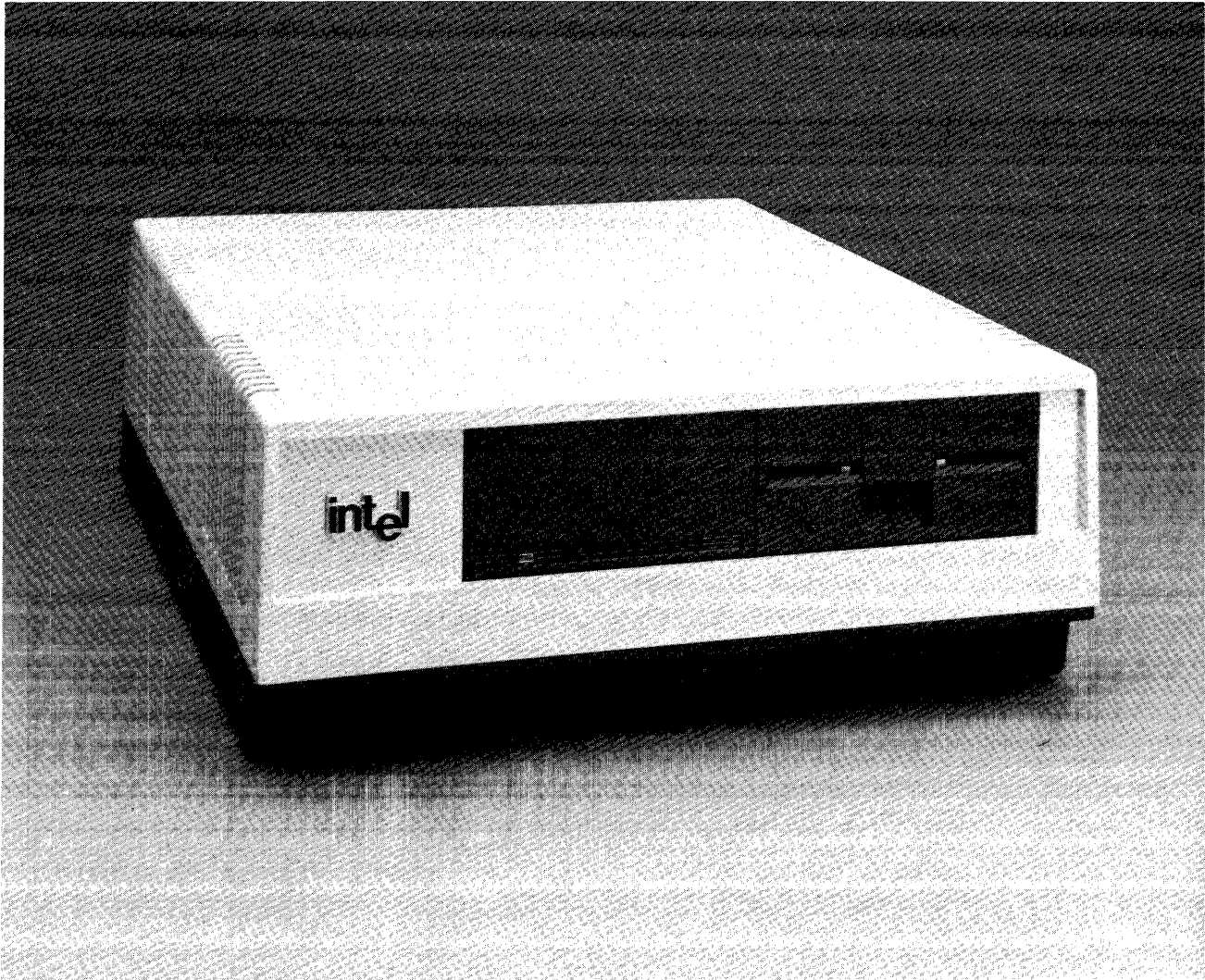




# SYSTEM 310 DISK CONFIGURATION GUIDE



# **SYSTEM 310 DISK CONFIGURATION GUIDE**

Order Number: 173207-002

## 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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REV.	REVISION HISTORY	DATE
-001	Original issue	10/83
-002	Discusses disk configuration in an 86/30- or 286/10-based system	11/84

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The System 310 is a flexible microcomputer system that offers you a choice of disk drives. The chassis has space for installing two full-height, 5½-inch disk drives. This space can be filled with any one of the following combinations:

- Two flexible disk drives
- One flexible disk drive and one Winchester hard disk drive
- One flexible disk drive and one blank panel

You can order the System 310 preconfigured in one of these combinations. Later, you can add or change drives to meet the changing needs of your application. This manual shows you how to integrate either a Winchester hard disk drive or a flexible disk drive into your System 310 Microcomputer.

Adding a Winchester hard disk drive to your System 310 involves installing the following items:

- Winchester hard disk drive
- iSBC® 215G Winchester Controller Board
- iSBC 213 Data Separator Board
- iSBC 213 Data Scrambler Card

Adding a flexible disk drive to your System 310 involves installing the following items:

- Flexible disk drive
- iSBX™ 218A Flexible Diskette Controller Board

## **Audience**

This manual is written for the experienced hardware service technician or field service engineer who needs to install or remove drives in the System 310.

## **WARNING**

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Installation and service procedures described in this manual are to be done by qualified technical personnel only. Qualified personnel should not do any maintenance and installation procedures other than those described in this manual.

Unless otherwise noted, all procedures should be done in a static-free work area.

---

## Manual Organization

This manual is organized into four chapters and four appendixes as follows:

### **Chapter 1, Introduction**

Briefly introduces the System 310 Microcomputer, this manual, and the disk drives.

### **Chapter 2, General Removal and Replacement Procedures**

Shows you how to remove the system top cover, back panel, drive assembly, and cardcage boards.

### **Chapter 3, Flexible Disk Drive**

Gives detailed instructions for configuring and installing 5 $\frac{1}{4}$ -inch flexible disk drives and the iSBX 218A Flexible Diskette Controller Board. Includes moving the iSBX 218A board from the processor board to the iSBC 215G Winchester Controller Board. Includes factory-standard jumper settings and required jumper changes. Includes quick reference summaries of the steps needed to install the 218A board on the 215G board and the steps needed to add a flexible disk drive to the system.

### **Chapter 4, Winchester Disk Drive**

Gives detailed instructions for configuring and installing 5 $\frac{1}{4}$ -inch Winchester drives, the iSBC 215G controller board, the iSBC 213 data separator board, and the iSBC 213 scrambler card. Includes factory-standard jumper settings and required jumper changes. Includes a quick reference summary of the steps needed to add a Winchester disk drive to the system.

### **Appendix A, Flexible Disk Drive and Controller Specifications**

Lists specifications for the 5 $\frac{1}{4}$ -inch flexible disk drive and the iSBX 218A Flexible Diskette Controller Board.

### **Appendix B, Winchester Disk Drive and Controller Specifications**

Lists specifications for 5 $\frac{1}{4}$ -inch Winchester disk drives and the iSBC 215G Winchester Controller Board.

### **Appendix C, Service Information**

Gives information about obtaining Intel product service.

### **Appendix D, Related Publications**

Lists titles and order numbers of other Intel publications related to this manual.



## Abbreviations

For easier reading, we have generally used these abbreviations in the manual:

Full Name	Abbreviation
flexible disk drive	flexible drive
Winchester technology hard disk drive	Winchester drive or hard disk drive
iSBC 213 Scrambler Card	scrambler card
iSBC 213 Data Separator Board	data separator
iSBC 215G Winchester Disk Controller Board	215G Winchester board or 215G board
iSBC 86/30 Single Board Computer	86/30 processor board or 86/30 board
iSBC 286/10 Single Board Computer	286/10 processor board or 286/10 board
iSBX 218A Flexible Diskette Controller Board	218A disk board or 218A board

When a description applies equally to the 86/30 or the 286/10 processor board, we've simply used "processor board."

## Drive Overview

Table 1-1 gives an overview of the flexible and hard disk drives as configured in the System 310. The table has three main parts:

- Winchester drive and its related boards
- Flexible drive and its related boards
- Tasks or components common to both types of drives

Table 1-1. Drive Overview

Drive Type	Item Needed	Description
Winchester	Drive unit	Hard disk drive that conforms to an industry-standard 5¼-inch form factor (ST506/SA612 interface).
	215G Winchester Board	Serves as the interface between the physical drive, host memory, and the processor board. The 215G board is equipped with two iSBX connectors that allow it to serve as host for up to two MULTIMODULE™ expansion boards, such as a 218A disk board. Although the board supports up to four Winchester drives, the actual maximum in the current System 310 configuration is one drive because of limitations imposed by other system components (e.g., the existing power supply supports one such drive).
	213 Data Separator Board	The 215G board does not include data separator circuitry, so a board for this task must be installed if a Winchester drive is installed in the System 310. This board separates the serial data stream from the Winchester drive into separate data and clock signals for the 215G board.  The data separator board has three 20-pin I/O connectors for data/control signal transfers. It handles data transfers at 5 megabits/sec using modified frequency modulation (MFM) data encoding for writing and reading on Winchester drives. The design of the board includes data encoding and decoding, write precompensation, address mark generation/detection, and multiplexing for interface to two drives. The 213 board supports two Winchester drives.
	213 Scrambler Card	The scrambler card is the wiring interface between the drive and the 215G Winchester board. It rearranges the interconnect wiring to adapt the controller to the drive, routing the signal lines from the disk drives and data separator board to the corresponding lines on the 215G board. This card is installed on the inside of the chassis back panel.

Table 1-1. Drive Overview (Continued)

Drive Type	Item Needed	Description
Flexible	Drive unit	Flexible disk drive that conforms to an industry-standard full-height 5¼-inch form factor; format is 48 tracks per inch (TPI); double-sided, double-density.
Flexible and Winchester	218A Flexible Diskette Controller Board	Serves as the interface between the flexible drive and the processor board. This is a MULTIMODULE expansion board that can be installed on host boards that have iSBX connectors; the 218A board can be mounted either on the main processor board (86/30 or 286/10) or on the 215G Winchester board. If the system doesn't have a Winchester drive, the factory-standard location for the 218A board is on the processor board. Jumper connections differ according to which host board the 218A board is installed on.
	Terminator Resistor Pack	The terminator resistor pack plugs into a standard IC socket located on the circuit board that's installed on the drive unit itself. Each drive type must have a terminator installed on the last drive of that type in a series. If one flexible drive is installed, it must have a terminator; if two flexible drives, the second one must have a terminator; if one flexible drive and one Winchester drive, each must have a terminator. Make sure that only the last drive in a series has a terminator; see Chapter 3 (flexible) or Chapter 4 (Winchester) for specific socket locations.
	Drive address	So that the processor can distinguish one drive from another, each drive must be given an address. Use the drive select function to assign addresses; see Chapter 3 (flexible) or Chapter 4 (Winchester) for specific instructions. Note that if you have one drive of each type (i.e., one Winchester and one flexible drive), they will both have drive address 0.

This chapter describes general removal and replacement procedures that must be performed to install either a flexible drive or a Winchester drive.

### CAUTION

We recommend that you wear static control wrist straps and cords when handling boards and drives. These devices can be damaged by static electricity as you handle them while installing or removing a 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, vinyl, or styrofoam in the work area.

### NOTE

Before making any system modifications, run the system diagnostic tests to ensure system integrity; see the system diagnostic manuals for details (refer to Appendix D for manual titles).

To install a drive, you must remove and replace the following items:

- Top cover
- Back panel
- Drive assembly
- Cardcage boards

To do the removal and replacement tasks, have the following items handy:

- Medium-sized Phillips screwdriver suitable for #6 or #8 screws
- Static control wrist straps and ground cord
- One or more conductive foam pads about 10 inches square and  $\frac{1}{2}$ -inch thick (to place boards on)

### WARNING

---

To avoid potentially lethal electrical shock, always turn off the system power switch and disconnect the AC power cord before removing or installing any part in the System 310. Wait at least one minute before disassembling the system to allow the capacitors to discharge.

---

## Top Cover Removal and Replacement

1. Turn the system power switch off and disconnect the AC power cord from the back of the chassis.

### CAUTION

The system weighs about 40 pounds; be careful when handling it not to drop or severely jar the chassis. The Winchester drive can be easily damaged, or the board connectors can be loosened.

2. As shown in Figure 2-1, turn the system on its side to gain access to the bottom of the chassis.
3. Remove the four #8 screws that hold the top cover to the bottom of the chassis.
4. With one hand, hold the top cover in place, and with your free hand carefully lower the system back onto its base.
5. From the back panel, remove the two #6 Phillips screws (upper left and right corners) that hold the cover to the back panel. Move the cover slightly forward to clear the disk drives, then lift it up and set it aside.
6. To replace the top cover, do the above steps in reverse order. When lowering the cover into place, be careful not to catch any protruding cables.

