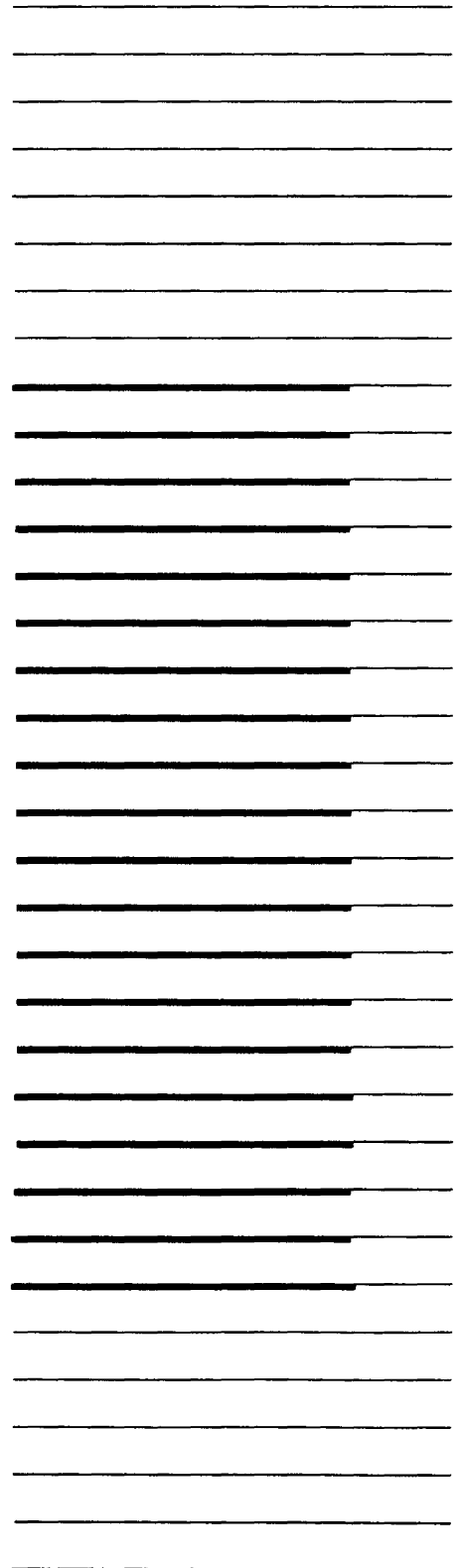




**ACB-4525Z User's Manual  
5-1/4" Winchester Disk Controller  
SCSI to ESDI**



### **3.0 INSTALLATION**

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The ACB-4525Z is a self-contained circuit board. All logical and electronic functions required for its normal operation are contained on the circuit board. The ACB-4525Z is simple to install, operate, and maintain.

#### **3.1 UNPACKING**

The ACB-4525Z is shipped in a protective carton with shock absorbing material and static protecting material completely surrounding the card. The carton should be examined for external damage as it is opened. The cards were physically inspected when packed. Any mechanical damage to the cards should be reported to the shipper and to Adaptec as soon as possible.

#### **CAUTION**

All circuit boards containing VLSI circuitry have some sensitivity to electrostatic discharge. The ACB-4525Z is no exception. Proper handling precautions, including personnel grounding and work surface grounding, should be taken to prevent circuit stress which can cause premature circuit failure.

#### **3.2 PREPARATION OF INSTALLATION AREA**

The ACB-4525Z is generally designed into the host system or the peripheral disk system. Proper attention should be given to the location of the ACB-4525Z so the necessary ventilation, installation clearances, and cabling paths are provided.

The power output is low enough that convective ventilation will be sufficient if the air and surrounding surfaces are at a temperature of 55 degrees Centigrade or less. If this requirement cannot be met by the system enclosure in its worst case environment, then the system enclosure must provide for appropriate ventilation and cooling.

Care should be taken to support the card mechanically. Any appropriate combination of the eight mounting holes provided can be used, depending on the forces to which the system will be subjected. No conductive material should come in contact with the ACB-4525Z.

Installation clearances, for both the ACB-4525Z and the selected power and signal cabling configuration, should be sufficient to optimize system cost, manufacturability, and maintainability.

