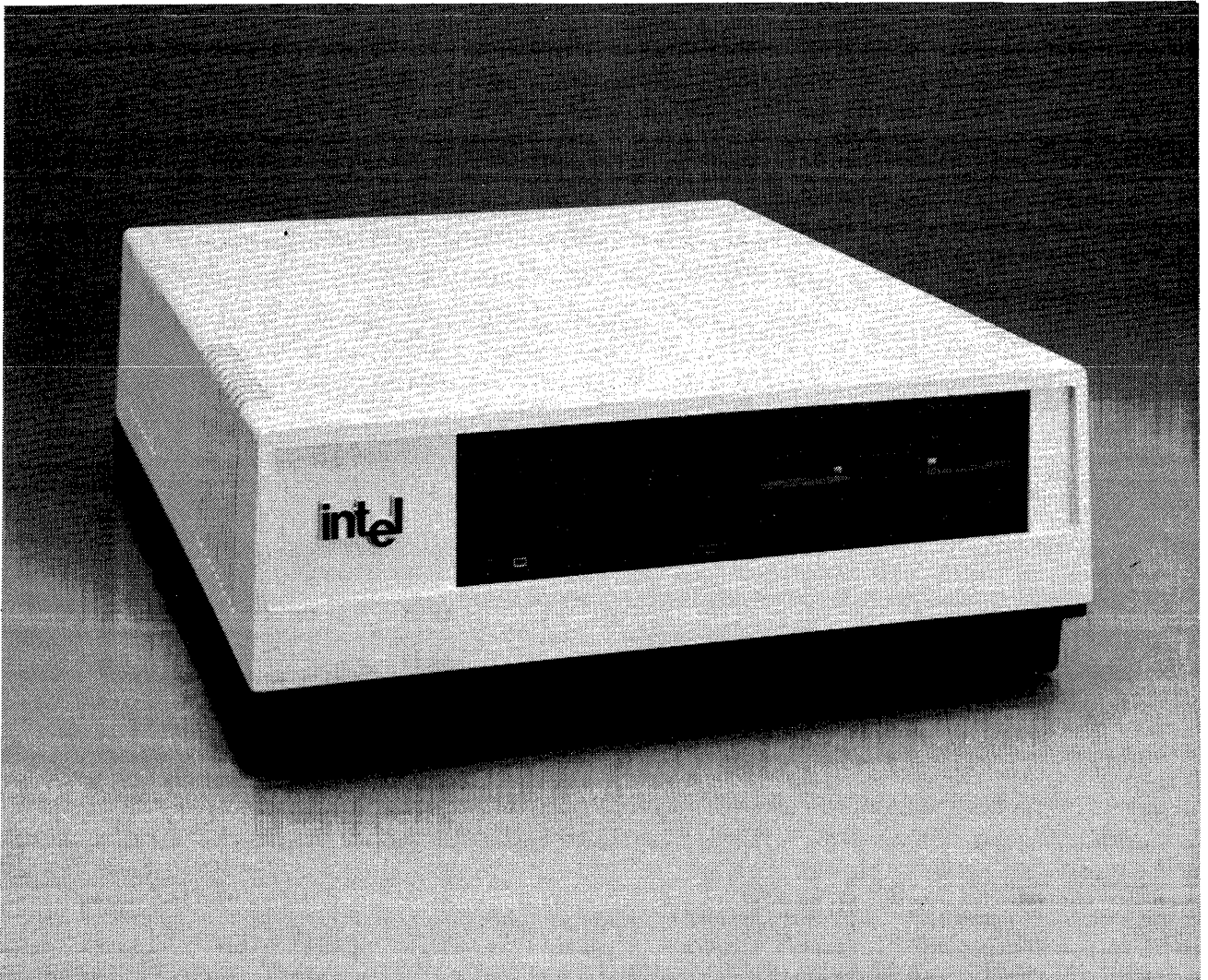




SYSTEM 310 HARDWARE MAINTENANCE MANUAL



SYSTEM 310 HARDWARE MAINTENANCE MANUAL

Order Number: 173208-001

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This manual contains information that is necessary for servicing the Intel System 310 Microcomputer at the field-replaceable module level. It is intended to be used by qualified service technicians who have a basic understanding of computer science and electronics. Except where it is necessary to show how the various components function together as a system, this manual contains no detailed circuit-level information. For detailed information on most modules, you must refer to the hardware reference manuals listed below under "Related Publications." Briefly, the topics of the chapters are as follows:

- Chapter 1 describes the components of the System 310 and shows how they function together as a system. It also lists the system specifications.
- Chapter 2 contains preventive maintenance procedures and troubleshooting information.
- Chapter 3 contains removal and replacement procedures for field-replaceable components.
- Chapter 4 contains a parts list, schematics, and interconnecting wiring diagrams.
- Appendix A describes the factory-standard versions of the System 310 and it provides jumper settings and other configuration information for major system components.

RELATED PUBLICATIONS

The following documents contain additional information about the System 310:

System 310 Publications Guide, Order Number 173441

Introduction to the System 310 Microcomputer, Order Number 173202

System 310 Installation and Operation Guide, Order Number 173211

System 310 Hardware Integration Guide, Order Number 173203

System 310 Memory Configuration Guide: 86-Based Systems, Order Number 173206

System 310 Memory Configuration Guide: 286-Based Systems, Order Number 173443

System 310 Processor Configuration Guide: iSBC® 86/30 Single Board Computer, Order Number 173205

System 310 Processor Configuration Guide: iSBC 286/10 Single Board Computer, Order Number 173442

System 310 Disk Configuration Guide, Order Number 173201

The following manuals contain detailed information on certain components of the System 310:

iSBC 86/14 and iSBC 86/30 Single Board Computer Hardware Reference Manual, Order Number 144044

Guide to Using the iSBC 286/10 Single Board Computer , Order Number 146271

iSBC 012B Technical Manual, Order Number 112748

iSBC 028CX/056CX/012CX RAM Boards Hardware Reference Manual, Order Number 145158

iSBX™ 218A Flexible Disk Controller Hardware Reference Manual, Order Number 121583

iSBC 215 Generic Winchester Controller Hardware Reference Manual, Order Number 144780

i213A 5¼" Winchester Disk Data Separator Hardware Reference Manual, Order Number 133144

The following documents contain information on general subjects related to the System 310:

OEM Systems Handbook, Order Number 210941

Intel MULTIBUS® Specification, Order Number 9800683



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This chapter is an introduction to the System 310. It contains an overview that describes the components of the System and explains how those components function together as a system. In addition, there is a listing of the electrical, physical, and environmental specifications of the System 310.

SYSTEM OVERVIEW

Figure 1-1 is a block diagram of the System 310, showing the functional relationships among the components of a typical system. As shown in the block diagram, the System 310's major functional elements are:

- The processor board.
- Memory, which may be contained entirely on the processor or may include one or more separate memory boards.
- The flexible diskette and Winchester drives and their controllers.
- The backplane.
- The front panel switches and indicators.
- The power supply.

Figure 1-2 shows the locations of most of the System 310's components. The processor boards, memory boards, and disk controllers are housed within the cardcage, which is described in more detail later.

THE MULTIBUS® SYSTEM BUS

The architecture of the System 310 is based upon Intel's industry-standard (IEEE-796) MULTIBUS® system bus. The MULTIBUS system bus provides a common electrical and physical structure for transferring data between the processors, memories, disk controllers, and other MULTIBUS-compatible circuit board modules comprising the core of the System 310.

MULTIBUS circuit boards are classed either as bus masters or slaves. The processor boards and the Winchester controller used in the System 310 are bus masters. A bus master has the ability to control the bus; it exercises this control by generating command signals and

memory addresses. Bus masters may exchange control of the bus with other bus masters. Slaves decode addresses and act upon the command signals from the bus masters. The memory boards used in the System 310 are examples of slaves.

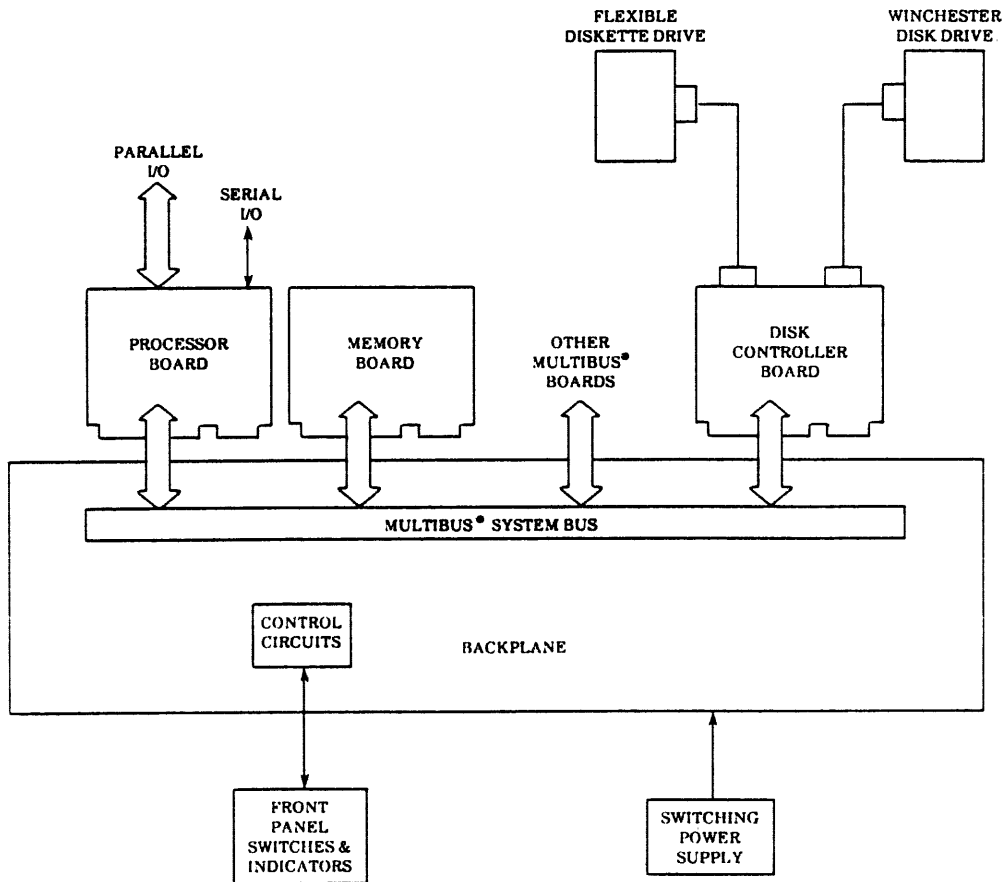


Figure 1-1. System 310 Block Diagram

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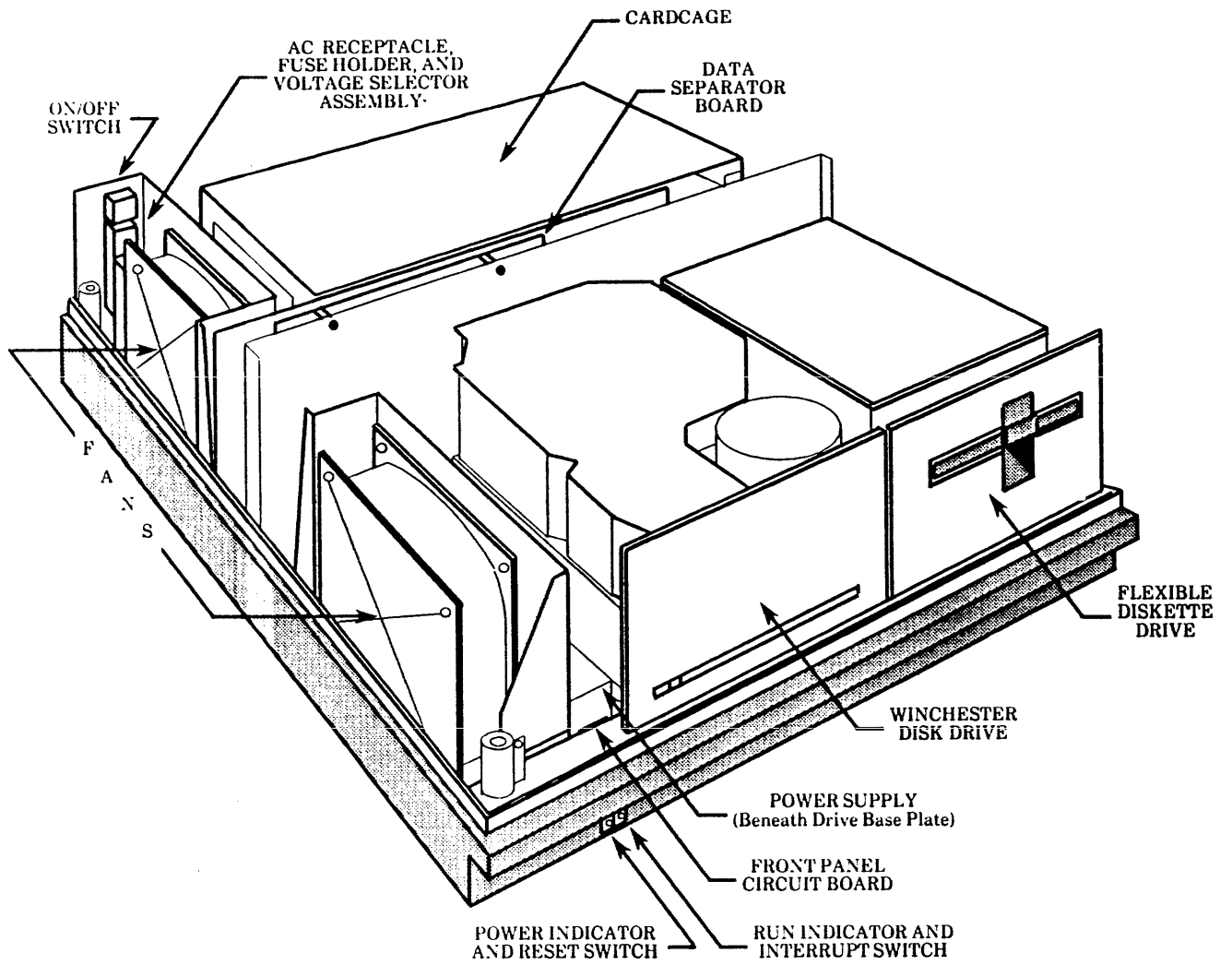


Figure 1-2. Major System 310 Components

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The backplane circuit board mounted on the cardcage assembly provides the MULTIBUS interconnection path. The signal lines that make up the MULTIBUS system bus consist of the following groups:

- 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 address space. 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*.

PROCESSORS

Each factory-standard System 310 contains a processor board based upon either the 8086 microprocessor or an upward-compatible version of the 8086, such as the 80286. The iSBC® 86/30 and iSBC 286/10 Single Board Computers are typical of the processor boards used in the System 310. Both of these boards are complete computer systems, with on-board RAM, ROM, and peripheral I/O capability.

Figure 1-9, a foldout page located at the end of this chapter, is a block diagram of a System 310 that uses the 86/30 board as its processor. This diagram shows in some detail how the system's components are interconnected. (You will need to refer to Figure 1-9 from time to time during the remainder of the system overview.)

The iSBC® 86/30 Single Board Computer

The 86/30 board uses the 16-bit 8086 microprocessor. The 8086 directs the 86/30 board's operation through an on-board "local" bus. Using the local bus, the 8086 communicates with the 86/30 board's resident functions:

- EPROM, which contains the system firmware. Included in the firmware are the system monitor and system confidence test programs.

- Local RAM
- An RS-232C Serial Communications Port
- A Centronics*-compatible parallel printer interface
- Two programmable interval timers
- A programmable priority interrupt controller

As a means of expanding on-board functions, additional circuit modules may be mounted directly on the 86/30 board. These modules connect to the 86/30 through one of the two iSBX™ (bus extension) connectors or through an ic socket (in place of an existing component).

The iSBX connectors are an extension of the local bus; they allow modules connected to them to be directly accessed by the 8086. The iSBX 218A Flexible Diskette Controller, for example, uses an iSBX connector.

The iSBC 337 Numeric Data Processor MULTIMODULE is mounted on the 86/30 board in place of the 8086 microprocessor (which is then installed on the iSBC 337 board). The iSBC 337 adds advanced numeric data processing functions, such as floating-point arithmetic, to the 8086's instruction set.

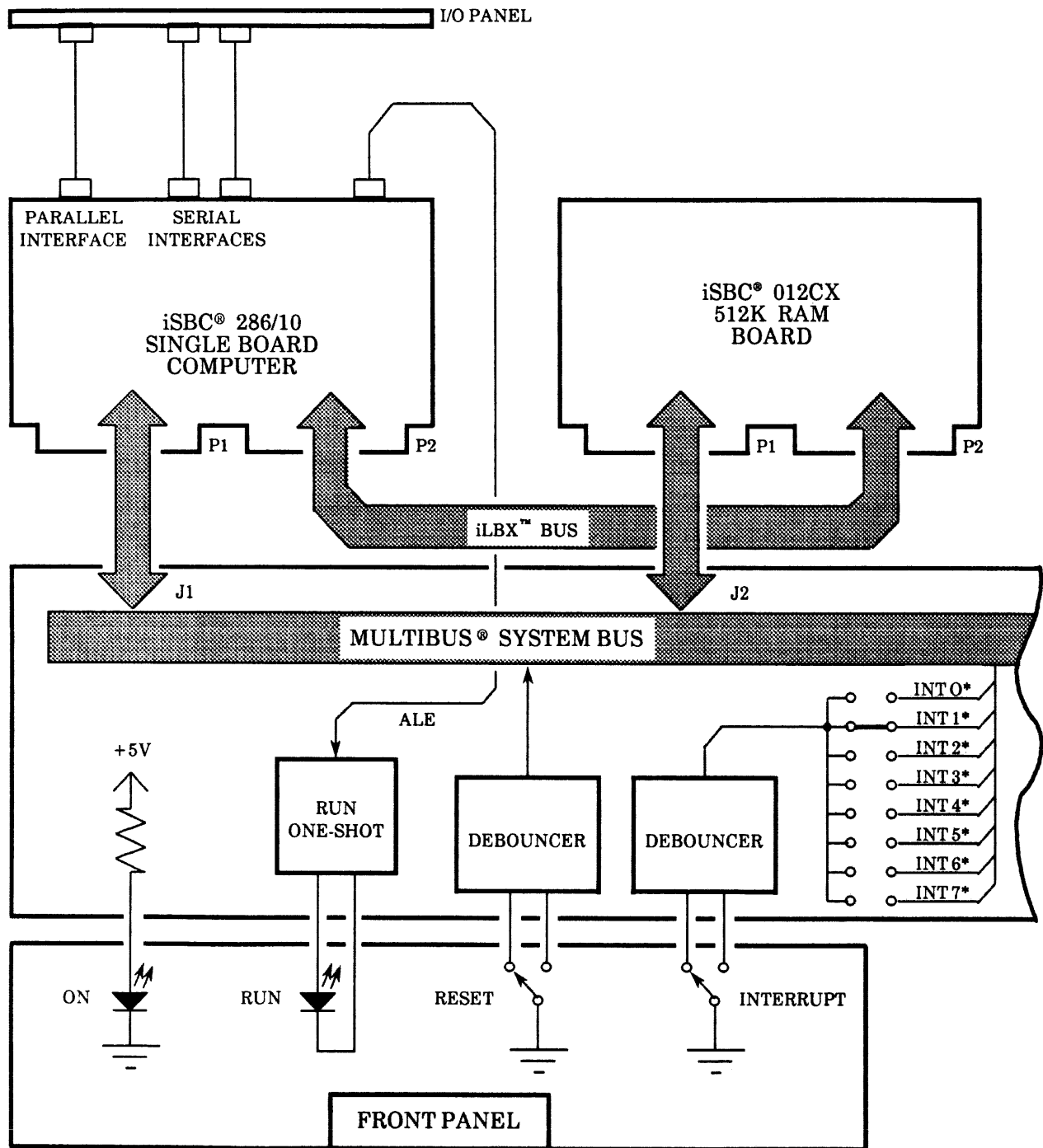
The 8086 directly addresses 1 megabyte of memory. The minimum amount of memory contained on the 86/30 board is 128K bytes. This can be expanded to 256K by mounting an iSBC 304 RAM Expansion MULTIMODULE™ board on the 86/30 board. Beyond 256K, additional MULTIBUS memory boards must be added. A memory map is provided later in this chapter under "Memory."

For detailed information on the 86/30 board, see the *iSBC 86/14 and 86/30 Single Board Computer Hardware Reference Manual*. For configuration information (how to set jumpers for addressing, interrupts, etc.), refer to the *System 310 86-Based Processor Configuration Guide*.

The iSBC® 286/10 Single Board Computer

Figure 1-3 is a partial block diagram of a System 310 that uses an iSBC 286/10 as its processor. As shown in the block diagram, one of the principal differences between the 86/30- and 286/10-based systems is that the 286/10 uses the iLBX™ Local Bus Extension. The iLBX bus allows the 286/10 to address off-board memory as if it were on-board. This results in increased speed since it avoids delays inherent in accessing memory through the MULTIBUS system bus. The iLBX bus provides 24-bit addressing, which allows the 286/10 to directly address 16 megabytes of memory.

*Centronics is a trademark of Centronics Data Computer Corp.



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Figure 1-3. iSBC® 286/10-Based System Block Diagram

The 286/10 is based upon the 80286 microprocessor. The 80286 has two addressing modes: a real address mode, in which it directly addresses one megabyte, and a protected virtual address mode, in which one or more one gigabyte "virtual" address blocks are mapped into a 16 megabyte real address space. The protected virtual address mode is particularly suited to multiuser and multitasking operating systems, such as the XENIX* operating system available for the System 310.

The 286/10 has eight 28-pin sockets for on-board memory. These JEDEC-standard "sites" may contain a combination of RAM, EPROM, and other memory devices; however, in the System 310 the 286/10 contains only EPROM. On-board capacity can be expanded using the iSBC 341 JEDEC Site Expansion Module, which provides an additional eight sites. A memory map of the System 310 is provided later in this chapter under "Memory."

Other functions on the 286/10 board include two serial ports, three programmable timers, a Centronics-compatible parallel printer interface, and two programmable priority interrupt controllers. An 80287 Numeric Data Processor may be added to the 286/10 to provide advanced numeric data processing functions.

The *Guide to Using the iSBC 286/10 Single Board Computer* contains detailed information on the 286/10. For configuration information (setting jumpers for memory addressing, interrupts, etc.), see the *System 310 286-Based Processor Configuraton Guide*.

System Interrupts

The MULTIBUS system bus provides eight parallel priority interrupt lines, INT0* (Interrupt 0) through INT7* (Interrupt 7), that MULTIBUS boards and other system components use to gain the processor's attention whenever its intervention is required. The Interrupt switch on the front panel, for example, asserts INT1*, which forces the processor to stop what it is doing and begin executing the system monitor program.

NOTE

The asterisk symbol, used at the end of a signal mnemonic, means that the signal is true when at the logic low state. For example, the signal INT0* (Interrupt 0) is true when low. The absence of an asterisk indicates that the signal is true when at the logic high state.

Figure 1-4 is a diagram of the standard interrupt configuration for an 86/30-based System 310. As the diagram shows, the 86/30 board contains a priority interrupt controller (PIC) that has eight interrupt

*XENIX is a trademark of Microsoft Corporation.

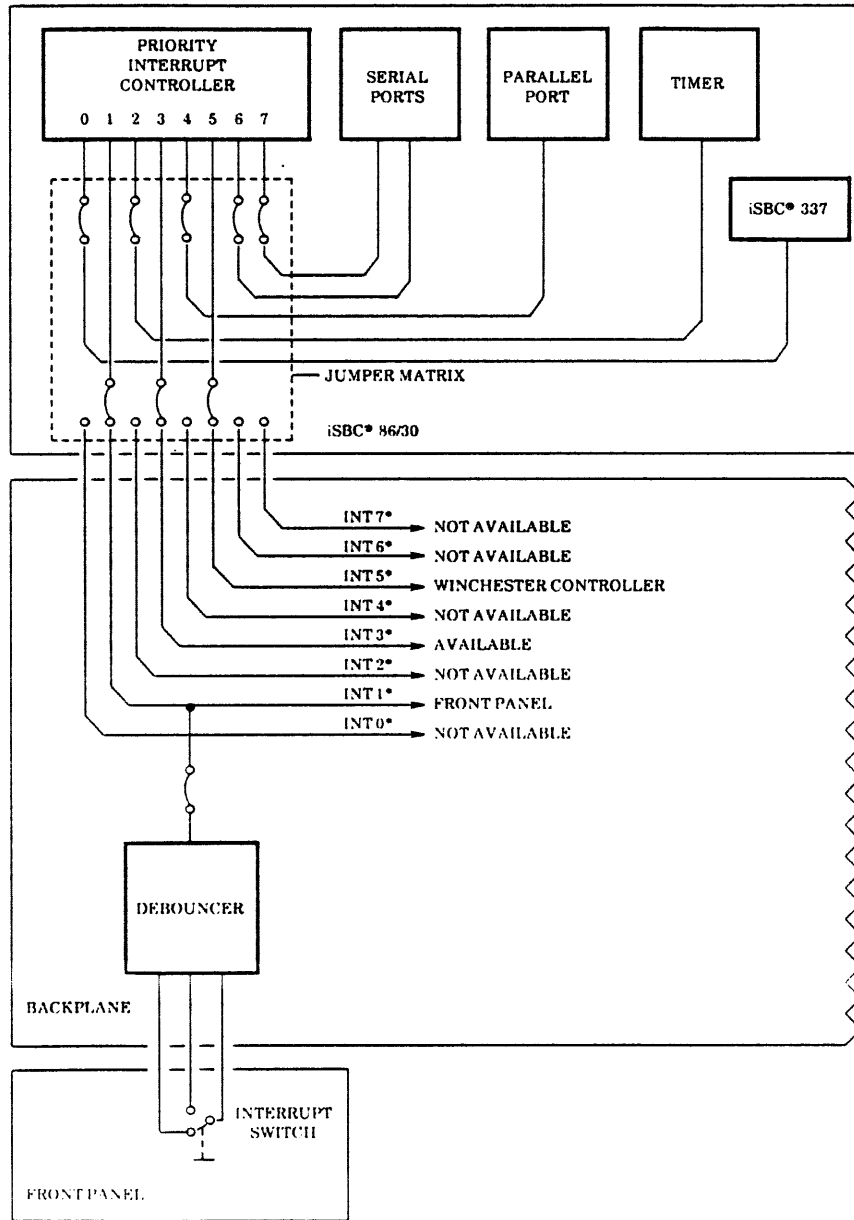


Figure 1-4. iSBC 86/30-Based System Interrupts

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inputs. A jumper matrix permits interrupt signals from various on-board and off-board sources to be routed to the PIC.

