



## WARE INSTALLATION

### RODUCTION

ion describes the steps necessary to install the ACB-4070 hardware. First the operating environment, procedure, and board layout are described. This section describes the integration of the drive, controller, and host

### ENVIRONMENTAL REQUIREMENTS

4000 Series Controllers will perform properly over the 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
Pressure (bars)	20,000 POH @ 55° C	

### PACKING

Carrier is responsible for damage incurred during shipment. In the event of damage, have the carrier note the damage on both the shipping receipt and the freight bill, then notify your freight representative so that the necessary insurance claims can be processed.

When shipping, use the packing slip to label each of the individual items listed on the slip. Use appropriate packing container and packing material for possible return of the equipment to the factory be

ACB-4070, LIKE ALL ELECTRONIC EQUIPMENT, ARE SENSITIVE. PLEASE TAKE THE PROPER PRECAUTIONS WHEN HANDLING THE BOARD. KEEP THE BOARD IN ITS CONDUCTIVE WRAPPING UNTIL IT IS FIGURED AND READY TO BE INSTALLED IN YOUR SYSTEM.

### BOARD LAYOUT

The board layout is shown in Figure 3-1. The ACB-4070 is shown in Figure 3-2. These figures show the location of the firmware, terminators, jumpers and connectors.

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The shipping receipt should be used to document any damage to the equipment.  
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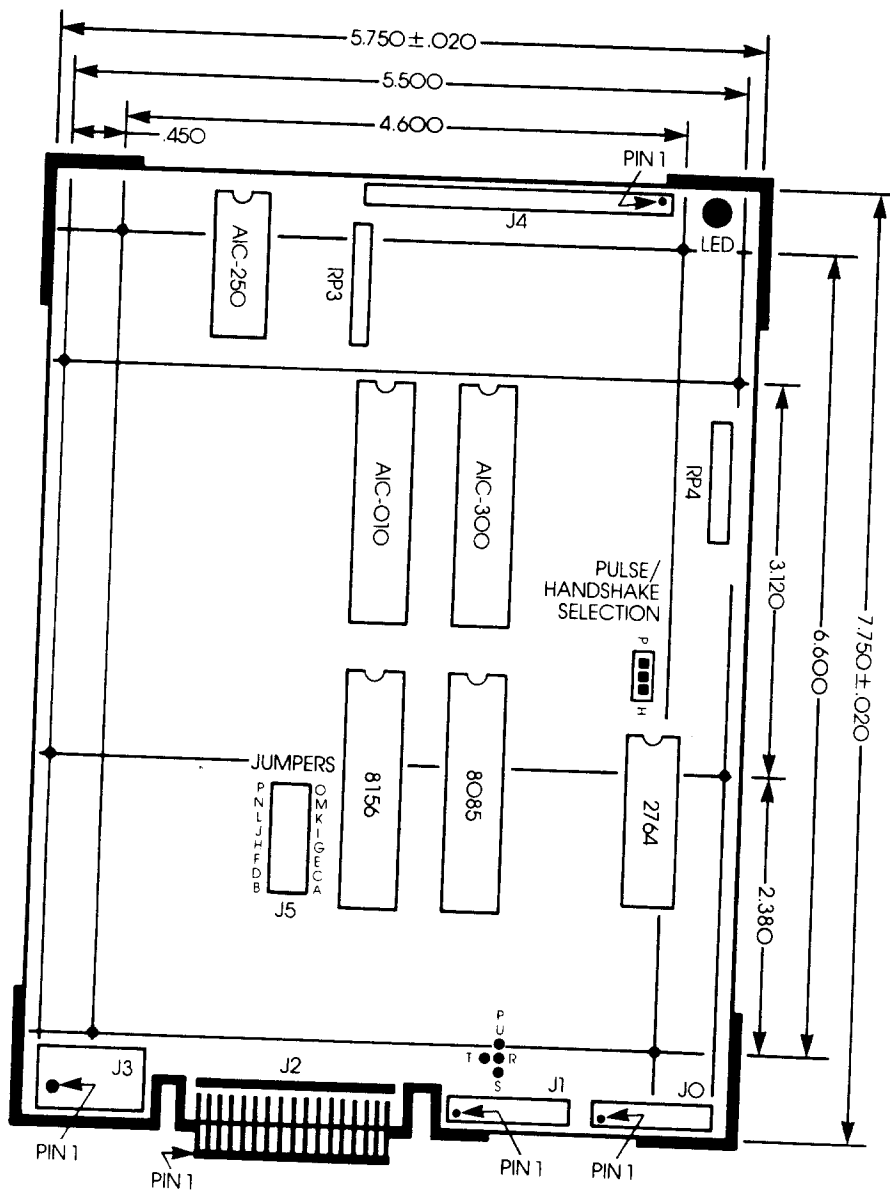


