adaptec

ACB-2370/ACB-2372

User's Manual

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FCC COMPLIANCE

This equipment generates and uses radio frequency and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in *Subpart J of Part 15 of FCC Rules,* which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient the receiving antenna.
Relocate the computer with respect to the receiver.
Move the computer away from the receiver.
Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

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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-237X board. This includes both hardware and software installation, as well as basic troubleshooting information.

1.2 REFERENCE DOCUMENTS

- IBM PC AT Guide to Operations Manual
- IBM DOS Reference Manual Version 3.0 or Higher
- IBM PC AT Technical Reference Manual
- Appropriate Disk Drive User's Manual

1.3 OVERVIEW OF PRODUCT

The Adaptec ACB-2372 is a high-performance 2,7 RLL Hard Disk and Floppy Disk Controller for the IBM PC AT and equivalent personal computers. The ACB-2370 is a 2,7 RLL Hard Disk Controller. The ACB-237X controllers are software and hardware compatible with the IBM PC AT hard disk controller interface.

The Adaptec ACB-2372 2,7 RLL Hard Disk and Floppy Disk Controller and ACB-2370 Hard Disk Controller have the following features:

- *IBM hardware compatible.* Plugs directly into AT bus compatible systems without modification. Register (port) compatible to the IBM AT controller, giving true compatibility.

- *IBM software compatible.* Runs all software, without change, that runs on the IBM AT controller. Runs software that communicates through the AT system BIOS or directly to the controller registers, thus, the highest AT compatibility is achieved.

- *Supports two 2,7 run-length limited (RLL) qualified ST-412/506 drives.* Runs High Performance 7.5 MHz RLL drives from all major RLL manufacturers. Supports two drives that have different capacities, different access times and different manufacturers without controller modification. Drives with up to 16 heads and 4096 cylinders are supported by the controller through the registers, 1024 cylinders via INT 13. Provides both the highest capacity and highest performance.

- *Can support more than 1024 cylinders under DOS.* A built-in partition driver allows use of drives with more than 1024 cylinders under DOS. Breaks the DOS INT 13 limit. See Appendix VIII for details.

- *Highest AT 2,7 RLL performance.* The combination of non-interleaved operation, low controller overhead, and 26 sectors per track give the ACB-237X the highest transfer rate available today. This is from 700 Kilobytes per second to as high as 750 Kilobytes per second data transfer depending on system configuration, thus the highest system performance in multitrack data transfers.

- *Non-interleaved operation.* This gives the ability to read one track of data in one disk revolution, the maximum rate that the drive can give data to the controller. This provides the fastest controller/drive performance.

- *Most accurate 2,7 RLL data separator.* The AIC-6225 Data Separator chip used in all Adaptec 2,7 RLL designs has the smallest data separator window margin in the industry. For the ACB-237X, the window margin is 3.3 nanoseconds compared to 6-10 nanoseconds for the competition. This insures the hightest data reliability for your valuable data.

- *Optional on-board Adaptec ACB-BIOS.* This provides the most functionality of any AT controller. The copyrighted ACB-BIOS contains the low level format, defect management, data verification, autoconfiguration of any drive without changing AT system BIOS, large disk partitioning and DOS device driver. The ACB-BIOS functions are also accessible by your customized redirected I/O drive configuration program.

- *ACB-BIOS low-level primary format.* This provides the ability on the controller to format the drive without the need of system diagnostics or changing the AT system BIOS.

- *ACB-BIOS ability to add grown defects, save and protect all defect lists.* This gives the ability to run additional defect tests and add the defects to those the manufacturer found. Also the controller saves and protects both the manufacturer's and grown lists from accidental erasure, thus the highest data reliability.

- *ACB-BIOS sector-level defect mapping.* This flags a sector on the disk to be unusable and reports to the operating system its location, giving system level data integrity.

- *ACB-BIOS data verification using worst case data patterns.* This tests the disk with the worst possible combinations of data before valuable user data is placed on the disk. This provides the highest data reliability.

- *ACB-BIOS autoconfiguration of any 2,7 RLL drive, not in AT system BIOS.* This allows any 2,7 RLL drive to be formatted and used without changing the AT system BIOS drive tables. This simplifies the cumbersome task of changing EPROM drive tables to add 2,7 RLL. The controller writes the drive parameters onto the drive during format and reads them on power up. This is ideal for field upgrades since the controller does not need to be hardware configured to the specific drive. This achieves the highest drive flexibility possible.

- *ACB-BIOS large disk logical partitioning.* Since many 2,7 RLL drives are greater than the 32 MB limitation set by DOS 3.0, 3.1 and 3.2, this allows you to divide the drive into volumes of any size up to 32 MB each. Up to 16 volumes can be defined on one drive or 24 volumes on two drives, maximizing the drive capacity under a DOS environment.

- *ACB-BIOS downloadable DOS driver.* The ACB-BIOS has a device driver that is downloaded to a floppy. This allows access to the 16 or 24 32 MB volumes defined by the Large Disk Logical Partitioning. This gives all of

the software necessary to go beyond 32 MB right on the controller, thus reducing your support and eliminating the need to write a device driver.

- *XT height board.* This allows use in both XT and AT height machines, thus giving you flexibility in choosing your machine's enclosure.

- *High component integration using Adaptec ICs.* Adaptec is committed to IC developement in order to integrate and to reduce the price of both boards and ICs. Adaptec's ICs are used in all Adaptec boards and in most integrated drives on the market; therefore, Adaptec components are proven in reliability and in high volume production.

- *Use of surface mount technology.* Adaptec is committed to the leading edge of technology. Surface Mount Technology allows greater functionality in smaller spaces, as well as higher reliability.

The ACB-2372 has these additional features:

- *Support of two IBM AT-type floppy disk drives.* Compatible with the most popular IBM floppy capacities. This includes 360 KB and 1.2 MB floppy capacities for 5 1/4" floppy compatibility. Also supports 3 1/2" floppies that use the 5 1/4" floppy drive interface.

- *Analog floppy data separator.* This gives much higher data integrity than digital data separators. Thus floppy data reliability and data retrievability are improved over previous AT floppy controllers.

1.4 HARDWARE AND SOFTWARE REQUIREMENTS

The Adaptec ACB-2372 Hard Disk and Floppy Disk Controller has been designed to run in IBM PC AT-compatible computers that do not have a separate or embedded floppy disk controller.

The Adaptec ACB-2370 Hard Disk Controller has been designed to run in IBM PC AT-compatible computers that have a separate or embedded floppy disk controller.

In order to install an Adaptec ACB-237X into an IBM PC AT-compatible computer, the following configuration is required:

1. ACB-2372: IBM PC AT-compatible computer without floppy disk controller.
   ACB-2370: IBM PC AT-compatible computer with floppy disk controller.

Note: Compatible computers are defined to have I/O bus speeds of 6 MHz with one I/O wait state, 8 MHz with one I/O wait state or 10 MHz with two I/O wait states. I/O bus speed is not the same as CPU or memory speeds. For example, a 16 MHz 286 or 386 machine typically runs the I/O bus at 8 MHz with one I/O wait state.

2. PC or MS-DOS Version 3.0 or higher. System and supplemental program diskettes.

   The ACB-237X will also run with non-DOS operating systems and networks. Please refer to the appendix for operation with Interactive System Unix V/386, SCO Xenix V.2.x , Novell NetWare 2.x, OS/2 and other operating systems.

3. A "set-up" diskette that allows the PC AT-compatible computer's configuration RAM to be set up (such as the diagnostics diskette IBM supplies with its PC ATs.)

4. Adaptec ACB-2372 hard disk and floppy disk controller or ACB-2370 hard disk controller.

5. A 2,7 RLL qualified Winchester disk drive (Ask your drive manufacturer if your drive is qualified for 2,7 RLL data encoding).

6. 5 1/4" or 3 1/2" floppy disk drive.

7. 20- and 34-pin flat or twisted ribbon cables for hard disk.

8. 34-pin twisted ribbon cable for floppy disk.

2.1 INTRODUCTION

This section describes the steps necessary to install the ACB-237X 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 ENVIRONMENTAL REQUIREMENTS

The ACB-237X will perform properly over the following range of conditions:

Operating	Storage
Temperature:	0° to 55°C (32° to 131°F)
	-40° to 75°C (-8° to 167°F)
Humidity (Noncondensing):	0% to 95%
	10% to 95%
Altitude (Feet):	Sea level to 10,000
	Sea level to 20,000
MTBF (Hours):	20,000 at 55°C

2.3 UNPACKING PROCEDURE

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 or distributor be necessary.

CAUTION: THE ACB-237X 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 READY TO BE CONFIGURED AND INSTALLED IN YOUR SYSTEM.

2.4 ACB-2372 BOARD LAYOUT

The ACB-2372 is shown in Figure 2-1. This figure shows the location of the controller microcode, ACB-BIOS, jumpers and connectors. Note that Pin 1 of the connectors is identified by a square solder pad on the solder side of the board. The dimensions of the board are:

Width: 3.9 Inches
Length: 13.0 Inches
Height: 0.75 Inches

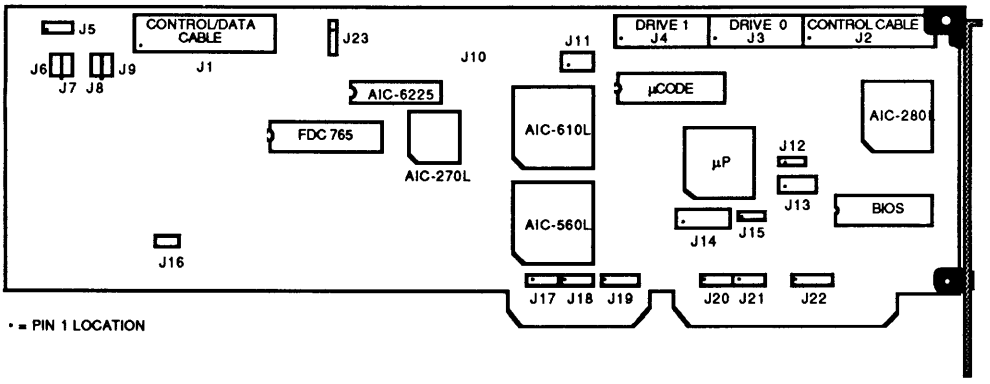


FIGURE 2-1. BOARD LAYOUT

2.5 ACB-2370 BOARD LAYOUT

The ACB-2370 is shown in Figure 2-2. This figure shows the location of the controller microcode, ACB-BIOS, jumpers and connectors. Note that Pin 1 of the connectors is identified by a square solder pad on the solder side of the board. The dimensions of the board are:

Width: 3.9 Inches
Length: 8.0 Inches
Height: 0.75 Inches

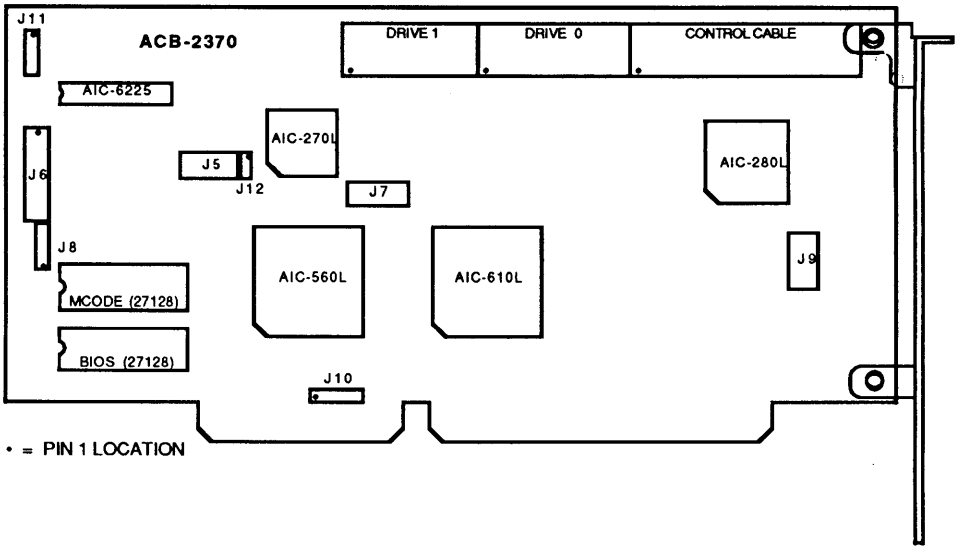


FIGURE 2-2. BOARD LAYOUT

2.6 SYSTEM REQUIREMENTS

The ACB-237X was designed to be installed in an IBM PC AT-compatible personal computer; thus, it requires the same system resources as the IBM AT hard disk controller.