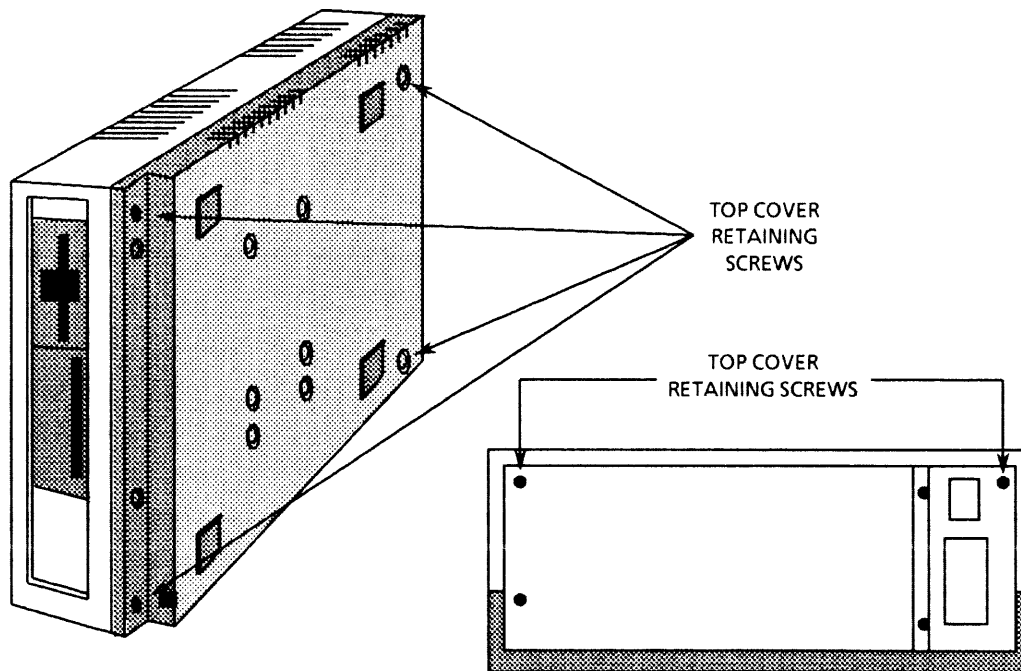


Figure 2-1. Removing Top Cover

F-0120-2

## Back Panel Removal and Replacement

1. Turn the system power switch off and disconnect the AC power cord from the back of the chassis.
2. Remove the four screws holding the back panel in place (see Figure 2-2) (two #6 sheet metal screws and two #6 machine screws).
3. Tilt the top of the back panel out from the back of the chassis and lift it out of the slot in the chassis base.
4. For easier access to the cardcage, disconnect the cables from the back panel to the processor board. Carefully note the location and orientation of the cables. Also disconnect other data and control cables that may be in the way.
5. Place the back panel on a flat, grounded, static-safe work surface.
6. To replace the back panel, do the above steps in reverse order.

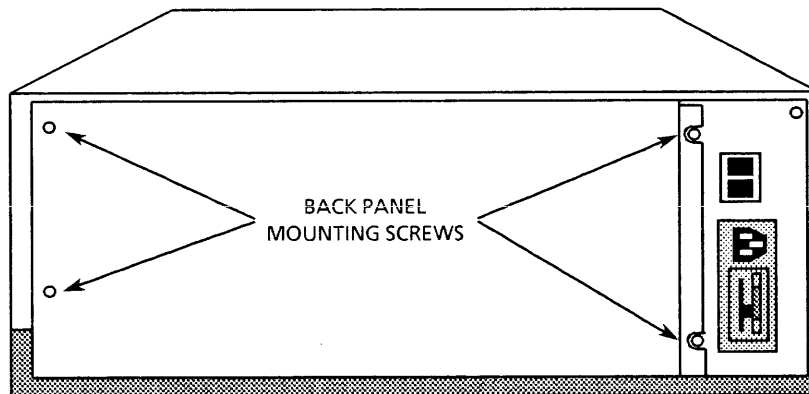


Figure 2-2. Removing Back Panel

F-0003

## Drive Assembly Removal and Replacement

In the System 310, the disk drives are mounted on a metal plate called the drive plate, which sits on top of the power supply cover. Your system has one of two types of drive plates, either Release 2.1 or Release 2.0. The main difference between the two types is in how they are removed from the system. Figures 2-3 and 2-4 illustrate the differences.

### WARNING

To avoid potentially lethal electrical shock, always turn off the power switch and disconnect the AC power cord before removing or installing any part in the System 310. The line voltages on the power supply under the peripheral support are lethal—up to 370 volts DC. Wait at least one minute before disassembling the system to allow the capacitors to discharge.

The Release 2.1 plate is held in place by five screws, all accessible from inside the chassis (Figure 2-3).

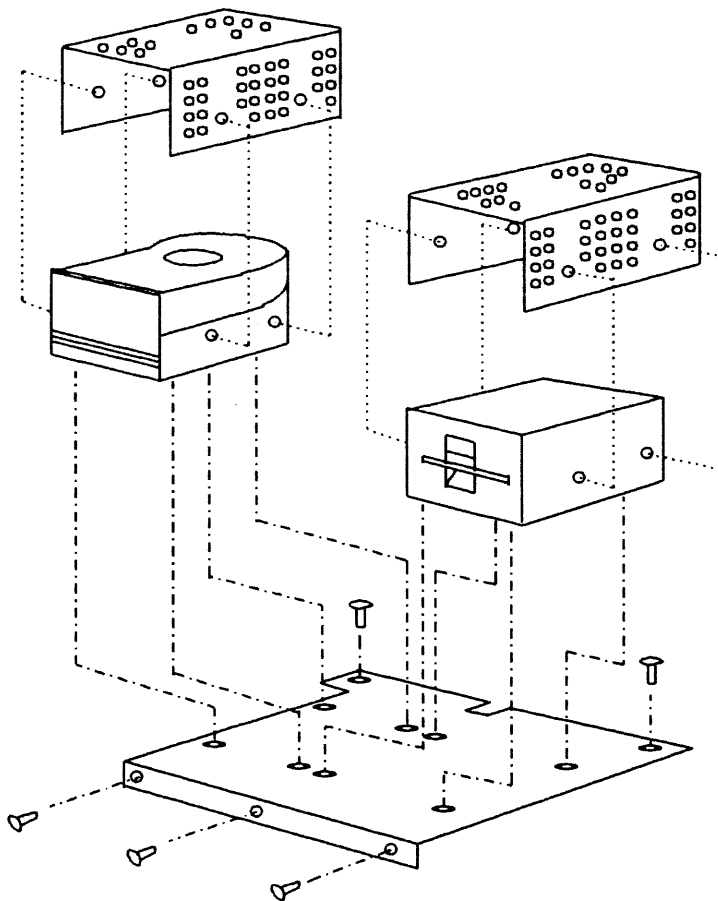


Figure 2-3. Drive Assembly (Release 2.1)

F-0002-1

The Release 2.0 plate is held in place by four screws; the back two are accessible from inside the chassis, but the front two must be accessed from the bottom of the chassis (Figure 2-4).

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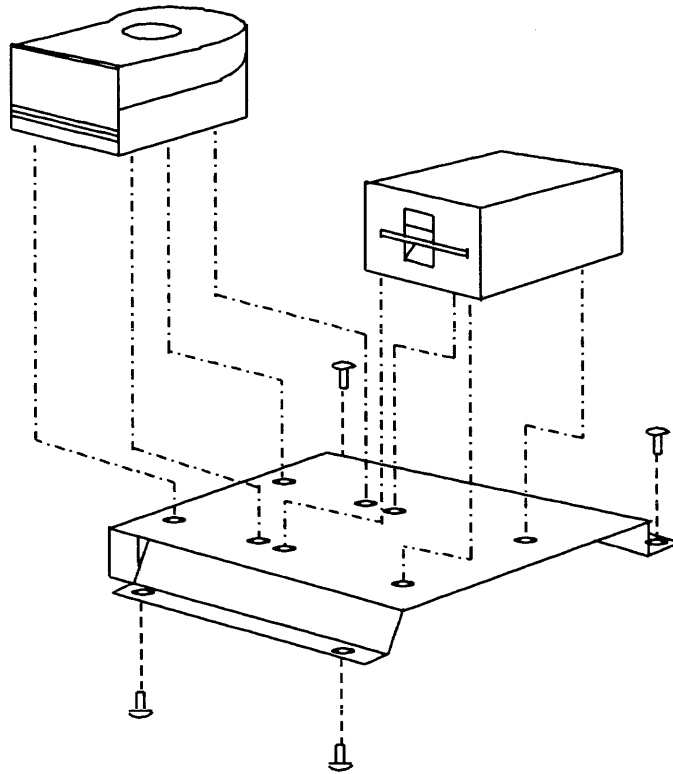


Figure 2-4. Drive Assembly (Release 2.0)

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F-0020



## CAUTION

Do not drop or severely jar the drive or drive assembly. The drive mechanism could be damaged or the support could be bent.

### Release 2.1 Drive Assembly Removal

1. Turn the system power switch off and disconnect the AC power cord from the back of the chassis. Make sure the flexible disk drive has no disk inside.
2. Remove the system top cover as described earlier in this chapter.
3. Using a medium-sized, long-shafted Phillips screwdriver, loosen the two screws located in the back of each drive.
4. Remove the three Phillips screws from the front of the drive plate.
5. Slide the drive assembly forward and carefully lay it on top of the cardcage.
6. Disconnect all cables from the back of the drives. Lift the drive assembly clear of the system, turn it over, and carefully lay it down on a soft surface. Then remove the four Phillips screws located on the base of the drive as shown in Figure 2-3.
7. To install a drive, perform the above steps in reverse order.

### Release 2.0 Drive Assembly Removal

1. Turn the system power switch off and disconnect the AC power cord from the back of the chassis. Make sure the flexible disk drive has no disk inside.
2. Remove the system top cover as described earlier in this chapter.
3. Remove the screw securing the green ground wire to the chassis above the RESET and INTERRUPT switches.
4. Locate and unplug the ribbon cable from J10 on the backplane.
5. Using a medium-sized, long-shafted Phillips screwdriver, loosen the two screws located in the back of the drives.
6. From under the front lip of the chassis base, remove the two Phillips screws that hold the drive plate to the chassis.
7. Lift the drive assembly clear of the power supply, turn it over, and carefully lay it on top of the cardcage.
8. Disconnect all cables from the back of the drives. Lift the drive assembly clear of the system, turn it over, and carefully lay it down on a soft surface. Then remove the four Phillips screws located on the base of the drive as shown in Figure 2-4.
9. To install a drive, perform the above steps in reverse order.

## Removing and Installing Boards in the Cardcage

When adding a drive to the system, you'll need to reconfigure two boards: the drive controller board and the processor board. Use the following procedures for removing and installing boards in the cardcage.

(If you are simply replacing a drive unit, you may not need to remove the board; see the *System 310 Hardware Maintenance Manual* for more information.)

### WARNING

---

To avoid potentially lethal electrical shock, always turn off the system power switch and disconnect the AC power cord before removing or installing any part in the System 310. Wait at least one minute before disassembling the system to allow the capacitors to discharge.

---

### CAUTION

We recommend that you wear static control wrist straps and cords when handling boards and drives.

### Removing Boards

1. Turn the system power switch off and disconnect the AC power cord from the back of the chassis.
2. Remove the back panel as described earlier.
3. Disconnect any cables from the board you are going to remove, or any cables that are in the way. Mark the connectors or make a diagram so you'll be able to reconnect them.
4. Loosen the four screws, two on each side, that hold the card retainers on each side of the cardcage; it isn't necessary to remove the screws. Remove the card retainers (Figure 2-5).
5. Place your thumbs on the inside edge of the white ejector levers of the board and pull toward you (Figure 2-5). The board will pop loose from its connector on the backplane.
6. Remove the board from the cardcage and place it on a flat, static-safe surface, component-side up.