FIGURE 3-1. ACB-4000A BOARD LAYOUT

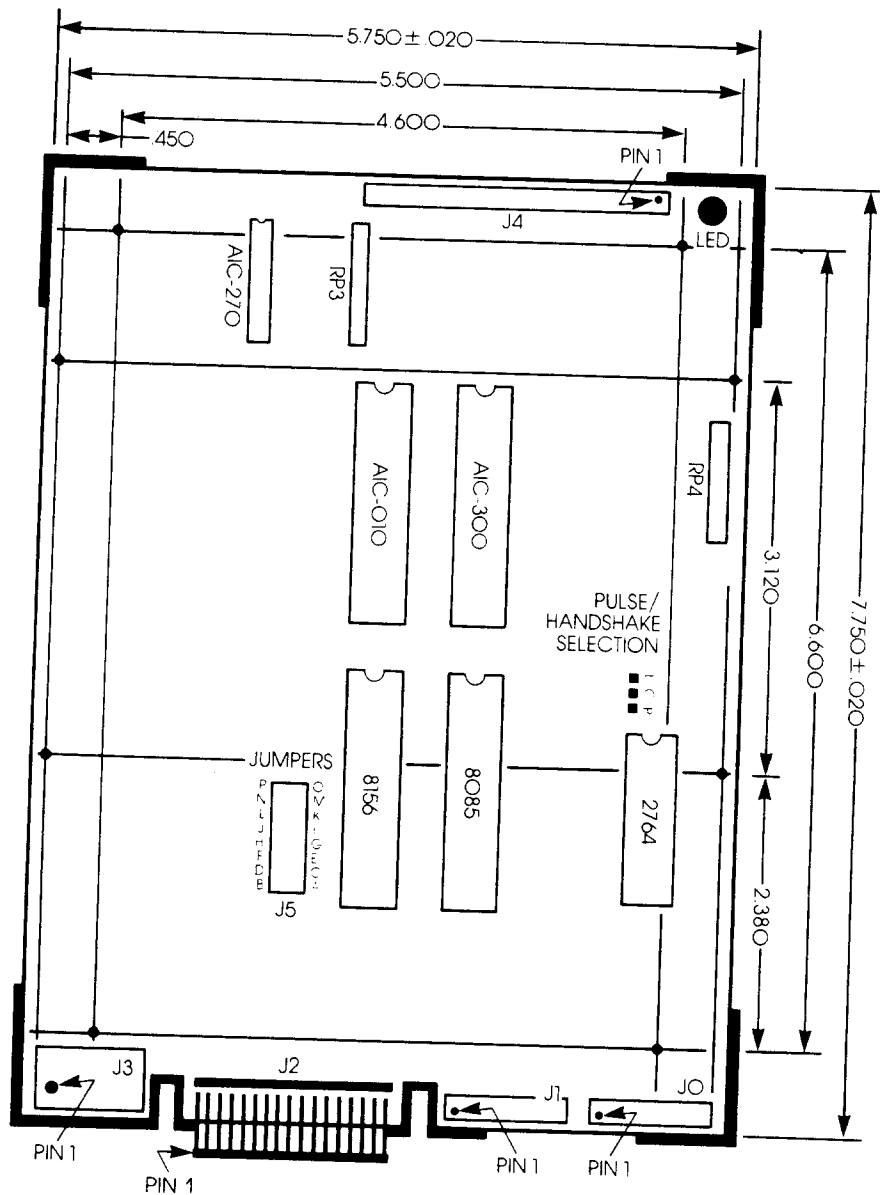


FIGURE 3-2. ACB-4070 BOARD LAYOUT

### 3.5 INTEGRATION OF CONTROLLER AND DRIVE

To install the Adaptec ACB-4000A or ACB-4070 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.

#### 3.5.1 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.

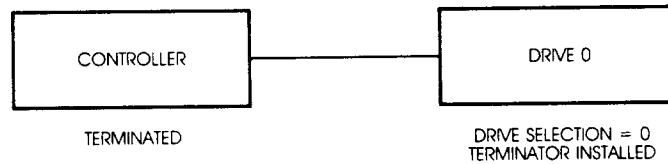
**NOTE:**

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.

