lp: Loopback (Test Connector Required)
Pattern Exp=00000000 Rec=01010000 XOR=01010000
Signal: (LPT Error) Centronics Pin 12
Signal: (LPT Ack) Centronics Pin 10

Test Description--Memory Subsystem Test (RAM MEMORY)

The SCT tests the 286/12 processor on-board memory with a combined checkerboard-address test (5AA5H pattern). This routine tests all memory up to the first nonexistent memory that occurs on a 16K boundary. Testing will not go beyond 0E000:0H (compatibility mode 896 KB). The 16K boundary protects iSBC 544A and 188/48 communications boards from having memory testing performed. Failure of this routine produces the following error message:

RAM MEMORY: [ssss:oooo] Exp=xxxx Rec=xxxx XOR=bbbbbbbb

where [ssss:oooo] = hex address of word being verified
xxxx = hex digits
bbbbbbbb = binary display of suspected stuck bits (MSB...LSB)

Test Descriptions--Boot Subsystem Tests

The following section describes individual boot subsystem tests, with suggested responses to each test's error messages.

Spinup Test

NOTE

The spinup test is part of the Winchester test. It cannot be invoked independently through the SCT monitor extension.

This test is run only to test a Winchester disk drive. The test resets the drive controller and attempts to initialize and spin up Winchester drive 0. The test will then wait until the controller posts status that the drive is ready or that the normal polling sequence times out. The test waits 20 seconds for the drive to spin up. Each time this occurs, the message "Spinning Up" is updated on the screen.

CAUTION

This test provides system resets to the 80186 processor on the drive controller board. Repeated operation from the monitor command line is not recommended. This test should be used only for starting up the Winchester drive.

If any failure occurs during this test, one or more of the following error messages is displayed:

:W0: Wini Init
Transfer Status
UNIT NOT READY

Message	What to Do
RESET ERROR	1. Make sure the drive controller board and cables are properly installed. 2. Check the memory subsystem for either an addressing error or memory overlap. 3. Replace the controller board.
INITIALIZE ERROR	1. Make sure the Winchester disk is correctly formatted. 2. Check the integrity of all control and data cables. 3. Check all power cables for proper connection (the drive select LED should be on). 4. Replace the controller board. 5. Replace the Winchester disk drive.

Winchester Test

The first part of this test is the spin up test. This test resets the drive controller. This routine initializes the drive controller and invokes the self-test RAM/ROM microdiagnostics. The test also activates the Winchester boot device and reads block 0 (head 0, track 0, sector 0) for disk characteristics (the iRMX/XENIX/MS-DOS label). If the device characteristics are not as expected, one of the following warning messages is issued.

Error in label: device granularity
media-type flags

This error indicates that the disk was formatted by a program other than iRMX or XENIX (for example, an iMDDX drive diagnostic).

Successful controller initialization invokes the self-test DIAGNOSTIC TRACK WRITE/READ microdiagnostics. Note that the microdiagnostics are PASS/FAIL; but the SCT monitor extension can provide more status information. This routine also checks that the drive controller can generate an interrupt.

If any failure occurs, one or more of the following error messages is displayed:

Message	What to Do
RESET ERROR	1. Make sure the device controller board is properly installed. 2. Check the memory subsystem for either an addressing error or memory overlap. 3. Replace the controller board.
INITIALIZE ERROR or Transfer Status UNIT NOT READY	1. Make sure the Winchester disk is correctly formatted. 2. Check the integrity of all control and data cables. 3. If this error occurred after the read operation, make sure the device label is correct. 4. Check all power cables for proper connections. The drive select LED should be on. 5. Replace the Winchester disk drive. 6. Replace the controller board.
READ ERROR	1. Make sure the Winchester disk is correctly formatted. 2. Check the integrity of all control and data cables. 3. Replace the Winchester disk drive. 4. Replace the controller board.

Message	What to Do
WRITE/READ MICRO	1. Make sure the Winchester disk's diagnostic track is formatted. 2. Make sure the device label is correct. 3. Check the integrity of all control and data cables. 4. Replace the Winchester disk drive. 5. Replace the controller board.
RECAL (Recalibrate)	1. Check the integrity of all control and data cables. 2. Replace the Winchester disk drive. 3. Replace the controller board.
CONTRL INTERRUPT	1. Make sure the drive controller interrupt jumpering is correct. 2. Check the processor interrupt jumpering. 3. Replace the controller board. 4. Replace the processor board.

After taking corrective action, run the complete power-up SCT to verify that the problem has been corrected.

Floppy Test

This test initializes and tests the flexible disk controller and drive (boot device).

This routine initializes the flexible disk boot device and reads block 0 (head 0, track 0, sector 0) for disk characteristics (in the iRMX/XENIX/MS-DOS volume label). If the boot device is not initialized, its status is examined to determine if the device state is UNREADY or FAULT. A warning message is issued but the test proceeds. The test then does a recalibrate operation.

If a failure occurs during the Floppy Test, one or more of the following messages is displayed. If the Spinup and Winchester Tests also report errors, correct those errors before taking the following steps.

Message	What to Do
OFFLINE	If the boot device cannot be initialized, its status is examined to determine if it is in an UNREADY state (no disk installed or drive is disconnected), in which case it is reported OFFLINE. This is not considered an error.
FLOPPY: Reset Error	1. Make sure the controller board is properly installed. 2. Check the memory subsystem for an addressing error or memory overlap. 3. Replace the controller board.
FLOPPY: Initialization Error	1. Check that the flexible disk is properly inserted in the drive. 2. Try a different disk. 3. Check the integrity of all control and data cables. 4. Replace the controller board. 5. Replace the flexible disk drive.
FLOPPY: Read Error	1. If a XENIX **tar** disk is used in this test, this error message will be displayed. Only XENIX boot disks should be used. 2. Verify that cylinder 0, head 0 of the flexible disk is formatted for single density 128-byte blocks. 3. Check the integrity of all control and data cables. 4. Clean the flexible disk drive heads. 5. Replace the flexible disk drive. 6. Replace the controller board.

Message	What to Do
FLOPPY: Recal Error	1. Check the integrity of all control and data cables. 2. Try a different disk. 3. Check all power cables for proper connection. 4. Replace the flexible disk drive. 5. Replace the controller board.
FLOPPY: Controller Interrupt Error	1. Check the interrupt jumpering on the controller board. 2. Check the interrupt jumpering on the processor board. 3. Replace the controller board. 4. Replace the processor board.

After taking corrective action, run the complete power-up SCT to verify that the problem has been corrected.

Tape Test (SCT Monitor Extension Only)

This test is invoked by the "Wtf" command in the SCT Monitor Extension. The test resets the controller, initializes the controller and the tape drive, loads the tape, and reads the first block on the tape (block 0). If a failure occurs, one or more of the following messages is displayed:

Message	What to Do
OFFLINE	If the boot device cannot be initialized, the system determines whether it is in an UNREADY state, in which case, it is reported OFFLINE. This is not considered an error. The message may also mean that the drive is not installed.
TAPE: Reset Error	1. Make sure the controller board is properly installed. 2. Check the memory subsystem for either an addressing error or memory overlap. 3. Replace the controller board.
TAPE: Initialization Error	1. Make sure the controller board is properly installed. 2. Check the integrity of all control and data cables. 3. Check all power cables. 4. Make sure the Winchester disk drive is properly installed. 5. Replace the controller board.
TAPE: Load Error	1. Make sure the tape in the drive is properly formatted. 2. Check the integrity of all control and data cables. 3. Check all the power cables. 4. Try a different tape. 5. Replace the tape drive. 6. Replace the controller board.
TAPE: Read Error	1. Make sure the tape in the drive is properly formatted. 2. Check the integrity of all control and data cables. 3. Check all the power cables. 4. Try a different tape. 5. Replace the tape drive. 6. Replace the controller board.

Message	What to Do
Tape Reset	1. Check peripheral controller board. 2. Check the power cables for proper connection. 3. Check the power supply.
Transfer Status	1. Check peripheral controller board. 2. Check the power cables for proper connection. 3. Change tape cartridge. 4. Replace drive.
INVALID COMMAND	1. Check the cables for proper connection. 2. Replace the controller board.

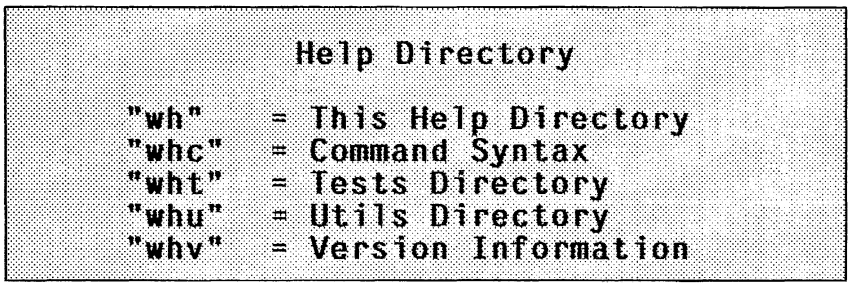
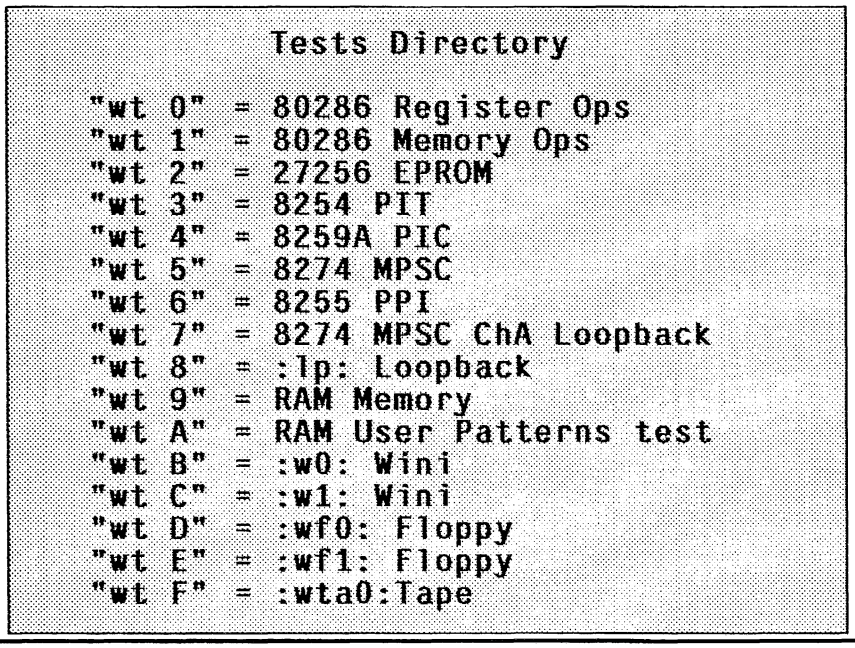
Using the SCT Monitor Extension

The SCT Monitor Extension is a special subset of commands that use the system debug monitor (SDM) command line and prompt (".").

Select the SCT Monitor Extension instead of booting the operating system (by entering a period in response to the prompt during the attended SCT) if you want to use

- a system installation diskette
- a diagnostic test
- some other boot file
- the iSDM 286 monitor to run the SCT help, testing, and utilities functions or to debug hardware

The following table details the commands available.

Task:	Enter:
To select the monitor: Follow the steps under "Running the SCT." Enter an uppercase U after setting the baud rate. When the 8274 MPSC prompt appears, type a period (.) within six seconds. Then display a menu or select a test or utility by entering one of the commands listed below.	U •
To display the available on-line help menus:  Help Directory "wh" = This Help Directory "whc" = Command Syntax "wht" = Tests Directory "whu" = Utils Directory "whv" = Version Information	wh
To display a one-screen tutorial on command syntax for the looping and repeat commands. Use these commands to cause a test or series of tests to be repeated.	whc
To display the menu of all standard and optional test routines:  Tests Directory "wt 0" = 80286 Register Ops "wt 1" = 80286 Memory Ops "wt 2" = 27256 EPROM "wt 3" = 8254 PIT "wt 4" = 8259A PIC "wt 5" = 8274 MPSC "wt 6" = 8255 PPI "wt 7" = 8274 MPSC ChA Loopback "wt 8" = :lp: Loopback "wt 9" = RAM Memory "wt A" = RAM User Patterns test "wt B" = :w0: Wini "wt C" = :w1: Wini "wt D" = :wf0: Floppy "wt E" = :wf1: Floppy "wt F" = :wta0:Tape	wht

Task:	Enter:
To start a test running, enter the test number as listed in the Tests Directory menu. For some tests, prompts will be displayed for you to respond to.	wt *test*
To display the utility menu:	whu
To run a utility program. Enter the *utility* number as listed in the Utils Directory menu.	wu *utility*

```
Utils Directory

"wu 0" = Testing Summary
"wu 1" = Clear Testing Summary
"wu 2" = Set SCT Display Mode
"wu 3" = Set Stop on Error
"wu 4" = Display Disk IOPB
"wu 5" = Clean Floppy Disk Heads
```

Utility Descriptions

Utility:	Task:	Enter:
Testing Summary	To display a summary of all SCT command-line testing, including the number of test attempts and failures for each test. Any test that fails is indicated by an arrow in the right margin.	wu 0
Clear Testing Summary	To clear the testing summary to all zeros.	wu 1
Set SCT Display Mode	To select the level of test result details you want to see: **NORMAL** - Simple messages such as PASS and FAIL as each subsystem passes a test **VERBOSE** - Additional test status information **SUPERDEBUG** - Exhaustive test status information	wu 2
Set Stop on Error	To set the SCT to stop when an error condition exists.	wu 3
Display Disk IOPB	To view the Winchester controller's parameter block data structures based on wakeup address 0100:0000H. The system looks up the data, formats it, and displays it on the screen.	wu 4

Clean Floppy Disk Heads	To clean the flexible disk drive heads (up to four drives, either 5¼-inch or 8-inch). After selecting the utility, respond to these screen prompts:
	
	`Select DRIVE TYPE`
	`"0" = 5.25"`
	`"1" = 8.00"`
	`Enter [0H .. 1H]`
	`---`
	`Select DRIVE UNIT`
	`Enter [ 0H .. 3H]`
	`---`
	`Insert Cleaning Diskette, then Select Cleaning Track`
	`Enter [1H .. DH]`
	`---`
	While cleaning is in progress, the screen displays
	
	`cleaning :wfn: #...`
	
	where *n* = the drive unit being cleaned, followed by one "." for each second the test lasts.
		wu 5

No-Test Option during System Software Debugging

If you are debugging system software, you may want to reset the system frequently without running the entire SCT each time. This is useful for checking system memory, for example, after a program has malfunctioned.

To select the no-test option: press the (R)eset switch and then within one second press the (I)nterrupt switch. Enter "U" (tells the system to scan for the terminal baud rate) or wait 20 seconds and the system will default to 9600 baud.

If the SCT recognizes your input (at 9600 baud), the screen will display two backspaces instead of an asterisk. If not, try again--press RESET, then press INTERRUPT.

CAUTION

Always run the entire SCT at least once when you start the system at the beginning of a session. If you select the no-test option before running the SCT at least once, system operation is unpredictable: the hardware is not adequately initialized; booting the system software or diagnostics may produce unreliable results. In general we recommend that you run the entire SCT unless doing specific debugging tasks.

Troubleshooting without Diagnostics

If the System 310AP is completely inoperative or not working well enough to run the diagnostic programs, or if a problem cannot be fixed by simply switching a circuit board or disk drive, you must systematically eliminate potential causes until you have found the right one. The following section will help you do this.

Preliminary Checks

The first step in troubleshooting is to make a preliminary check for obvious causes:

- The system may not have been properly installed (refer to the *System 310AP Owner's Manual)*
- Broken or loose wires and cables
- Improperly seated circuit boards in the cardcage
- Improperly seated connectors
- Broken or loose components

AC and DC Power Problems

The 310AP can be powered from an uninterruptable power supply (UPS). However, since the 310AP uses an internal switching power supply, the UPS must meet the following requirements:

- It must have a switch-over time of zero; that is, the AC power to the 310AP must always be supplied from the UPS rather than from the AC line until a power failure occurs, then switching to the UPS.
- It must be able to supply current in bursts up to three or four times the rated rms (average) value for the 310AP. In general, UPSs that use a ferro-resonant transformer for voltage sine wave smoothing cannot supply the 310AP in this manner.

The most obvious cause of complete system failure is lack of AC or DC power. You can quickly check two of the power supply outputs as follows:

1. If the power light on the front panel is on, there is voltage on the +5 VDC output.
2. If either fan is working, there is voltage on the -12 VDC output.

Loss of +5 VDC power will cause complete system failure (although the fans may continue running). Loss of either 12 VDC supply may result in only partial failure. The +12 VDC supply is used only for the disk and tape drives and RS-232C ports; the -12 VDC supply is used only for the RS-232C ports and the fans (in standard versions of the System 310AP).

If all of the supply voltages have been lost, then AC power has been lost, the fuse has blown, or the power supply failed. The loss of a single supply voltage may be caused by a short circuit somewhere in the system or by a failure within the power supply. You can check for shorts by removing loads from the supply, one by one, until the lost supply voltage comes back on. It is easiest to do this by starting with the circuit boards in the cardcage. Remember to turn off power before removing a board.

After a load is checked, return it to the system. The 310AP has a minimum load requirement for power supply operation.

The checks listed above do not guarantee that the supply voltages are within tolerance. To be sure of these voltages, you should check them with an accurate voltmeter. Figure 2-2 shows where the DC supply voltages can be measured on the system backplane. All voltages should be within 5% of the specified value.

Loss of AC power or a complete failure of the power supply results in a dead System 310AP. Confirm the following, as described in the *System 310AP Owner's Manual.*

- Power switch on
- Power cord connected to an active outlet
- Fuse not blown (and of proper current rating)
- Line voltage selector set to the proper range
- AC distribution path has continuity through the power switch, the line filter, the voltage selector assembly, and the wiring harness to the power supply (start checking at the power supply end)

System Backplane and Front Panel Control Problems

The bus priority arbitrator circuit or the front panel circuitry can disrupt system operation. The bus priority arbitrator can hang up the MULTIBUS interface. In this case, the processor cannot communicate over the MULTIBUS system bus. This could be caused by improper jumper settings or a component malfunction.

To eliminate the bus priority arbitrator as a cause of the problem, you can bypass its circuitry by removing all the jumpers on the bus priority jumper matrix and connecting a jumper between pins E45 and E31 on the backplane. (Refer to the system backplane circuit diagram in Chapter 4.) This connects the processor's bus request line to its bus priority input line, granting it exclusive access to the bus. The processor should then be able to access slave devices, such as the memory boards, although other bus masters, such as the peripheral controller board, will not work properly since they cannot gain control of the bus.