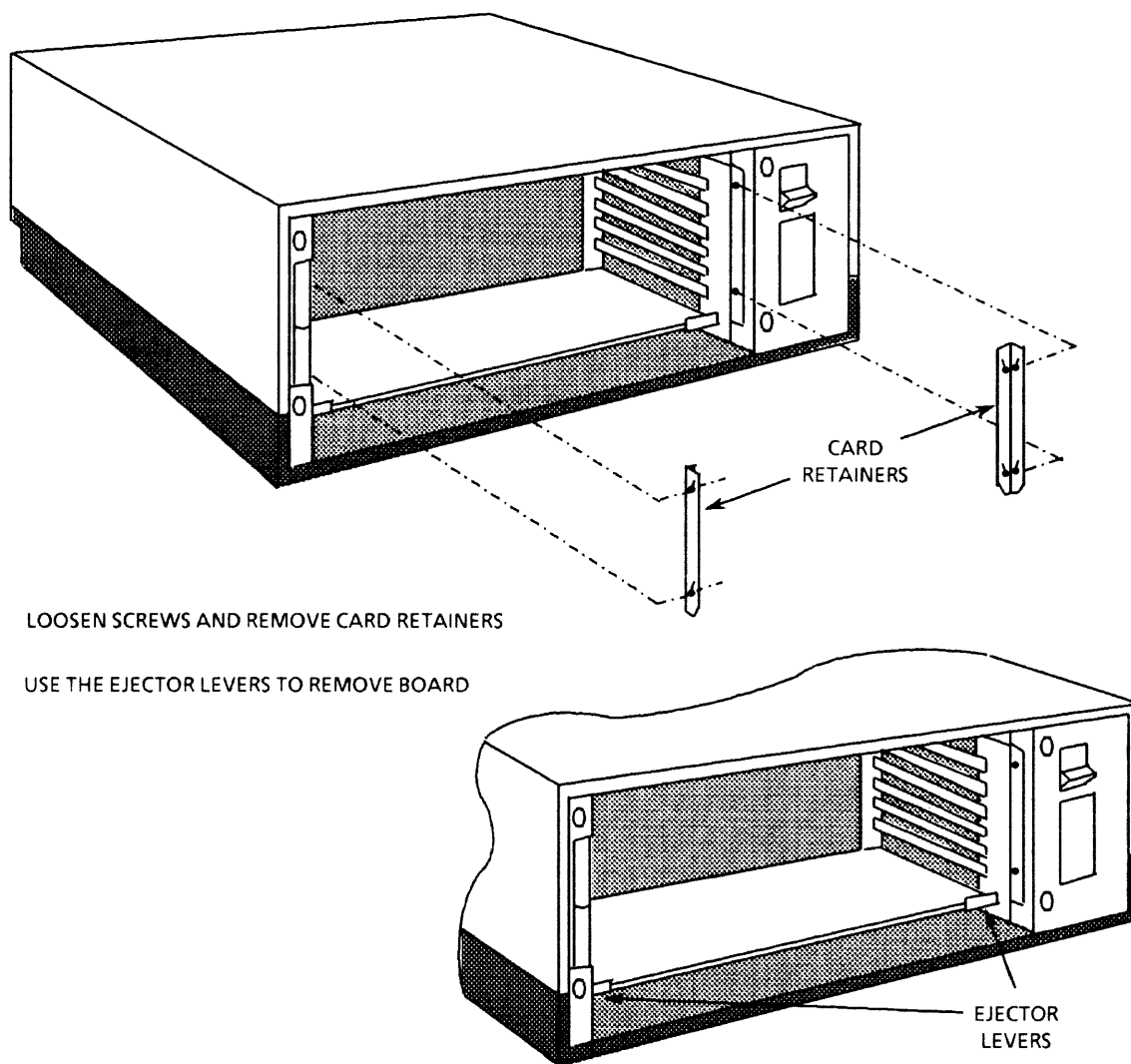


Figure 2-5. Removing Boards from the Cardcage

F-0262

## Installing Boards

To install a board, basically you reverse the procedure for removing boards. But it's important to note the following information about board and slot compatibility.

### **iLBX™ Bus: Board and Slot Compatibility**

Not all boards can be inserted in any cardcage slot in the 286/10-based System 310. In this system, certain slots are reserved for boards that access the iLBX™ (Local Bus Extension) interface, a dedicated execution bus that lets the 80286 CPU access off-board memory as quickly as if it were on board. The iLBX interface is implemented over the P2 backplane. In a factory-standard system configuration, the bottom three of the seven P2 backplane slots--J1, J2, and J3--carry iLBX signals. Two additional slots, J4 and J5, can be user-modified to handle iLBX-compatible boards.

## CAUTION

Do not install non-iLBX circuit boards in slots reserved for iLBX boards, and do not install iLBX circuit boards in non-iLBX slots. If you do, the system may be damaged. Check with your Intel sales representative before adding boards.

### **Installation Procedures for Boards**

1. Determine the correct slot for the board you want to install. The top and bottom slots in the cardcage are wider to allow room for host boards with MULTIMODULE expansion boards installed. The processor board and 215G controller board are examples of host boards.
2. With the component side up, slide the board into the slot. Rock it carefully from side to side as you push to help seat the board in the edge connector. When the board is fully seated, the ejector levers lie nearly flat along the edge of the board.
3. Tug on the board to make sure it's firmly in place. If the board comes out when you tug on it, repeat step 2.
4. Put the card retainers back into place, and tighten the four Phillips screws that secure them.
5. Reconnect to the board any cables you disconnected or cables you are installing for a new drive in the system.
6. Replace the back panel.

Each System 310 comes with one 5¼-inch flexible disk drive already installed. The flexible disk interface (iSBX 218A board) is compatible with off-the-shelf SA450/SA460-compatible drives. Although the 218A board supports up to four drives, the system power supply supports the addition of only one other drive, either a Winchester drive or a second flexible drive.

In a flexible drive-based system, the 218A board comes factory-installed on the system processor board (86/30 or 286/10). If you install a Winchester drive and 215G board, you have a choice of leaving the 218A board on the processor board or moving it to the 215G board.

#### **NOTE**

Even though the change is optional, we recommend moving the 218A board and making the necessary jumper changes. If the 218A board is left on the processor board, the system runs slower because Direct Memory Access (DMA) is not available and the system does not run in real time under the iRMX™ operating system.

This chapter gives information about the following:

- Moving the 218A disk board to a 215G Winchester board
  - Jumpers on the 218A board when it is installed on a processor board
  - Default (factory-standard) jumpers on the 86/30 processor board or the 286/10 processor board, no 218A board installed
  - Default jumpers on the 215G board, no 218A board installed
  - Jumper changes necessary when moving 218A board to 215G board
- Adding a second flexible disk drive to the system
- Quick reference installation, 218A board on 215G board
- Quick reference installation, second flexible disk drive

## Moving the 218A Disk Board to the 215G Winchester Board

Moving the 218A board to the 215G Winchester board requires the following tasks:

- Removing the 218A board from the processor board
- Changing jumper connections on the 218A, processor, and 215G boards
- Installing the 218A board on the 215G board
- Installing the 215G and the processor boards in the cardcage

To do the tasks, have the following items handy:

- Phillips screwdrivers suitable for #6 or #8 screws
- Foam pad about 10 inches square and  $\frac{1}{2}$ -inch thick

## Removing the 218A Board from the Processor Board

### WARNING

---

To avoid potentially lethal electrical shock, always turn off the system power switch and disconnect the AC power cord before removing or installing any part in the System 310. Wait at least one minute before disassembling the system to allow the capacitors to discharge.

---

1. Turn the system power switch off and disconnect the AC power cord from the rear of the chassis.

### CAUTION

We recommend that you wear static control wrist straps and cords when handling boards and drives. These devices can be damaged by static electricity as you handle them while installing or removing a 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, vinyl, or styrofoam in the work area.

2. As described in Chapter 2, remove the system back panel, card retainers, and processor board (bottom slot).
3. Locate the 218A board on the processor board. The 218A board is installed in the same relative location on both the 86/30 and 286/10 processor boards. On the 86/30 board, the 218A board is mounted on iSBX connector J4; on the 286/10 board, it's on iSBX connector J6.

4. From the solder side of the processor board, remove the nylon screws that hold the spacers to the board. Save the spacers and screws to remount the 218A board on the 215G board.
5. Place the 218A board with the component side up on a grounded, static-safe surface. Next you must change the board jumpers.

### Changing Jumper Connections

When you move the 218A board to the 215G board, you need to change jumpers on both boards; in the 86-based system, you also need to change jumpers on the processor board.

- Table 3-1 lists jumpers on the 218A board when it is installed on a processor board (either 86/30 or 286/10).
- Table 3-2 lists standard jumpers on the 86/30 and 286/10 processor boards without a 218A board installed.
- Table 3-3 lists jumpers on the 215G board without a 218A board installed.
- Table 3-4 summarizes the changes needed when the 218A board is moved from the processor board to the 215G board.

Figures 3-1, 3-2, and 3-3 show jumper locations and changes on the 86/30 processor board, 215G board, and 218A board respectively. The 286/10 board is not shown because no changes are needed on this board when a 218A board is installed or removed.

Table 3-1. Jumpers Required on 218A Board When Installed on Processor Board

Jumpers Between Pins	Jumpers Between Pins
E5 to E8 E6 to E7 E9 to E10 E11 to E14 E16 to E17 E22 to E23 E24 to E25 E28 to E29 E31 to E32 E33 to E34 E36 to E37 E38 to E39	E40 to E41 E43 to E44 E47 to E48 E49 to E50 E53 to E54 E56 to E57 E58 to E59 E61 to E62 E64 to E65 E66 to E67 E68 to E69

Table 3-2. Jumpers Required on Processor Board (No 218A Board Installed)

Board	Jumpers Between Pins	Jumpers Between Pins	Jumpers Between Pins
iSBC 86/30*	2 to 3	60 to 63	147 to 158
	5 to 9	76 to 77	149 to 164
	13 to 14	84 to 85	152 to 169
	15 to 16	88 to 89	175 to 176
	17 to 18	90 to 91	178 to 179
	22 to 23	92 to 93	184 to 185
	26 to 32	94 to 95	189 to 193
	28 to 32	96 to 97	190 to 194
	30 to 31	96 to 102	191 to 195
	33 to 34	112 to 113	202 to 203
	36 to 37	123 to 124	205 to 207
	38 to 39	127 to 154	208 to 209
	40 to 41	128 to 155	213 to 214
	42 to 43	130 to 134	254 to 255
	44 to 53	131 to 142	258 to 259
	45 to 54	132 to 157	261 to 262
	46 to 55	136 to 159	263 to 264
	47 to 56	138 to 139	266 to 268
	48 to 57	139 to 145	267 to 269
	49 to 58	140 to 153	270 to 272
50 to 59	142 to 144	275 to 276	
52 to 61	144 to 145	277 to 278	
iSBC 286/10	5 to 6	98 to 100	197 to 206
	8 to 9	104 to 120	199 to 208
	12 to 13	108 to 144	200 to 209
	15 to 16	110 to 125	201 to 210
	27 to 32	116 to 130	202 to 211
	28 to 33	121 to 135	212 to 213
	29 to 34	122 to 147	216 to 217
	30 to 35	126 to 141	218 to 219
	31 to 36	133 to 139	222 to 223
	40 to 41	143 to 114	224 to 225
	43 to 44	149 to 150	226 to 227
	49 to 57	152 to 153	231 to 232
	62 to 63	155 to 156	236 to 237
	66 to 88	157 to 158	246 to 247
	70 to 72	159 to 160	249 to 250
	71 to 73	168 to 169	251 to 252
	75 to 76	173 to 174	253 to 254
	77 to 78	183 to 184	255 to 256
	85 to 87	190 to 191	261 to 262
	90 to 91	192 to 193	267 to 268
92 to 106	194 to 203	269 to 270	
94 to 131	195 to 204	271 to 272	
95 to 101	196 to 205	273 to 274	

\* If no iSBC 304 RAM Expansion MULTIMODULE board is installed on the 86/30 board, this board should have jumpers between pins 118 and 119 and between 232 and 233 in addition to the list above.



Table 3-3. Jumpers Required on 215G Board (No 218A Board Installed)

Board	Jumpers Between Pins	Jumpers Between Pins
iSBC 215G	W1-1 to W1-3 W3-1 to W3-2 W4-1 to W4-2 W5-1 to W5-3 W6-1 to W6-3 W7-1 to W7-3 W8-1 to W8-3 W9-1 to W9-2 W10-1 to W10-2 W11-1 to W11-3 W13-1 to W13-2 W14-1 to W14-2 W16-1 to W16-2 W17-1 to W17-2 W18-1 to W18-2	W19-C to W19-5 W20-1 to W20-2 W21-1 to W21-3 W23-1 to W23-2 W25-1 to W25-2 W27-1 to W27-2 W29-8 to W29-9 W30-1 to W30-20 W30-2 to W30-19 W31-1 to W31-2 W37-1 to W37-2 W38-1 to W38-2 W22-1 to W22-2 W33-1 to W33-2

Table 3-4. Jumper Changes When 218A Board Is Moved from Processor Board to 215G Board

System	Board to Make Changes on	Remove Jumper	Install Jumper
86-based system	218A board	E47 to E48 E33 to E34	E33 to E48 E46 to E47
	86/30 board	152 to 169	151 to 152
	215G board	W24-1 to W24-3* W4-1 to W4-2	W24-1 to W24-2
286-based system	218A board	E47 to E48 E33 to E34	E33 to E48 E46 to E47
	286/10 board	No changes	
	215G board	W24-1 to W24-3* W4-1 to W4-2	W24-1 to W24-2

\* Remove this jumper when no other direct memory access device is connected to iSBX connector J3.