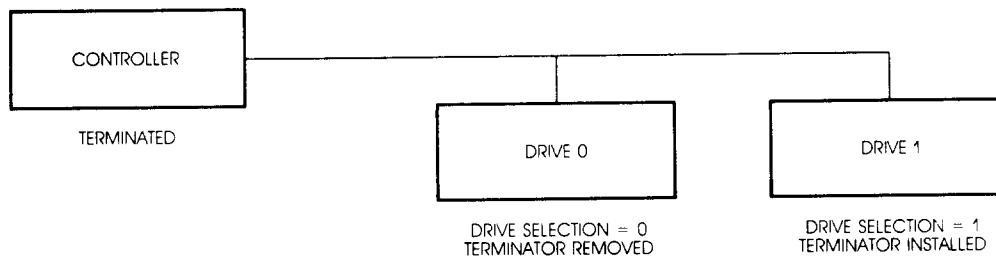
Before the drives can be cabled to the controller the drive cable terminator must be properly set. The terminator is used to reduce signal "ringing" in the cables. The terminator, as its name implies, must be at the end of each cable in order to have the controller and drive communicate properly. The controller has a permanent terminator built-in. The disk drives, since they can be connected in a daisy chain configuration 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 (see Figures 3-3 and 3-4).

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



**FIGURE 3-3. 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 3-4. TWO DRIVES, ONE CONTROLLER TERMINATION EXAMPLE**

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

### 3.5.2 CONTROLLER JUMPER SELECTION

The controller changeable parameters are defined as the variables that can be changed on the controller to accommodate the different drive characteristics. These parameters can easily be changed by use of the MODE SELECT command and by the use of the jumpers defined in Table 3-1.

TABLE 3-1. DEFINITION OF JUMPERS

<u>Jumper</u>	<u>Definition</u>	<u>Installed</u>	<u>Removed</u>
A-B	LSB of Controller's SCSI Address	bit = 1	bit = 0
C-D	Controller's SCSI Address	bit = 1	bit = 0
E-F	MSB of Controller's SCSI Address	bit = 1	bit = 0
G-H	DMA Transfer Rate	SYSCLOCK/4	DATA CLOCK/2
I-J	Extended Command Set (See Appendix D)	Enabled	Disabled
K-L	Not Used		
M-N	Support of Syquest 312, DMA 360 and drives that drop SEEK COMPLETE signal during head switching	Enabled	Disabled
O-P	Self Diagnostics	Enabled	Disabled
R-PU *	Write Precompensation turned off for both drives	Enabled	Disabled
R-S *	Write Precomp starts at same cylinder as reduced write current for both drives	Enabled	Disabled
R-T *	Write Precomp is applied to all tracks for both drives	Enabled	Disabled

NOTE: \* denotes that these jumpers are for the ACB-4000A only, they are not present on the ACB-4070.

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The variables are divided into five categories: SCSI address, host options, drive options, write precompensation options and diagnostics.

Jumpers A-B, C-D and E-F are used to select the controller's SCSI ID or address. They determine how the controller will be identified when installed in the SCSI bus.

Jumper G-H is used to select two DMA transfer rates on the SCSI bus. When removed, the controller will transfer data at the maximum rate allowed by the controller, equal to  $\text{DATACLOCK}/2$ . Some host adapters cannot support this data rate. When this jumper is installed, the data transfer rate is reduced to run at a rate of  $\text{SYSCLOCK}/4$  on single-sector transfers. This is one-half the controller's maximum DMA speed. Multisector transfers are always made at the maximum rate of  $\text{DATACLOCK}/2$ , with or without jumper.

Jumper I-J is used to enable the extended command set. This is used only when replacing SASI-type controllers. See Appendix D for details.

Jumper M-N is installed to support drives that drop the SEEK COMPLETE line on the ST506/412 interface during head switches. Some multi-sectored removable media drives that have wedge servo information on all surfaces require this jumper to be installed. Request 312 10 MB and DMA 360 10 MB drives require this jumper to be installed. The installation of this jumper does not affect the operation of drives that do not drop SEEK COMPLETE between head switches.

Jumpers R-PU, R-S and R-T are used to select write precompensation for both drives. Only one of these options can be selected at a time. This hardware jumper overrides any software selection made in the MODE SELECT command (see Section 5). The write precompensation used is 12ns. The ACB-4070 controller does not have these jumpers since 2,7 RLL encoding does not use write precompensation. Please see Figure 3-1 for location of these jumpers.

