



adaptec, inc.

ACB-2002A  
User's Manual

**LIBRARY COPY**

## 1.0 INTRODUCTION

---

### 1.1 SCOPE AND PURPOSE OF MANUAL

The purpose of this manual is to guide the system integrator through a successful installation of Adaptec's ACB-2002A board. This includes both hardware and software installation, as well as troubleshooting information.

### 1.2 REFERENCE DOCUMENTS

- \* IBM PC or XT Guide to Operation Manual
- \* IBM DOS Reference Manual Version 2.0, 2.1, or 3.0
- \* Appropriate Disk Drive OEM Manual

### 1.3 OVERVIEW OF PRODUCT

The Adaptec ACB-2002A is a high performance 5 1/4" and 3 1/2" Winchester Disk Controller for the IBM PC or XT and equivalent personal computers. The ACB-2002A is an extension of Adaptec's ACB-2002 board. The ACB-2002A has Adaptec's BIOS installed, while the ACB-2002 requires the system integrator to supply his own BIOS. The ACB-2002A is a complete "plug and play" controller board and requires no special BIOS or software driver.

The Adaptec ACB-2002A is one of the highest performance controllers available today for the IBM PC/XT compatible marketplace. In addition, it is fully hardware, software and format compatible with the IBM XT hard disk controller.

The Adaptec ACB-2002A Winchester Disk Controller has the following features:

- o Fully IBM hardware compatible. It plugs directly into the IBM PC/XT chassis without modification.
- o Fully IBM software compatible. It operates with all IBM PC/XT DOS hard disk drivers and application programs.
- o Fully IBM XT disk format compatible. You can interchange drives between the ACB-2002A and the IBM XT controller without reformatting.

- o Controls both 5 1/4" and 3 1/2" ST-506 type Winchester disk drives. This allows the system integrator to interchange drives to optimize space requirements.
- o On-board primary format utility. There is no need to send a software formatter on a floppy with every controller.
- o On-board Adaptec copyrighted BIOS. There is no need to write a special BIOS or software driver.
- o 2 to 1 interleaving of the disk. This achieves the maximum rate of DMA transfers that the IBM PC bus can accept. Also this interleave factor can be varied from 2 to 9.
- o User defined drive parameters. This gives you the ability to install any drive onto the controller without BIOS or firmware changes, i.e. device independence. This gives flexibility in the choice of drives and ease of mixing drives in manufacturing.
- o Auto-configuration of drive. The controller writes the drive parameters onto the drive during format and reads them on power-up. This allows formatting on one controller and no need to reinitialize on another ACB-2002A controller. This is ideal for field upgrade of drives with no user intervention.
- o Four standard drive tables in BIOS. This gives the option of using jumpers instead of user defined drive parameters.
- o Support of 2 ST506 type drives. The drives do not need to be the same in capacity or manufacturer. This allows the maximum expansion of hard disks on the IBM PC/XT.
- o Support of wedge servo drives such as Quantum, Syquest, Microscience International, and Tulin. This gives you drive flexibility and no need to order special controller firmware.
- o 13 microsecond high performance seek step rate. This achieves maximum performance of the drive by reducing the seek access time. Many drives that are now on the market take advantage of this feature.
- o Power-on diagnostics and self diagnostics for controller self checking. This gives a high confidence level that the controller is functioning properly.
- o Seek and data check recovery. This reduces the probability of erroneous data.
- o 32-bit Error Correction Code (ECC) on both ID and data fields. This corrects up to 11 bit burst errors, and guarantees data integrity.

#### 1.4 HARDWARE AND SOFTWARE REQUIREMENTS

The ACB-2002A can be installed in any IBM PC/XT or equivalent IBM compatible computer. The successful installation of the Adaptec ACB-2002A requires the following hardware and software.