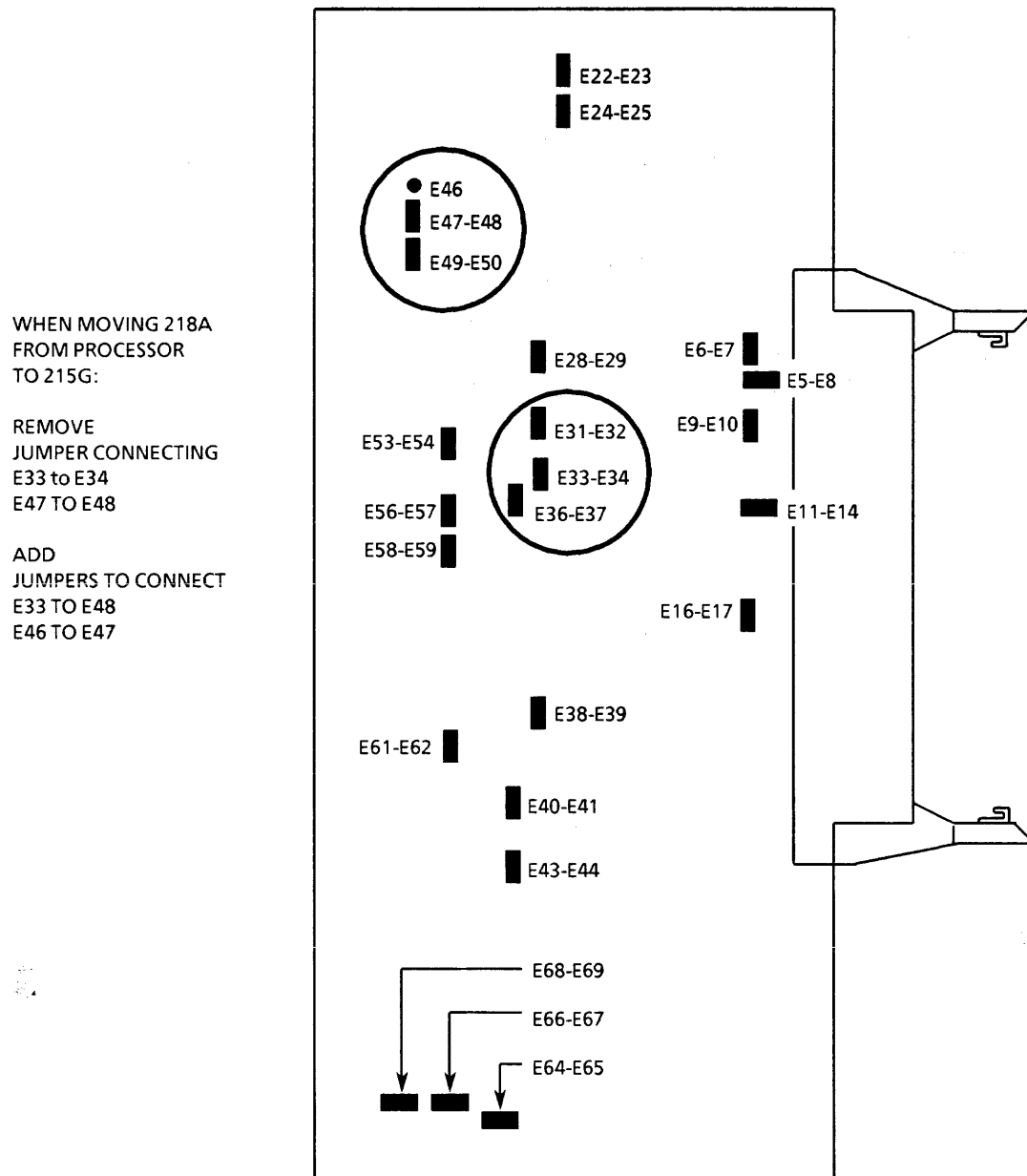


Figure 3-3. Jumper Changes on the 218A Disk Board

F-0114

### Installing the 218A Board on the 215G Board

1. Carefully place the 215G Winchester board on a grounded, static-safe surface, component side up. Locate iSBX connector J4 (Figure 3-4).
2. Find the mounting holes on the 215G board. Turn the board on edge, and from the solder side insert a nylon screw through one of the holes.

**CAUTION**

Overtightening could damage the nylon screws and the printed circuit boards.

3. Hold the screw in place while threading a spacer onto the screw. Use a flat-bladed screwdriver to tighten the screw and spacer assembly. Repeat for the remaining two mounting holes.
4. With both boards component-side up, line up the mounting holes on the 218A board with the spacers on the 215G board (Figure 3-4).
5. When the boards are aligned, insert a nylon screw through one of the mounting holes of the 218A board and thread the screw into the spacer. Tighten carefully, and repeat for the rest of the mounting holes.

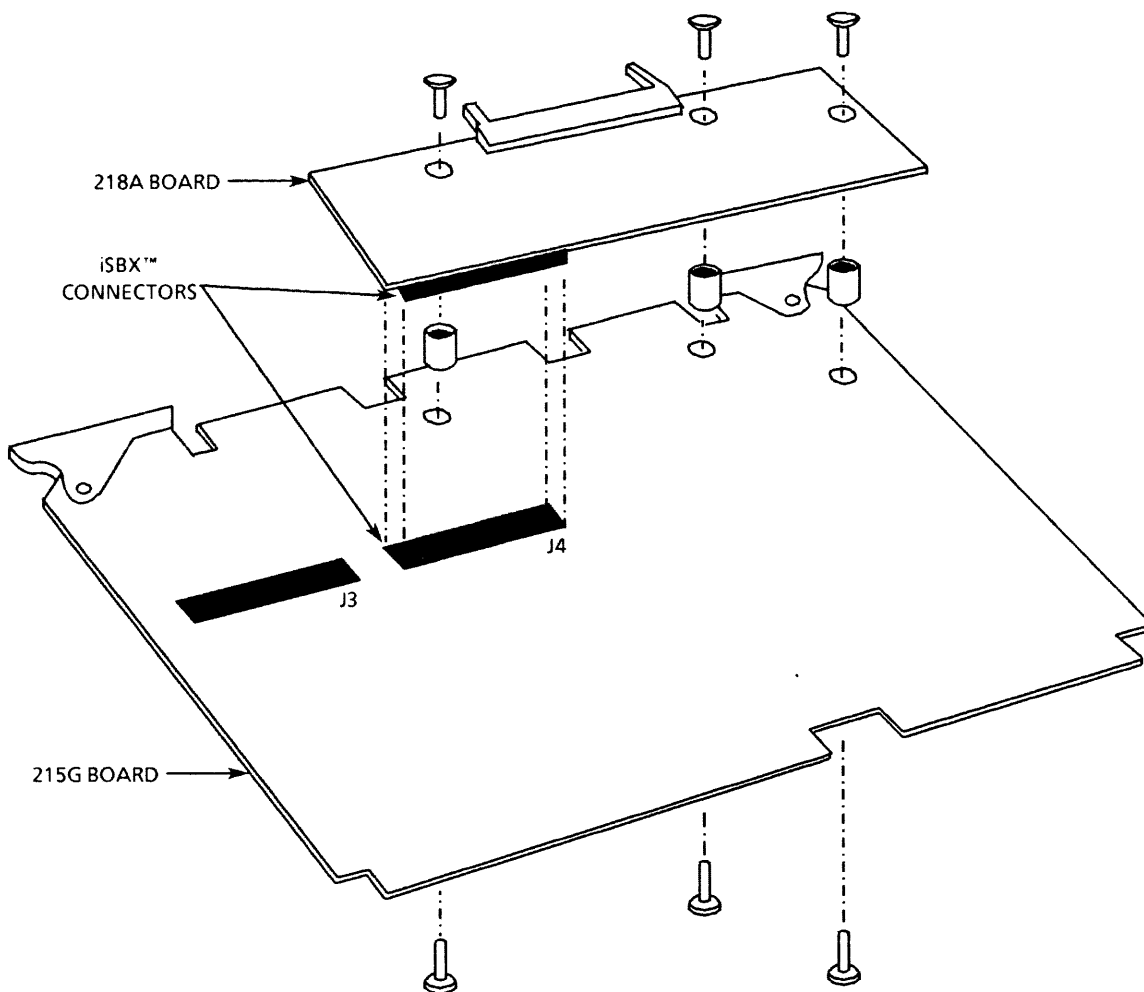


Figure 3-4. Installing 218A Board on 215G Winchester Board

F-0266

## Installing Boards in the Cardcage

After installing the 218A board on the 215G board, insert the assembly into the top slot of the cardcage. See Chapter 2 for details about inserting the boards and securing the card retainers.

### Slot Location

Both the top and bottom slots have extra space to hold a circuit board with an expansion module such as the 218A board installed on it. When reinstalling boards after making changes to them, you'll probably want to replace the processor board in the bottom slot and install the 215G board in the top slot. The top slot has highest priority on the bus, so installing the 215G board in this slot prevents the bus from hanging while waiting for access.

## CAUTION

*Only use iLBX-compatible circuit boards in cardcage slots served by the iLBX bus (286-based systems only). Otherwise, the system's operation will be disrupted and components could be damaged. In a factory-standard System 310, incompatible boards cannot be inserted into the wrong slots because any unoccupied iLBX slots are keyed with a plastic insert in the P1 backplane connectors as a warning against putting the wrong board in a given slot. If you modify the system to extend the iLBX bus interface, be sure to label or key the backplane slots so only the correct boards can be inserted.*

The reverse is also generally true: *only use boards that are non-iLBX-compatible in non-iLBX slots; these slots may carry signals that conflict with the iLBX signals.*

Note that the plastic insert must be removed before a board can be inserted in a keyed slot.

## Adding a Second Flexible Drive

This section tells how to add a second flexible drive unit and route the cables. This involves connecting the two flexible drives by cable in daisy-chain sequence and moving the terminator resistor pack from the single drive to the newly installed second drive.

The main tasks are as follows:

- Installing the metal cage that protects the drive from Electromagnetic Interference (EMI)
- Installing the drive in the system (see Chapter 2)
- Routing the drive cables
- Selecting each drive address by modifying the device select jumper block
- Installing a terminator resistor pack in the last flexible drive in the series and making sure that the first drive does **not** have a terminator installed.

### Installing the EMI-Protective Metal Cage

A metal cage surrounds the flexible drive to shield the drive and its media from Electromagnetic Interference (EMI). If the cage does not come already installed, you must install it before mounting the drive in the system.

1. Orient the metal cage so the large opening in the top of the cage is over the drive circuit board and the drive front panel fits against the open end of the cage.
2. Slide the drive into the cage. Secure the cage to the drive by installing one screw on the left side of the cage assembly (as front of drive faces you).

The screw for the right side also holds the DC distribution cable clamp to the right-hand side of the drive; don't install this screw until you've put the drive and drive assembly back into the chassis.

### Installing the Drive in the System

To mount the drive on the peripheral support and install it in the system, see Chapter 2.

## Routing the Drive Cables

A 34-conductor cable with a 50-pin PCB connector on one end and a 34-pin card edge connector on the other end connects the flexible drives to the 218A controller board in the cardcage. Pin 1 of the cable is color-marked along one edge.

## CAUTION

Make sure the drive cable lies flat over the cardcage, or the cable may be damaged when you replace the system top cover.

## Single Drive Cabling

Figure 3-5 illustrates the correct cable routing and connections for a single flexible drive. Connect the 50-pin PCB male header to connector J1 on the 218A board. Route the cable over the top of the cardcage. Connect the card edge connector to connector P2 on the flexible drive circuit board.