**NOTE:**

ON THE ACB-4000A, THESE JUMPERS ARE ORIENTED DIFFERENTLY THAN ON THE ACB-4000.

Jumper O-P is used to enable the ACB-4000 Series Controllers' Self Diagnostics. These diagnostics test the internal circuitry of the controller and can be used for incoming inspection of boards and test the internal circuitry of the controller. See Section 6 for operation and associated error codes.

Configure the jumpers at this time to meet your drive and system requirements.



5-2 CONTROLLER AND DRIVE CABLING  
 e configured, they can be  
 has three drive cable  
 described in Table 3-2.

**CONNECTOR DEFINITIONS**

ribbon cable  
 to drive 0

ribbon cable  
 to drive 1

ribbon cable  
 to both drives 0 and 1

Maximum Length

feet (6 meters)

feet (6 meters)

feet (6 meters)

orientation for the ACB-4000A  
 -1, and for the ACB-4070 in

ED ON THE SIDE CLOSEST TO THE

re 3-5.

Now that the drive and controller are  
 connected together. The controller  
 connectors J0, J1, and J2. These are

**TABLE 3-2. CONTROLLER TO ST506/412**

<u>Connector</u>	<u>Signals</u>	<u>Cable</u>
J0	Data	20-pin flat Connected to
J1	Data	20-pin flat Connected to
J2	Control	34-pin flat Connected to

HOST INTERF  
 (SCSI BUS)

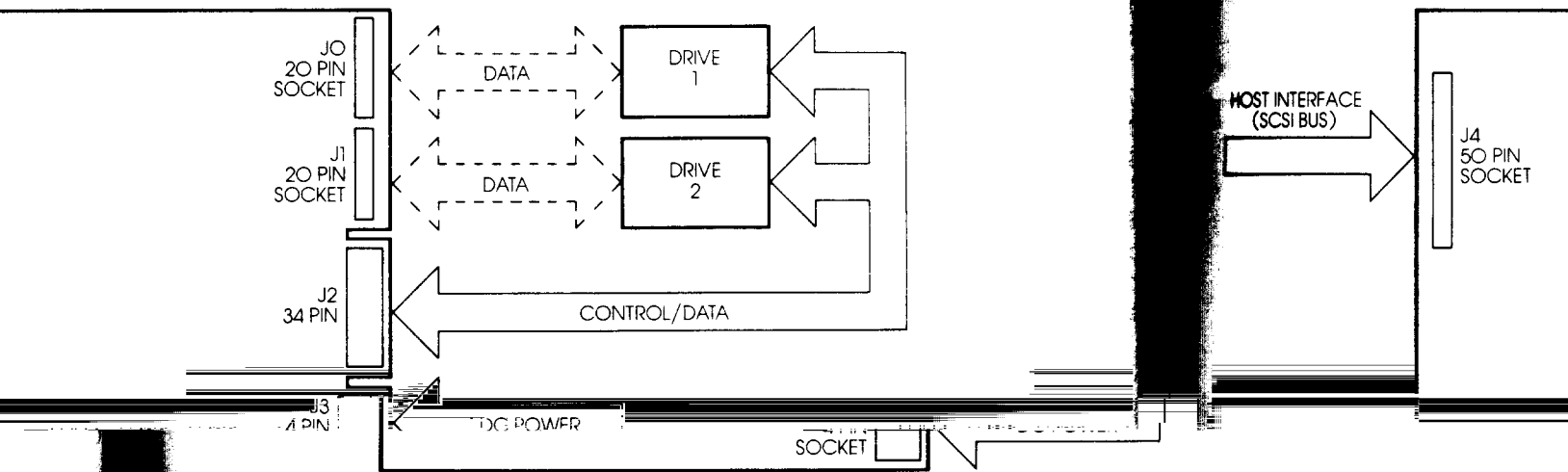
<u>Connector</u>	<u>Recommended Plug</u>	<u>Ma</u>
J0	3M Part # 3421	20
J1	3M Part # 3421	20
J2	3M Part # 3414	20

The connector locations and pin or  
 connectors are shown in Figure 3-  
 Figure 3-2.

**NOTE:**  
 PIN 1 OF J0, J1 AND J2 IS LOCATED  
 POWER CONNECTOR.

Connect the cables as shown in Figure

0000:



**FIGURE 3-5. CONTROLLER CABLING**

### 3.5.4 CONTROLLER POWER REQUIREMENTS AND GROUNDING

The power requirements for the ACB-4000 Series Controllers are shown in Table 3-3.