TABLE 2-1. ACB-237X SYSTEM MEMORY MAP

I/O Ports	
Hard Disk - Primary	1F0,1F1,1F2,1F3,1F4,1F5,1F6,1F7,3F6,3F7
- Secondary	170,171,172,173,174,175,176,177,376,377
*Floppy Disk - Primary	3F0,3F1,3F2,3F3,3F4,3F5
- Secondary	370,371,372,373,374,375
If the BIOS is enabled:	
BIOS Address - Primary	16 Kbytes from C8000H through CBFFFH
- Secondary	16 Kbytes CC000H through CFFFFH
Temporary Drive Parameters Table	Interrupt locations 60H through 67H

* *ACB-2372 only*

Drive Power

The IBM PC AT internal power supply does have sufficient current to power most hard disk drives in addition to its present load. Check with your drive vendor for an accurate estimate of its specific power requirements.

TABLE 2-2. ACB-2372 POWER REQUIREMENTS
(Typical)

+5V Power ——————>	1.5 Amp
–5V Power ——————>	Not Used
+12V Power ——————>	130mA
–12V Power ——————>	50mA

TABLE 2-3. ACB-2370 POWER REQUIREMENTS
(Typical)

+5V Power ——————>	1.5 Amp
–5V Power ——————>	Not Used
+12V Power ——————>	Not Used
–12V Power ——————>	Not Used

CAUTION: THE VALUES FOR THE POWER REQUIREMENTS WERE DETERMINED BY ACTUAL MEASUREMENTS IN AN IBM PC AT WHILE THE CONTROLLER WAS READING A HARD DISK. IF THESE VALUES ARE TO BE USED TO DESIGN THE CONTROLLER INTO A SPECIFIC APPLICATION, AT LEAST 20% SHOULD BE ADDED TO THESE LISTED VALUES AS A SAFETY MARGIN.

2.7 INTEGRATION INTO THE SYSTEM

To install the Adaptec ACB-237X 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 of the necessary steps to successfully install this hardware.

Step 1 Controller Jumper Setup and Definition

Check that the jumpers are set correctly for your application. Table 2-4 and 2-5 defines, in detail, connectors and jumper blocks.

TABLE 2-4. ACB-2372 CONTROLLER JUMPER DEFINITIONS

Note: Jumper positions and pin numbers are defined from left to right, or top to bottom, where applicable per Figure 2-1. An asterisk (*) denotes jumpers that are installed for a standard configuration.

J1	Floppy Disk control and data cable (34-pin), Both drives
J2	Hard disk control cable (34-pin), Both drives
J3	Hard disk data cable (20-pin), First drive (Drive 1)
J4	Hard disk data cable (20-pin), Second drive (Drive 2)
J5	Drive activity LED - Pins 1,4 are +5 Volts, Pins 2,3 are Signal Ground
J6	Manufacturing Test Points
J7	Manufacturing Test Points
J8	Manufacturing Test Points
J9	Manufacturing Test Points
J10	Manufacturing Test Points
J11	Manufacturing Test Points
J12	Adaptec ACB-BIOS address selection
	*Position 1 and 2 Jumpered for BIOS address C8000 - CBFFF
	Position 2 and 3 Jumpered for BIOS address CC000 - CFFFF
	No jumper ACB-BIOS disabled

Note: Install only one jumper on J12. No jumper should be installed if ACB-BIOS Disabled.

TABLE 2-4. ACB-2372 CONTROLLER JUMPER DEFINITIONS (Continued)

Note: Jumper positions and pin numbers are defined from left to right, or top to bottom, where applicable per Figure 2-1. An asterisk (*) denotes jumpers that are installed for a standard configuration.

J13	Manufacturing Test Points	
J14	BOARD CONFIGURATION JUMPERS	
	Position 1	Hard Disk Port Addresses
		Not installed: primary address 1F0 - 1F7
		Installed: secondary address 170 - 177
	Position 2	Floppy Disk Port Address
		Not installed: primary address 3F0 - 3F7
		Installed: secondary address 370 - 377
	Position 3	Bus Wait State
		Not installed: Enabled
		Installed: Disabled
	Position 4	Drive Recal goes to track 0 minus 1
		Not installed: Enabled (ST238)
		Installed: Disabled (ST4144R)
	Position 5	Not Used
	Position 6	Serial Monitor Mode
		Not installed: Disabled
		Installed: Enabled (2400 baud)
	Position 7	Manufacturing Test Point
J15	Serial Monitor Output	
J16	Manufacturing Test Points	
J17	Not Used	
J18	Not Used	
J19	Controller's system interrupt selection	
	*Pins 1 and 2 jumpered for IRQ14	
	Pins 2 and 3 jumpered for IRQ15	
	Pins 3 and 4 DO NOT USE	
J20	Floppy Disk DMA Acknowledge signal selection	
	*Pins 1 and 2 jumpered for DACK2	
	Pins 2 and 3 jumpered for DACK3	
J21	Floppy Disk Interrupt Request signal selection	
	Pins 1 and 2 jumpered for IRQ10	
	*Pins 2 and 3 jumpered for IRQ6	
J22	Floppy Disk DMA Request signal selection	
	Pins 1 and 2 jumpered for DREQ3	
	*Pins 2 and 3 jumpered for DREQ2	

TABLE 2-5. ACB-2370 CONTROLLER JUMPER DEFINITIONS

Note: Jumper positions and pin numbers are defined from left to right, or top to bottom, where applicable per Figure 2--2. An asterisk (*) denotes jumpers that are installed for a standard configuration.

J1 Hard disk data cable (20-pin), second drive (Drive 2)

J2 Hard disk data cable (20-pin), first drive (Drive 1)

J3 Hard disk control cable (34-pin), both drives

J4 Manufacturing test points

J5 Drive activity LED - Pins 1,4 are +5 Volts, Pins 2,3 are signal ground

J6 Board configuration jumpers

Position 1 Hard disk port addresses
Not installed: primary address 1F0 - 1F7
Installed: secondary address 170 - 177

Position 2 Not used

Position 3 Wait state (C & T)
Not installed: enabled
Installed: disabled

Position 4 Drive recal goes to track 0 minus 1
Not installed: enabled (ST238)
Installed: disabled (ST4144R)

Position 5 Not used

Position 6 Serial monitor mode
Not installed: disabled
Installed: enabled (2400 baud)

Position 7 Manufacturing test point

J7 Manufacturing test points

J8 Manufacturing test points

J9 Manufacturing test points

J10 Serial monitor output

J11 Manufacturing test points

J12 Manufacturing test points

J13 Controller's system interrupt selection
*Pins 1 and 2 jumpered for IRQ14
Pins 2 and 3 jumpered for IRQ15
Pins 3 and 4 DO NOT USE

J14 Adaptec ACB-BIOS address selection
*Position 1 and 2 Jumpered for BIOS address C8000 -CBFFF
Position 2 and 3 Jumpered for BIOS address CC000-CFFFF
No jumper ACB-BIOS disabled

Note: Install only one jumper on J14. No jumper should be installed if ACB-BIOS is disabled

J15 Manufacturing test points

Step 2 Hard Disk Cabling, Drive Selection and Termination

The drive changeable parameters that must be set are the drive selection switches (or jumpers) and the drive termination. The drive selection switches and cabling select the address (drive address 1-4) to which the drive will respond. This is accomplished either by setting both drives to be the second lowest address and using a twisted 34-pin cable, or by setting the drive address to the lowest two addresses and using a flat cable.

A. Twisted 34-Pin Cable

The typical AT 34-pin cable has three connectors. Between the first (middle) drive connector (for drive D) and the second drive connector (for drive C), wires 25 through 29 are twisted, thus inverting the drive selection wires. This type of twisted cable allows both drives to have their drive selection switches (or jumpers) to be the same. Both drives must be set to the SECOND lowest drive address. The controller will see the two drives to be drive 1 and drive 2, depending on the position of the connector that is used.

B. Flat 34-Pin Cable

In some cases a 34-pin flat (non-twisted) cable is used. This cable does not invert the drive selection wires but relies on the drive addresses to be unique for each drive. Now drive 1 must have its drive selection switches (or jumpers) set to be the lowest drive address (typically 1). Drive 2 must have its selection switches (or jumpers) set to be the second lowest drive address (typically 2). The controller will see the two drives to be drive 1 and drive 2, independent of the position on the connector that is used.

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 into it. The disk drives, since they can be connected in a daisy-chain configuration (see Figure 2-4), have a removable terminator. This is usually a 16-pin DIP resistor package located on the drive PCB. The last

physical drive in the chain must always have its terminator installed. When two drives are connected to the same controller, only the last one in the daisy chain is terminated (see Figures 2-3 and 2-4 for the ACB-2372. See Figures 2-5 and 2-6 for the ACB-2370). The other drive must have the terminator resistor removed.

Step 3 Floppy Disk Cabling, Drive Selection and Termination (ACB-2372 only)

The typical AT 34-pin floppy disk cable has three connectors. Between the first (middle) drive connector (for drive B) and the second drive connector (for drive A), wires 10 through 16 are twisted, thus inverting the drive selection wires. This type of twisted cable allows both drives to have their drive selection switches (or jumpers) to be the same. Both drives must be set to the SECOND lowest drive address (typically 1 since floppy drives are addressed as 0-3). The controller will see the two drives to be drive 0 and drive 1, depending on the position of the connector that is used.

Termination of the floppy disk drives is the same as the hard disk drives in step 2.

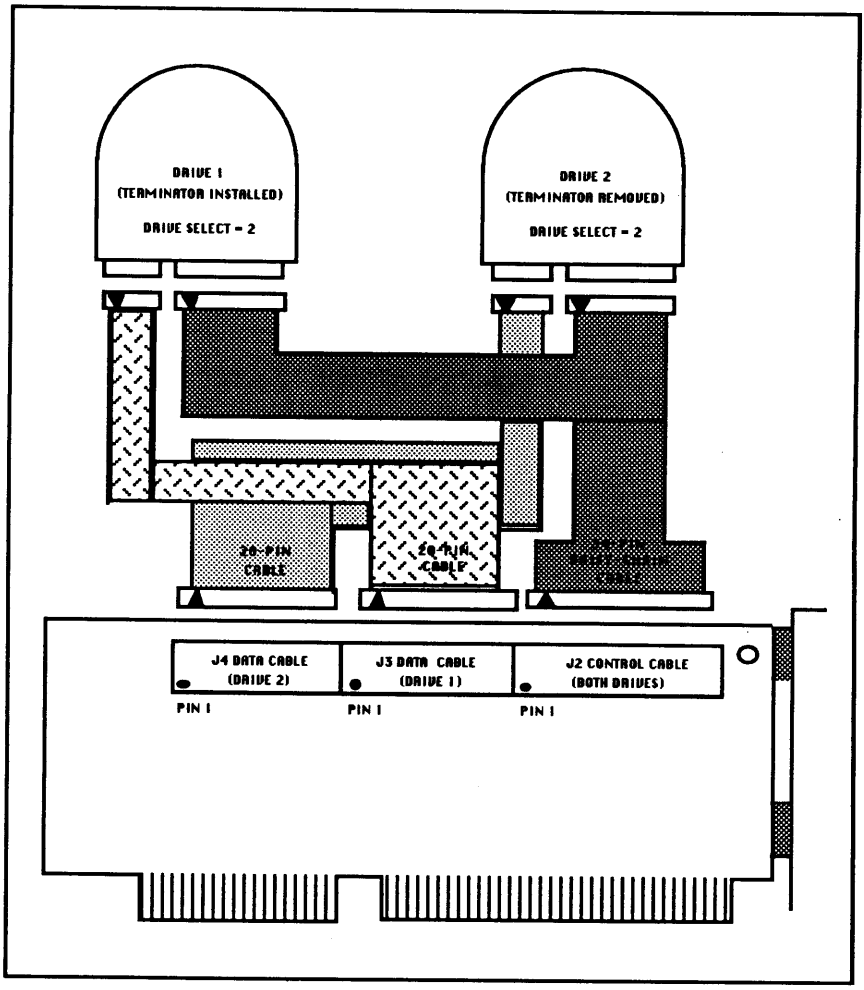


FIGURE 2-3. ACB-2372 CONTROLLER AND DRIVE CABLING-TWISTED CABLE
(HARD DISK CABLES)