Resident functions on the 86/30 board use five of the PIC's interrupt inputs. The remaining three inputs come from off-board functions by way of the backplane: the Winchester controller uses INT5*, the Interrupt switch uses INT1*, and INT3* is uncommitted.

As Figure 1-5 shows, the 286/10 board has two PICs: one master and one slave. The master and slave PICs work together to accommodate 15 interrupt sources; thus, the 286/10 board has more interrupts available for off-board system functions than the 86/30 board does.

MEMORY

Figures 1-6 and 1-7 are memory maps for 86/30- and 286/10-based systems, respectively. As these memory maps show, EPROM occupies the high end of the memory address space, while RAM addresses start at the bottom of the address space and go up.

As explained earlier, the 86/30 processor may contain up to 256K bytes of RAM. To expand memory capacity beyond 256K, systems based upon the 86/30 processor board typically use the iSBC 012B 512K RAM Board. The RAM address space must be contiguous. As memory is added, there must be no gaps between the end of one block of addresses and the beginning of the next.

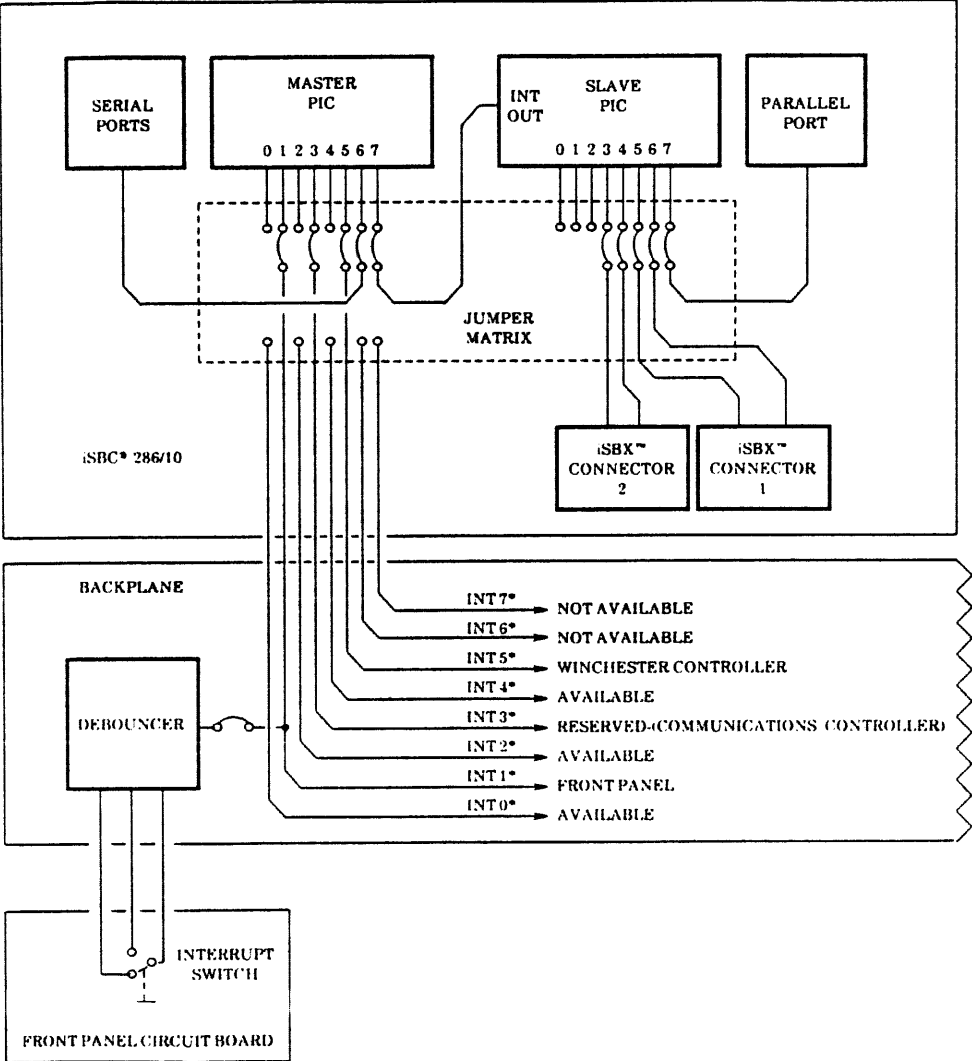
Systems based upon the 286/10 board typically use the iSBC 012CX 512K RAM Board. The main difference between the 012B and 012CX boards is that the 012CX has error checking and correction (ECC) and iLBX (Local Bus Extension) capability. Other memory boards, such as the iSBC 056A 256K RAM Board, may also be used in the System 310.

For detailed information on the memory boards, see the appropriate hardware reference manuals and the memory configuration guides listed in the front of this manual.

DISK DRIVES AND CONTROLLERS

Each System 310 has at least one flexible diskette drive. Typically, it will also have a 10-Megabyte Winchester hard disk drive. As shown in Figure 1-9, the major Winchester disk and flexible diskette system components include the following:

- The iSBC 215G Winchester Disk Controller. The iSBC 215G is a programmable, intelligent controller with its own 8089 I/O Processor. Once given instructions by the processor board, the iSBC 215G proceeds on its own, transferring disk data directly to system memory by DMA (Direct Memory Access).
- The i213A 5¼" Winchester Disk Data Separator. The purpose of the data separator is to separate the serial data stream from the Winchester drives into separate data and clock signals.



F-0159

Figure 1-5. iSBC® 286/10-Based System Interrupts

- The Winchester scrambler, which simply rearranges the interconnect wiring to adapt the controller to the drive.
- The Winchester and diskette drives, which both conform to an industry-standard 5¼" form factor.
- The iSBX 218A Flexible Diskette Controller, a MULTIMODULE board that may be mounted on either the processor or the Winchester controller. If a Winchester Controller is installed, the factory-standard location for the flexible diskette controller is on the Winchester controller.

For detailed information on the controller boards, see the appropriate hardware reference manuals. Jumper settings and other configuration information is contained in the *System 310 Disk Configuration Guide*.

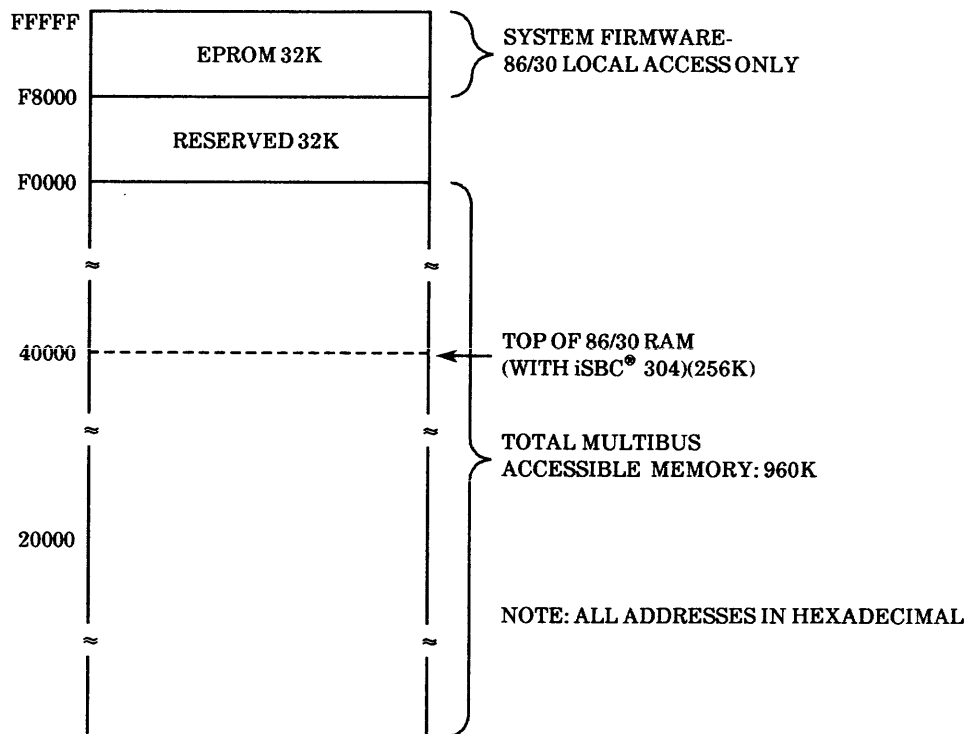
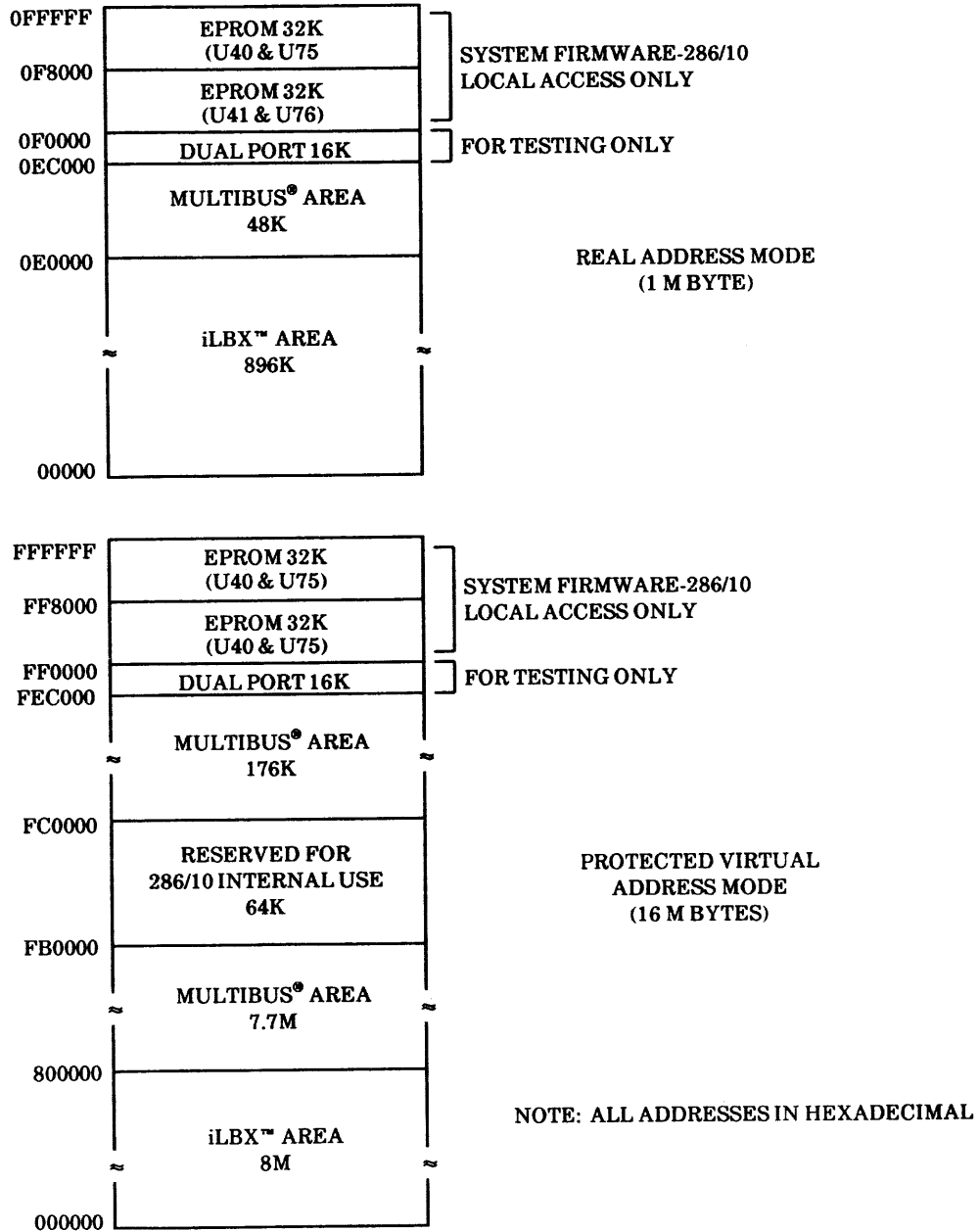


Figure 1-6. iSBC[®] 86/30-Based System Memory Map



F-0155

Figure 1-7. iSBC® 286/10-Based System Memory Map

BACKPLANE AND CARD CAGE

Figure 1-9 shows the backplane circuit board's major functional elements. The backplane serves four functions. First, it provides the MULTIBUS interconnections. Second, it contains a parallel bus request priority arbitration circuit. Third, it contains the electrical interface between the front panel controls and the rest of the system. Fourth, it distributes power to the MULTIBUS circuit boards and the fans.

The backplane is mounted on the rear of the cardcage. As shown in Figure 1-8, the cardcage has seven circuit board 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 circuit boards that have expansion modules mounted on them (such as the iSBX 218A on the Winchester Controller). Factory-standard System 310's have the processor mounted in the bottom slot (1) and the Winchester controller in the top slot (7). The memory boards are mounted adjacent to the processor, starting with slot 2. See the backplane component location and schematic diagrams in Chapter 3 for additional details on the backplane circuit board.

Bus Priority Arbitrator

MULTIBUS circuit boards fall into two categories: bus masters, such as the processor or Winchester controller; and slaves, such as the memory boards. Bus masters may request and take control of the bus in order to transfer data to or from slaves and other bus masters. Since there may be more than one bus master in the system, 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 the slots to be individually assigned a priority level. The factory default condition is for slot 1 to be given priority 1 (lowest), slot 2 to be given priority 2, and so on.

Technically, any board may be mounted in any slot. However, if the order of the boards is changed, the jumpers that set bus priority must be changed to maintain the proper priority relationships among the boards. Otherwise, the firmware and software may not work properly.

Front Panel Control Circuits

The Reset and Interrupt switches on the front of the System 310 each connect to a contact debouncing flip-flop on the backplane. The

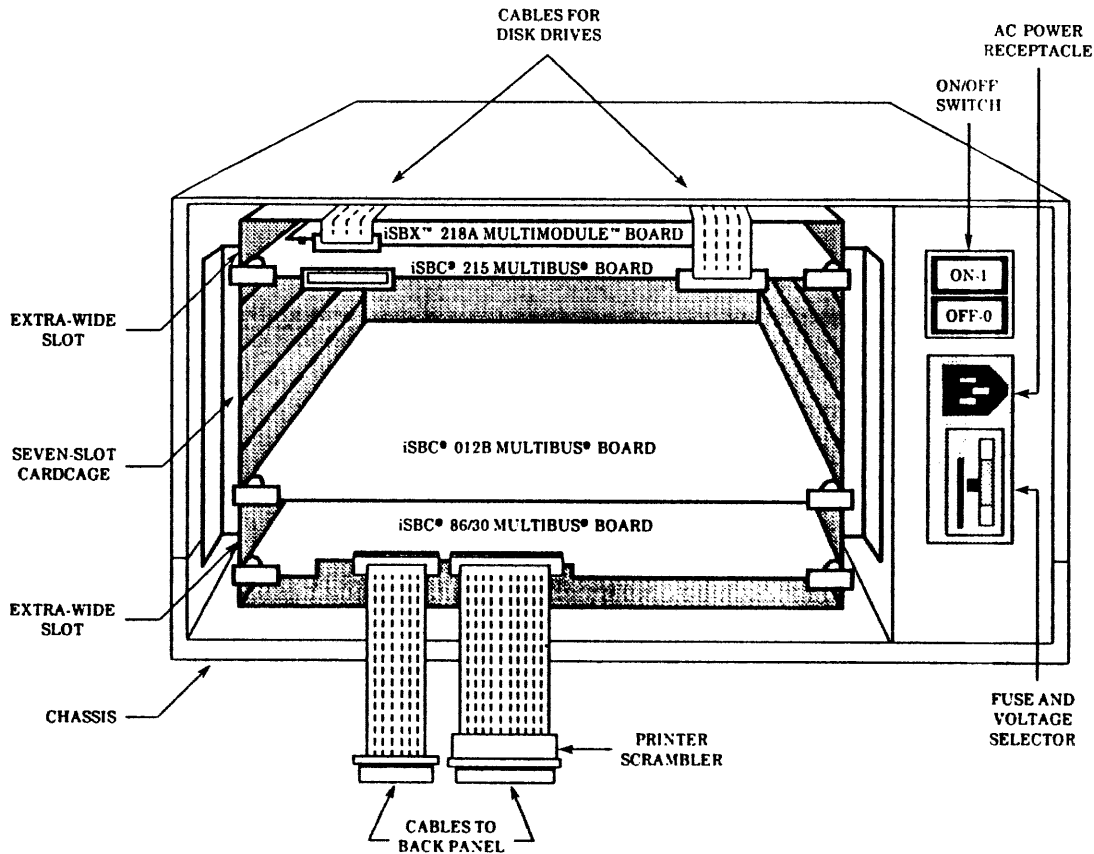


Figure 1-8. Cardcage Components

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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 drive the INIT* (initialize) signal line low, resetting the system to its initial power-up state.

The Run One-Shot drives the RUN indicator on the front of the System 310. The Run One-Shot is itself triggered by the ALE signal (Address Latch Enable) from the processor board. As long as ALE continues to switch state (meaning that the microprocessor is running), the one-shot is continuously retriggered and the RUN indicator remains on. The RUN indicator should go out only when the microprocessor on the processor board is in a "Wait" or "Halt" state. This can occur during DMA operations by other bus masters, while the processor is waiting to regain control of the bus.

The ON indicator is connected to the +5 VDC supply through a resistor on the backplane; it indicates only the presence of voltage on the +5 VDC output.

Fan Power

The front and rear fans receive power through the backplane. The rear fan is connected to +12 VDC through a 3-ohm resistor; the front fan is connected to -12 VDC, also through a 3-ohm resistor.

POWER SUPPLY AND POWER DISTRIBUTION

DC power in the System 310 is supplied by a 220 watt switching power supply that has the following outputs:

- +5 VDC at 30.0 A maximum
- +12 VDC at 4.7 A maximum
- -12 VDC at 4.7 A maximum

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 heavy leads that are connected to the backplane by terminal lugs. A cable assembly carries +12 VDC and -12 VDC to the backplane, +5 VDC to the Data Separator, and +5 VDC and +12 VDC to the disk drives. Chapter 3 contains a diagram of the DC power distribution.

There are three AC input leads to the power supply: one neutral, one for the 90 to 132 VAC range, and one for the 198 to 264 VAC range. The appropriate input is selected by a line voltage selector within the AC receptacle assembly.

Chapter 3 contains a diagram of AC power distribution. Line current enters the System 310 through a standard IEC connector in the AC receptacle assembly on the rear panel. Both the neutral and high sides of the line pass through the power switch. The high side of the line passes through the fuse in the receptacle assembly. From the power switch, the line current passes through a line filter. The neutral side then goes to the power supply and the high side goes to the line voltage selector where it is connected to one of the power supply inputs, according to the selected voltage range.

SPECIFICATIONS

Tables 1-1, 1-2, 1-3, and 1-4 list the system specifications of the System 310.

Table 1-1. AC Electrical Specifications

Characteristic	Limits
Voltage and maximum current	90 to 132 VAC, 4.6 A 198 to 264 VAC, 2.3 A
Frequency	47 to 63 Hz
Maximum power consumption	523 W
Fuses	6A (90 to 132 VAC) 3A (198 to 264 VAC)

Table 1-2. DC Power Supply Specifications

Characteristic	Limits
Voltage and maximum current	
5 VDC output	4.75 to 5.25 VDC, 30.0 A
12 VDC output	11.4 to 12.6 VDC, 4.7 A
-12 VDC output	-11.4 to -12.6 VDC, 4.7 A
Maximum total output power	220 W

Table 1-3. Physical Specifications

Characteristic	Limits
Height	6.5 in (165 mm)
Width	17 in (432 mm)
Depth	20 in (508 mm)
Weight	40 in (17.1 kg)

Table 1-4. Environmental Specifications

Characteristic	Limits
Temperature	
System in operation	
With flexible diskette	10° to 35° C
System not in operation	
With flexible diskette	10° to 51° C
No flexible diskette	-34° to 60° C
Humidity (system operating)	
Relative humidity	20% to 80% (noncondensing)
Maximum wet bulb	26° C
Density altitude	
System in operation	0 to 8,000 ft (2436 m)
System not in operation	0 to 40,000 ft (12180 m)
Shock	
Flexible diskette-based systems	
System in operation	1.0 g, 10 to 20 ms
System not in operation	15.0 g, 10 to 20 ms
Winchester drive-based systems	
System in operation	5.0 g
System not in operation	20.0 g
Vibration	
Flexible diskette-based systems	
System in operation	
5 to 25 Hz	0.0014 in (peak to peak)
25 to 55 Hz	0.0007 in (peak to peak)
55 to 300 Hz	0.36 g
System not in operation	
5 to 25 Hz	0.008 in (peak to peak)
25 to 55 Hz	0.004 in (peak to peak)
55 to 3000 Hz	2.0 g
Winchester drive-based systems	
System in operation	1.0 g
System not in operation	20.0 g

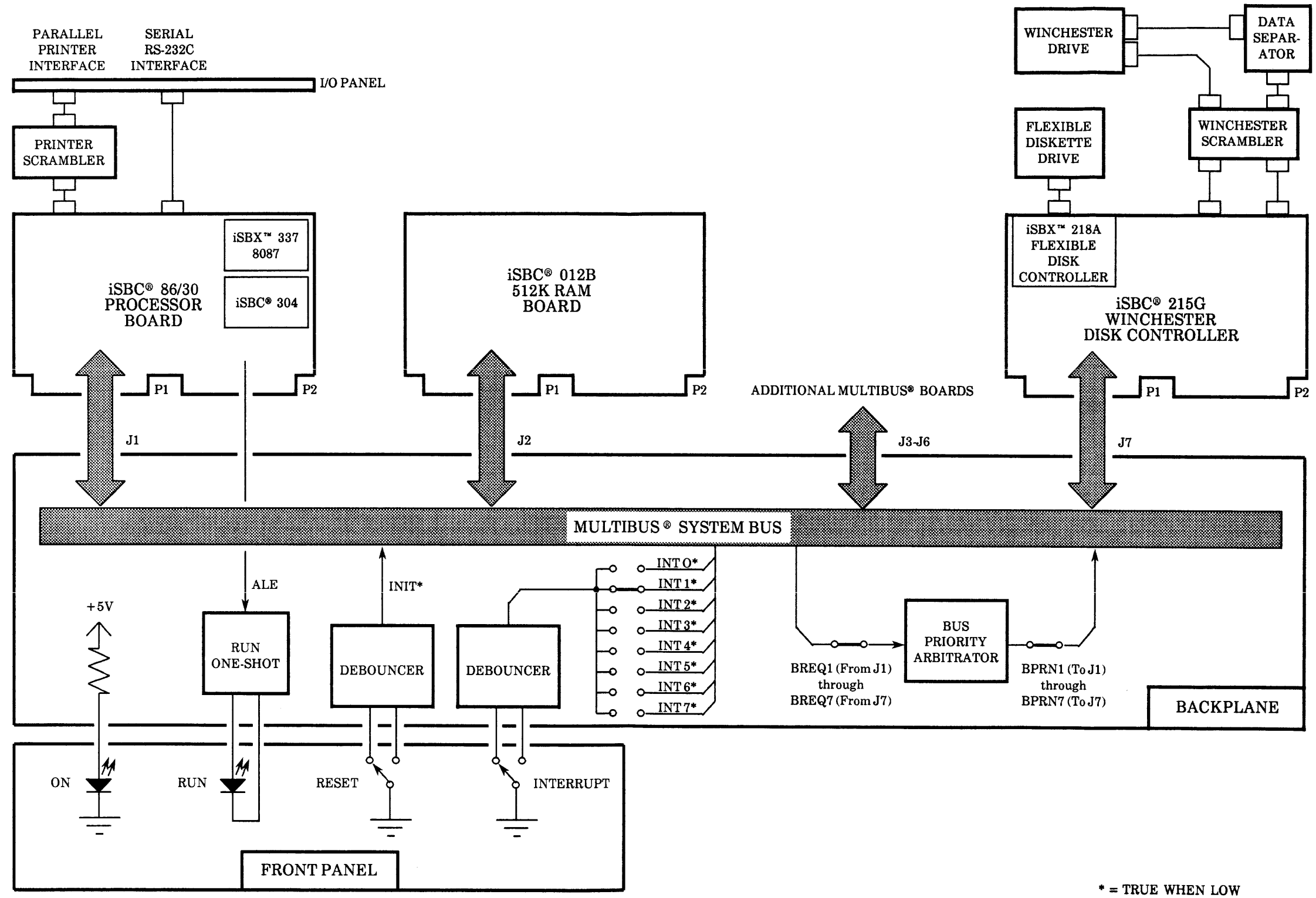


Figure 1-9. iSBC® 86/30-Based System Block Diagram

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This chapter contains preventive maintenance and troubleshooting procedures. These procedures should be performed only by qualified service technicians. In the front of this manual, under "Service Information," you will find instructions for obtaining service from Intel.