TABLE 3-3. POWER REQUIREMENTS

<u>Voltage</u> (Volts)	<u>Tolerance</u>	<u>Current</u> (Max. Amps)	<u>Ripple</u> (Volts, RMS)
+5 VDC	+/- 5%	1.5 A	150 mV
+12 VDC	+/- 10%	300 mA	150 mV

The power is applied through the four-pin connector J3. The recommended mating connector is AMP Part # 1-480424-0. Connector J3 pin assignments are shown in Figure 3-6.

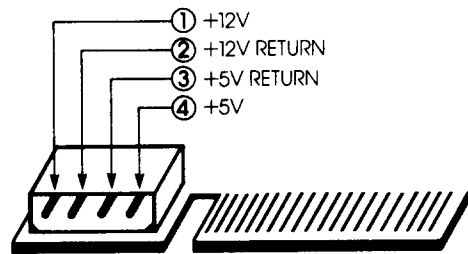


FIGURE 3-6. POWER CONNECTOR J3

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and attached Disk Drives should be connected to a Single-Point Grounding Scheme. This scheme connects the controller, drives, plus all other components within the cabinet to one point that is then connected to the chassis ground. See Figure 3-7.

FOLLOWED, RANDOM FORMAT, WRITE AND

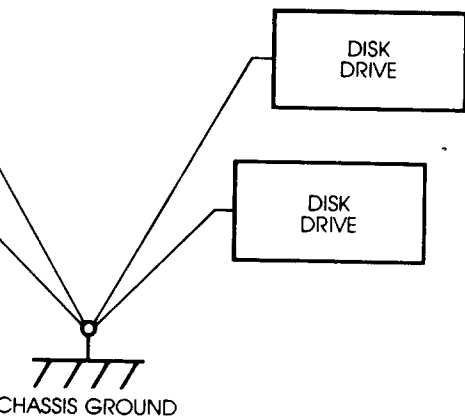


FIGURE 3-7. SINGLE-POINT GROUNDING SCHEME

SCSI CONTROLLER AND HOST ADAPTER

After the drive have been configured, they are connected to the SCSI host adapter. The controller and host adapter must take care of termination, cabling and the SCSI ID used by the host adapter and controller. This section addresses these topics.

IF YOU ARE REPLACING AN ACB-4000 SERIES CONTROLLER, PLEASE READ THE SOFTWARE CONSIDERATIONS.

HARDWARE IMPLEMENTATION

Controllers support the proposed ANSI Standard X3.19.2/82-2 Revision 14, Small Computer System Interface (SCSI).

ACB-4000 Series Controller using a Single-Point Grounding Scheme. All grounds from all components within the cabinet are connected to the chassis ground.

(Ripple Voltage, RMS)

0 mV  
0 mV

for J3. The 3. Connector

IF SINGLE-POINT GROUNDING IS NOT USED, ERRORS MAY OCCUR.

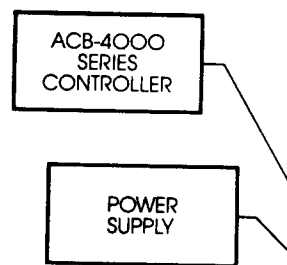


FIGURE 3-7. SINGLE-POINT GROUNDING SCHEME

SCSI CONTROLLER AND HOST ADAPTER

After the controller and host adapter have been configured, they are connected to the SCSI host adapter. The controller and host adapter must take care of termination, cabling and the SCSI ID used by the host adapter and controller. This section addresses these topics.

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HARDWARE IMPLEMENTATION

Controllers support the proposed ANSI Standard X3.19.2/82-2 Revision 14, Small Computer System Interface (SCSI).

The ACB-4000 Series supports 17 active lines and 25 ground<sup>3</sup> lines in a 50-pin flat cable. All odd number pins are ground. This is known as an unbalanced SCSI bus. The bus has open-collector drivers and is terminated at both ends by a 220 ohm pull-up resistor to +5V and a 330 ohm pull-down resistor to ground. The bus is low-active, thus a grounded line is considered active or asserted.

Eight of the lines are the byte-wide bidirectional data bus. The ACB-4000 Series supports DB7-0 data lines and does not support the data parity line. The data parity line is not terminated at the controller.