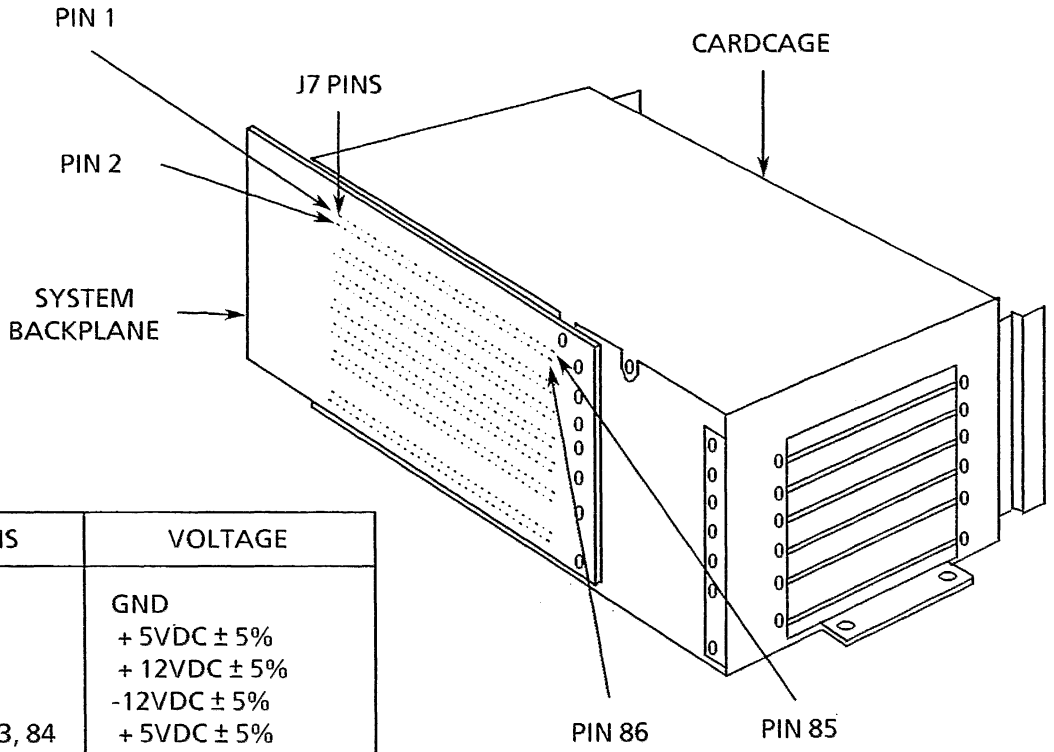
The front panel circuitry can fail in the following ways:

- If the front panel interrupt circuitry fails in such a way as to hold the INT1* interrupt line in the active state, the processor would be held in the interrupted state.

  You can eliminate the INTERRUPT switch as a cause by disconnecting the front panel interconnect cable at the backplane, then running the SCT. To eliminate the contact debouncing circuit on the backplane as a cause, remove the interrupt jumper from the INT1* position on the interrupt jumper matrix.

- The front panel reset circuitry could hold the system in the reset state. You can eliminate the RESET switch as a cause by disconnecting the front panel interconnect cable.

You can make a quick check of the run light circuit by holding the RESET switch down. This halts the processor, causing the run light to go off. When the RESET switch is released, the run light should come back on.



J7 PINS	VOLTAGE
1, 2	GND
3, 4, 5, 6	+ 5VDC ± 5%
7, 8	+ 12VDC ± 5%
79, 80	-12VDC ± 5%
81, 82, 83, 84	+ 5VDC ± 5%
85, 86	GND

F-0066

Figure 2-2. DC Voltage Measurement Locations

CHAPTER 3
REMOVAL AND REPLACEMENT PROCEDURES

This chapter contains removal and replacement procedures for the field-replaceable components of the System 310AP. These procedures should be performed only by qualified service technicians. Instructions for obtaining service from Intel are in Appendix C.

WARNING

The following installation and service procedures are to be done by qualified technical personnel only. Qualified personnel should not perform any service procedures other than those described.

Recommended Tools

- #1 Phillips screwdriver suitable for SAE #2 screws
- #2 Phillips screwdriver suitable for SAE #6 or SAE #8 screws
- Flat-bladed screwdriver suitable for SAE #4 screws
- Diagonal cutters
- Static control wrist straps and ground cord
- Foam pad about 25 cm (10 inches) square and 1.3 cm ($\frac{1}{2}$-inch) thick (to place boards on)
- Wire-wrap tools and #30 AWG wire-wrap wire

Top Cover Removal and Replacement

CAUTION

Do not drop or severely jar the chassis (the system weighs nearly 23 kg (50 pounds)). The Winchester disk drive can be easily damaged, or the board connectors can be loosened.

Step	Task
1	Turn the power switch off and disconnect the AC power cord from the rear of the chassis.
2	As shown in Figure 3-1, turn the chassis on its side so that you can gain access to the top cover retaining screws in the bottom of the chassis. See the caution below.
3	From the bottom of the chassis, remove the four screws holding the top cover in place, then set the chassis down on its base.
4	From the rear of the chassis, remove the two screws (upper left and upper right corners) holding the top cover to the back panel (see Figure 3-1).
5	Lift the top cover off, moving it slightly forward to clear the disk drives.
6	To replace the top cover, do the above steps in reverse order.

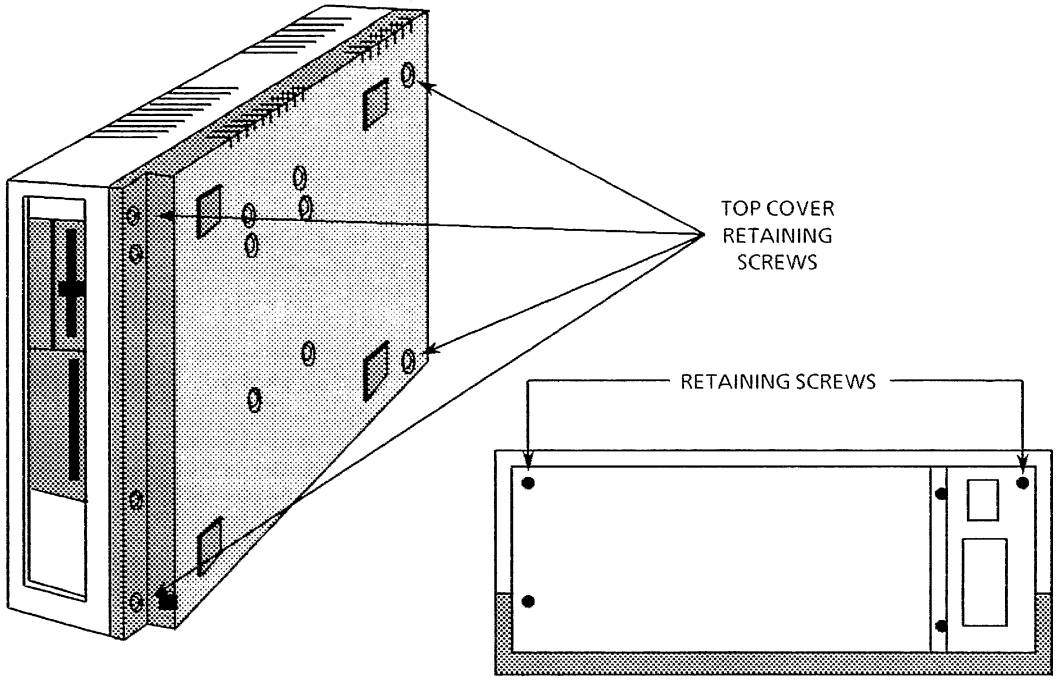
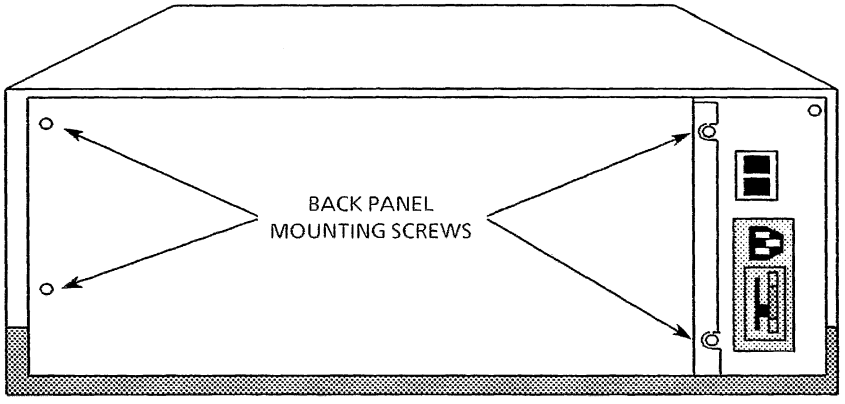


Figure 3-1. Top Cover Retaining Screws

Back Panel Removal and Replacement

Step	Task
1	Turn the power switch off and disconnect the AC power cord from the back of the system.
2	Remove the four screws holding the back panel in place (see Figure 3-2).
3	Tilt the top of the back panel out from the rear of the chassis and lift it out of the slot in the chassis base.
4	Access to the cardcage can be made easier by disconnecting the serial and parallel I/O connectors and laying the back panel aside.
5	To replace the back panel, do the above steps in reverse order.



F-0003

Figure 3-2. Back Panel Screw Locations

Cardcage Circuit Board Removal and Replacement

CAUTION

Many system components can be damaged by static electricity. We recommend that you wear static control wrist straps and cords when handling any system component. During removal or installation procedures, place boards flat on a grounded, static-safe surface, component-side up; do not slide them over any surface. Avoid having plastic in the work area.

Step	Task
1	Turn the power switch off and disconnect the AC power cord from the back of the system.
2	Remove the back panel as described earlier (Figure 3-2).
3	Disconnect any cables attached to the circuit board you are going to remove. Mark the connectors or make a diagram so that you know where they go. (For standard boards, see the interconnect diagrams in Chapter 4.)
4	Loosen the screws holding the card retainers on each side of the cardcage and remove the retainers. You do not need to remove the screws.
5	Pull on the ejector levers at each end of the circuit board to disconnect the board from the backplane.
6	Once a circuit board has been removed from the cardcage, it may be necessary to transfer one or more MULTIMODULE boards to the replacement board. Refer to the procedures later in this chapter for specific boards.
7	When replacing the board in the cardcage, seat the board into the backplane edge connector by carefully rocking the board from side to side as you push it in. Tug on the board to make sure it is firmly seated; if you can pull the board out without using the ejector tabs to pop it loose, the board is not seated in the backplane.

Processor Board Removal and Replacement

Step	Task
1	Remove the processor board from the cardcage as described earlier. Note which MULTIMODULE boards, if any, are installed on the board; these must be transferred to the replacement board.
2	Referring to Appendix A, install all jumpers required on the replacement board. The jumper configuration is determined in part by which MULTIMODULE boards are installed. (If jumpers have not been moved and replacement is exact, use the board being replaced as a jumpering guide.)
3	Remove the EPROMs from the old board and install them in corresponding locations on the replacement board.
4	Remove all MULTIMODULE boards and associated components from the old board and install them on the replacement board.
5	Install the replacement board in the cardcage as described earlier in the general removal and replacement procedure.

iSBC® 214 Board Removal and Replacement

Step	Task
1	Remove the iSBC 214 board from the cardcage as described earlier in the general removal and replacement procedure.
2	Referring to "iSBC 214 Jumper Configurations" in Appendix A, install jumpers as required on the replacement iSBC 214 board. (If jumpers have not been moved and replacement is exact, use the board being replaced as a jumpering guide.)
3	Install the new iSBC 214 in the cardcage, as described in the general removal and replacement procedure.

Cardcage Removal and Replacement

Step	Task
1	Turn the power switch off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier.
3	Remove the back panel as described earlier.
4	Remove all circuit boards from the cardcage.
5	As shown in Figure 3-3, five screws hold the cardcage in place: four outside and one inside near slot 1. Loosen or remove these screws as instructed in Figure 3-3.
6	Disconnect the cables and +5 VDC leads from the backplane. Mark the cables or make a diagram showing where they go.
7	Lift the cardcage out.
8	To replace the cardcage, do the above steps in reverse order.

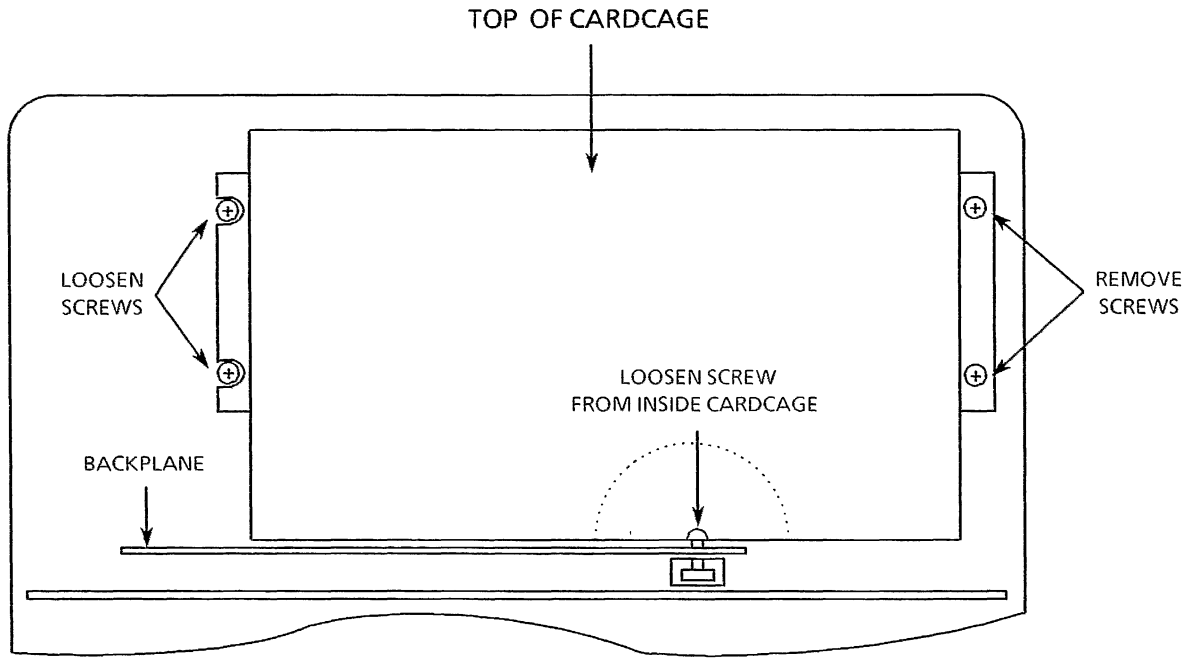


Figure 3-3. Cardcage Removal

Mass Storage Device Removal and Replacement

The mass storage devices are mounted on a plate called the peripheral mounting plate, which sits on top of the power supply cover (see Figure 3-4).

Step	Task
1	Turn the system off and disconnect the AC power cord from the back of the system. Make sure the flexible disk drive has either the original cardboard insert or a "scratch" disk inserted and latched. **CAUTION** Do not drop or severely jar the Winchester disk drive or base plate assembly. The disk drive can be easily damaged. Make sure the drive has come to complete halt (takes about one minute) before moving the system.
2	Remove the top cover as described earlier in this chapter.
3	Loosen the two screws located at the back of the peripheral mounting plate (Figure 3-5, step 1).
4	Remove the three Phillips screws from the front of the peripheral mounting plate (Figure 3-5, step 1).
5	Slide the drive assembly forward and disconnect and label all cables from the back of the drive.
6	After removing the drive assembly from the system, turn it over and set it on a soft surface. Then remove the four Phillips screws holding each drive in place, as shown in Figure 3-5, step 2.
7	To remove the shield covering the drive, remove the two Phillips screws located on each side of the drive as shown in Figure 3-5, step 3. Then lift the shield straight up until it clears the drive.
8	To install a mass storage device, perform the above steps in reverse order.