WARNING

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 310 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 310 and the AC mains. Use only the standard IEC three-wire power cord supplied with the System 310 and connect the power cord only to a standard three-wire outlet with a good earth ground.

The System 310 weighs 40 pounds. To avoid injury, have someone help you whenever you need to lift it.

PREVENTIVE MAINTENANCE

Preventive maintenance for the System 310 consists of cleaning the read/write heads in the flexible diskette drives, inspecting the various components of the system, and correcting potential problems.

GENERAL PREVENTIVE MAINTENANCE

Each time the System 310 is serviced (for example, during head cleaning or when new components are added) perform a general check of the system's condition, as follows:

1. Thoroughly check the system's operation by running the diagnostic programs. (See "Using Diagnostic Programs" later in this chapter.) Make sure that both fans are operating.
2. Check the installation: See that there is adequate space around the cabinet for ventilation and that the fans are not blocked.

Make sure that the system is operating within the environmental limits specified in Chapter 1 of this manual. The System should not be operated in areas where it can be severely jarred or subjected to high humidity or vibration.

Make sure that the interconnecting cables are not being chafed or pinched by the equipment and that the connectors are secure.

3. Remove the top cover and and I/O panel and check for broken or loose wires, improperly seated circuit boards or connectors, and broken or loose components.

FLEXIBLE DISKETTE HEAD CLEANING

The read/write heads in the flexible diskette drives must be cleaned every 12 months or after 150 hours of drive use. Use the following procedure to do this.

Equipment Required

In order to clean the diskette drive heads, you must have the following items:

- A diskette drive head cleaning kit having a standard 5¼" cleaning diskette and a container of isopropyl alcohol. (Isopropyl alcohol is the only approved solvent for head cleaning.) Head cleaning kits are available from several manufacturers.
- The SDT218 test program, located either on the Winchester disk or flexible diskette. The SDT218 program belongs to the System 300 Series Diagnostic Software package.
- A video display terminal connected to the system. The terminal should be set up for 9600 baud operation, with parity off.

Using the Head Cleaning Utility Program

The head cleaning utility program is a part of the SDT218 system diagnostic test program for the iSBX 218A Flexible Disk Controller and diskette drives. To use the head cleaning utility, you must call up SDT218, as follows:

1. Turn on the system, or press the Reset switch. As the initialization sequence begins, the system displays a series of asterisks on the terminal.

2. Press SHIFT-U on the keyboard, then press either the Interrupt switch on the front panel or CONTROL-C on the keyboard.

This passes control of the system to the system monitor.

3. When the monitor prompt character (.) appears, invoke SDT218 as follows.

If SDT218 is located on the Winchester drive, enter

```
b /sdt dir/sdt218<CR>
```

(Leave a space between the "b" and the "/". The symbol <CR> represents the RETURN key.)

If SDT218 is located on flexible diskette, install the diskette in drive 0 and enter

```
b :wf0:/sdt dir/sdt218<CR>
```

As soon as SDT218 is loaded into memory, it displays the message

```
SYSTEM DIAGNOSTIC TEST-218 Vx.y  
Copyright 1983 Intel Corporation.
```

where Vx.y is the version of the test that you are using.

At this point SDT218 begins to ask you for input from the keyboard.

4. When SDT218 displays the message

```
ENTER CODE OF DEVICE TO BE TESTED:  
(0) DEFAULT 8" FLOPPY  
(1) DEFAULT 5.25" FLOPPY  
(2) OTHER
```

enter 2<CR> on the keyboard.

5. When SDT218 displays the message

```
ENTER CODE FOR MEDIA SIZE:  
(0) 8"  
(1) 5.25"
```

enter 1<CR>.

6. When SDT218 displays the message

```
IS UNIT 0 BEING TESTED? (Y OR [N])
```

enter Y<CR> if you are cleaning drive 0's heads; otherwise press <CR>.

If you answer no, SDT218 goes on to ask if you are testing Units 1, 2, and 3. Answer yes only for the drive whose heads you want to clean.

If you answer yes, SDT218 asks about the characteristics of the drive.

7. When SDT218 displays the message

IS THIS UNIT BACKED UP?

press <CR>.

8. When SDT218 displays the message

**SPECIFY DECIMAL NUMBER OF BYTES PER SURFACE:
[nnT]**

where [nnT] represents the default setting, enter 40 for 48 tpi drives, or 80 for 96 tpi drives. If the default setting is correct, simply press <CR>.

9. When SDT218 displays the message

**SPECIFY DECIMAL NUMBER OF SECTORS PER SURFACE:
[nnT]**

press <CR>.

10. When SDT218 displays the message

**SPECIFY DECIMAL NUMBER OF BYTES PER SECTOR:
[nnT]**

press <CR>.

At this point SDT218 may ask if you are testing units 1, 2, or 3, depending on your previous (step 6) answers.

Press <CR>.

11. When SDT218 displays the message

ENTER A 1 TO 5 DIGIT DECIMAL RANDOM NUMBER SEED: [nT]

press <CR>.

12. When SDT218 displays the message

DO YOU WISH TO USE THE UTILITY TESTS: (Y OR [NO])

enter Y<CR>.

13. If the flexible diskette controller is mounted on the Winchester controller (Winchester drive installed), enter REC 33<CR> on the keyboard.

If the flexible diskette controller is mounted on the processor board (no Winchester), enter REC 31<CR>.

14. Next, you must tell the SDT218 which area on the cleaning diskette to use, as follows:

Enter V(b)=n<CR>

where n is a number between 1 and 12 representing an unused track on the cleaning diskette. If track 3 was used last, for example, enter V(b)=4<CR>. As each track is used, it should be marked off in the area provided on the cleaning diskette's jacket. See the instructions with the head cleaning kit.

15. Prepare the cleaning diskette using isopropyl alcohol and insert it into the drive to be cleaned.

16. Enter

TEST 31<CR> (no Winchester installed)

or

TEST 33<CR> (Winchester installed)

17. As the head cleaning utility runs, it loads the head against the cleaning diskette for 30 seconds. It also displays a series of "FAIL" messages on the terminal--ignore these.

When finished, SDT218 displays the message

Head cleaning complete--remove cleaning diskette
0033H CLEAN HEAD Utility "FAILED"

TROUBLESHOOTING

The purpose of this section is to help you determine the cause of malfunctions within the System 310. The procedures given here are intended primarily to isolate problems to a field-replaceable module or assembly.

USING DIAGNOSTIC PROGRAMS

There are three diagnostic programs that you can use in troubleshooting the System 310. The System Confidence Test (SCT), which is contained in PROM on the processor board, is executed each time the system is powered up, or when the Reset switch is pressed.

The SCT is primarily a "go-no go" test that indicates whether or not a particular subsystem is functional.

The System Diagnostic Test (SDT) and System Analysis Test (SAT) are contained on a flexible diskette or the Winchester drive and must be loaded into system memory to be used. The SDT and SAT both perform extensive and detailed testing on the various subsystems and can provide information on the cause of a malfunction.

All three of the diagnostic programs are described in detail in the *System 300 Series Diagnostic Software User's Guide*. The use of the SCT will be briefly discussed here; the SDT and SAT will not be discussed further.

The System Confidence Test

The System Confidence Test tests most parts of the major System 310 subsystems, including the following:

- The serial and parallel I/O ports on the processor board.
- The RAM on the processor and memory boards.
- The ROM on the processor board.
- The priority interrupt controller on the processor board.
- The Winchester disk drive and controller.
- The flexible diskette drive(s) and controller.
- The numeric data processor.

In order to run and interpret the results of the SCT, the processor board must be at least partly functional, otherwise the tests cannot even begin. The microprocessor must be running and able to access at least part of the on-board ROM and RAM, and the RS-232 port normally used for terminal communications must be working well enough so that the test results can be reported on the terminal.

To run the SCT, proceed as follows:

1. Set up a Video Display Terminal for 9600 baud operation, with parity off, and connect it to the RS-232 port (J20) on the I/O panel. Turn the terminal on and let it warm up.
2. Turn on the on the System 310. (If it is already on, press the Reset switch.) After a short delay, the System 310 begins sending a series of asterisks to the terminal.
3. Enter an uppercase "U" on the terminal's keyboard. The "U" initiates the SCT. (If you do not enter the "U", the system eventually starts the SCT anyway, with slightly different results--this is discussed later).

4. Shortly after you enter the CONTROL-U, the system will display a message asking you for input from the keyboard. The display appears approximately as follows:

<u>TEST</u>	<u>STATUS</u>
USART/Timer	GO
PIC . *. INPUT "I"	

At this point you have four options:

- a. Do nothing. If you do not respond within six seconds, the PIC (priority interrupt controller) test is reported "NO-GO" and control of the System 310 passes to the system monitor program. You can press the Reset switch to start testing again.
- b. Enter the letter "m". This causes extra memory testing to be done. For each error, the SCT displays the segment and offset address of the error, the expected data and the actual data read at that location, and the Exclusive-OR of the actual and expected data (showing the locations of the bits that were in error).
- c. Enter any other character except Control-C, Control-D, or Control-L. This causes testing to continue.
- d. Enter Control-C. This aborts the testing and returns control of the system to the system monitor.

As the SCT proceeds, the terminal display shows which part of the system is being tested and the status of that part. The display shown in Figure 2-1 is typical of one produced by a Winchester disk-based system. For testing purposes, the system is divided into three subsystems: processor, memory, and boot (disk) subsystems. The subsystems are further divided into component parts, such as the priority interrupt controller or parallel port in the processor subsystem. As each part passes a test, the SCT displays a period (.) just to the right of the part's name; a failed test is indicated by a question mark (?). If the part passes all tests, its status is "GO"; any failed test produces a "NO GO" status. A diskette drive may be reported "OFFLINE" if no diskette is installed or the drive is disconnected.

Figure 2-2 is an abbreviated SCT display that occurs when you do not respond at initialization by entering the uppercase "U." This display indicates only the status of the major subsystems.

Notice that (if you have a diskette installed) as the SCT accesses the flexible diskette drive during testing, the head load indicator on the front of the drive goes on and you can hear the head mechanism as it moves from track to track. This is a useful indication of processor and disk subsystem activity if the RS-232 port is not working, or if there is no terminal connected to the port.

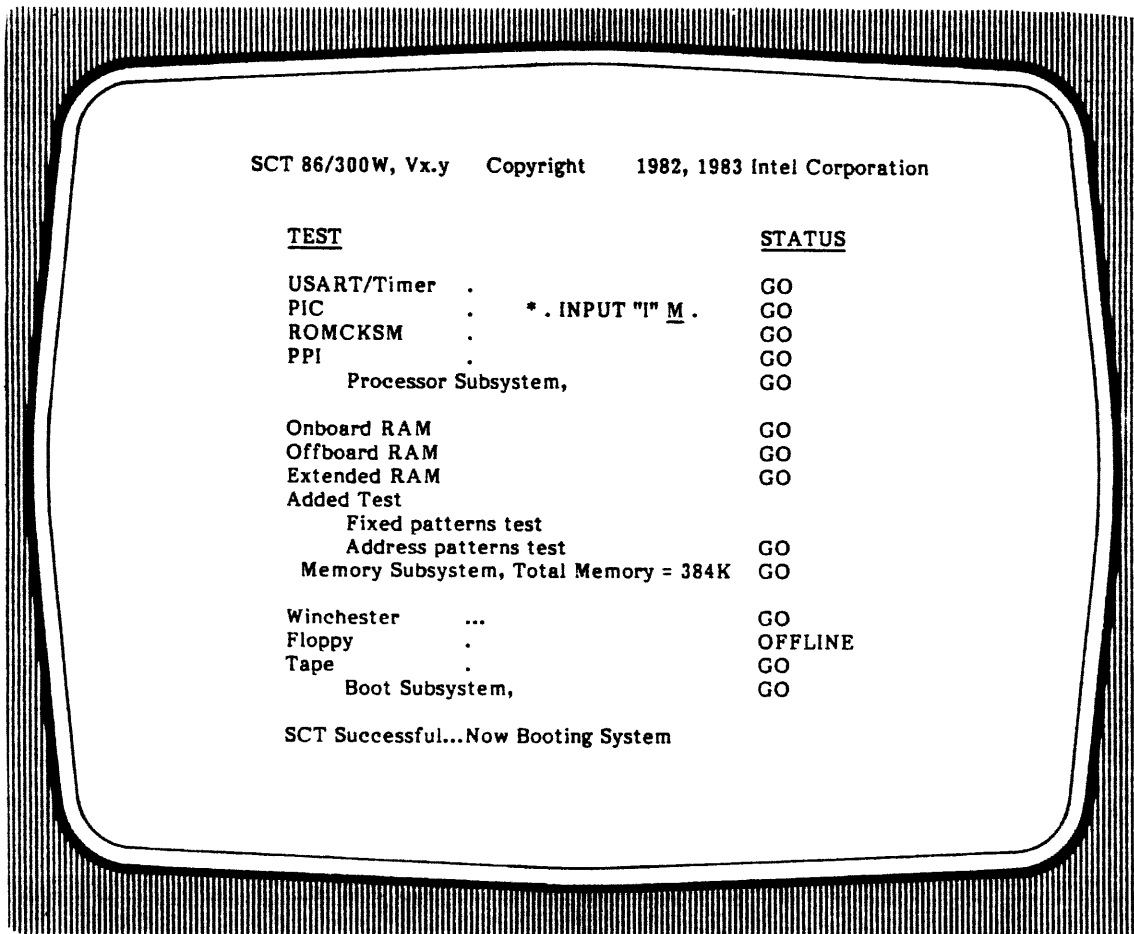


Figure 2-1. System Confidence Test Display

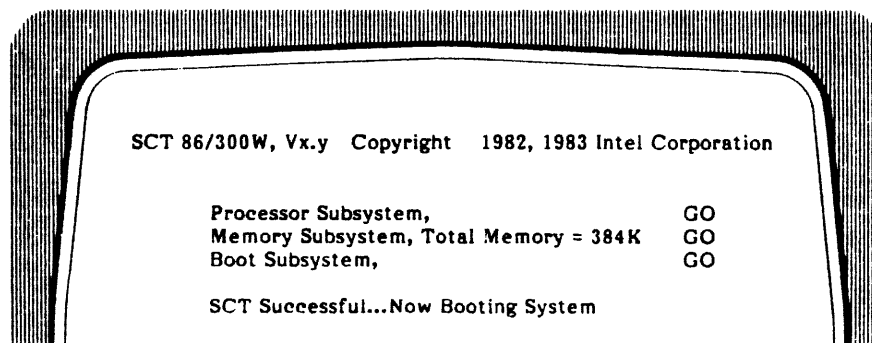


Figure 2-2. Abbreviated System Confidence Test Display

You can abort the SCT at any time by entering Control-C on the keyboard or by pressing the Interrupt switch on the front panel. These actions return control of system to the system monitor.

GENERAL TROUBLESHOOTING

If the System 310 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, it is necessary to determine the cause of the problem by systematically eliminating potential causes until you have found the right one. The information in the following paragraphs is designed to help you do this.

Preliminary Checks

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

- Broken or loose wires
- Improperly seated circuit boards in the cardcage
- Improperly seated connectors
- Broken or loose components

AC and DC Power Problems

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

1. If the "ON" indicator on the front panel is on, there is voltage on the +5 volt output.
2. If the rear fan is working, there is voltage present on the +12 volt output.
3. If the front fan is working, there is voltage present on the -12 volt output.

Loss of +5 volt power always causes complete system failure (although the fans may continue running). Loss of either 12 volt supply may result only in partial failure. The +12 volt supply is used only for the disk drives, rear fan, and RS-232 ports; the -12 volt supply is used only for the RS-232 ports and front fan (in standard versions of the System 310).

If all of the supply voltages have been lost, either AC power has been lost or there was a major failure in the power supply. 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 disconnecting a board.

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 appropriate digital voltmeter. Figure 2-3 shows where the supply voltages can be measured. All of the voltages should be within 5% of the specified value.

Loss of AC power or a complete failure of the power supply results in a completely dead System 310. Check the following:

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

Backplane and Front Panel Control Problems.

It is possible for the bus priority arbitrator circuit or the front panel circuitry to disrupt system operation. The bus priority arbitrator can "hang up" the MULTIBUS interface. This would be indicated by an inability of the processor to access anything over the MULTIBUS system bus. This could be caused by improper jumper settings or a component malfunction. You can bypass the bus priority arbitrator by removing all the jumpers on the bus priority jumper matrix and connecting a jumper between pins E45 and E31 on the backplane. This connects the processor's bus request line to its bus priority input line, thereby granting it exclusive access to the bus. The processor should then be able to access slave devices, such as the memory boards. (Bus masters, such as the Winchester controller, would not work properly since they cannot gain control of the bus.)

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 switch as a cause of this problem by disconnecting the front panel interconnect cable at the backplane. To eliminate the debouncing circuit on the backplane as a cause of the problem, 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 of this problem by disconnecting the front panel interconnect cable.

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

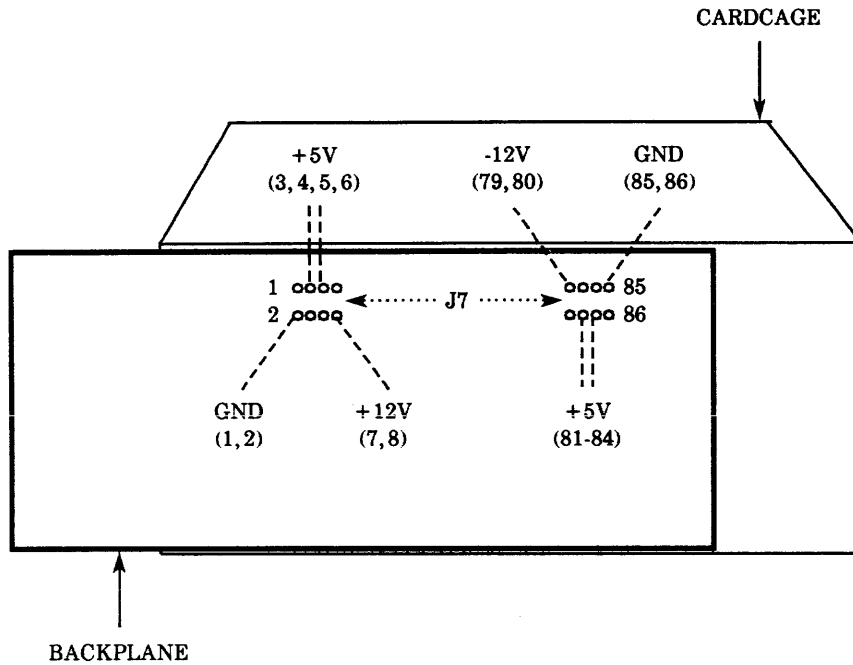


Figure 2-3. DC Voltage Measurement Locations

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CHAPTER 3 REMOVAL AND REPLACEMENT PROCEDURES

This chapter contains Removal and Replacement procedures for the System 310's field-replaceable components. These procedures should be performed only by qualified service technicians. You will find instructions for obtaining service from Intel in the front of this manual under "Service Information."

WARNING

The following procedures could expose you to hazardous voltages. Always turn off the power switch and disconnect the AC power cord before removing and replacing any component in the System 310.

TOP COVER REMOVAL AND REPLACEMENT

To remove and replace the top cover, you need a medium sized phillips screwdriver suitable for # 6 screws. Proceed as follows:

1. Turn the power switch to "off" and disconnect the 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.

CAUTION

Do not drop or severely jar the chassis; the Winchester drive can be damaged.

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 two screws (upper left and upper right corners) holding the top cover to the I/O panel .
5. Lift the top cover off, moving it slightly forward to clear the disk drives.
6. Top cover replacement is the reverse of the removal procedure.

I/O PANEL REMOVAL AND REPLACEMENT

To remove the rear panel, you need a medium-sized phillips screwdriver suitable for # 6 screws. Proceed as follows:

1. Remove the four screws holding the I/O panel in place. (Refer to Figure 3-1.)
2. Tilt the top of the I/O panel out from the rear of the chassis and lift it out of the slot in the chassis base.
3. Access to the cardcage can be made easier by disconnecting the serial and parallel I/O port connectors at the processor board (bottom slot) and laying the I/O panel on top of the chassis.
4. I/O panel replacement is the reverse of the removal procedure.

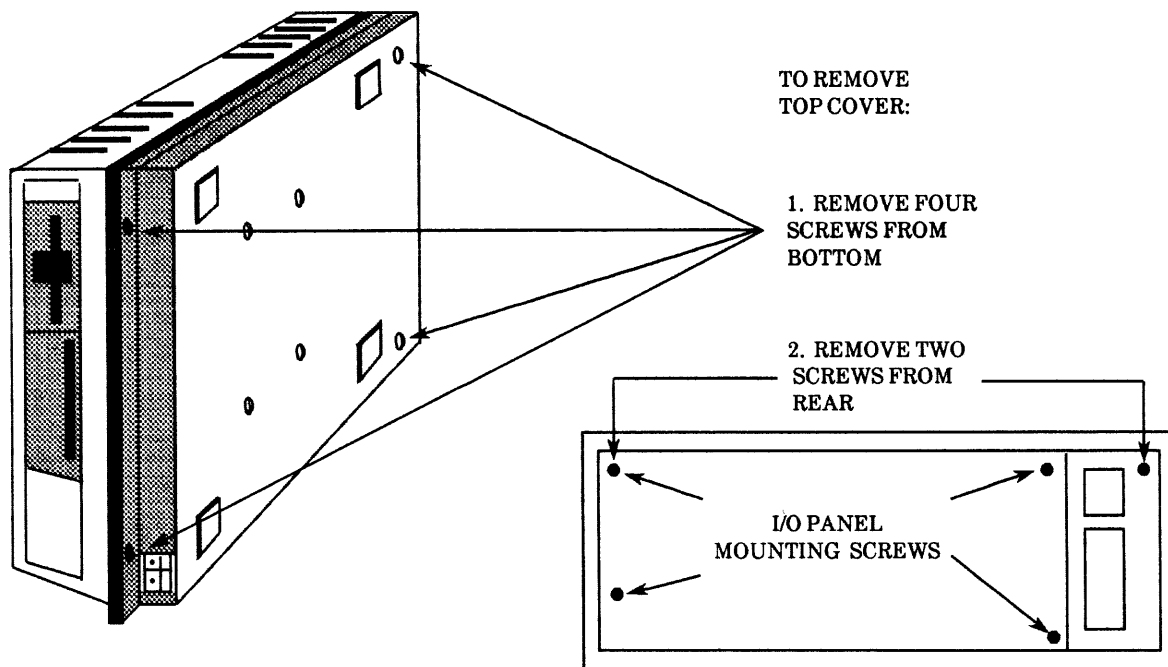


Figure 3-1. Top Cover and I/O Panel Removal

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CARDCAGE CIRCUIT BOARD REMOVAL AND REPLACEMENT

The first part of this procedure is a general procedure to be used when removing and replacing any of the MULTIBUS circuit boards in the cardcage. Procedures for removing and replacing specific boards follow the general procedure.

To remove circuit boards from the cardcage, you need a medium-sized phillips screwdriver suitable for # 6 or # 8 screws. To remove MULTIMODULE boards you need a flat-bladed screwdriver suitable for #6 screws. In addition, to make some of the jumper changes required when installing replacement boards, you need wire-wrap tools and a supply of #30 kynar-insulated wire.

CAUTION

The circuit boards can be damaged if they are removed or replaced while power is on. Always turn off power before a board is removed or replaced.

Proceed as follows:

1. Turn the power switch to "off" and remove the I/O panel.
2. 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 3.)
3. Loosen the screws holding the circuit board retainers on each side of the cardcage and remove the retainers. It is not necessary to remove the screws.
4. Pull on the ejector levers at each end of the circuit board to disconnect the board from the backplane.
5. 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 for the specific boards.
6. 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. When the board is fully seated, the ejector levers lie flat along the board edge.

iSBC® 86/30 BOARD REMOVAL AND REPLACEMENT

1. Remove the 86/30 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 "iSBC 86/30 Configurations" in Appendix A install all jumpers required on the replacement board. The jumper configuration is determined, in part, by which MULTIMODULE boards are installed.
 3. Remove EPROMs U39, U40, U57, and U58 from the old board and install them in corresponding locations on the replacement 86/30 board.
 4. Remove all MULTIMODULE boards and associated components from the old board and install them on the new 86/30 board, as follows:

Referring to Figure 3-2, remove the iSBC 304 RAM Expansion MULTIMODULE and the address decoding PROM, U66, from the old board and install them on the new board. It is necessary to transfer U72 (8203), U73 (74S373), and U95 (74S373) from the new 86/30 board to the 304 board in order to do this.