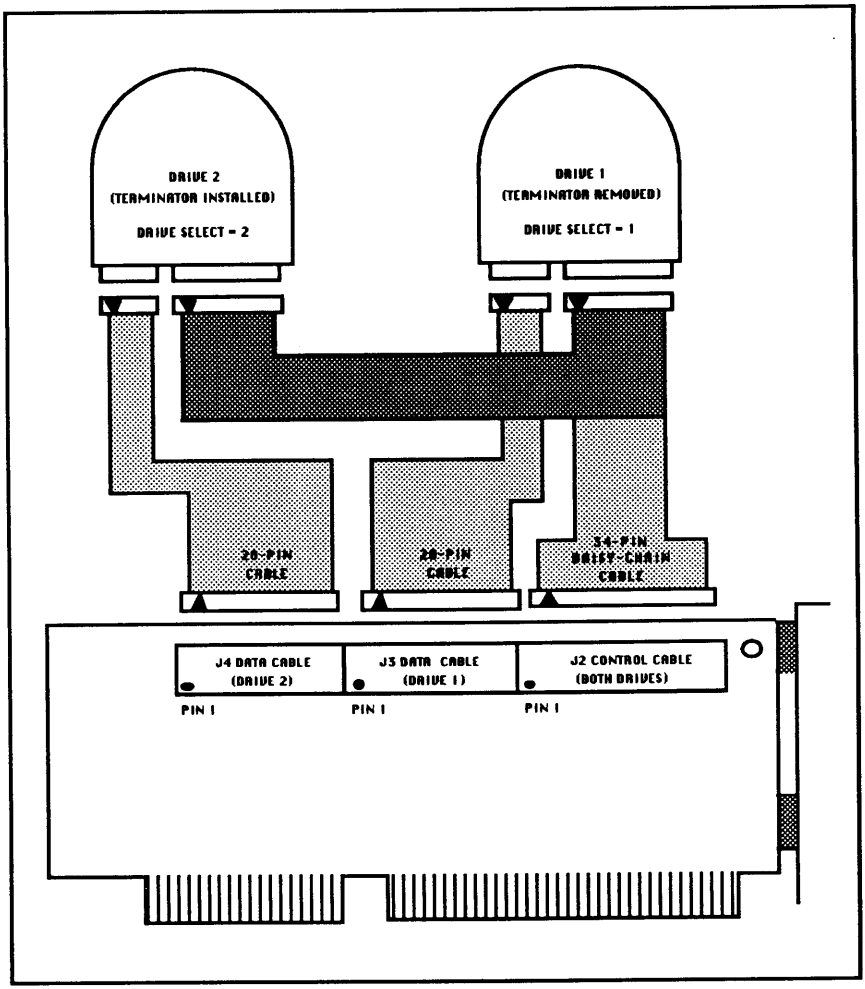


FIGURE 2-4. ACB-2372 CONTROLLER AND DRIVE CABLING-FLAT CABLE
(HARD DISK CABLES)

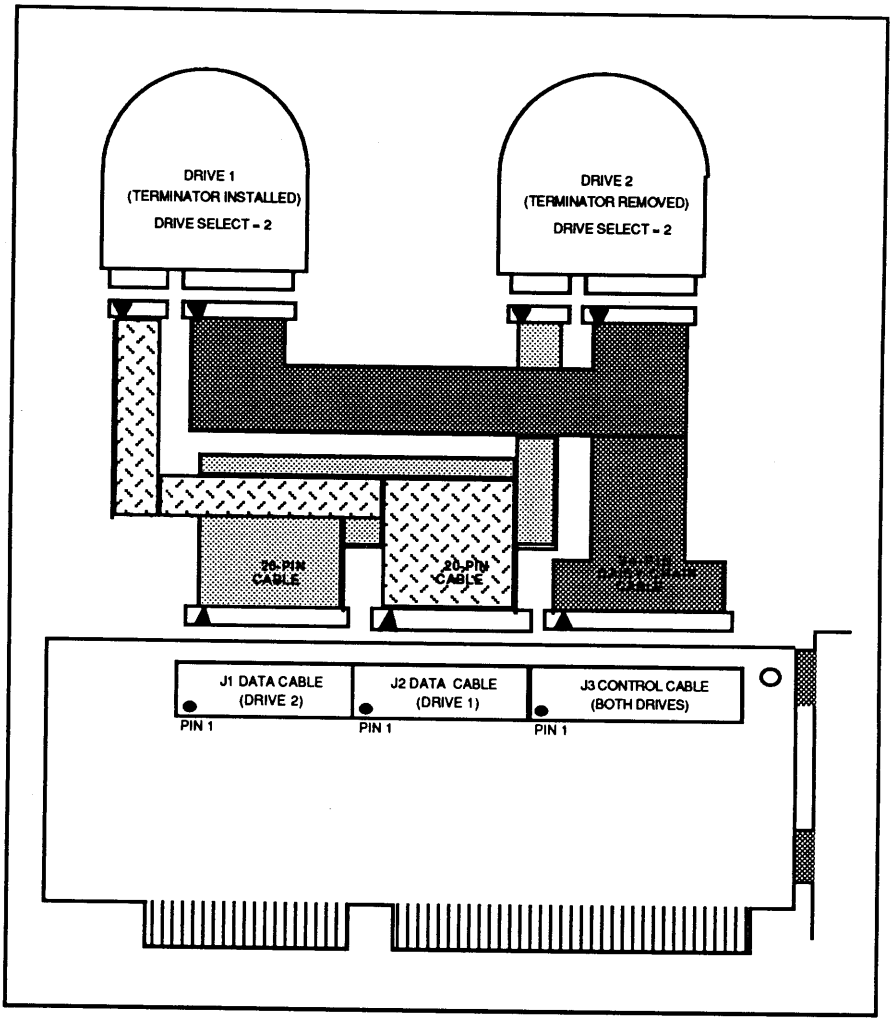


FIGURE 2-5. ACB-2370 CONTROLLER AND DRIVE CABLING-TWISTED CABLE
(HARD DISK CABLES)

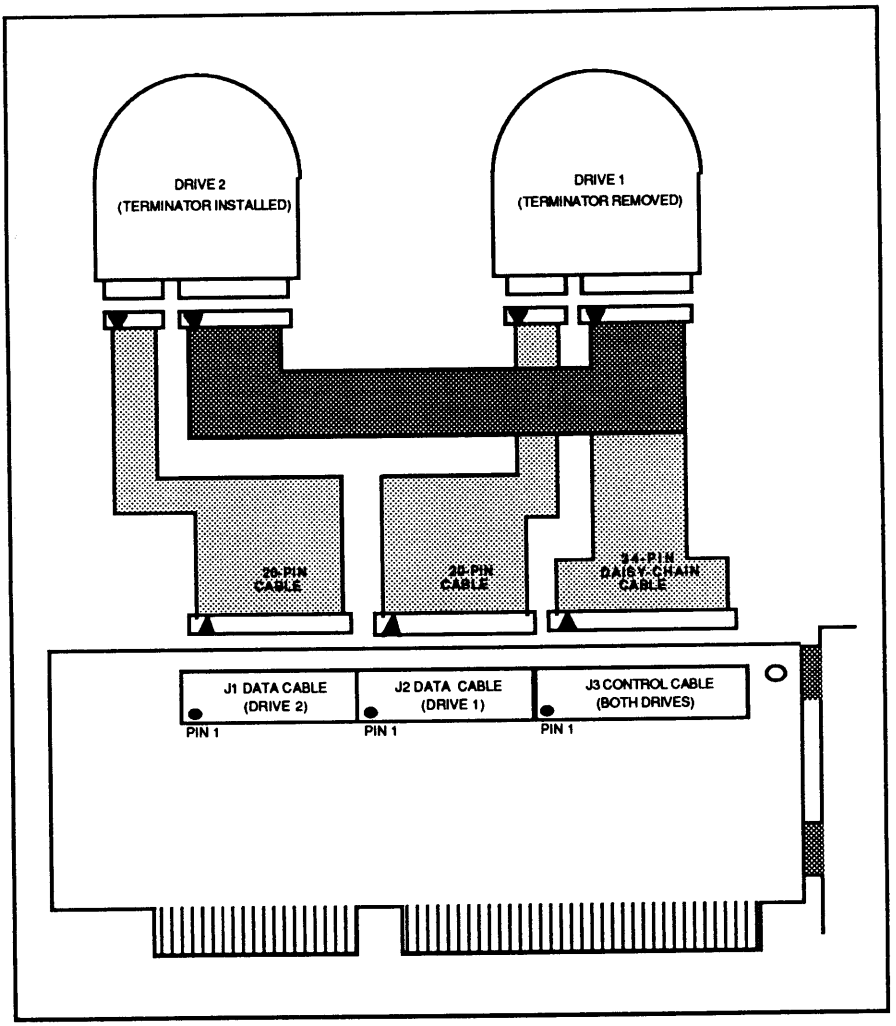


FIGURE 2-6. ACB-2370 CONTROLLER AND DRIVE CABLING-FLAT CABLE
(HARD DISK CABLES)

Step 4 Mounting the Drives and Controller in the PC AT

Now that the drives and controller are configured, they can be connected and installed in the system.

The controller has three (ACB-2370) or four (ACB-2372) cable connectors: J1, J2, J3, and J4. Their function, suggested connector plugs and maximum cable length are described in Table 2-6 and 2-7.

TABLE 2-6. ACB-2372 CONTROLLER CONNECTOR DEFINITIONS

Connector	*Signals*	*Cable*
J1	Control/Data	34-pin flat ribbon cable. Connected to both floppy drives 0 and 1.
J2	Control	34-pin flat ribbon cable. Connected to both RLL drives 1 and 2.
J3	Data	20-pin flat ribbon cable. Connected to RLL drive 1. 2,7
J4	Data	20-pin flat ribbon cable. Connected to RLL drive 2. 2,7

Connector	*Recommended Plug*	*Maximum Length*
J1	3M Part #3414	20 feet (6 meters)
J2	3M Part #3414	20 feet (6 meters)
J3	3M Part #3421	20 feet (6 meters)
J4	3M Part #3421	20 feet (6 meters)

TABLE 2-7. ACB-2370 CONTROLLER CONNECTOR DEFINITIONS

Connector	*Signals*	*Cable*
J1	Data	20-pin flat ribbon cable. Connected to RLL drive 2. 2,7
J2	Data	20-pin flat ribbon cable. Connected to RLL drive 1. 2,7
J3	Control	34-pin flat ribbon cable. Connected to both RLL drives 1 and 2.

Connector	*Recommended Plug*	*Maximum Length*
J1	3M Part #3421	20 feet (6 meters)
J2	3M Part #3421	20 feet (6 meters)
J3	3M Part #3414	20 feet (6 meters)

Attach the cables to the controller, making sure that the pin 1 indicator on the cable goes to pin 1 on the controller. The connector locations and pin orientation for ACB-2372 connectors are shown in Figure 2-3 and 2-4, for ACB-2370, see Figure 2-5 and 2-6.

Now the controller must be installed into a 16-bit slot on the PC AT motherboard. Next, mount the drive(s) in any available drive bay in the AT. Consult your PC AT owner's manual for details of performing the installation of options into the motherboard expansion slots and for instructions on mounting a hard disk and floppy disk in the system. Once both the drive(s) and controller are installed in the system, complete the installation by connecting the data cable to drive 1, connect data to drive 2 and connect the daisy-chain control cable to both drives (see Figures 2-3 through 2-6). For the ACB-2372, connect the control/data cable from J1 to both floppy drives. Finally, connect the drive power connectors from the PC AT power supply to all drives.

At this point, the floppy disk, hard disk and controller hardware is completely installed in the PC AT system.

CAUTION: TAKE TIME NOW TO VERIFY THAT ALL OF THE DRIVE AND CONTROLLER CABLE CONNECTORS ARE CORRECTLY CONNECTED, AND THAT POWER CABLES ARE CONNECTED TO ALL DRIVES.