Nine of the lines are the control and status lines. The ACB-4000 Series supports all nine lines including BSY, SEL, C/D, I/O, MSG, REQ, ACK, ATN AND RST.

The RST, reset line, is a "hard" reset and causes the controller to abort its current operation and to get off of the bus. Any outstanding operation is aborted. The SCSI specification has a minimum RST pulse width of 25 microseconds. The ACB-4000 Series allows a minimum RST pulsewidth of 50 nanoseconds to accommodate older SASI-type host adapters.

### 3.6.2 SASI AND SCSI HOST ADAPTER CONSIDERATIONS

When using a SASI or SCSI host adapter the following areas must be considered: SCSI handshake timing, transfer rate of controller, use of ATN line, and I/O driver design termination. Appendices A, B, C, and D address these topics.

### 3.6.3 CONTROLLER ADDRESSING AND TERMINATION

In order for the ACB-4000 Series Controllers to operate properly in a system environment, the controller must be properly selected and terminated. The controller can be jumpered to be selected as SCSI device ID or address 0 through 7. See Table 3-1 for the definition of these jumpers and install any that are needed.

In a single controller system use the controller SCSI ID = 0 which requires no jumpers for locations A-B, C-D and E-F on the controller.

The SCSI bus is a daisy-chained bus between host adapter and I/O controllers. In order to reduce signal ringing, the two ends of the bus must be terminated. This termination consists of a 220-ohm resistor to +5 Volts and a 330-ohm resistor to ground for each signal line. Check your host adapter to see if it is terminated. The ACB-4000 Series Controllers have socketed

~~terminator packs located at J4 and J5 for this termination and  
noted in Figures 3-1 and 3-2.~~

17 active lines and 25 ground pins are grouped together and must be terminated, i.e. RP3 and RP4 must be terminated. In a multiple I/O controller system, the bus has open both ends by a 220-ohm resistor to ground. The bus must be terminated only if the ACB-4000 Series Controller is the controller system both must be terminated, i.e. RP3 and RP4 must be terminated. In a multiple I/O controller system, the bus has open both ends by a 220-ohm resistor to ground. The bus must be terminated only if the ACB-4000 Series Controller is the controller system.

### CONTROLLER AND HOST ADAPTER CABLING

The controller and host adapter are addressed and properly, they can be cabled together.

After 50-pin connector J4 is the SCSI bus connector. A ribbon cable with a maximum length of 20 feet (6 meters) is required. A 3M Part #3425-3000 cable connector is required.

### WARM UP OPERATION

If the drive is correctly formatted, the controller will seek the last cylinder and read the largest block address. The parameter information and largest block address are stored in the ACB-4000 Series Controller.

After the last block address has been read, the controller will drive back to Track 0, stopping several times in 'zones' to read the defect count at that point. This defect count is also saved in the controller to allow the controller to better predict the location of the block on the drive.

In addition to the drive seeks and reads, the Adaptec ACB-4000 Series Controllers do a series of self-diagnostics after power-up. Immediate selection of the disk and movement of the heads during this period is a sign of properly functioning Adaptec ACB-4000 Series Controllers.

When power is supplied to the system, the controller will enter power-up mode and wait for a minimum of 18 seconds for the controller to become ready. During the 18-second power-on sequence, the controller is checking for drive 0 and drive 1 to become ready (nine seconds/drive). If the host senses a command requiring access to a drive before it has become ready (and more than 18 seconds have elapsed) the controller will accept the command and continue to check for a ready status. Once the drive comes ready, the controller will then execute the command; if 18 seconds elapse and the drive does not come ready, a DRIVE NOT READY (04 hex) error will result. The controller will then check for a ready status on the next command requiring access to that drive.

Once a drive comes ready, the controller will recalibrate the head to track 0 if needed. If the drive started at track 0, the controller will step the head off of track 0 to confirm that the drive can seek and that the track 0 signal was valid. With the drive's ability to seek confirmed, the controller then seeks back to track 0. The drive actuator (if it can be seen) appears to make a short 'blip.'

The controller then attempts to read from track 0 parameter information which is written during formatting. If the drive is unformatted or had been formatted by another vendors controller, the parameter information is not present so the controller then sets a bit in its memory called 'blown format' to warn the user

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That the drive format is blown, the reset sequence is stopped and the controller command. The drive must be formatted to allow access to disk data.