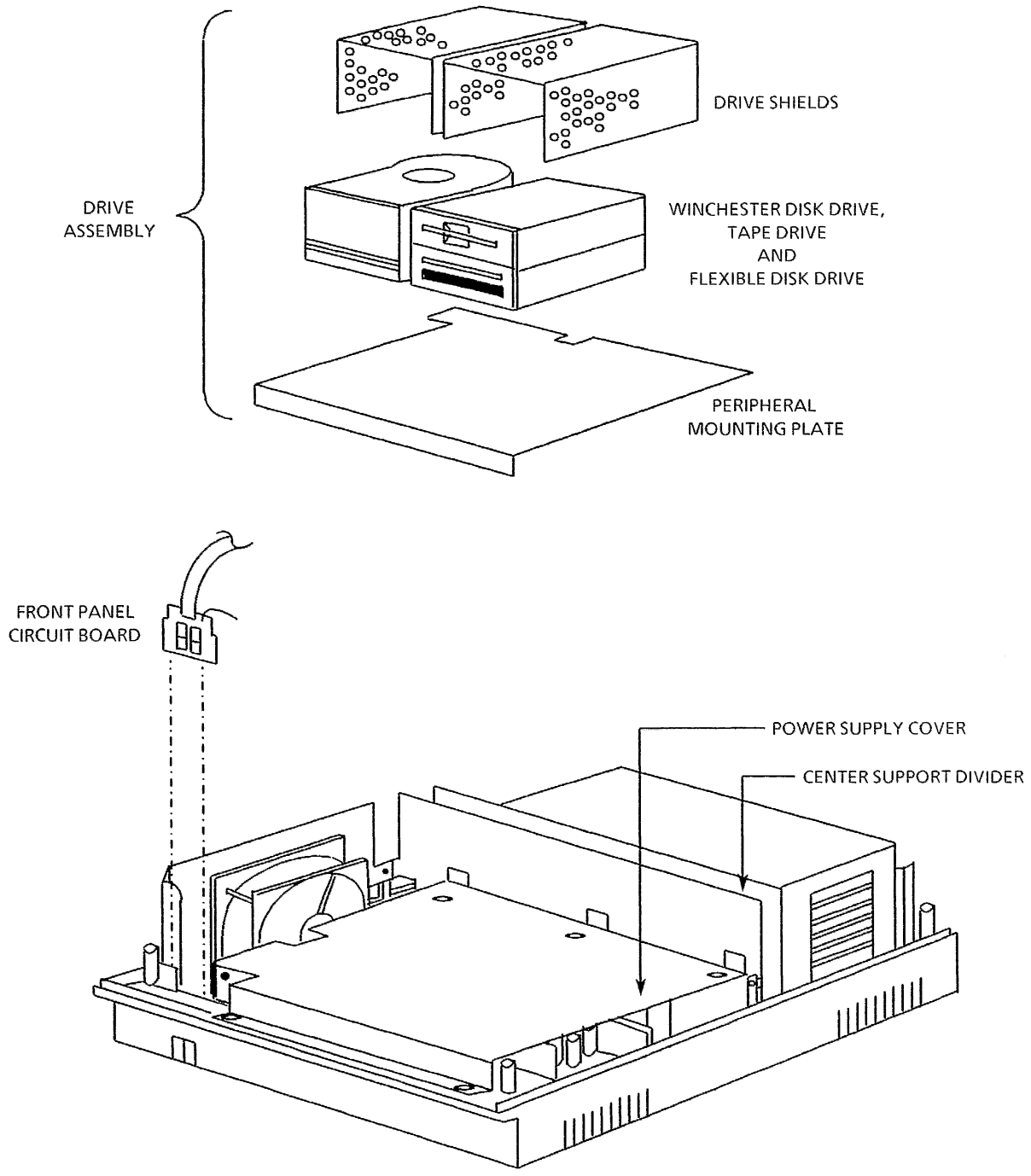


Figure 3-4. Exploded View of Drive Assembly

STEP 3

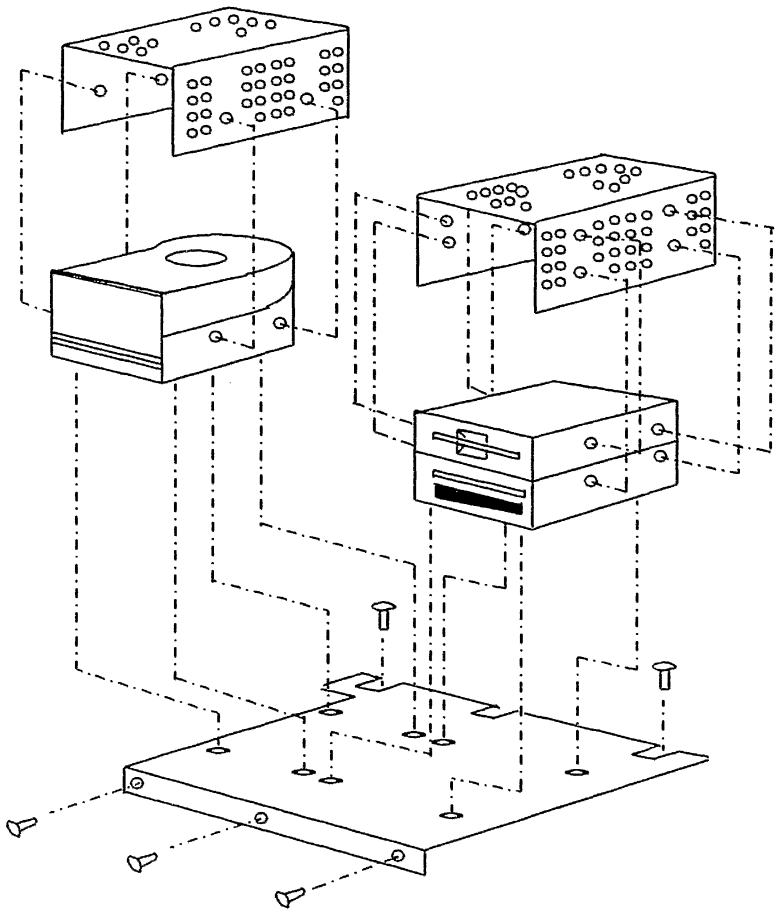
REMOVE 4 SCREWS
CONNECTING EACH
DRIVE SHIELD TO DRIVE

STEP 2

REMOVE 8 SCREWS
CONNECTING
DRIVES TO DRIVE PLATE

STEP 1

REMOVE 3 SCREWS
AT FRONT
AND LOOSEN 2 SCREWS
AT REAR
CONNECTING
PERIPHERAL MOUNTING PLATE TO
POWER SUPPLY COVER

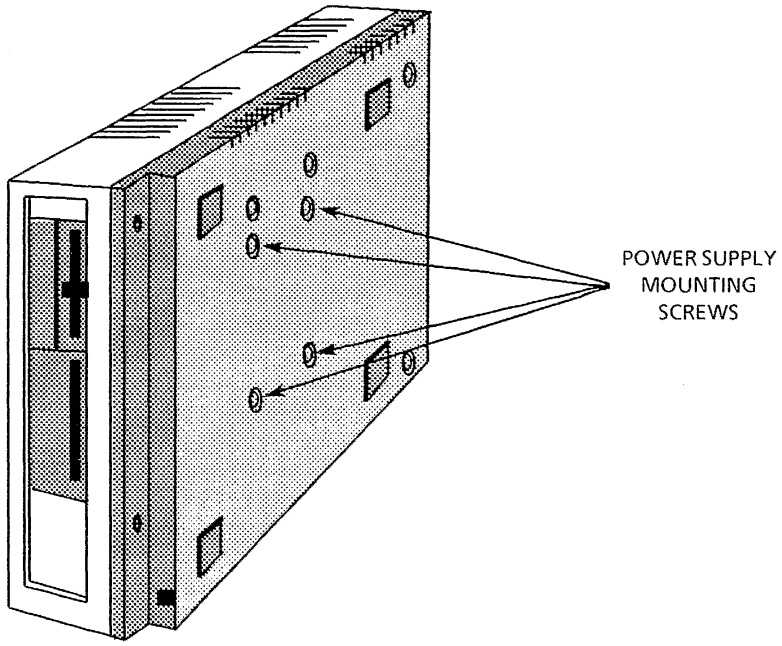


F-0002

Figure 3-5. Drive Assembly Screw Locations

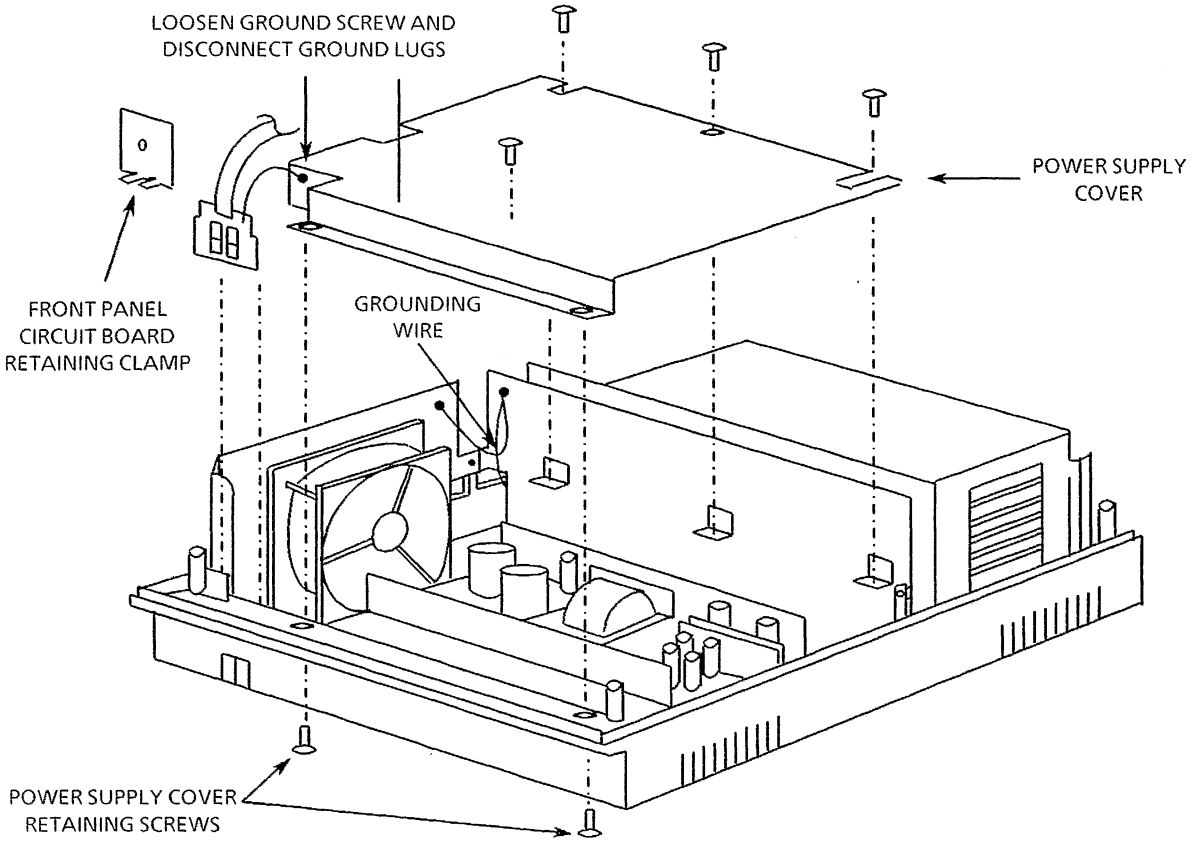
Power Supply Removal and Replacement

Step	Task
1	Turn the system off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier in this chapter, but before lowering the chassis back to the work surface, remove the four screws shown in Figure 3-6. These screws hold the power supply to the chassis base.
3	Remove the disk drive assembly as previously described. You do not have to remove the drives from the drive base plate.
4	Remove the three Phillips screws from the back of the power supply cover as shown in Figure 3-7. Then remove the two screws from the front of the power supply cover.
5	Loosen the Phillips screw holding the two green grounding wires to the front panel circuit board cover and remove the wires.
6	Unfasten the ribbon cable from the plastic cable holder on top of the power supply cover.
7	Carefully lift the power supply cover, making sure you don't snag any of the wires coming out of the power supply.
8	Refer to Figure 3-8 and disconnect all AC and DC distribution cables from the power supply. Mark all cables and connectors to ensure proper reconnection.
9	Lift power supply up and out of the system.
10	To replace power supply, place it near its mounting position and connect the AC and DC distribution cables. NOTE Position the DC distribution cables near the open end of the power supply chassis. They provide the least obstruction to airflow in this position.
11	Slip the DC distribution cable into the cable clamps mounted on the center support divider.
12	Holding the power supply in its final mounting position, lift the front of the system, and install the four power supply mounting screws.
13	Remount the remaining components by performing steps 8 through 1 in reverse order.



F-0120-1

Figure 3-6. Power Supply Mounting Screws



F-0004

Figure 3-7. Power Supply Cover and Front Panel Circuit Board Removal

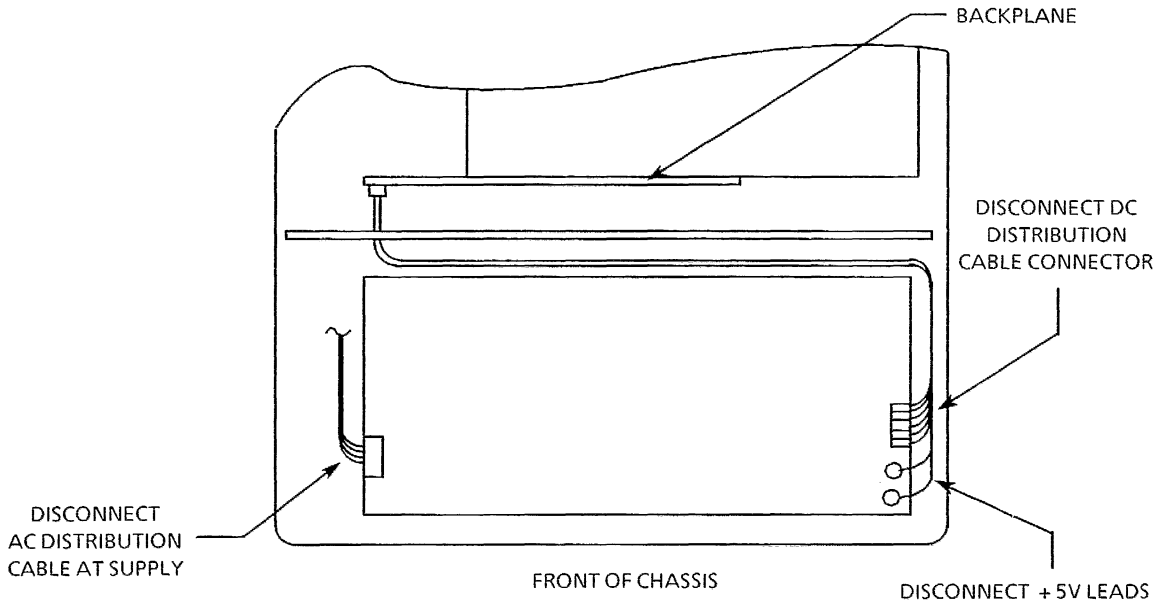


Figure 3-8. Power Supply Cables

Front Panel Circuit Board Removal and Replacement

Step	Task
1	Turn the system off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier.
3	Remove the Phillips screw holding the two green ground wires to the circuit board cover shown in Figure 3-7.
4	Remove the front panel cable from the clamp on the power supply cover.
5	Remove the front panel circuit board.
6	Press in on the RESET and INTERRUPT switches while lifting the board out of the system.
7	Trace the ribbon cable to the backplane and disconnect it. See Figure 3-9.
8	To replace the circuit board, do the above steps in reverse order.

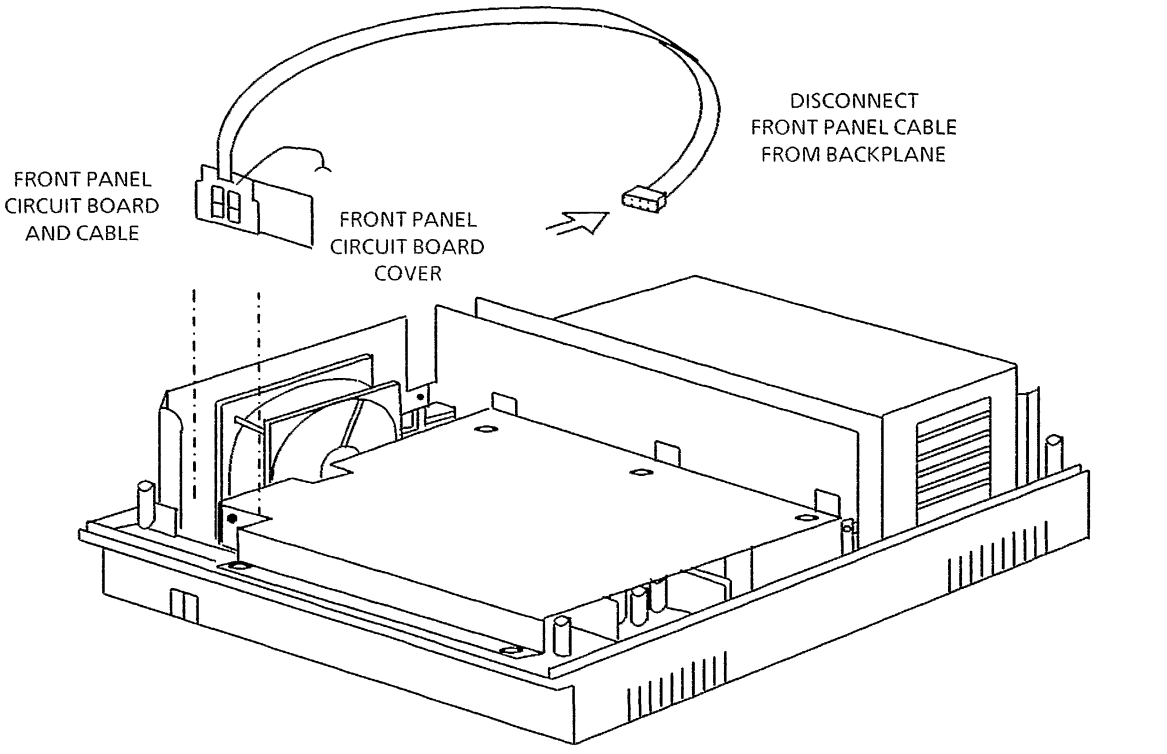


Figure 3-9. Front Panel Circuit Board Cable Connection

System Backplane Removal and Replacement

CAUTION

When replacing a backplane, you must align the MULTIBUS connectors correctly with the card guide slots to prevent damaging boards when inserting them.

Step	Task
1	Turn the system off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier.
3	Remove the back panel as described earlier.
4	Remove the cardcage as described earlier.
5	Remove the two screws holding the system backplane to the P2 backplane, then remove the four screws holding the backplane to the cardcage.
6	To replace the backplane, perform the above steps in reverse order.
7	Put the new backplane in place and start, do not tighten, the four screws that hold it to the cardcage. Insert MULTIBUS circuit boards in both the top and bottom slots of the cardcage; carefully but firmly engage each board in its P1 backplane connector. When you are sure the MULTIBUS connectors are aligned correctly with the card guide slots, tighten the four screws securing the backplane in place.
8	Remove the MULTIBUS boards in order to replace the screws that hold the system backplane to the P2 backplane.

P2 Backplane Removal and Replacement

CAUTION

When replacing a backplane, you must align the MULTIBUS connectors correctly with the card guide slots to prevent damaging boards when inserting them.

Step	Task
1	Turn the system off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier.
3	Remove the back panel as described earlier.
4	Remove the cardcage as described eariler.
5	Unwrap the wire going to pin E47 on the system backplane.
6	Remove the five screws holding the P2 backplane in place (see Figure 3-10).
7	To replace the P2 backplane, perform the above steps in reverse order.