3.1 INTRODUCTION

The following procedure will guide you through the preparation of a single hard disk using DOS. At the end of this procedure, a 32 MB RLL drive and a Seagate ST-277R 65 MB drive with two 32 megabyte volumes will be formatted.

This software installation process allows an entire RLL drive to be used under DOS 3.0, 3.1, 3.2 and 3.3. These all have a 32 MB limitation for one logical drive. Under DOS 3.3, DOS FDISK permits using drives greater than 32 MB by creating an Extended Partition that is divided into logical drives. Under DOS 3.0, 3.1 and 3.2, the Adaptec Volume Partitioning Program plus the Adaptec Device Driver allows using drives greater than 32 MB by dividing the drive into volumes of capacities up to 32 MB. The drive can also be formatted by the controller to be used by non-DOS operating systems and device drivers.

CAUTION: IF YOU ENCOUNTER ANY PROBLEMS WHILE ATTEMPTING TO PERFORM THIS INSTALLATION, REFER TO CHAPTER 4, TROUBLESHOOTING.

Note: There is no software installation required for the floppy drive(s) other than formatting floppies under DOS.

3.2 ADAPTEC ACB-237X SOFTWARE INSTALLATION FLOWCHART

The software installation process is best described by the following flowchart.

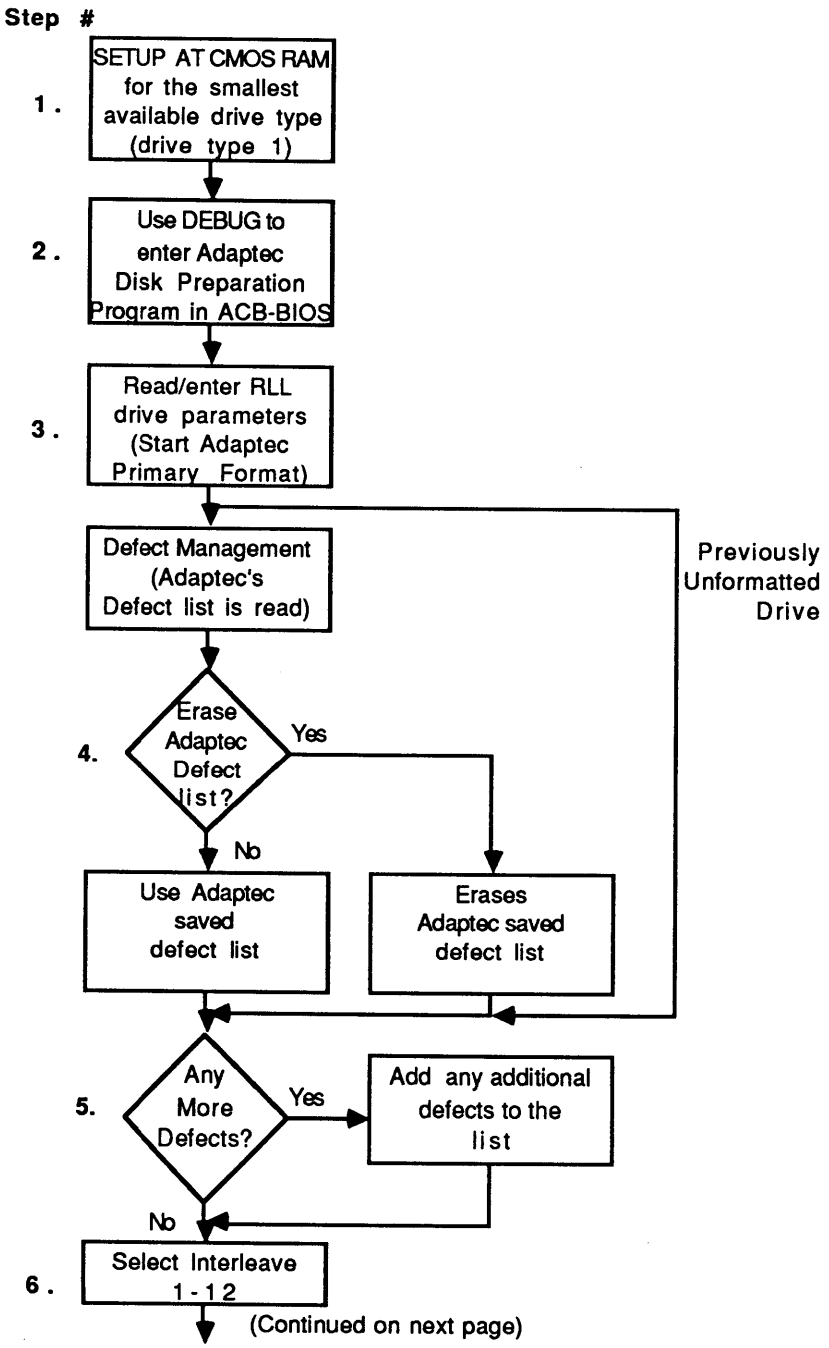
Note that four possible paths may be taken. All paths follow the same first 7 steps.

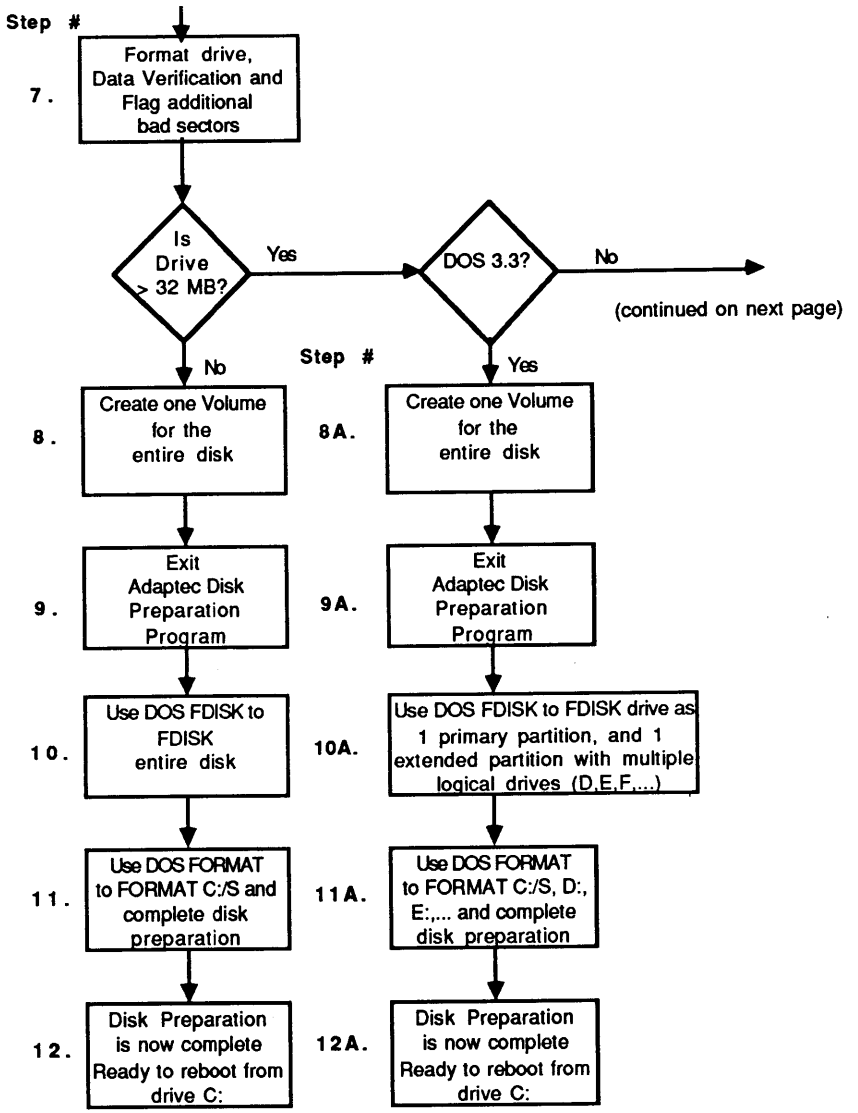
Path 1 through 7 and 8 through 12 is used for drives that format to be less than 32 MB. This applies to any version of DOS 3.x.

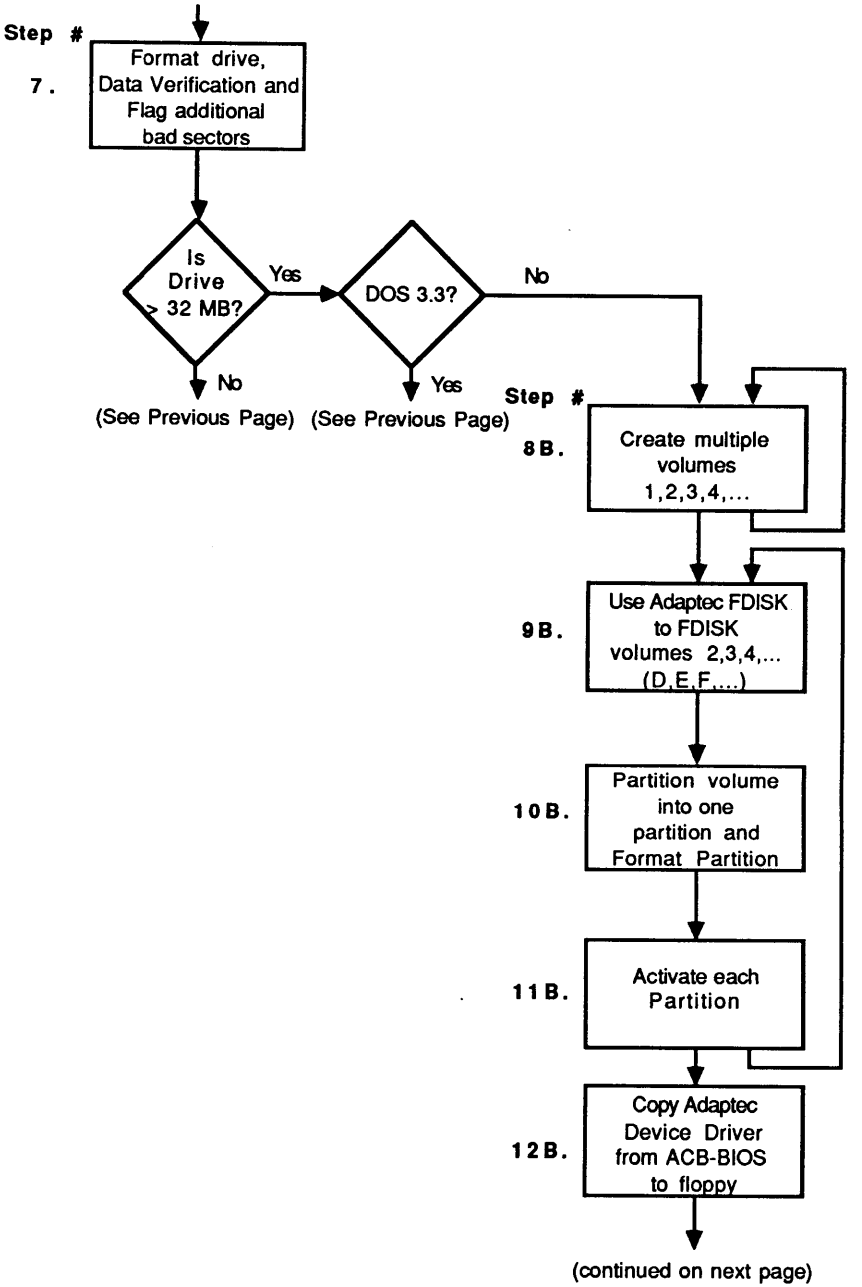
Path 1 through 7 and 8A through 12A is used for greater than 32 MB drives for DOS 3.3.

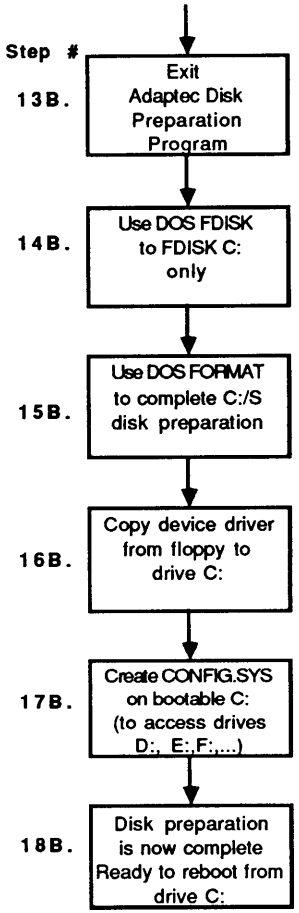
Path 1 through 7 and 8B through 18B is used for greater than 32 MB drives for DOS 3.0, 3.1 and 3.2, and for drives with more than 1024 cylinders under DOS.