**NOTE:**  
IF THE CONTROLLER DOES NOT OPERATE AS DESCRIBED IN SECTION 6 FOR TROUBLESHOOTING PROCEDURES.

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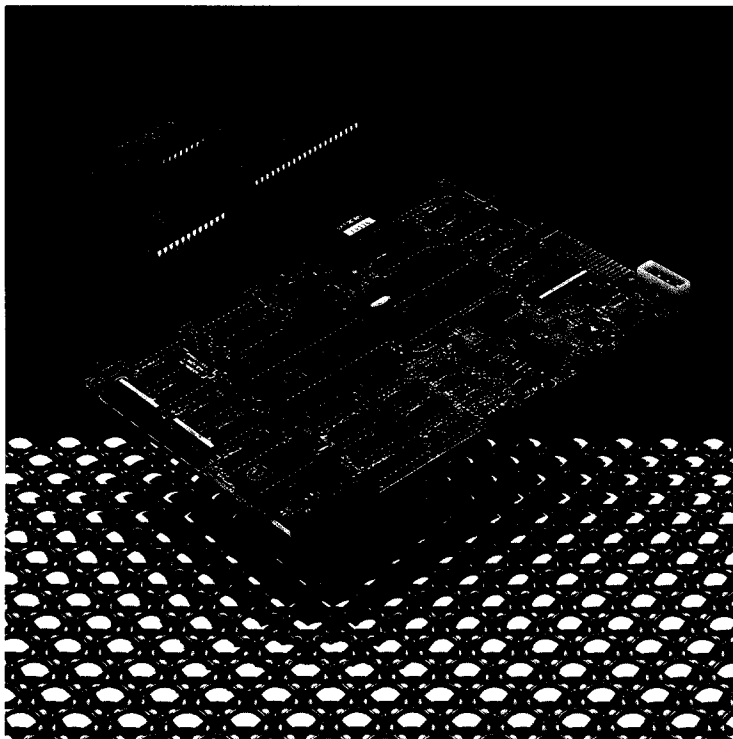
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Adaptec ACB-4000 Winchester controller products are intelligent, high performance/low cost devices which utilize proprietary LSI chips and a commercially available MOS microprocessor. These products are designed specifically for the OEM and system integrator markets for use in cost sensitive, high performance Winchester disk drive applications.

These boards are among the easiest and most efficient controllers to interface with your system because Adaptec controller products use the industry standard SASI/ANSI SCSI bidirectional bus interface, and its associated high level command set.

Non-interleaved operation is standard on all ACB-4000's, making possible a minimum of twice the throughput of competitive controllers. A dual-ported FIFO buffer eliminates data overruns and controls non-interleaved operation. Programmable interleaving is provided for those who desire this feature.

After formatting, a "perfect" disk is presented to the system. Long seeks to alternate tracks are eliminated and the effective data capacity of the drive is increased since disk media defects are skipped at the sector level. Instead of skipping an entire track and subsequently seeking to a spare track, Adaptec controllers simply skip a bad sector and allocate its logical address to the next good one.

Error detection and correction is provided by a 32 bit ECC designed for 5.25" Winchester disk drives. Error correction is transparent to the user.

Device independent host software is now possible with Adaptec controllers. All physical characteristics of the disk drive (number of heads, cylinders, bytes per sector, etc.) are stored on the disk during formatting. The ACB-4000 reads this data when powered on and configures itself to support the attached drives.

This high performance feature set is made possible through the use of proprietary LSI devices designed

and manufactured by Adaptec. These chips are used exclusively in the high speed data path, leaving low speed functions to microprocessor control. The Encode/Decode functions, along with write precompensation, delay lines, and address mark handling are combined in one device, the AIC-250. The resulting NRZ data is fed to the controller chip for deserializing and ECC checking and error correction. Disk data format control is also provided by this part. High speed buffer control is also accomplished by a custom device, the AIC-300.