Referring to Figure 3-3, remove the iSBC 337 Numeric Data Processor from the old board and install it on the new board. To do this, remove the 8086 microprocessor, U48, from the new board, install it on the iSBC 337, then install the iSBC 337 on the new board.

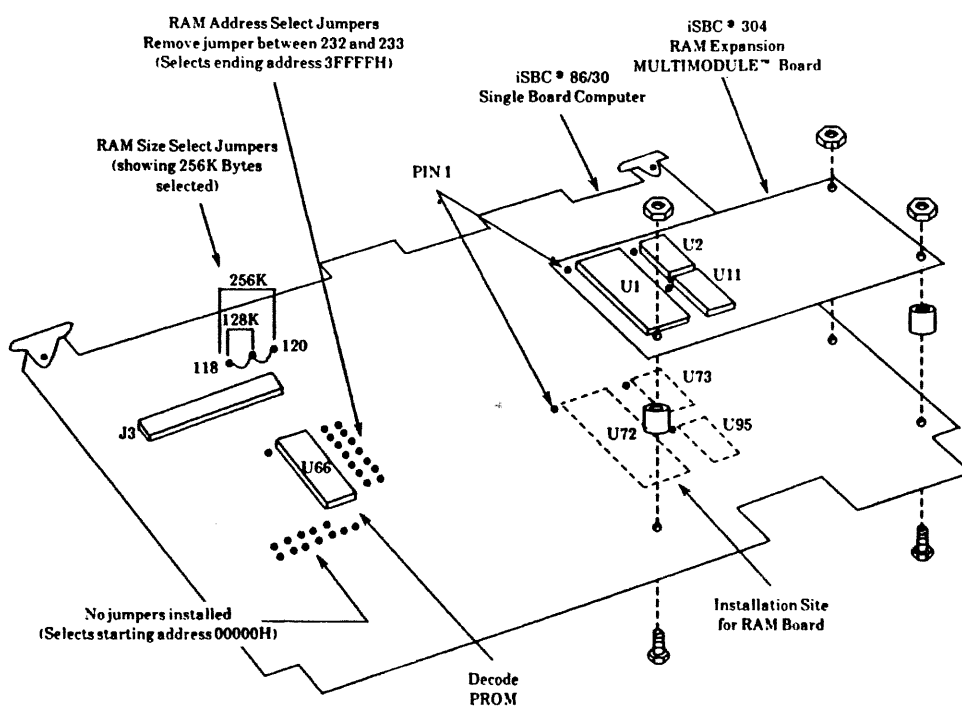
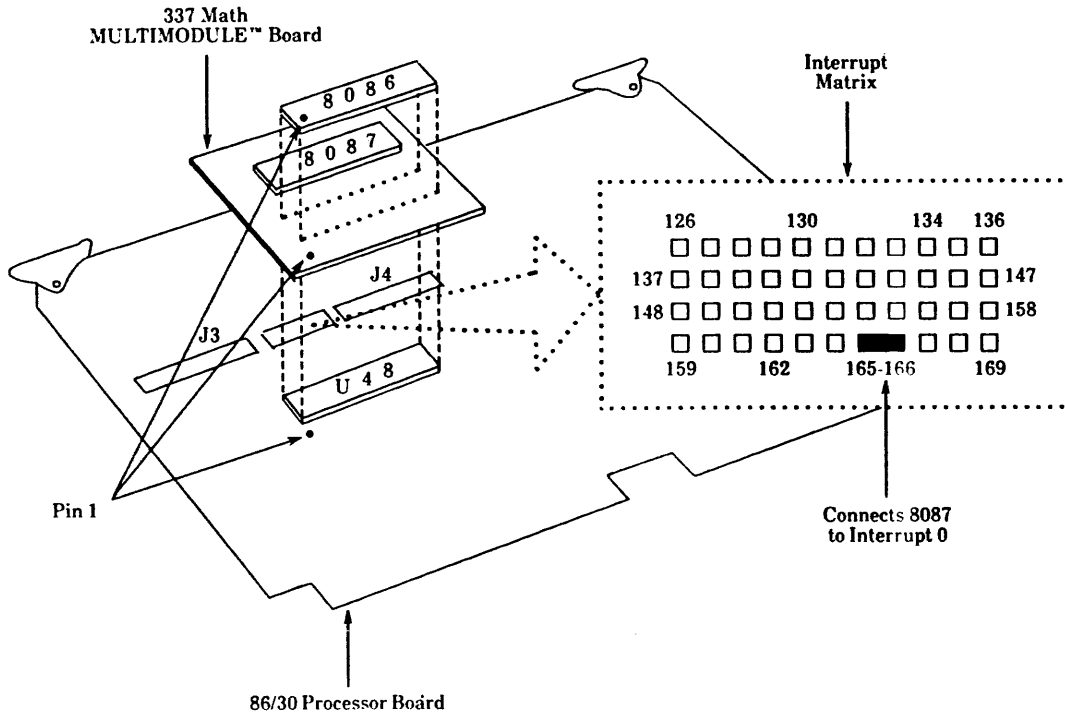


Figure 3-2. iSBC® 304 RAM Board Removal

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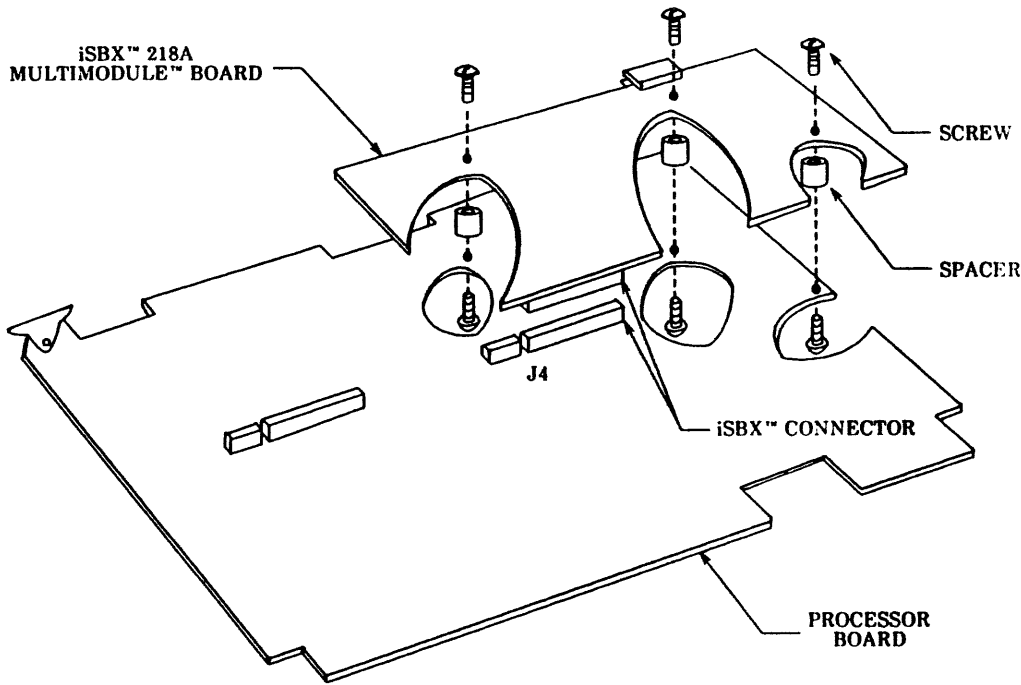
Figure 3-3. iSBC® 337 Numeric Data Processor Removal

Referring to Figure 3-4, Remove the iSBX 218A Flexible Diskette Controller from the old board and install it in the corresponding location on the new board.

5. Install the replacement 86/30 board in the cardcage as described earlier in the general removal and replacement procedure.

iSBC® 215G BOARD REMOVAL AND REPLACEMENT

1. Remove the iSBC 215G board from the cardcage as described earlier in the general removal and replacement procedure. Note whether or not an iSBX 218A MULTIMODULE is installed on the board.
2. Referring to "iSBC 215G Configurations" in Appendix A, install jumpers, as required, on the replacement iSBC 215G board. The jumper configuration is determined, in part, by whether or not an iSBX 218A is installed.
3. Remove the iSBX 218A (if present) from the old board and install it on the new board.



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Figure 3-4. iSBC® 218A Flexible Diskette Controller Removal

4. Install the replacement iSBX 215G in the cardcage, as described in the general removal and replacement procedure.

MEMORY BOARD REMOVAL AND REPLACEMENT

1. Remove the memory board from the cardcage as described earlier in the general removal and replacement procedure.
2. Referring to the jumper configuration sections in Appendix A, set the replacement board's jumpers. The jumper settings depend, in part, on the address space occupied by the board. The settings listed in Appendix A apply only to standard versions of the System 310. See the appropriate memory configuration guide for setting up nonstandard systems.
3. Install the replacement board in the cardcage, as described in the general removal and replacement procedure.

iSBX™ 218A REMOVAL AND REPLACEMENT

1. Remove the 218A board's host board (either the 86/30 board or the 215G board) from the cardcage.

2. Remove the old 218A board from the host board and mount the replacement board in its place.
3. Referring to "iSBX 218A Configurations" in Appendix A, set the 218A board's jumpers.
4. Install the host board in the cardcage, as described earlier in the general removal and replacement procedure.

iSBC® 304 BOARD REMOVAL AND REPLACEMENT

1. Remove the 86/30 board from the cardcage, as described earlier in the general removal and replacement procedure.
2. Install the replacement 304 board on the 86/30 board.
3. Replace the 86/30 board in the cardcage, as described in the general removal and replacement procedure.

DATA SEPARATOR REMOVAL AND REPLACEMENT

To remove the data separator, you need a flat-blade screwdriver suitable for # 6 screws. Proceed as follows:

1. Turn the power switch to "off", disconnect the power cord, and remove the top cover.
2. Referring to Figure 3-5, carefully remove the nylon nuts and screws holding the top of the data separator circuit board to the center mounting panel.
3. Pull the board out far enough to gain access to the data and power connectors and disconnect them. Note the connector placement.
4. Pull the data separator up and out.
5. Data separator replacement is the reverse of the removal procedure.

DISK DRIVE REMOVAL AND REPLACEMENT

To remove the disk drives, you need a long-shafted phillips screwdriver suitable for # 6 or # 8 screws and a foam pad about 10" square and $\frac{1}{2}$ " thick.

CAUTION

Do not drop or severely jar the Winchester drive or base plate assembly. The Winchester drive can be damaged.

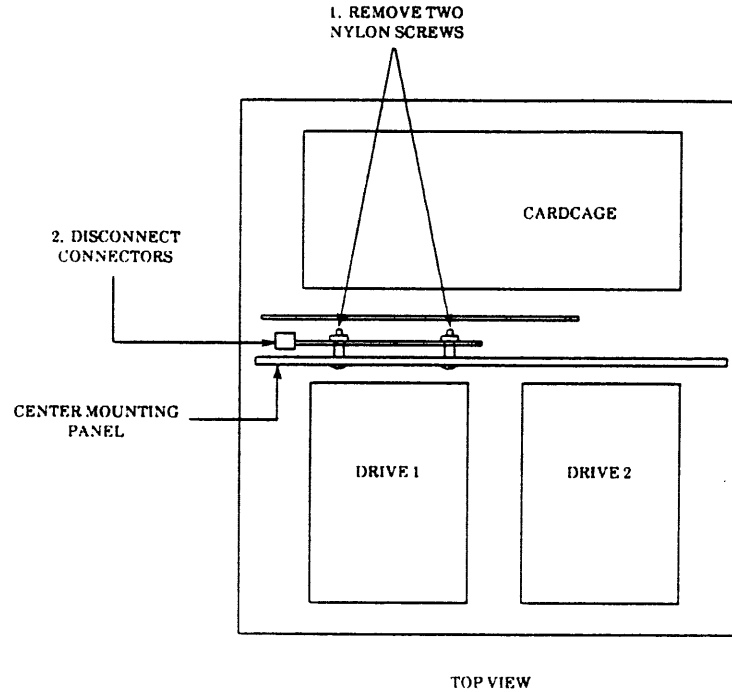


Figure 3-5. Data Separator Removal

F-0164

Remove and replace the Winchester disk and flexible diskette drives as follows:

1. Turn the power switch to "off" and disconnect the power cord from the rear of the chassis.
2. Remove the top cover. As you are removing the top cover retaining screws from the bottom of the chassis, also remove the two screws holding the front of the disk drive base plate. As shown in Figure 3-6, these screws are located just under the front lip of the chassis base.
3. After the top cover is off, loosen the two screws holding the rear of the drive base plate. Refer to Figure 3-6.
4. Disconnect the front panel control cable from the Backplane and position the cable away from the drive base plate.
5. Loosen the screw and disconnect the ground lugs just above the front panel circuit board.
6. Remove the screw holding the DC distribution cable clamp to the right-hand side of the drive.

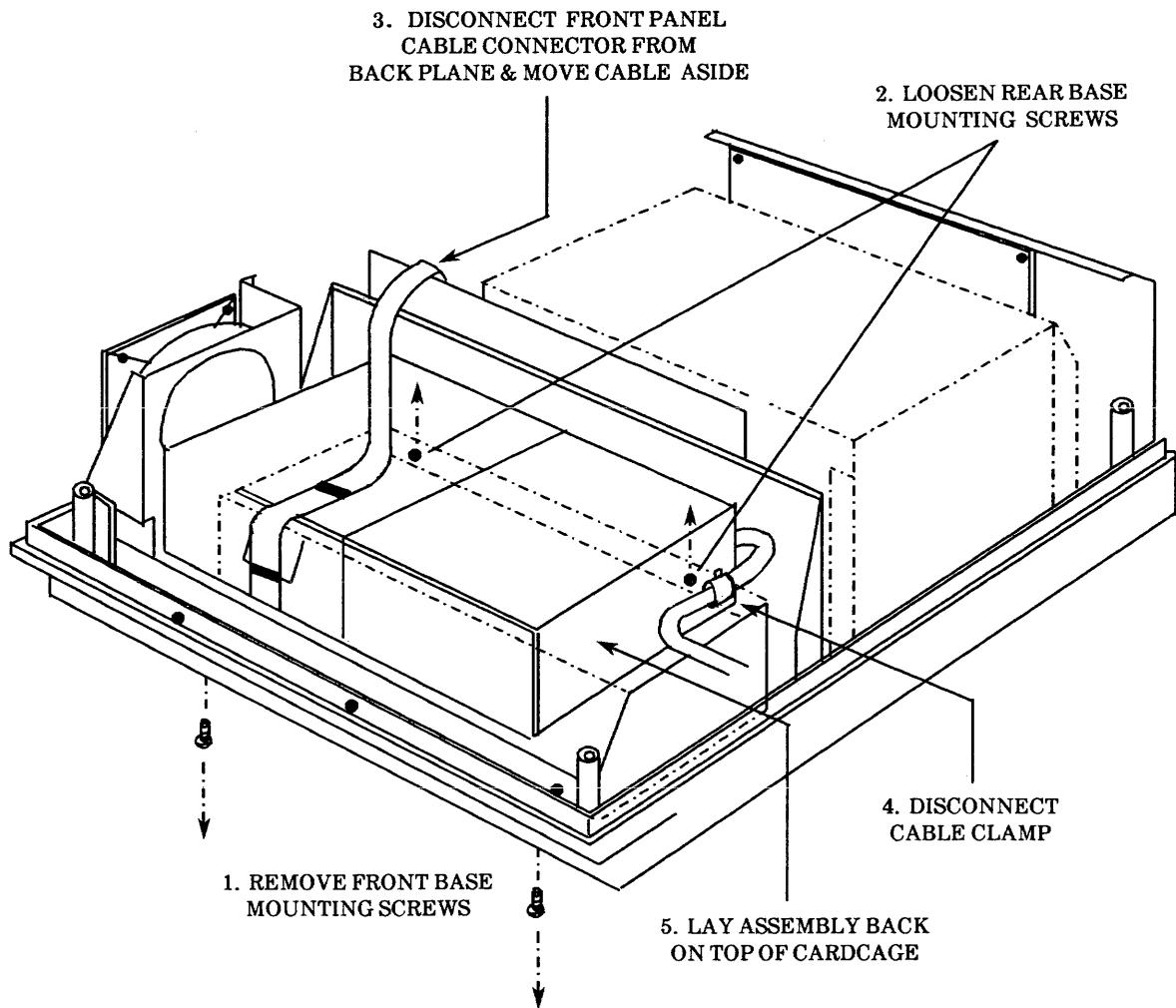


Figure 3-6. Disk Drive Removal

F.0068-1

6. Lift up the front of the base plate and pull it forward far enough to clear the rear retaining screws.
7. Place the foam pad on top of the cardcage.
8. Lift the drive assembly up, turn it over, and set it upside down on the foam pad.
9. Winchester drive removal:

Disconnect the power, data, and control cables. Make a note of their location and orientation. (Refer to the interconnection diagram in Chapter 3).

Remove the four screws holding the drive to the base plate and remove the drive.

Diskette drive removal:

Remove the four screws holding the drive to the base plate. Move the drive out from under the base plate and remove the shield assembly. The shield assembly is held in place by one screw. (One was removed earlier, with the DC cable clamp.)

Disconnect the drive control and power cables. Note the orientation of the cables.

11. Drive replacement is the reverse of the removal procedure. Make sure when installing a new drive that the drive's jumpers are set properly and that the bus terminator boards are installed as required. Appendix A of this manual gives the factory settings for standard configurations of the System 310. The *System 310 Disk Configuration Guide* gives detailed instructions for setting jumpers and installing terminator boards in the drives.

POWER SUPPLY REMOVAL AND REPLACEMENT

To remove and replace the power supply, you need the same equipment as for disk drive removal. In addition, you need a 3/8" open end wrench. Proceed as follows:

1. Turn the power switch to "off" and disconnect the power cord from the rear of the chassis.
2. Remove the top cover. As you are removing the top cover retaining screws from the bottom of the chassis, also remove the two screws holding the front of the drive base plate and the four screws holding the power supply in place. See Figure 3-7
3. Dismount the drive base plate assembly as described earlier in "Disk Drive Removal and Replacement", and lay the assembly on top of the cardcage.

4. Referring to Figure 3-8, disconnect the AC and DC distribution cable connectors located near the power supply.
5. Disconnect the +5 VDC distribution cables at the Backplane.
6. Remove the power supply.

Power supply replacement:

7. Place the the power supply in position in the chassis base.
8. Tilt the front of the chassis up and start the four power supply mounting screws.
9. Connect the AC and DC distribution cables.
10. Connect the +5 VDC distribution cables to the backplane, routing the cables through the clamps on the front of the center mounting panel and under the left side of the panel. Make sure that the cables are connected to the proper terminal on the backplane.
11. Remount the remaining components in reverse order to their removal. Tighten down the power supply mounting screws.

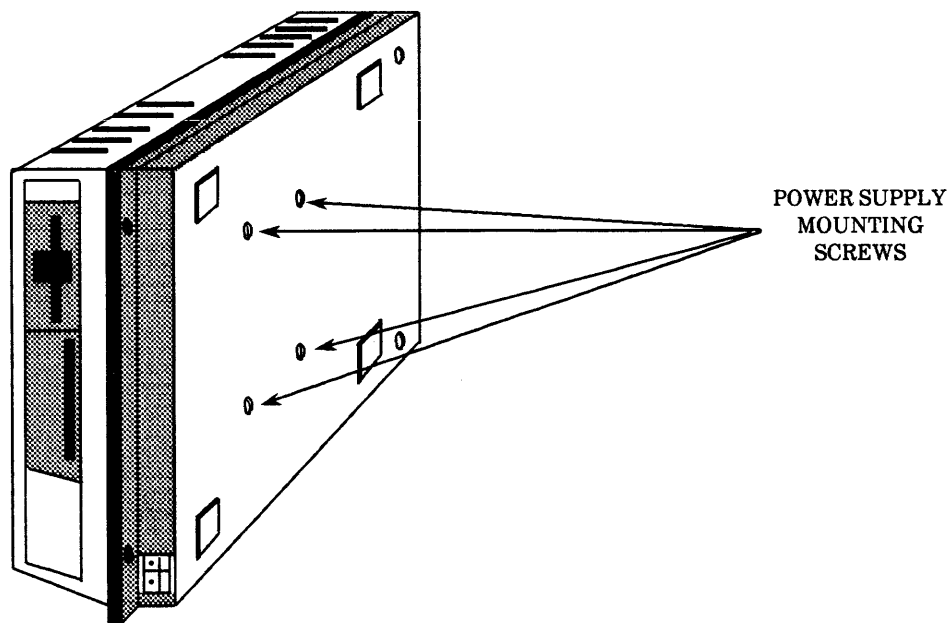


Figure 3-7. Power Supply Mounting Screws

F-0120-1

CARDCAGE REMOVAL AND REPLACEMENT

To remove and replace the cardcage, you need a phillips screwdriver suitable for #6 or #8 screws. Proceed as follows:

1. Turn the power switch to "off" and disconnect the power cord.
2. Remove the top cover and I/O panel.
3. Remove all circuit boards from the cardcage.
4. As shown in Figure 3-9, there are five screws holding the cardcage in place: four outside and one inside near slot 1. Remove the four outside screws and loosen the inside screw.
5. Disconnect the cables and +5 VDC leads from the backplane. Mark the cables or make a diagram showing where they go.
6. Lift the cardcage out.
7. Cardcage replacement is the reverse of the removal procedure.

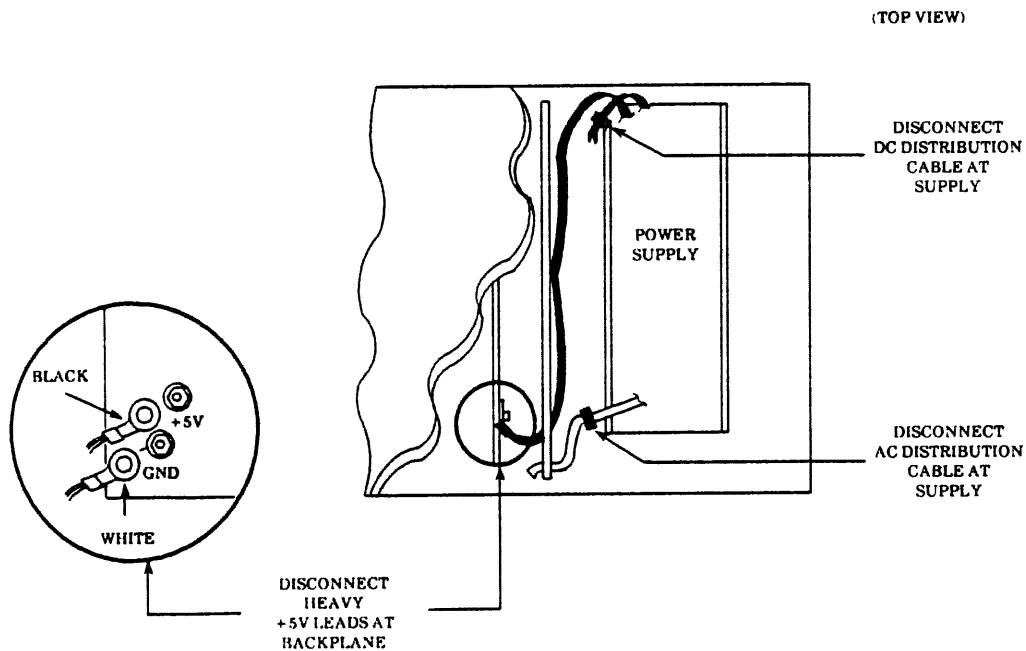


Figure 3-8. Power Supply Cables

F-0166

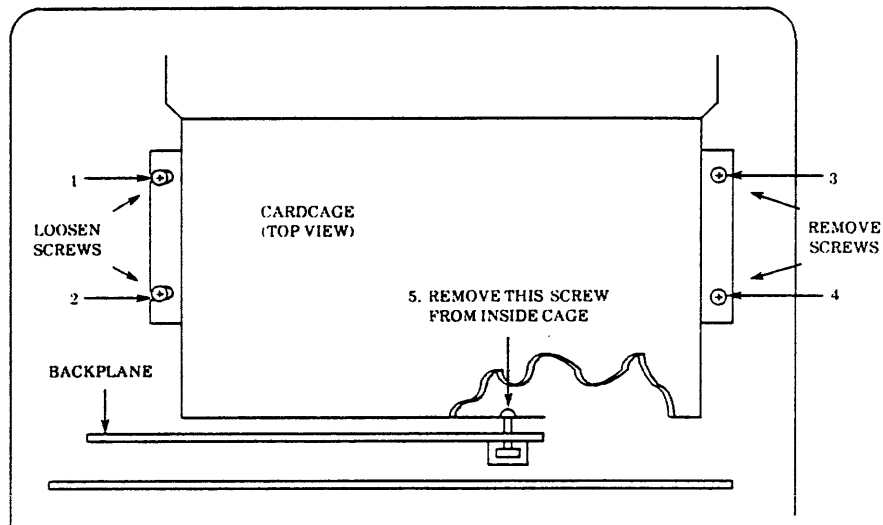


Figure 3-9. Cardcage Removal

E-0168

BACKPLANE REMOVAL AND REPLACEMENT

To remove and replace the backplane, you need a phillips screwdriver suitable for # 6 or # 8 screws and wire-wrap tools for #30 kynar-insulated wire. Remove and replace the backplane circuit board as follows:

1. Turn the power switch to "off" and disconnect the power cord.
2. Remove the top cover and I/O panel.
3. Remove the cardcage, as previously described.
4. Remove the screw holding the auxiliary connector to the backplane, then remove the three screws holding the backplane to the cardcage. (See figure 3-10.)
5. Unwrap the ALE signal lead from pin E47 on the backplane.
6. Backplane replacement is the reverse of the removal procedure. After the backplane is mounted to the cardcage, trim and strip the ALE signal lead, then wrap it on pin E47.