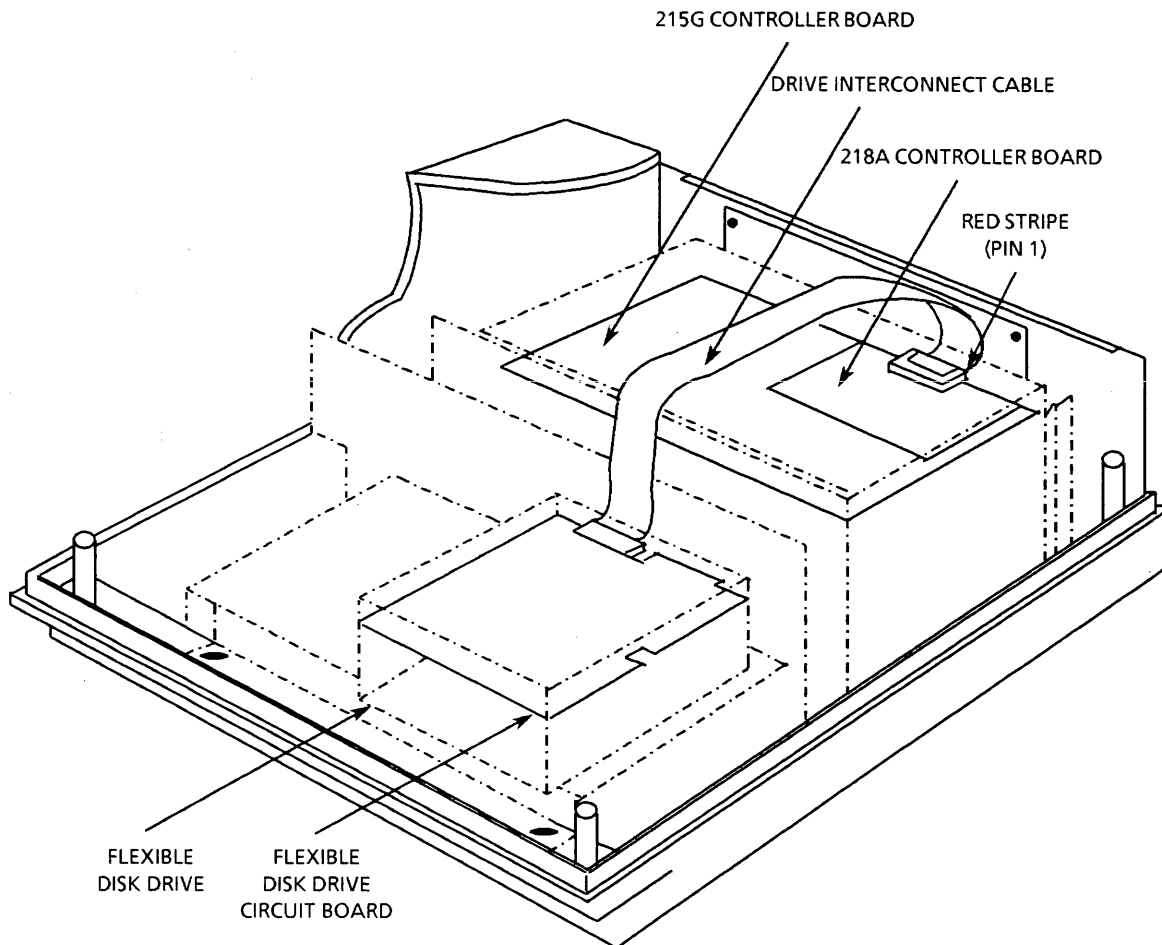


Figure 3-5. Cable Routing for Single Flexible Drive

F-0019

### Dual Drive Cabling

Figure 3-6 shows the cable connections and routing when two flexible drives are installed in the system. The cable must be routed as shown to link the two drives in daisy-chain sequence.

Connect the 50-pin PCB connector to the 218A controller. Route the cable over the top of the cardcage. Connect the main segment of cable to drive 0, and connect the shorter segment of cable to drive 1, as shown in Figure 3-6.

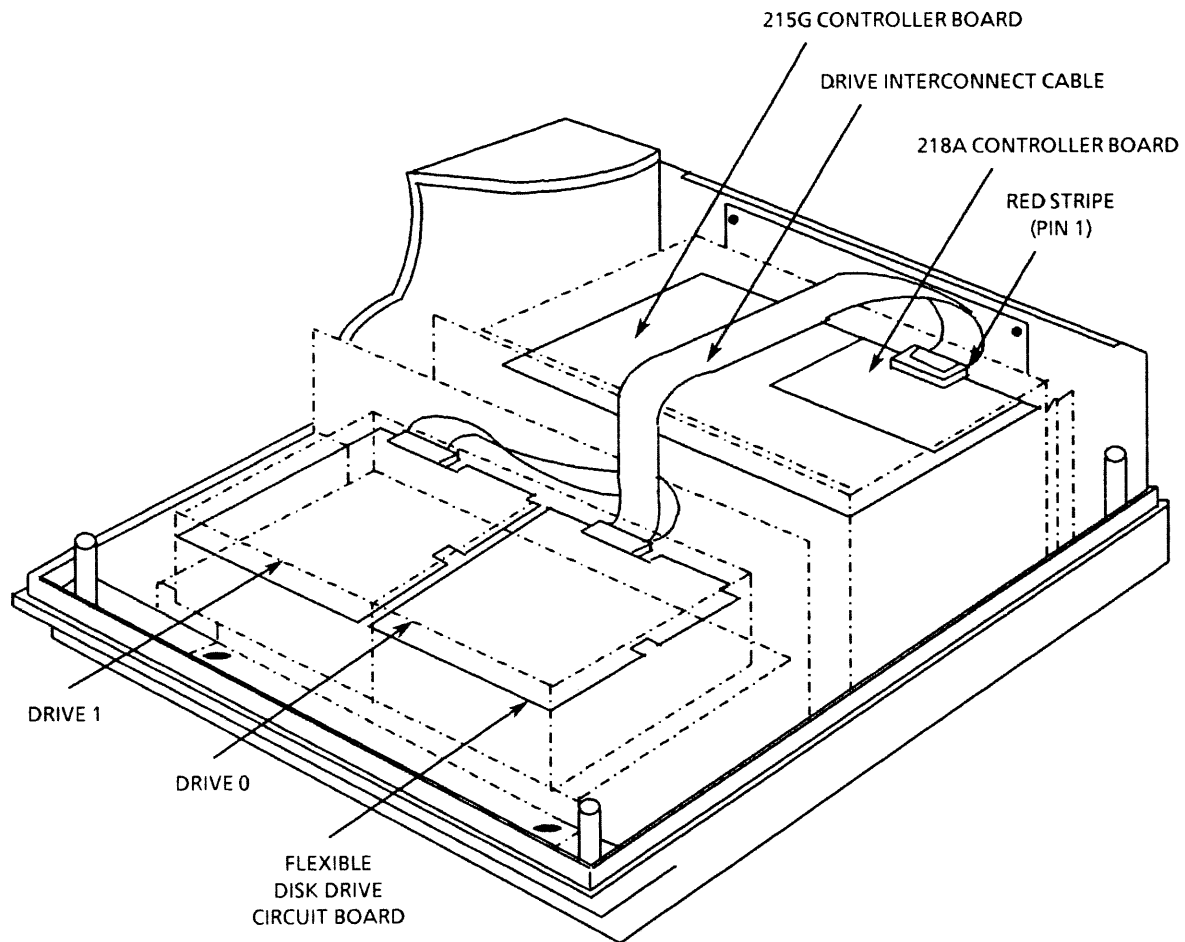


Figure 3-6. Cable Routing for Dual Flexible Drives

F-0018



## CAUTION

We recommend that you wear static control wrist straps and cords when handling boards and drives. This caution applies equally to the next two sections.

### Selecting the Drive Address

For the microprocessor to distinguish one installed drive from another, you must select a unique address for each drive. The method of selecting this address and the physical location of any related jumpers or switches depend on the specific drive you are installing. As an example, this section includes information about address selection on the 48 TPI flexible disk drive in the factory-standard System 310.

Select the address by modifying a device select jumper block located on the circuit board mounted on top of the drive unit (Figure 3-7). The jumper block has six metal strips on it.

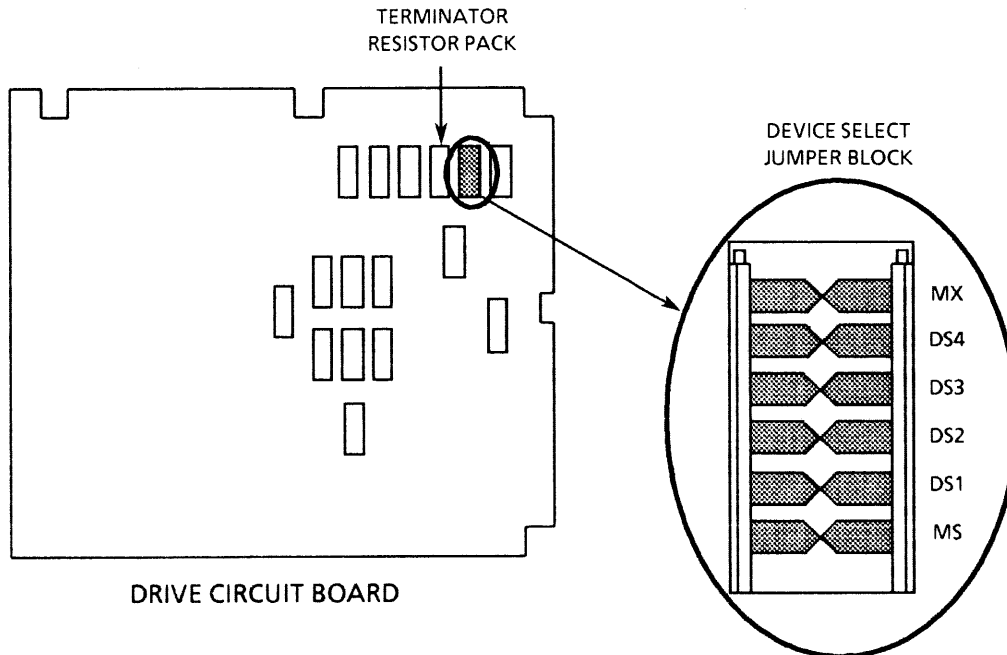
1. Assign a disk drive address corresponding to the drive number. Although typically the first drive in a series is called drive 0 and the second one drive 1, on this board the jumper block settings are labeled DS1, DS2, DS3, and DS4. Thus, it's convenient to assign addresses (DS)1 and (DS)2.
2. Determine which drive is first in the series and which is last by physical location and sequence of the drive cable; the one at the end of the interconnect cable is last.
3. On the device select jumper block, break all the metal strips *except* the one labeled with the same number you've assigned as the address for that drive. Use a small, flat-bladed screwdriver or a penknife to break the metal strips.
  - a. In a standard single-drive version of the system: break DS2, DS3, DS4, MX, and MS.
  - b. In a System 310 with two flexible drives: for drive 0, break DS2, DS3, DS4, MX, and MS; for drive 1, break DS1, DS3, DS4, MX, and MS.

### Installing the Terminator Resistor Pack

Each drive system must have a terminator resistor pack installed in the last drive of the series. This resistor pack plugs into a standard IC socket on the drive circuit board. The location of the socket depends on the specific drive you are installing. As an example, this section includes information about the flexible disk drive circuit board in the factory-standard System 310. Figure 3-7 shows the location of the socket with the resistor pack installed.

In a factory-standard System 310 with only one drive of a given type, flexible or Winchester, the resistor pack is already installed in the correct location for each drive. When you install a second flexible drive, remove the terminator from drive 1 and install it on the circuit board for drive 2 (the last drive in the series).

Systems with both flexible drives and Winchester drives must have a resistor pack installed on the drive circuit board of the last drive of each type of drive.



F-0305

Figure 3-7. Drive Address Select Jumper Block and Terminator Resistor Pack

#### NOTE

After installing the drives and replacing the back panel and top cover, we recommend that you test the system, particularly the new components. Plug in the AC power cord, turn the system power switch on, and press RESET. Run the System Confidence Test and the appropriate System Diagnostic Tests (for example, for the flexible and Winchester drives, 218A and 215G boards, processor board). Refer to your system diagnostic manual (see Appendix D) for more information about the tests.

## Quick Reference Information

For quick reference, the following tables summarize removal and replacement steps:

- Table 3-5 tells how to move the 218A board to the 215G board.
- Table 3-6 tells how to add a second flexible drive to your system.

Table 3-5. Quick Reference--Installing 218A Board on 215G Board

Step	General Task	Chapter
1	Before making any modifications, run system confidence and diagnostic tests to check system integrity (see the system diagnostic manual; Appendix D lists titles).	3 App.D
2	Turn the system power switch off and unplug the power cord. Wait one minute--lethal voltages need time to discharge.	
3	Remove the system back panel.	2
4	Note the locations of connectors and cables between the back panel and processor board, and between the back panel and front panel. Disconnect the cables and lay the back panel flat on a grounded, static-safe surface.	2
5	Remove the card retainers.	2
6	Remove the processor board from the bottom cardcage slot.	2
7	Make jumper changes on the processor board, 218A disk board, and 215G Winchester board.	3, 4
8	Install the 218A board on the 215G board.	3
9	Replace boards in the cardcage (processor board in bottom slot, 215G board in top slot).	2
10	Route and connect the cables from the drives to the appropriate board in the cardcage (processor board, 218A or 215G board).	3
11	Reconnect any cables that were disconnected.	2
12	Replace the card retainers.	2
13	Replace the back panel.	2
14	Plug in the power cord and turn the system power switch on. Press the RESET switch on the system front panel.	
15	Again run the appropriate system diagnostic tests to make sure the hardware is working correctly.	3 App.D

Table 3-6. Quick Reference--Installing Second Flexible Drive

Step	General Task	Chapter
1	Before making any modifications, run system confidence and diagnostic tests to check system integrity (see the system diagnostic manual; Appendix D lists titles).	3 App.D
2	Turn the system power switch off and unplug the power cord. Wait one minute--lethal voltages need time to discharge.	
3	Remove the system top cover and back panel.	2
4	Note the locations of connectors and cables between the back panel and processor board, and between the back panel and front panel. Disconnect the cables and lay the back panel flat on a grounded, static-safe surface.	2
5	Disconnect the following: front panel control cable from the backplane; ground wire from left front corner of the peripheral support; DC distribution cable clamp from right side of the flexible disk drive.	2
6	Place a foam pad on the cardcage or on a flat surface.	2
7	Install the metal protective shield around the second drive.	3
8	Place the second flexible drive upside down on the foam pad.	3
9	Remove the peripheral support from the system chassis.	2
10	Turn the drive assembly upside down over the new drive.	2
11	Install the drive unit on the peripheral support and turn the drive and drive assembly right-side up.	2
12	Connect the power cables and drive interconnect cables to the drive circuit boards.	2
13	Replace the drive and drive assembly in the chassis.	2
14	Route and connect the drive cables to the appropriate board in the cardcage (218A board on the processor board).	3
15	Set the drive select function to assign each drive an address.	3
16	Make sure a terminator resistor pack is installed on the drive circuit board for the last drive in the series.	3
17	Reconnect any cables that were disconnected.	2
18	Replace the back panel and top cover.	2
19	Plug in the power cord and turn the system power switch on. Press the RESET switch on the system front panel.	
20	Again run the appropriate system diagnostic tests to make sure the hardware is working correctly.	3 App.D

If your system includes only a 5¼-inch flexible disk drive, you can add a 5¼-inch Winchester drive. The Winchester interface (215G board with 213 data separator) is ST506/SA612-compatible and will support most ST506/SA612 disk drives for up to two drives.