##### Hardware

1. IBM PC or XT or equivalent IBM compatible computer with:
  - a. One 5 1/4" floppy diskette drive
  - b. One available system expansion slot
  - c. Room for one 5 1/4" or 3 1/2" Winchester (hard) disk drive
2. 5 1/4" or 3 1/2" Winchester disk drive(s) having the industry standard ST506 interface with maximum capacity of 16 Mega-bytes.
3. External power supply or power booster to support the power required by the Winchester disk drive. If using an IBM XT or a very low power drive in the IBM PC, this is not required.
4. 20-pin and 34-pin flat ribbon cables to connect the drive to the controller.

##### Software

1. IBM PC/XT DOS version 2.0 or newer revisions.

#### 1.5 SPECIAL APPLICATIONS FIRMWARE

<b>APPLICATION</b>	<b>COMMENTS</b>
AT&T 6300	Requires AT&T motherboard boot ROM revision 1.2 or later
COMPAQ DESKPRO	Requires Adaptec firmware P/N 400110-00A or later plus BIOS P/N 400051-00B or later
8 MHz PC's	Same as Compaq Deskpro
PC/IX Operating System	Requires Adaptec firmware P/N 400110-00A or later
DMA 360 and Syquest 312 drive operation	Requires Adaptec ACB-2010A product with firmware revision 400062-00B or later
16 MB to 64 MB using 1 or 2 physical drives	Requires Adaptec ACB-2010A using logical unit partitioning

## 1.6 QUICK INSTALLATION

For those of you that cannot wait to use your ACB-2002A controller, the following steps will get you up and running. This installation is for one drive of capacity up to 16 MB but using only 10 MB (see section 3.2 to format to 16 MB). After you install it, please read the complete User's Manual so you can use ALL of the capabilities of the ACB-2002A.

### **STEP 1**

Be sure that you have all the required hardware and software as detailed in section 1.4, i.e. an IBM PC/XT, DOS 2.0, or newer revisions, drive, power supply and cables.

### **STEP 2**

Become acquainted with the ACB-2002A board, looking at the location of jumpers and connectors. See figure 2.1.

### **STEP 3**

Configure the drive to be "drive 0" by setting the switches on the drive. Be sure that the drive is terminated. See figure 2.2.

### **STEP 4**

Configure the controller so it matches your drive as follows:

<u>DRIVE VENDOR AND CAPACITY</u>	<u>INSTALL JUMPERS</u>
Miniscribe 10 MB	M-N and O-P
Syquest 5 MB	M-N and E-F
Miniscribe 16MB	O-P
Seagate 10MB	none
Microscience 10 MB	E-F
ALL OTHERS	A-B

See section 2.5.2, 2.5.2.1 and 2.5.2.2.

### **STEP 5**

Refer to figure 2.4. Connect the drive to the controller using your 34 pin and 20 pin cables. Drive 0 uses the connectors nearest to the edge of the board, J0 and J2. See section 2.5.3.

**IMPORTANT:** BE SURE THAT PIN 1 OF THE CONTROLLER GOES TO PIN 1 OF THE DRIVE. WHEN MOUNTING IN THE PC, PIN 1 IS FACING DOWN.

### **STEP 6**

If using 3 1/2" or 5 1/4" half height drives no extra power supply is needed. If using a 5 1/4" full height drive in a IBM PC attach an additional power supply. If using an IBM XT no additional supply is needed. See section 2.5.4.

### STEP 7

Mount the drive and controller inside the PC. Turn power ON. IF ANY PROBLEMS ARISE, SEE CHAPTER 4 TO TROUBLESHOOT.

### STEP 8

Boot from floppy drive A using the Supplemental DOS diskette that contains DEBUG. See Section 3.2.

<u>TYPE</u>		<u>COMMENTS</u>
A>DEBUG	<CR>	<Carriage return>
-G=C800:CCC	<CR>	<Carriage return>
3		(interleave factor)
0		(drive ID)
N		(or 'Y' if you are using one of the drives in STEP 4)
3	<CR>	(with A-B jumper or 5 without A-B jumper installed)
0	<CR>	(landing zone, not used)
8	<CR>	(ECC correction span)
133	<CR>	(Write pre-comp not used, max. cylinder+1)
133	<CR>	(reduced write current, not used)
4	<CR>	(head count, or use 2 )
132	<CR>	(number of cylinder,132 hex=306 decimal)

WAIT until format is complete  
press CTRL and BREAK (SCROLL LOCK) keys at same time

### STEP 9

TURN THE SYSTEM OFF. INSTALL THE DOS SYSTEM DISKETTE WITH "FDISK" AND "FORMAT" INTO DRIVE "A". THEN TURN THE SYSTEM BACK ON, THUS COLD BOOTING. Type FDISK and answer questions, then run FORMAT. See section 3.3.