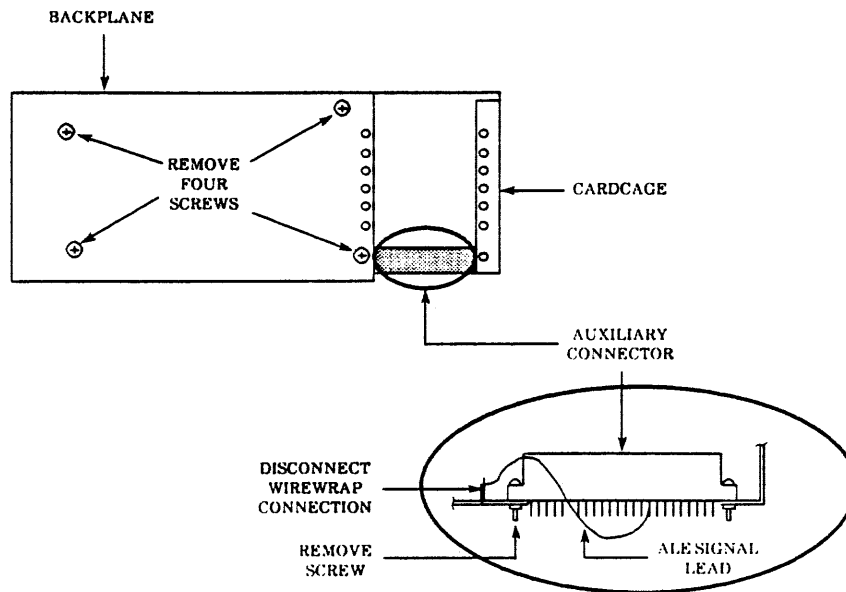


Figure 3-10. Backplane Removal

F 0171

FRONT FAN REMOVAL AND REPLACEMENT

To remove and replace the front fan, you need a phillips screwdriver suitable for # 6 or # 8 screws. Proceed as follows:

1. Turn the power switch to "off", disconnect the power cord, and remove the top cover.
2. Referring to Figure 3-11, remove the screw holding the AC cable clamp to the fan housing, then remove the four screws holding the front fan housing to the chassis base. Note the position of the ground lug.
3. Disconnect the fan's power cable from the backplane.
4. Remove the housing from the chassis base.
5. Remove the four screws holding the fan to the housing. Note the orientation of the power cable with respect to the housing.
6. Fan replacement is the reverse of the removal procedure. Position the power cable in the same orientation as noted in step 5. Remember to reconnect the ground lug.

REAR FAN REMOVAL AND REPLACEMENT

To remove and replace the rear fan, you need a phillips screwdriver suitable for # 6 or # 8 screws. Proceed as follows:

1. Turn the power switch to "off", disconnect the power cord, and remove the top cover.
2. Referring to Figure 3-11, remove the four screws holding the rear fan/AC distribution housing to the chassis base.
3. Disconnect the fan's power cable from the backplane. Note the orientation of the connector.
4. Lift the housing out of the chassis as far as the cabling will allow, then remove the four screws holding the fan to the housing. Note the orientation of the power cable with respect to the housing.
5. Fan replacement is the reverse of the removal procedure. Mount the fan in the same orientation as noted in step 4. Make sure the plug is oriented as noted in step 3. Check to make sure the fan is operating after installation.

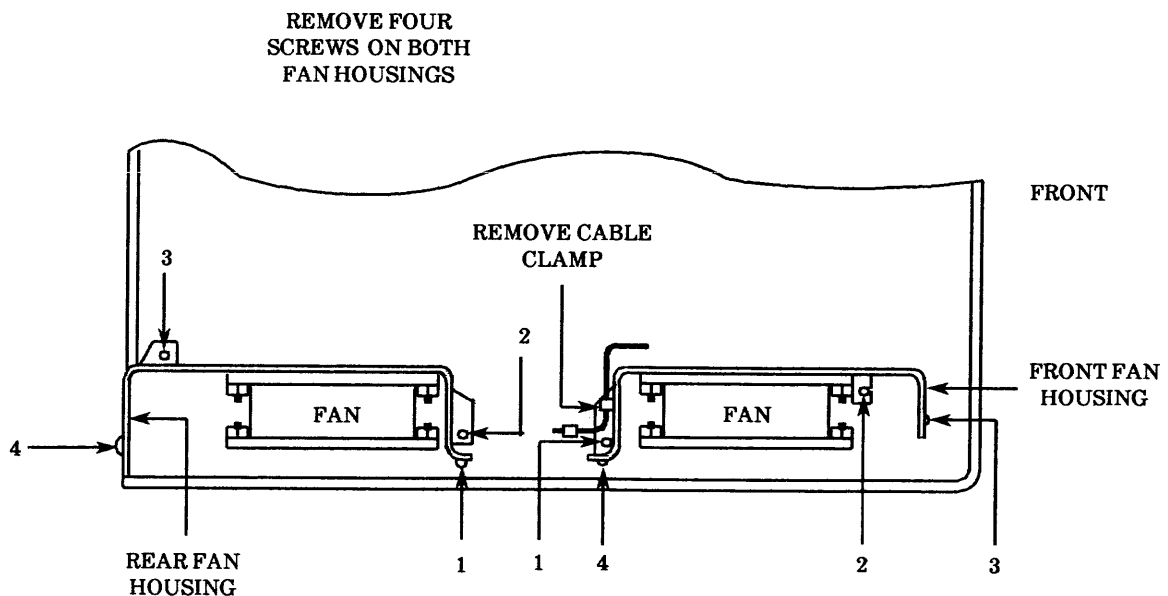


Figure 3-11. Front and Rear Fan Removal

F-0165

POWER SWITCH REMOVAL AND REPLACEMENT

Remove the power switch as follows:

1. Turn the power switch to "off", disconnect the power cord, and remove the top cover.
2. Disconnect the leads from the power switch. Make a diagram of the lead locations.
3. As shown in Figure 3-12, 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 housing. It is easiest to press in the top retainers first, tip top of the switch out, then press in the bottom retainers and remove the switch.
4. Replace the power switch by snapping it in place from the rear of the housing.

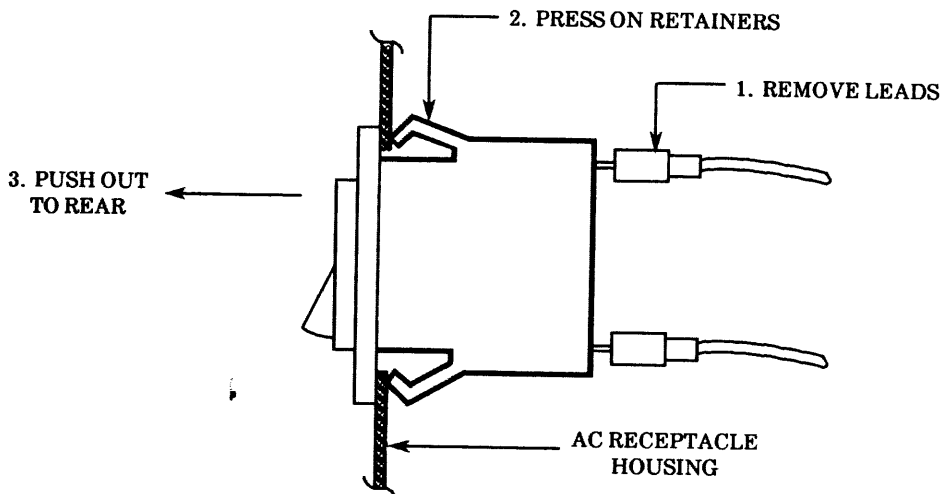


Figure 3-12. Power Switch Removal

F-0167

AC RECEPTACLE REMOVAL AND REPLACEMENT

The AC receptacle and distribution cable are removed as an assembly. To remove and replace the AC receptacle assembly, you need a phillips screwdriver suitable for # 6 or # 8 screws and pair of pliers or large flat-blade screwdriver. Proceed as follows:

1. Turn the power switch to "off", disconnect the power cord, and remove the top cover.
2. Remove the rear fan/AC distribution housing from the chassis base as described earlier in "Rear Fan Removal and Replacement."
3. Disconnect the AC ground lugs (green lead with yellow stripe) at the AC housing, line filter, cardcage, center mounting panel, rear fan housing, and drive base plate.
4. Disconnect the leads from the bottom of the power switch.
5. Disconnect the AC distribution cable connector at the power supply.
6. The AC receptacle assembly is held in place by pop-out retainers on the top and bottom of the assembly. Press in the retainers with the pliers or flat-bladed screwdriver and remove the assembly through the rear of the housing. It is best to disengage one side at time. See Figure 3-13.
7. After the receptacle assembly is clear of the housing, carefully feed the AC distribution Cable out through the rear of the housing.
8. AC distribution cable replacement is the reverse of the removal procedure.

FRONT PANEL CIRCUIT BOARD REMOVAL AND REPLACEMENT

To remove and replace the front panel circuit board, you need a long-shanked phillips screwdriver suitable for # 8 screws. Proceed as follows:

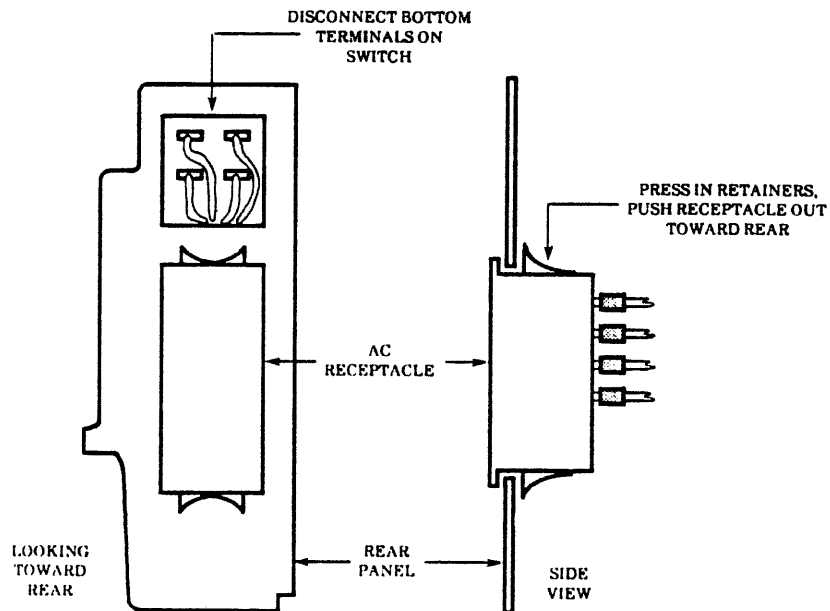
1. Turn the power switch to "off", disconnect the power cord, and remove the top cover.
2. Dismount the disk drive base plate assembly as described earlier under "Disk Drive Removal and Replacement." Do not remove the assembly completely--just enough so that you can lift the front of the assembly. Disconnect the ground lug on the front of the drive base plate.
3. Lift the front of the drive base plate and pull the front panel circuit board out of its slot.

4. Disconnect the front panel control cable from the backplane.
5. Front panel circuit board replacement is the reverse of the removal procedure.

WINCHESTER SCRAMBLER REMOVAL AND REPLACEMENT

To remove and replace the Winchester scrambler circuit board, you need a phillips screwdriver suitable for # 8 screws. Proceed as follows:

1. Turn the power switch to "off" and remove the I/O panel.
2. Disconnect the control and data cables at the Winchester controller board and the Winchester scrambler.
3. Remove the two screws holding the Winchester scrambler to the I/O panel.
4. Winchester scrambler replacement is the reverse of the removal procedure.



F-0170

Figure 3-13. AC Receptacle Removal and Replacement

FUSE REMOVAL AND REPLACEMENT

The fuse is located within the AC receptacle assembly on the rear panel. To remove and replace the fuse, proceed as follows:

1. Turn the power switch to "off" and unplug the power cord.
2. To gain access to the fuse, slide the clear plastic cover on the AC receptacle up.
3. Pull on the fuse ejector lever, labeled "fuse pull", to disengage one side of the fuse.
4. Pull the other side of the fuse loose from the fuseholder.
5. To replace the fuse, snap both ends in place in the fuseholder.

Fuse sizes:

90 to 132 VAC 6A
198 to 264 VAC 3A



CHAPTER 4 PARTS LIST AND DIAGRAMS

This chapter contains a field replaceable parts list, schematic diagrams, interconnecting wiring diagrams, and illustrations showing component locations and cable routing.

FIELD REPLACEABLE PARTS

The following list contains part numbers for the field-replaceable parts for the System 310. For most part numbers there is a reference to an illustration showing component locations.

Description	Part Number	Figure
Power supply, 220W	107941	4-17
PBA, iSBC 86/30	172843	4-2
PBA, iSBC 215G (with firmware)	172835	4-4
PBA, iSBX 218A	145591	4-8
PBA, iSBC 012B	112642	none
PBA, iSBC 337	142696	4-2
PBA, Winchester scrambler	172983	4-4,5
PBA, iSBC 213A	132727	4-4
PBA, iSBC 304	143561	4-2
PBA, front panel	173215	4-12
PBA, backplane	173238	4-9
Winchester drive, 10 MB	133217	4-4
Flexible disk drive, 48 tpi	133882	4-8
Flexible diskette firmware PROMs (4ea), SCT300F	173173	4-2
Winchester disk firmware PROMs (4ea), SCT300W	172826	4-2
Fan, DC	172861	4-17
Printer scrambler	172986	4-2
Cable, DC distribution	172850	4-17
Cable, AC distribution	173717	4-15
Cable, Winchester scrambler to data separator	172820	4-4
Cable, Winchester scrambler to Winchester drive	172821	4-4
Cable, data separator to Winchester drive	172822	4-4
Cable, Flexible disk drive to controller	173262	4-8
Cable, RS-232	144553	4-2
Filter, line		4-15
Connector, Auxiliary	102238	4-2

DIAGRAMS

This section contains interconnecting wiring diagrams and illustrations showing cable routing and component locations for the major subsystems of the System 310. Also included are schematic diagrams of the backplane, front panel, and winchester scrambler circuit boards.

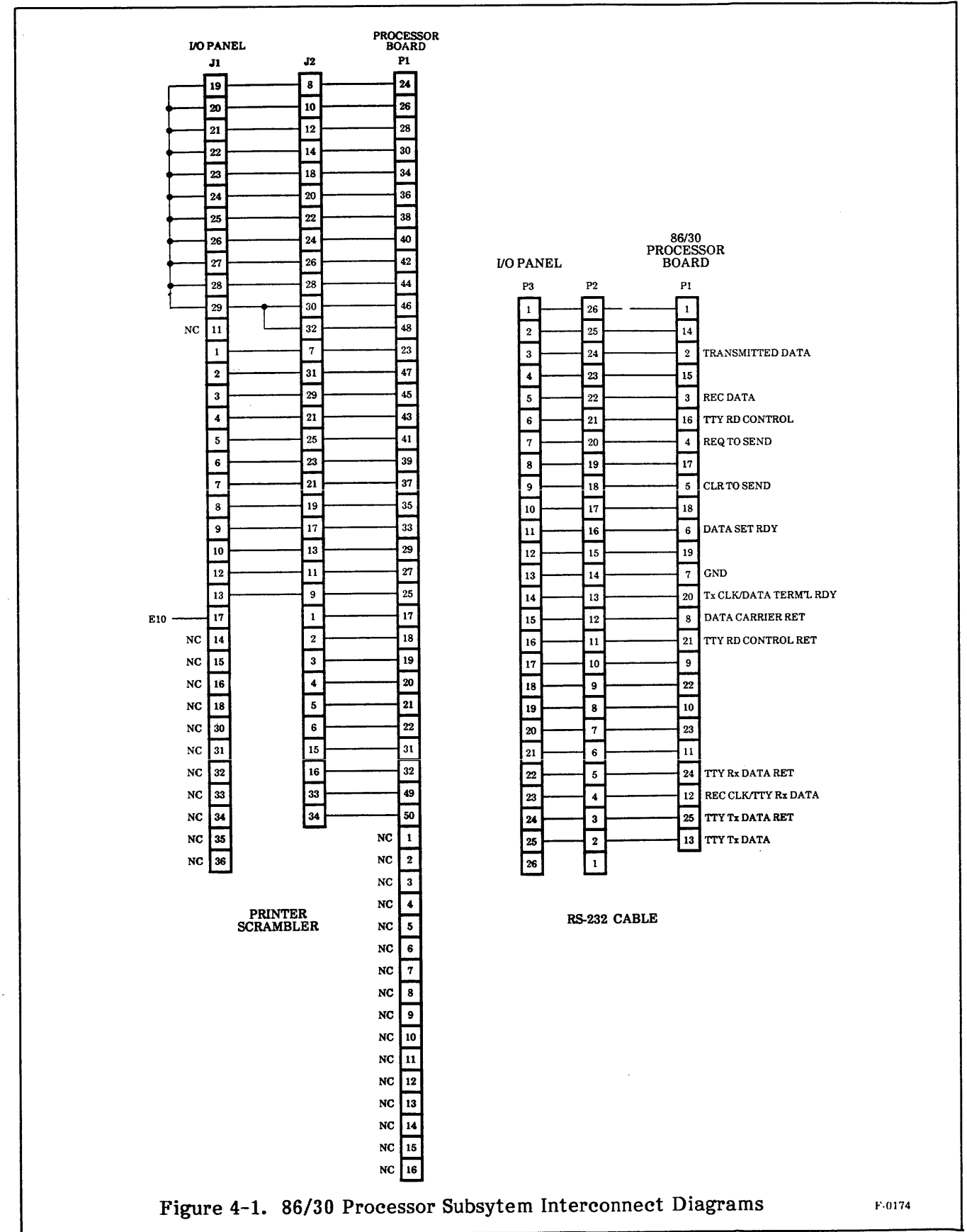


Figure 4-1. 86/30 Processor Subsystem Interconnect Diagrams

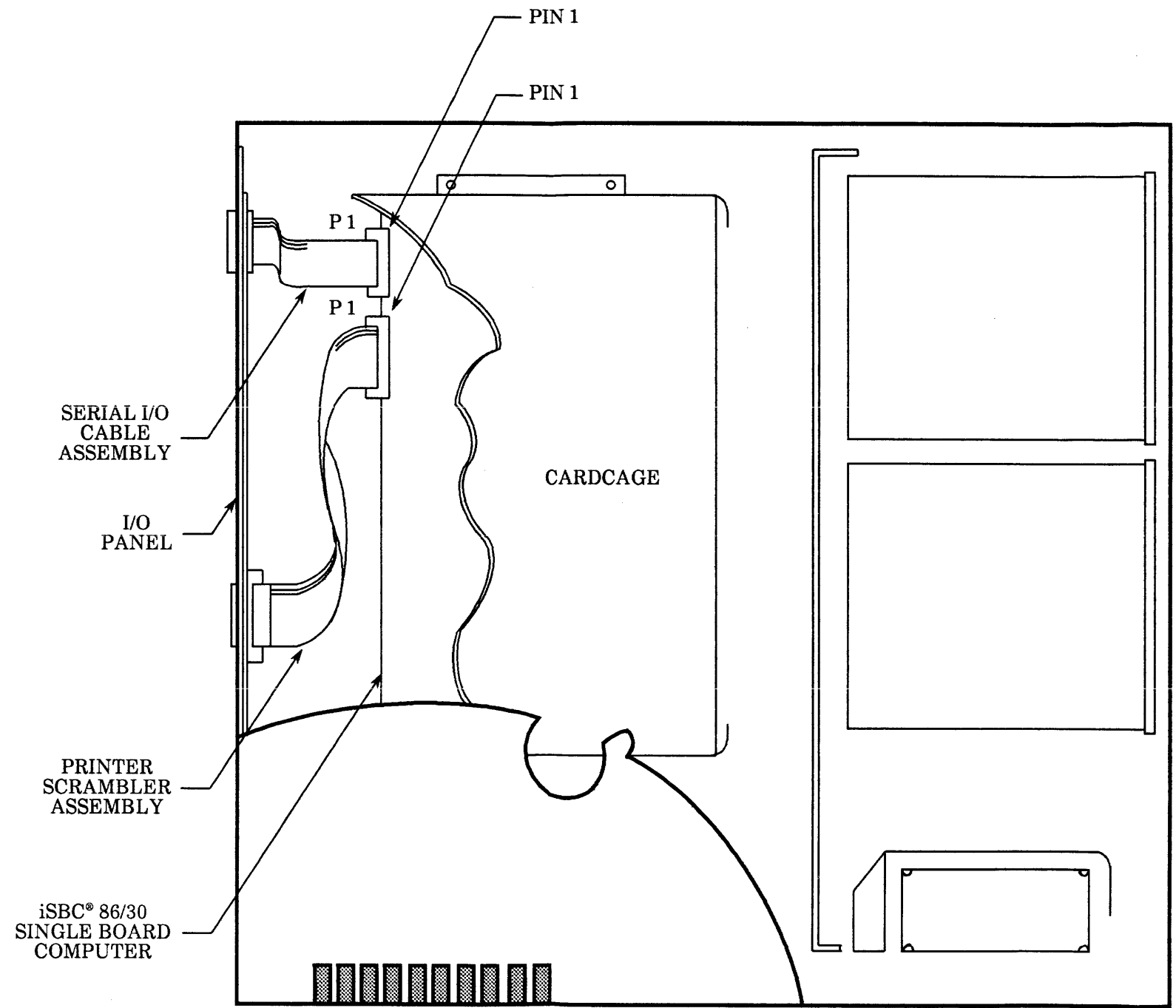


Figure 4-2. 86/30 Processor Subsystem Component Locations

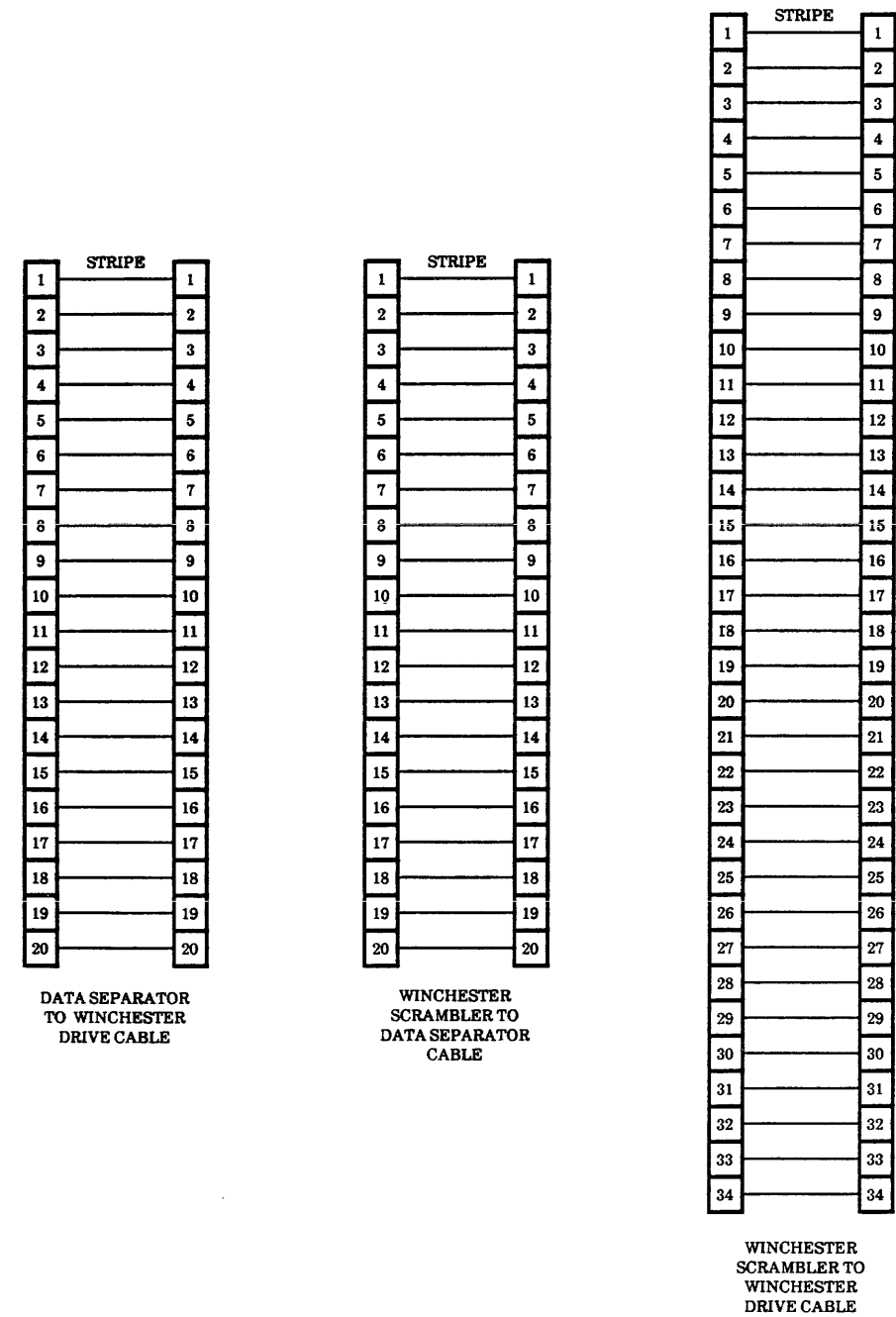
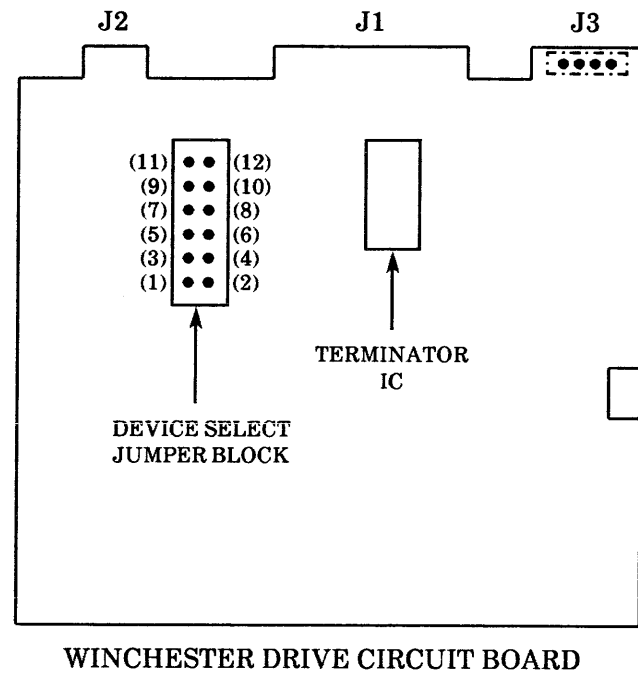