This chapter gives the following information about how to install a Winchester drive and the boards and cables that support it:

- Setting jumpers on the 215G Winchester board
- Installing the 215G Winchester board
- Installing the drive unit
- Installing the data separator board
- Installing the scrambler card
- Connecting and routing the data and control cables
- Selecting the drive address by modifying the address jumper block
- Checking the location of the drive terminator resistor pack
- Changing the system firmware
- Quick reference installation, Winchester drive

### **CAUTION**

We recommend that you wear static control wrist straps and cords when handling boards and drives. These devices can be damaged by static electricity as you handle them while installing or removing a 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, vinyl, or styrofoam in the work area.

## Setting Jumpers

Table 4-1 lists jumper settings for a 215G board that does not have a 218A board mounted on it.

Jumper changes are necessary if you install a Winchester drive in a flexible-drive-based system and move the 218A disk board from the processor board to the 215G Winchester board. Table 4-2 specifies the changes to make on the 215G board. Chapter 3 describes this task in detail and also lists processor board jumper changes.

Table 4-1. Jumpers on 215G Board (No 218A Board on 215G)

Board	Jumpers Between Pins	Jumpers Between Pins
iSBC 215G	W1-1 to W1-3 W3-1 to W3-2 W4-1 to W4-2 W5-1 to W5-3 W6-1 to W6-3 W7-1 to W7-3 W8-1 to W8-3 W9-1 to W9-2 W10-1 to W10-2 W11-1 to W11-3 W13-1 to W13-2 W14-1 to W14-2 W16-1 to W16-2 W17-1 to W17-2 W18-1 to W18-2	W19-C to W19-5 W20-1 to W20-2 W21-1 to W21-3 W23-1 to W23-2 W25-1 to W25-2 W27-1 to W27-2 W29-8 to W29-9 W30-1 to W30-20 W30-2 to W30-19 W31-1 to W31-2 W37-1 to W37-2 W38-1 to W38-2 W22-1 to W22-2 W33-1 to W33-2

Table 4-2. Jumpers Changes on 215G Board When 218A Board Is Moved to 215G

System	Board to Make Changes on	Remove Jumper	Install Jumper
86-based system	215G board	W24-1 to W24-3* W4-1 to W4-2	W24-1 to W24-2
286-based system	215G board	W24-1 to W24-3* W4-1 to W4-2	W24-1 to W24-2

\* Remove this jumper when no other direct memory access device is connected to iSBX connector J3.

## Installing Boards in the Cardcage

After setting the board jumpers, insert the 215G board into the top slot of the cardcage. See Chapter 2 for details about inserting the board and securing the card retainers.

### Slot Location

Both the top and bottom slots have extra space to hold a circuit board with an expansion module such as the 218A board installed on it. When reinstalling boards after making changes to them, you'll probably want to replace the processor board in the bottom slot and install the 215G board in the top slot. The top slot has highest priority on the bus, so installing the 215G board in this slot prevents the bus from hanging while waiting for access.

### CAUTION

*Only use iLBX-compatible circuit boards in cardcage slots served by the iLBX bus (286-based systems only). Otherwise, the system's operation will be disrupted and components could be damaged. In a factory-standard System 310, incompatible boards cannot be inserted into the wrong slots because any unoccupied iLBX slots are keyed with a plastic insert in the P1 backplane connectors as a warning against putting the wrong board in a given slot. If you modify the system to extend the iLBX bus interface, be sure to label or key the backplane slots so only the correct boards can be inserted.*

*The reverse is also generally true: only use boards that are non-iLBX-compatible in non-iLBX slots; these slots may carry signals that conflict with the iLBX signals.*

Note that the plastic insert must be removed before a board can be inserted in a keyed slot.

## Installing the Winchester Drive

To mount the drive unit on the peripheral support, see Chapter 2. The following sections tell how to install the boards and cables that must be installed along with the Winchester drive.

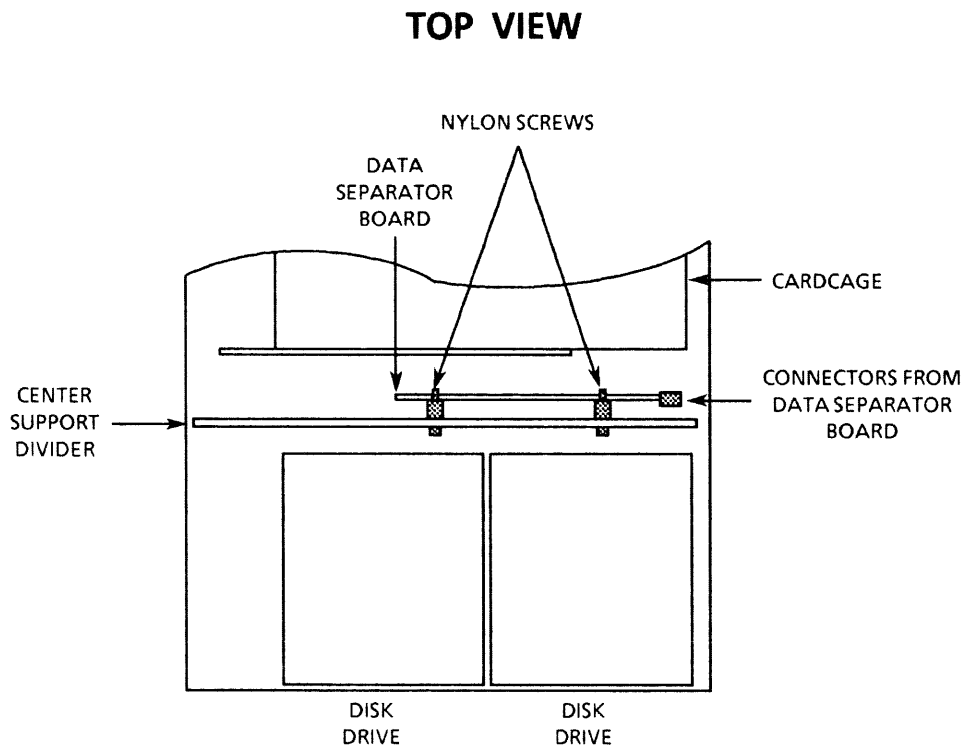
### CAUTION

Overtightening could damage the nylon screws and the printed circuit boards. This caution applies to the following sections in which instructions are given for installing boards.

## Installing the Data Separator Board

The data separator board must be installed in the space between the backplane and the center support divider, attached to the divider (Figure 4-1). To install this board, use a flat-bladed screwdriver suitable for #6 screws.

1. Turn the system so the back of the chassis faces you.
2. Insert the data separator in the space between the backplane and the center support divider, with the component side toward the cardcage and the edge connectors toward the fans.
3. Slide the board toward the left side of the chassis and lift up the board's left side slightly. At the bottom left corner of the board is the J4 4-pin power/ground connector. The DC power supply wiring harness is already in place in the chassis; insert 4-pin connector P4 at J4 and slide the board back into place.
4. Align the mounting holes at the top of the board with the mounting holes on the divider. From the component side, insert each nylon screw through the data separator board.
5. Slide a nylon spacer onto each screw, then insert the screws through the mounting holes on the divider.
6. From the back of the divider, add the nylon nuts. Carefully tighten the screws.



F-0164

Figure 4-1. Location of Data Separator Board



## Installing the Scrambler Card

The scrambler card for the Winchester drive must be installed on the inside of the chassis back panel. To install this card, use a Phillips screwdriver suitable for #8 screws.

1. On the back panel, locate the two scrambler mounting holes.
2. From the back (outside) of the back panel, insert screws through the mounting holes; the board comes with two #8 Phillips screws, two  $\frac{1}{2}$ -inch metal studs, and two nuts.
3. Slide a  $\frac{1}{2}$ -inch metal stud over each screw.
4. On the inside of the back panel, place the scrambler over the screws. The solder side of the scrambler should be toward the back panel and the component side facing you (with the name "INTEL" in the upper left corner) (Figure 4-2).
5. From the front of the card, add the nuts. Carefully tighten the screws.

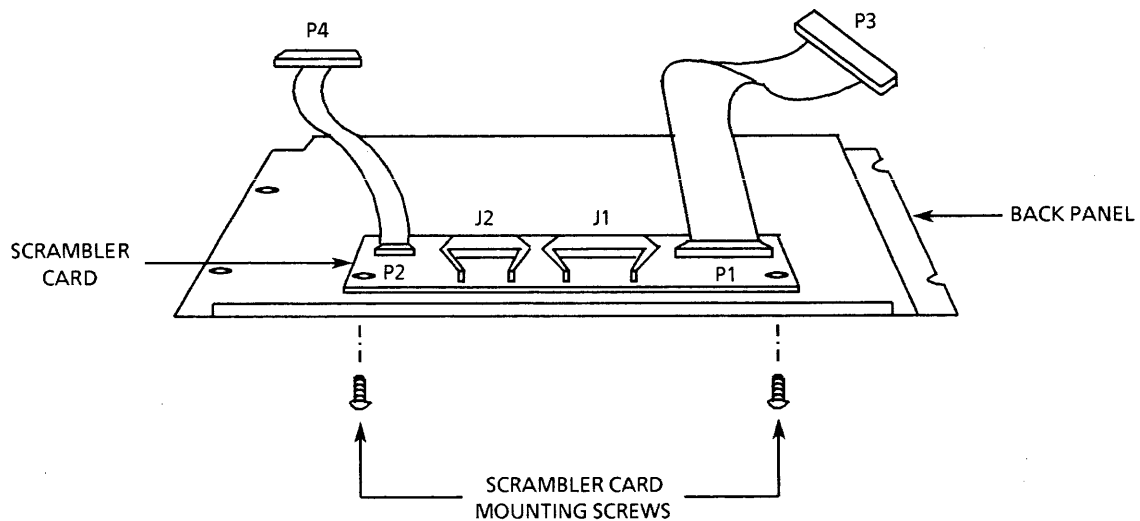


Figure 4-2. Location of Scrambler Card

F-0022

## Connecting and Routing Data and Control Cables

When installing a Winchester drive in the system, connect and route the data and control cables as described in Table 4-3. Figure 4-3 shows the physical routing, and Figure 4-4 shows the data and control signal paths between boards.

### NOTE

For all cables and connectors in the table, orient pin 1 on each cable with pin 1 on its mating connector.

Table 4-3. Winchester Drive Cable Routing

Step	From/To	Cable	Connections and Routing
1	Scrambler card to 215G board (control signals)	50-conductor with PCB male connector on each end	Connect one cable end to PCB female header at connector P1 on scrambler card and the other end to connector P3 at J1 on the 215G board.
2	Scrambler card to 215G board (data signals)	20-conductor with PCB male connector on each end	Connect one cable end to PCB female header at connector P2 on scramblercard and the other end to connector P4 at J2 on the 215G board.
3	Scrambler card to data separator board (data signals)	20-conductor with PCB male header on one end, card edge connector on the other	Connect male header to PCB female header at connector J2 on scrambler card. Route cable over the cardcage to card edge connector J3 on the data separator board.
4	Scrambler card to Winchester drive circuit board (control signals) (black plastic sleeve)	34-conductor with PCB male header on one end, card edge connector on the other	Connect male header to PCB female header at connector J1 on scrambler card. Route cable over the cardcage to card edge connector J1 on the drive circuit board.
5	Winchester drive circuit board to data separator board (data signals)	20-conductor with card edge connector on each end	Connect one cable end to card edge connector J2 on the drive circuit board. Route cable along back of drive and connect other end to connector J1 on the data separator board.
6	Winchester drive power cable	(Not shown in Figure 4-3)	The DC power supply wiring harness is already in place in the chassis. Insert DC line connector P3 into connector J3 on the drive circuit board.