## 2.0 HARDWARE INSTALLATION

---

### 2.1 INTRODUCTION

This section describes the steps necessary to install the ACB-2002A board into the computer. First the operating environment, unpacking procedure, and board layout are described. This section also describes the integration of the drive and controller into the computer.

### 2.2 ENVIRONMENT REQUIREMENTS

The ACB-2002A will perform properly over the following range of conditions:

	<u>Operating</u>	<u>Storage</u>
Temperature F/C	32/0 to 131/55	-40/-40 to 167/75
Humidity	10% to 95%	10% to 95%
Altitude, feet	Sea level to 10,000	Sea level to 20,000
MTBF, Hours	20,000 POH @ 55 C	

### 2.3 UNPACKING

The carrier is responsible for damage incurred during shipment. In case of damage, have the carrier note the damage on both the delivery receipt and the freight bill, then notify your freight company representative so that the necessary insurance claims can be initiated.

After opening the shipping container, use the packing slip to verify receipt of the individual items listed on the slip. Retain the shipping container and packing material for possible later reuse should return of the equipment to the factory be necessary.

#### **NOTE:**

THE ACB-2002A, LIKE ALL ELECTRONIC EQUIPMENT IS STATIC SENSITIVE. PLEASE TAKE THE PROPER PRECAUTIONS WHEN HANDLING THE BOARD. KEEP THE BOARD IN ITS CONDUCTIVE WRAPPING UNTIL IT IS CONFIGURED AND READY TO BE INSTALLED IN YOUR SYSTEM.

### 2.4 BOARD LAYOUT

The ACB-2002A is shown in Figure 2-1. This figure shows the location of the firmware, BIOS, jumpers and connectors. Note that pin 1 of the connector is located closest to the PC bus edge connector.