Figure 4-3. Winchester Disk Subsystem Interconnect Diagrams



WINCHESTER DRIVE CIRCUIT BOARD

Function	Jumper Block Pin Numbers
Drive Select 0	1, 2
Drive Select 1	3, 4
Drive Select 2	5, 6
Drive Select 3	7, 8
Reserved	9, 10
Reserved	11, 12

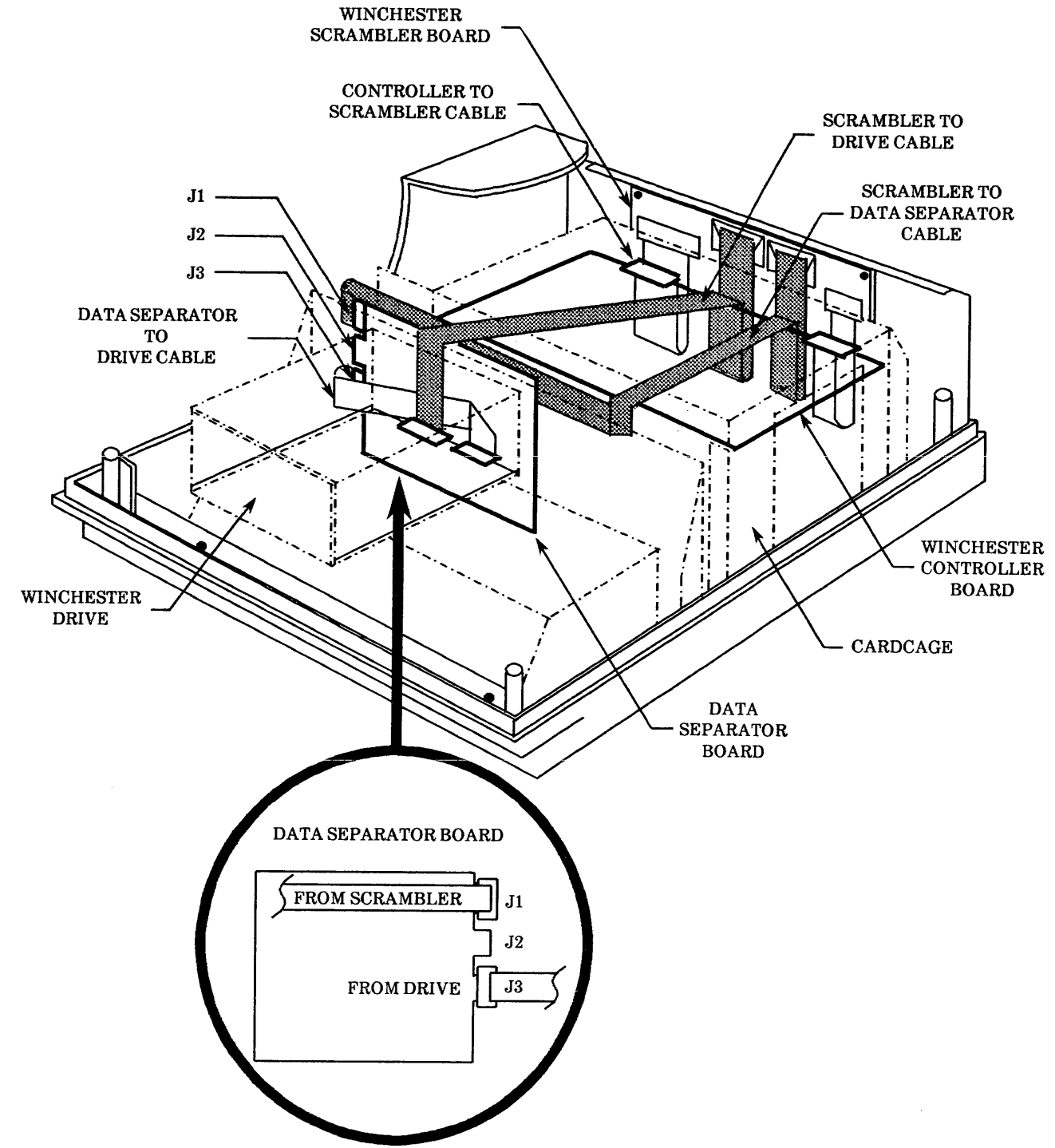
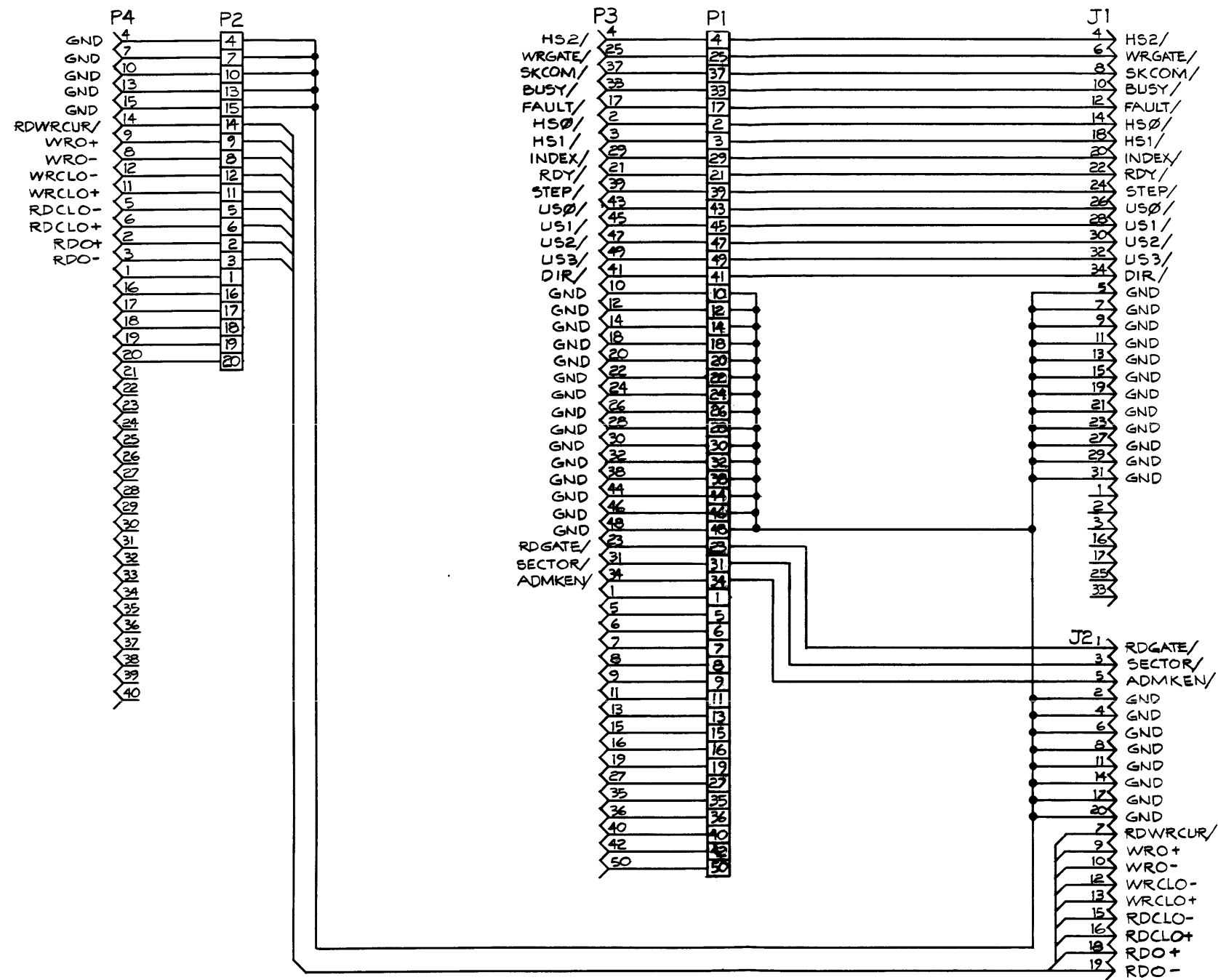
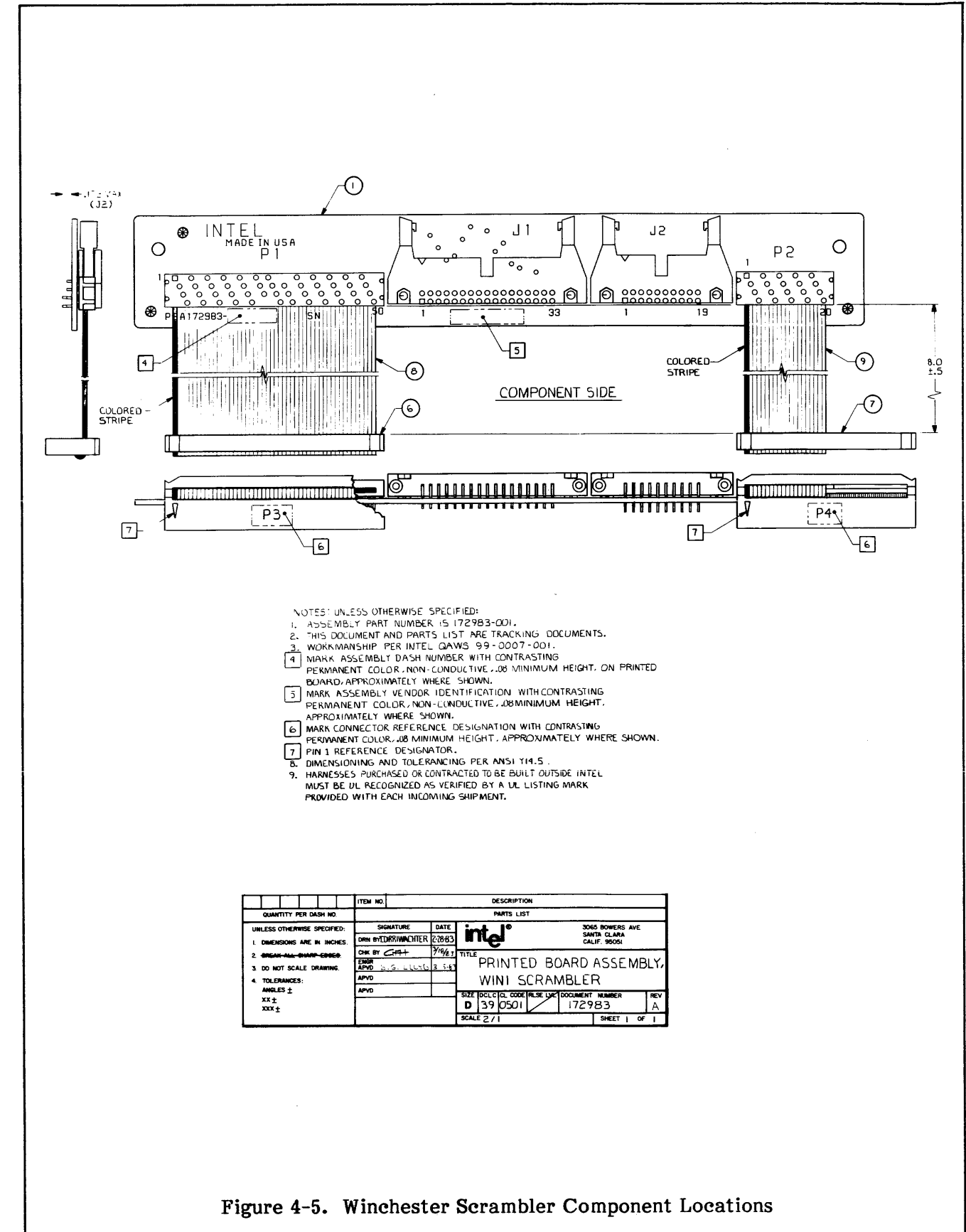


Figure 4-4. Winchester Disk Subsystem Component Locations



SIGNATURE	DATE	intel	3065 BOWERS AVE SANTA CLARA CALIF. 95051
DRN BY PLUNKETT	2/2/63		
CHK BY GAT	7/1/63	TITLE SCHEMATIC DIAGRAM	
ENGR APVD S. LLOYD	7/1/63	PBA, WINI SCRAMBLER	
APVD		SIZE D	CLC L CL CODE /
APVD		39	0100
		SCALE	172984 A
			SHEET OF

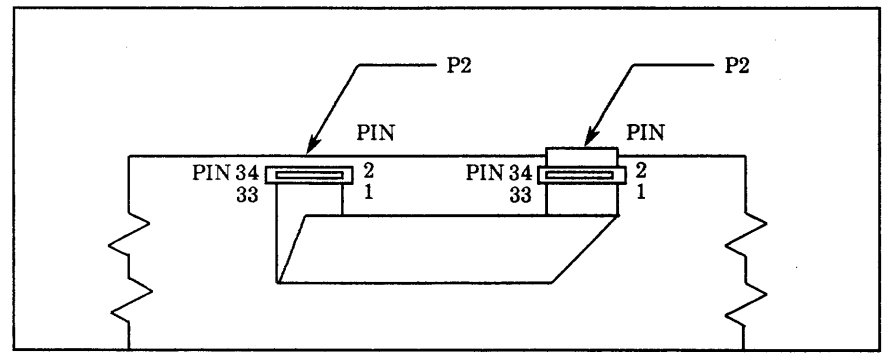
Figure 4-6. Winchester Scrambler Schematic Diagram



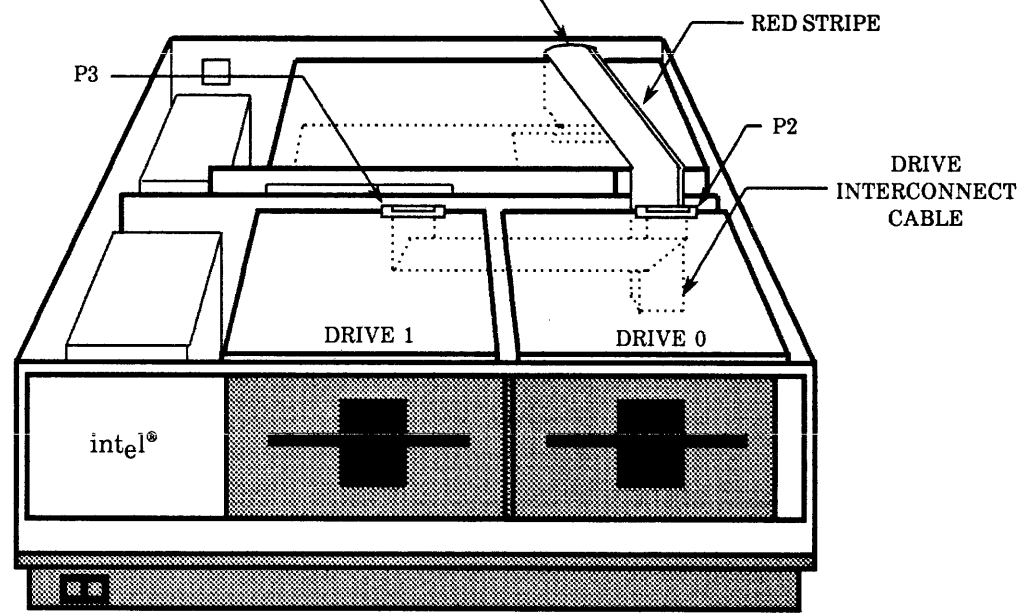
- NOTES: UNLESS OTHERWISE SPECIFIED:
1. ASSEMBLY PART NUMBER IS 172983-001.
 2. THIS DOCUMENT AND PARTS LIST ARE TRACKING DOCUMENTS.
 3. WORKMANSHIP PER INTEL QAWS 99-0007-001.
 4. MARK ASSEMBLY DASH NUMBER WITH CONTRASTING PERMANENT COLOR, NON-CONDUCTIVE, .08 MINIMUM HEIGHT, ON PRINTED BOARD, APPROXIMATELY WHERE SHOWN.
 5. MARK ASSEMBLY VENDOR IDENTIFICATION WITH CONTRASTING PERMANENT COLOR, NON-CONDUCTIVE, .08 MINIMUM HEIGHT, APPROXIMATELY WHERE SHOWN.
 6. MARK CONNECTOR REFERENCE DESIGNATION WITH CONTRASTING PERMANENT COLOR, .08 MINIMUM HEIGHT, APPROXIMATELY WHERE SHOWN.
 7. PIN 1 REFERENCE DESIGNATOR.
 8. DIMENSIONING AND TOLERANCING PER ANSI Y14.5.
 9. HARNESSSES PURCHASED OR CONTRACTED TO BE BUILT OUTSIDE INTEL MUST BE UL RECOGNIZED AS VERIFIED BY A UL LISTING MARK PROVIDED WITH EACH INCOMING SHIPMENT.

QUANTITY PER DASH NO.	ITEM NO.	DESCRIPTION																																								
UNLESS OTHERWISE SPECIFIED:		<table border="1"> <tr> <td>SIGNATURE</td> <td>DATE</td> <td rowspan="2"> intel 3060 BOWERS AVE SANTA CLARA CALIF. 95051 </td> </tr> <tr> <td>DRN BY: DRWINNER</td> <td>2/28/83</td> </tr> <tr> <td>CHK BY: [Signature]</td> <td>3/9/83</td> <td>TITLE</td> </tr> <tr> <td>ENGR: [Signature]</td> <td></td> <td>PRINTED BOARD ASSEMBLY, WINI SCRAMBLER</td> </tr> <tr> <td>APVD: [Signature]</td> <td></td> <td>REV</td> </tr> <tr> <td>APVD: [Signature]</td> <td></td> <td> <table border="1"> <tr> <td>SIZE</td> <td>DATE</td> <td>CODE</td> <td>FILE</td> <td>DOC</td> <td>NUMBER</td> <td>REV</td> </tr> <tr> <td>D</td> <td>39</td> <td>0501</td> <td></td> <td></td> <td>172983</td> <td>A</td> </tr> </table> </td> </tr> <tr> <td colspan="2">ANGLES ±</td> <td>SCALE: 2/1</td> </tr> <tr> <td>XX ±</td> <td></td> <td>SHEET 1 OF 1</td> </tr> <tr> <td>XXX ±</td> <td></td> <td></td> </tr> </table>	SIGNATURE	DATE	intel 3060 BOWERS AVE SANTA CLARA CALIF. 95051	DRN BY: DRWINNER	2/28/83	CHK BY: [Signature]	3/9/83	TITLE	ENGR: [Signature]		PRINTED BOARD ASSEMBLY, WINI SCRAMBLER	APVD: [Signature]		REV	APVD: [Signature]		<table border="1"> <tr> <td>SIZE</td> <td>DATE</td> <td>CODE</td> <td>FILE</td> <td>DOC</td> <td>NUMBER</td> <td>REV</td> </tr> <tr> <td>D</td> <td>39</td> <td>0501</td> <td></td> <td></td> <td>172983</td> <td>A</td> </tr> </table>	SIZE	DATE	CODE	FILE	DOC	NUMBER	REV	D	39	0501			172983	A	ANGLES ±		SCALE: 2/1	XX ±		SHEET 1 OF 1	XXX ±		
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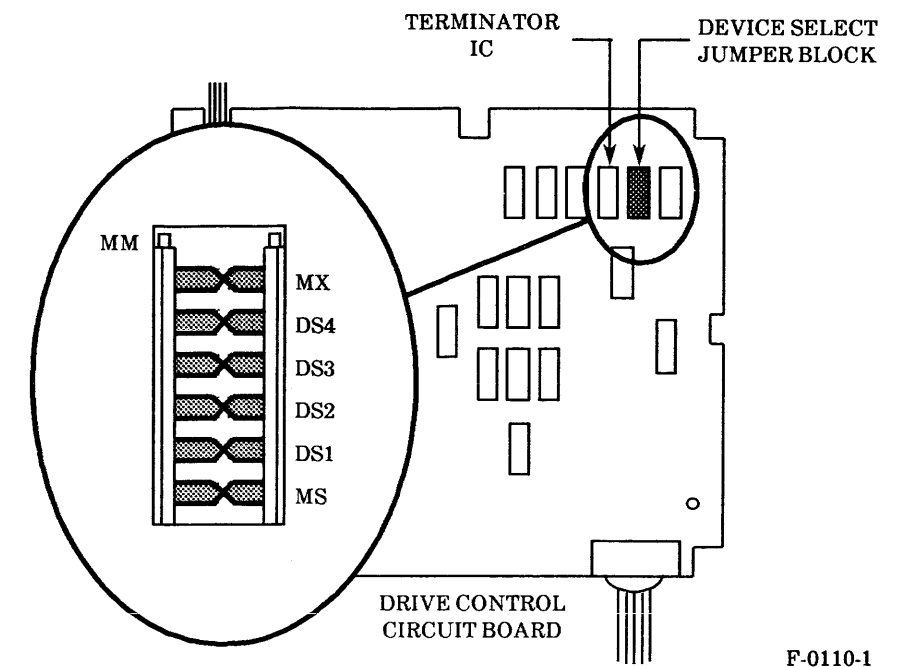
Figure 4-5. Winchester Scrambler Component Locations



CONNECTOR TO
218A CONTROLLER BOARD
(on 86/30 board in dual-drive installation)

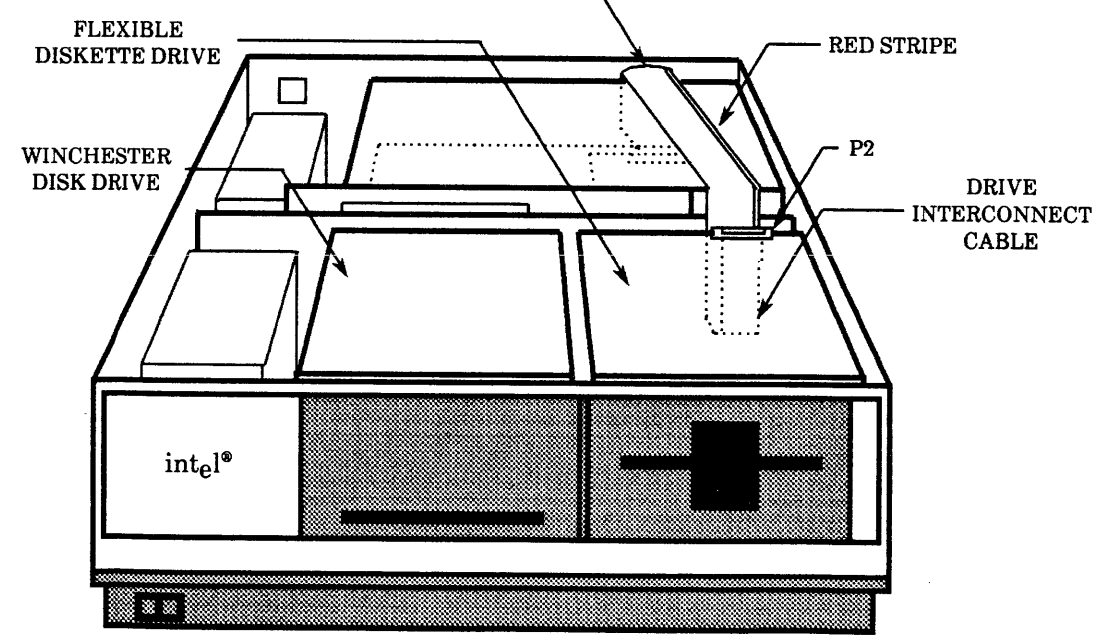


DUAL-DRIVE INSTALLATION



F-0110-1

CONNECTOR TO
218A CONTROLLER BOARD
(on 215G board in single-drive installation)