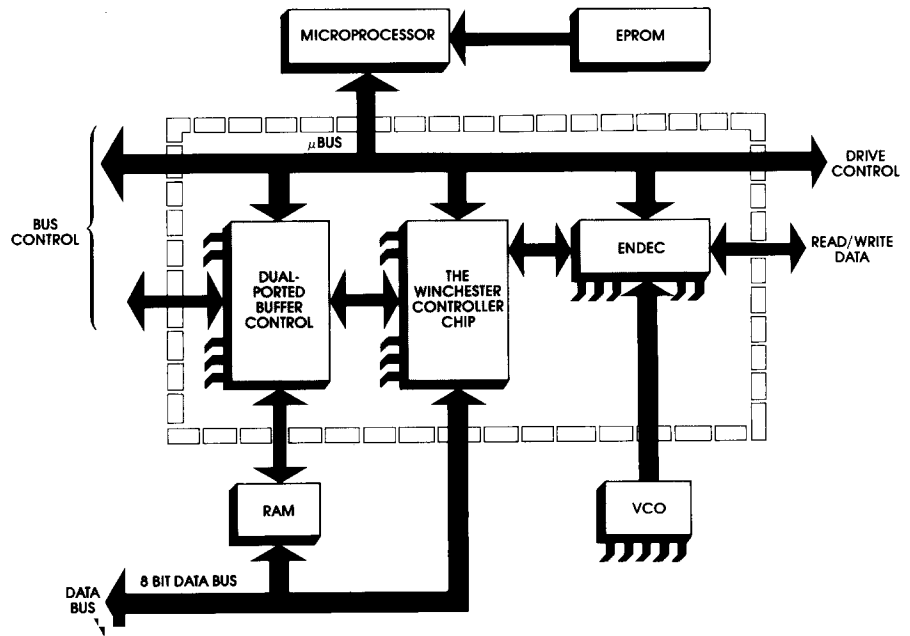
Adaptec controllers are the best you can make... or buy. To further lower your system cost, Adaptec licenses manufacturing rights to the ACB-4000. Adaptec also provides complete manufacturing data and controller software. Add the ACS-4000 Chip Set and off the shelf components to complete a very low cost controller.

 adaptec, inc.



## Features

- **Complete Device Independence**  
One software driver works with all "ST-506" disk sizes
- **Industry standard host interface (SASI/SCSI; ANSI X3T9.2)**  
Over 150,000 SASI Bus Interfaces Delivered
- **Drive compatibility**  
Seagate Technology ST-500 Series and Compatible Drives (Buffered seek)
- **Ease of use**  
One Pass Rapid Formatting  
Logical Block Addressing  
Variable Block Size (256, 512 or 1024)  
Multiple Block Data Transfer (up to 64K blocks)  
Implied Seek
- **Versatility**  
Multiple Controllers/Channel  
Multiple Hosts/Channel  
Five Megabits/Second Disk Transfer Rate
- **High Performance**  
Read/Write Without Interrupting  
Dual-Ported I/F O Buffer  
Fully Transparent Defect Skipping at the Sector Level  
Error Detection/Correction (32-bit ECC)  
High Speed Data Search  
16 Head support  
High Speed Seek Pulses
- **Host Bus Signals**  
I/O (Input/Output) Data Direction  
C/D (Command/Data) Data type  
REQ (Request) Data or command available  
BSY (Busy) Controller Busy  
MSG (Message) Controller/Host Adapter Comm.  
ACK (Acknowledge) Data or Command received  
RST (Reset) Reset all Controllers/Host Adapters  
SEL (Select) Selects or Reselects SCSI Device  
ATN (Attention) Message Request



ACB 4000 SERIES  
SIMPLIFIED BLOCK DIAGRAM  
SASI (ANSI SCSI)  
WINCHESTER DISK CONTROLLER

## Controller Commands

READ  
SEEK  
RECEIVE DIAGNOSTIC  
TEST UNIT READY  
FORMAT UNIT  
WRITE  
SEND DIAGNOSTIC  
VERIFY  
REZERO UNIT  
MODE SELECT  
READ CAPACITY  
SEARCH DATA EQUAL  
REQUEST SENSE  
WRITE AND VERIFY  
MODE SENSE  
TRANSLATE

## Board Physical Dimensions

Width 5.75 inches  
Length 7.75 inches  
Height .5 inches  
Weight 1 lb (shipping)

## Environmental

**Operating**  
Temperature 0°C (32°F) to 55°C (131°F)  
Humidity 10% to 95% Non-condensing

**Storage**  
Temperature -40°C (-40°F) to 75°C (167°F)  
Humidity 10% to 95% Non-condensing

**Power Requirements**  
+5VDC @ 1.5A (Max)  
+12VDC @ 300 mA (Max)

## SOFTWARE INSTALLATION

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### INTRODUCTION

This section describes the steps necessary to install the ACB-4000 and ACB-4070 hardware. First the operating environment, installation procedure, and board layout are described. This section describes the integration of the drive, controller, and host system.

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Life, Hours	20,000 POH @ 55° C	

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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 future reuse should return of the equipment to the factory be necessary.

#### NOTE:

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### BOARD LAYOUT

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