FRONT VIEW OF P2 BACKPLANE FROM INSIDE CARDCAGE

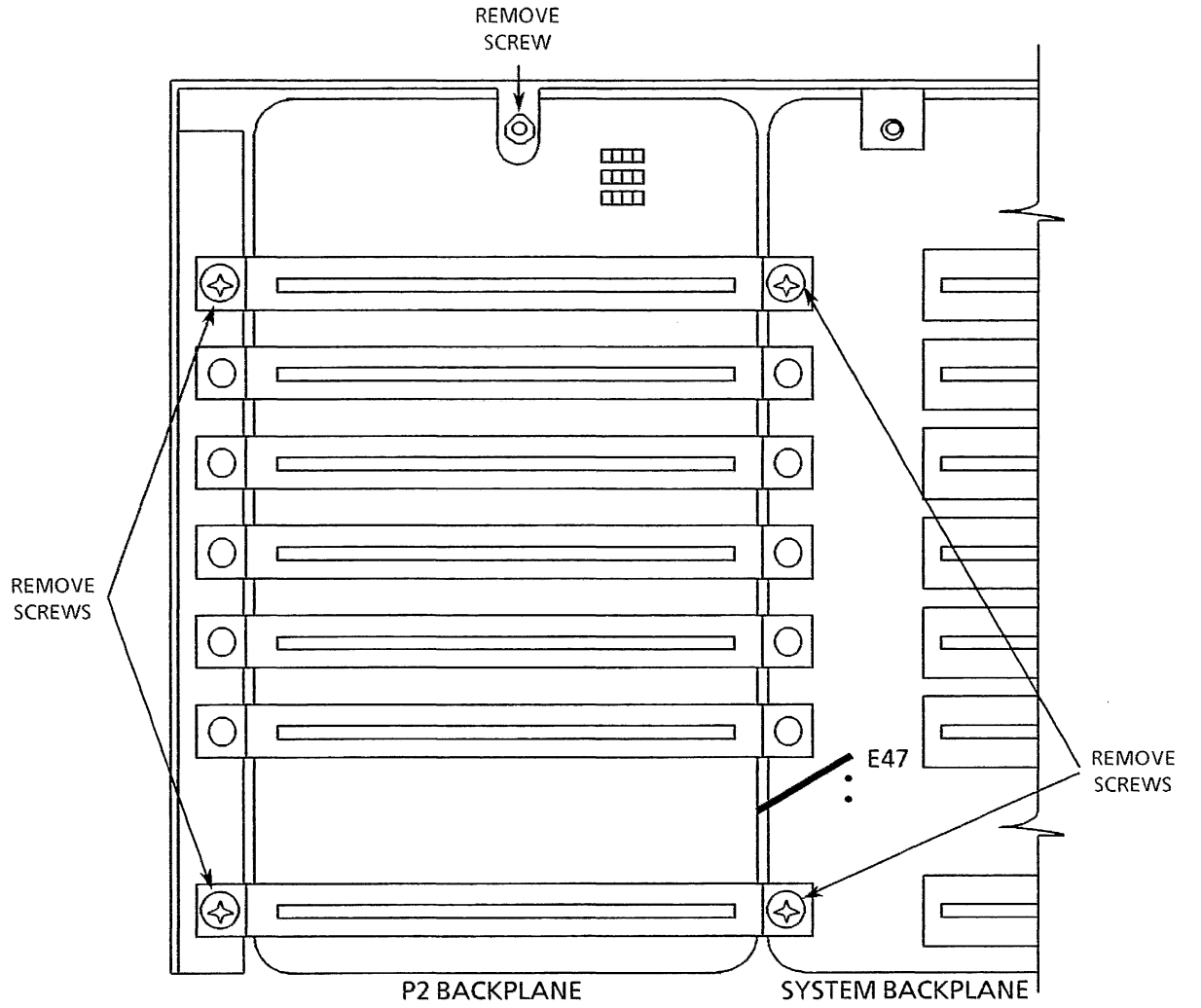


Figure 3-10. P2 Backplane Removal

Front Fan Removal and Replacement

Step	Task
1	Turn the power switch off and disconnect the AC power cord from the rear of the chassis.
2	Remove the top cover as described earlier.
3	Remove the five screws on the front fan assembly (see Figure 3-11): four holding the fan assembly to the chassis and one securing the ground wire to the fan assembly.
4	Trace the blue and red DC wires to the backplane and disconnect them.
5	Thread the wires through the center divider until the wires are free.
6	Remove the fan assembly from the chassis base.
7	To remove the fan from the housing, remove the four Phillips screws and nuts holding the fan to the housing. See Figure 3-12.
8	To replace the fan, perform the above steps in reverse order.

Rear Fan Removal and Replacement

Step	Task
1	Turn the system off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier.
3	Remove the four screws on the rear fan assembly (see Figure 3-11) holding the fan assembly to the chassis and loosen the two screws securing the ground wires to the fan assembly.
4	Trace the blue and red DC wires to the backplane and disconnect them.
5	Remove the fan assembly from the chassis base.
6	To remove the fan from the housing, remove the four Phillips screws holding the fan to the housing. See Figure 3-12.
7	To replace the fan, perform the above steps in reverse order.

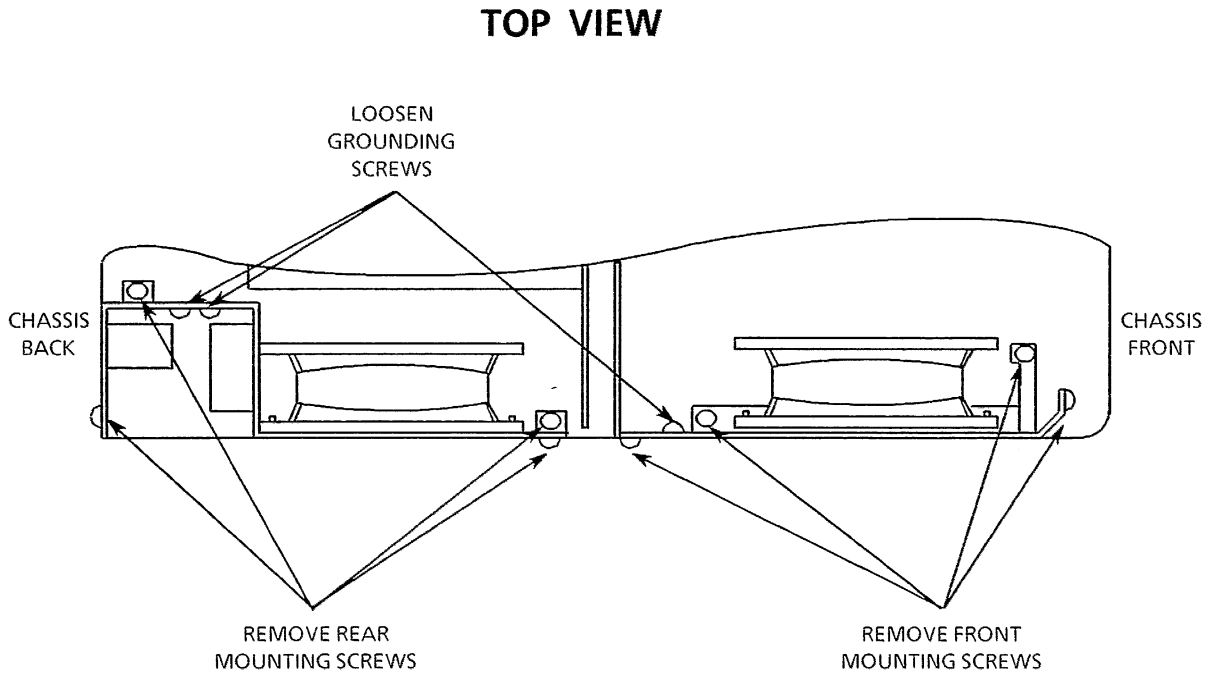


Figure 3-11. Front and Rear Fan Assembly Mounting Screws

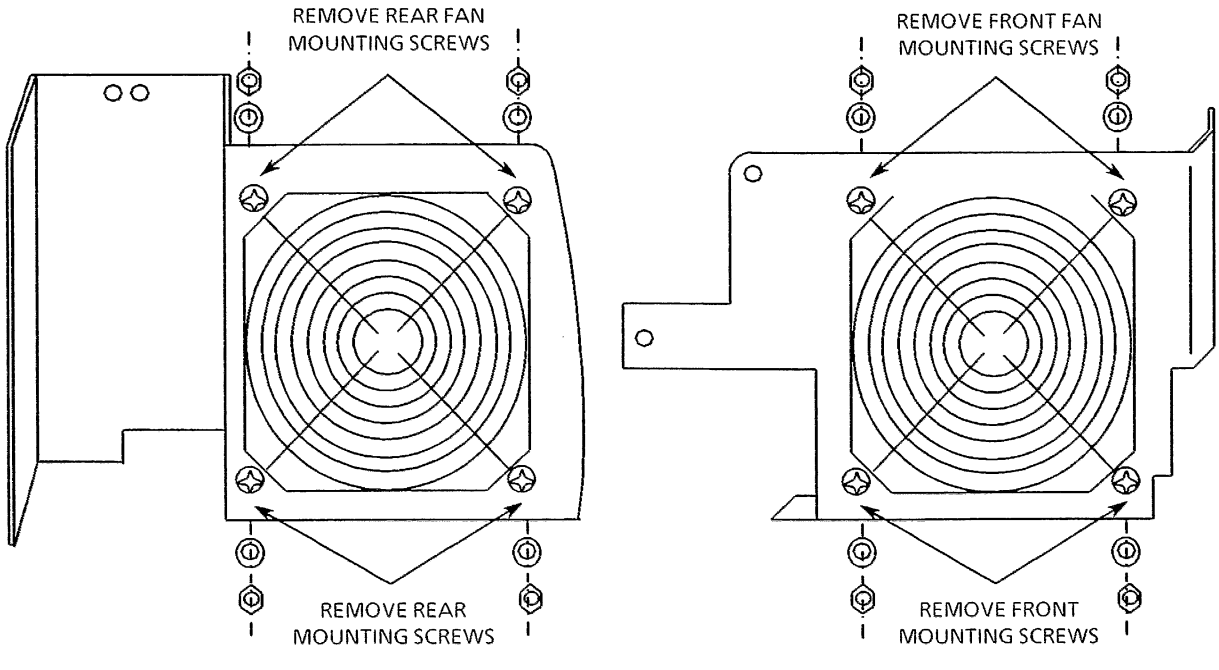


Figure 3-12. Fan Retaining Screws

Power Switch Removal and Replacement

Step	Task
1	Turn the power switch off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier in this chapter.
3	Make a diagram of the lead locations. Disconnect the leads from the power switch.
4	As shown in Figure 3-13, the power switch is held in place by pop-out retainers on the top and bottom of the switch body. Press in the retainers and remove the switch through the rear of the chassis. It is easiest to press in the top retainers first, tip the top of the switch out, then press in the bottom retainers and remove the switch.
5	Replace the power switch by snapping it in place from the rear of the chassis.

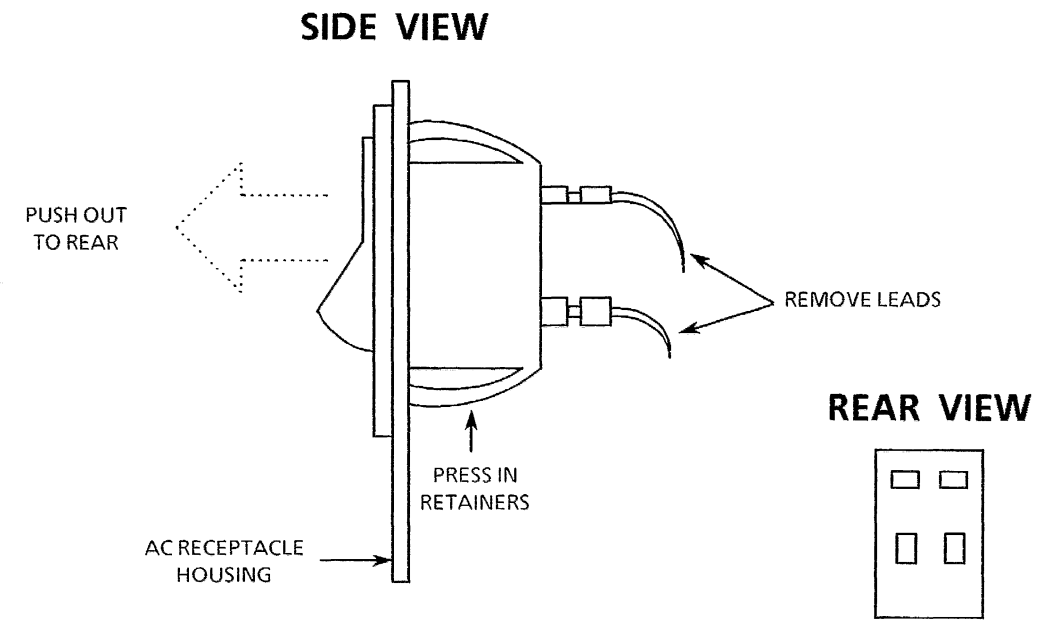


Figure 3-13. Power Switch Removal

AC Receptacle/Voltage Selector Removal and Replacement

The AC receptacle/voltage selector and distribution cable are removed as an assembly. To ensure proper reconnection, mark all cables and connectors.

Step	Task
1	Turn the power switch off and disconnect the AC power cord from the back of the system.
2	Remove the top cover as described earlier in this chapter.
3	Remove the rear fan from the chassis base as described earlier in this chapter.
4.	Remove the power switch as described earlier in this chapter.
5	Disconnect the AC ground lugs (green lead with yellow stripe) at the AC housing, line filter, cardcage, center support divider, rear fan housing, and drive base plate.
6	Disconnect the leads from the bottom of the power switch.
7	Disconnect the AC distribution cable connector at the power supply and line filter.
8	The AC receptacle/voltage selector assembly is held in place by pop-out retainers on the top and bottom of the assembly. Press in the retainers with pliers or a flat-bladed screwdriver and remove the assembly through the rear of the housing. It is best to disengage one side at time. See Figure 3-14.
9	After the receptacle assembly is clear of the housing, carefully feed the AC distribution cable out through the rear of the housing.
10	To replace the AC receptacle/voltage selector and distribution cable, perform the above steps in reverse order.

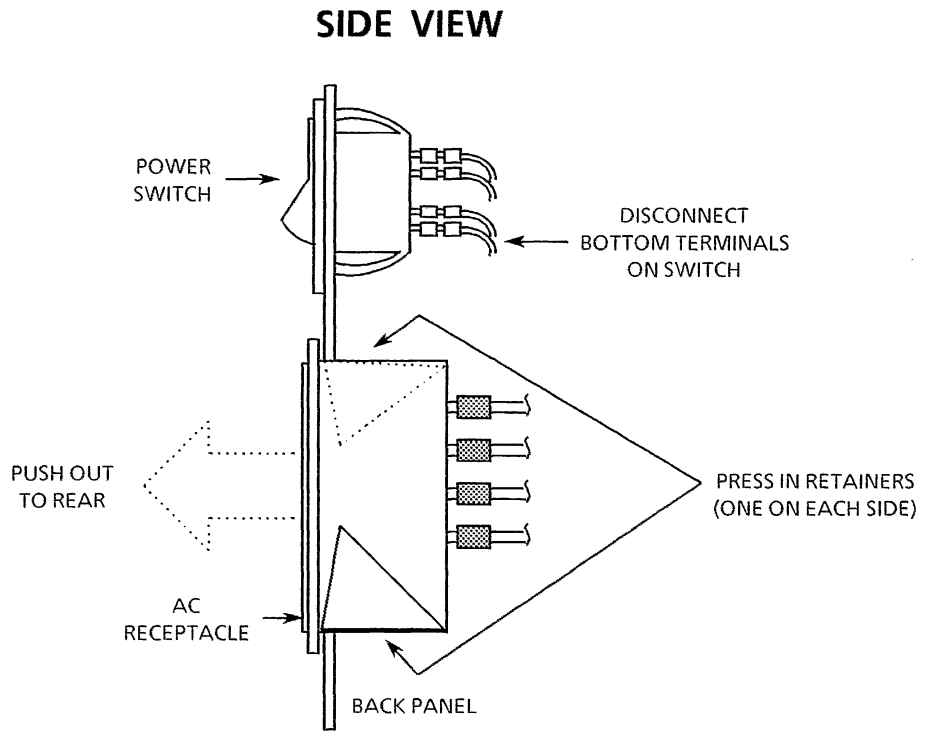


Figure 3-14. AC Receptacle/Voltage Selector Removal and Replacement

Fuse Removal and Replacement

The fuse is located within the AC receptacle assembly on the back panel.

Step	Task
1	Turn the power switch off and unplug the AC power cord.
2	To gain access to the fuse, slide up the clear plastic cover on the AC receptacle.
3	Pull on the lever labeled FUSE PULL to disengage one side of the fuse.
4	Pull the fuse loose from the fuse holder.
5	To replace the fuse, perform the above steps in reverse order.

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CHAPTER 4
MAINTENANCE DIAGRAMS

This chapter contains interconnecting wiring diagrams and illustrations showing cable routing and component locations for major subsystems of the System 310AP. Also included are schematic diagrams for the backplanes and front panel.

The diagrams and their locations are as follows:

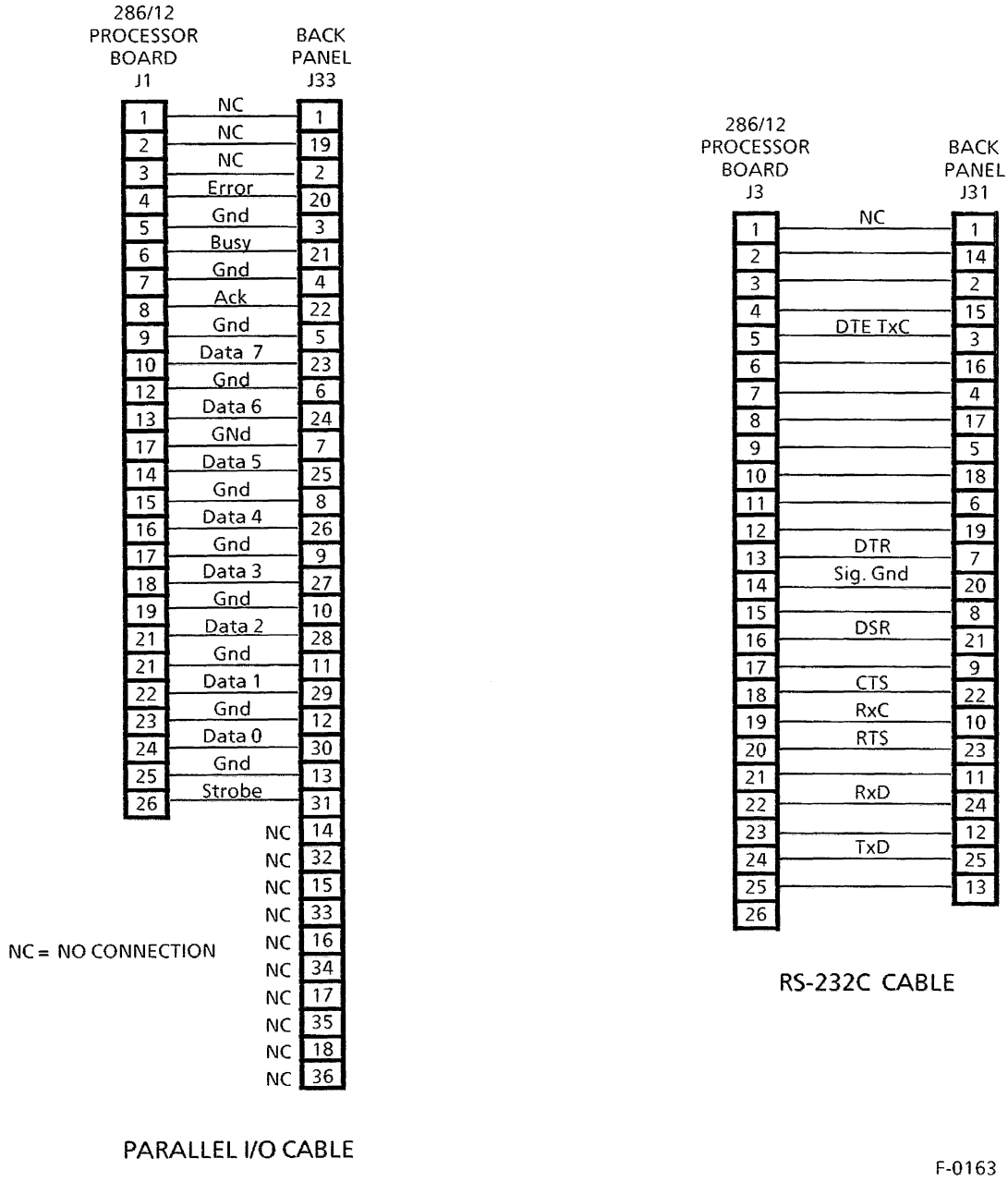

Figure 4-1. iSBC® 286/12 Processor Subsystem Interconnect Diagrams

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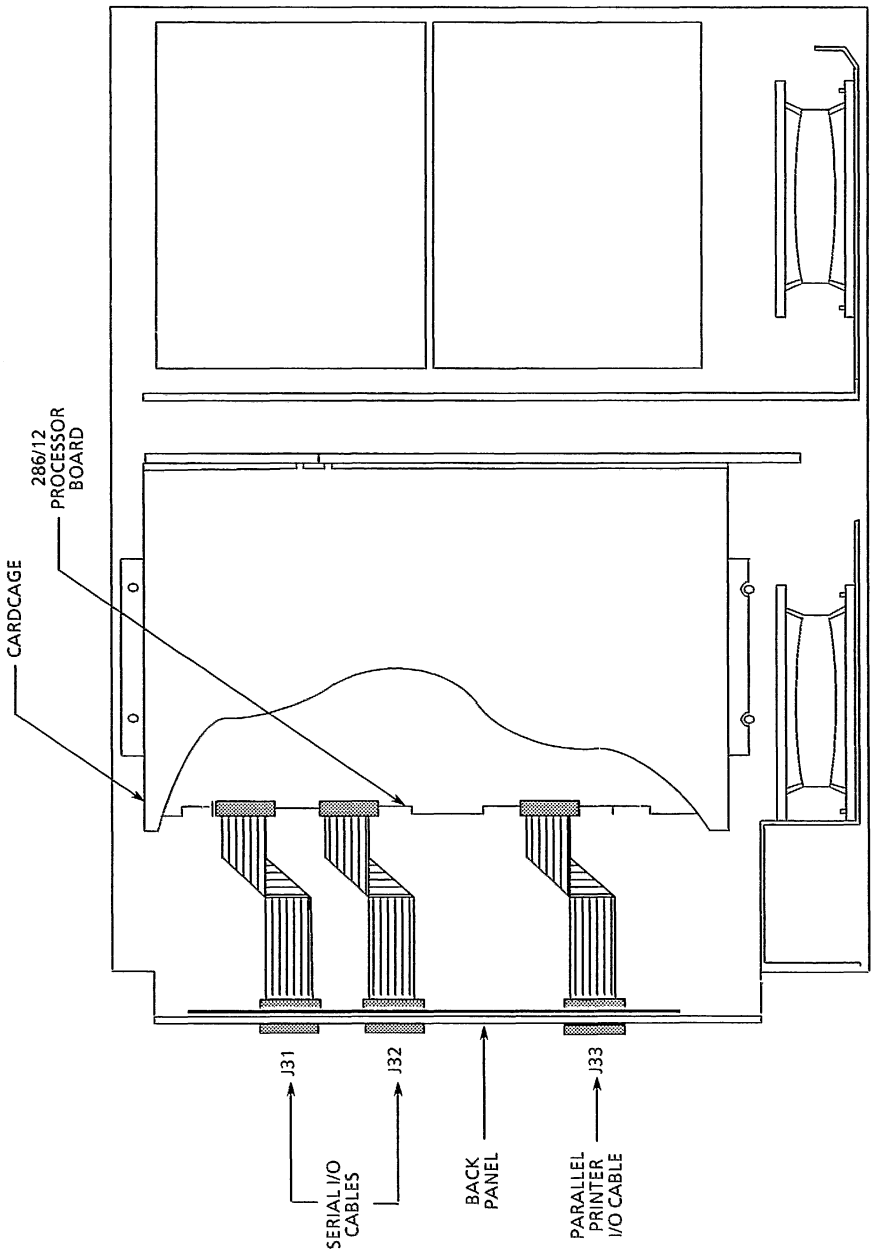