SINGLE-DRIVE INSTALLATION

Figure 4-8. Diskette Drive Subsystem Component Locations

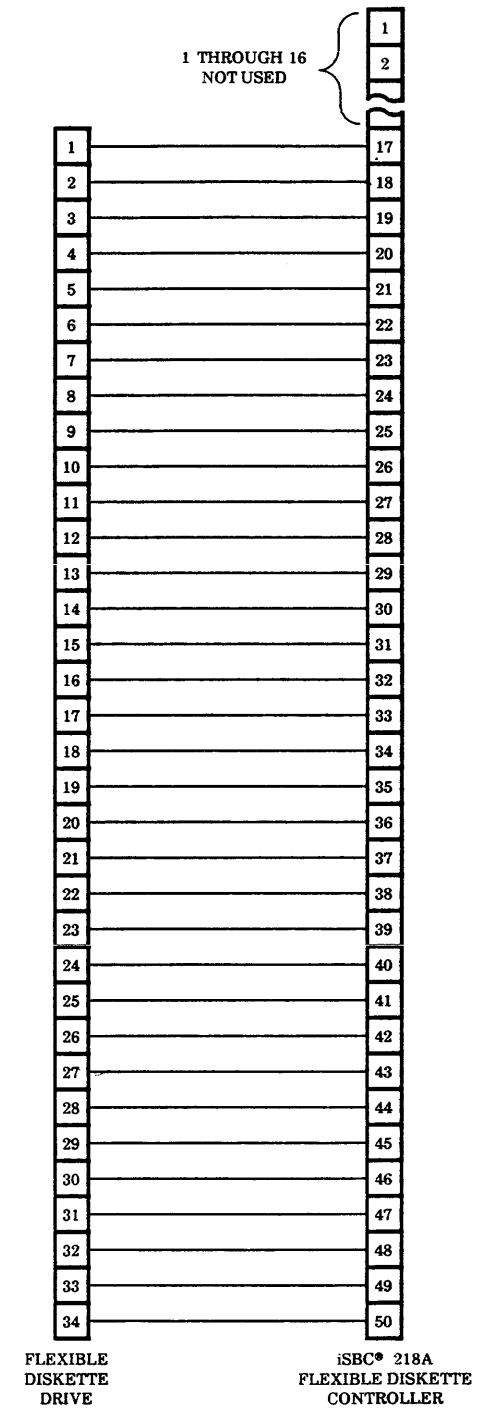
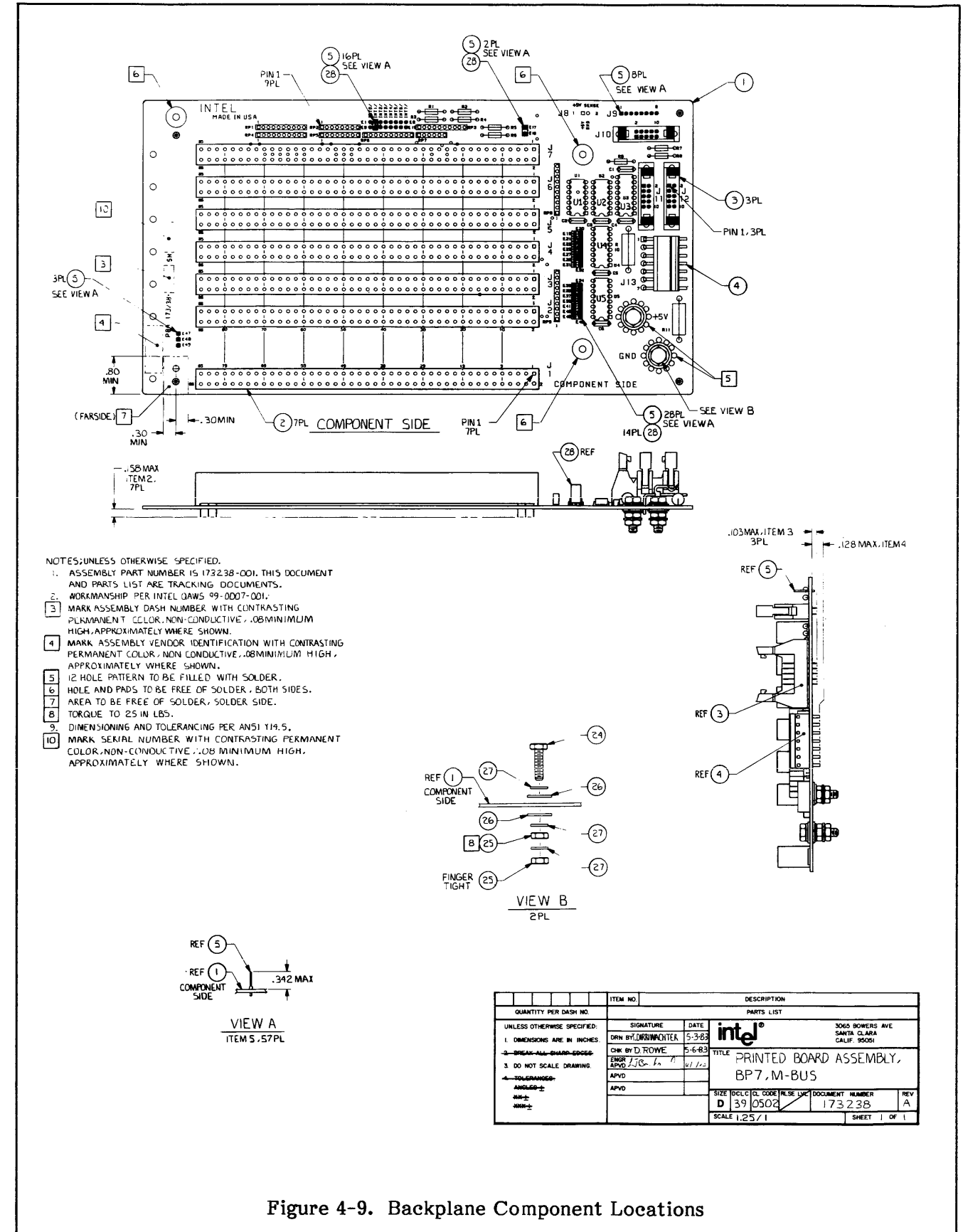


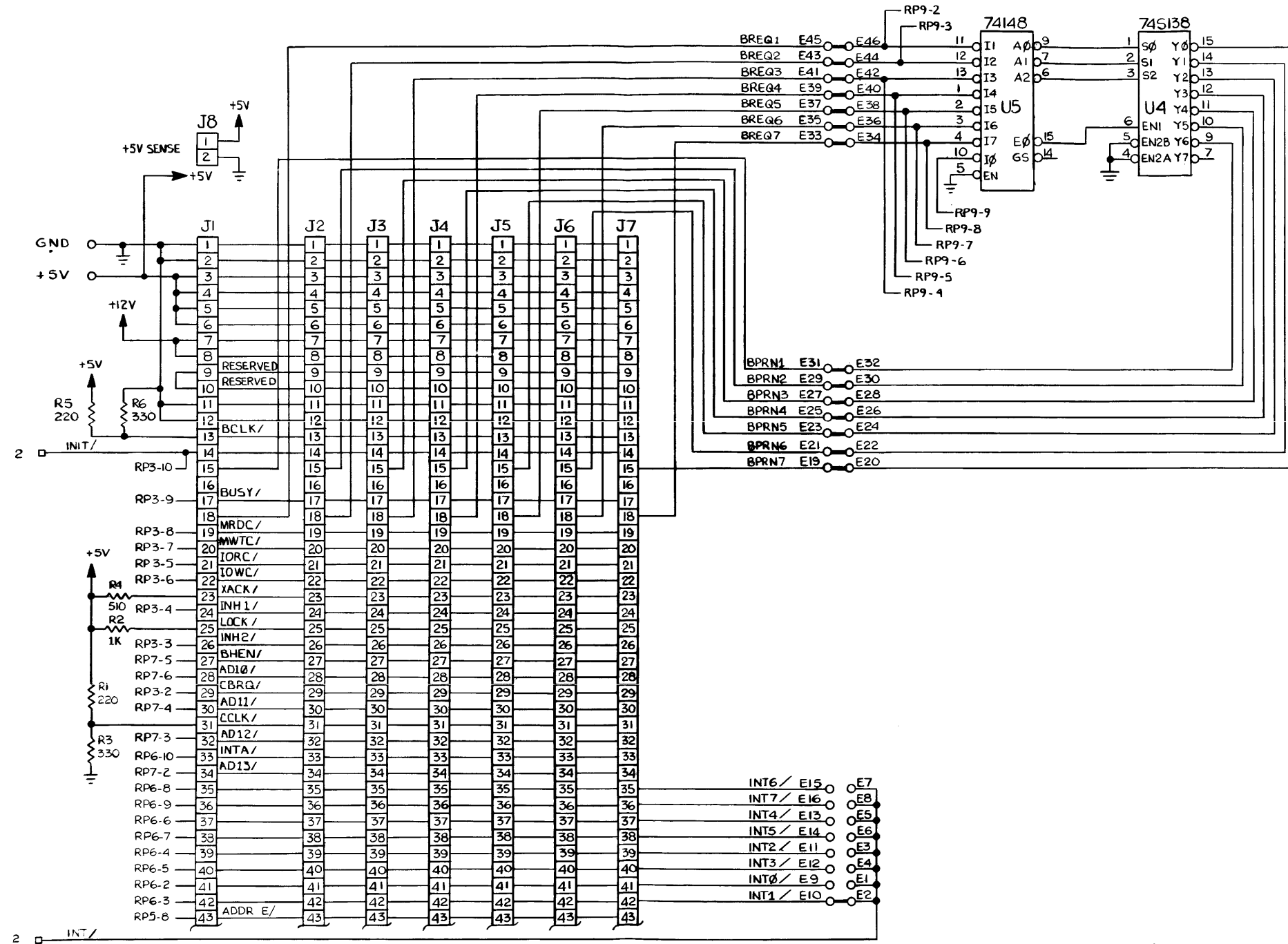
Figure 4-7. Diskette Drive Interconnect Diagram



- NOTES: UNLESS OTHERWISE SPECIFIED.
1. ASSEMBLY PART NUMBER IS 173238-001. THIS DOCUMENT AND PARTS LIST ARE TRACKING DOCUMENTS.
 2. WORKMANSHIP PER INTEL QAWS 99-0007-001.
 3. MARK ASSEMBLY DASH NUMBER WITH CONTRASTING PERMANENT COLOR, NON-CONDUCTIVE, .08 MINIMUM HIGH, APPROXIMATELY WHERE SHOWN.
 4. MARK ASSEMBLY VENDOR IDENTIFICATION WITH CONTRASTING PERMANENT COLOR, NON-CONDUCTIVE, .08 MINIMUM HIGH, APPROXIMATELY WHERE SHOWN.
 5. 12 HOLE PATTERN TO BE FILLED WITH SOLDER.
 6. HOLE AND PADS TO BE FREE OF SOLDER, BOTH SIDES.
 7. AREA TO BE FREE OF SOLDER, SOLDER SIDE.
 8. TORQUE TO 25 IN LBS.
 9. DIMENSIONING AND TOLERANCING PER ANSI Y14.5.
 10. MARK SERIAL NUMBER WITH CONTRASTING PERMANENT COLOR, NON-CONDUCTIVE, .08 MINIMUM HIGH, APPROXIMATELY WHERE SHOWN.

QUANTITY PER DASH NO.	ITEM NO.	DESCRIPTION	PARTS LIST
UNLESS OTHERWISE SPECIFIED:			
1. DIMENSIONS ARE IN INCHES	SIGNATURE	DATE	3065 BOWERS AVE SANTA CLARA CALIF. 95051
2. BREAK ALL SHARP EDGES	DRN BY: D. ROWE	5-6-83	TITLE PRINTED BOARD ASSEMBLY, BP7, M-BUS
3. DO NOT SCALE DRAWING	ENGR: APVD	5/1/83	
4. TOLERANCES	APVD		SIZE D 39 0502
			SCALE 1.25/1
			DOCUMENT NUMBER 173238
			REV A
			SHEET 1 OF 1

Figure 4-9. Backplane Component Locations



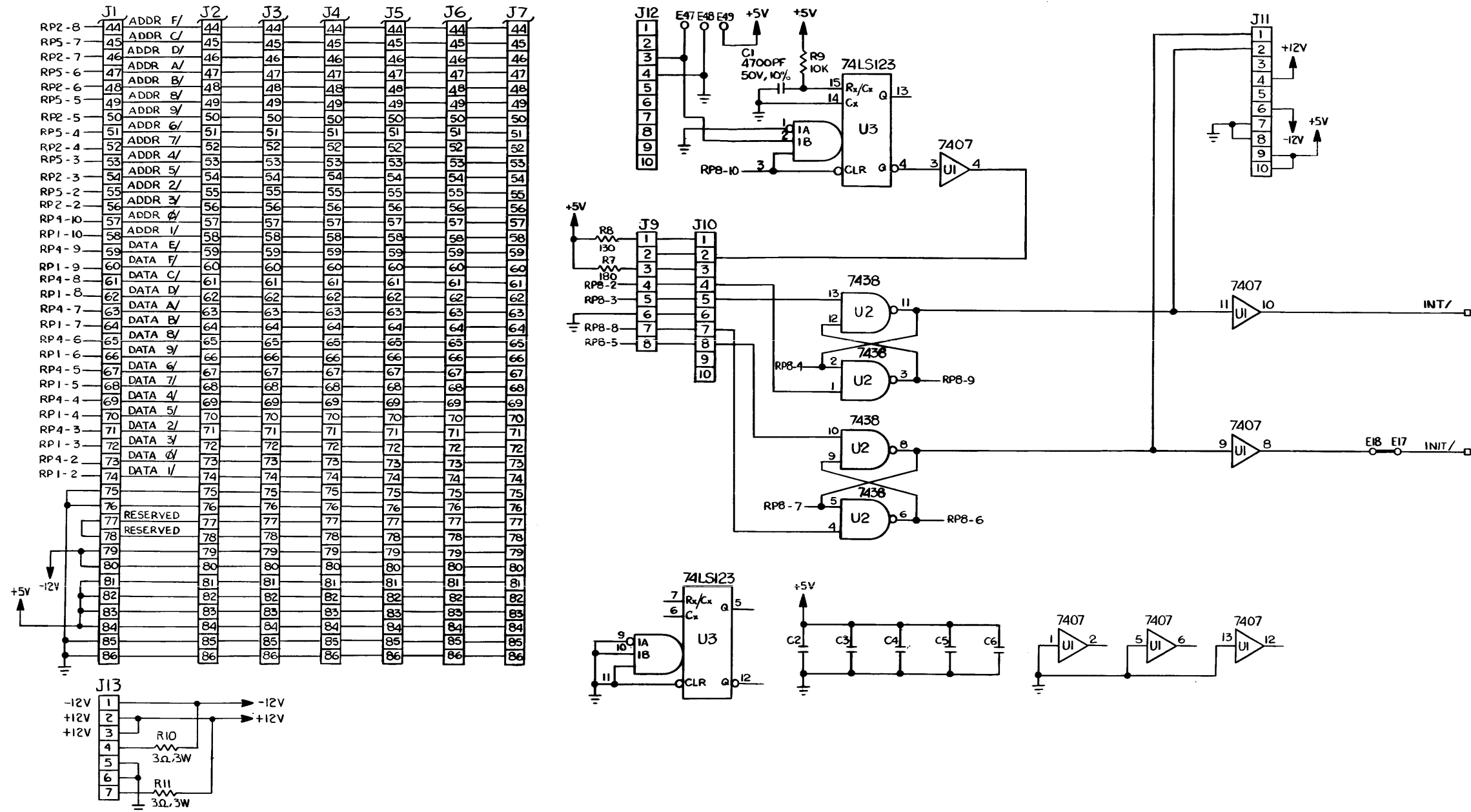
- NOTES. UNLESS OTHERWISE SPECIFIED.
1. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
 2. RESISTOR PACK (RP) VALUES ARE AS FOLLOWS:
RP3, 6 AND 9 ARE 1K. RP1, 2, 4, 5, 7, AND 8 ARE 2.2K.
 3. RPX-X DENOTES +5V.
 4. CAPACITANCE VALUES ARE .01 UF, 50V, +80% - 20%.

DEVICE TABLE				
REF DES	DEVICE TYPE	POWER PINS		UNUSED LOGIC ELEMENTS OUTPUT PINS
		GND	+5V	
U1	7407	7	14	U1-2, U1-6, U1-12
U2	7438	7	14	
U3	74LS123	8	16	U3-5, U3-12
U4	74LS138	8	16	
U5	74148	8	16	

REFERENCE DESIGNATION	QUANTITY PER DASH NO.	ITEM NO.	DESCRIPTION
LAST USED	NOT USED		
C6			
R11			
RP9			
U5			
E+9			
J13	J8		

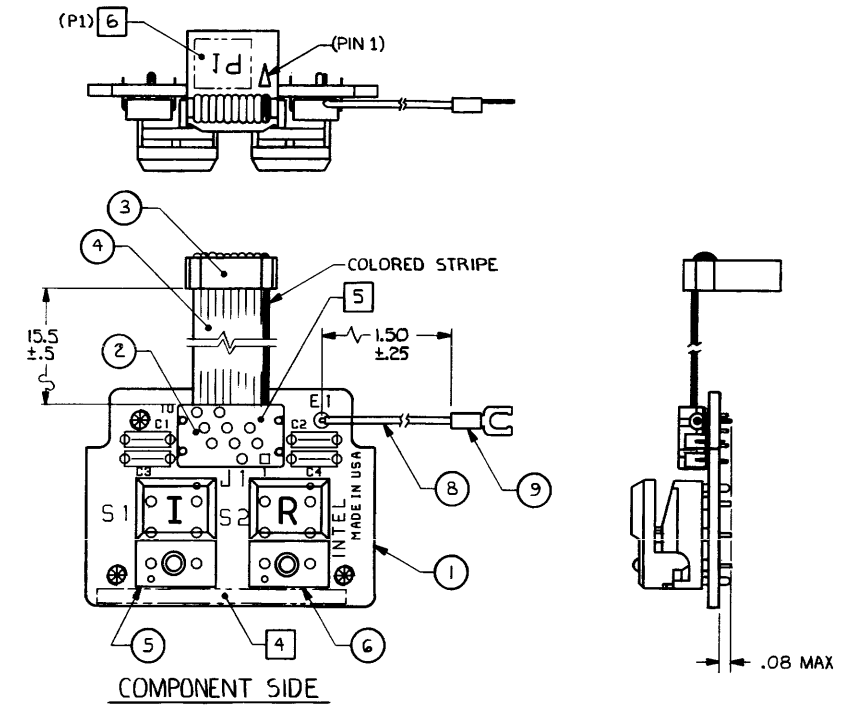
SIGNATURE		DATE	 3065 BOWERS AVE SANTA CLARA CALIF. 95051
DRN BY V. TRAN		5-3-83	
CHK BY D. ROWE		5-6-83	TITLE
ENGR APVD [Signature]		4/7/83	SCHEMATIC DIAGRAM, PBA, BP 7, M-BUS
APVD			SIZE DCLC CL CODE FILE LTR DOCUMENT NUMBER
APVD			D 39 0100 173239
SCALE NONE			REV A
			SHEET 1 OF 2

Figure 4-10. Backplane Schematic Diagram (Sheet 1)



SIZE	DOCUMENT NUMBER	SHEET	REV
D	173 239	2	A

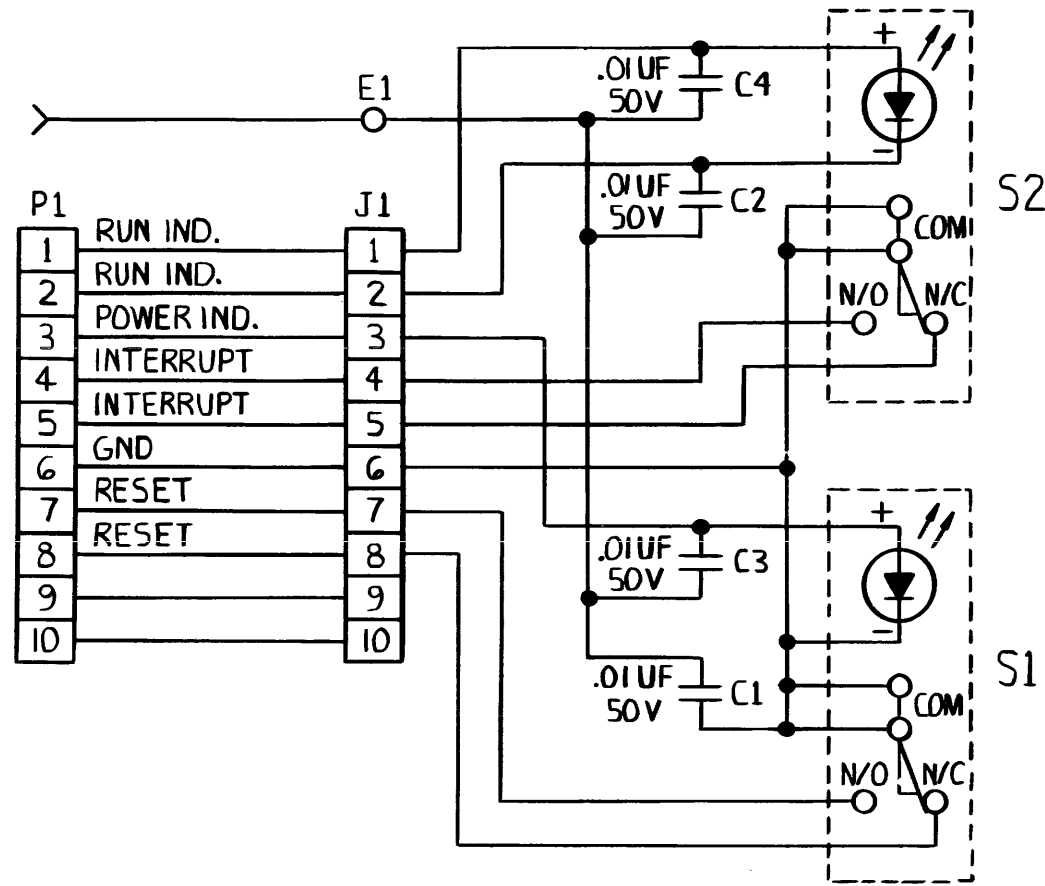
Figure 4-11. Backplane Schematic Diagram (Sheet 2)



- NOTES; UNLESS OTHERWISE SPECIFIED:
1. ASSEMBLY PART NUMBER IS 173660-001.
 2. THIS DOCUMENT AND PARTS LIST ARE TRACKING DOCUMENTS.
 3. WORKMANSHIP PER INTEL 99-0007-001.
 4. MARK "PDA", PART NUMBER, AND SERIAL NUMBER WITH CONTRASTING PERMANENT COLOR, NON-CONDUCTIVE, .08 MINIMUM HIGH, APPROXIMATELY WHERE SHOWN.
 5. MARK ASSEMBLY VENDOR IDENTIFICATION WITH CONTRASTING PERMANENT COLOR, .08 MINIMUM HIGH, ON CONNECTOR J1, APPROXIMATELY WHERE SHOWN.
 6. MARK CONNECTOR REFERENCE DESIGNATION WITH CONTRASTING PERMANENT COLOR, .08 MINIMUM HIGH, APPROXIMATELY WHERE SHOWN.
 7. HARNESES PURCHASED OR CONTRACTED TO BE BUILT OUTSIDE INTEL MUST BE UL RECOGNIZED AS VERIFIED BY A UL LISTING MARK PROVIDED WITH EACH INCOMING SHIPMENT.
 8. DIMENSIONING AND TOLERANCING PER ANSI Y14.5.