Path 1 through 9 is used for UNIX, XENIX, OS/2, Novell & 3rd-party partitioning software.


Step #
1.
SETUP AT CMOS RAM for the smallest available drive type (drive type 1)
2.
Use DEBUG to enter Adaptec Disk Preparation Program in ACB-BIOS
3.
Read/enter RLL drive parameters (Start Adaptec Primary Format)
Defect Management (Adaptec's Defect list is read)
Previously Unformatted Drive
4.
Erase Adaptec Defect list?
Yes
No
Use Adaptec saved defect list
Erases Adaptec saved defect list
5.
Any More Defects?
Yes
Add any additional defects to the list
No
6.
Select Interleave 1-12
(Continued on next page)


Step #
7.
Format drive, Data Verification and Flag additional bad sectors
Is Drive > 32 MB?
Yes
DOS 3.3?
No
(continued on next page)
No
Step #
Yes
8.
Create one Volume for the entire disk
8A.
Create one Volume for the entire disk
9.
Exit Adaptec Disk Preparation Program
9A.
Exit Adaptec Disk Preparation Program
10.
Use DOS FDISK to FDISK entire disk
10A.
Use DOS FDISK to FDISK drive as 1 primary partition, and 1 extended partition with multiple logical drives (D,E,F,...)
11.
Use DOS FORMAT to FORMAT C:/S and complete disk preparation
11A.
Use DOS FORMAT to FORMAT C:/S, D:, E:,... and complete disk preparation
12.
Disk Preparation is now complete Ready to reboot from drive C:
12A.
Disk Preparation is now complete Ready to reboot from drive C:


Step #
7.
Format drive, Data Verification and Flag additional bad sectors
Is Drive > 32 MB?
Yes
DOS 3.3?
No
No
(See Previous Page)
Yes
(See Previous Page)
Step #
8B.
Create multiple volumes 1,2,3,4,...
9B.
Use Adaptec FDISK to FDISK volumes 2,3,4,... (D,E,F,...)
10B.
Partition volume into one partition and Format Partition
11B.
Activate each Partition
12B.
Copy Adaptec Device Driver from ACB-BIOS to floppy
(continued on next page)


Step #
13B.
Exit Adaptec Disk Preparation Program
14B.
Use DOS FDISK to FDISK C: only
15B.
Use DOS FORMAT to complete C:/S disk preparation
16B.
Copy device driver from floppy to drive C:
17B.
Create CONFIG.SYS on bootable C: (to access drives D:, E:,F:,...)
18B.
Disk preparation is now complete Ready to reboot from drive C:

3.3 ADAPTEC ACB-237X FORMAT PROCEDURE FOR A SINGLE HARD DISK DRIVE

Step 1 Setting Up the PC AT Configuration RAM for a Single Hard Disk With the Appropriate Drive Type

After you have completed the hardware installation of your ACB-237X and hard disk drive, turn the system power switch on. Boot from the PC AT diagnostics diskette or any diskette that contains software for configuring the PC AT SETUP parameters (CMOS RAM).

Note: When booting the PC AT with an UNFORMATTED hard disk installed, the system may report a "1790" disk failure. Ignore the message, press F1 to continue.

Invoke the SETUP RAM configuration software (i.e., option four in the IBM PC AT diagnostics program). Then follow the SETUP program's menu to set up your system for a single hard disk. Be sure to choose a drive type that is a subset of the actual disk parameters. The number of cylinders indicated by the drive type specified must be less than the actual number of cylinders on your drive. For example, with the IBM/AT, use drive type 1 (smallest available drive type) regardless of the actual drive configuration. This is necessary for proper operation of the PC AT power-on diagnostics.

After the PC AT internal configuration has been set up, reboot the system with DOS Version 3.0 or higher.

Step 2 Use DEBUG to enter the Adaptec Disk Preparation Program

Put a disk with a copy of DOS' DEBUG program into the floppy drive and invoke the program by typing **DEBUG** at the DOS prompt, then press return (see screen dump below). At the debug prompt, type **G=C800:5** and press return. This will invoke Adaptec's Disk Preparation Program.

Step 3 Read or Enter the RLL Drive Parameters (Start the Adaptec Primary Format)

Next, select Option **0** to format the drive. If the drive has been previously formatted with an ACB-237X controller, the saved cylinder and head count will be displayed. With an unformatted drive, the number of cylinders, heads and sectors are the default parameters of 305 cylinders, 4 heads and 26 sectors. If the values are not correct, type **N** and enter the correct drive parameters. In this case, the drive has **612** cylinders and **4** heads. Enter **Y** if correct and **Y** to continue formatting the drive. An example of what you should see on the screen is shown below.

Note: One cylinder on the drive is reserved for use by the controller. The controller automatically subtracts this cylinder from the total number of available cylinders on the drive.

```
A>DEBUG          <CR>
-G=C800:5        <CR>

Adaptec RLL Disk Preparation Program  V 1.0
Copyright (c) 1987  Adaptec, Inc.  All rights reserved.
Choose:    0 - to primary format the drive
           1 - to create DOS & Adaptec logical partitions
           2 - to select another drive, (drive 0 is currently
           selected)
           3 - to generate Adaptec logical partition device driver
           4 - to generate Adaptec auto-configuration device driver
           5 - to end this program

Enter your selection :  0  <CR>

Please enter drive parameters :
   Cylinder count :  612  <CR>
   Head count :  4 <CR>

Are the above correct (y/n)?  Y  <CR>

Drive 0 has 611 cylinders, 4 heads, 26 sectors

All data in it will be LOST!!! continue (y/n) ?  Y  <CR>
```

Step 4 Choose to ERASE or NOT ERASE the Adaptec Saved Defect List

If your drive was previously formatted with Adaptec's ACB-237X, the saved defect list will now be displayed. NORMALLY DO NOT ERASE THE SAVED DEFECT LIST. It is your choice to ERASE or NOT ERASE the Adaptec saved defect list. If you choose to erase, say if the controller, drive or cables were incorrectly set or defective, then the Adaptec saved list will be erased.

Step 5 Enter Any More Defects

Next, the program will prompt you for the drive defect format. If you have no additional defect locations to enter, then select Option **0**. Otherwise, choose the defect format that matches the list of defects you wish to enter.

```
        Saved defect list (cyl/physical sector) :
        Surface 0:
                        145/10  208/28   (for example)
        Surface 1:
        Surface 2:
        Surface 3:
    Want to ERASE saved defect list (y/n) ? N <CR>
    Please specify additional defect format:
        0 - No Additional Defects
        1 - Cyl/Head/MFM byte offset
        2 - Head/Cyl/MFM byte offset
        3 - Cyl/Head/RLL byte offset
        4 - Head/Cyl/RLL byte offset
        5 - Cyl/Head/Logical Sector      your selection : 0 <CR>
```

Step 6 Select Interleave Factor

Now select an interleave by typing the desired interleave factor (**1 to 12**) and pressing return. An interleave factor of one is used in the example below. If you have entered a defect list, it will be displayed on the screen for you to verify.

Note that the defect locations have been translated into cylinder/logical sector format. Surface numbers correspond to head numbers.

Step 7 Primary Format the Drive, Automatic Data Verification and Automatic Flagging of Bad Sectors

Check to be sure that all of the parameters that you have entered are correct, then enter **Y** to continue. Enter **Y** to primary format the drive. The controller will now perform the primary format. The program formats the drive from high cylinder to low cylinder, marking the defects as bad sectors. After formatting each track, the program will write and verify the track with worst case data patterns. Any defective sectors found during this write/verify process that are not in the defect list will be added to the defect list. The same track is reformatted with the newly found defective sectors marked bad. The track is then written and again verified against defects. The process is repeated for every track on the drive. ECC retries are disabled during this verification.

When the controller has finished formatting the drive, you should see "Format complete!" displayed at the bottom of the screen, indicating a successful format. An example of what you should see on the screen is shown below.

Note: If the format operation does not complete properly, (i.e., Format complete! *is not displayed after formatting) see Chapter 4, Troubleshooting.*

Interleave (1 to 12) : **1 <CR>**

Total defect list (cyl/sector) :

Surface 0:
145/10 208/28 (for example)
Surface 1:

Surface 2:

Surface 3:

Are the above correct (y/n) ? **Y <CR>**

Will format the drive. Continue (y/n) ? **Y <CR>**

Formatting Drive ...

Head XX Cyl XXXX

Format complete !

Steps 8-12 Formatting a Drive that is Less than 32 MB
(See Steps 8A-12A and 8B-18B for Greater than 32 MB Drives)

Step 8 Create One Volume for the Entire Disk

Now that the drive has been primary formatted, it is *necessary* to configure the drive as a single DOS 3.x volume. From the main menu, choose Option **1** ("To create DOS & Adaptec logical partitions (volumes)") to create a volume on the drive.

Adaptec's volume partition menu will then be displayed on the screen. Choose Option **0** to create a volume, and select volume number **1** (drive C:) as the volume number to be created. Enter the total number of cylinders available (displayed on the program menu) as the number of cylinders to be used by this volume. An example, using **611** cylinders, of what should be displayed on the screen is shown below.

Volume Partition Program
Drive 0 has 611 cylinders, 4 heads, 26 sectors

Vol #	Drive	Start	End	Vol #	Drive	Start	End
1	C			9			
2				10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Choose : 0 - to create a volume
1 - to delete a volume
2 - to FDISK a volume
3 - to return to main program
enter your selection : **0 <CR>**
volume number : **1 <CR>**
Volume 1 always starts from cyl. 0
number of cyl. (each cyl. will have 52 KB) : **611 <CR>**

Adaptec's Volume Partitioning Program will ask you to verify that what you have entered is correct before it writes these parameters on disk. If you are satisfied with the parameters that are displayed, then type **Y** and press return.

Note: Cylinders are numbered beginning with 0; thus, in the example below, the 611 available cylinders used in partition 1 are labeled as cylinders 0 through 610.

Volume Partition Program
Drive 0 has 611 cylinders, 4 heads, 26 sectors

Vol #	Drive	Start	End	Vol #	Drive	Start	End
1	C	0	610	9			
2				10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Are the above correct (y/n) ? **Y <CR>**

Step 9 Exit Adaptec Disk Preparation Program

Exit the Adaptec primary format routine by first selecting option **3** to return to the main menu, and then selecting Option **5** to end the program (exit to DOS).

Step 10 Preparing the Disk for Use by DOS 3.x With the DOS FDISK Program

At this point, the primary format of your hard disk is complete. The disk must now be FDISK partitioned by DOS 3.x.

Insert a diskette containing a copy of the DOS 3.x FDISK and FORMAT programs in the floppy disk drive. Use FDISK to create a DOS partition of any size up to 32 MB. Return to DOS 3.x when finished.

Step 11 Use DOS FORMAT to High Level Format Drive C:.

Use FORMAT C:/S to format and copy the DOS 3.x system to drive C:.

Step 12 Now reboot system from drive C:

The disk preparation is now complete and you are ready to reboot and copy programs to drive C:.

Steps 8A-12A and 8B-18B For Drives Greater than 32 MB

As an example of a drive greater than 32 MB, a Seagate ST-277R is used. Steps 1-7 are performed with 820 cylinders and 6 heads instead of 612 cylinders and 4 heads. The following steps are then performed.

Steps 8A-12A Logical Partitioning A Drive Greater than 32 MB Using DOS 3.3
(See Steps 8B-18B for DOS 3.0, 3.1 and 3.2)

Step 8A Create One Volume for the Entire Disk

Now that the drive has been primary formatted, it is necessary to configure the drive as a single DOS 3.3 volume. From the main menu, choose Option **1** ("To create DOS & Adaptec logical partitions (volumes)") to create a volume on the drive.