The ACB-4525Z emits a small amount of radio-frequency signals. Extremely sensitive components, such as high-bandwidth analog sensors, should be properly shielded from the ACB-4525Z. Normal case construction is sufficient to shield the ACB-4525Z as required by the FCC. If FCC compliance is required and the SCSI leaves the box in which the ACB-4525Z is installed, the high-frequency signals generated by normal SCSI operation may require connector and cable shielding.

The ACB-4525Z and all other partially shielded electronic devices are sensitive to high-power, high-frequency electrical or magnetic sources. The ACB-4525Z should be protected from such sources while it is operating. In particular, unshielded switching power supplies should be physically isolated from all electronic boards and their interconnecting cables. External noise sources, such as welding machines and radio transmitters, should be similarly isolated from electronic systems. Cable and connector shielding may be required in some environments.

An appropriate power source must be provided. Care should be taken to prevent ground loops and other power disturbances.

Proper programming support must be provided to generate the required command sequences. Additional program support must be provided to manage the SCSI protocols. Use of the advanced performance-oriented functions will require a more powerful SCSI host adapter that supports disconnect/reconnect and arbitration. Use of the advanced command functions requires expanded software support. Adaptec's host adapters will provide the required SCSI protocol services, but must receive the commands to be executed from appropriate system software. Many other SCSI systems are also available.

### 3.3    INSTALLATION

The following steps are required for installation of the ACB-4525Z into a system properly designed to accept it. These steps are separate from any other testing and installation procedures required by other portions of the system, but can often be done in conjunction with those other installation steps.

- 1) Inspect the ACB-4525Z for obvious physical damage before installing.
- 2) Install proper jumpers (see Section 3.4) to enable the desired ACB-4525Z functions and to define the address of the ACB-4525Z on the SCSI Bus.
- 3) Install the ACB-4525Z with appropriate mounting hardware.

- 4) Make the required cable connections to the ACB-4525Z. The cable connections are:

J1 - Power cable  
 J0 - SCSI cable  
 J3, J4, - ESDI data cable (radial connections as required)  
 J2 - ESDI control cable.

- 5) Install ESDI drives according to the manufacturer's directions. The drives must have appropriate drive select addresses and bus terminators set. The last ESDI drive on the control cable daisy chain must be terminated.
- 6) Power on the system and perform any power-on test procedures required by the system.
- 7) Format the attached drives. (See Section 3.7.)

**NOTE:**

IN A PRODUCTION ENVIRONMENT, THE DRIVES MAY BE OPTIONALLY FORMATTED BY A DEDICATED ACB-4525Z MANUFACTURING WORK STATION BEFORE INSTALLATION. DUE TO THE INTELLIGENCE OF ESDI DRIVES, ALL PARAMETERS ARE STORED ON THE DRIVE BY THE FORMATTING PROCEDURE, FURTHER FORMATTING OR PARAMETER SPECIFICATION IS NOT REQUIRED AFTER INSTALLATION. THE ACB-4525Z WILL AUTOCONFIGURE FROM THE DRIVE PARAMETERS AT POWER-ON TIME.

- 8) Perform appropriate system test and verification procedures. Errors related to drive operation, ACB-4525Z operation, SCSI operation, and certain installation errors will be indicated through the normal SCSI error presentation mechanism.

3.4 CONFIGURING THE ACB-4525Z

The ACB-4525Z has a number of options that must be selected by the installation of hardware jumpers located at position J5 on the controller. The function of each jumper pair is shown.

|   |     |   |                             |
|---|-----|---|-----------------------------|
| P | o o | O | Diagnostics                 |
| N | o o | M | Parity Enable               |
| L | o o | K | Disable Unit Attention      |
| J | o o | I | Start Spindle               |
| H | o o | G | Enable Zero Latency         |
| F | o o | E | SCSI Address 2 <sup>2</sup> |
| D | o o | C | SCSI Address 2 <sup>1</sup> |
| B | o o | A | SCSI Address 2 <sup>0</sup> |

J5

## Jumper settings for the ACB-4525S4000

|   |     |   |                                 |
|---|-----|---|---------------------------------|
| P | o o | O | Diagnostics                     |
| N | o o | M | Parity Enable                   |
| L | o o | K | Disable Unit Attention          |
| J | o o | I | Start Spindle                   |
| H | o o | G | Adaptec 5500/4000 Compatibility |
| F | o o | E | SCSI Address 2 <sup>o</sup> 2   |
| D | o o | C | SCSI Address 2 <sup>o</sup> 1   |
| B | o o | A | SCSI Address 2 <sup>o</sup> 0   |

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J5

### 3.4.1 DIAGNOSTIC MODE

The installation of the O-P jumper will cause the ACB-4525Z to continuously repeat a diagnostic self-test. See Appendix B for details of this self-test.