QUANTITY PER DASH NO.	ITEM NO.	DESCRIPTION																																						
UNLESS OTHERWISE SPECIFIED: 1. DIMENSIONS ARE IN INCHES. 2. BREAK-ALL SHARP CORNERS. 3. DO NOT SCALE DRAWING. 4. TOLERANCES: XX ± XXX ±		<table border="1"> <tr> <td>SIGNATURE</td> <td>DATE</td> <td rowspan="2"> </td> <td rowspan="2"> 3065 BOWERS AVE. SANTA CLARA CALIF. 95051 </td> </tr> <tr> <td>DRN BY: D. ROWE</td> <td>2/24/83</td> </tr> <tr> <td>CHK BY: D. ROWE</td> <td>2/24/83</td> <td colspan="2">TITLE PRINTED BOARD ASSEMBLY, SWITCH AND LIGHT</td> </tr> <tr> <td>ENGR</td> <td>APVD</td> <td>SIZE</td> <td>DATE</td> </tr> <tr> <td>APVD</td> <td></td> <td>C 139</td> <td>0501</td> </tr> <tr> <td></td> <td></td> <td>CL CODE</td> <td>RELSE LVL</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>DOCUMENT NUMBER</td> <td>REV</td> </tr> <tr> <td></td> <td></td> <td>173660</td> <td>A</td> </tr> <tr> <td></td> <td></td> <td>SCALE 2/1</td> <td>SHEET 1 OF 1</td> </tr> </table>	SIGNATURE	DATE		3065 BOWERS AVE. SANTA CLARA CALIF. 95051	DRN BY: D. ROWE	2/24/83	CHK BY: D. ROWE	2/24/83	TITLE PRINTED BOARD ASSEMBLY, SWITCH AND LIGHT		ENGR	APVD	SIZE	DATE	APVD		C 139	0501			CL CODE	RELSE LVL							DOCUMENT NUMBER	REV			173660	A			SCALE 2/1	SHEET 1 OF 1
SIGNATURE	DATE		3065 BOWERS AVE. SANTA CLARA CALIF. 95051																																					
DRN BY: D. ROWE	2/24/83																																							
CHK BY: D. ROWE	2/24/83	TITLE PRINTED BOARD ASSEMBLY, SWITCH AND LIGHT																																						
ENGR	APVD	SIZE	DATE																																					
APVD		C 139	0501																																					
		CL CODE	RELSE LVL																																					
		DOCUMENT NUMBER	REV																																					
		173660	A																																					
		SCALE 2/1	SHEET 1 OF 1																																					

Figure 4-12. Front Panel Circuit Board Component Locations



ITEM NO.		DESCRIPTION					
QUANTITY PER DASH NO.		PARTS LIST					
UNLESS OTHERWISE SPECIFIED: 1. DIMENSIONS ARE IN INCHES. 2. BREAK ALL SHARP EDGES. 3. DO NOT SCALE DRAWING. 4. TOLERANCES: ANGLES ± XX ± XXX ±	SIGNATURE	DATE	intel® 3065 BOWERS AVE. SANTA CLARA CALIF. 95051				
	DRN BY T. PHELPS	4-20-83					
	CHK BY D. ROWE	5-9-83	TITLE				
	ENGR APVD <i>[Signature]</i>	5-11-83	SCHMATIC DIAGRAM, PBA, SWITCH AND LIGHT				
APVD		SIZE	DCLC	CL CODE	RLSE LVL	DOCUMENT NUMBER	REV
APVD		B	39	0100		173216	A
SCALE NONE						SHEET 1 OF 1	

Figure 4-13. Front Panel Circuit Board Schematic Diagram

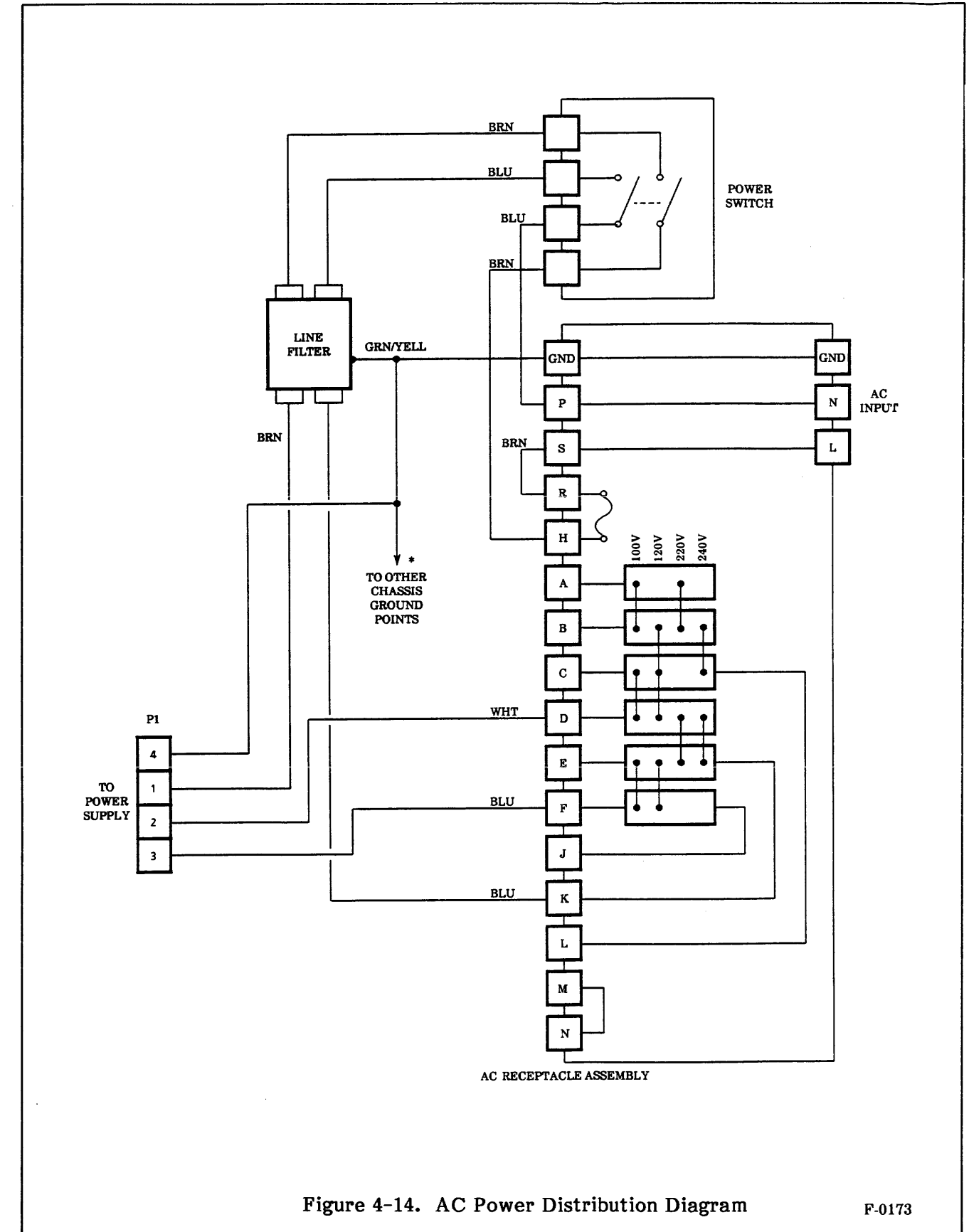


Figure 4-14. AC Power Distribution Diagram

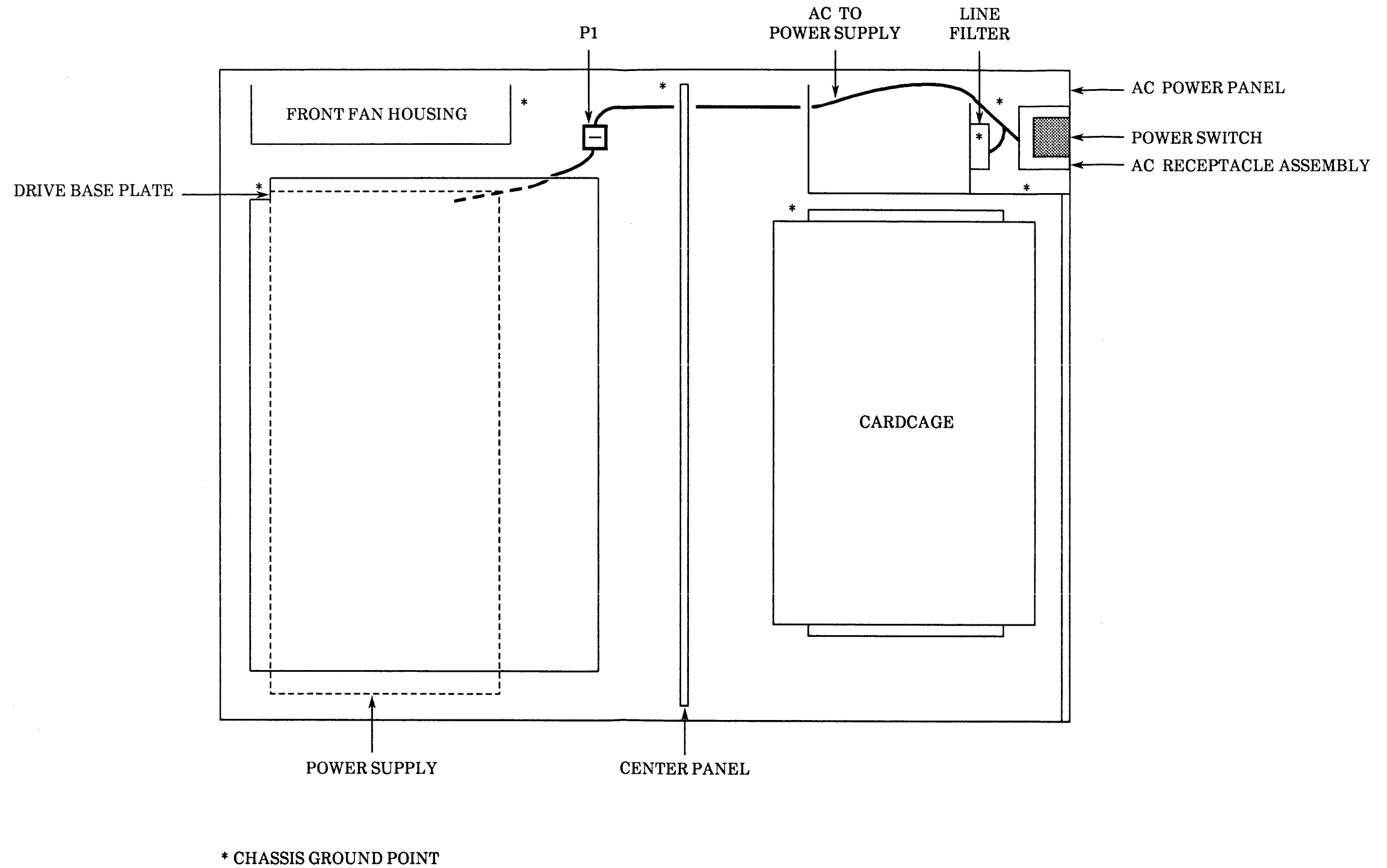


Figure 4-15. AC Power Distribution Component Locations

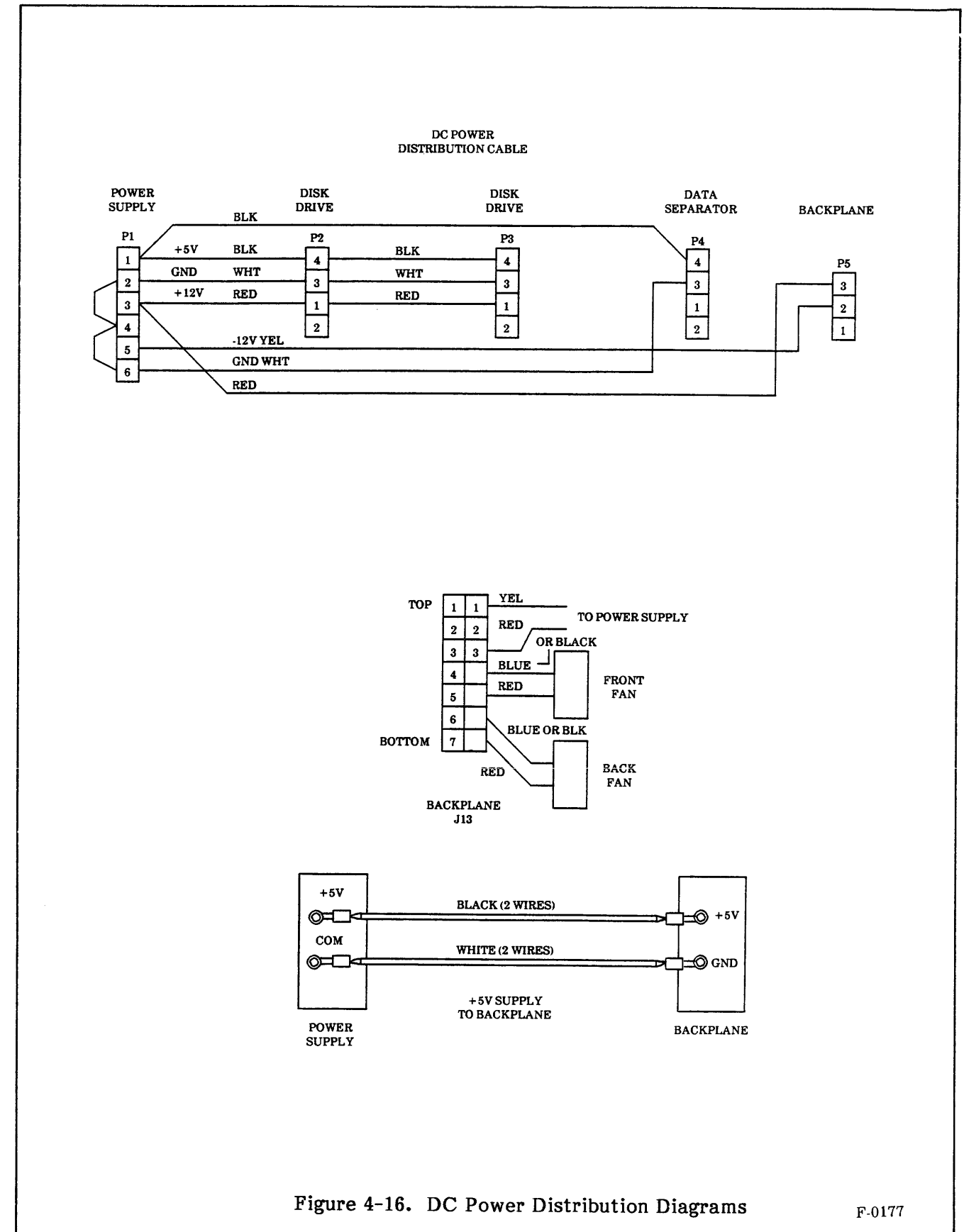


Figure 4-16. DC Power Distribution Diagrams

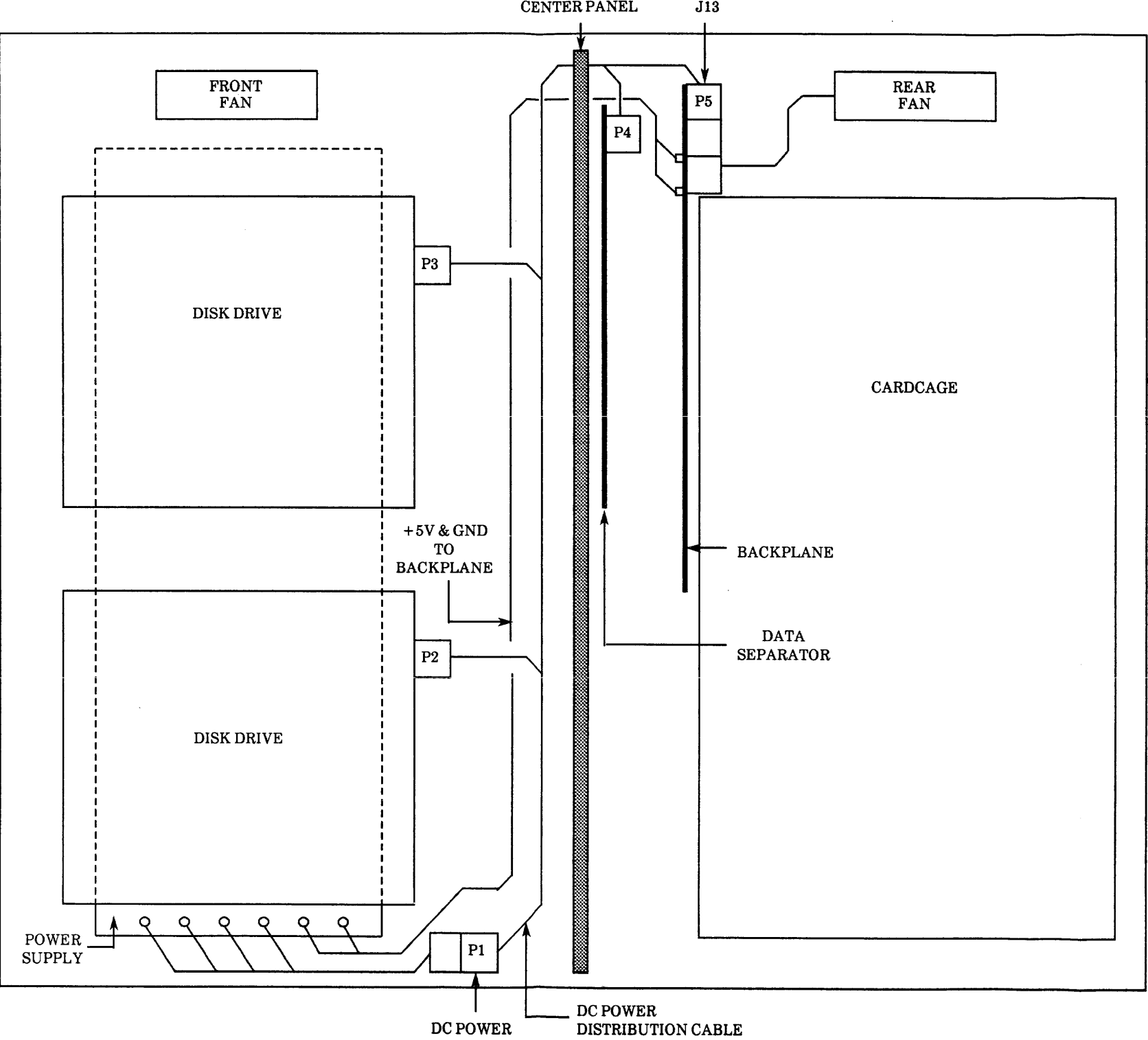


Figure 4-17. DC Power Distribution Component Locations



APPENDIX A STANDARD SYSTEM CONFIGURATIONS

This Appendix contains brief descriptions of the standard versions of the System 310 and it summarizes 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 complete instructions, see the configuration guides listed in the preface of this manual.

STANDARD VERSIONS OF THE SYSTEM 310

The major components of five standard versions of the System 310 are listed below. Chassis and interconnecting components are not listed.

System 310-1:

- iSBC 86/30 Single Board Computer
- iSBC 218A Flexible Diskette Controller
- 48 tpi 5¼" flexible diskette drive
- 220-watt switching power supply

System 310-2:

- iSBC 86/30 Single Board Computer
- iSBC 304 RAM Expansion MULTIMODULE
- iSBC 337 Numeric Data Processor
- iSBC 218A Flexible Diskette Controller
- iSBC 215G Winchester Disk Controller
- i213A 5¼" Winchester Disk Data Separator
- 48 tpi 5¼" flexible diskette drive
- 10 M byte, 5¼" Winchester disk drive
- 220-watt switching power supply

System 310-3:

- iSBC 86/30 Single Board Computer

- iSBC 012B 512K RAM Board
- iSBC 337 Numeric Data Processor
- iSBC 218A Flexible Diskette Controller
- iSBC 215G Winchester Disk Controller
- i213A 5¼" Winchester Disk Data Separator
- 48 tpi 5¼" flexible diskette drive
- 10 M byte, 5¼" Winchester disk drive
- 220-watt switching power supply

System 310-4:

- iSBC 286/10 Single Board Computer
- iSBC 012CX 512K RAM Board
- 80287 Numeric Data Processor
- iSBC 218A Flexible Diskette Controller
- 48 tpi 5¼" flexible diskette drive
- 220-watt switching power supply

System 310-5:

- iSBC 286/10 Single Board Computer
- iSBC 012CX 512K RAM Board
- 80287 Numeric Data Processor
- iSBC 218A Flexible Diskette Controller
- iSBC 215G Winchester Disk Controller
- i213A 5¼" Winchester Disk Data Separator
- 48 tpi 5¼" flexible diskette drive
- 10 M byte, 5¼" Winchester disk drive
- 220-watt switching power supply

iSBC• 86/30 JUMPER CONFIGURATIONS

Jumpers must be installed between the following pins on 86/30 boards in *all* standard System 310 configurations.

2 to 3	60 to 63	147 to 158
5 to 9	76 to 77	149 to 164
13 to 14	84 to 85	175 to 176
15 to 16	88 to 89	178 to 179
17 to 18	90 to 91	184 to 185
22 to 23	92 to 93	189 to 193
26 to 32	94 to 95	190 to 194
28 to 32	96 to 97	191 to 195
30 to 31	96 to 102	202 to 203
33 to 34	112 to 113	205 to 207
36 to 37	123 to 124	208 to 209
38 to 39	127 to 154	213 to 214
40 to 41	128 to 155	254 to 255
42 to 43	130 to 134	258 to 259
44 to 53	131 to 142	261 to 262
45 to 54	132 to 157	263 to 264
46 to 55	136 to 159	266 to 268
47 to 56	138 to 139	267 to 269
48 to 57	139 to 145	270 to 272
49 to 58	140 to 153	275 to 276
50 to 59	142 to 144	277 to 278
52 to 61	144 to 145	

The presence or absence of MULTIMODULE boards on the 86/30 board determines the settings of additional jumpers, as follows:

1. If *no* iSBX 218A is mounted on the 86/30 board, install a jumper between pins 151 and 152
2. If there is an iSBX 218A mounted on the 86/30 board, install a jumper between pins 152 and 169; remove the jumper between pins 151 and 152.
3. If *no* iSBC 304 is mounted on the 86/30 board, install a jumper between pins 118 and 119, and between pins 232 and 233.
4. If there is an iSBX 304 mounted on the 86/30 board, install jumpers between pins 118 and 119, and 119 and 120. Remove the jumper between pins 232 and 233.

NOTE

Those 86/30 boards that have an iSBC 304 installed require a different address decoding PROM (U66) than those without the iSBC 304 .

5. If there is an iSBC 337 mounted on the 86/30 board, install a jumper between pins 165 and 167.

iSBC®215G JUMPER CONFIGURATIONS

If there is *no* iSBX 218A board mounted on the 215G board, the following jumpers must be installed.

W1-1 to W1-3	W19- to W19-5
W3-1 to W3-2	W20-1 to W20-2
W4-1 to W4-2	W21-1 to W21-3
W5-1 to W5-2	W23-1 to W23-2
W7-1 to W7-3	W27-1 to W27-3
W8-1 to W8-3	W29-8 to W29-9
W9-1 to W9-2	W30-1 to W30-20
W10-1 to W10-2	W30-2 to W30-19
W11-1 to W11-3	W31-1 to W31-2
W13-1 to W13-2	W37-1 to W37-2
W14-1 to W14-2	W38-1 to W38-2
W16-1 to W16-2	W22-1 to W22-2
W17-1 to W17-2	W33-1 to W33-2
W18-1 to W18-2.	

If there is an iSBX 218A board mounted on the the 215G board, remove the jumper from W4-1 to W4-2 and install a jumper between W24-1 and W24-2. (All other jumpers remain the same as for the 215G with no 218A board.)

iSBX™ 218A JUMPER CONFIGURATIONS

If the 218A board is mounted on the iSBC 215G board, install the following jumpers:

E6 to E7	E40 to E41
E5 to E8	E43 to E44
E9 to E10	E46 to E47
E11 to E14	E49 to E50
E16 to E17	E53 to E54
E22 to E23	E55 to E57
E28 to E29	E61 to E62
E31 to E32	E64 to E65
E33 to E48	E66 to E67
E36 to E37	E68 to E69
E38 to E39	

If the 218A board is mounted on the iSBC 86/30 board, remove the following jumpers: E46 to E47 and E33 to E48. Install the following jumpers: E33 to E34 and E47 to E48. All other jumpers remain the same as for the 21G installation.

iSBC® 012B JUMPER CONFIGURATIONS

In standard versions of the system 310 where the iSBC 012B is the only memory board in the system (no iSBC 304, or other MULTIBUS memory board), install jumpers at the following locations.

W1	W12A	W25
W2	W13A	W26
W3	W14A	W27
W4	W15	W29

W6	W16	W30
W7A	W20	W31
W8A	W21	W32
W9A	W22	W33A
W10A	W23	W34A
W11A	W24	

BACKPLANE JUMPER CONFIGURATIONS

In all standard versions of the System 310, install jumpers at the following locations.

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

WINCHESTER DISK DRIVE JUMPER CONFIGURATIONS

In all standard versions of the System 310 (single Winchester drive), install a jumper between pins 1 and 2 (drive select 0) in the drive select jumper block. (See Chapter 4 for component locations.)

FLEXIBLE DISKETTE DRIVE JUMPER CONFIGURATIONS

In all standard single-drive versions of the System 310:

1. Cut shunts DS2, DS3, DS4, MS, and MX in the drive select shunt block; install the shunt block in pins 2 through 13 of the shunt block socket. (See Chapter 4 for component locations.)
2. Install a control bus terminator resistor pack.

In all standard dual-drive versions of the System 310:

1. Cut shunts DS2, DS3, DS4, MS, and MX in the drive select shunt block for drive 0. Install the shunt block in pins 2 through 13 of the shunt block socket.
2. Cut shunts DS1, DS3, DS4, MS, and MX in the shunt block for drive 1. Install the shunt block in pins 2 through 13 of the shunt block socket.
3. Install a control bus terminator resistor pack in drive 1.



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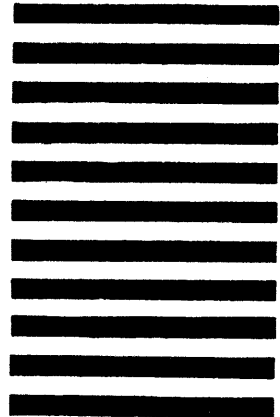
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