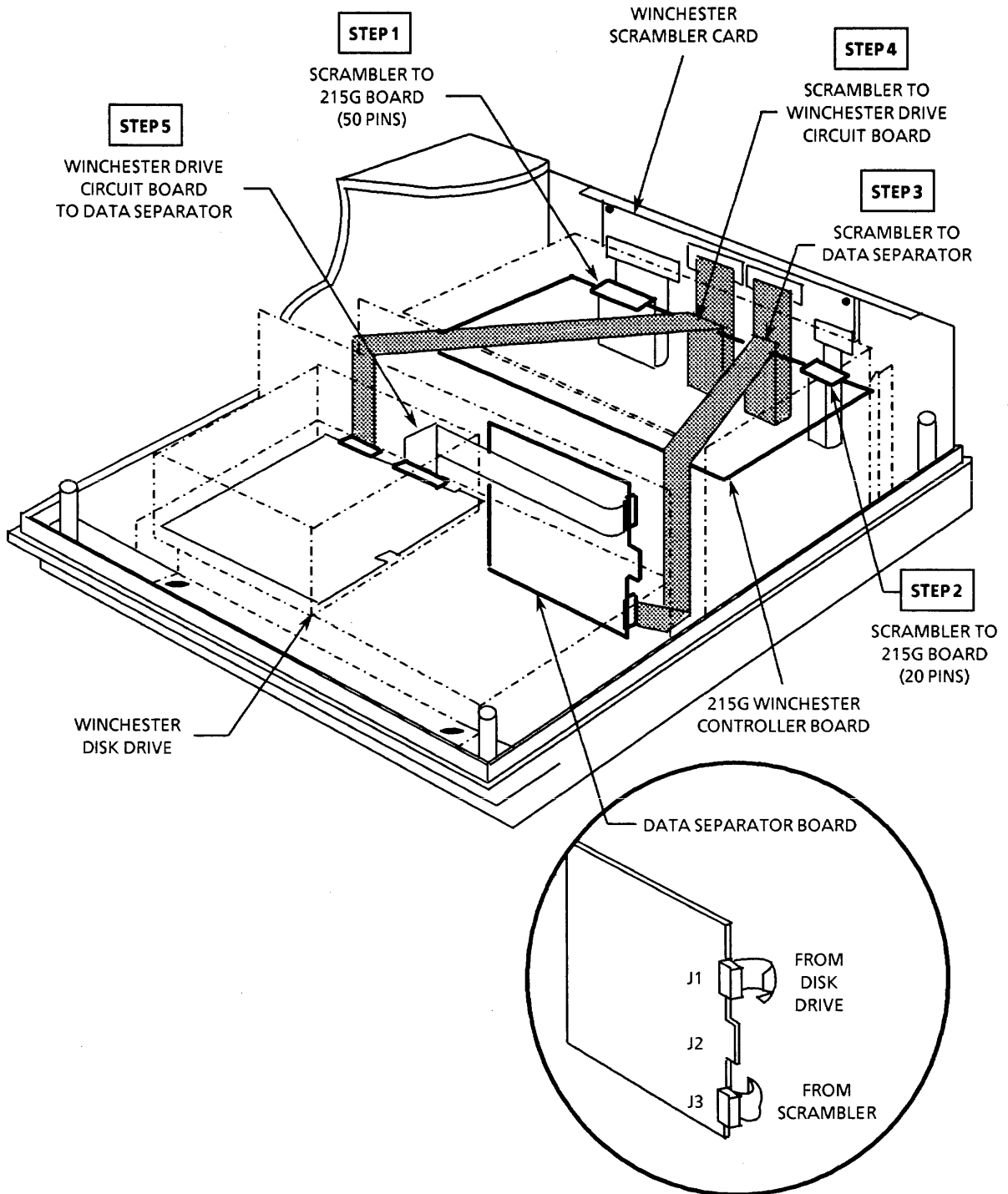


Figure 4-3. Data and Control Cable Routing

F-0021

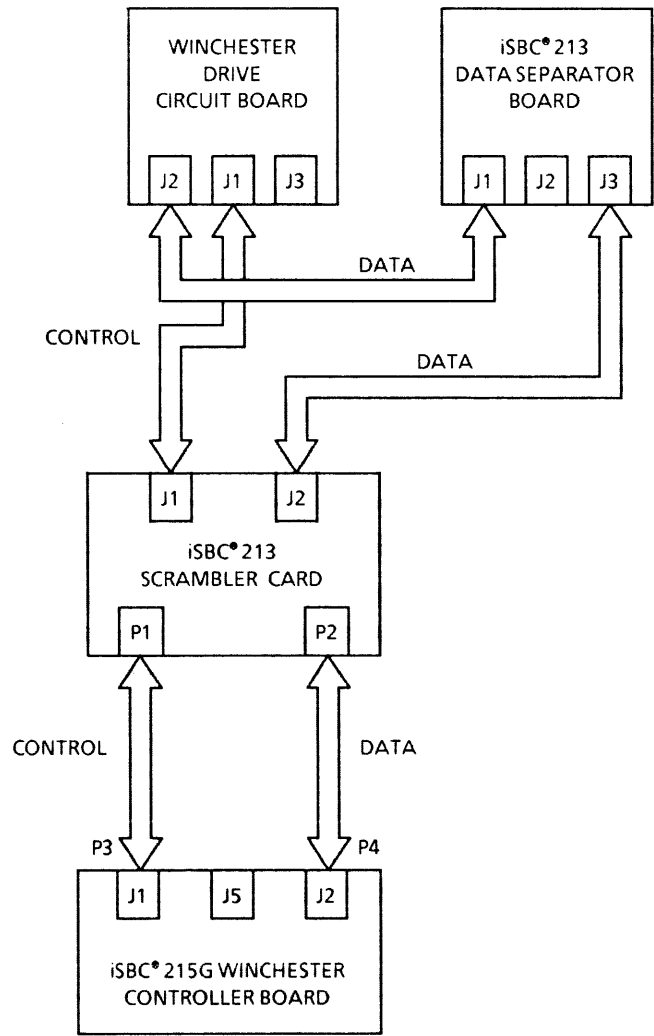


Figure 4-4. Winchester Drive Data and Control Signal Paths

F-0254

**CAUTION**

We recommend that you wear static control wrist straps and cords when handling boards and drives. Also, do not jar or drop drives; they can be easily damaged.

**Selecting the Drive Address**

For the microprocessor to distinguish one installed drive from another, you must select a unique address for each drive. (However, remember that if you have one Winchester and one flexible disk drive, they will both have address 0, since they are different drive types.) The method of selecting this address and the physical location of any related jumpers or switches depend on the specific drive you are installing. As an example, this section includes general information about address selection on a Winchester drive.

Select the address by modifying a device select jumper block on the drive circuit board (Figure 4-5).

1. Assign a disk drive address corresponding to the drive number. In this example, the jumper block pin sets on the drive circuit board are numbered DS0, DS1, DS2, and DS3. It's convenient to assign address (DS)0 to a single Winchester drive. (The address for a Winchester drive can be the same as that for a flexible drive, because the two are controlled from different controller boards.)
2. Install a jumper on the pin set that's labeled with the same number you've assigned as the address for that drive. In all standard versions of the System 310 with a single Winchester drive installed, this jumper should already be installed between pins 1 and 2 to indicate a drive 0 address.

### Checking the Terminator Resistor Pack

Each drive system must have a terminator resistor pack installed in the last drive of the series. The resistor pack plugs into a standard IC socket on the drive circuit board. The location of the socket depends on the specific drive you are installing, so the information and figure are general rather than specific. Systems that have both flexible drives and Winchester drives must have a resistor pack installed on the control circuit board of the last drive of each type of drive system. In a factory-standard System 310 with only one drive of a given type, the resistor pack is already installed in the correct location for each drive.

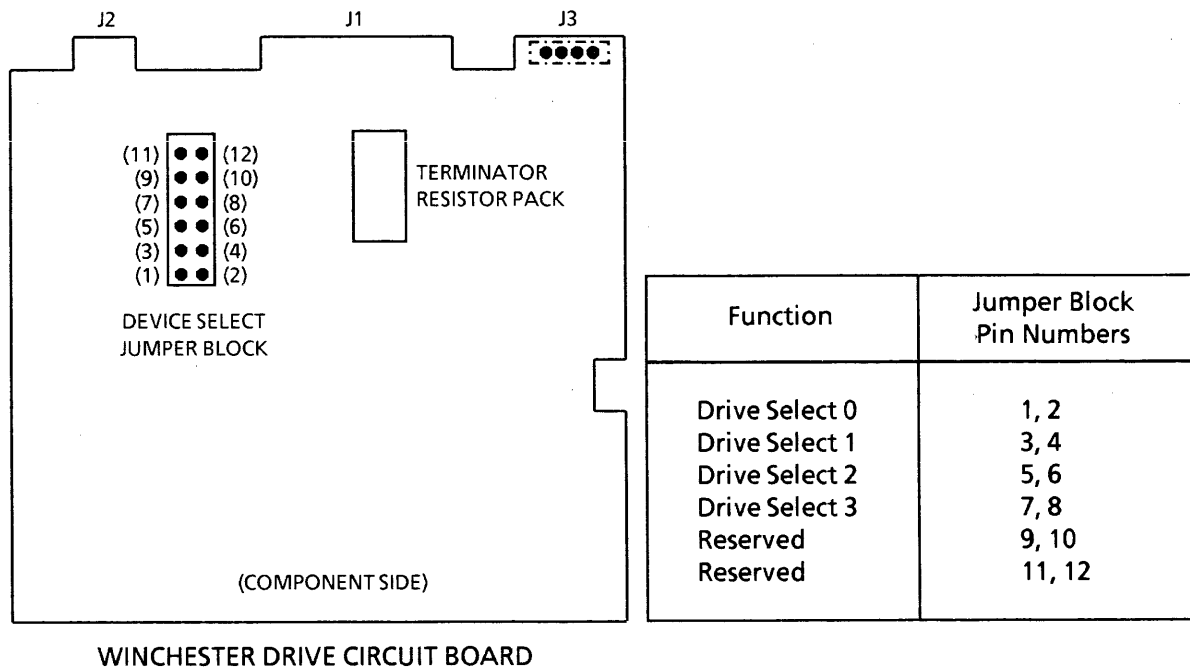


Figure 4-5. Drive Address Select Jumper Block and Terminator Resistor Pack

F-0113

## System Firmware

When you add a Winchester drive to a system that doesn't have one, you must change the system firmware. Winchester-related firmware includes tests that check both the Winchester and the flexible drives. The firmware also contains a program that enables the operating system to be loaded from the Winchester disk rather than from flexible disks. The firmware includes the following three programs:

- System Confidence Tests (SCTs)
- Bootstrap Loader
- iSDM™ 86 or iSDM 286 System Debug Monitor

The **System Confidence Tests (SCTs)** begin automatically when you turn on power to the system or press the front panel RESET switch. They test the basic operation of several hardware modules. In a System 310 without a 215G controller board, the SCT checks only the condition of the flexible drive system.

The **Bootstrap Loader** comes in two versions, both of which load the operating system automatically—one from the flexible drive, the other from the Winchester drive. The factory-standard System 310 comes with the appropriate firmware in place.

The commands in the **System Debug Monitor** program enable you to do elementary debugging such as examining memory contents in hexadecimal or filling memory with test values. (For more information, see the system debug reference manual listed in Appendix D.)

## Changing the Firmware EPROMs

System 286/310 firmware is contained in four 27128-1 or equivalent EPROMs installed on the processor board. Figure 4-6 shows the location and socket numbers for both processor boards. After adding a Winchester drive to the system, replace the EPROMs.

### CAUTION

EPROMs can be damaged by static electricity. We recommend that you wear static control wrist straps and cords when handling them.

1. Remove the EPROMs from the processor board one at a time, noting the orientation of the notch on the chip.

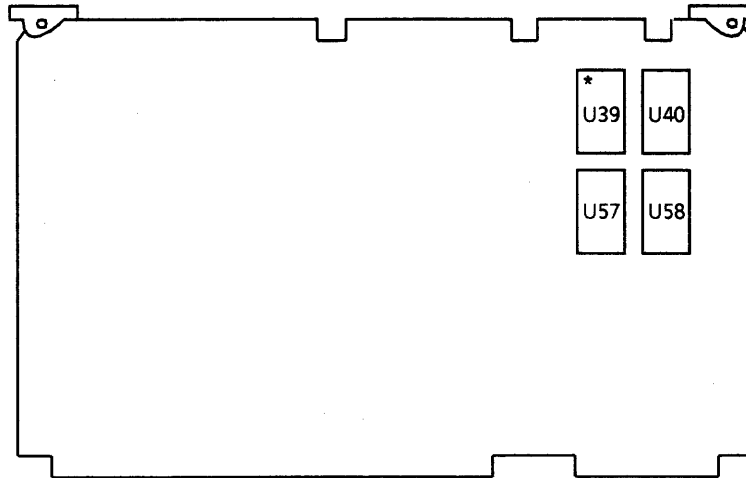
On 86/30 board: remove EPROMs in sockets U39, U40, U57, and U58.

On 286/10 board: remove EPROMs in sockets U40, U41, U75, and U76.