Figure 4-2. iSBC® 286/12 Processor Cabling Locations

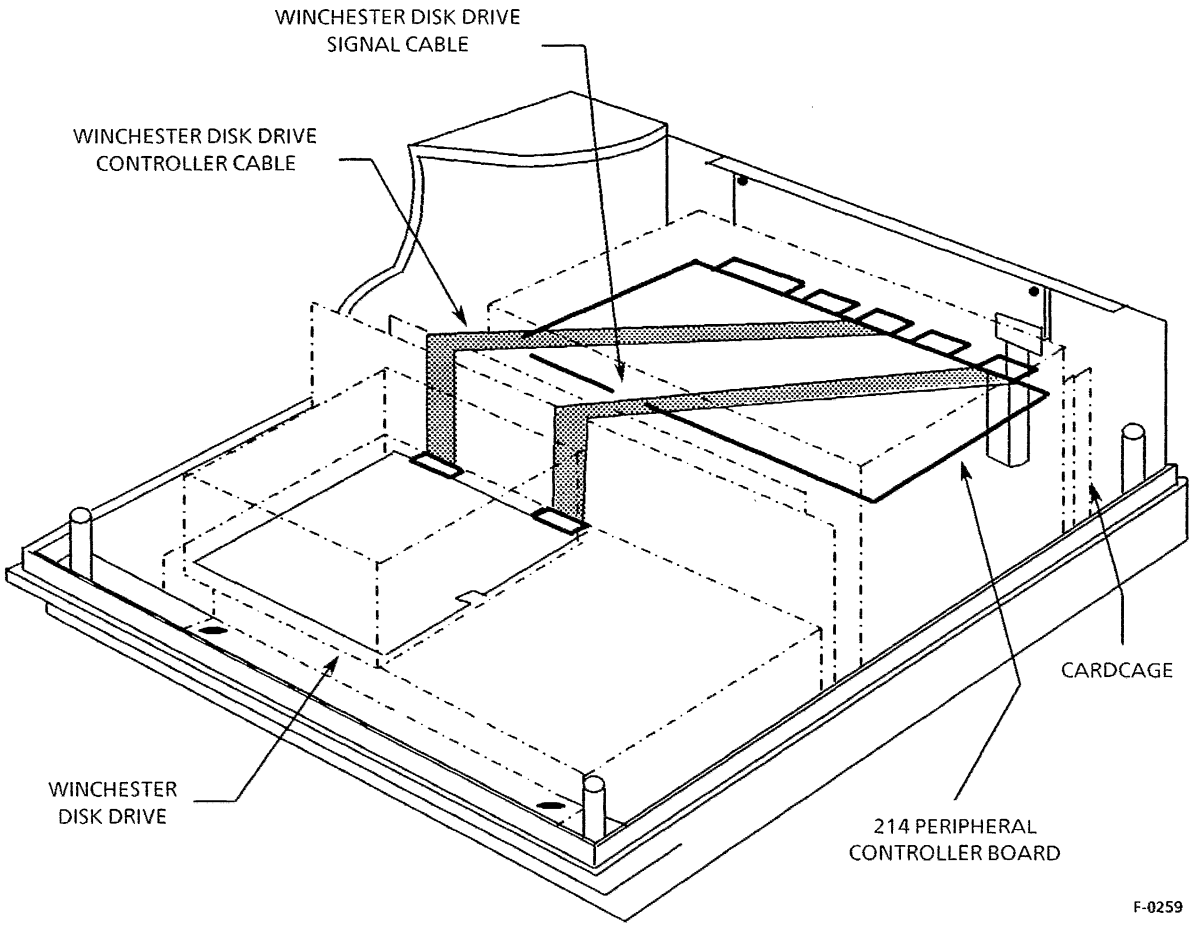

Figure 4-3. Winchester Disk Drive Subsystem Component Locations

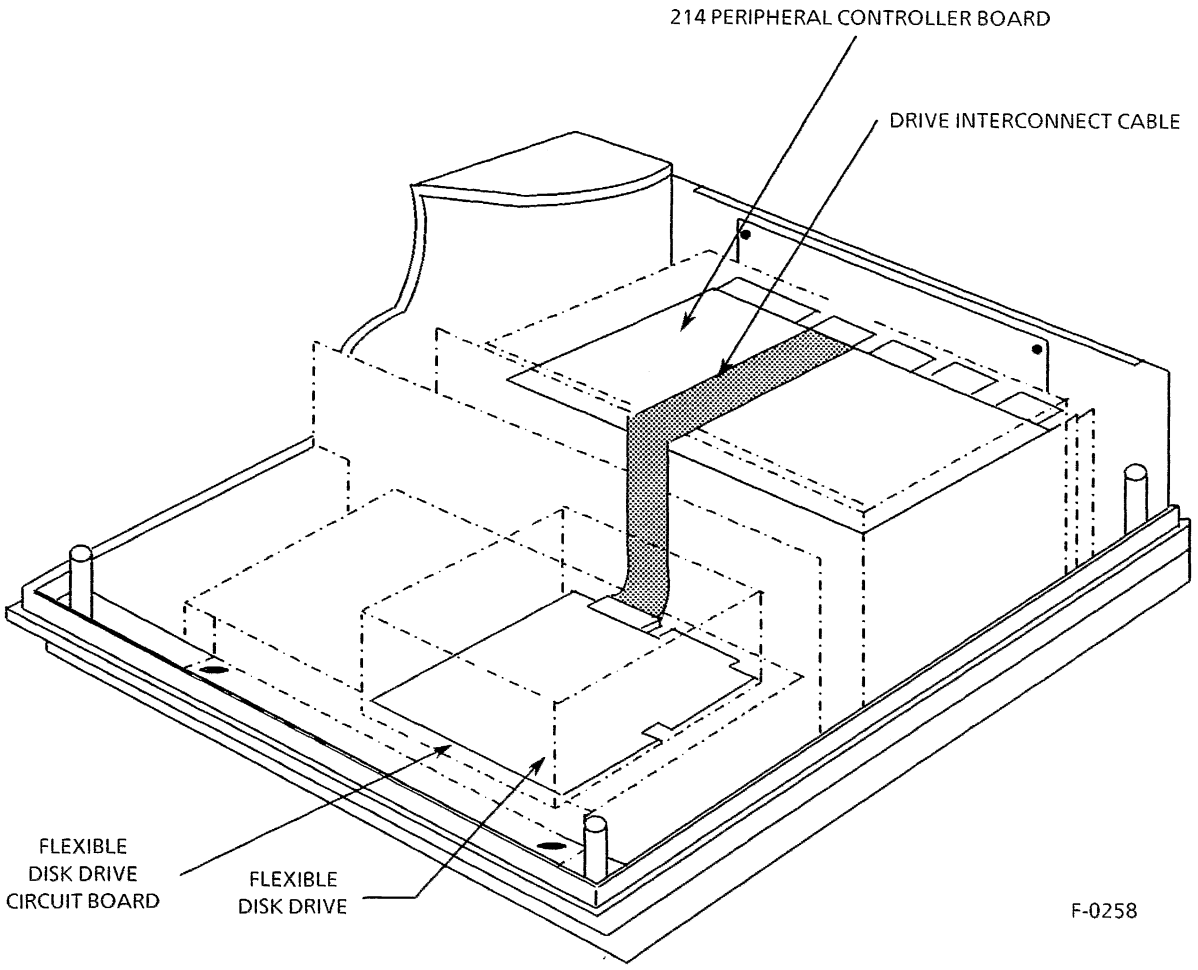

Figure 4-4. Flexible Disk Drive Subsystem Component Locations

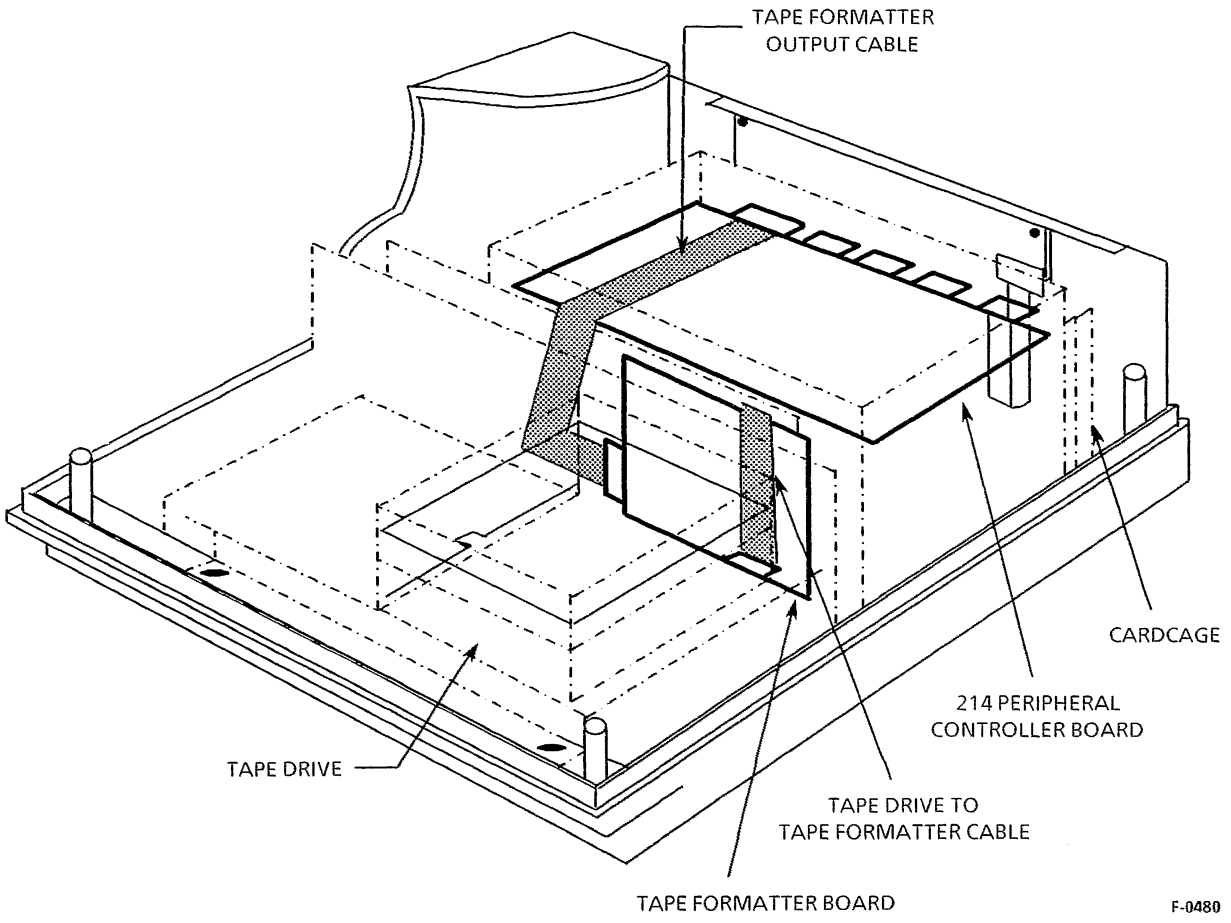

Figure 4-5. Tape Drive Subsystem Components Location

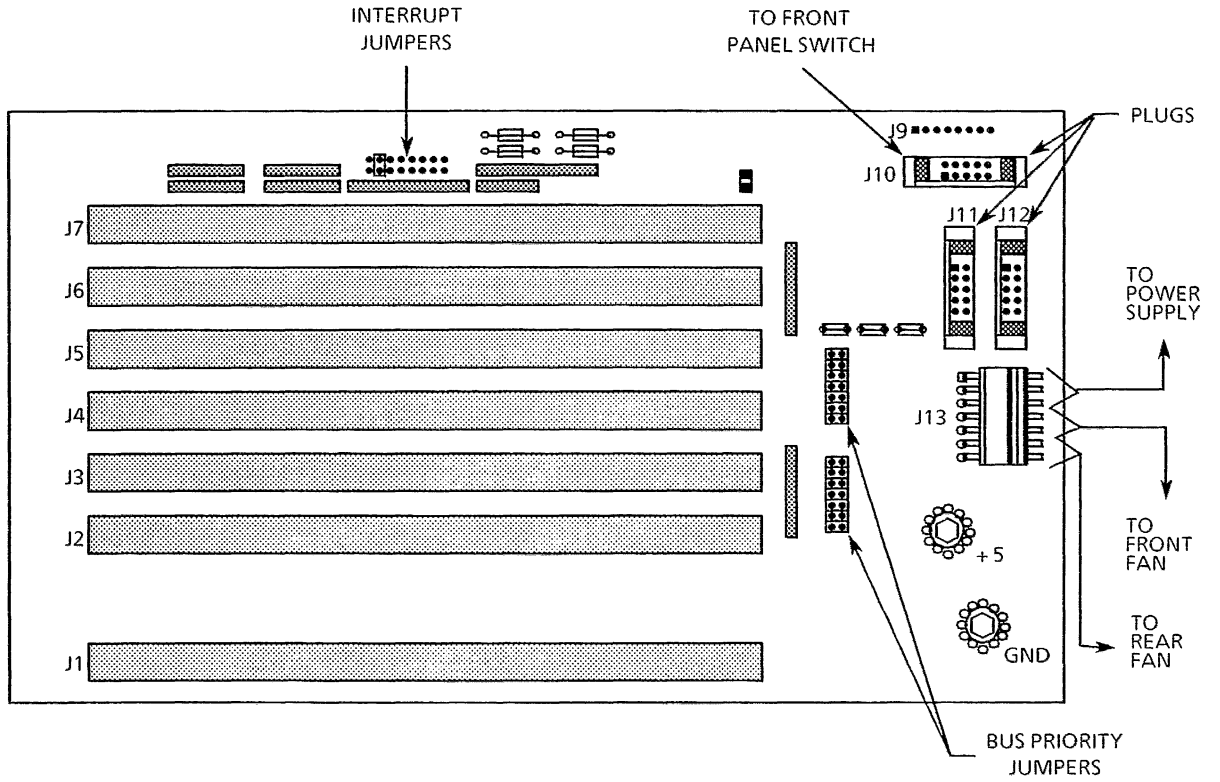

Figure 4-6. System Backplane Components Locations

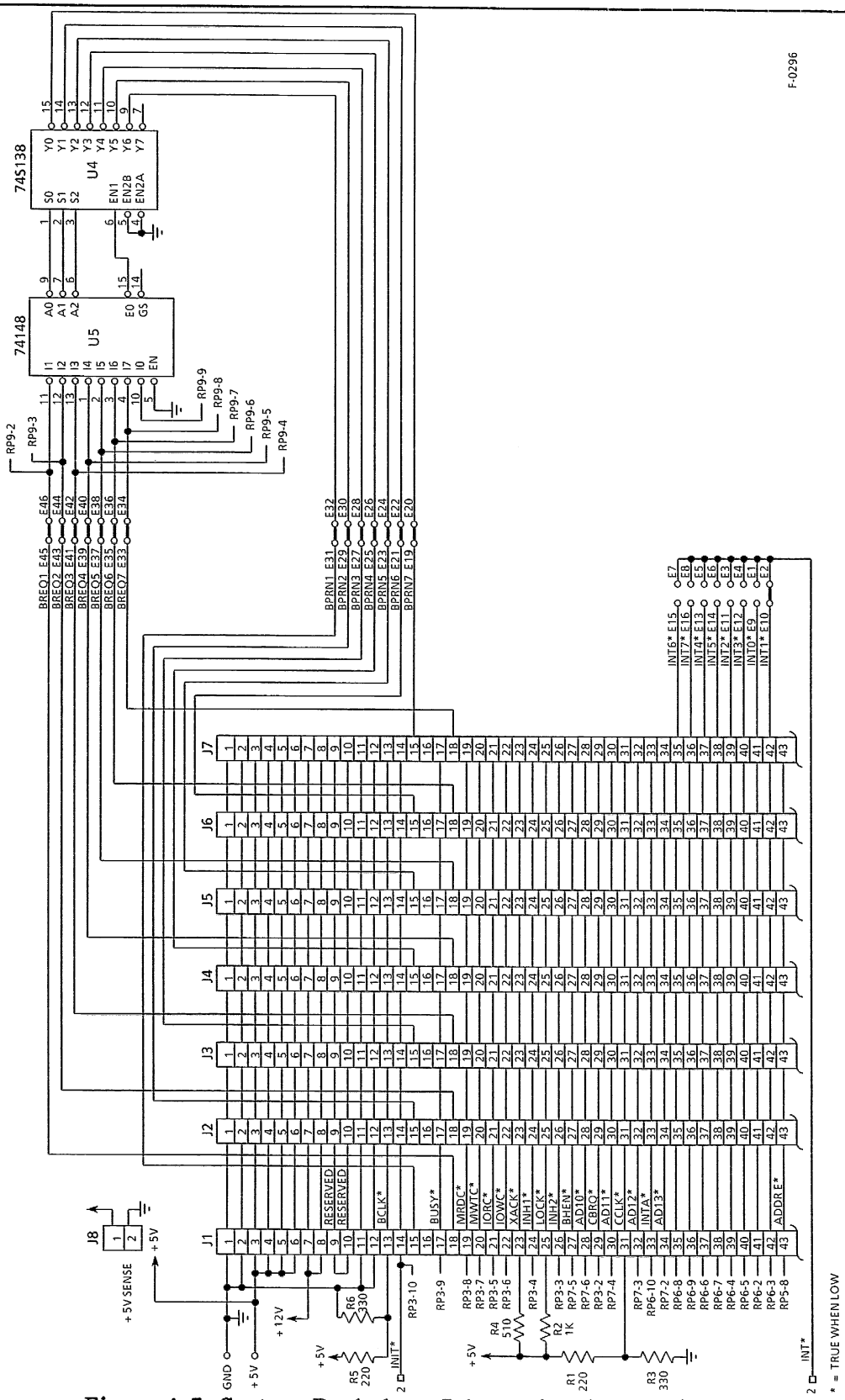

Figure 4-7. System Backplane Schematic Diagram (Sheet 1)

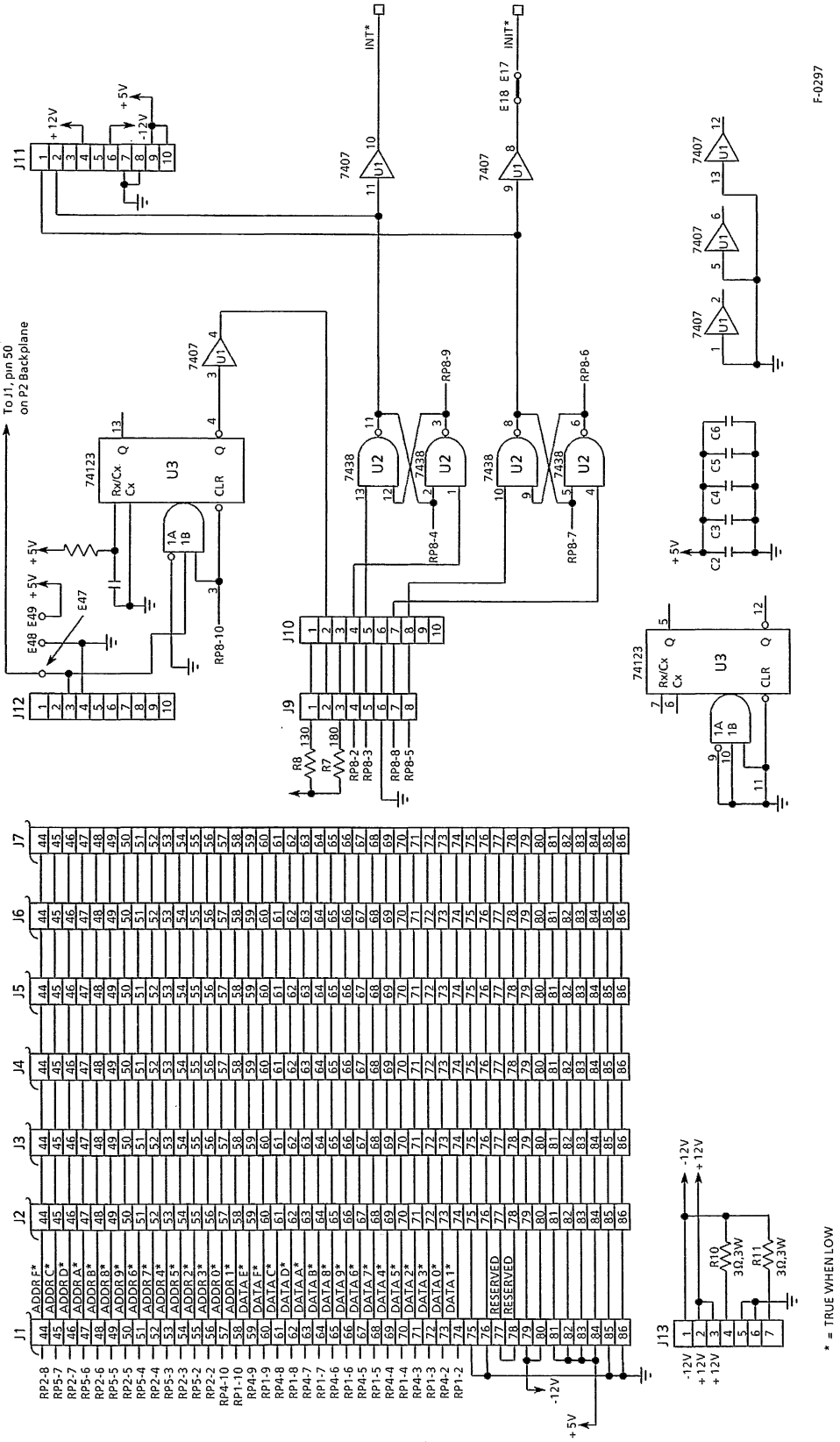

Figure 4-8. System Backplane Schematic Diagram (Sheet 2)

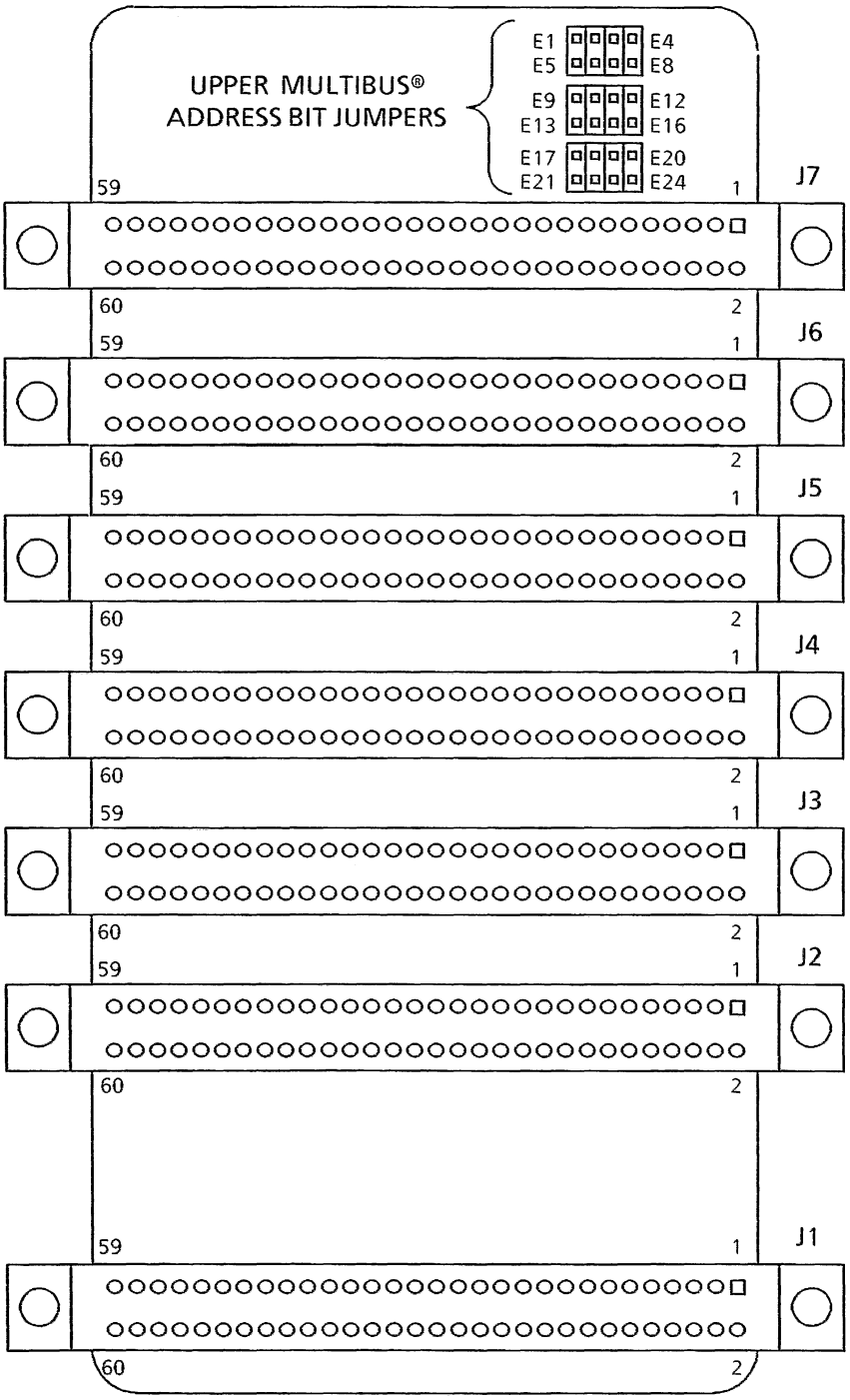

Figure 4-9. P2 Backplane Component Locations

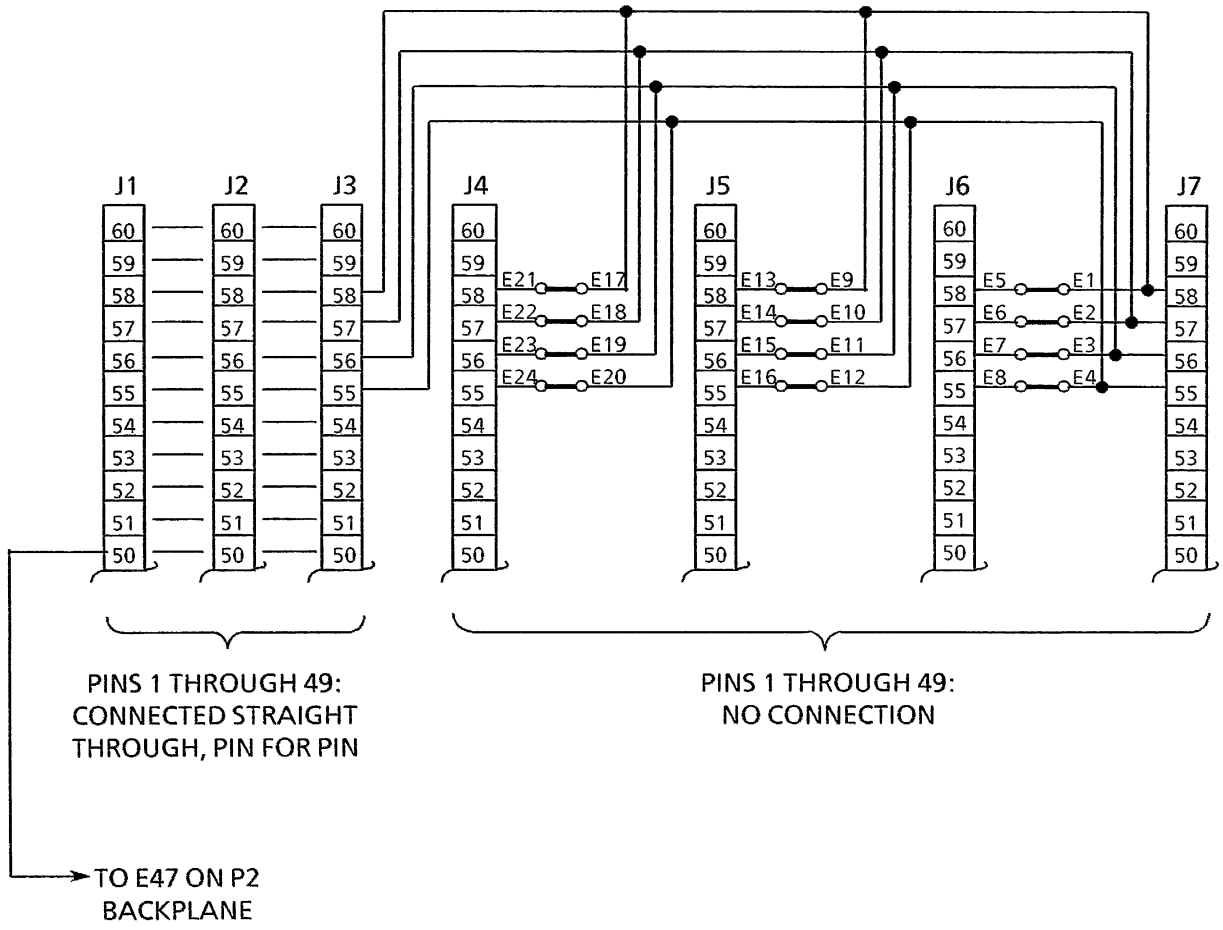

Figure 4-10. P2 Backplane Schematic Diagram

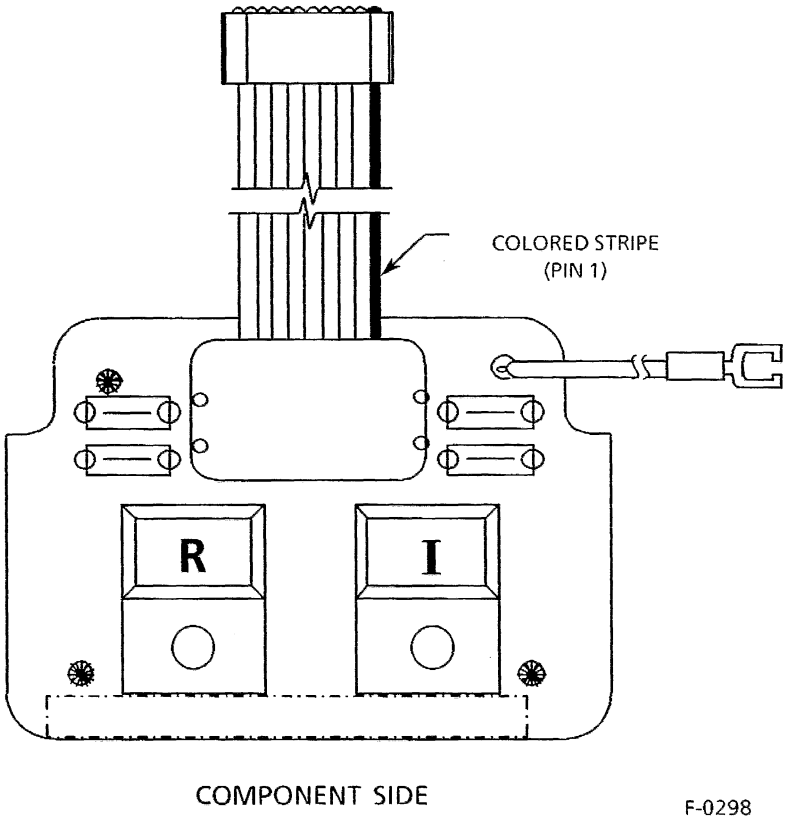

Figure 4-11. Front Panel Circuit Board Component Locations

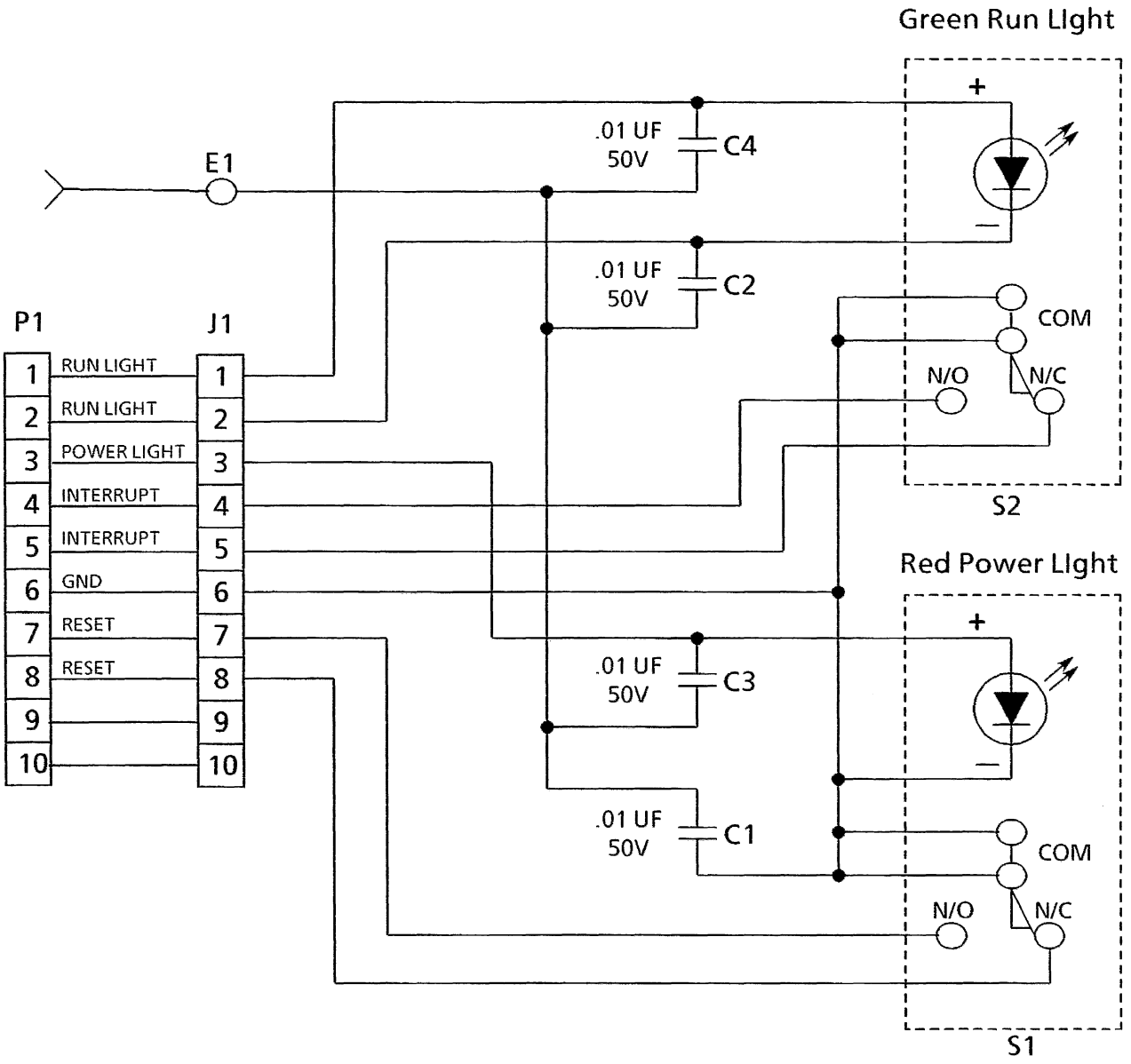

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Figure 4-12. Front Panel Circuit Board Schematic Diagram