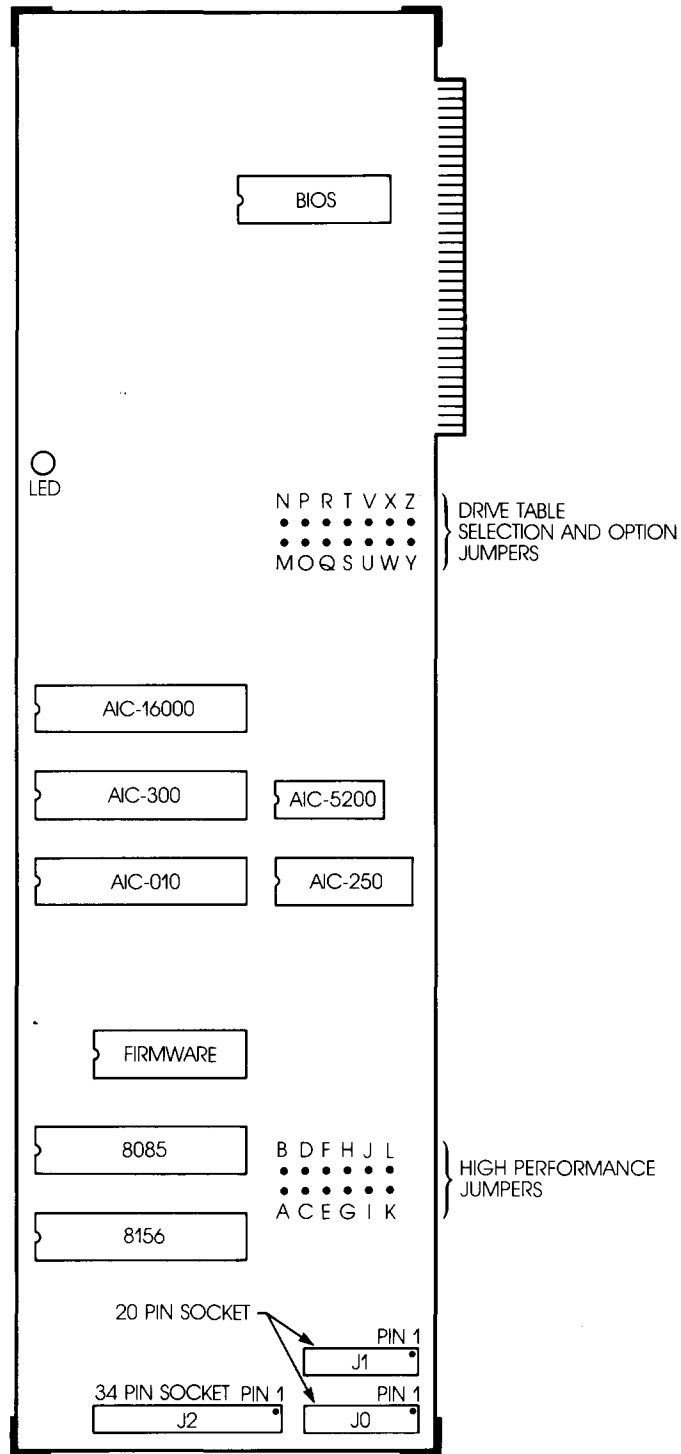


Figure 2-1. Board Layout



## 2.5 INTEGRATION INTO THE SYSTEM

To install the Adaptec ACB-2002A board into your system you must first configure the drive(s), set the controller jumpers and connect the drive cables properly. This section describes all the necessary steps needed to successfully install this hardware.

In order to configure the drives, you need the Disk Drive OEM Manual that was supplied with your drive. (If you do not have this manual call your Drive vendor for assistance.) This manual is required to obtain the drive characteristics for your particular drive. The controller must match the drive parameters, i.e. number of heads, number of cylinders, step pulse rate, etc. in order to function successfully. The drive parameters are divided into two categories; one being the drive changeable parameters and two, the controller changeable parameters.

### 2.5.1 DRIVE SELECTION AND TERMINATION

The drive changeable parameters are the drive selection switches (or jumpers) and the drive termination. These parameters allow a drive to be selected as drive 0, 1, 2 or 3. This is accomplished by changing the drive address selection switches or jumpers.

**NOTE:**

SOME DRIVE MANUFACTURERS HAVE DESIGNATED THE DRIVE ADDRESSES TO BE 1,2,3,4 INSTEAD OF 0,1,2,3. DO NOT SET THE DRIVE AS A RADIAL SELECTED DRIVE. RADIAL SELECTION WILL SET ALL DRIVE OUTPUT SIGNALS TO BE ACTIVE, EVEN IF THE DRIVE IS NOT SELECTED. IN THIS CASE, THE DRIVE LED WILL BE ON AT ALL TIMES.

Use the two lowest drive addresses available as drive "0" and drive "1" to be seen by the controller.

Before the drives can be cabled to the controller the drive cable terminator must be properly set. The terminator is used to reduce signal "ringing" in the cables. The terminator, as its name implies, must be at the end of each cable in order to have the controller and drive communicate properly. The controller has a permanent terminator built-in. The disk drives, since they can be connected in a daisy chain configuration (see Figure 2-3), have a removable terminator. This is usually a 16-pin DIP resistor package. The last physical drive in the chain must have its terminator installed.

Example 1: When one drive and one controller are used, both must be terminated.

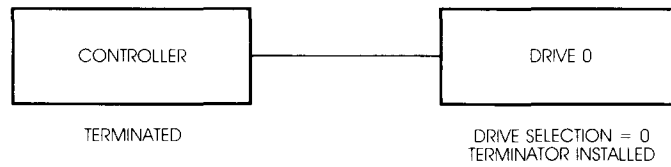


Figure 2-2. One Drive, One Controller Termination Example

Example 2: When two drives and one controller are used, only the last one in the chain is terminated.