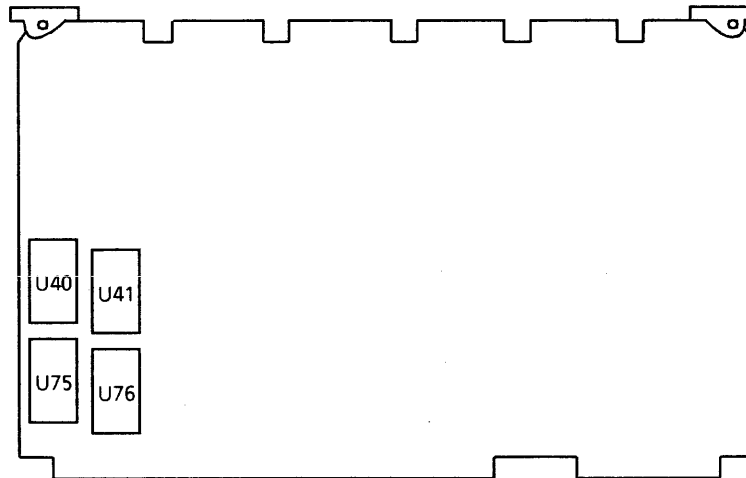
2. As you remove each EPROM, replace it with the appropriate new one, making sure the new chip is oriented correctly.

### NOTE

After modifying the system, we recommend that you test the system, particularly the new components. Refer to your system diagnostic manual (see Appendix D) for more information about system testing.



86/30 PROCESSOR BOARD



286/10 PROCESSOR BOARD

\* PIN 1 LOCATION AT UPPER LEFT CORNER OF EACH EPROM

Figure 4-6. System Firmware EPROM Locations on Processor Board

F-0303

## Quick Reference Information

For quick reference, Table 4-4 summarizes the steps needed to install and configure a Winchester drive in the system.

Table 4-4. Quick Reference--Installing Winchester Drive

Step	General Task	Chapter
1	Before making any modifications, run system confidence and diagnostic tests to check system integrity (see the system diagnostic manual; Appendix D lists titles).	4 App.D
2	Turn the system power switch off and unplug the power cord. Wait one minute--lethal voltages need time to discharge.	
3	Remove the system top cover and back panel.	2
4	Note the locations of connectors and cables between the back panel and processor board, and between the back panel and the front panel. Disconnect the cables and lay the back panel flat on a grounded, static-safe surface.	2
5	Remove the card retainers.	2
6	Remove the processor board from the bottom cardcage slot.	2
7	Make any necessary jumper changes on the processor board, 218A disk board, and 215G Winchester board. Also change the firmware EPROMs on the processor board if you want to load the operating system from the Winchester drive instead of from the flexible drive.	3, 4
8	Replace the boards in the cardcage (processor board in the bottom slot, 215G board in the top).	2
9	Disconnect the ground wire from left front corner of the peripheral support and the DC distribution cable clamp from the right side of the flexible disk drive.	2
10	Place a foam pad on the cardcage or on a grounded, static-safe surface.	2
11	Place the Winchester drive upside down on the foam pad.	2
12	Set the drive select function on the drive circuit board to assign a drive address.	4
13	Make sure a terminator resistor pack is installed on the drive circuit board for the last drive of each type (Winchester and flexible).	4



Table 4-4. Quick Reference--Installing Winchester Drive (Continued)

Step	General Task	Chapter
14	Remove the peripheral support from the system chassis.	2
15	Turn the drive assembly upside down over the Winchester drive.	2
16	Install the drive unit on the peripheral support and turn the drive assembly right-side up.	2
17	Install the data separator board on the center support divider.	4
18	Install the scrambler card on the back panel.	4
19	Connect and route all data and control cables between the drive and its associated boards, and power cords from the system power supply.	4
20	Replace the card retainers.	2
21	Replace the peripheral support in the chassis.	2
22	Reconnect any back panel cables that may still be loose.	2
23	Replace the back panel and top cover.	2
24	Plug in the power cord and turn the system power switch on. Press the RESET switch on the system front panel.	
25	Again run the appropriate system diagnostic tests to make sure the hardware is working correctly.	4 App.D

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## APPENDIX A FLEXIBLE DISK DRIVE AND CONTROLLER SPECIFICATIONS

### NOTE

The following specifications refer to Intel-supplied drives only.

### Flexible Disk Drive

#### Performance

Capacity (in bytes)	Double Density (MFM)
Unformatted	
Per disk (40 track)	500,000
Per surface (40 track)	250,000
Per track	6,250
Formatted (16 sectors/track)	
Per disk (40 track)	327,680
Per track	4,096
Per sector	256
Formatted (8 sectors/track)	
Per disk (40 track)	409,612
Per track	5,120
Per sector	512
Formatted (18 sectors/track)	
Per disk (40 track)	N/A
Per track	4,608
Per sector	256
Transfer Rate	250 Kbits/sec
Average Latency	100 ms
Access Time, Track to Track	20 ms
Average (40 track)	275 ms
Head Settling Time	15 ms

**Functional**

	<b>Double Density (MFM)</b>
Rotational Speed	300 RPM
Recording Density (40 track)	5876 BPI
Flux Density (40 track)	5876 FCI
Track Density	48 TPI

**Physical**

<b>Environmental Limits</b>	<b>Operating</b>	<b>Shipping</b>	<b>Storage</b>
Ambient Temperature	40° to 95°F 4° to 35°C	-40° to 144°F -40° to 63°C	-8° to 117°F -22° to 48°C
Relative Humidity (noncondensing)	20 to 80%	1 to 95%	1 to 95%
Maximum Wet Bulb	78°F (26°C)	N/A	N/A
DC Voltage Requirements (drive-dependent)	+12V $\pm$ 5% @ 1.80A maximum +5V $\pm$ 5% @ 0.70A maximum		
Dimensions (exclusive of front panel)			
Width	5.75 in. (146.1 mm)		
Height	3.25 in. (82.6 mm)		
Length	8.0 in. (203.2 mm) nominal		
Weight	3 lbs. (1.36 kg) nominal		

**iSBX™ 218A Flexible Diskette Controller Board****Physical**

<b>Environmental Limits</b>	
Operating Temperature	32°F to 131°F 0°C to 55°C
Relative Humidity	Up to 90% without condensation
DC Voltage Requirements	+5V $\pm$ 0.25V, @ 1.7A maximum
<b>Physical Characteristics</b>	
Width	3.15 in. (8.0 cm)
Length	7.50 in. (19.1 cm)
Weight	4.50 oz. (126 gm)
Height	0.83 in. (2.1 cm)
Height including host board	1.13 in. (2.87 cm)



## APPENDIX B WINCHESTER DISK DRIVE AND CONTROLLER SPECIFICATIONS

### NOTE

The following drive specifications refer to Intel-supplied drives only.

### Winchester Drive

#### Performance

Capacity (in bytes)	12 MB drive	19 MB drive	42MB drive
Unformatted			
Per Drive	12.76 Mbytes	19.14 Mbytes	42.66 Mbytes
Per Surface	3.19 Mbytes	3.19 Mbytes	5.33 Mbytes
Per Track	10.4 Kbytes	10.4 Kbytes	10.4 Kbytes
Formatted			
Per Drive	10.9 Mbytes	16.37 Mbytes	37.01 Mbytes
Per Surface	2.73 Mbytes	2.73 Mbytes	4.63 Mbytes
Per Track	9.2 Kbytes	9.2 Kbytes	9.2 Kbytes
Per Sector	1024 Bytes	1024 Bytes	1024 Bytes
Sectors/Track	9	9	9
Transfer Rate	5.0 Mbits/sec	5.0 Mbits/sec	5.0 Mbits/sec
Average Latency	8.33 msec	8.33 msec	8.5 msec
Maximum Seek Time (including head settling)	200 msec	200 msec	90 msec
Average Seek Time, Buffered (including head settling)	95 msec	80 msec	50 msec

#### Functional

Rotational Speed	3600 RPM	3600 RPM	3529 RPM
Recording Density	9180 BPI	9180 BPI	9200 BPI
Flux Density	9180 FCI	9180 FCI	9180 FCI
Track Density	345 TPI	345 TPI	591 TPI
Recording Mode	MFM	MFM	MFM
Spin-up Time, Maximum	30 sec	30 sec	35 sec

**Physical****Environmental Limits**

Ambient Temperature  
 Temperature Gradient  
 Relative Humidity  
 (noncondensing)  
 Maximum Wet Bulb

**Operating**

50° to 115°F (10° to 46°C)  
 18°F/hr (-8°C/hr)  
 10 to 85%  
 78°F (26°C)

**Shock**

Operating 5 g  
 Nonoperating 20 g

**DC Voltage Requirements**

+12V  $\pm$  10% @ 1.7A typical (3.5A starting)  
 +5V  $\pm$  5% @ 0.9A typical (1.5A maximum)

**EMI Susceptibility**

1 volt/meter

**Dimensions (exclusive of front panel)**

Width 5.75 in. (146.1 mm)  
 Height 3.25 in. (82.6 mm)  
 Length 8.00 in. (203.2 mm) nominal  
 Weight Less than 5 lbs. (2.27 kg) nominal

**iSBC® 215G Winchester Disk Controller Board****Physical****Environmental Limits**

Operating Temperature 32° to 131°F (0° to 55°C)  
 Relative Humidity Up to 90% without condensation

**DC Voltage Requirements**

+5V  $\pm$  5% @ 4.52 maximum  
 -5V  $\pm$  5% @ .015 maximum

**Dimensions**

Width 6.8 in. (17.2 cm)  
 Length 12.0 in. (30.5 cm)  
 Weight 19 oz. (0.54 kg)  
 Height 0.5 in. (1.3 cm)  
 Height with iSBX MULTIMODULE  
 board installed 1.13 in. (2.87 cm)



## APPENDIX C SERVICE INFORMATION

United States customers may obtain service and repair assistance by contacting the Intel Customer Support Center in Phoenix, Arizona (phone numbers listed below). Customers outside the United States should contact their sales source (Intel Sales Office or Authorized Distributor) for service information.

Before calling Customer Support, you should have the following information:

- The date you received the product.
- The complete part number (including the dash number) of the product. This number is usually silk-screened onto printed circuit boards and printed on the label of other products.
- The serial number of the product. This is usually silk-screened onto printed circuit boards and printed on the label of other products.
- Your shipping and billing addresses.
- A purchase order number for billing purposes if your Intel product warranty has expired.
- Extended warranty agreement information, if applicable.

### Service and Repair Assistance

Use the following telephone numbers to contact Customer Support:

Regional Telephone Numbers		TWX Numbers
Western Region	(602) 869-4951	910-951-1330
Midwestern Region	(602) 869-4392	910-951-0687
Eastern Region	(602) 869-4045	
International	(602) 869-4391	

Always contact Customer Support before returning a product to Intel for repair. When you make the request, you will be given an authorization number, shipping instructions, and other information that will help Intel provide you with fast, efficient service.

If you are returning a product because of damage sustained during shipment or if the product is out of warranty, a purchase order is required before Intel can initiate repair.

Use the original factory packaging material in preparing a product for shipment to the repair center. If that material is not available, ensure the product is adequately protected by wrapping it in cushioning material before enclosing it in a heavy-duty corrugated shipping carton. All cartons should be labeled "FRAGILE" to ensure careful handling. If a printed circuit board is being returned, a material such as Air Cap TH-240, manufactured by the Sealed Air Corporation of Hawthorne, New Jersey, should be used to give adequate cushioning. Address and ship only to the address specified by Customer Support.

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## APPENDIX D RELATED PUBLICATIONS

These publications give information about the System 310 and Intel products in general. The system introduction manual includes brief descriptions of all other System 310 manuals and related manuals.

Order publications from this address:

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

### System Manuals

*Introduction to the System 310 Microcomputer*, Order Number 173202

*System 310 Installation and Operation Guide*, Order Number 173211

*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 Hardware Maintenance Manual*, Order Number 173208

*System 310 Communications Configuration Guide*, Order Number 173771

### Diagnostic Information

*System 86/300 Series Diagnostic Maintenance Manual*, Order Number 144813

*System 286/300 Series Diagnostic Software User's Guide*, Order Number 173767

*iSDM 86 System Debug Monitor Reference Manual*, Order Number 146165

*iSDM 286 System Debug Monitor Reference Manual*, Order Number 145804

## **Circuit Board Manuals**

*iSBX 218A Flexible Diskette Controller Board Hardware Reference Manual*, Order Number 145911

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

*iSBC 213 Data Separator Kit Installation Guide*, Order Number 146232

*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

## **Intel Product Handbooks**

*Microsystem Components Handbook*, Order Number 230843

*OEM Systems Handbook*, Order Number 210941



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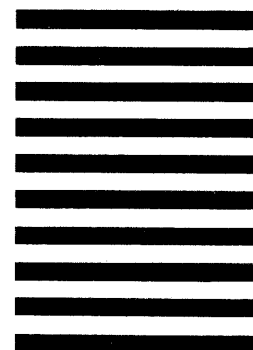
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