### 3.4.2 PARITY ENABLE

The installation of the M-N jumper will cause the ACB-4525Z to check for bus out (data into the ACB-4525Z) parity errors. This jumper should only be installed if all SCSI devices communicating with the ACB-4525Z generate SCSI data parity. The ACB-4525Z will always generate parity on bus in data transfers.

### 3.4.3 DISABLE UNIT ATTENTION

Normally the ACB-4525Z will support SCSI Unit Attention. To allow normal operation with some hosts that do not support Unit Attention, the installation of the L K jumper will disable Unit Attention on the CCS mode. Unit Attention is also not supported if the H G jumper is installed on the ACB-4525S4000.

### 3.4.4 START SPINDLE

Normally, the ACB-4525Z will issue a START SPINDLE command at power up. However, with jumper I-J installed the initiator must issue a START SPINDLE command before the drive will spin up. This feature allows the initiator to control the power sequencing (and peak surge current) of the attached drives.

### 3.4.5 ENABLE ZERO LATENCY (ACB-4525Z ONLY)

With jumper installed, the ACB-4525Z will default to zero latency option set upon power up or SCSI reset. This option is reset via mode select (page 6-42 ), or responding to Mify Data Pointer message with "Message Reject." See 4.2.2.2.

#### 3.4.5.1 ADAPTEC ACB-5500/4000 COMPATIBILITY (ACB-4525S4000)

When jumper G-H is installed, operation of the ACB-4525Z will deviate from the Common Command Set specification in some areas. This jumper provides a software protocol which is fully compatible with the ACB-5500 and ACB-4000 families of hard disk controllers.

The following is a short description of the command set differences.

The REQUEST SENSE command will return only four bytes of sense data. With the G-H jumper removed, the REQUEST SENSE command will always return sense data in the extended sense format.

The FORMAT command will allow the specification of a data fill pattern other than 6Ch and a defect list may be provided by the host, but it will not be possible to use the manufacturer's supplied defect list.

The REASSIGN BLOCK command is not implemented for use with the G-H jumper installed.

The INQUIRY command will return a maximum of four data bytes.

The MODE SELECT and MODE SENSE commands will provide disk information only, retry handling will be specified through the SEND DIAGNOSTICS command.

The READ and WRITE BUFFER commands are implemented in a vendor-unique manner with different op codes than the CCS specification.

For more detailed information on operation with the G-H jumper installed, see Appendix C and/or an ACB-4000A or ACB-5500 User's Manual.

#### 3.4.6 SCSI BUS ADDRESS

The installation of jumpers A-B, C-D, and E-F set the SCSI bus address for the ACB-4525Z. SCSI devices can have an address of zero to seven, but no two devices on the same bus can have the same address.

#### 3.5 POWERING ON THE ACB-4525Z

Once the ACB-4525Z is properly configured, the controller may be powered on. When power is supplied to the system, the controller will enter a power-up mode and wait for a maximum of 18 seconds for the drive to become ready. During the 18-second power-on sequence, the controller performs a self-test and begins checking for drives 0 and 1 to become ready. If the host sends a command requiring access to a drive before it has become ready, a DRIVE NOT READY (04h) error will result. The controller will then check for a ready status on the next command requiring access to that drive.

If the drive does not come ready within 18 seconds after the controller is powered on, the controller will not perform automatic initialization if and when the drive becomes ready. To perform this function, the host must use the Reinitialize Drive option (60h) of the Send Diagnostic Command.

When a command is received and the drive is ready but not initialized, the controller will read the drive's configuration data before executing the command. Once a drive is formatted, the host can determine the drive size (READ CAPACITY, 25h, command) and self-configure without any driver software modification.