Adaptec's volume partition menu will then be displayed on the screen. Choose Option **0** to create a volume, and select volume number **1** (drive C:) as the volume number to be created. Enter the total number of cylinders available (displayed on the program menu) as the number of cylinders to be used by this volume. An example, using **819** cylinders, of what should be displayed on the screen is shown below.

Volume Partition Program
Drive 0 has 819 cylinders, 6 heads, 26 sectors

Vol #	Drive	Start	End	Vol #	Drive	Start	End
1	C			9			
2				10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Choose : 0 - to create a volume
1 - to delete a volume
2 - to FDISK a volume
3 - to return to main program
enter your selection : **0 <CR>**
volume number : **1 <CR>**
Volume 1 always starts from cyl. 0
number of cyl. (each cyl. will have 80 KB) : **819 <CR>**

Adaptec's Volume Partitioning Program will ask you to verify that what you have entered is correct before it writes these parameters on disk. If you are satisfied with the parameters that are displayed, then type Y and press return.

Note: Cylinders are numbered beginning with 0; thus, in the example below, the 819 available cylinders used in partition 1 are labeled as cylinders 0 through 818.

Volume Partition Program
Drive 0 has 819 cylinders, 6 heads, 26 sectors

Vol #	Drive	Start	End	Vol #	Drive	Start	End
1	C	0	818	9			
2				10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Are the above correct (y/n) ? **Y** **<CR>**

Step 9A Exit Adaptec Disk Preparation Program

Exit the Adaptec primary format routine by first selecting option **3** to return to the main menu, and then selecting Option **5** to end the program (exit to DOS).

Step 10A Preparing the Disk for Use by DOS 3.3 With the DOS FDISK Program

At this point, the primary format of your hard disk is complete. The disk must now be FDISK partitioned by DOS 3.3.

Insert a diskette containing a copy of the DOS 3.3 FDISK and FORMAT programs in the floppy disk drive. Use FDISK to create one primary DOS partition of any size up to 32 MB. DOS 3.3 automatically limits the primary partition to be 33.5 MB. Next, select the extended partition and use the remaining number of cylinders for the extended partition. Lastly, divide the extended partition into logical drives D:, E:, F:,... of any desired size. Return to DOS 3.3 when finished.

Step 11A Use DOS FORMAT to High Level Format Drive C:, D:, E:, F:,...

Use FORMAT C:/S to format and copy the DOS 3.3 system to drive C:. Use FORMAT D:, FORMAT E:, FORMAT F:, ... to format the remaining logical drives.

Step 12A Now reboot system from drive C:

The disk preparation is now complete and you are ready to reboot and copy programs to drive C:, D:, E:, F:,...

Steps 8B-18B Logical Partitioning A Drive Greater than 32 MB Using Adaptec Logical Partitioning Program and DOS 3.0, 3.1 or 3.2

With DOS Version 3.0, 3.1 and 3.2, the amount of hard disk storage accessible by the operating system is limited to two physical volumes of up to 32 MB each. Thus, to fully utilize the capacity of drives with more than 32 MB, the Adaptec Volume Partitioning Program allows a single drive to be logically divided into as many as 16 volumes of up to 32 MB each. The loadable device driver, supplied in the Adaptec ACB-BIOS, then provides DOS with the ability to access all of the logical drives.

The following procedure describes the steps necessary to format your hard disk with multiple Adaptec logical partitions. It also describes how to load the Adaptec device driver from the ACB-237X ACB-BIOS onto your bootable floppy and hard disk.

Step 8B Creation of Multiple Volumes on a single Physical Disk

Steps 1 through 7 have given us a hard disk that has a primary format but must be divided into volumes that are less than, or equal to, the DOS 3.0, 3.1 and 3.2 limitation of 32 MB.

To calculate the exact number of cylinders to use for your volume, given the maximum DOS volume to be 32 MB, record the number of kilobytes-per-cylinder displayed by the program. Divide this number into the amount of storage you desire to get the correct number of cylinders needed. Remember, 1 megabyte = 1024 kilobytes. Thus, if your drive has 80 KB per cylinder and you want to create a 32 MB partition (32 x 1024 = 32, 768 KB), then the number of cylinders needed would be 32,768 KB/80 KB = 409 cylinders.

Now select option **1** to create DOS & Adaptec logical volumes. Next, create a volume of up to 32 MB, for example, using 409 cylinders for each of two volumes. Create a volume by selecting option **0**. The first volume (1) starts at cylinder 0 and ends at cylinder.408, using **409** cylinders.

Volume Partition Program
Drive 0 has 819 cylinders, 6 heads, 26 sectors

Vol #	Drive	Start	End	Vol #	Drive	Start	End
1	C	0	408	9			
2				10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Choose :0 - to create a volume
1 - to delete a volume
2 - to FDISK a volume
3 - to return to main program
enter your selection : **0** **<CR>**
volume number : **1** **<CR>**
volume 1 always starts from cyl. 0
number of cyl. (each cyl. will have 80 KB) : **409** **<CR>**

Are the above correct (y/n) ? **Y** **<CR>**

Adaptec's Volume Partitioning Program will ask you to verify that what you have entered is correct before it writes these parameters to the hard disk. If you are satisfied with the parameters that are displayed, then type **Y** and press return.

Proceed for volume 2 given the above starting and ending cylinder values. Option **0**, for volume **2**, start at cylinder **409**, and go for **409** cylinders. Check correctness? **Y**.

The second volume starts at cylinder 409 and ends at 817.

Step 9B Use Adaptec FDISK to FDISK volume 2 (Volume 1 will later be FDISKed by DOS).

The Adaptec FDISK option must now be used to create an active partition in the volume. Choose to FDISK a volume option by typing **2** and pressing return. The program will ask you which volume you would like to FDISK. Choose volume **2**.

Volume Partition Program
Drive 0 has 819 cylinders, 6 heads, 26 sectors

Vol #	Drive	Start	End	Vol #	Drive	Start	End
1	C	0	408	9			
2		409	817	10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Choose :0 - to create a volume
1 - to delete a volume
2 - to FDISK a volume
3 - to return to main program
please enter your selection : **2 <CR>**
volume number : **2 <CR>**

Step 10B Create a DOS Partition for the Entire Volume 2, and Format the Partition (Volume)

Choose option **0** to create a DOS partition. The simplest method to create a partition is to make it the same size as the volume. In this case, choose partition **1** to start at cylinder **409** and go for **409** cylinders. Next check for

correctness, then answer **Y**, then if you are sure again answer **Y**. The Adaptec FDISK program will automatically DOS FORMAT the drive at this time.

Part # Start End Mode O.S. Status

1
2
3
4

Choose : 0 - to create a DOS partition
1 - to activate a partition
2 - to delete a partition
3 - to format a DOS partition
4 - to return to volume partition program

please enter your selection : **0 <CR>**

Part # Start End Mode O.S. Status

1
2
3
4

creating a partition
partition number : **1 <CR>**
starting cyl. : **409 <CR>**
number of cyl. (each cyl. will have 80 KB) : **409 <CR>**

Step 11B Now Activate Partition #1 for Volume 2. (You would repeat Steps 9B, 10B and 11B if there was a volume 3,4,...)

Now select option **1** to activate partition # **1**. The display will match your selection.

Lastly, return to the volume partition program by choosing **4**, then to the main menu by choosing **3**.

Part #	Start	End	Mode	O.S.	Status
1	409	817	unformatted		not active
2					
3					
4					

Are the above correct (y/n) ? **Y <CR>**

Will format the partition. All data will be LOST !!! continue (y/n)?
Y <CR>
Head XX Cylinder XXXX

Part #	Start	End	Mode	O.S.	Status
1	409	817	formatted		not active
2					
3					
4					

Choose :0 - to create a DOS partition
1 - to activate a partition
2 - to delete a partition
3 - to format a DOS partition
4 - to return to volume partition program
please enter your selection : **1 <CR>**
activating a partition
partition number : **1 <CR>**

You have now completed the creation of a logical Adaptec volume with an active partition. Remember, Adaptec volumes can only be accessed by DOS through the use of the Adaptec device driver.

Step 12B Copy the Adaptec Device Driver from the ACB-BIOS to the floppy

.

The volume partition can now be used by DOS if the Adaptec device driver is installed.

From the main program menu select Option **3** ("Generate Device Driver").

Option 3 will allow you to load a copy of the Adaptec device driver onto a floppy diskette. Insert a bootable floppy diskette with at least 5 KB of available storage into drive A: Next, enter the name you wish to use for the device driver at the prompt. In the example below, the name "ADAPTEC" is given for the device driver file name.

enter file name: **A:/ADAPTEC <CR>**

A copy of the Adaptec device driver will now be written on your floppy diskette.

Step 13B Exit the Adaptec Disk Preparation Program

Now, exit the Adaptec Disk Preparation Program by selecting Option **5** from the main menu. Control will be returned to DOS, and you should see the DOS "A:>" prompt.

Step 14B Use DOS FDISK to FDISK C: only

At this point, the primary format, volume partition, and high level format for D: is complete. Only Drive C: needs to be FDISKed by DOS 3.0, 3.1 or 3.2.

Insert a diskette containing a copy of the DOS FDISK and FORMAT programs in the floppy disk drive. Use FDISK to create one DOS partition for fixed disk Drive 1. Return to DOS when finished.

Step 15B Use DOS FORMAT to High Level Format Drive C:/S only.

Use FORMAT C:/S to format and copy the DOS system to drive C:.

Step 16B Copy the Adaptec Device Driver from the floppy to drive C:

Use COPY A:ADAPTEC C: to copy the device driver to C:.

Step 17B Create CONFIG.SYS on drive C:

In order for DOS to use the Adaptec device driver, it must be installed when the system boots. This is accomplished by using any text editor or COPY CON to create a CONFIG.SYS file that contains the command:

DEVICE=file name

Where "file name" is the name given to the Adaptec device driver (ADAPTEC in the example above). If you already have a CONFIG.SYS file for your system, then simply add this line to the file.

Step 18B Now reboot system from drive C:

The disk preparation is now complete and you are ready to reboot and copy programs to drive C:, D:, and E:

Now, whenever you boot from your hard disk, the system will boot from drive C: and the Adaptec device driver will be automatically installed.

4.1 INTRODUCTION

This section describes the procedures needed to troubleshoot problems that may arise when installing the Adaptec ACB-237X controller board. These are the most commonly found problems and are not inclusive of every application.

CAUTION: WHEN TROUBLESHOOTING PROBLEMS, USE THE MOST BASIC SYSTEM CONFIGURATION. THAT IS, ONE HARD DISK DRIVE ON THE ACB-237X AND ALL OTHER DEVICES SUCH AS PRINTERS, MODEMS, ETC. REMOVED. ONCE THE SYSTEM WORKS FOR THE BASIC CONFIGURATION, ADD DRIVES AND DEVICES TO THE SYSTEM ONE AT A TIME AND RETEST AFTER EACH ADDITION.

If these procedures fail to give a solution to your problem, recheck your steps, read the entire manual, document the problem, and check with the technical support department where you bought the controller.

4.2 ADAPTEC ACB-237X TROUBLESHOOTING CHECKLIST

— A 1790 Error is normal for an unformatted drive. Just press F1 to continue.

— For the ACB-2372, check floppy cables; be sure J1 goes to both drives. Be sure that Pin 1 on the controller is connected to Pin 1 of the drive. If only one drive is being used, only the last connector on the twisted cable should be used.

— Make sure the drive is RLL certified. Check with the manufacturer.

— Check to see that the SETUP program and CMOS RAM show drive type 1 is selected.

— Check the drive select jumper on hard disk drive; be sure that it is correctly set for the type of cable you are using (See Section 2.7, step 2).

— Check jumpers on controller.

— Check hard disk cables;
For the ACB-2372, be sure J3 goes to Drive 1, J4 goes to Drive 2, and J2 goes to both drives. Be sure that Pin 1 on the controller is connected to Pin 1 of the drive. If only one drive is being used, only J2 and J3 should be used.
For the ACB-2370, be sure J2 goes to Drive 1, J1 goes to Drive 2, and J3 goes to both drives. Be sure that Pin 1 on the controller is connected to Pin 1 of the drive. If only one drive is being used, only J2 and J3 should be used.

— Check that the terminator on each drive is set properly (see Section 2.7, Step 2).

— Check that the power supply can support the added current required by the drive. Be sure that the +5V and +12V voltages are correct. Consult with the drive vendor for the correct drive power requirements.