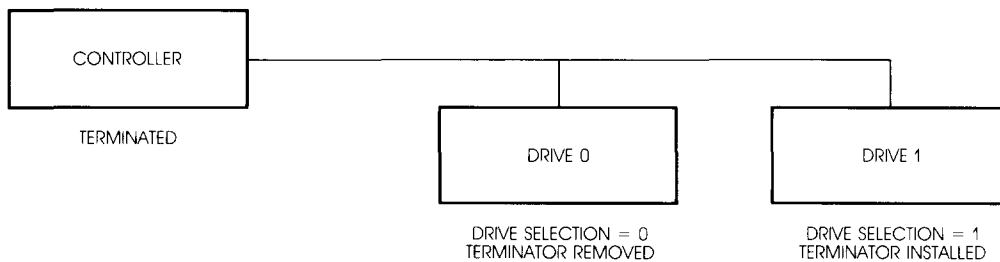


Figure 2-3. Two Drive, One Controller Termination Example

Now select the proper drive addresses and remove or install the required terminators for your system.

### 2.5.2 CONTROLLER JUMPER SELECTION

The controller changeable parameters are defined as the variables that can be changed to accommodate the different drive characteristics. These parameters can easily be changed by jumper(s) or defined by the user (see Chapter 3 ) for the drive being used.

The parameters shown in Table 2-1 need to be taken from the Disk Drive OEM Manual and specifications. Table 2-2 shows the drives supported by the BIOS and selected by the jumpers. If the drive you are using is not selected by jumpers , Table 2-1 must be completed. Table 2-1 will be used in Section 3.2 when the user defined drive parameters are discussed.

Table 2-1. Drive Table

	<u>Drive 0</u>	<u>Drive 1</u>
Drive Manufacturer and Model	_____	_____
Unformatted Drive Capacity	_____	_____ MB
Wedge Servo Format used (Y/N)	_____	_____
Minimum Step Pulse rate for buffered Step rate; 3 mSec for non-buffered	_____	_____ uSec
Write Precompensation starts	_____	_____ cylinder
Reduced Write Current starts	_____	_____ cylinder
Number of Data Heads	_____	_____ heads
Number of Cylinders	_____	_____ cylinders

These parameters make up what is called a drive table.

#### 2.5.2.1 DRIVE TABLE SELECTION JUMPERS

The ACB-2002A has drive tables for the most commonly used drives. These tables reside in the Adaptec ACB-2002A BIOS EPROM. See Appendix A for a description of the BIOS.

The drive tables in the ACB-2002A BIOS support the following drives: 10MB half height-Miniscribe 3012H or equivalent, 5MB Syquest SQ-306 or equivalent, 20MB-Miniscribe 4020H or equivalent, 10MB full height-Seagate ST412 or equivalent (see Table 2-2). These drive tables are selected by jumpers on the board. Other drives can be attached to the ACB-2002A by use of the user defined parameters described in the software installation section.

**NOTE:**

THE ACB-2002A IS SHIPPED ALREADY CONFIGURED TO BE USED WITH A SEAGATE ST412 OR EQUIVALENT 10 MB DRIVE. (SEE TABLE 3 OF TABLE 2-2.)

Table 2-2. ACB-2002A Default Drive Tables

	<u>Table 0</u>	<u>Table 1</u>	<u>Table 2</u>	<u>Table 3</u>
Drives Supported (or equivalent)	Miniscribe 3012H	Syquest SQ-306	Miniscribe 4020H	Seagate ST412 (Microsci., Tandon, Cogito, IMI, CMI)
Unformatted Drive Capacity	12.75MB	6.38MB	20.0MB	12.17MB
Wedge Servo Format	no	yes	no	no (yes for Microsci.)
Step Pulse Code (Rate)	5 (70 uSec)	5 (70 uSec)	5 (70 uSec)	5 (70 uSec)
Ship/Land Zone (+ cyl. above max cylinder)	0	0	0	0
Write Precomp Cylinder	613 (not used)	307 (not used)	128	128
Reduced Write Current Cyl.	613 (not used)	307 (not used)	481 (not used)	307 (not used)
Number of Data Heads	2	2	4	4
Number of Cylinders	612	306	480	306

If needed, see Appendix C for equivalent hexadecimal values.