### 3.6 COMMUNICATING WITH THE ACB-4525Z

The SCSI bus is a simple bus to interface. However, a quick reading of the SCSI spec may leave one lost due to its extreme attention to detail. Also, some SASI-like controllers exist on the market which allow some deviation from the ANSI/SCSI protocol. The important point to remember in designing a drive routine is that once the controller is started by the host, THE CONTROLLER CONTROLS THE SCSI BUS. The controller drives the data direction line (I/O), the phase lines (C/D and MSG) and initiates data transfers (REQ). The host driver should make no assumptions about the bus phases or byte counts. In addition, the controller can (and will) change phases between operations while going through intermediate phases. Thus, the phase lines (C/D and MSG) are only valid when the controller asserts REQ. Do not write your driver or allow your hardware to follow phases when REQ is not active or it may be 'fooled' by phase changes between REQ.

Also, some other controllers only support six-byte commands, thus some users have set up counters in their software to send a six-byte command. Since the ACB-4525Z controller supports six- and 10-byte commands, the hardware/software should not count out the command bytes but rather should send command bytes as long as the controller requests them. Trust the controller; it 'knows' how many bytes it needs.

The sequence of operations for a single command used in the simplest of SCSI applications would be:

- 1) Select the controller onto the bus (wake it up). Be sure Select remains asserted until the controller responds Busy.
- 2) Send the ACB-4525Z the appropriate command bytes until it changes phases (do not count bytes). If too many or too few bytes are REQuested, check for valid command op code and proper SCSI REQ/ACK timing. To ensure 1:1 interleave, the maximum REQ/ACK delay must be less than 280 nanoseconds.

- 3) If required, send/receive data until phase changes (do not count bytes; the controller will determine data direction).
- 4) Receive (REQ/ACK cycle) one status byte and save for evaluation (see Section 4.5).
- 5) Receive (REQ/ACK cycle) one message byte (see Section 4.2).
- 6) Check status byte. If Busy bit set, resend command; if Check bit set, send REQUEST SENSE (03h) command to get error.

A sample MODE SELECT command is shown below for a hard-sectored drive with two spare sectors per cylinder allocated for slipping defects. A Mode Select Command is not required preceding the Format Command when using the ACB-4525Z. The Mode Select Command is only necessary if the host desires to modify any of the changeable Mode Select parameters.



Step 1: MODE SELECT COMMAND

| <u>Hex</u> | <u>Description</u>                     |
|------------|--|
| 15         | OP Code (15h) for MODE SELECT          |
| 00         | Command for LUN 0                      |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 1C         | Number of bytes appended (1Ch)         |
| 00         | Reserved                               |
|            | Extent Descriptor List                 |
| 00         | Reserved                               |
| 00         | Medium Type                            |
| 00         | Reserved                               |
| 00         | Block Descriptor length                |
|            | Direct Access Device Format Parameters |
| 03         | Mode Select Page Code                  |
| 16         | Page Length to follow                  |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 02         | Alternate Sectors per zone (LSB)       |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Track Skew (sectors to skew per track) |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |
| 00         | Reserved                               |

After the Mode Select has been transferred to the controller and good completion status has been sent to the host, the drive may be formatted.

Step 2: FORMAT UNIT COMMAND

Interleave of 1:1  
Three spare sectors per cylinder  
Hard-Sectored Drive

FORMAT UNIT command

| <u>Hex</u> | <u>Description</u>   |
|------------|--|
| 04         | Op code (04h for FORMAT UNIT command)  |
| 00         | Lun 0 No defect data list, format with known defect information from primary and grown defect data lists maintained by drive and controller and do not accept a defect list from the host. |
| 00         | Reserved   |
| 00         | High byte of interleave (must be 00)   |
| 01         | Low byte of interleave   |
| 00         | Reserved   |

The ACB-4525Z provides true device independence by automatically formatting out all media defects by reading the manufacturer's defect map at format time. The user may specify, through the Mode Select command, the number of sectors per cylinder to be left available for future use in expectation of field grown defects. In the event of a grown defect, the Reassign Blocks Command uses a spare sector in the same cylinder, or on maximum cylinder - 1, to provide perfectly clean media. This intelligent defect handling scheme eliminates performance degradation due to media defects.

The ACB-4525Z allows the user to select the desired interleave factor with the FORMAT UNIT command. The interleave can range from one to the number of sectors-per-track. The number represents the number of physical rotations of the disk which are necessary to read an entire track of data.