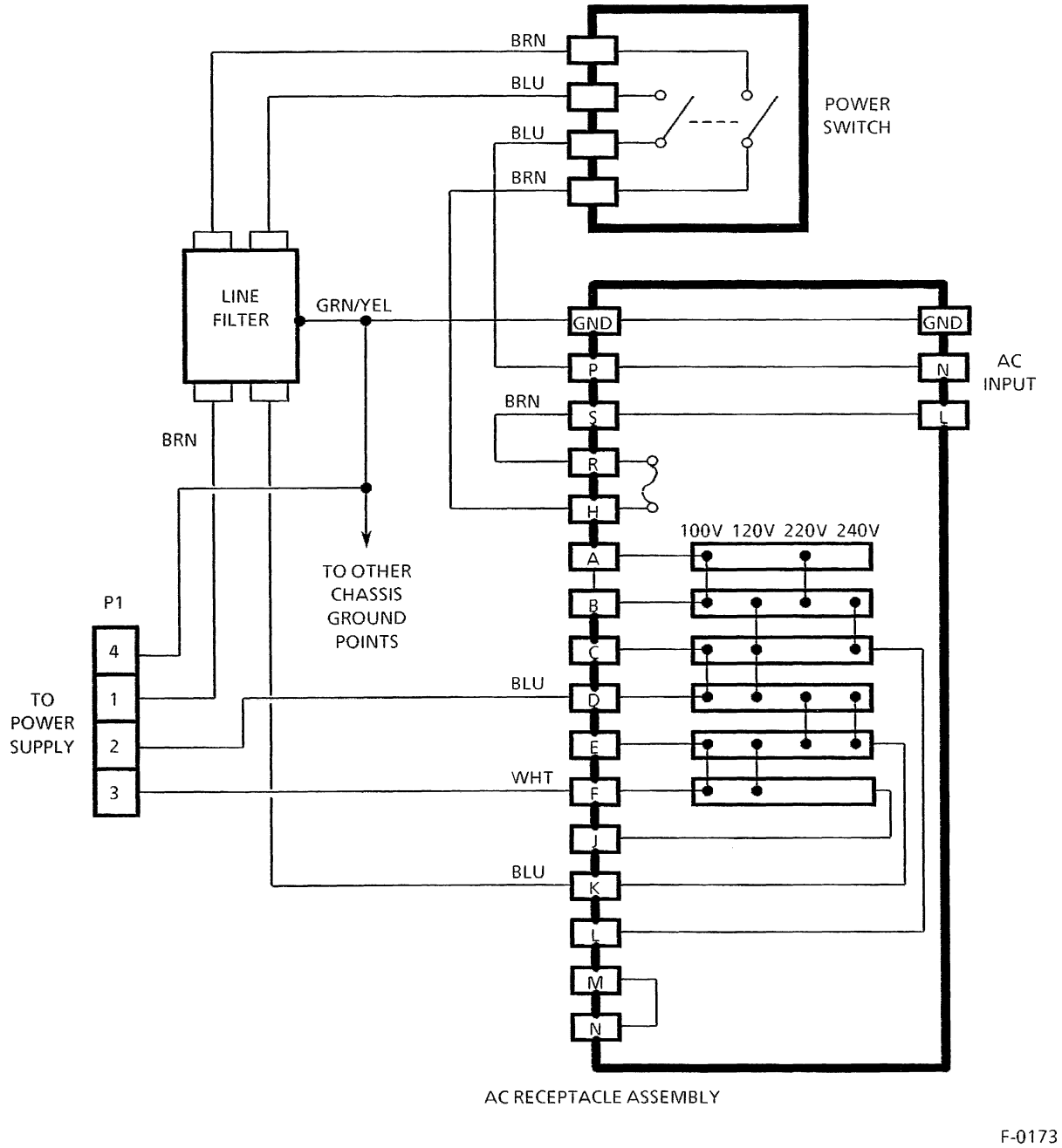

Figure 4-13. AC Power Distribution Diagram

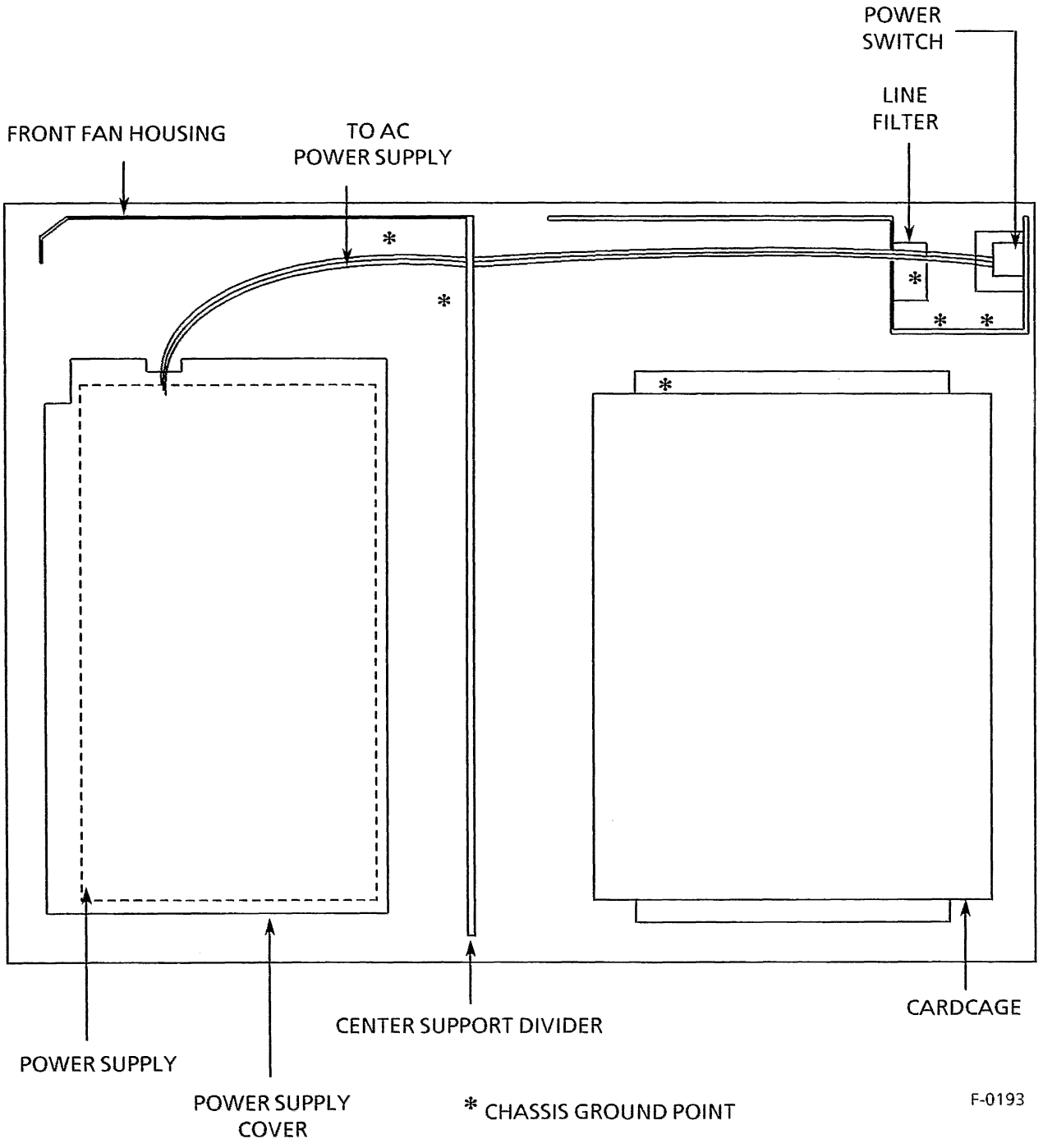

Figure 4-14. AC Power Distribution Component Locations

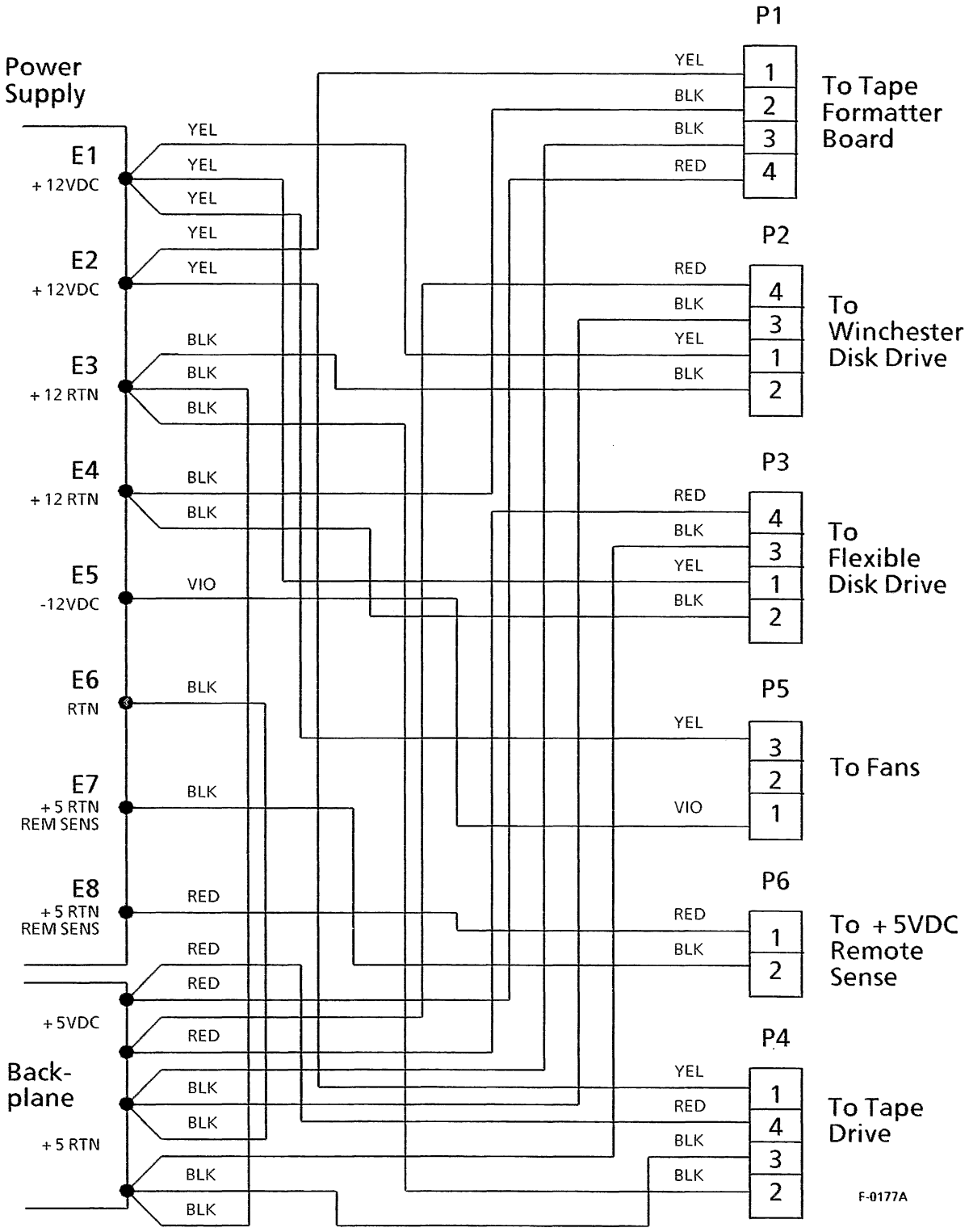

Figure 4-15. DC Power Distribution Interconnect Diagram

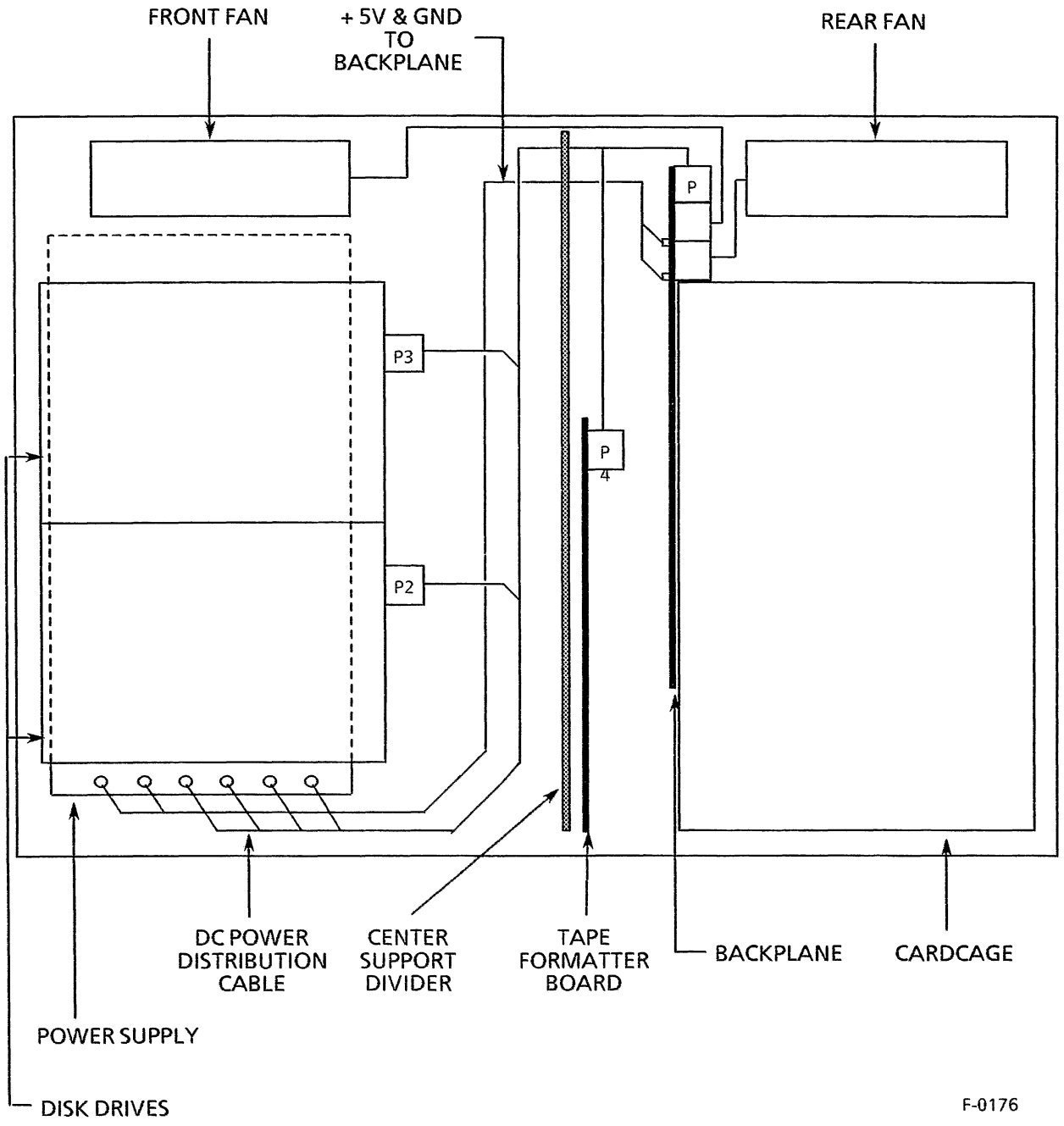

Figure 4-16. DC Power Distribution Component Locations

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APPENDIX A
STANDARD SYSTEM CONFIGURATION

This appendix contains the jumper settings for standard system components. It is intended as a quick reference for checking that jumpers and other configuration options are properly set. For more complete information, see the manuals listed in Appendix D.

iSBC® 286/12 Jumper Configurations for 310AP Installation

The following jumpers must be installed on the iSBC 286/12 processor board in the System 310AP. This table includes the changes that cause the P2 connector to operate in synchronous mode and the board to recognize the 80287 coprocessor.

For complete 286/12 board configuration information, see the hardware reference manual listed in Appendix D of this manual.

From-To	From-To	From-To	From-To
E5-E6	E9-E15	E11-E17	E12-E18
E19-E20	2E4-E25	E28-E29	E32-E33
E36-E37	E40-E41	E44-E45	E48-E49
E52-E53	E56-E57	E63-E64	E77-E97
E79-E99	E80-E100	E81-E101	E84-E104
E85-E105	E86-E106	E87-E107	E88-E108
E89-E109	E90-E110	E91-E111	E92-E112
E93-E113	E94-E114	E95-E115	E98-E118
E102-E122	E103-E123	E116-E117	E127-E132
E128-E133	E136-E137	E142-E143	E146-E147
E152-E153	E156-E158	E159-E160	E161-E162
E167-E168	E171-E172	E173-E174	E175-E176
E179-E180	E182-E183	E184-E185	E187-E189
E188-E190	E196-E208	E197-E210	E205-E218
E206-E219	E207-E220	E211-E224	E212-E225
E213-E226	E214-E215	E227-E228	E229-E230
E231-E232	E243-E244	E245-E246	E247-E248

iSBC® 214 Jumper Configurations

The 214 board is configured for use in the 310AP as it is shipped from the factory, that is, with the factory default jumpers installed. These default jumpers are listed below for quick reference; for complete configuration information, see the hardware reference manual listed in Appendix D of this manual.