These four tables are selected by jumpers M-N, O-P for drive 0 and Q-R, S-T for drive 1. Table 2-3 defines the jumper selection of each drive and table.

Table 2-3. Jumper Selection of Drive Tables

<u>Table for Drive 0</u>	<u>Installed</u>	<u>Removed</u>
0	M-N and O-P	---
1	M-N	O-P
2	O-P	M-N
3	---	M-N and O-P

<u>Table for Drive 1</u>	<u>Installed</u>	<u>Removed</u>
0	Q-R and S-T	---
1	Q-R	S-T
2	S-T	Q-R
3	---	Q-R and S-T

### 2.5.2.2 HIGH PERFORMANCE JUMPERS

The ACB-2002A also has jumpers for a high performance step rate of 13 microseconds, 200 microseconds step rate, or 3 milliseconds, non-buffered step rate, wedge servo drives, 1.0 microsecond per byte DMA speed, and self diagnostics.

The 13 uSec step rate is selected by jumper A-B in conjunction with a seek step pulse code of 3 (see software installation Section 3.2.2). If two drives are used, and the A-B jumper is installed, only the drive that uses code 3 will be stepped at the 13 uSec rate. The default tables use seek step pulse code 5, or 70 microseconds. Performance of drives given in Table 2-2 can be improved if formatted using the A-B jumper and drive parameters inputted as noted in section 3.2.

A 200 uSec step rate is selected by jumper A-B in conjunction with a seek step pulse rate of 4.

A 3 mSec step rate is selected by jumper A-B in conjunction with a seek step pulse code of 0. This is used for older, non-buffered step rate drives.

The wedge servo format is selected by jumper E-F. Drives from Microscience International, Quantum, Syquest and Tulin require this format. If two physical drives are used and one of them requires this format, this jumper must be installed. The second non-wedge servo format drive will not be affected by this jumper.

The controller self diagnostics are run when jumper K-L is installed. See Chapter 4 for the description of the self diagnostics.

Table 2-4. High Performance Jumpers

<u>Jumper</u>	<u>Installed</u>	<u>Removed</u>
A-B	13 uSec high performance step rate (when used with step code 3) or 200 uSec step rate (when used with step code 4) or 3 mSec step rate (when used with step code 0)	70 uS step rate (when used with step code 5) or 3ms step rate (when used with step code 3)
C-D	Not used	---
E-F	Wedge Servo Drive	Non-Wedge servo
G-H	Not Used	
I-J	Not used	---
K-L	Self-Diagnostics	---

### 2.5.3 DRIVE AND CONTROLLER CABLING

Now that the drive and controller are configured, they can be connected together. The controller has three cable connectors J0, J1 and J2. Their function, suggested connector plug and maximum cable length are described in Table 2-5.

Table 2-5. Controller Connector Definitions

<u>Connector</u>	<u>Signals</u>	<u>Cable</u>
J0	Data	20-pin flat ribbon cable Connected to drive 0
J1	Data	20-pin flat ribbon cable Connected to drive 1
J2	Control	34-pin flat ribbon cable Connected to both drives 0 and 1

<u>Connector</u>	<u>Recommended Plug</u>	<u>Maximum Length</u>
J0	3M Part # 3421	20 feet (6 meters)
J1	3M Part # 3421	20 feet (6 meters)

The connector locations and pin orientation for ACB-2002A connectors are shown in Figure 2-1.

**NOTE:**

WHEN MOUNTING IN THE IBM PC/XT, PIN 1 OF THE CONNECTOR AND CABLE WILL BE FACING DOWN. THE TWO CONNECTORS J0 AND J2, ALONG THE OUTSIDE EDGE OF THE BOARD, ARE USED WHEN ONLY 1 DRIVE IS PRESENT. ALL THREE CONNECTORS J0, J1 AND J2 ARE USED WHEN 2 DRIVES ARE PRESENT. REMEMBER THAT THE LAST PHYSICAL DRIVE IN THE CHAIN MUST HAVE THE TERMINATOR INSTALLED.