— You must always create a volume after the low-level format has finished, before exiting Adaptec's menu. If DOS FDISK shows only 1 or 2 cylinders, you did not create a volume.

— The area greater than 1024 cylinders on a hard drive cannot be accessed through DOS. Adaptec's Partitioning & Driver must be used.

— Remember that you must Activate each Adaptec partition after using Adaptec's "FDISK".

— For system hang or boot problems, try installing the BUS WAIT STATE jumper. The DTK 10MHz system needs this jumper installed on the controller board.

— Some AT systems may continue to retry booting to the hard drive even though it has not been formatted yet. You will have to allow this re-trying to continue for up to two minutes before the system will boot to the floppy drive. Then you can proceed to Debug and format the drive.

— "Recal Error" is usually caused by improper cabling, or Drive-Select jumpering of the hard drive. If the error persists after checking these, then try:

For ACB-2372: J14 position 4 installed
For ACB-2370: J6 position 4 installed

— If none of the above steps cure the problem, then swap out components in this order:

Replace the cables with a known-good set of cables.
Swap the drive with a known-good drive.
Swap the 237X controller with another 237X controller.

4.3 CONTROLLER ERROR CODES

Tables 4-1 through 4-5 specify class 00, 01, 02, 03, and 04 error codes which may be returned by the ACB-237X. Note that the most significant bit (the address valid bit) of the one-byte error code may be set in some cases. Thus, 80-8F, 90-9F, A0-AF, B0-BF, and C0-CF are also valid errors corresponding to error codes 00-0F, 10-1F, 20-2F, 30-3F, and 40-4F, respectively.

TABLE 4-1. CLASS 00 ERROR CODES (DRIVE ERRORS)

Code	*Error*
00	No Error Occurred During Last Command
01	No Index Signal Found
02	No Seek Complete Found
03	Write Fault Found
04	Drive Not Ready
05	— Not Assigned —
06	No Track 00 Signal
07	— Not Assigned —
08	Seek Operation Not Yet Complete
09	— Not Assigned —
0A	— Not Assigned —
0B-0F	— Not Assigned —

TABLE 4-2. CLASS 01 ERROR CODES (DATA RECOVER ERRORS)

Code	*Error*
10	ID ECC Error
11	Uncorrectable Data ECC Error Found
12	ID Address Mark Not Found (sector not found)
13	Data Address Mark Not Found
14	Sector Not Found (no ID errors found)
15	Seek Error (wrong cylinder)
16	No ID AM and ID ECC error (sector not found)
17	— Not Assigned —
18	Corrected ECC Error(s)
19	Access to Sector Flagged As Bad
1A	Format Error Detected
1B-1F	— Not Assigned —

TABLE 4-3. CLASS 02 ERROR CODES (SYSTEM-RELATED ERRORS)

Code	*Error*
20	Invalid Command
21	Illegal Parameter (cyl., head, sector)
22	— Not Assigned —
23	Cylinder Overflow (during command)
24	Format Command With the Wrong Number of Sectors Per Track
25-2F	— Not Assigned —

TABLE 4-4. CLASS 03 ERROR CODES (DIAGNOSTICS ERRORS)

Code	*Error*
30	Internal CPU RAM Failed
31	Controller ROM Checksum Error
32	ECC Diagnostic Failed
33	SERDES RAM Failed
34	Disk Buffer RAM Failed
35	Buffer Controller Registers Failed
36	Drive Interface IC Failed
37	Host Interface IC Failed
38	CPU Self-Test Failed
39-3F	— Not Assigned —

TABLE 4-5. CLASS 04 ERROR CODES
(TIMEOUTS AND MISC. ERRORS)

Code	*Error*
40	Data Time-Out
41	Format Time-Out
42	SERDES Time-Out
43	Selection Time-Out

4.6 BIOS ERROR CODES

Table 4-6 specifies error codes that may be returned during format or verify.

TABLE 4-6. BIOS ERROR CODES

Code	*Error*
01	Bad Command Passed to Disk I/O
02	Address Mark Not Found
04	Requested Sector Not Found
05	Reset Failed
07	Drive Parameter Activity Failed
09	Attempt to DMA Across 64K Boundary
0A	Access to Bad Sector
0B	Bad Track Flag Detected
10	Bad ECC on Disk Read
11	ECC Corrected Data Error
20	Controller Timeout
40	Seek Operation Failed
80	Attachment Failed to Respond
BB	Undefined Error Occurred
FF	Sense Operation Failed

APPENDIX I

INSTALLING SCO XENIX V.2.2 WITH ADAPTEC ACB-23XX DISK CONTROLLERS

Adaptec ACB-23XX controllers are fully compatible with SCO Xenix V.2.2 and newer. The following instructions describe the process for installing the Xenix operating system on a disk subsystem using an Adaptec AT disk controller. The following items are required to successfully perform this installation:

1) SCO XENIX V.2.2 or newer. Operating system software and documentation
2) DOS 3.1 or newer, Operating system software and documentation
3) PC AT-compatible computer
4) Adaptec ACB-23XX disk controller
5) Hard disk drive (ESDI for use with ACB-232X, RLL for ACB-237X)

1.0 INSTALLING THE DISK SUBSYSTEM

First, the hard disk and controller must be installed in the AT and formatted for use by the Adaptec controller. See Sections 2 (Hardware Installation) and 3 (Software Installation) of the Adaptec ACB-23XX User's Manual.

During the software installation process (Section 3 of the ACB-23XX User's Manual), it is necessary to create a volume on the hard disk. At this point, a single partition must be created that contains all of the available cylinders on the drive. (Follow the instructions given for preparing a disk for use with DOS 3.3.)

When the hard disk has been successfully formatted with a single volume for the entire disk, you are ready to proceed with the installation of the Xenix operating system.

2.0 INSTALLING THE XENIX OPERATING SYSTEM

To install Xenix, follow the installation instructions given in the SCO XENIX System V Operating System Run Time Environment (HW) reference manual. The instructions are given in Chapter 2, "Installation Procedure"> During this installation process, the dkinit program (invoked by hdinit) is used to set the parameters for the hard disk. At his point, be sure to select option 1 (Display current disk parameters) and verify that the values displayed for cylinders, heads and sectors/track are correct. If the parameters are not correct, please retry this installation procedure. If correct, continue with the Xenix installation as directed.

If any problems are encountered during the Xenix installation, please see Section 2.7 of the SCO Xenix, Run Time Environment (HW) reference for troubleshooting information.

APPENDIX II

INSTALLING ISC UNIX 386/ix WITH ADAPTEC ACB-23XX DISK CONTROLLERS

Adaptec ACB-23XX controllers are fully compatible with ISC UNIX SYSTEM V 386/ix, and newer. The following instructions describe the process for installing the Xenix operating system on a disk subsystem using an Adaptec AT disk controller.

The following items are required to successfully perform this installation:

1) ISC UNIX 386/ix, or newer. Operating system software and documentation.
2) PC AT-compatible computer.
3) Adaptec ACB-23XX disk controller
4) Hard disk drive (ESDI for use with ACB-232X, RLL for ACB-237X).

1.0 INSTALLING THE DISK SUBSYSTEM

First, the hard disk and controller must be installed in the AT and formatted for use by the Adaptec controller. See Sections 2 (Hardware Installation) and 3 (Software Installation).

During the software installation process (Section 3 of the ACB-23XX User's Manual), it is necessary to create a volume on the hard disk. *At this point, a single partition must be created that contains all of the available cylinders on the drive.* (Follow the instructions given for preparing a disk for use with DOS 3.3.

When the hard disk has been successfully formatted with a single volume for the entire disk, you are ready to proceed with the installation of the Xenix operating system.

2.0 INSTALLING THE UNIX OPERATING SYSTEM

To install UNIX, follow the installation instructions given in the ISC UNIX 386/ix User's Manual titled "Using 386/ix Products Managing 386/ix Products. The instructions are given in Section 3, "Installation Procedure".

APPENDIX III

OS/2 INSTALLATION PROCEDURE AND ADAPTEC ACB-23XX COMPATIBILITY WITH MS OS/2 AND IBM OS/2

1.0 OS/2 COMPATIBILITY

Adaptec ACB-23XX controllers have been tested successfully with IBM OS/2 version 1.0. However, due to a problem discovered with Microsoft's version of OS/2, any 1:1 interleave hard disk controller is not compatible with the current MS OS/2 revision 1.0. A specific revision of the Microsoft OS/2 hard disk device driver is required for reliable operation of any ACB-23XX product with MS OS/2 1.0.

2.0 NEW DISK01.SYS REQUIRED FOR MS OS/2 OPERATION

The name of the device driver that must be replaced is DISK01.SYS. This device driver is available from Microsoft, although a specific revision number of the file was not available at the time this note was written. However, the driver can be referenced as the latest revision of DISK01.SYS. For those on the Microsoft developers program, it is also available on the Microsoft developers bulletin board as DISK01.NEW. Also, the new revision of the device driver will be supplied in the next release of OS/2 from Microsoft. This driver was originally made available to correct problems observed when MS OS/2 was used on Compaq 386 machines with a 1:1 interleave, ESDI hard disk subsystem. The failure mode, observed when using the DISK01.SYS supplied with MS OS/2 1.0, was a random rebooting of the system during, and/or after, reading data from the hard disk.

Microsoft OS/2 versions 1.0 and 1.02, with the replacement disk device driver (described above), have been tested with the ACB-23XX controllers and were found to be fully compatible.

3.0 WINDOWS COMPATIBILITY

Microsoft Windows 286 and Windows 386 have both been tested and are fully compatible with Adaptec's ACB-23XX products. Both software packages work whether invoked from the DOS operating system, or from the DOS compatibility window under the OS/2 operating system.

4.0 OS/2 INSTALLATION

Disk preparation under OS/2 is very similar to DOS disk preparation. OS/2 uses the FDISK.COM and FORMAT.COM programs to create and format OS/2

partitions on the fixed disk. The following instructions outline basic fixed disk preparation, and OS/2 installation.

First, the hard disk and controller must be installed in the AT and formatted for use by the Adaptec controller. See Sections 2 (Hardware Installation) and 3 (Software Installation) of the Adaptec ACB-23XX User's Manual. You will need the DOS operating system and DEBUG utility to successfully complete this installation. OS/2 does not have a DEBUG-like utility.

During the software installation process (Section 3 of the ACB-23XX User's Manual), it is necessary to create a volume on the hard disk. At this point, a single partition must be created that contains all of the available cylinders on the drive. (Follow the instructions given for preparing a disk for use with DOS 3.3).

When the hard disk has been successfully formatted with a single volume for the entire disk, you are ready to proceed with the installation of the OS/2 operating system.

Finally, insert the OS/2 installation diskette in the floppy drive, and press Ctrl+Alt+Del to reboot the system. The OS/2 operating system will boot and the installation program will automatically guide you through the FDISK and FORMAT procedures for your fixed disk, as well as completing the OS/2 installation.

APPENDIX IV

NOVELL 2.0A SOFTWARE PATCH FOR USE WITH ADAPTEC ACB-23XX DISK CONTROLLERS

This software patch allows Novell Advanced Netware to operate with the Adaptec ACB-23XX family of products. The patch provides support for hard disks with greater than 17 sectors per track. This patch may be used with the following versions of Novell Netware.

Novell 2.0a /SFT-1, and
/SFT-2

1.0 THE FILES TO BE MODIFIED

For the /SFT versions of Novell 2.0a, the following files, found on the **Installation** diskette, must be modified:

COMPSURF.EXE
INSTALL.EXE
DISKED.EXE
LOADER.DAT, and

The following additional files, found on the **Genos-4** diskette, must also be modified:

NET$OS.OBJ
PREPARE.EXE

2.0 PATCHING THE FILES

Using an editor capable of modifying executable files, (Norton Utilities, AT86, etc.) the following strings of machine code must be changed in each of the files listed above for your version of Novell 2.0a. The procedure for making these changes consists of: first loading the file into memory, then searching the file for the hexidecimal string to be modified, and finally, changing the appropriate bytes as shown below. Note that some of these strings may appear more than once in a single file.