From-To	From-To	From-To
E2-E3	E4-E5	E11-E12
E15-E16	E17-E18	E20-E21
E22-E23	231-E33	E36-E37
E38-E39	E57-E58	E75-E76
E77-E78	E79-E80	E82-E83
E86-E87	E89-E90	E91-E92
E93-E94	E98-E99	E101-E102
E103-E104	E105-E106	E111-E112
E113-E114	E115-E116	E117-E118
E119-E120	E121-E122	E126-E129
E135-E138	E137-E140	E142-E143
E144-E145		

NOTE

Three jumpers--E25-E26, E27-E28, and E29-E30--are used for calibration purposes at the factory and are board-specific. They should not be changed.

iSBC® 188/48 Jumper Configurations

The 188/48 board is configured for DCE use in the 310AP. These default jumpers are listed below for quick reference; for complete configuration information, see the hardware reference manual listed in Appendix D of this manual.

From-To	From-To	From-To	From-To	From-To
E9-E344	E10-E11	E12-E13	E17-E19	E18-E20
E21-2E3	E22-E24	E25-E27	E26-E28	E29-E31
E32-E34	E36-E37	E38-E40	E39-E41	E42-E44
E43-E45	E46-E48	E47-E49	E50-E52	E53-E55
E57-E58	E67-E69	E68-E70	E71-E73	E72-E74
E75-E77	E76-E78	E79-E81	E82-E84	E85-E86
E88-E90	E89-E91	E92-E94	E93-E95	E96-E98
E97-E99	E100-E102	E103-E105	E106-E107	E109-E110
E119-E121	E120-E122	E123-E125	E124-E126	E127-E129
E128-E130	E131-E133	E134-E136	E137-E138	E140-E142
E141-E143	E144-146	E145-E147	E148-E150	E149-E151
E152-E154	E155-E157	E159-E160	E164-E165	E168-E169
E172-E174	E173-E175	E176-E178	E177-E179	E180-E182
E181-E183	E184-E186	E187-E189	E198-E199	E202-E204
E203-E205	E206-E208	E207-E209	E210E-212	E211-E213
E214-E216	E217-E219	E220-E227	E224-E225	E226-E234
E231-E232	E242-E243	E246-E247	E248-E249	E251-E252
E253-E254	E255-E256	E260-E261	E264E-265	E277E-278
E280-E281	E282E-283	E284-E285	E287-E288	E290-E291
E292-E293	E294-E295	E296-E297	E298-E299	E300-E301
E307-E308	E315-E316	E317-E318	E324-E325	E326-E327
E328-E329	E333-E334	E335-E336	E348-E349	E351-E352

iSBC® 544A Jumper Configurations

The 544A board is configured for use in the 310AP. The default jumpers configure the 544A board for use with the XENIX operating system. The tables below show the default configuration and the changes required for use with the iRMX operating system and multiple boards. For complete configuration information, see the hardware reference manual listed in Appendix D of this manual.

Default Configuration

From-To	From-To	From-To	From-To
E2-E4	E6-7E	E9-E11	E13-E14
E16-E18	E20-E21	E23-E25	E27-E28
E29-E30	E32-E33	E38-E39	E41-E42
E43-E44	E45-E46	E47-E48	E49-E50
E51-E108	E53-E54	E55-E56	E57-E58
E59-E60	E61-E62	E63-E64	E65-E66
E67-E68	E70-E71	E72-E73	E80-E85
E92-E93	E94-E95	E96-E97	E98-E99
E100-E101	E104-E105		

Jumper Changes for Multiple 544A Boards in a Standard XENIX System

Jumper changes for multiple 544A boards in a XENIX system are listed below. These are the only changes required to use the board as a second or third communications controller in a standard XENIX configuration.

Sequence of Boards	Hex Address	Action Required
First Board	FE000:0	None
Second Board	FE400:0	Remove E96 - E97
Third Board	FE800:0	Remove E98 - E99

Jumper Changes for the iRMX™ 86 Operating System

Jumper changes for the iSBC 544A board in an iRMX 86 configuration are listed below.

Remove	Install
E59-E60	E59-E112
E61-E62	E61-E113
E63-E64	E63-E114
E65-E66	E65-E115
E72-E73	

Jumper Changes for Multiple 544A Boards in a Standard iRMX™ 86 System

Jumper changes for multiple 544A boards used in an iRMX 86 system are listed below. Make sure the boards are configured as above for iRMX 86 operation before making these changes.

Sequence of Boards	Hex Address	Action Required
First Board	E000:0	None
Second Board	E400:0	Remove E96 - E97
Third Board	E800:0	Remove E98 - E99

iSBC®552 OpenNET™ / Ethernet Board Jumper Configuration

This list describes the 552 board configured specifically for use in the System 310AP. You don't need to make these jumper changes; the changes are made at the factory to the default settings on the board. This list is for reference only.

Install	Install
E1-E2	E5-E6
E7-E8	E11-E12
E13-E14	E17-E18
E19-E20	E23-E24
E50-E65	E61-E76
E62-E67	E63-E78
E64-E79	E66-E81
E67-E82	E68-E83
E69-E84	

Remove
E42-E56
E55-E70
E104-E110

iSBC® EX Memory Jumper Configuration

If your system has expanded memory, it contains an iSBC 010, 020, or 040 EX RAM board. For your reference only, we've listed the default jumpering for these boards. If you add another EX board to the system, you must consult the memory board reference manual for configuration information.

From-To	From-To	From-To
E13-14	E15-16	E17-18
E23-24	E35-36	E45-46
E51-52	E55-56	E57-58
E60-61	E62-63	E66-68

System Backplane Jumper Configurations

In all System 310APs, install jumpers on the system backplane at the following locations.

From-To	From-To	From-To
E2-E10	E19-E20	E21-E22
E23-E24	E25-E26	E27-E28
E29-E30	E31-E32	E33-E34
E35-E36	E37-E38	E39-E40
E41-E42	E43-E44	E45-E46

P2 Backplane Jumper Configurations

In most System 310APs (non-NRM versions), install jumpers on the P2 backplane at the following locations.

From-To	From-To	From-To
E1-E5	E2-E6	E3-E7
E4-E8	E9-E13*	E19-E23*
E10-E14*	E11-E15*	E12-E16*
E17-E21*	E18-E22*	E20-E24*

* In NRM versions of the System 310AP, these jumpers should be removed.

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APPENDIX B
SPECIFICATION

This appendix lists the environmental, electrical, and physical specifications for the System 310AP.

Table B-1. Environmental Specifications

Characteristic	Limits
Temperature	
System operating, flexible disk installed	10° to 35°C (50 to 95°F)
System not operating	
Flexible disk installed	10° to 51°C (50 to 124°F)
No flexible disk installed	-34° to 60°C (-29° to 140°F)
Humidity (system operating)	
Relative humidity	20% to 80% (noncondensing)
Maximum wet bulb	26°C (78.8°F)
Altitude	
System operating	0 to 2,438 m (8,000 ft)
System not operating	0 to 12,192 m (40,000 ft)
Shock	
System operating	1.0 G
System not operating	30.0 G
Vibration	
Flexible disk drive-based systems	
System operating	
5 to 25 Hz	0.036 mm (0.0014 in.) peak to peak
25 to 55 Hz	0.018 mm (0.0007 in.) peak to peak
55 to 300 Hz	0.36 G
System not operating	
5 to 25 Hz	0.20 mm (0.008 in.) peak to peak
25 to 55 Hz	0.10 mm (0.004 in.) peak to peak
55 to 300 Hz	2.0 G
Winchester disk drive-based systems	
System operating	1.0 G
System not operating	20.0 G

Table B-2. AC Electrical Specifications

Characteristic	Limits
Voltage range and maximum current	88 to 132 VAC, 7A 176 to 264 VAC, 4A
Frequency	47 to 63 Hz
Maximum power consumption	600W
Fuses Minimum Branch Circuit Fusing	10A (88 to 132 VAC) 6A (176 to 264 VAC) 15A

Table B-3. DC Power Supply Specifications

Characteristic	Limits
Voltage and maximum current +5 VDC output +12 VDC output -12 VDC output	 4.75 to 5.25 VDC, 45.0A 11.4 to 12.6 VDC, 8.0A -11.4 to -12.6 VDC, 2.5A
Maximum total output power	360W

Table B-4. Physical Specifications

Characteristic	Limits
Height	165 mm (6.5 in.)
Width	451 mm(17.75 in.)
Depth	518 mm (20.5 in.)
Weight	22.7 kg (50 lb) average

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APPENDIX C
INSTALLING THE SYSTEM IN A RACK

The system can be installed in a standard 19-inch EIA equipment rack that has Chassis Trak 300S nonpivoting rack slides (or the equivalent).

WARNING

Rack-mounting the system requires removing the system's top cover. This permits direct access to hazardous voltages. Accidental contact with these voltages may result in severe electrical shock or death. Only a qualified technical person should do this procedure.

NOTE

If you remove the system from an equipment rack and install it in a floorstand, make sure the rubber pads are installed on the bottom of the system.

Step	Installing the System in an Equipment Rack
1	Remove the top cover as described in Chapter 3.
2	Remove the mounting bars from the Chassis Trak Slides as described in this appendix.
3	Mount the system in the rack as described in this appendix.

Step	Removing Mounting Bars from the Chassis Trak Slides
	The Chassis Trak slide consists of two parallel tracks, each having two telescoping bars. These bars extend to let you slide the system out easily after it is mounted. The innermost of the two telescoping bars is called the mounting bar.
1	Each mounting bar is held in place, when fully extended, by a spring lock. Pull each bar outward from the track until the bar locks into place.
2	Press the spring-lock (where it comes through the slide) and remove the bar by pulling it straight out from the slide.
3	Set the bar aside; repeat this procedure to remove the other mounting bar.

Step	Mounting the System in the Rack
	Each mounting bar is 16½ inches long and 1½ inches high with five holes, two of which line up with the mounting holes in the side of the chassis. Tools and hardware and needed: • 4 #10 slotted pan head screws -- maximum length 9/16 inch • 4 #10 machine screw nuts • 1 screwdriver **WARNING** Do not use screws longer than 9/16 inch. Longer screws may touch system wiring and cause electrical shock.
1	Figure 4 shows steps A and B: **A.** To attach the mounting bars to the sides of the system, place the #10 machine screw nuts in the nut holders located inside the system chassis. Position one of the bars against the side of the system and pass the screws through the bar as shown in Step A. **B.** Tighten the screws until the bar is secure. Repeat steps A and B to mount the other bar on the opposite side.
2	Replace the top cover on the system. Lower the cover over the chassis, slightly forward of the drives, then slide it back into place. Replace the two screws that hold the top cover to the back panel (upper left and right corners of back panel). Tilt the system on its side, and replace the four screws in the bottom of the chassis. Carefully lower the system back down.
3	Extend the telescoping bars from the Chassis Trak slides and make sure they lock into place.

Step	Mounting the System in the Rack (Continued)
4	**C.** As shown in Figure 4, lift the system and slide it into the extended bars of the Chassis Trak slides. Slide it into the track until it locks into place. Then push it in as far as it will go.

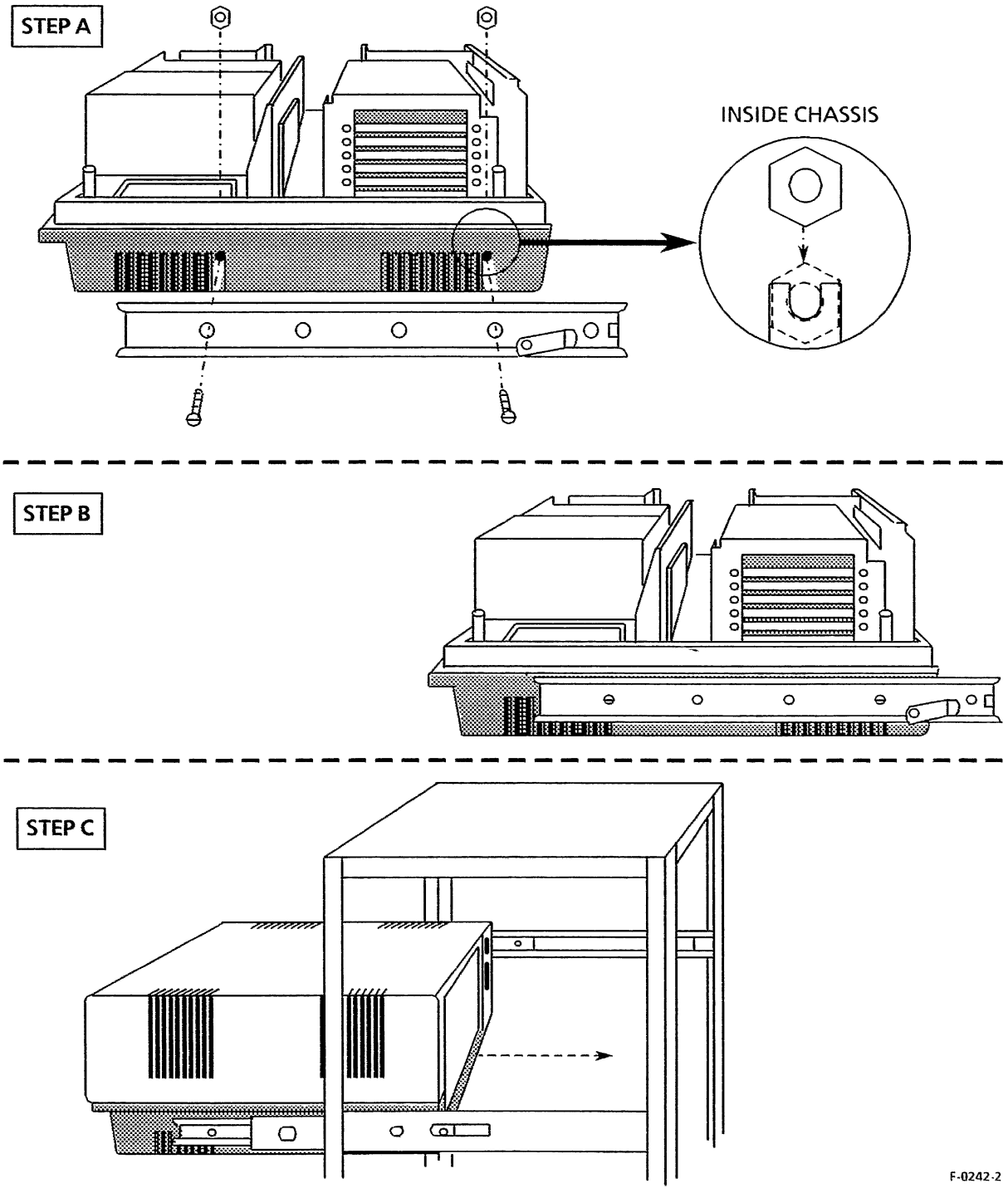

Figure 4. Installing the System in a Rack

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APPENDIX D
SERVICE INFORMATION

Customer Support Service Engineering provides both a Return Replacement Authorization (RRA) and Direct Return Authorization (DRA) service.

The RRA service provides replacement of a defective product. Return the defective product to Intel, freight prepaid. Intel will replace the product. This service is not offered on all products, is subject to availability, and is available only to customers in a non-serviceable area. Intel expects to ship 90% of these products within 48 hours of receiving the defective product.

The DRA service provides repair work. Return the defective product to Intel, freight prepaid. Intel will repair and test the product and update the product with all mandatory Engineering Change Orders. The product serial number will not change. Normal turn around time is four to six weeks.

Determine which service will be needed. Before calling Customer Support Service, have the following necessary information ready:

a. Name and serial number of the system.

b. Purchase order number for repair and shipping charges.

c. If it is a warranty repair, the proof of purchase showing the system was received within 90 days of the service request date. Without proof, services will be billed at the current rate.

d. Your shipping and billing address.

e. Your contact name and telephone number.

In correspondence with Customer Support Service, reference the authorization number on the packing slip, the purchase order, and other related documents.

Before shipping remove all user modifications. Protect the equipment from damage by using the following guidelines for shipping:

a. Use the original factory packing material, if available.

b. Allow room in the box for protective padding, for example, flow pack, foam, etc.

c. Write the return authorization number on the outside of the box and label the box "FRAGILE."

NOTE

Damage sustained due to the lack of compliance in safe return packaging could result in extra repair charges.

d. Forward the product and all correspondence to:

Intel Corporation
Customer Support Marketing Administration
Billing Department - DV-1-704
2402 W. Beardsley Road
Phoenix, Arizona 85027
Authorization #_____

Obtaining RRA or DRA Service

In the United States or Canada call:

1-602-869-4862 or
1-602-869-4838

In Western Europe and Israel, contact your local sales office.

IN countries not mentioned above, send a Telex to:

ATT: CSO Marketing Administration
TLX: 910-951-1330

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APPENDIX E
RELATED PUBLICATIONS

The publications listed here give information about the System 310AP and Intel products in general. The *System 310AP Owner's Manual* and the *System 310AP Hardware Maintenance Manual* are the only publications shipped with the system. All other items must be ordered from the following address:

Intel Corporation
Literature Department
3065 Bowers Avenue
Santa Clara, CA 95051

System 310AP and Related Products

System 310AP Owner's Manual, Order Number 175425

System 310AP Hardware Maintenance Manual, Order Number 175426

iSBC 286/12 Single Board Computer Hardware Reference Manual, Order Number 147533

iSBC 214 Peripheral Controller Hardware Reference Manual, Order Number 134910

iSBC 012/010/020/040 EX RAM Boards Hardware Reference Manual, Order Number 147783

Intel MULTIBUS Specification, Order Number 980683

iMDDX Diagnostic Executive User's Guide, Order Number 176211

iMDDX Diagnostic Test Developer's Guide, Order Number 174033

iSDM 286 System Debug Monitor Reference Manual, Order Number 145804

iSBC 552 Ethernet Communications Controller Hardware Reference Manual, Order Number 122141

iSBC 544 Intelligent Communications Controller Board Hardware Reference Manual, Order Number 9800616

iSBC 544A Intelligent Communications Controller Addendum to 544 Board Hardware Reference Manual, Order Number 134960

iSBC 188/48 Advanced Communicating Computer Hardware Reference Manual, Order Number 146218

General Information about Intel Products

Literature Guide, Order Number 210621--a free bimonthly list of available Intel publications, including manuals, handbooks, and brochures, plus some books available from commercial publishers.

OEM Systems Handbook, Order Number 210941

Microsystem Components Handbook, Order Number 230843

Software Handbook, Order Number 230786

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