Connect the cables as shown in Figure 2-4.

2.5.4 DRIVE POWER REQUIREMENTS

The IBM PC internal power supply does NOT have sufficient current to power most hard disk drives in addition to its present load. Either an external power supply or a power booster may be required. Many 3 1/2" and 5 1/4" half height drives do not need an extra power supply. The IBM XT has sufficient power and no extra power supply is needed. If needed, install and test the supply and drive separately at this time.

**NOTE:**

BE SURE TO FOLLOW THE DISK DRIVE OEM MANUAL'S RECOMMENDATIONS WHEN GROUNDING THE DRIVE. IF PROPER GROUNDING IS NOT FOLLOWED, RANDOM FORMAT, WRITE AND READ ERRORS MAY OCCUR.

Next mount the ACB-2002A controller board and disk drive in the PC.

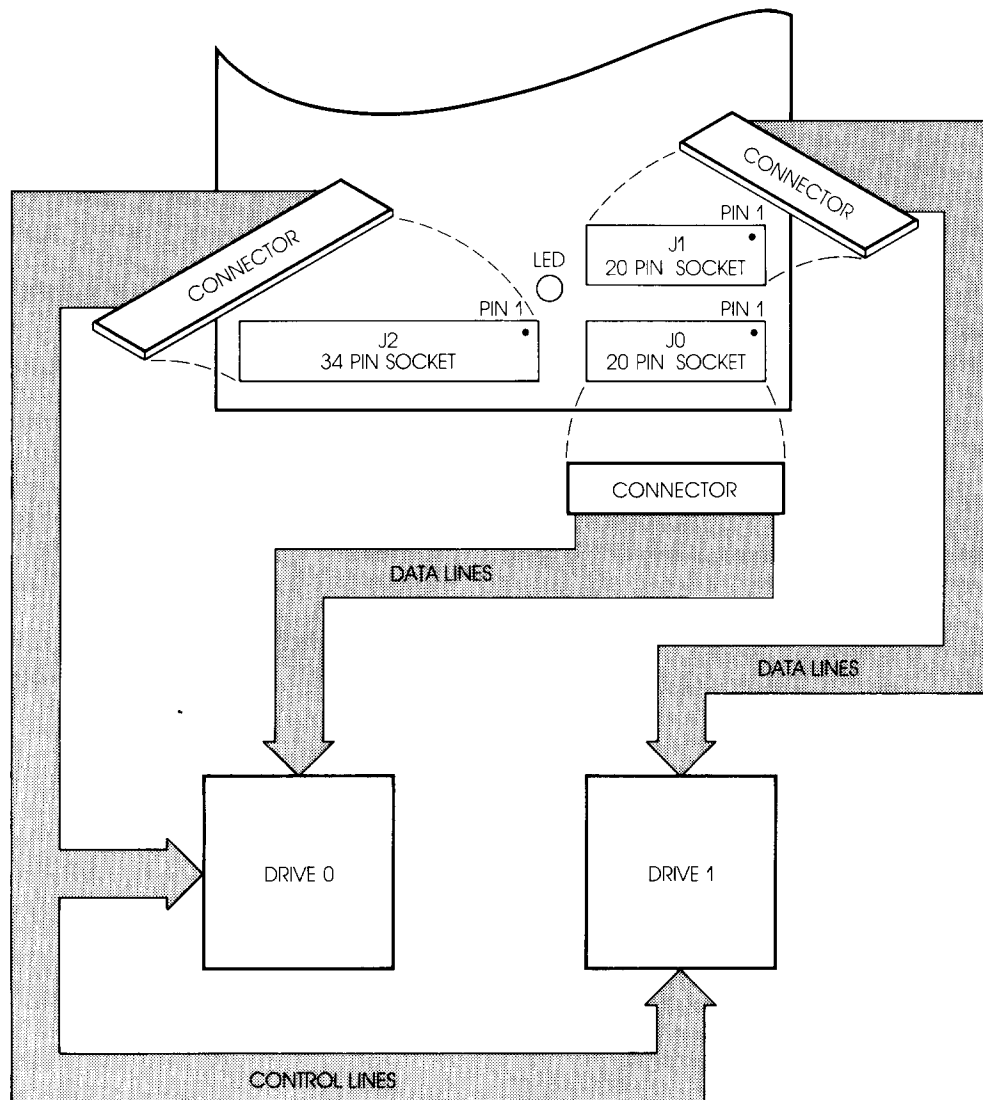
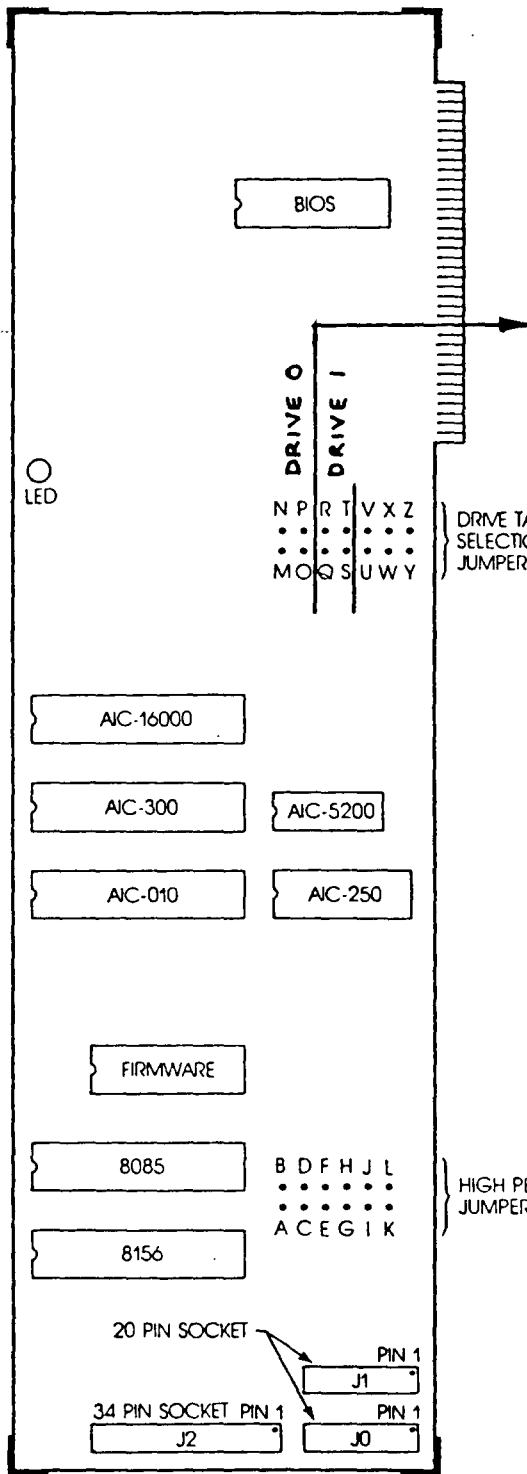


Figure 2-4. Controller and Drive Cabling



2002A

DMA 3  
 IRQ 5  
 I/O PORTS 320 - 323  
 BIOS ADDRESS C8000 - C9FFF



CAP CYLS HDS INSTALL

Miniscribe 3012	10MB	612	2	H-N	O-P
Syquest SQ306	5MB	306	2	H-N	E-F
Miniscribe 4020	16MB	480	4		O-P
Seagate ST412	10MB	306	4		NONE

‡ HEX ‡ (ST225)  
 DEBUG  
 G=C800:CCC  
 Interleave.....2  
 Drive ID.....0  
 Default Parameters.....N  
 Step Rate.....3  
 Landing Zone.....0  
 Ecc Correction.....B  
 Write Precomp.....12C  
 Reduced Write.....26B  
 Heads.....4  
 Cylinders.....267

	INSTALLED	REMOVED
A - B	3 = 13uS	3mS
	4 = 200us	
	0 = 3mS	
		5 = 70uS
C - D	Not Used	
E - F	Wedge Servo	
G - H	Not Used	
I - J	Not Used	
K - L	Self Diags	