ORIGINAL
HEX STRING CHANGE TO NEW HEX STRING FOR:

17 sectors/track	26 sect/trk	34 sect/trk	35 sect/trk	36 sect/trk
8AC1241F	8AC1241F	8AC1243F	8AC1243F	8AC1243F
FE22	FE34	FE44	FE46	FE48
EE22	EE34	EE44	EE46	EE48
3C12	3C1B	3C23	3C24	3C25
B911	B91A	B922	B923	B924
B96400BAF701		B90002BAF701		
	B90002BAF701	B90002BAF701		
	B90002BAF701			
The last change listed is in the LOADER.DAT file only.				
80E11F	80E11F	80E13F	80E13F	80E13F

YOU MUST STILL MODIFY YOUR SYSTEM BIOS TO PROVIDE A DRIVE TYPE TABLE WITH THE CORRECT NUMBER OF CYLINDERS AND SECTORS PER TRACK FOR NOVELL 2.0A TO RUN.
AFTER LOW-LEVEL FORMAT, THE ADAPTEC BIOS MUST BE DISABLED BY REMOVING THE BIOS ADDRESS SELECTION JUMPER FROM THE CONTROLLER (I.E, REMOVE ANY JUMPER FROM J11 ON ACB-2322).
Novell 2.0a does not support a disk with capacity greater than 250 MBytes. *The system BIOS drive type table must specify less than 250 MBytes worth of storage*. Use the following to calculate the maximum number of cylinders that may be specified:

MAXIMUM NUMBER OF CYLINDERS = 512,000 + (SECTORS PER TRACK X HEAD COUNT)

Upredictable results may occur when attempting to use a disk with greater than 250 MBytes of storage.

APPENDIX V

NOVELL 2.1 SOFTWARE PATCH FOR USE WITH ADAPTEC ACB-23XX DISK CONTROLLERS

This appendix describes a patch to allow use of the ACB-23XX controllers with Novell 2.1.

This software patch has the advantage of allowing the use of the Adaptec primary format and autoconfiguration feature. This feature gives you the capability to use all kinds of different disk types while leaving the "setup" of the disk type definition to "TYPE 1". Also, there is no need to modify the content of the motherboard BIOS. The following paragraph describes the necessary steps for using Novell 2.1 with Adaptec controllers.

Step 1
Make sure the Adaptec BIOS is enabled (factory default). Use your PC AT setup program to select drive TYPE 1.

Step 2: Primary format
When formatting the drive for the first time, the Adaptec disk preparation program must be used. This is mandatory for the autoconfiguration to work properly. Later the disk can be reformatted with the Novell compsurf program, if desired. The Adaptec disk preparation is started by entering the DOS debug program, then typing the command:

G=C800:5 <CR>

Option 0 of the menu is used to do the primary format. When the primary format is finished, option 1 (to create Adaptec and logical partition) must be used in order to get a successful autoconfiguration. Select option 0 (to create a volume). Select volume number 1. For the number of cylinders, enter the total amount of cylinders available. This amount is displayed on top of the screen, and it can be larger than 1024.

Exit the disk preparation program with option 3, then option 5.

Step 3:
Executing the patch on Novell 2.1 software.

Novell 2.1 is delivered with a standard driver program called ATDISK.OBJ. That file must be patched before the generation of the utilities and the Operating System. This is done with the standard DOS debug program.

1) Make a back-up of the original diskette. Work from the back-up diskette.
2) Load the debugger and the ATDISK.OBJ file by entering the command

Debug ATDISK.OBJ <CR>

3) Search for the hexadecimal code sequence B9 64 00 by entering the command:

S CS:0 FFFF B9 64 00 <CR>

The debugger should find one occurrence of that sequence and tell you the address of the first byte of the sequence with a display having the following format:

XXXX:YYYY where YYYY is the address of the first byte of the sequence

In the sequence of code B9 64 00, the value 64 must be replaced by value 00 and the value 00 must be replaced by value 02.

This is done by entering the command:

E CS:YYYY <CR>

The debugger displays the value B9; press the space bar once the debugger displays the value 64; type in 00, then press the space bar. The debugger will now display the value 02; type in 01 and press the return key. To make sure that the patch was properly done, you may display the new code sequence by entering the command:

D CS:YYYY <CR>

You should now observe the sequence B9 00 02.

4) Search for the hexadecimal sequence of code 3D 00 C8 72 by entering the command:

S CS: 0 FFFF 3D 00 C8 72 <CR>

The debugger should find TWO occurrences of that sequence and tell you the address of the first byte of each sequence with a display having the following format:

AAAA:BBBB where BBBB and YYYY are the addresses of the
XXXX:YYYY first byte of each occurrence

In the sequence 3D 00 C8 72, the value C8 must be replaced by value 00. This is done by entering the command:

E CS:BBBB <CR>

The debugger displays the value 3D; press the space bar twice and the debugger displays the value C8; type in 00 and press the return key. The second occurrence must also be modified by entering the command:

E CS:YYYY <CR>

Again, the debugger displays the value 3D; press the space bar twice and the debugger displays the value C8; type in 00 and press the return key.

To make sure that the patch was properly done, you may do a display by entering the command:

D CS:BBBB <CR>

You should now observe the sequence 3D 00 00 72.

5) The patched file is now saved on the diskette by entering the command:

W <CR>

Step 4:
The standard Novell 2.1 software generation procedure can now be followed, i.e., the link of the utilities (compsurf.exe, disked.exe, repair.exe, etc...) and the Operating System.

Step 5:
Once the link and generation is finished, the newly generated compsurf.exe program can be run. Compsurf is a program supplied by Novell to assess the disk data reliability. It has the ability to primary format and extensively verify the hard disk.

If you use the compsurf format option, it is recommended to enter the manufacturer defect list. Compsurf has its own defect handling and maps defects at a track level (if a track contains one or several defects, all blocks on that track are marked bad).

Step 6: Installing Novell 2.1 software:
Once compsurf.exe is done (message "disk passed"), the Novell 2.1 software can be installed following the standard installation procedure described by Novell.

APPENDIX VI

ADAPTEC AUTO-CONFIGURATION

Auto-configuration for non-listed drive types.

In DOS 3.X, Interrupts 60-67 are available for use as vectors to user programs.

Adaptec 23XX controllers use the memory space occupied by Int 60-67 as a data area, instead of for vector pointers. We store the drive parameters there, in a table. Sixteen bytes (Int 60-63) are for drive 1, and 16 bytes (Int 64-67) are for drive 2. These tables contain the true cylinder, head and sector count for each drive. This feature allows the user to install hard drives that do not match the standard list of drive types in the AT BIOS.

Occasionally, products such as expanded memory or disk caching, will want to use Interrupts 60-67 as vectors to their code. This will conflict with our use of these locations, because our drive table will be overwritten by their pointers.

For this special case, we have included an auto-configuration driver in your controller BIOS. This driver can be downloaded from your controller and put into a CONFIG.SYS file on your hard drive. At system boot, DOS will execute the device driver. With the driver installed, we do not use Int 60-67 to store the drive parameter table. Instead, the standard hard drive interrupts 41 and 46 are used as vectors to point to our drive table, which is now in a protected memory location reserved by DOS.

When to use the auto-configuration driver.

If you have created volumes using Adaptec's partitioning, and put the partitioning driver into a CONFIG.SYS file, then you do not need the autoconfiguration driver. (It is included in the partitioning driver.)

If you did not use Adapte'c partitioning driver, you may want to copy the auto-configuration driver into a CONFIG.SYS file on your boot disk. This will ensure that no software will conflict with your hard disk table. However, if you have no software that uses Int 60-67, you can run without a device driver installed.

The following have been reported to need Int 60-67 locations:

Superpck Cache	Triangle CICS/PC Emulator
Desqview	Columbia Kermit
IBM Displaywrite 3	Wang Terminal-Emulator cards

How to use the auto-configuration driver

The auto-configuration driver is accessible by using the DEBUG program from your hard drive or your DOS floppy.

At the prompt enter:

```
A>DEBUG <CR>
-G=C800:5 <CR>
```

The Adaptec Disk Preparation Menu will come up on the screen.

Choose option 4, "to generate Adaptec auto-configuration device driver".

Now you can copy the driver into a file that you name. If your C drive is already formatted, you can copy the driver to C. (If not, then copy the driver to a file on your A: floppy. After your C drive is formatted, then copy the driver from A, over to the C drive.)

```
enter file name: C: ADAPTEC.DVR <CR>
```

A copy of the driver will now be written onto the specified drive.

Now create or modify your CONFIG.SYS file to include the driver.

If you have an already existing CONFIG.SYS file on your hard drive, then modify the file to have DEVICE = ADAPTEC.DVR as the first statement.

If you do not have an existing CONFIG.SYS file, then create one in the following way:

```
C>COPYCONCONFIG.SYS <CR>
DEVICE = ADAPTEC.DVR <F6> <CR>
```

Now your drive table will be located in a protected area at boot time.

APPENDIX VII

DRIVER & OPERATING SYSTEM SUPPORT: ADAPTEC'S ACB-23XX FAMILY

	I/O DRIVER STATUS	
VENDOR	O/S	Revision
Interactive Systems Corporation 2401 Colorado Ave. Santa Monica, CA 90404 213-453-8649	Unix 386/ix	1.03 1.04
Santa Cruz Operation 400 Encinal St. P.O. Box 1900 Santa Cruz, CA 95061-9990 408-425-7222	SCO XENIX V /286/386	2.2
Microsoft Corp. 16011 N.E. 36th Way Box 97017 Redmond, WA 98073-9717 206-882-8080	PC/MS DOS MS/OS/2 with DISK01.SYS MS OS/2	3.X 1.0 1.02
Microport Systems 10 Victor Square Scotts Valley, CA 95066 800-722-UNIX 800-822-UNIX (In CA)	System V/386	2.2RLL
Ontrack Computer Systems 6200 Bury Drive Eden Prairie, MN 55346 612-937-5815	Novell	2.0a SFT 2.1
The Software Link 3577 Parkway Ln. Atlanta, GA 30092 404-448-5465	PC-MOS	

IBM Corp. Old Orchard Rd. Armonk, Ny 10504 914-765-1900	OS/2 OS/2	Std. 1.0 Std. 1.1
Golden Bow Systems 2870 Fifth Ave., Ste. 201 San Diego, CA 92103 (619) 298-9349	Vfeature Deluxe	2.57
Storage Dimensions 2145 Hamilton Ave. San Jose, CA 95125 (408) 395-2688	Speedstor	5.11

APPENDIX VIII

FORMATTING AND ACCESSING DRIVES WITH GREATER THAN 1024 CYLINDERS USING ADAPTEC'S ACB-23XX CONTROLLERS

Adaptec ACB-23XX BIOS No. 412801-00C and later revisions contain a hard disk format utility that includes support for drives with greater than 1024 cylinders. The user interface for this utility is identical to that supplied in previous revisions of the BIOS. however, there are several steps that are required to make access to the cylinders beyond 1024 possible.

The first step in this installation is to format the hard disk. Follow the instructions exactly as they are presented in the User's Manual for initiating the format. When the format completes it is then necessary to volume partition the drive. This is accomplished by selecting option 1 from the format utility main menu. The first 1024 cylinders on the drive may be partitioned exactly as described in the User's Manual.

Since DOS is not able to address the cylinders above 1024, cylinders 1024 and greater can only be accessed from an Adaptec Partition, using the Adaptec Partition Device Driver. This means that in order to access these cylinders, they must be included in a volume created in the Adaptec Volume Partition program (option 1 in the BIOS format routine). Create as many 32 MB or less volumes to include each of these cylinders in a partition. Then select the option to FDISK each of the volumes. Under the FDISK menu, you will need to create a single partition that uses all of the cylinders allocated to each volume. This process will also format the partition for use by the Adaptec device driver. When the partition format completes, select the appropriate option to activate the partition. When each of the Adaptec volumes has been created and prepared using FDISK, they will be accessible by the device driver.

At this point, the low-level format and volume partitioning of the hard disk will be complete. Exit the format utility and follow the instructions in the User's Manual for preparing the first 1024 cylinders of the disk for DOS using the FDISK.COM and FORMAT.COM utilities. After the DOS format has been completed and the system transferred to the hard disk, be sure to transfer the Adaptec partition device driver from the controller BIOS onto the hard disk and create the appropriate entry in the system CONFIG.SYS file. Please see the User's Manual for complete instructions on installing the device driver in your system.

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